HSRC RESEARCH OUTPUTS

1933

CATALOGUE OF FUNDAMENTAL GEO-SPATIAL DATASETS FOR AFRICA

HSRC
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CENTRE DE SUIVI ECOLOGIQUE (CSE)
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REGIONAL CENTRE FOR THE MAPPING OF RESOURCES FOR DEVELOPMENT (RCMRD)
REGIONAL CENTRE FOR TRAINING IN AEROSPACE SURVEYS (RECTAS)

MARCH 2007

Catalogue of Fundamental Geo-spatial datasets for Africa

Project Report

Prepared for:

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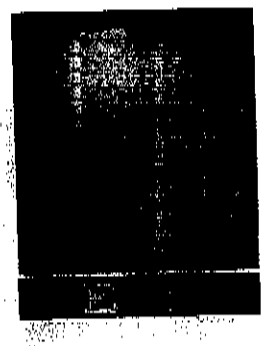

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A project of this nature involves a team of players and without them it would not have been successful. Derek Clarke, Chief-Director Surveys and Mapping, South Africa, realised the potential of such a project and provided the funding for the project. His input throughout the project was valuable.

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The sub-regional partners played a crucial role in ensuring that relevant organisations were included in the survey and obtaining completed questionnaires from these. Each sub-regional partner also took responsibility for managing the sub-regional affairs related to the project. The key people were: Adewale Akingbade, Ahmed Abdelrehim, Amadou Sall, Assize Toure, Didier Devers, Guyguy Mangoni and Hussein Farah.

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Quality control was conducted by Emily Shiruma, S'bo Zama and Sonja Vorster.

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ABBREVIATIONS

CD:SM	Chief Directorate: Surveys and Mapping
CEDARE	Centre for Environment and Development for the Arab Region and Europe
CODI	Committee on the Development Information
CSE	Centre de Suivi Ecologique
EA	Enumeration Area
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organisation
GIS	Geographical Information System
GLCN	Global Land Cover Network
HSRC	Human Sciences Research Council
ICA	International Cartographic Association
ICT	Information and Communication Technology
ISCGM	International Steering Committee for Global Mapping
ISO	International Standards Organization
MDG	Millenium Development Goals
NEPAD	New Partnership for Africa's Development
NICI	National Information and Communication Infrastructures
OSFAC	Observatoire Satellital des Forêts d'Afrique Centrale
RCMRD	Regional Centre for Mapping of Resources for Development
RECTAS	Regional Centre for Training in Aerospace Surveys
SDI	Spatial Data Infrastructure
UNECA	United Nations Economic Commission for Africa

1. Introduction

The extent to which countries on the African continent have access to the necessary geo-information needed for sustainable development and the implementation of the Millennium Development Goals (MDG) is largely unknown. Practitioners from across the continent have in various forums raised the concern about the lack of fundamental geospatial datasets. They have also raised the concern about the availability of base maps, maps being out of date or of too course a scale, geo-information not being complete or comprehensive enough and not being in an electronic format (Ottichilo, 2005). This is not to say that Africa has no geo-information at all.

Research has shown that indeed many countries on the continent have access to geospatial data. There are many initiatives on the continent that have and are collecting geo-information. Some very good examples of these are the Africover initiative that resorts under the Global Land Cover Network (GLCN) of the Food and Agriculture Organisation (FAO), the Global Mapping Project being implemented by the International Steering Committee for Global Mapping (ISCGM), the Geohazards project as part of a Global Earth Observation System of Systems and the TIGER initiative (UNECA, 2005). It is therefore not necessarily the case that Africa does not have the geoinformation that it requires to bring about its own development.

The question then is - what information is available for each of the different countries of the continent and is it in a form that will allow it to be effectively utilized in decision-making? What is important to emphasize in looking at the availability of information is that it is done within an appropriate framework. The problem in Africa at the present moment is that there is insufficient knowledge of what geo-information is available, at which scale and format. In addition, the key issues that have been identified are the availability and accessibility of geo-information on the continent (Menneke and West, 2001; Schwabe, 2003).

Based on the above issues an initiative was proposed at a special workshop of representatives from African countries held in August 2003 in Durban, South Africa. The outcome of this workshop was the Durban Statement on Mapping Africa for Africa (the Mapping Africa for Africa – MAFA - initiative). This Durban Statement was adopted by the General Assembly of the International Cartographic Association in 2003 and by the Committee on Development Information's Geo-information sub-committee (CODI-Geo) at the third meeting held in Addis Ababa in April 2005. The document provides a set of recommendations and an action plan for the implementation of geo-information activities in association with international and continental partners.

The vision of MAFA is to accelerate the development of the geo-information industry in Africa so that it can contribute to sustainable development on the continent and enable the goals and objectives of the New Partnership for Africa's Development (NEPAD) to be accomplished. Key recommendations included that CODI-Geo in collaboration with the ICA coordinate the implementation of MAFA activities. These activities would need to be in line

with the priorities of the NEPAD and would be implemented through the establishment of a working group (Nyapola, 2005).

The Durban Statement recommended that regional centres and institutions should play a key coordination role in the communication of MAFA activities and in the dissemination of information. Priority activities included the identification of fundamental geospatial datasets and the conducting of an inventory of these datasets and resources within each country. However, for this to be done it was decided that an initial project needed to be undertaken to define what is meant by a fundamental geospatial dataset. The Human Sciences Research Council (HSRC) and EIS-AFRICA were contracted to undertake this project.

A user needs assessment was conducted across the continent by sub-regional, regional and global partners to define what fundamental datasets are and which geospatial datasets could be classified as fundamental. Before this could be undertaken a set of criteria was identified that assisted in defining and identifying the fundamental geospatial sets. The set of criteria that were used included: coverage over the area of interest, consistency of need, sufficient detail and a diversity of users from different sectors must derive significant benefit from their use. Fundamental data should also have acceptable standards and validation processes that ensure consistency, reliability, quality, continuity and accuracy.

With the inputs received from geo-information practitioners across Africa the following definition of fundamental datasets was adopted:

Fundamental data *sets are the minimum primary sets of data that cannot be derived from other data sets, and that are required to spatially represent phenomena, objects or themes important for the realisation of economic, social, and environmental benefits consistently across Africa at the local, national, sub-regional and regional levels.*

Considering this definition a set of fundamental datasets were identified and included the following groups of data:

- Geodetic Control Network
- Imagery
- Hypsography
- Hydrography
- Administrative boundaries
- Geographic names
- Land management units/areas
- Transportation
- Utilities and services
- Natural environment

These datasets were hierarchically ordered into different levels, categories and themes that reflect their relative and sequential importance in the development of geospatial datasets in

Africa. The hierarchy also reflects the functional uses of the fundamental data sets as a geographic reference frame, as base geography and as a geo-coding scheme needed to give non-spatial data a geographical reference. The study also presented findings on what spatial features should form part of the fundamental datasets, what attributes should be associated with each dataset, what level of detail the data sets should be developed at, what metadata should be developed and what were the requirements for the temporal updating of the fundamental data sets.

After defining what a fundamental geospatial dataset was a further study was commissioned to catalogue these datasets. By going through this exercise it would then be possible to undertake a gap analysis to see which of the fundamental geospatial datasets were either missing or were not suitable for use at a national and sub-regional level. The inventory would cover the most recent fundamental datasets held by government agencies, parastatals, NGOs, the private sector and multi-national agencies (e.g. United Nations agencies) at a national, sub-regional, continental and international level. The inventory would cover both hard copy and digital datasets. Attributes and metadata, conforming to the ISO 19115 standard, would be collected for each of the fundamental geospatial datasets.

This report covers the approaches used in the above-mentioned study and describes the findings. Included in this report is information on the availability of fundamental geospatial datasets and their attributes for individual countries. It can be concluded that the study was overall successful. The main reasons for stating this is that an extensive network of regional centres and partners with their national counterparts has been established across the continent. This network can be utilized for future studies in the geo-information industry in Africa.

In a study of this nature one must also anticipate some problems, especially if one considers that information for 30 fundamental geospatial datasets needed to be collected for each country in Africa. This required a strong management team and the effective participation of all partners, which was sometimes difficult to achieve considering the great distances and technological divides that separate the different regions on the continent. Nevertheless, extensive information was collected on the availability and attributes of the fundamental geospatial datasets at a national and sub-regional level. Through this exercise an understanding has been obtained as to what the gaps in the fundamental geospatial datasets are. The findings will provide an opportunity to identify the priorities and develop appropriate strategies so that the geo-information needed to assist Africa in achieving its development and NEPAD objectives.

2. Study Approach and Considerations

2.1 Project management

A project management team comprising the HSRC and EIS-AFRICA was set up to guide the implementation of the project. Partner institutions were also identified at the sub-regional level as follows:

East Africa:	Regional Centre for Mapping of Resources for Development (RCMRD)
Coastal West Africa:	Regional Centre for Training in Aerospace Surveys (RECTAS)
Sahelian West Africa:	Centre de Suivi Ecologique (CSE)
Southern Africa:	EIS-AFRICA
Central Africa:	Observatoire Satellital des Forêts d'Afrique Centrale (OSFAC) in collaboration with the University of Maryland
North Africa:	Centre for Environment and Development for the Arab Region and Europe (CEDARE)

The HSRC assumed responsibility for overall project administration, liaison with international partners and the Chief Directorate: Surveys & Mapping (CD:SM). EIS-AFRICA was responsible coordinating the inputs from the sub-regional partners.

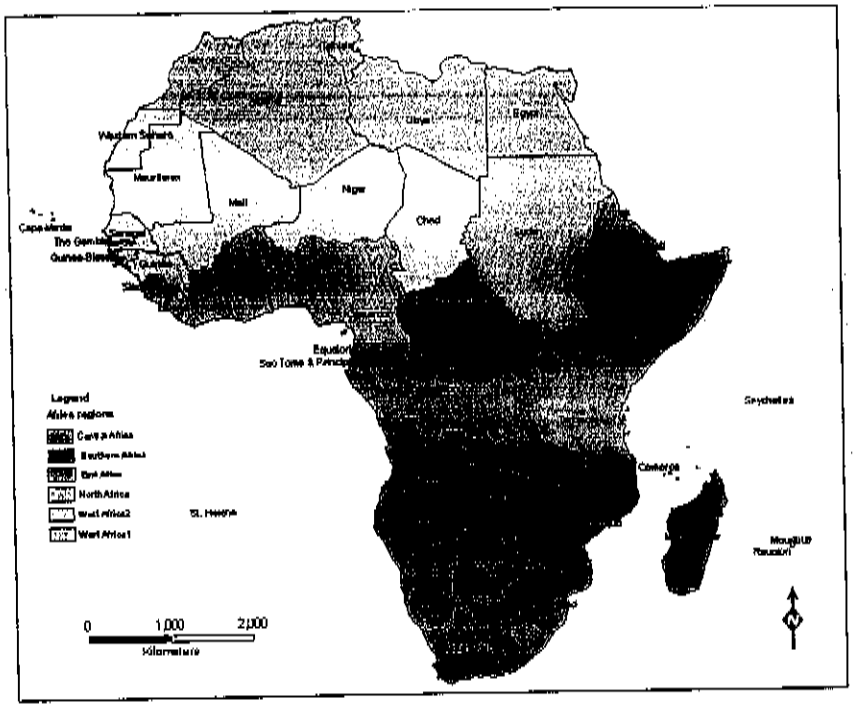

Figure 2.1: Sub-regional distribution for the purpose of this study

Since the project team was big and spatially dispersed it was of very high importance to keep the communication channels open. The initialisation workshop and teleconferencing proved to be very helpful in ensuring that all partners were on the same level of

understanding, in sharing experiences and expertise and in motivating people. For future projects it would be recommended to budget more time and money for such activities. E-mail was used for day-to-day communication.

2.2 Methodology

The study team considered that there were three key strands in the study:

- Identification of fundamental geospatial datasets *available* for each country through the process of collecting information on the available geospatial datasets
- Building a registry or *catalogue* that contains details of the available fundamental geospatial datasets, including metadata;
- Establishing what is *lacking* in terms of the fundamental datasets in each country.

A central question at the heart of the adopted methodological approach applicable to each of the 30 datasets was: *did the dataset exist anywhere?* If it did, the approach was then to establish where it could be found, its characteristics on the basis of selected criteria for fundamental datasets for Africa as defined by the earlier study, and then to provide a description of the dataset. If the dataset did not exist, this would be reported as a gap (see Figure 2.2). The inventory covered all 54 countries in Africa.

A survey questionnaire approach was adopted as the main tool for the systematic collection and cataloguing of the relevant information from countries. However, before developing the questionnaire, and in order to establish the existence of any of the datasets, a desktop study of inventories and catalogues of geospatial datasets in Africa and elsewhere in the world was undertaken. The primary purpose of the desktop study was to gather as much information on available fundamental geospatial datasets and to identify as many potential sources as possible. This included literature search on inventories and catalogues that had been undertaken on geospatial datasets in Africa at the sub-regional and international levels. Part of this search was to identify any international organisations that are custodians of the fundamental geospatial datasets.

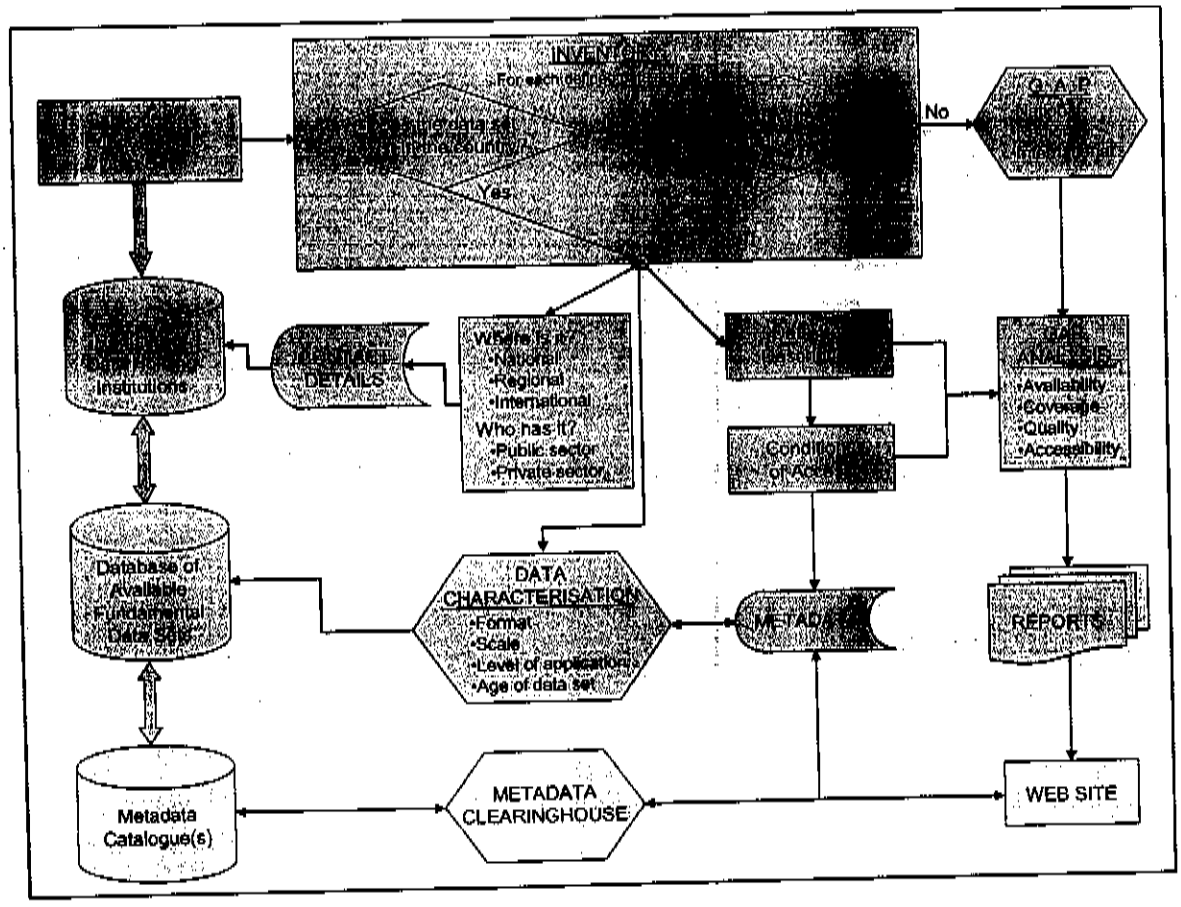

Figure 2.2: Methodological approach for the inventory and cataloguing process

Data holding organisations surveyed included government establishments (ministries, departments, semi-government institutions or para-statals), non-governmental organizations, and private sector entities both at the country and international levels as well as multi-national agencies (e.g. United Nations agencies and the World Bank).

2.3 Structure of the questionnaire

As outlined above, the questionnaire was based on three key strands, and focused on the following "project deliverables":

a) an inventory of available fundamental datasets

b) gap analysis and report

c) a metadata catalogue

However, in order to produce the project deliverables the questionnaire was structured to provide vital information on several elements of the fundamental datasets available in each African country, as well as those held by "external" organisations.

The questionnaire was designed to capture the characteristics of identified datasets, e.g. formats, scales, age of the dataset, the application level and various metadata descriptors.

Since the approach was to establish the existence or otherwise of datasets, irrespective of *where* the dataset was held and *who* held it, provision was made to cater for the possibility that some fundamental datasets may be held privately. For this reason, it was necessary to establish the conditions of access for each dataset to provide for the possibility of a negotiated access to the data when required.

The questionnaire had seven sections (see Annexure 1):

- The first section related to information about the respondent of the questionnaire and the data-holding institution.
- The second section established the existence or otherwise of the dataset, either by a custodian institution or by some other organisation that holds the dataset as a result of its own functions.
- The third section dealt with characteristics of the data with respect to available scales, completeness of coverage, publishing year, last update year and whether or not metadata for the dataset existed.
- The fourth section established the formats of available datasets. Data types/formats for the inventory included hard-copy maps, databases, digital spatial data (structured and unstructured).
- The fifth section dealt with data accessibility.
- The sixth section dealt with metadata based on the *ESRI Profile* of the ISO 19115 Core Metadata Elements.
- The seventh section was for (official) use and had to be completed by the national collaborator.

The questionnaire was designed with a focus on ease of completion. For the most part it listed the 30 pre-determined datasets, and required the respondent simply to indicate by checking boxes as appropriate.

It should be noted that much of the information required could be obtained from, or are the same as that would be contained in, a metadatabase about the fundamental data sets. However, the study team took the view not to assume that all potential respondents would be familiar with the *concept* of metadata, or that they would have metadatabases from which they could extract the required information.

2.4 Questionnaire administration

Sub-regional partners identified national collaborators to assist in the inventorying and cataloguing process. Such collaborators were typically organisations or individuals in the public or private sectors that have a good standing in their countries, have a good network with geoinformation organisations, and have capacity to assist with the project. Sub-regional partners involved in the project all have well-established networks with geoinformation

institutions. These networks were leveraged in order to save time and to obtain as much information as possible. Apart from the benefit of covering a wide variety of potential sources, the view of the study team was that this approach would also strengthen critical networks that can be used in the future for other geospatial projects. Furthermore, it allowed national partners the opportunity to participate in a pan-Africa project identifying fundamental geospatial datasets in their respective countries. A list of national collaborators who participated in the study is attached in Annexure 2.

National collaborators were required to identify key institutions that potentially hold fundamental datasets, either as custodians, or by virtue of their own functions. The national collaborators first created contact lists of all the different agencies that they identified, associating each with the respective datasets they that held. National collaborators distributed questionnaires to the data-holding institutions by the most appropriate and reliable way, including e-mail, courier, fax, regular mail (post) and in person.

Despite several efforts, there were countries where no contacts were established. On top of this of those where contacts were established, some never responded to the questionnaire. A total of nine countries were therefore not part of this survey and included: Angola, Botswana, Comoros, Eritrea, Guinea, Ivory Coast, Liberia, Sao Tome & Principe, Western Sahara and Zambia.

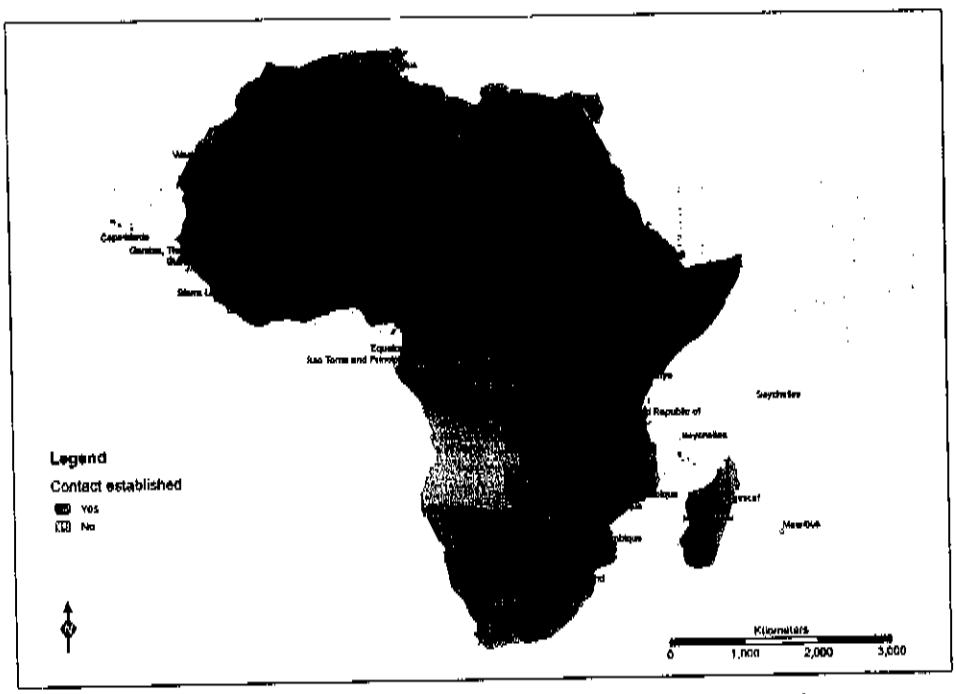

Figure 2.3: Countries where no contacts could be established

Completed questionnaires for respective countries were collated and forwarded by the national collaborator via courier to the respective sub-regional partner. The sub-regional partner collated and validated the returned questionnaires, including a check for completeness, and then forwarded the completed and validated questionnaires to the project management team.

The sub-regional partners submitted reports on the inventory process, highlighting any salient issues, challenges and significant outcomes.

The international component of the study included contacting identified agencies via telephone and e-mail. A total of 71 organisations were identified and contacted. Annexure 3 contains a list of all the organisations and their contact details. Although a large number of organisations were contacted the response was very poor. Despite this, a large number of datasets were covered, because multi-nationals often have data for more than one geospatial dataset.

2.5 Data capture and analysis

A data capture interface was designed to capture the data. This allowed the data to be immediately available in a database format without having to do any conversions. A total of 426 questionnaires were captured – including data from organisations within countries and multinational organisations.

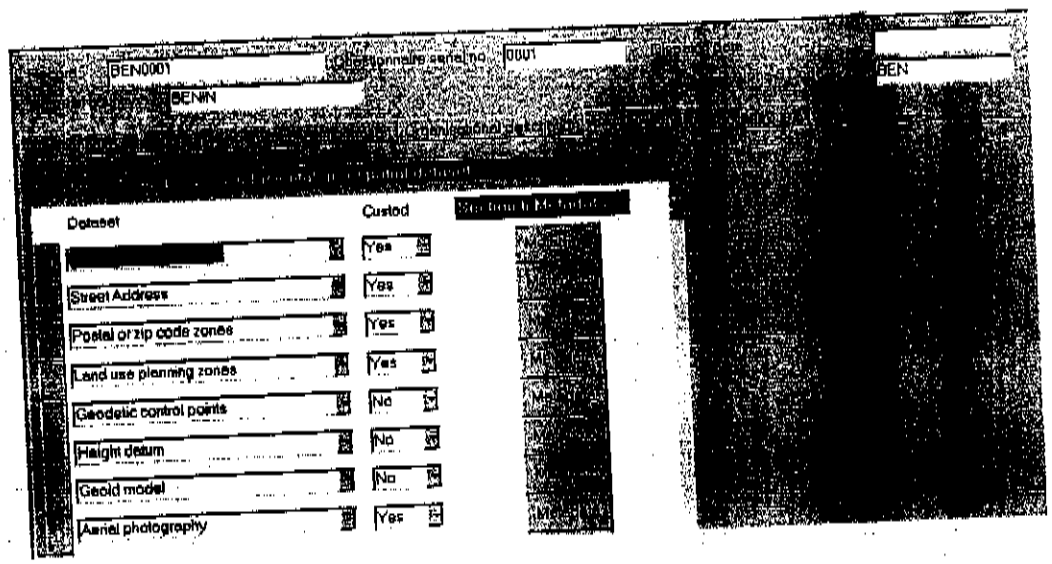

Figure 2.4: Data capturing interface

The project management team assumed responsibility for the capture of data from each of the questionnaires. A database was be created for the purpose of data capture, querying, retrieval, and analysis of the survey data. It was expected that three outputs will be established from the captured data. The first will be a register of all institutions holding any of the fundamental dataset captured for African countries. The second will be a database of available fundamental datasets including data characteristics (formats, scales, age, etc.). The third output will be the metadata catalogue structured on the basis of the *ESRI Profile* of the International Standards Organisation (ISO) 19115 Core Metadata Elements. The first two files can be extracted from the final survey database while the latter will be constructed from the metadata capturing tool.

2.6 Metadata

At the project initialisation workshop it was agreed to use a commercial software package to capture metadata. This was done for a number of reasons. Firstly, it was assumed that since this package was one of the major vendors in Africa, many organisations would already have their metadata in this format and it would therefore reduce our data capture time and also that of the organisation completing the questionnaire. Secondly, the software uses the ISO standard so there was no need to design a database which represents such a standard.

The acceptance of this decision was dependent on the UNECA being able to import this format of data into their metadata clearinghouse. A sample was successfully imported in September and the metadata capturing therefore continued using the vendor software.

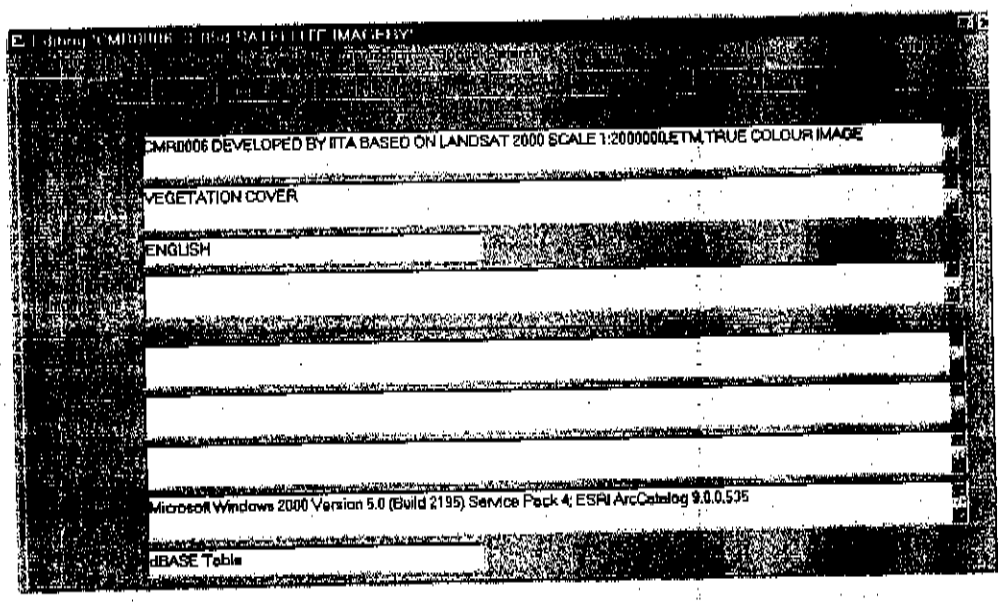

Figure 2.5: Metadata capturing

Many organisations did not provide metadata and those that did provide, did not provide the completed metadata. Again the metadata received from international agencies proved to be useful to fill gaps.

2.7 Gap analysis

The gap analysis conducted in this study was based on the information management concept of *information gap analysis*. Gap analysis is used to obtain an understanding of what information is available and what information is required to fulfill the business needs. In this instance the "information" refers to information about the fundamental data sets in Africa as collected via the questionnaire.

According to literature, an organisation can conduct a conceptual-physical gap analysis or a data-function one. In this study a "Conceptual-Physical" gap analysis was done. The

conceptual inventory (the 30 fundamental data sets) was compared with the physical inventory (gathered through the questionnaire).

The *gap analysis* dealt with two broad aspects:

i) a basic analysis (as requested by the client), in terms of *availability* or the *non-existence* of the fundamental dataset *anywhere*, and

ii) intermediate analysis (based on additional information from the questionnaire), and dealing with issues relating to completeness of spatial coverage, inconsistency, quality, etc., in the datasets in terms of suitability for use in decision-making.

An oversupply analysis was also undertaken.

2.7.1 Basic Gap Analysis

The basic gap analysis consisted of a matrix of countries by fundamental datasets. A calculation has been done to indicate what percentage of fundamental datasets is available per country. The results are discussed in Chapter 3.

Table 2.1: Example of cross tabulation of countries and data sets

	Geodetic control points	Height datum	Geoid model	% Data Sets
Algeria	✓	✓		60
Angola		✓	✓	60
Benin			✓	30
Botswana	✓	✓	✓	100

The same analysis could bd done per dataset will render results like, e.g. in 30 countries there are no data on boundaries. See the example below. Both these analyses will identify priorities in terms of datasets and countries.

Table 2.2: Example of cross tabulation of countries and data sets

	Uganda	Zambia	Zimbabwe	% Countries
Geodetic control points	✓	✓		60
Height datum		✓	✓	60
Geoid model			✓	30
	✓	✓	✓	100

The third component of the basic gap analysis was the availability of metadata. If metadata does not exist, it will be recorded as a gap.

2.7.2 Intermediate gap analysis

Scale availability

Each level of the fundamental data sets required different scales of data. The benchmarks set here are only a recommendation based on the fact that the study aims to establish a common reference for Africa. Data gathered on scale/resolution in Section 3 of the questionnaire was analysed here.

For the Primary Reference (Level 0) of the fundamental data sets, the benchmark is data up to the scale of 50 000. This means that options a) or b) in Question 3-01 to 3-03 is acceptable for Level 0 data. The Base Geography (Level 1) is derived from the more detailed primary reference layer, but in turn it is used as base for further derived data and therefore the benchmark scale for data is up to 50 000. In the case of imagery a 50 000 scale-equivalent source should be used. The benchmark for data housed in the Administration and Spatial Organisation category (Level 2) is a scale of up to 250 000. Level 3 (Environmental) data also has a benchmark scale of up to 250 000.

Data that does not fulfill the above requirements constituted a gap.

Quality

The quality of data sets can be measured in several ways. This study limited itself to the scale and temporal consistencies. Scale consistency refers to the situation where particular data sets are available at different scales. That is, the completeness of spatial coverage of a country is achieved only by putting together data at different scales. For instance, it may happen that some countries may have complete coverage of natural water bodies. However, sections of the country may have been mapped at different scales (e.g. 1:50 000 in some areas and 1:100 000 in other areas, etc.) and the "completeness of coverage" is achieved only when the various scales are put together. Temporal consistency refers to the situation where a particular data set has been acquired at different dates and "completeness of coverage" is a patchwork of data from different eras. For example, roads data that had been developed at three different times. In both situations the data sets would not be homogeneous and quality (e.g. representation and a possibly changed "ground truth") issues arise.

The date of first publication of data will have to be examined to determine temporal consistency. Although no cut-off date in time will be set, it will be important to flag data older than a specific date. The report will not be able to pass a judgement about the age of data sets. Consistency in terms of the time periods of data capture (e.g. every 5 years) could also be investigated.

Completeness of spatial coverage

Section 3 of the questionnaire also asked about the completeness of spatial coverage. The results of this question was analysed based on the four application levels identified in the previous study. The table below indicates the detail.

Table 2.3: Levels of application for completeness of spatial coverage

Level of Detail	Application Level	Equiv. Map Scale
High	Local/municipality level	1:10 000
Medium	Sub-national/provincial level	1:50 000
Low	National level	1:250 000
General	Regional	1:1 000 000

Each level of application will have to be cross tabulated with completeness of spatial coverage.

Data format

Section 4 of the questionnaire asked about data format. The first benchmark will be the percentage of datasets that are not in digital format (i.e. reports, hard copy maps and tables). The second benchmark is the percentage of datasets that is not in a GIS format. Both these percentages will be indicative of the gap.

Data accessibility

Access to data is an important indicator. Section 5 of the questionnaire collects data on accessibility of data. The percentage of datasets that have "restricted access" will be regarded as a gap.

2.7.3 Oversupply

The oversupply analysis will indicate where too much data exists. This can be measured at the country level as well as at the data level. It will provide an indication of where more coordination in the geo-information industry is required, as well as less data capturing.

2.8 Quality control

A quality control exercise was undertaken to ensure the quality of the questionnaires received. A regionally representative sample was drawn to ensure each region was presented in the sample. Thereafter a country within that region was randomly selected and all the questionnaires for that country were followed up. The sample is shown below.

Table 2.4: Countries selected for quality control

Country	Region
Cameroon	West Africa (E*)
DRC	Central Africa
Egypt	North Africa
Guinea Bissau	West Africa (F**)
Mozambique	Southern Africa
Somalia	East Africa

*E refers to Anglophone/Coastal West Africa

**F refers to Francophone/Sahelian West Africa

The person completing each questionnaire was briefly interviewed telephonically to check the validity of the questionnaire. After the completion of the interview an index was calculated to indicate the completeness of the questionnaire (Annexure 4 contains the interview schedule). The index indicates how complete the questionnaire was before the quality control was conducted. The following findings are displayed in Table 2.5.

As can be seen from the table, questionnaires for the DRC and Egypt were very well completed since respondents did not have anything to add. For Mozambique more information was added during the quality control interview and therefore the initial completion rate for the country was 54%. The respondents in the remaining countries in the sample could not be reached and therefore the results for these are missing.

Table 2.5: Results of quality control

Country	Completeness %
Cameroon	Missing
DRC	100
Egypt	100
Guinea Bissau	Missing
Mozambique	54
Somalia	Missing

3. Findings

This section encompasses not only the findings in terms of geo-spatial datasets, but also considers the findings in terms of the metadata and the lessons learnt throughout the study. In terms of the datasets the findings will focus on individual geo-spatial datasets. Separate country reports deal with results per country. The level (e.g. Level 0 – III) of fundamental datasets across regions will also be compared. A gap analysis will follow this and will aim to indicate not only the lack of a dataset, but also the extent to which the quality, scale, etc. of the dataset might be problematic.

The division of regions as discussed are indicated in Chapter 2. Please refer to the relevant map for clarity on the regional analysis.

For countries that were not surveyed, it was accepted that geo-spatial datasets do not exist, except for those covered by international agencies. Despite the fact that a number of countries were not surveyed, geo-spatial datasets for these were actually fairly well covered by international agencies.

3.1 Dataset availability

The availability of datasets form part of the basic gap analysis. This analysis can also be considered from a country level and indeed is the outcome of a country analysis which is published separately from this main report. A matrix which summarises the availability of the 30 fundamental dataset is found overleaf. This data availability section will focus on the indications of the matrix. Dataset and regional trends will be discussed at the end of this section. Firstly, a dataset analysis will take place.

3.1.1 Geodetic control points

Although not a high count, the majority of countries on the continent (59%) has geodetic control point datasets. Geodetic control points refer to a list of coordinates with information on the history of establishment of the network as well as network design in digital map/GIS format.

From Figure 3.1 it can be seen that Mozambique in Southern Africa do not have this dataset. Other countries which do not have geodetic control points data are situated in the central northern part of the continent, the horn of Africa and Morocco in the northwest.

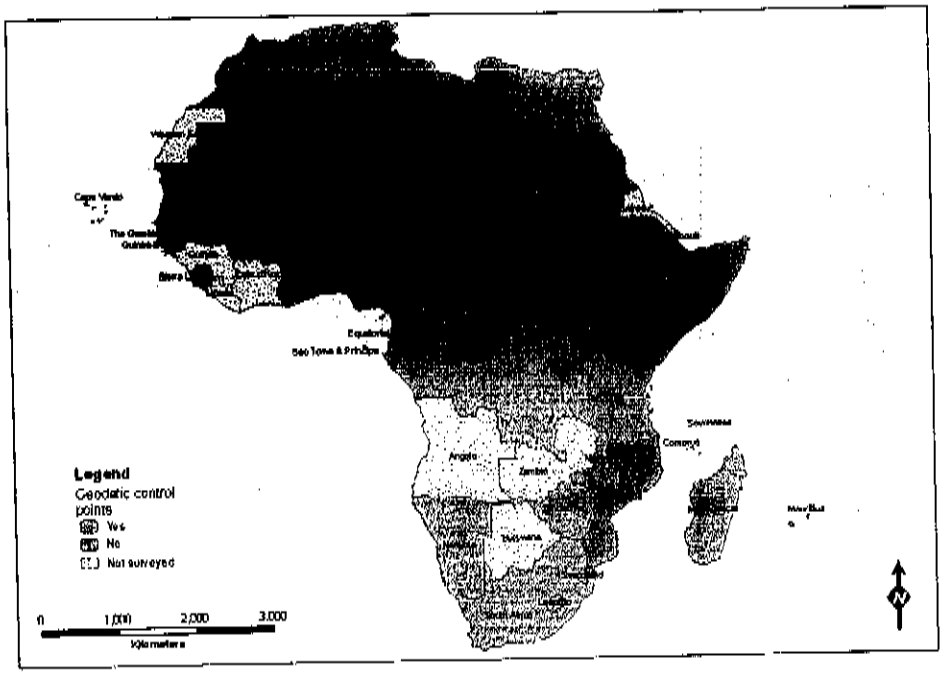

Figure 3.1: Distribution of geodetic control points datasets

A regional summary of geodetic control points datasets indicate that the Central African region is the best off while North Africa has the lowest count.

Table 3.1: Summary of geodetic control points datasets per region

Region	% Countries
Central Africa	80
East Africa	58
North Africa	33
Southern Africa	64
West Africa (E)*	70
West Africa (F)*	50

*As indicated earlier these refer to English-speaking/Coastal West Africa and French-speaking/Sahelian West Africa.

Table 3.2: Summary of fundamental geo-spatial datasets per country

Country	Geodetic control points	Height datum	Geoid model	Aerial photography	Satellite imagery	DEM	Spot heights	Bathymetry	Coastline	Water bodies	Administrative boundaries	Populated places
Algeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Angola					Yes	Yes		Yes		Yes	Yes	Yes
Benin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Botswana					Yes	Yes				Yes	Yes	Yes
Burkina Faso		Yes			Yes	Yes	Yes			Yes	Yes	Yes
Burundi					Yes	Yes		Yes	Yes	Yes	Yes	Yes
Cameroon	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cape Verde		Yes		Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Central African Republic				Yes	Yes	Yes		Yes		Yes	Yes	Yes
Chad				Yes	Yes	Yes				Yes		Yes
Comoros					Yes	Yes		Yes		Yes	Yes	Yes
Congo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Congo, DRC	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cote d'Ivory					Yes	Yes		Yes		Yes	Yes	Yes
Djibouti	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Egypt	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Equatorial Guinea	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eritrea					Yes	Yes		Yes		Yes	Yes	Yes
Ethiopia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gabon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ghana	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Guinea					Yes	Yes		Yes		Yes	Yes	Yes
Guinea-Bissau	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Kenya	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lesotho	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
Liberia					Yes	Yes		Yes		Yes	Yes	Yes
Libya					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Country	Geodetic control points	Height datum	Geoid model	Aerial photography	Satellite imagery	DEM	Spot heights	Bathymetry	Coastline	Water bodies	Government boundaries	Populated places
Madagascar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Malawi	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Mali	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Mauritania	Yes	Yes		Yes	Yes	Yes		Yes		Yes	Yes	Yes
Mauritius	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Morocco				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mozambique				Yes	Yes	Yes		Yes		Yes	Yes	Yes
Namibia	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Niger				Yes	Yes	Yes				Yes	Yes	Yes
Nigeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sao Tome & Principe					Yes	Yes		Yes		Yes	Yes	Yes
Senegal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seychelles	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sierra Leone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Somalia	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
South Africa	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Sudan			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Swaziland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tanzania	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
The Gambia	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Togo	Yes	Yes		Yes	Yes	Yes		Yes		Yes	Yes	Yes
Tunisia				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Uganda	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
Western Sahara					Yes	Yes		Yes		Yes	Yes	Yes
Zambia					Yes	Yes				Yes	Yes	Yes
Zimbabwe	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes

Country	EA	Place names	Feature names	Land parcels	Land tenure	Street address	Postal code zones	Land use planning zones	Roads	Road centrelines	Railways	Airports
Algeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Angola		Yes	Yes						Yes		Yes	Yes
Benin		Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
Botswana		Yes	Yes						Yes		Yes	Yes
Burkina Faso	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Burundi		Yes	Yes						Yes		Yes	Yes
Cameroon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cape Verde		Yes	Yes						Yes		Yes	Yes
Central African Republic		Yes	Yes	Yes		Yes			Yes	Yes	Yes	Yes
Chad	Yes	Yes	Yes	Yes				Yes	Yes		Yes	Yes
Comoros		Yes	Yes						Yes	Yes	Yes	Yes
Congo		Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes
Congo, DRC	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
Cote d'Ivory		Yes	Yes						Yes	Yes	Yes	Yes
Djibouti		Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes
Egypt	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Equatorial Guinea		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
Eritrea		Yes	Yes						Yes		Yes	Yes
Ethiopia	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Gabon	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ghana	Yes	Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes
Guinea		Yes	Yes						Yes		Yes	Yes
Guinea-Bissau		Yes	Yes	Yes		Yes			Yes	Yes	Yes	Yes
Kenya	Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes
Lesotho	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Liberia		Yes	Yes						Yes		Yes	Yes
Libya	No	Yes	Yes						Yes		Yes	Yes

Country	EA	Place names	Feature names	Land parcels	Land tenure	Street address	Postal code zones	Land use planning zones	Roads	Road centrelines	Railways	Airports
Madagascar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Malawi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mali		Yes	Yes	Yes					Yes	Yes	Yes	Yes
Mauritania		Yes	Yes	Yes		Yes		Yes	Yes		Yes	Yes
Mauritius	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes
Morocco		Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
Mozambique		Yes	Yes	Yes	Yes				Yes		Yes	Yes
Namibia	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Niger		Yes	Yes			Yes			Yes	Yes	Yes	Yes
Nigeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Sao Tome & Principe	No	Yes	Yes						Yes		Yes	Yes
Senegal	No	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes
Seychelles	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Sierra Leone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Somalia		Yes	Yes						Yes		Yes	Yes
South Africa	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes
Sudan	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Swaziland	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Tanzania	No	Yes	Yes		Yes	Yes			Yes		Yes	Yes
The Gambia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Togo		Yes	Yes	Yes		Yes			Yes		Yes	Yes
Tunisia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Uganda		Yes	Yes	Yes	Yes				Yes	Yes	Yes	Yes
Western Sahara	No	Yes	Yes						Yes		Yes	Yes
Zambia		Yes	Yes						Yes		Yes	Yes
Zimbabwe	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Country	Bridges	Power	Telecomms	Land cover	Soils	Geology
Algeria	Yes	Yes	Yes	Yes	Yes	Yes
Angola						
Benin						
Botswana	Yes			Yes		
Burkina Faso	Yes			Yes	Yes	
Burundi				Yes		
Cameroon	Yes	Yes	Yes	Yes	Yes	Yes
Cape Verde				Yes		
Central African Republic	Yes	Yes	Yes	Yes	Yes	Yes
Chad	Yes			Yes	Yes	
Comoros						
Congo	Yes	Yes	Yes	Yes	Yes	Yes
Congo, DRC	Yes	Yes	Yes	Yes	Yes	Yes
Cote d'Ivory						
Djibouti					Yes	Yes
Egypt	Yes	Yes	Yes	Yes	Yes	Yes
Equatorial Guinea	Yes	Yes	Yes	Yes	Yes	Yes
Eritrea				Yes		
Ethiopia	Yes	Yes	Yes	Yes	Yes	Yes
Gabon	Yes	Yes	Yes	Yes	Yes	Yes
Ghana	Yes			Yes	Yes	Yes
Guinea						
Guinea-Bissau	Yes					
Kenya	Yes			Yes	Yes	Yes
Lesotho	Yes	Yes	Yes	Yes	Yes	Yes
Liberia						
Libya				Yes	Yes	Yes

Country	Bridges	Power	Telecomms	Land cover	Soils	Geology
Madagascar	Yes	Yes	Yes	Yes	Yes	Yes
Malawi	Yes	Yes	Yes	Yes	Yes	Yes
Mali	Yes	No		Yes	Yes	Yes
Mauritania				Yes		Yes
Mauritius						
Morocco				Yes	Yes	
Mozambique				Yes	Yes	Yes
Namibia	Yes	Yes	Yes	Yes	Yes	Yes
Niger	Yes	Yes		Yes	Yes	
Nigeria	Yes	Yes	Yes	Yes	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes	Yes	Yes
Sao Tome & Principe						
Senegal				Yes	Yes	Yes
Seychelles	Yes	Yes	Yes		Yes	Yes
Sierra Leone	Yes	Yes	Yes	Yes	Yes	Yes
Somalia				Yes	Yes	Yes
South Africa		Yes	Yes	Yes	Yes	Yes
Sudan	Yes	Yes	Yes	Yes	Yes	Yes
Swaziland	Yes	Yes	Yes	Yes	Yes	Yes
Tanzania		Yes		Yes		
The Gambia	Yes	Yes	Yes	Yes	Yes	Yes
Togo	Yes	Yes		Yes	Yes	Yes
Tunisia	Yes	Yes	Yes	Yes	Yes	Yes
Uganda	Yes			Yes		Yes
Western Sahara						
Zambia						
Zimbabwe	Yes	Yes	Yes	Yes	Yes	Yes

3.1.2 Height datum

Fifty eight percent of countries indicated that they have height datum datasets. This data refers to a list of primary height points in digital map/GIS form (vertical datum surface).

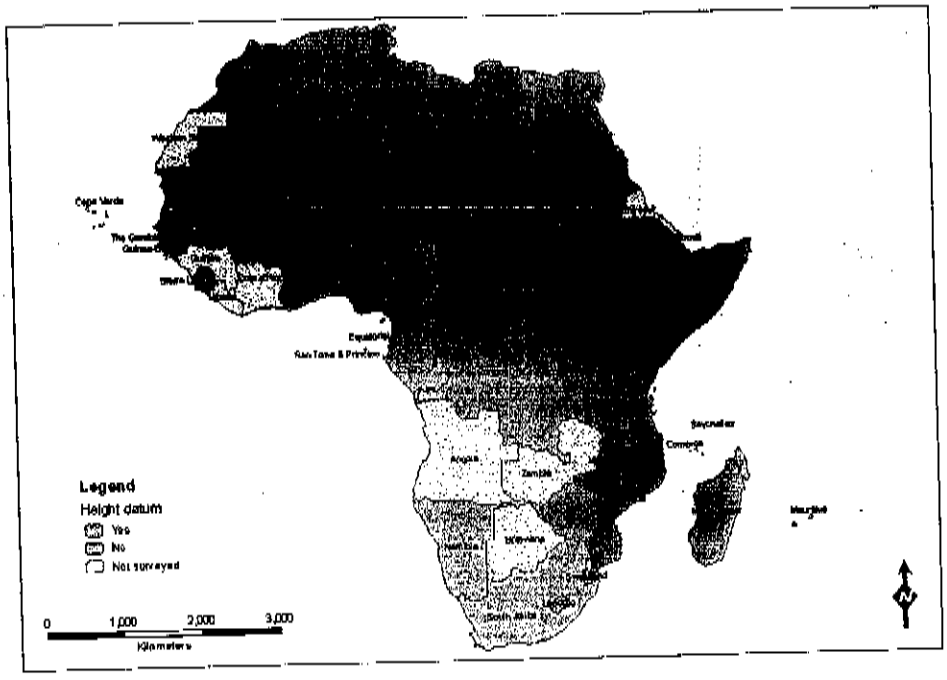

Figure 3.2: Distribution of height datum datasets

Countries across the northern part of the continent don't have height datum datasets. This band stretches from Somalia in the east to Tunisia in the north. In southern Africa it was mostly the countries that were not surveyed which did not have height datum datasets.

Table 3.3: Summary of height datum datasets per region

Region	% Countries
Central Africa	60
East Africa	58
North Africa	33
Southern Africa	64
West Africa (E)	60
West Africa (F)	60

The overall regional percentages for height datum datasets tend to be low with no region having more than 64% of its countries with this dataset. The North African region has the lowest percentage of countries with height datum datasets.

3.1.3: Geoid model

This data refers to geoid-ellipsoid separations (heights at individual points) to convert from GPS observations to heights. A very low 37% of countries indicated they had geoid model datasets.

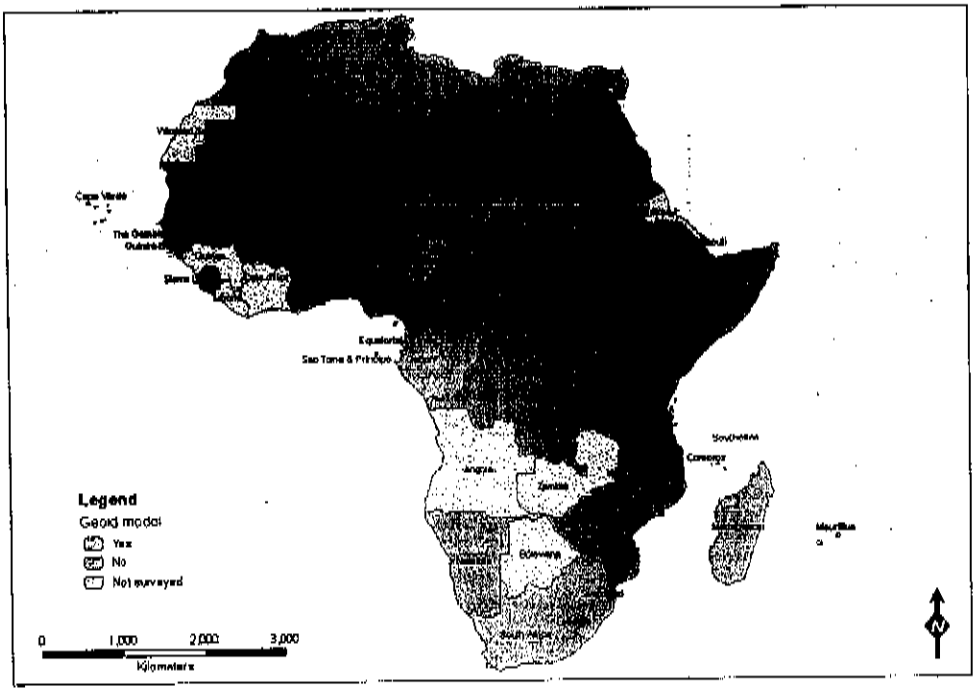

Figure 3.3: Distribution of geoid model datasets

It is clear from Figure 3.3 that there is a lack of geoid model datasets on the continent. Few countries have such a dataset and these countries are distributed all over the continent. Very few francophone countries seem to have such data.

Table 3.4: Summary of geoid model datasets per region

Region	% Countries
Central Africa	40
East Africa	33
North Africa	50
Southern Africa	46
West Africa (E)	40
West Africa (F)	20

The regional count for geoid model datasets are very low with the North African region accounting for 50% of its countries having this dataset. In French-speaking West Africa the count is as low as 20%.

3.1.4 Aerial photography

By far the majority of countries (74%) have datasets on aerial photography. Most of these datasets can be traced to international agencies.

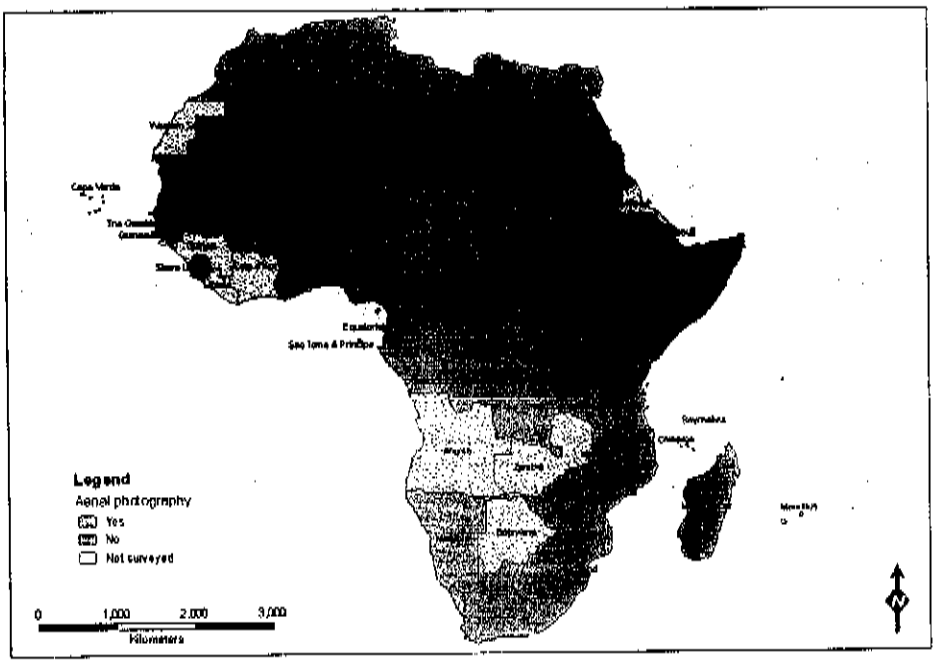

Figure 3.4: Distribution of aerial photography datasets

Many of the countries with no aerial photography datasets were also not part of the survey. In general, the continent is well covered in terms of this dataset.

Table 3.5: Summary of aerial photography datasets per region

Region	% Countries
Central Africa	100
East Africa	67
North Africa	83
Southern Africa	73
West Africa (E)	60
West Africa (F)	80

The East African region has the lowest regional percentage of this dataset while Central Africa has a 100% coverage.

3.1.5 Satellite imagery

All countries in Africa are covered by satellite imagery. This is based on the fact that many international agencies have satellite imagery for the continent. The regional distribution of this dataset is therefore equal. Since all countries are covered, no map was reproduced to indicate the distribution of this dataset.

3.1.6 Digital elevation model

This dataset is also to be found in all countries in the continent. DEM refers to the vertical distance from the earth's surface to a base defined by the adopted height datum. The accuracy and completeness of such data will be discussed in the gap analysis section. The

regional distribution for digital elevation model (DEM) datasets on the continent is therefore also equal.

3.1.7 Spot heights

Fifty nine percent of countries have spot height datasets. Spot heights refer to the heights of peaks. In the map it can be seen that many of the countries who don't have spot heights data are situated in the central Sahara area of the continent. A few countries in the south don't have spot height data together with some francophone west African countries.

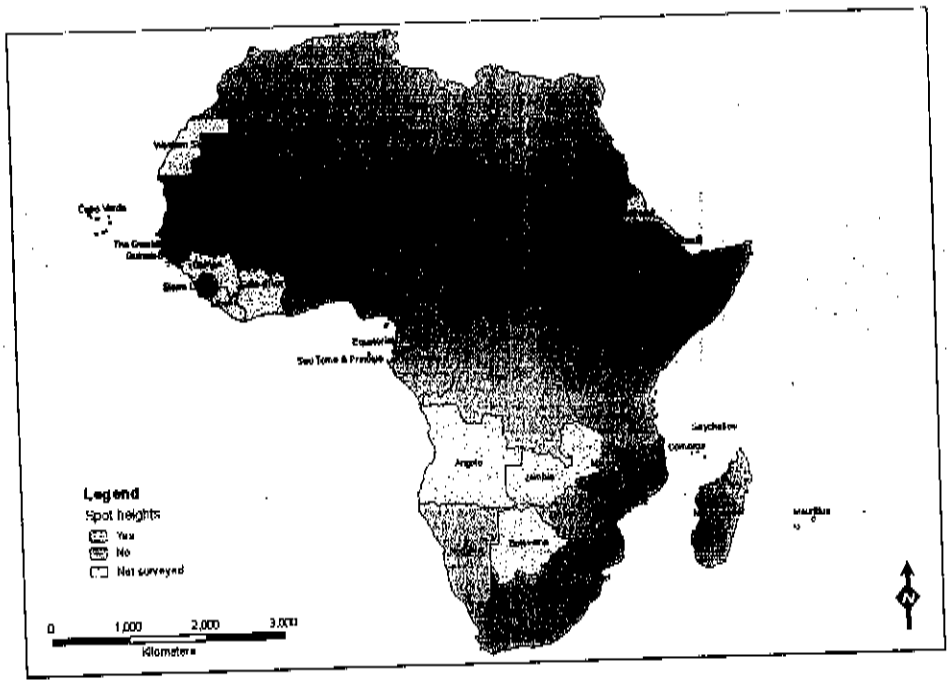

Figure 3.5: Distribution of spot height datasets

Table 3.6: Summary of spot height datasets per region

Region	% Countries
Central Africa	80
East Africa	58
North Africa	100
Southern Africa	55
West Africa (E)	60
West Africa (F)	30

In comparison to other fundamental datasets, North Africa has a 100% coverage for spot height data. As with many other dataset French-speaking West Africa has a low coverage for this dataset.

3.1.8 Bathymetry

Bathymetry datasets are mostly in the hands of international agencies. This dataset is only applicable to countries which have a coastline and refers to the vertical distance of earth's

surface from base defined by Lowest Astronomical Tide. A 100% of those countries with a coastline have bathymetry data. There are 10 landlocked countries on the continent which would therefore not have any bathymetry data.

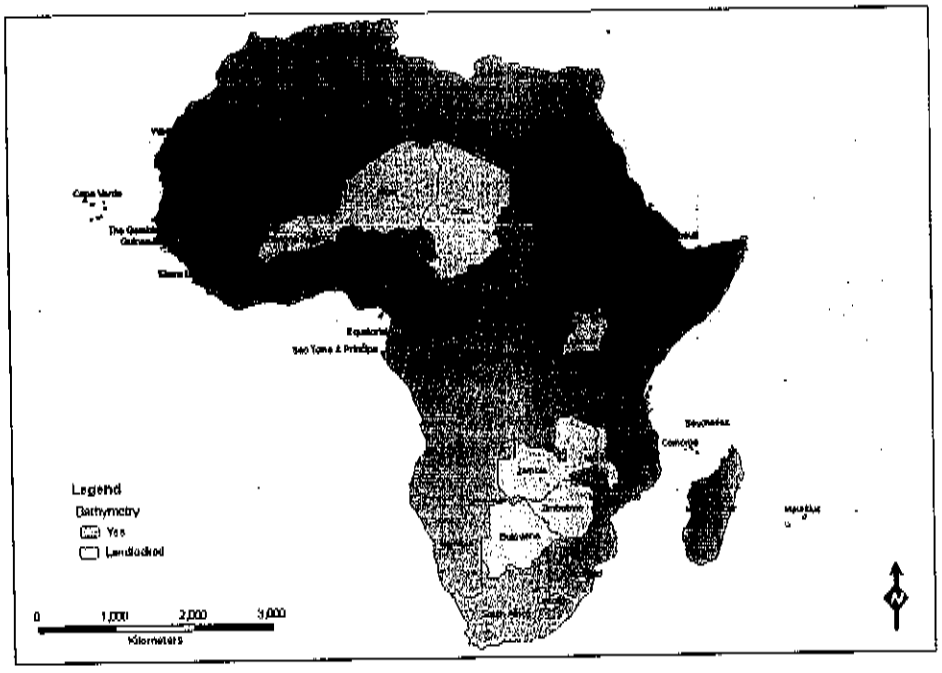

Figure 3.6: Distribution of bathymetry datasets

The countries on the map which don't have bathymetry data ("landlocked") are those which are landlocked and therefore would not have bathymetry data. Some countries indicated they have bathymetry data (e.g. Mali, Central African Republic, Rwanda and Burundi) although they don't have a coastline. This situation indicates an over-supply of data.

3.1.9 Coastline

Thirty percent of countries with coastlines do not have coastline data. The majority of countries (70%) do however have this data while the 10 landlocked countries do not. This dataset refers to the limit of land features usually at mean high water level.

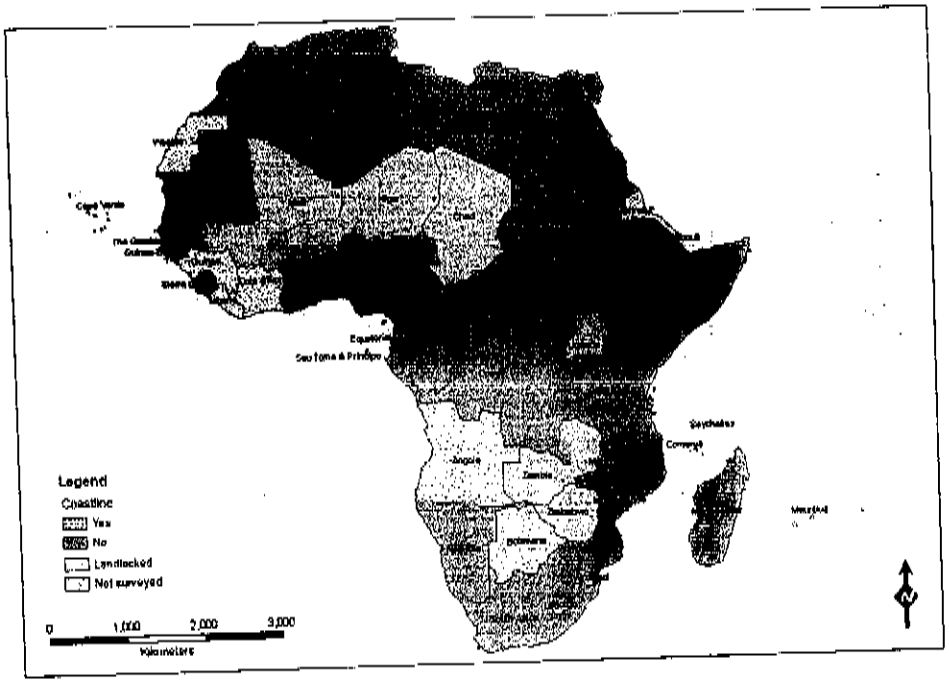

Figure 3.7: Distribution of coastline datasets

Countries who partook in the survey and do not have coastline data are Mozambique, Togo, Benin and Mauritania. A number of countries with shorelines were not surveyed and therefore one does not know whether they have coastline data or not.

Table 3.7: Summary of coastline datasets per region

Region	% of Coastal countries
Central Africa	100
East Africa	66
North Africa	100
Southern Africa	60
West Africa (E)	50
West Africa (F)	57

The regional perspective on the availability of this dataset is quite varied. The coastal countries of Central and Eastern Africa have a 100% coverage while the coverage in the other regions are just above average – between 50-66%.

3.1.10 Natural water bodies

This dataset refers to the location of watercourses, drainage networks and all inland water bodies (streams, rivers, canals, ponds, lakes, etc.). A 100% of all the countries in Africa have this geo-spatial dataset and the coverage is therefore complete.

3.1.11 Government/Administrative boundaries

The coverage for this dataset is 98% of all the countries. The countries for which the dataset do not exist are Comoros and Mauritius. This dataset refers to limits of administrative and jurisdictional authority.

3.1.12 Populated places

The geo-spatial dataset on populated places includes population centres like urban areas, towns, localities and rural settlements. A 100% of countries in Africa have this dataset.

3.1.13 Enumeration Areas

This dataset is seemingly very scarce since only 43% of all countries have Enumeration Area (EA) datasets. The EA geo-spatial dataset refers to boundaries of areas delineated for the purpose of collecting demographic census information.

From the map it can be seen that many countries in northwest Africa do not have this dataset. The same applies to a band of countries in the eastern part of the continent and some central African countries.

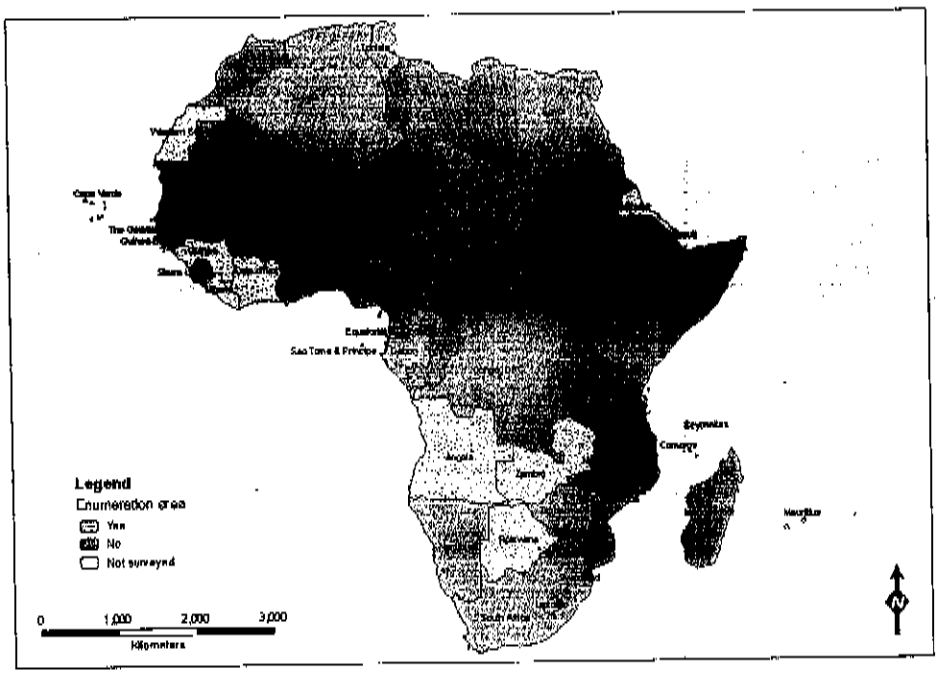

Figure 3.8: Distribution of enumeration area datasets

Table 3.8 Summary of EA datasets per region

Region	% Countries
Central Africa	40
East Africa	33
North Africa	67
Southern Africa	64
West Africa (E)	40
West Africa (F)	20

North and Southern Africa are the best off regions while the remainder of the regions all have a below 50% coverage.

3.1.14 Place names

Ninety eight percent of all countries have a geo-spatial dataset on place names. The only country without such a data set is Comoros. This dataset focuses on the official and local names of places.

3.1.15 Feature names

A dataset on feature names would include official and local names of cultural and geographic features (including roads). This geo-spatial dataset was represented in 100% of all the African countries.

3.1.16 Land parcel/ Cadastre

Only 65% of countries indicated that they have this dataset. This dataset is defined as "a consistent framework of land parcel/cadastre boundaries defined for land tenure purposes, referenced to a common datum".

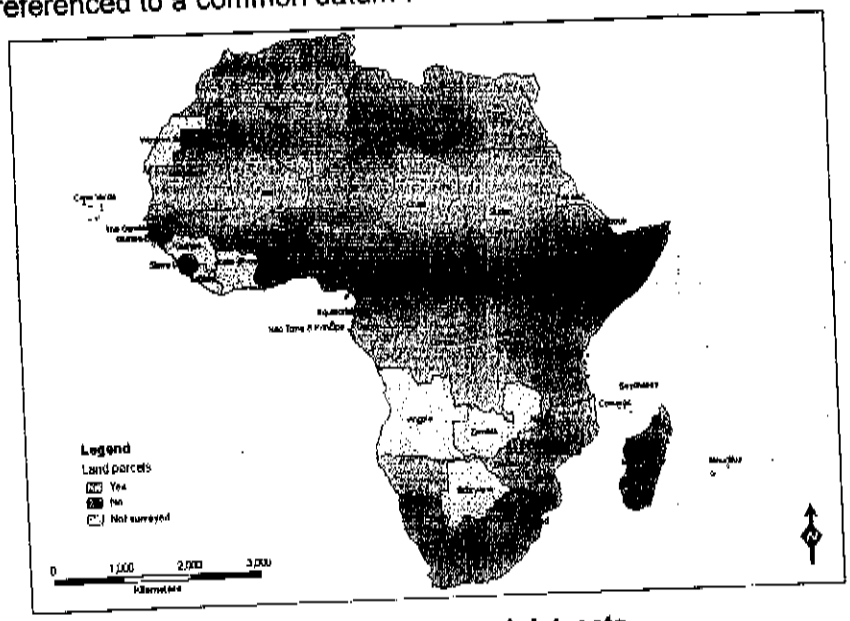

Figure 3.9: Distribution of land parcel datasets

A few countries in eastern and western Africa indicated this data does not exist. In the central north of the continent Libya and Niger does not have this data either.

Table 3.9: Summary of land parcel datasets per region

Region	% Countries
Central Africa	100
East Africa	42
North Africa	83
Southern Africa	73
West Africa (E)	70
West Africa (F)	50

The countries in the Central African region all have this dataset. East African countries with a 42% coverage seem to be the worst off in terms of land parcel data.

3.1.17 Land tenure

Land tenure refers to current, proposed and historical details of all tenures, e.g. details of ownership, vesting and including traditional forms of land holding. Only 38% of all countries on the continent have such a geo-spatial dataset. There are also no international agencies with such data for the whole continent.

As can be seen from the map, few countries have this dataset. These countries are located on the eastern side of the continent and stretches from Swaziland to Egypt, with groupings in the west, northwest and west coast.

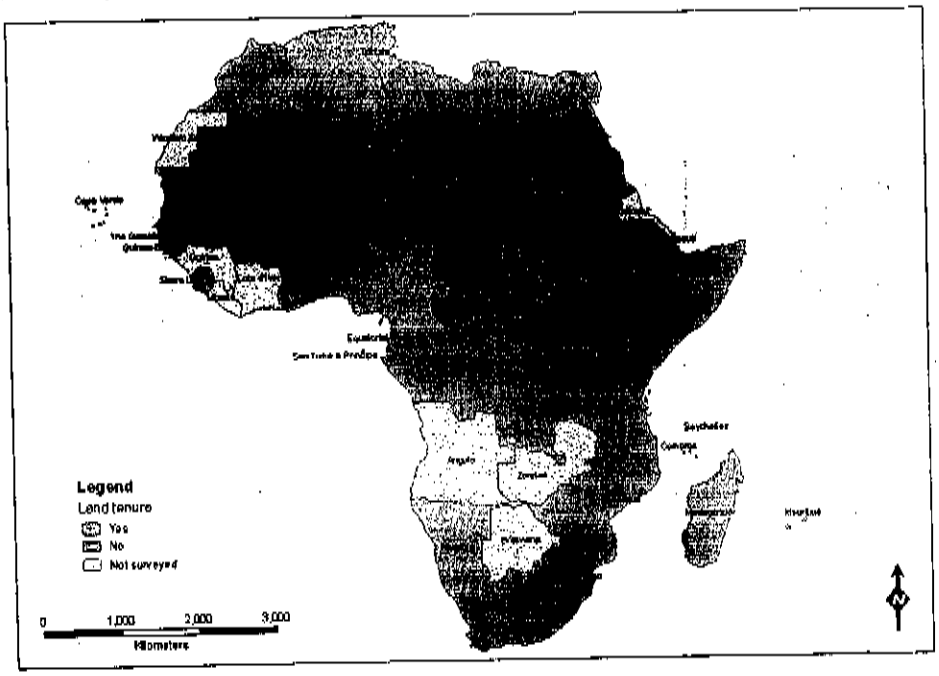

Figure 3.10: Distribution of land tenure datasets

Table 3.10: Summary of land tenure datasets per region

Region	% Countries
Central Africa	0
East Africa	42
North Africa	67
Southern Africa	64
West Africa (E)	30
West Africa (F)	20

The only two regions with more than 50% of the countries having this dataset are North and Southern Africa. The remainder of the regions all have a coverage of less than 50% of countries. Central Africa is the worst off with no countries at all having such a land tenure dataset.

3.1.18 Street addresses

Forty six percent of all countries indicated that they have such a dataset. This dataset refers to unique street addresses of parcels or properties. No international agencies hold such datasets either and given the fact that it usually requires intensive labour to collect or create such datasets can understand the lack of it.

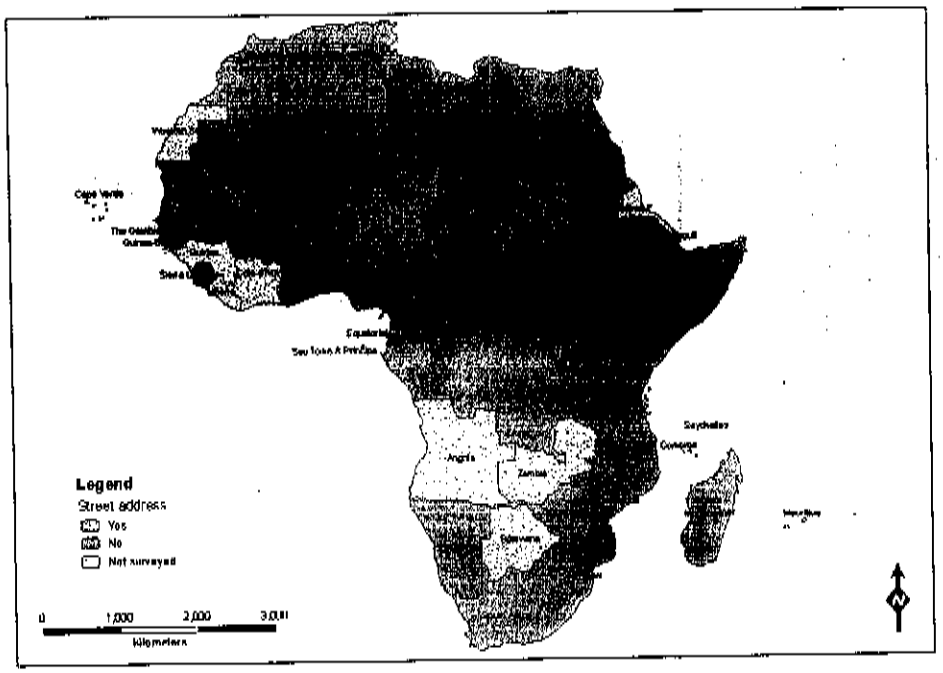

Figure 3.11: Distribution of street address datasets

A block of countries in eastern Africa do not have street address data. In north Africa Libya and Chad do not have this data, while in francophone Western Africa Mali and Ghana do not have it either.

Table 3.11: Summary of street address datasets per region

Region	% Countries
Central Africa	60
East Africa	17
North Africa	83
Southern Africa	36
West Africa (E)	60
West Africa (F)	50

North Africa is the only region with a significant percentage of countries having street address datasets. Central and West African regions are around a 50% coverage while Southern and East Africa are very poorly off in terms of street address datasets.

3.1.19 Postal or zip code zones

This dataset is very poorly covered, because only 30% of all countries indicated that they have such a geo-spatial dataset. This dataset includes boundaries of post code areas.

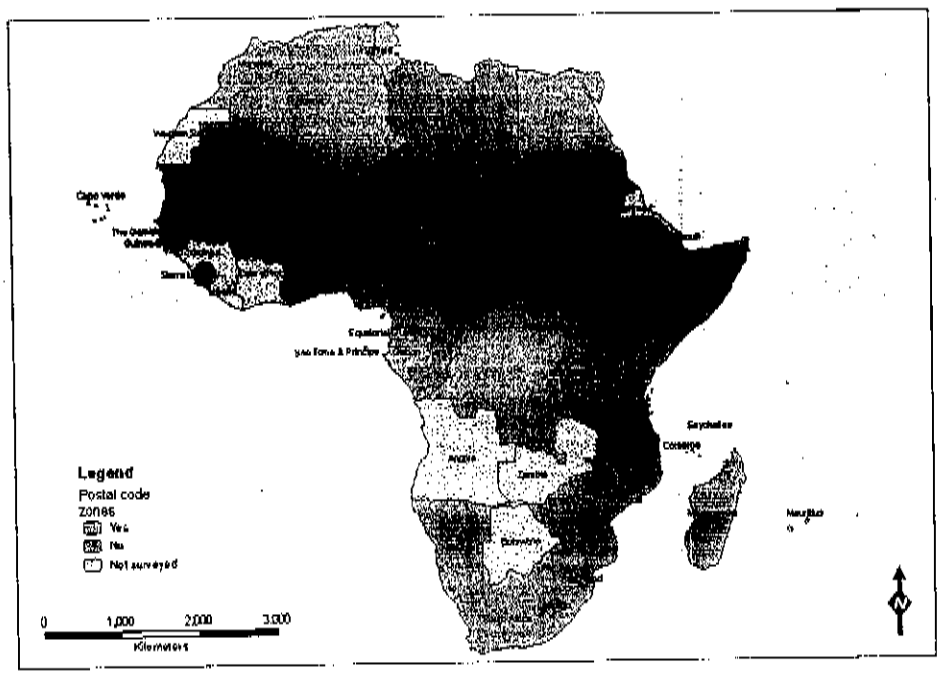

Figure 3.12: Distribution of postal code datasets

Very few countries have this data as can be seen from the map. In Southern Africa only Malawi and Madagascar have such a dataset while in East Africa Ethiopia have such data. The region with the highest count of countries with such a dataset is anglophone West Africa with 5.

Table 3.12: Summary of postal code datasets per region

Region	% Countries
Central Africa	60
East Africa	8
North Africa	67
Southern Africa	18
West Africa (E)	50
West Africa (F)	10

The two best off regions are North and Central Africa. The French-speaking West Africa and East Africa regions are worst off and reflect percentages of lower than 11%.

3.1.20 Land use planning zones

This dataset refers to boundaries of areas of permitted/restricted land use defined by planning authorities (and includes conservation areas, heritage sites and restricted areas). Fifty seven percent of countries indicated that they have this dataset.

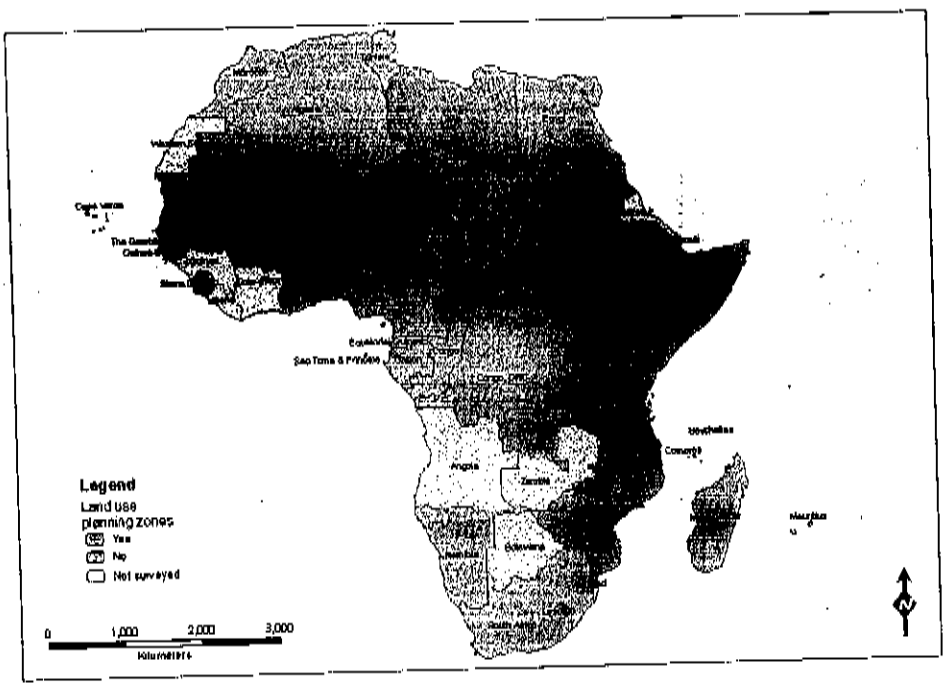

Figure 3.13: Distribution of land use planning zones datasets

Countries on the eastern part of the continent not have this dataset. In the south of the continent countries like Mozambique do not have the data. A band of countries from Libya in the north to Guinea Bissau in the southwest do not have the data either.

Table 3.13: Summary of land use planning datasets per region

Region	% Countries
Central Africa	80
East Africa	42
North Africa	83
Southern Africa	64
West Africa (E)	60
West Africa (F)	40

Sahelian (French-speaking) West Africa has the lowest percentage of countries with this dataset. Central and Northern Africa are best off with 80% and more countries having access to this data.

3.1.21 Roads

Due to the coverage of international agencies, all countries in Africa have access to data on roads. It is can therefore be regarded as one of the building blocks of geo-spatial data in Africa together with other data set off 100% coverage. This dataset refers to the network of physical roads and carriageways.

3.1.22 Road centrelines

In comparison to roads, only 56% of countries have spatial data on road centrelines. Such datasets should contain the centrelines of roads and carriageways.

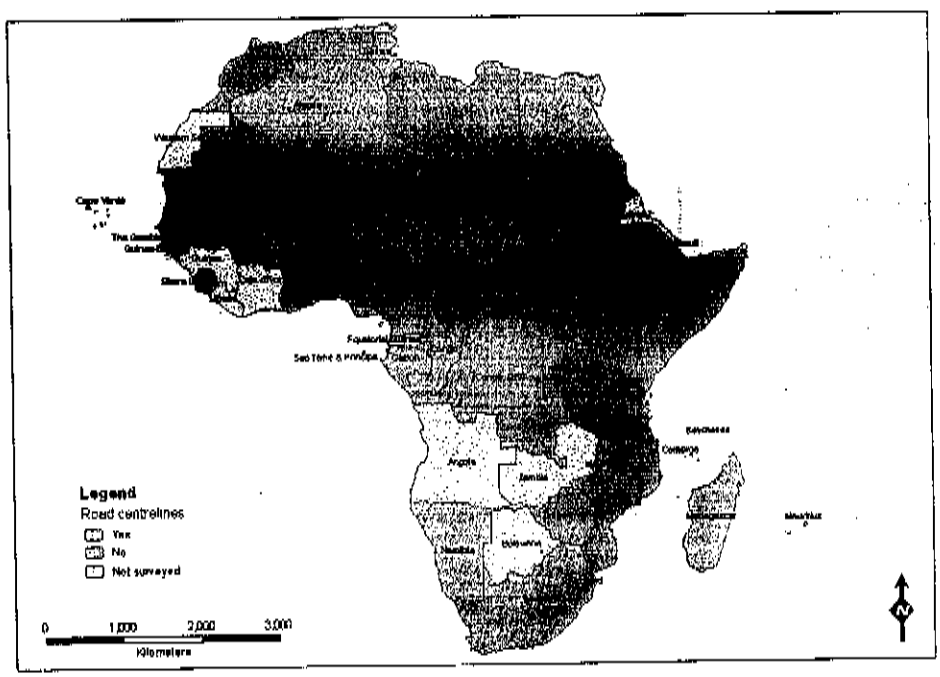

Figure 3.14: Distribution of road centrelines datasets

Many countries on the west coast of Africa lack this dataset. In southern Africa it is the countries of Mauritius and Mozambique which are lacking in data on road centrelines. Central African Republic and Libya don't have this data either.

Table 3.14: Summary of road centreline datasets per region

Region	% Countries
Central Africa	80
East Africa	50
North Africa	67
Southern Africa	64
West Africa (E)	50
West Africa (F)	40

The Central African region is the best of in terms of road centreline datasets since 80% of the countries in that region have such data. Most of the other regions have a fair to low coverage with percentages ranging from 40-67%.

3.1.23 Railways

This data refers to the network of railway lines and due to international data sources all countries in Africa have railways data.

3.1.24 Airports and ports

The same applies for airports and ports where 100% of African countries have this dataset. The dataset refers to the location of airports, sea ports and navigation aids.

3.1.25 Bridges and tunnels

Fifty seven percent of countries have such a data set. This data includes bridges which are structures built to carry a road, path, railway, etc. across a gorge, valley, road, railway, river, body of water or any other physical obstacle. Tunnels are artificial underground passages through a hill or under a road or river etc., especially for railways or roads to pass through.

Due to coverage by international agencies, many countries have data on bridges and tunnels. On the west coast of the continent most countries either do not have this dataset or were not surveyed. Libya in the northern part is also lacking in having data on bridges. Along the horn of Africa and the east coast, most countries do not have this dataset. The central part of the continent is well covered.

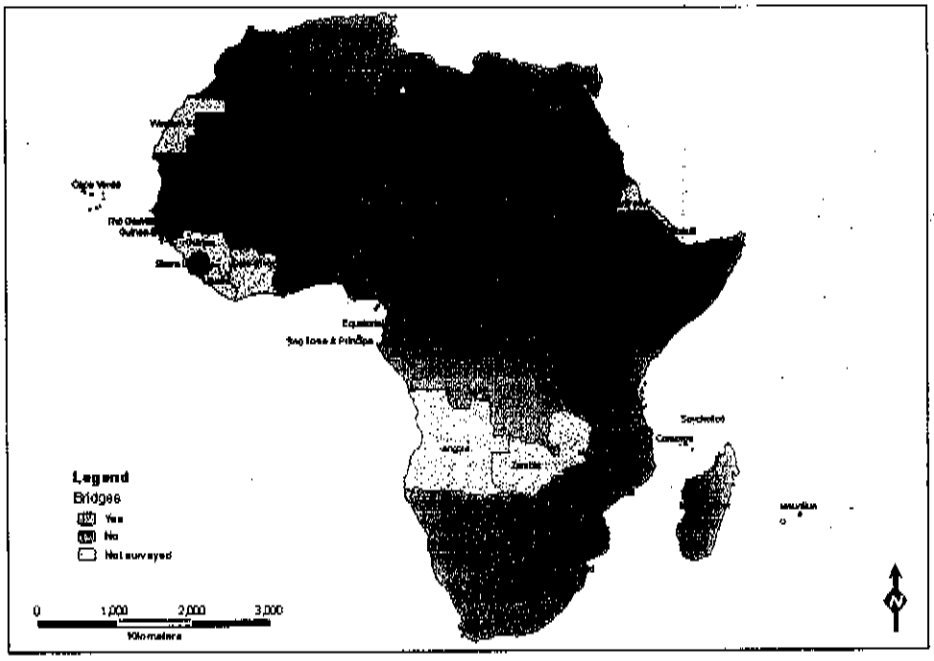

Figure 3.15: Distribution of bridges and tunnels datasets

Table 3.15: Summary of bridges and tunnels datasets per region

Region	% Countries
Central Africa	100
East Africa	42
North Africa	67
Southern Africa	64
West Africa (E)	60
West Africa (F)	40

East and West Africa (francophone) are worst off in terms of this dataset. Central Africa is the best off with a 100% coverage.

3.1.26 Power infrastructure

This dataset refers to the locations of trunk or national grid power line networks and major assets/installations and sources. Only 48% of countries indicated having this spatial dataset. This is a below average coverage.

The western part of the continent, with the exception of Togo and The Gambia, does not have geo-spatial datasets on power infrastructure. Libya and Chad do not have the dataset while in the eastern part of the continent the horn of Africa, Kenya, Somalia and Uganda are lacking power infrastructure data.

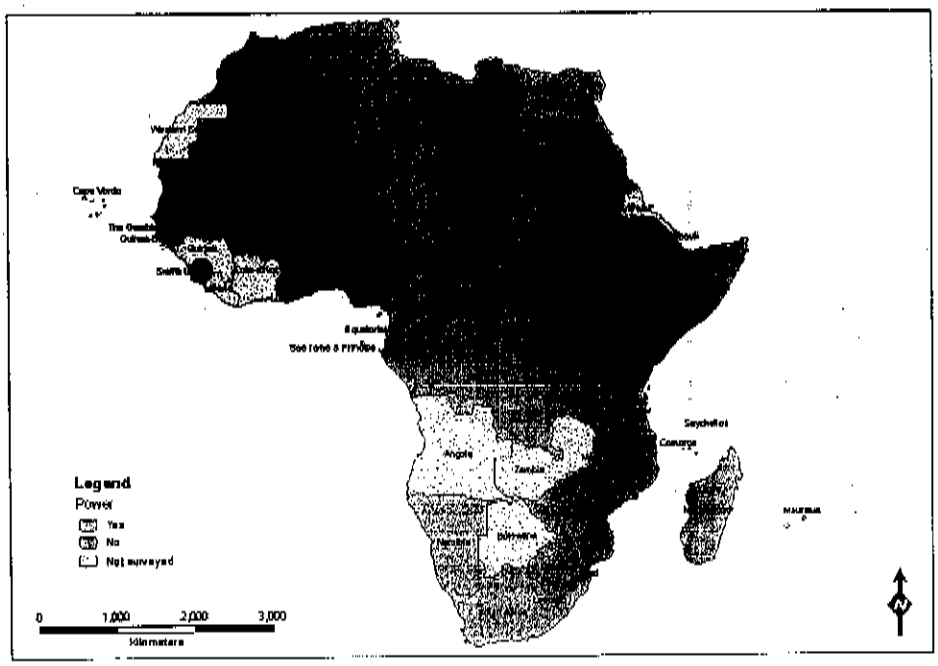

Figure 3.16: Distribution of power infrastructure datasets

In the south countries like Mozambique and Mauritius are lacking power infrastructure data.

Table 3.16: Summary of power infrastructure datasets per region

Region	% Countries
Central Africa	100
East Africa	33
North Africa	67
Southern Africa	64
West Africa (E)	40
West Africa (F)	20

The regional distribution of this dataset is quite marked and ranges between 20-100%. The Central African region is best off with a 100% coverage. North and Southern Africa are just above average in terms of coverage, while East and West Africa are worst off with percentages of 40% and below.

3.1.27 Telecommunications

This spatial data refers to locations of trunk communication networks and major assets. Only 43% of countries have such a dataset. In many instances the telecommunications industry is in the hands of private companies and the existence of such data is seen as providing confidential data to potential opposition parties.

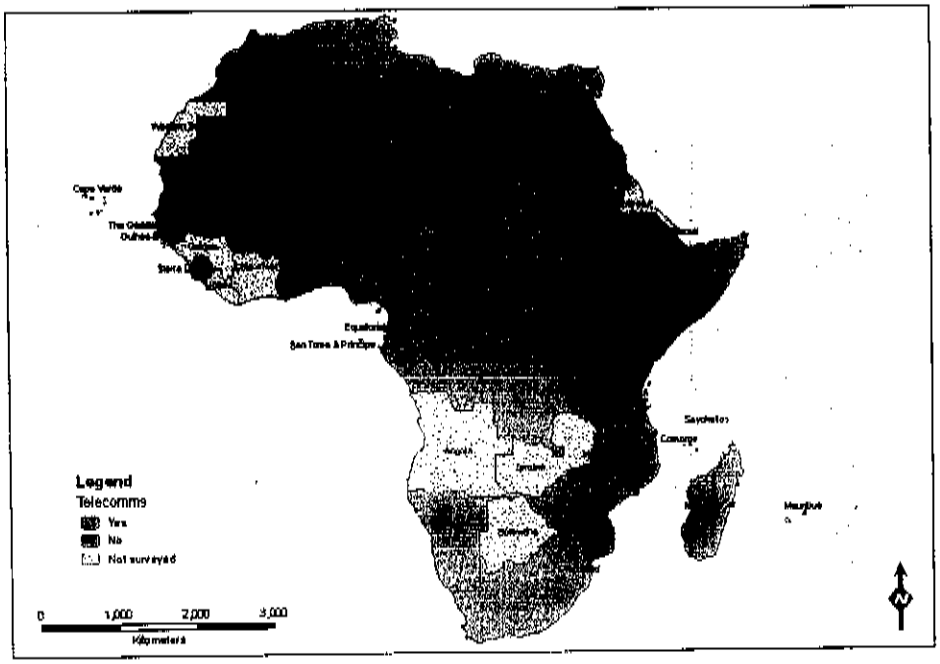

Figure 3.17: Distribution of telecommunication datasets

With the exception of The Gambia and Sierra Leone, none of the west African countries have this data set. In the north Libya and Morocco are lacking telecommunication data while in the east most countries are lacking as well.

Table 3.17: Summary of telecommunications datasets per region

Region	% Countries
Central Africa	100
East Africa	25
North Africa	67
Southern Africa	64
West Africa (E)	30
West Africa (F)	10

The regional distribution of telecommunication datasets is quite varied ranging between 10-100%. francophone West African is the worst off while Central Africa is the best off. North and Southern Africa are in the middle ranges.

3.1.28 Land cover

This data refers to the observed bio-physical cover over on the earth's surface. Although many international agencies have such data, it does not extend to the whole continent. By far the majority (76%) of countries have such a dataset.

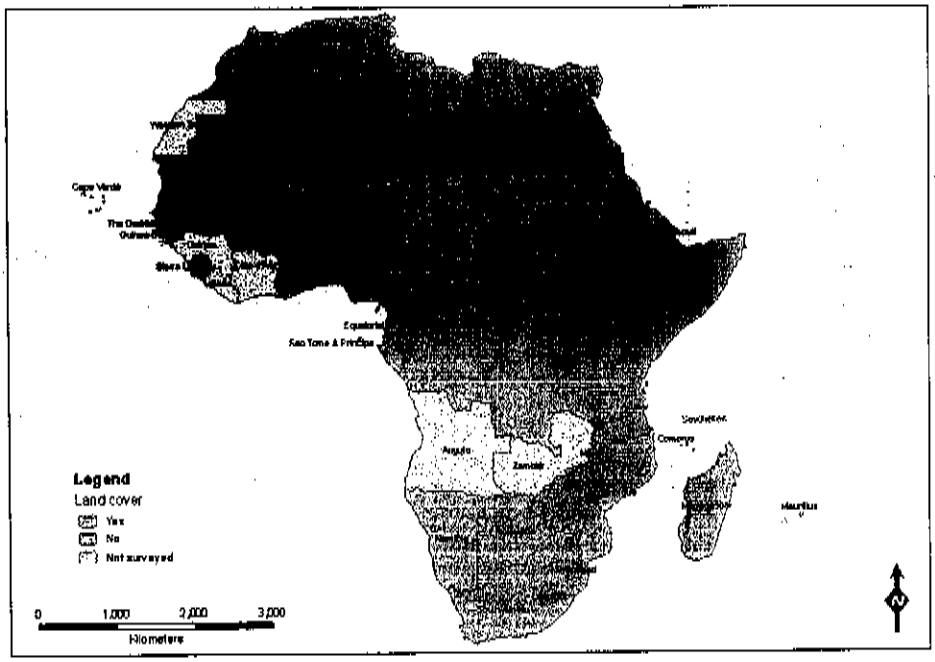

Figure 3.18: Distribution of land cover datasets

The few countries that do not have this data are: Djibouti, Benin, Guinea-Bissau, Mauritius and Seychelles.

Table 3.18: Summary of land cover datasets per region

Region	% Countries
Central Africa	100
East Africa	67
North Africa	100
Southern Africa	82
West Africa (E)	60
West Africa (F)	70

In all regions more than 60% of countries have a dataset on land cover. Central and North Africa both have 100% of the countries with such a dataset.

3.1.29 Soils

This geo-spatial dataset encompasses the boundaries and classifications of soil resources. A total of 67% of African countries have such a dataset.

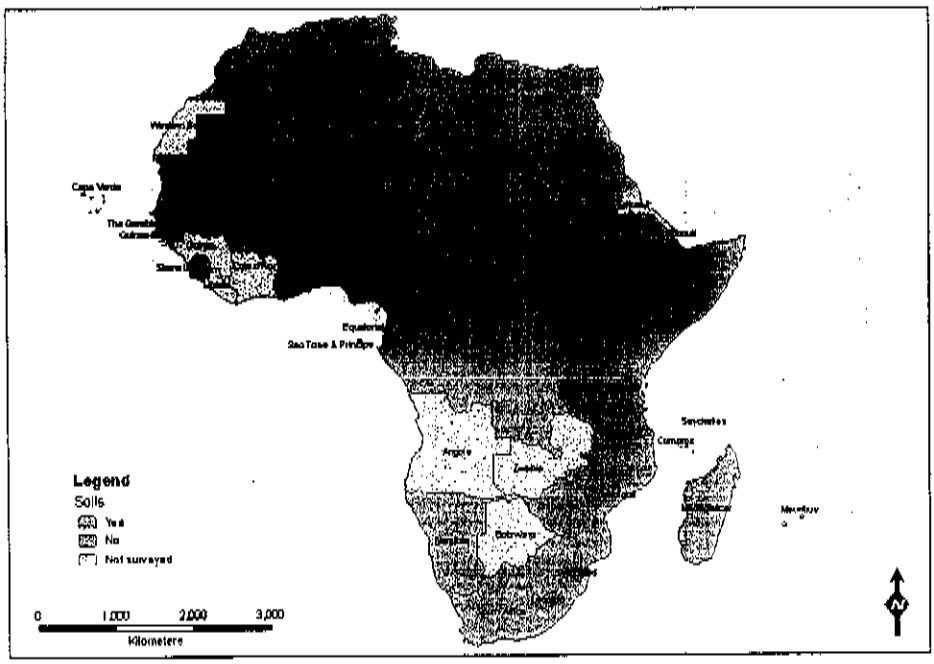

Figure 3.19: Distribution of soil datasets

In the southern part of Africa, Angola, Zambia and Botswana were not surveyed. In East Africa Tanzania and Uganda does not have soil datasets. In West Africa four countries do not have this dataset.

Table 3.19: Summary of soil datasets per region

Region	% Countries
Central Africa	100
East Africa	50
North Africa	100
Southern Africa	73
West Africa (E)	60
West Africa (F)	50

The range between the regions on the continent is smaller than for other datasets. Central and Northern Africa are the best off in terms of soil data. East and West (French-speaking) Africa are the worst off.

3.1.30 Geology

The last dataset on which countries had to complete questions was geology. This data refers to boundaries and classification of geological units. Sixty three percent of countries had such datasets.

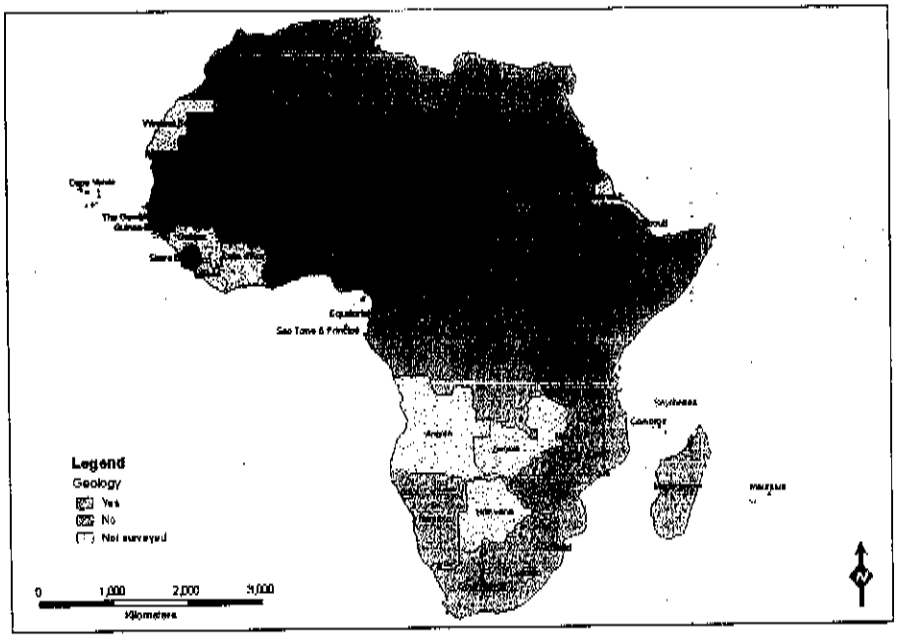

Figure 3.20: Distribution of geology datasets

In francophone West Africa few countries have geology data. Countries in central Africa are well represented in terms of geological spatial data. In southern Africa all countries have this data set.

Table 3.20: Summary of geology datasets per region

Region	% Countries
Central Africa	100
East Africa	58
North Africa	83
Southern Africa	73
West Africa (E)	50
West Africa (F)	40

Central Africa has the highest coverage of this dataset with 100% of its countries having such a set. French-speaking West Africa is the lowest with 40%.

In conclusion, datasets with a 100% coverage are those where lack of country datasets were supplemented by international datasets. Fundamental geo-spatial datasets with a 100% coverage on the continent are:

- roads
- bathymetry
- satellite imagery
- airports & ports
- DEM
- natural water bodies.

The above datasets can be used as the building blocks for establishing further geo-spatial data on the continent.

The fundamental geo-spatial datasets with the worst coverage is postal codes (30%). Other datasets for which the coverage was below 40% were geoid model (37%) and land tenure (38%). The best off regions in terms of individual geo-spatial datasets seem to be Central and North Africa with high percentages for most datasets. The worst off regions are East and French-speaking West Africa.

Table 3.21: Summary of continental data representation

Dataset	% Representation
Aerial photography	74
Airports & Ports	100
Bathymetry	100
Bridges & Tunnels	57
Coastline	70
DEM	100
Enumeration Area	43
Feature names	100
Geodetic control points	59
Geoid model	37
Geology	63
Government boundaries	96
Height datum	57
Land cover	76
Land parcels	65
Land tenure	39
Land use planning zones	57
Natural water bodies	100
Place names	98
Populated places	100
Postal code zones	30
Power	48
Railways	100
Road centrelines	56
Roads	100
Satellite imagery	100
Soils	67
Spot heights	59
Street address	46
Telecomms	43

In conclusion about the availability of data, the survey results might create the impression that many geo-spatial datasets may exist completely for the continent. From knowledge at the ground level our team know that this is not always the case. As indicated previously, many countries were very well surveyed and this means that there will be a higher likelihood of various datasets being indicated for that country. What might therefore seem like an adequate representation of data, will have to be verified by more detailed investigation about the quality of the data. This will be done in further sections of this chapter.

3.2 Levels of fundamental data

In the previous study various levels of the fundamental geo-spatial datasets were identified. In this section the availability of datasets will be analysed by fundamental level (Table 3.22 and 3.23). The first level (Level 0) includes geodetic control points, height datum and geoid model.

Table 3.22: List of levels and fundamental geo-spatial datasets

Level	Category	Data Theme	Data Set
0	Primary Reference	Geodetic Control Network	Geodetic control points
			Height datum
			Geoid model
I	Base geography	Rectified Imagery	Aerial photography
			Satellite imagery
		Hypsography	Digital elevation model
			Spot heights
			Bathymetry
		Hydrography	Coastline
			Natural water bodies
II	Administration and spatial organisation	Boundaries	Governmental units
			Populated places
			Enumeration areas
		Geographic names	Place Names
			Feature Names
		[Land management units/areas]	Land Parcels/Cadastre
			Land Tenure
			Street Address
			Postal or zip code zones
			Land use planning zones
	Infrastructure	Transportation	Roads
			Road centrelines
			Railways
			Airports and ports
		Structures	[Bridges and tunnels]
		Utilities and services	Power

Level	Category	Data Theme	Data Set
			Telecommunications
III	Environmental Information	Natural environment	Land cover
			Soils
			Geology

The survey results for the four levels of data indicate markedly different values. On average 51% of the countries have data for Level 0. Level 0 is considered the primary requirement for setting-up a geo-information structure in a country.

Level I, which forms the base geography (on which other geo-information can be built), is present in 86% of African countries. This is the highest score of comparing all levels.

Level II data is represented in 65% of African countries. This data is organised around the sub-levels of infrastructure and spatial organisation in a country.

Table 3.23: Realisation of levels by geo-spatial datasets

Level	Category	Data Set	% Countries
0	Primary Reference	Geodetic control points	58
		Height datum	58
		Geoid model	36
		Average for Level 0	***51***
I	Base geography	Aerial photography	75
		Satellite imagery	100
		Digital elevation model	100
		Spot heights	60
		Bathymetry	100
		Coastline	70
		Natural water bodies	100
		Average for Level I	***86***
II	Administration and spatial organisation	Governmental units	96
		Populated places	69
		Enumeration areas	42
		Place Names	98
		Feature Names	69
		Land Parcels/Cadastre	64
		Land Tenure	38
		Street Address	45
		Postal or zip code zones	29
		Land use planning zones	56
	Infrastructure	Roads	100
		Road centrelines	56

Level	Category	Data Set	% Countries
		Railways	100
		Airports and ports	100
		[Bridges and tunnels]	58
		Power	47
		Telecommunications	44
		Average for Level II	***65***
III	Environmental Information	Land cover	76
		Soils	67
		Geology	64
		Average for Level III	***69***

The average percentage of countries that have Level III data is 69%. Level I is the only level for which the percentage of countries is above 80%. For all other levels, the number of countries having these datasets are below 70%.

3.3 Land cover: Southern Africa

The land cover component of the project focused on obtaining information about land cover, its availability and potential sources for Southern Africa. The final report for this part of the study is available as a separate report.

3.4 Gap analysis

Section 3.1 focused on the basic gap analysis, while this section will focus on the intermediate and oversupply analysis. In terms of the intermediate gap analysis focus will be given on scale availability, quality, completeness of spatial coverage, data format and data accessibility. The oversupply of data will also be discussed in the final instance.

Table 3.24: Gap analysis of geo-spatial datasets

Level of gap analysis	Components
Basic	Dataset
	Country
Intermediate	Scale availability
	Quality
	Completeness of spatial coverage
	Data format
	Data accessibility
Oversupply	

3.4.1 Scale availability

For the Primary Reference (Level 0) of the fundamental data sets, the benchmark is data up to the scale of 1:50 000. This means that options a) or b) in Question 3-01 to 3-03 is acceptable for Level 0 data.

In terms of geodetic control points the following was found. Forty five percent of datasets conform to the required scale of up to 1:50 000 while for height datum the comparative figure was 53%. The majority of these dataset is therefore not available at a useful scale.

The Base Geography (Level 1) is derived from the more detailed primary reference layer, but in turn it is used as base for further derived data and therefore the benchmark scale for data is up to 50 000. In the case of imagery a 50 000 scale-equivalent source should be used.

The findings for base geography indicated the following scale availability. The percentage column indicates the percentage of datasets which was available at the applicable scale (i.e. up to 50 000).

Table 3.25: Scale availability for Base Geography

Dataset	% Datasets
Aerial photography	100
Satellite imagery	86
Digital elevation model	43
Spot heights	55
Bathymetry	54
Coastline	49
Natural water bodies	45

Table 3.25 indicates that of the existing aerial photography and satellite imagery datasets for Africa, respectively 100% and 86% are at a scale which is useful as base for further derived data. (Care should be taken to remember that these percentages refer to those data for which information was received and does not indicate completeness of the dataset.) Just above 50% of spot heights and bathymetry data are available up to the 50 000 scale, while low percentages of the other base geography datasets are available at this scale. The majority of datasets in the Base Geography level are therefore not available at the required scale.

The benchmark for data housed in the Administration and Spatial Organisation category (Level 2) is a scale of up to 250 000. The table indicates high percentages of the data on EA, street address and postal codes data are at a useful scale. Although these percentages are high, one should remember the presence of such datasets on the continent were low. A lower percentage of datasets like place and feature names which are available continental wide are collected at a suitable scale. Most data represented in Level 2 are available at a scale of up to 250 000.

Table 3.26: Scale availability for Administration and Spatial organisation datasets

Dataset	% Datasets
Governmental units	80
Populated places	83
Enumeration areas	100
Place Names	83
Feature Names	88
Land Parcels/Cadastre	93
Land Tenure	97
Street Address	100
Postal or zip code zones	100
Land use planning zones	92
Roads	83
Road centrelines	100
Railways	78
Airports and ports	85
Bridges and tunnels	85
Power	82
Telecommunications	89

Level 3 (Environmental) data also has a benchmark scale of up to 250 000. Of the land cover datasets on the continent 70% or more are at a scale of up to 250 000 and is therefore useful.

Table 3.27: Scale availability for Environmental datasets

Dataset	% Datasets
Land cover	86
Soils	74
Geology	72

3.4.2 Completeness

Questions on data completeness was asked to obtain an indication of the spatial coverage. The investigation of the results on data at preferred scales versus completeness rendered the following results. Due to the richness of the data, these results are analysed continentally and not by country.

Table 3.28: Levels of application for completeness of spatial coverage

Level of Detail	Application Level	Equiv. Map scale
High	Local/municipality level	1:10 000
Medium	Sub-national/provincial level	1:50 000
Low	National level	1:250 000
General	Regional	1:1 000 000

Table 3.29 indicates the results of the completeness of datasets. To decomplicate the understanding, the completeness was measured for a complete spatial coverage (i.e. 100%) at the relevant scales (e.g. for geodetic control points 53% of the data at the high level was 100% completed.). Percentages do not add up to 100 because the cross tables were generated at the scales specified in the questionnaire.

Table 3.29: Levels of application for completeness of spatial coverage

Data Set	Level of detail(%)			
	High	Medium	Low	General
Geodetic control points	53	33	30	27
Height datum	36	0	28	40
Aerial photography	26	19	-*	-
Satellite imagery	27	35	60	
Digital elevation model	14	47	33	41
Spot heights	33	12	30	33
Bathymetry	36	0	45	25
Coastline	42	12	50	73
Natural water bodies	36	25	36	50
Governmental units	-	38	50	66
Populated places	-	50	28	69
Enumeration areas	39	25	-	-
Place Names	-	27	19	62
Feature Names	44	12	19	62
Land Parcels/Cadastre	22	25	18	0
Land Tenure	-	0	23	100
Street Address	16	10	0	-
Postal or zip code zones	100	11	50	-
Land use planning zones	-	23	35	33
Roads	-	32	28	41
Road centrelines	25	-	-	-
Railways	-	35	38	84
Airports and ports	-	51	20	89
Bridges and tunnels	30	44	15	33
Power	57	16	32	16

	Level of [illegible]			
	High	Medium	[illegible]	[illegible]
Telecommunications	80	12	22	0
Land cover	-	25	33	42
Soils	-	12	30	47
Geology	-	14	33	66

*- a missing value indicates that no question was asked about data at this spatial level

Very few datasets had a high percentage of data which were 100% completed. Postal codes and telecommunications data had the highest percentage of data which can be used at the *high* spatial level (i.e. up to 10 000 scale). Care should however be taken in this interpretation, because both of these datasets had very low percentages of data availability on the continent. What this means, is that although postal codes and telecommunications datasets are not available in many countries, in those where it is available, the data is useful at a high spatial level.

For many datasets, no information was collected about the high spatial level of application. The remainder of the datasets had fairly low percentages of completeness with all datasets (expect postal code and telecommunications) indicating below 58% completeness at this level.

On the *medium* spatial level (up to 50 000 scale) most datasets were below 52% completed. This indicates a gap on the medium level of the spatial completeness of the data.

At the low spatial level (i.e. up to 250 000 scale) 50% of datasets were not completed (with the exception of satellite imagery which indicated a 60% completeness at this spatial level.) This finding also indicates a gap at this spatial level of application.

On the general spatial application level (up to 1 000 000 scale) more datasets had a higher percentage of completeness. The lowest score was 0 (telecommunications) while the highest was land tenure with a 100% completeness at this scale. Percentages for other datasets range between 16% and 89%.

Low percentages of spatial completeness across all spatial levels indicate that most fundamental geo-spatial datasets do not have a 100% coverage. Subsequently gaps exist in terms of scale.

3.4.3 Data format

The data format was recorded in a number of options and for the sake of analysis this report considers the gap to be those datasets which are in non-digital (i.e. hardcopy) and non-GIS format. The percentages will not add up to 100%, because respondents could choose more than one option. This means for example that a value of 4% of data in a non-GIS format does not imply that 96% of the data will be in a GIS format.

Table 3.30: Data format of geo-spatial datasets

Dataset	% Non-digital format	% Non-GIS format
Geodetic control points	11	7
Height datum	9	6
Geoid model	3	2
Aerial photography	11	7
Satellite imagery	7	6
Digital elevation model	4	4
Spot heights	9	6
Bathymetry	4	6
Coastline	8	5
Natural water bodies	12	7
Governmental units	13	14
Populated places	9	6
Enumeration areas	5	4
Place Names	12	8
Feature Names	11	9
Land Parcels/Cadastre	8	6
Land Tenure	4	3
Street Address	3	3
Postal or zip code zones	2	1
Land use planning zones	9	6
Roads	12	9
Road centrelines	4	3
Railways	8	5
Airports and ports	8	5
Bridges and tunnels	6	4
Power	6	4
Telecommunications	5	3
Land cover	14	10
Soils	8	6
Geology	9	6

From the above data it is clear that low percentages of geo-spatial datasets are in a non-digital format with the highest being land cover at 14%. In terms of the data being in a non-GIS format government (administrative) units had the highest score of 14%. The remainder of the datasets had fairly low percentages of data being in a non-GIS format. One could therefore assume that available fundamental geo-spatial datasets are mostly available electronically and in a GIS format.

3.4.4 Data accessibility

Section 5 of the questionnaire collected data on the accessibility of data. The percentage of datasets that have *restricted access* was regarded as a gap and is reflected in Table 3.31. From the table it can be seen that a low percentage of data has restrictions in terms of access. The highest recorded figure was 6% for aerial photography. This indicates that most fundamental geo-spatial datasets are available without major restrictions.

Table 3.31: Data accessibility of geo-spatial datasets

Dataset	% Restricted access
Geodetic control points	2
Height datum	3
Geoid model	0
Aerial photography	6
Satellite imagery	5
Digital elevation model	3
Spot heights	2
Bathymetry	1
Coastline	1
Natural water bodies	3
Governmental units	4
Populated places	3
Enumeration areas	1
Place Names	2
Feature Names	2
Land Parcels/Cadastre	3
Land Tenure	1
Street Address	1
Postal or zip code zones	0
Land use planning zones	1
Roads	4
Road centrelines	2
Railways	3
Airports and ports	3
Bridges and tunnels	1
Power	2
Telecommunications	3
Land cover	4
Soils	3
Geology	4

In conclusion: Level 0 geo-spatial data is not available at a suitable scale. Most data (less than 85%) for Level 1 is also not at a suitable scale. For Level 2 and 3 data the scale is suitable, but the continental coverage of the data is on average 67%.

3.4.5 Oversupply

In some countries like Cameroon there were many agencies having the same dataset which indicates a lack of coordination on a national level. In other countries oversupply occured when multi-national and national agencies have the same data.

There were a number of countries that were well-surveyed – Cameroon, DRC, Ethiopia, Ghana, Nigeria, Senegal and South Africa. Not only did they submit a high number of questionnaires, but also a wide range of datasets covered.

In conclusion, this section on the availability of the geo-spatial data has shown that although many datasets exist, the information about the quality of such data is either missing or indicates that the geo-spatial data is not useful at all. It would therefore seem that the majority of the geo-spatial data is not useful and this might require further investigation.

3.5 Metadata

The availability of metadata for each of the fundamental datasets received is a key part of the overall survey. The metadata received will be published on the UNECA's metadata clearinghouse and will serve to strengthen the African SDI and more importantly improve access to geo-information in Africa. The table below (table 3.32) illustrates a matrix of the 54 countries surveyed and the availability of metadata for each of the 30 fundamental datasets. The metadata availability section will focus on the indications of this matrix. Metadata availability and regional trends per dataset will be described in the following paragraphs. It must be noted that this section describes the metadata received for the purposes of this study and does not indicate the true picture of metadata in Africa, because

Table 3.32: Metadata received by country

Country	control points	datum	model	photography	imagery	digital	heights		coastline
Algeria						(Yes SRTM)			
Angola						(Yes SRTM)			
Benin						(Yes SRTM)			
Botswana						(Yes GlobalMap/SRTM)*			(Yes GlobalMap)
Burkina Faso					Yes	(Yes GlobalMap/SRTM)			(Yes GlobalMap)
Burundi						(Yes SRTM)			
Cameroon					Yes	(Yes SRTM)			Yes
Cape Verde						(Yes SRTM)		Yes (GEBCO)	
CAR						(Yes SRTM)			
Chad						(Yes SRTM)			
Comores						(Yes SRTM)		Yes (GEBCO)	
Congo						(Yes SRTM)			
Djibuti						(Yes SRTM)	Yes	Yes (GEBCO)	
DRC						(Yes SRTM)		Yes (GEBCO)	
Egypt	Yes*				Yes	Yes (Yes SRTM)	Yes	Yes (GEBCO)	
Equatorial Guinea						(Yes SRTM)		Yes (GEBCO)	
Eritrea						(Yes SRTM)		Yes (GEBCO)	
Ethiopia						(Yes SRTM)		Yes (GEBCO)	
Gabon						(Yes SRTM)		Yes (GEBCO)	
Ghana	Yes	Yes		Yes		Yes (Yes SRTM)	Yes	Yes (GEBCO)	Yes
Guinea						(Yes SRTM)		Yes (GEBCO)	
Guinea Bissau						(Yes SRTM)		Yes (GEBCO)	
Ivory Coast						(Yes SRTM)		Yes (GEBCO)	
Kenya				Yes		Yes		Yes (GEBCO)	Yes
Lesotho		Yes		Yes	Yes	Yes (Yes SRTM)			
Liberia						(Yes SRTM)		Yes (GEBCO)	
Libya						(Yes SRTM)		Yes (GEBCO)	

Notes:

Yes: refers to the availability of a datasets in-country

(Yes): refers to the availability of a datasets from an international agency

Country	Geodetic control points	Height datum	Geoid model	Aerial photography	Satellite imagery	Digital elevation model	Spot heights	Bathymetry	Coastline
Madagascar		Yes			Yes	Yes (Yes SRTM)	Yes	Yes (GEBCO)	Yes
Malawi						(Yes SRTM)			
Mali						(Yes SRTM)		Yes (GEBCO)	
Mauritania						(Yes SRTM)		Yes (GEBCO)	
Mauritius						(Yes SRTM)		Yes (GEBCO)	
Morocco					Yes	(Yes SRTM)		Yes (GEBCO)	
Mozambique						(Yes SRTM)		Yes (GEBCO)	
Namibia	Yes		Yes	Yes	Yes	(Yes SRTM)		Yes (Yes GEBCO)	
Niger						(Yes SRTM)			
Nigeria	Yes			Yes	Yes	(Yes SRTM)		Yes (GEBCO)	Yes
Rwanda						(Yes SRTM)		Yes (GEBCO)	
Sao Tome & Principe						(Yes SRTM)		Yes (GEBCO)	
Senegal						(Yes SRTM)		Yes (GEBCO)	
Seychelles						(Yes SRTM)		Yes (GEBCO)	
Sierra Leone						(Yes SRTM)		Yes (GEBCO)	Yes
Somalia						(Yes SRTM)		Yes (GEBCO)	
South Africa						Yes (Yes SRTM)		Yes (GEBCO)	Yes
Sudan						(Yes SRTM)		Yes (GEBCO)	
Swaziland						Yes (Yes SRTM)*			Yes
Tanzania						(Yes SRTM)		Yes (GEBCO)	
The Gambia	Yes	Yes		Yes		(Yes SRTM)		Yes (GEBCO)	
Togo						(Yes SRTM)		Yes (GEBCO)	
Tunisia						(Yes SRTM)		Yes (GEBCO)	
Uganda	Yes		Yes		Yes	(Yes SRTM)			
Western Sahara						(Yes SRTM)		Yes (GEBCO)	
Zambia						(Yes SRTM)			
Zimbabwe	Yes		Yes		Yes	Yes (Yes SRTM)	Yes		

Notes:

Yes (Yes): refers to the availability of the dataset from national and international sources. E.g. Yes (Yes SRTM) means that the datasets can be sourced from a national agency and the international SRTM.

Country						
Algeria	(Yes SRTM)					
Angola	(Yes SRTM)					
Benin	(Yes SRTM)					
Botswana	(Yes GlobalMap/SRTM)	(Yes GlobalMap/SRTM)	(Yes GlobalMap/SRTM)		(Yes GlobalMap/SRTM)	(Yes GlobalMap/SRTM)
Burkina Faso	(Yes GlobalMap/SRTM)	(Yes GlobalMap/SRTM)	(Yes GlobalMap)		(Yes GlobalMap)	(Yes GlobalMap)
Burundi	(Yes SRTM)	(Yes SALB)				
Cameroon	Yes (Yes SRTM)	(Yes SALB)	Yes			
Cape Verde	(Yes SRTM)					
CAR	(Yes SRTM)					
Chad	Yes (Yes SRTM)	Yes				
Comores	(Yes SRTM)					
Congo	(Yes SRTM)					
Djibuti	(Yes SRTM)	Yes	Yes			
DRC	(Yes SRTM)					
Egypt	(Yes SRTM)					
Equatorial-Guinea	(Yes SRTM)					
Eritrea	(Yes SRTM)					
Ethiopia	Yes (Yes SRTM)					
Gabon	(Yes SRTM)					
Ghana	Yes (Yes SRTM)	Yes		Yes	Yes	Yes
Guinea	(Yes SRTM)					
Guinea Bissau	(Yes SRTM)					
Ivory Coast	(Yes SRTM)					
Kenya	Yes	Yes	Yes		Yes	Yes
Lesotho	(Yes SRTM)					
Liberia	(Yes SRTM)					
Libya	Yes (Yes SRTM)					

Madagascar	Yes (Yes SRTM)	Yes	Yes		Yes	
Malawi	Yes (Yes SRTM)					
Mali	(Yes SRTM)					
Mauritania	(Yes SRTM)					
Mauritius	(Yes SRTM)					
Morocco	(Yes SRTM)					
Mozambique	(Yes SRTM)					
Namibia	(Yes SRTM)					
Niger	(Yes SRTM)					
Nigeria	Yes (Yes SRTM)					
Rwanda	Yes (Yes SRTM)	Yes		Yes		
Sao Tome & Principe	(Yes SRTM)					
Senegal	(Yes SRTM)					
Seychelles	(Yes SRTM)					
Sierra Leone	(Yes SRTM)					
Somalia	(Yes SRTM)					
South Africa	Yes (Yes SRTM)	(Yes SALB)				
Sudan	(Yes SRTM)					
Swaziland	Yes (Yes SRTM)	Yes	Yes		Yes	Yes
Tanzania	(Yes SRTM)					
The Gambia	(Yes SRTM)	Yes	Yes	Yes	Yes	Yes
Togo	(Yes SRTM)					
Tunisia	(Yes SRTM)					
Uganda	(Yes SRTM)	Yes			Yes	
Western Sahara	(Yes SRTM)					
Zambia	(Yes SRTM)					
Zimbabwe	Yes (Yes SRTM)	Yes			Yes	

Country	Land parcels/ cadastre	Land tenure	Postal address	Postal or zip code zones	Land use planning zones	Roads	Road centrelines	Railways
Algeria						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Angola						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Benin						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Botswana						(Yes Globalmap/DCW-VMAP))		(Yes Globalmap/DCW-VMAP))
Burkina Faso						(Yes GlobalMap/SRTM)		(Yes GlobalMap)
Burundi						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Cameroon						Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Cape Verde						(Yes DCW-VMAP)		(Yes DCW-VMAP)
CAR						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Chad						Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Comores						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Congo						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Djibuti						(Yes DCW-VMAP)		(Yes DCW-VMAP)
DRC						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Egypt	Yes					(Yes DCW-VMAP)		(Yes DCW-VMAP)
Equatorial-Guinea						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Eritrea						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Ethiopia						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Gabon						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Ghana	Yes				Yes	Yes (Yes DCW-VMAP)	Yes	Yes (Yes DCW-VMAP)
Guinea						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Guinea Bissau						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Ivory Coast						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Kenya						Yes	Yes	Yes
Lesotho					Yes	Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Liberia						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Libya						(Yes DCW-VMAP)		(Yes DCW-VMAP)

	[illegible] centre	[illegible] centre lines		Code Zones	Planning Zones	[illegible]	centrelines	[illegible]
Madagascar						Yes (Yes DCW-VMAP)		Yes (Yes DCW-VMAP)
Malawi						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Mali						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Mauritania						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Mauritius						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Morocco						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Mozambique						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Namibia						Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Niger						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Nigeria						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Rwanda	Yes					Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Sao Tome & Principe						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Senegal						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Seychelles						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Sierra Leone						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Somalia						(Yes DCW-VMAP)		(Yes DCW-VMAP)
South Africa	Yes					(Yes DCW-VMAP)		(Yes DCW-VMAP)
Sudan						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Swaziland						Yes (Yes DCW-VMAP)		Yes (Yes DCW-VMAP)
Tanzania						(Yes DCW-VMAP)		(Yes DCW-VMAP)
The Gambia	Yes					(Yes DCW-VMAP)		(Yes DCW-VMAP)
Togo						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Tunisia						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Uganda	Yes					Yes (Yes DCW-VMAP)		(Yes DCW-VMAP)
Western Sahara						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Zambia						(Yes DCW-VMAP)		(Yes DCW-VMAP)
Zimbabwe						Yes (Yes DCW-VMAP)		Yes (Yes DCW-VMAP)

Country	Airports and ports	Bridges and tunnels	Power	Telecommunications	Land cover	Soils	Geology
Algeria	(Yes DCW-VMAP)						
Angola	(Yes DCW-VMAP)						
Benin	(Yes DCW-VMAP)						
Botswana	(Yes Globalmap/DCW-VMAP))	(Yes GlobalMap)			(Yes GlobalMap)		
Burkina Faso	(Yes GlobalMap/SRTM)	(Yes GlobalMap/SRTM)			(Yes GlobalMap)	Yes	
Burundi	(Yes DCW-VMAP)				(Yes DCW-VMAP/FAO)		
Cameroon	(Yes DCW-VMAP)				Yes		
Cape Verde	(Yes DCW-VMAP)						
CAR	(Yes DCW-VMAP)						
Chad	(Yes DCW-VMAP)				Yes	Yes	Yes
Comores	(Yes DCW-VMAP)						
Congo	(Yes DCW-VMAP)						
Djibuti	(Yes DCW-VMAP)						
DRC	(Yes DCW-VMAP)				(Yes FAO)		
Egypt	(Yes DCW-VMAP)						
Equatorial-Guinea	(Yes DCW-VMAP)						
Eritrea	(Yes DCW-VMAP)				(Yes FAO)		
Ethiopia	(Yes DCW-VMAP)						Yes
Gabon	(Yes DCW-VMAP)						
Ghana	(Yes DCW-VMAP)					Yes	Yes
Guinea	(Yes DCW-VMAP)						
Guinea Bissau	(Yes DCW-VMAP)						
Ivory Coast	(Yes DCW-VMAP)						
Kenya	Yes	Yes			(Yes FAO)	Yes	
Lesotho	(Yes DCW-VMAP)	Yes			Yes	Yes	Yes
Liberia	(Yes DCW-VMAP)						
Libya	(Yes DCW-VMAP)				(Yes FAO)		

Madagascar	Yes (Yes DCW-VMAP)			Yes	Yes		
Malawi	(Yes DCW-VMAP)				Yes	Yes	
Mali	(Yes DCW-VMAP)						
Mauritania	(Yes DCW-VMAP)						
Mauritius	(Yes DCW-VMAP)						
Morocco	(Yes DCW-VMAP)				Yes		
Mozambique	(Yes DCW-VMAP)					Yes	
Namibia	(Yes DCW-VMAP)				Yes		
Niger	(Yes DCW-VMAP)						
Nigeria	(Yes DCW-VMAP)						
Rwanda	(Yes DCW-VMAP)		Yes	Yes	(Yes FAO)		Yes
Sao Tome & Principe	(Yes DCW-VMAP)						
Senegal	(Yes DCW-VMAP)						
Seychelles	(Yes DCW-VMAP)						
Sierra Leone	(Yes DCW-VMAP)					Yes	
Somalia	(Yes DCW-VMAP)				(Yes FAO)		
South Africa	(Yes DCW-VMAP)		Yes		Yes		
Sudan	(Yes DCW-VMAP)				(Yes FAO)		
Swaziland	Yes (Yes DCW-VMAP)	Yes			Yes		
Tanzania	(Yes DCW-VMAP)				(Yes FAO)		
The Gambia	(Yes DCW-VMAP)				Yes	Yes	
Togo	(Yes DCW-VMAP)						
Tunisia	(Yes DCW-VMAP)						
Uganda	(Yes DCW-VMAP)				Yes (Yes FAO)		Yes
Western Sahara	(Yes DCW-VMAP)						
Zambia	(Yes DCW-VMAP)						
Zimbabwe			Yes		Yes		Yes

many organisations failed to submit their metadata for consideration.

The purpose of this section is also to describe the metadata received per sub-region and not describe the condition or quality of the metadata records. The summary tables will indicate actual numbers of metadata records received per region as opposed to percentages.

3.5.1 Geodetic control points

Only eight countries out of 54 (15%) submitted metadata on geodetic control points.

Table 3.33: Summary of metadata on geodetic control points datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	1
Southern Africa	3
West Africa (E)	2
West Africa (F)	1

3.5.2 Height datum

Only five countries out of 54 (9%) submitted metadata on height datum's.

Table 3.34: Summary of metadata on Height datum datasets per region

Region	No. of countries
Central Africa	0
East Africa	0
North Africa	0
Southern Africa	3
West Africa (E)	1
West Africa (F)	1

3.5.3 Geoid model

Only four countries out of 54 (7%) submitted metadata on their geoid model. Overall low counts for geoid model metadata was evident across the continent.

Table 3.35: Summary of metadata on geoid model datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	3
West Africa (E)	0
West Africa (F)	0

3.5.4 Aerial photography

Only seven countries out of 54 (13%) submitted metadata on aerial photography. Both Central and North Africa had no metadata for this dataset.

Table 3.36: Summary of metadata on aerial photography datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	3
West Africa (E)	2
West Africa (F)	1

3.5.5 Satellite imagery

Eleven countries out of 54 (20%) submitted metadata on satellite imagery. This is despite the fact that a 100% of countries on the continent have such a dataset. Both Central and francophone West Africa had 0 datasets for satellite imagery.

Table 3.37: Summary of metadata on satellite imagery datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	2
Southern Africa	5
West Africa (E)	3
West Africa (F)	0

3.5.6 Digital elevation model

There was 100 % metadata submitted for DEMs and this was primarily due to the fact the there was complete coverage by SRTM and in some instances Global Map data for Africa. In addition 7 of the 54 African (13%) countries submitted their own national DEM metadata.

Table 3.38: Summary of metadata on digital elevation models datasets per region

Region	No. of countries
Central Africa	5
East Africa	12
North Africa	6
Southern Africa	11
West Africa (E)	10
West Africa (F)	10

3.5.7 Spot heights

Five countries out of 54 (9%) submitted metadata on spot heights.

Table 3.39: Summary of metadata on spot heights datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	1
Southern Africa	2
West Africa (E)	1
West Africa (F)	0

3.5.8 Bathymetry

Metadata for 38 countries out of 54 (70%) were received for bathymetry. The majority of this metadata was provided by the international organisation GEBCO. Only one country submitted national metadata.

Table 3.40: Summary of metadata on bathymetry datasets per region

Region	No. of countries
Central Africa	3
East Africa	11
North Africa	5
Southern Africa	4
West Africa (E)	7
West Africa (F)	8

3.5.9 Coastline

Ten metadata records on coastlines were submitted out a possible 54 (19%). Three regions on the continent did not have any metadata for coastline datasets.

Table 3.41: Summary of metadata on coastline datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	4
West Africa (E)	5
West Africa (F)	0

3.5.10 Natural water bodies

There was 100% metadata coverage on natural water bodies for Africa. This was due to the metadata available from SRTM and Global Map for the whole continent. Eleven countries also had their own national metadata on natural water bodies.

Table 3.42: Summary of metadata of natural water bodies datasets per region

Region	No. of countries
Central Africa	5
East Africa	12
North Africa	6
Southern Africa	11
West Africa (E)	10
West Africa (F)	10

3.5.11 Governmental units

Metadata of only fifteen out of 54 countries (28%) on government units were received. In Central and North Africa there was no metadata for this dataset.

Table 3.43: Summary of metadata on government units datasets per region

Region	No. of countries
Central Africa	0
East Africa	5
North Africa	0
Southern Africa	5
West Africa (E)	3
West Africa (F)	2

3.5.12 Populated places

Nine metadata records were received populated places. That is a response of 17% of all countries.

Table 3.44: Summary of metadata on populated places per region

Region	No. of countries
Central Africa	0
East Africa	2
North Africa	0
Southern Africa	4
West Africa (E)	2
West Africa (F)	1

3.5.13 Enumeration areas

Four countries out of 54 (7%) submitted metadata on enumeration areas. No metadata was again found in Central and North Africa for this dataset.

Table 3.45: Summary of metadata of enumeration areas datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	1
West Africa (E)	1
West Africa (F)	1

3.5.14 Place Names

Nine countries out of 54 (17%) submitted metadata on place names.

Table 3.46: Summary of metadata on place names datasets per region

Region	No. of countries
Central Africa	0
East Africa	2
North Africa	0
Southern Africa	4
West Africa (E)	2
West Africa (F)	1

3.5.15 Feature Names

Only seven countries out of 54 (13%) submitted metadata on feature names. Central and North Africa had no metadata for this dataset.

Table 3.47: Summary of metadata of Feature names datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	3
West Africa (E)	2
West Africa (F)	1

3.5.16 Land Parcels/Cadastre

Six countries out of 54 (11%) submitted metadata on land parcels and cadastre. Central Africa showed no metadata for this dataset.

Table 3.48: Summary of metadata land parcels datasets per region

Region	No. of countries
Central Africa	0
East Africa	2
North Africa	1
Southern Africa	1
West Africa (E)	1
West Africa (F)	1

3.5.17 Land Tenure

Only South Africa submitted metadata on land tenure.

Table 3.49: Summary of metadata on land tenure datasets per region

Region	No. of countries
Central Africa	0
East Africa	0
North Africa	0
Southern Africa	1
West Africa (E)	0
West Africa (F)	0

3.5.18 Street Address

Only South Africa submitted metadata on street addresses. The regional distribution of metadata for street addresses was therefore very low.

Table 3.50: Summary of metadata on street address datasets per region

Region	No. of countries
Central Africa	0
East Africa	0
North Africa	0
Southern Africa	1
West Africa (E)	0
West Africa (F)	0

3.5.19 Postal or zip code zones

No metadata was received with regard to postal or zip codes.

Table 3.51: Summary of metadata on postal or zip code zones datasets per region

Region	No. of countries
Central Africa	0
East Africa	0
North Africa	0
Southern Africa	0
West Africa (E)	0
West Africa (F)	0

3.5.20 Land use planning zones

Three countries out of 54 (6%) submitted metadata on land use planning zones.

Table 3.52: Summary of metadata of land use planning zones datasets per region

Region	No. of countries
Central Africa	0
East Africa	0
North Africa	0
Southern Africa	2
West Africa (E)	1
West Africa (F)	0

3.5.21 Roads

There is 100% metadata coverage of roads in Africa due to the Digital Chart of the World and VMAP initiatives. Another eight countries submitted metadata on roads based on their national databases.

Table 3.53: Summary of metadata on roads datasets per region

Region	No. of countries
Central Africa	5
East Africa	12
North Africa	6
Southern Africa	11
West Africa (E)	10
West Africa (F)	10

3.5.22 Road centrelines

Only Kenya and South Africa have metadata on road centrelines.

Table 3.54: Summary of metadata on road centrelines per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	1
West Africa (E)	0
West Africa (F)	0

3.5.23 Railways

Complete metadata for African railways was provided by the Digital Chart of the World.

Table 3.55: Summary of metadata on railways datasets per region

Region	No. of countries
Central Africa	5
East Africa	12
North Africa	6
Southern Africa	11
West Africa (English)	10
West Africa (French)	10

3.5.24 Airports and ports

Complete metadata for African airports and ports were provided by the Digital Chart of the World.

Table 3.56: Summary of metadata on airports and ports datasets per region

Region	No. of countries
Central Africa	5
East Africa	12
North Africa	6
Southern Africa	11
West Africa (E)	10
West Africa (F)	10

3.5.25 Bridges and tunnels

Only five countries out of 54 (9%) submitted metadata on bridges and tunnels. Central, North and francophone West Africa indicated no metadata for this dataset.

Table 3.57: Summary of metadata of bridges and tunnels datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	3
West Africa (E)	1
West Africa (F)	0

3.5.26 Power

Three countries out of 54 (6%) submitted metadata on Power.

Table 3.58: Summary of metadata on power datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	2
West Africa (E)	0
West Africa (F)	0

3.5.27 Telecommunications

Only Rwanda and Madagascar submitted metadata on telecommunications.

Table 3.59: Summary of metadata on telecommunication datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	1
West Africa (E)	0
West Africa (F)	0

3.5.28 Land Cover

Twenty three countries out of 54 (43%) submitted metadata on land cover. Much of this can be attributed to the FAO Land cover initiatives in Africa.

Table 3.60: Summary of metadata on land cover datasets per region

Region	No. of countries
Central Africa	1
East Africa	7
North Africa	3
Southern Africa	8
West Africa (E)	2
West Africa (F)	2

3.5.29 Soils

Ten countries out of 54 (19%) submitted metadata on soils.

Table 3.61: Summary of metadata on soils datasets per region

Region	No. of countries
Central Africa	0
East Africa	1
North Africa	0
Southern Africa	4
West Africa (E)	3
West Africa (F)	2

3.5.30 Geology

Eight countries out of 54 (15%) submitted metadata on geology. Again Central and North Africa did not submit any metadata for this dataset.

Table 3.62: Summary of metadata on geology datasets per region

Region	No. of countries
Central Africa	0
East Africa	3
North Africa	0
Southern Africa	3
West Africa (E)	1
West Africa (F)	1

Summary

Metadata records were extremely difficult to source and the results illustrated in the tables above attest to the fact that very little metadata is captured by data custodians and functional data holders.

Table 3.63: Percentages metadata received per dataset

Dataset	Percentage (%)
Geodetic control points	15
Height datum	9
Geoid model	7
Aerial photography	13
Satellite imagery	20
Digital elevation model	100
Spot heights	9
Bathymetry	70
Coastline	19
Natural water bodies	100
Governmental units	28
Populated places	17
Enumeration areas	7
Place Names	17
Feature Names	13
Land Parcels/Cadastre	11
Land Tenure	2
Street Address	2
Postal or zip code zones	0
Land use planning zones	6
Roads	100
Road centrelines	4
Railways	100
Airports and ports	100
Bridges and tunnels	9

Dataset	Percentage (%)
Power	6
Telecommunications	4
Land cover	43
Soils	19
Geology	10

There were only five datasets that had 100% metadata coverage. These datasets were almost exclusively provided by international agencies and covered the entire continent. Land cover metadata at 43% was the next best return and here too it is largely due to the work of the FAO's Global Land Cover work. A great number of geo-spatial datasets had less than 10% metadata.

In terms of the regions, Southern African returned the most metadata. Central and North African had fewer countries to report on (5 and 6 respectively) but their metadata returns were minimal. In comparison to geo-spatial datasets coverage, these regions had a fairly good coverage but metadata seems to be lacking.

It is evident from the results shown above that the value of metadata capture and documentation is not a priority with many of Africa's geo-information communities and data custodians.

3.6 Lessons learnt

The purpose of this section is to reflect upon the enormous task that was undertaken in attempting to catalogue fundamental geospatial data in Africa and importantly learn from the successes and failures encountered. The aim of the lessons learnt section is also to reflect on events in a structured way, to be able to learn from what happened (or didn't happen) and to reuse that learning process and add to it over time.

It can be argued that a geo-information initiative of this scale has yet to be attempted anywhere in world. The HSRC/ EIS-AFRICA team together with their sub-regional partners (CEDARE, RCMRD, RECTAS, OSFAC and CSE) was very optimistic that their consortium had all the right contacts and credentials to carry out this task with ease. This confidence could be put down to the success of the first phase of the study i.e. the Determination of fundamental geo-spatial datasets in Africa.

The consortium believed it was best placed to complete this project successfully, with the best expertise and most importantly with the best contacts in Africa and internationally. It was also believed that the existing Spatial Data Infrastructures (SDI's) in many African countries would make the compiling of the catalogue a lot easier.

Much work has been done over the past decades in Africa to develop Spatial Data Infrastructure. These included several key components of developing a SDI namely, the

establishment of national geo-spatial data committees that look at national fundamental or core geo-spatial datasets, data standards (including metadata) and the development of clearinghouse facilities where one could search for data or links to data.

The UNECA has engaged with many African governments around the issues of the development of National Information and Communication Infrastructures (NICI's). NICI's are seen to be essential to supporting decision making around nations' development priorities. SDI's are very much part of a successful NICI and contributes toward knowledge management and decision-support within government agencies.

With many geo-information experts claiming that eighty percent (80%) of all government data is spatial in nature, it would be assumed that the value of an SDI would be self explanatory to African governments. What this study has revealed is that while many countries have established SDI's at various levels, many of these where in all practical terms non-existent. Our experience in reality was quite different, while we managed to establish contacts in all but four of the official 54 African countries (including island states), getting questionnaires filled in correctly or filled in at all, became a demanding and time consuming process.

National Data committees existed only in name and many SDI websites had no data, metadata or contactable links. This meant that all the sub-regional partners had to make contact with national consultants to survey their respective countries. The search for these consultants was difficult and in some cases impossible. This resulted in time delays and increased costs as many national consultants had to be sub-contracted.

This study has shown that while there are guidelines to the technical implementation of a SDI and numerous international best-practices to guide us, it is the "softer" institutional issues that can pose the biggest barrier to obtaining national assessments. Geo-spatial data is still regarded a sensitive in many African countries and with the military responsible for mapping in many countries, it's an almost impossible task of obtaining any information that could benefit the continent as a whole within the timeframe of a project of this nature. Despite the fact that an official letter from the UNECA was used to introduce the study to potential participants, the response rate was still low in many instances. Governments should be approached to support these studies by official UNECA correspondence. Countries that provided inadequate information were often signatories at CODI and therefore endorsed the development of national spatial data infrastructures and it would seem that these governments must be reminded of their commitment to the CODI process.

Another lesson learnt is that more time needs to be allocated to the establishment of national contacts and they should be remunerated appropriately. Some sub-regional partners co-funded the study to ensure adequate national participation.

The study utilised a single survey instrument (albeit in English and French). The lack of participation by Angola could possibly be ascribed to the fact that there wasn't a Portuguese version of the questionnaire available. The questionnaire became cumbersome to manage by agencies that held several datasets for more than one country, because the number of countries multiplied by the number of datasets increased the response time dramatically. In future the questionnaire should be simple, a web-based option should be available and complimentary instruments such as telephonic or face to face interviews should also be utilised. Importantly too, the questionnaire must be available in all the official languages of Africa (English, French, Arabic and Portuguese).

The questions on metadata which was attached to the questionnaire were seen as too detailed by many respondents. Some respondents had metadata within their organisations and while others (the majority) couldn't or wouldn't fill in the metadata because they found it too time consuming. Where metadata was given, it was often incomplete and in some cases, not understandable. The metadata survey was essentially a study on its own and should have been separated from the broader catalogue process.

The culture of understanding that intelligent decisions are based on sound empirical tested data is absolutely vital for the implementation of sound knowledge management and decision supports systems. The value of capturing, verification, use and sharing of the fundamental geo-spatial datasets as part of nations' information infrastructure, must be realised. As mentioned earlier, geo-spatial information is seen as critical to support governments' development priorities. With technologies like Google Earth that provide imagery of the whole globe, national governments should realise the restrictive role spatial information policies could have on development and services.

3.7 Conclusion

It would be imprudent to believe that SDI will work in Africa if it is sold as purely a technology driven solution. The reality of Africa is that the basic ICT infrastructure is inadequate in most instances and unreliable at best. Clearinghouses, web map services etc. require reliable IT infrastructure. For SDI to work and succeed it must be designed and developed in line with national priorities such as the NICI's. It also requires networks of people committed to information sharing to be the basis from which a successful SDI can be created and more importantly sustained.

This study would have been easier to undertake if there were national champions that could be contacted to provide accurate and up to date details of countries' fundamental data inventory. This was evident in Namibia and Madagascar who had such champions and subsequently questionnaires were completed within a few weeks.

Have the results of the surveys and lessons we have learnt pointed to a failure in SDI development in Africa? One cannot conclude that, but there needs to be a re-think on the approach used to gain political buy-in, sustained funding and implementation.

4. Conclusion

The summary of the conclusions, policy implications of the findings and suggestions for further action are presented in this chapter.

In terms of the fundamental geo-spatial datasets it was found that all datasets are available in Africa – to a lesser or greater degree. Seven datasets are available in below 50% of the countries on the continent. Another nine datasets are available in all countries (i.e.100% availability). The quality of these data, however, remain questionable.

Country gaps of the fundamental geo-spatial datasets do exist. Countries with the most gaps in terms of the datasets are: Angola, Botswana, Burundi, Cape Verde, Eritrea, Ivory Coast, Liberia, Libya, Western Sahara and Zambia.

Contrary to what might have been expected, a low percentage of datasets (less than 10%) on the continent are in non-GIS format. This means most of the fundamental geo-spatial datasets should be easy to integrate into a traditional GIS environment. This knowledge makes it easier to plan for future geo-information initiatives on the continent.

The value of metadata is not seen and therefore the keeping of metadata is not prioritised. Many institutions did not have metadata while others did not have it in a format which could be easily transformed to the questionnaire format. The low priority of metadata can be seen in the fact that for only five datasets there was a 100% metadata available. This lack of metadata could also indicate that existing geo-spatial data are not useful, since it could not be described in terms of its attributes, how it was created, lack of geo-spatial reference, etc.

It is often the softer issues that hamper research. Many initiatives have taken place in Africa to establish SDI's and other geo-spatial data infrastructure, so one would expect a general knowledge and openness across the continent to such operations. Yet, it is often institutional issues which seem to obstruct the verification of such infrastructure.

4.1 Policy implications

Since this study was carried out over international boundaries, one has to accept that not all countries will place the same priority on executing a study of this nature successfully. It is therefore also difficult to make policy recommendations since there is no regional body which can legally enforce any recommendations of this study.

However, it remains important to analyse the findings strategically in order to coordinate future initiatives in this field of study. We would therefore recommend that the CODI IV meeting should consider to strongly urge national governments to place a priority on the (further) development of the fundamental geo-spatial datasets.

The implementation of national SDI's seem not to have been successful in most African countries, and we would therefore recommend a re-design of the thinking around SDI's. The implementing of structures might be too abstract for the solving of real data issues. Approaching SDI establishment from the data or demand-side might show better results.

4.2 Unresolved issues

Although the initial aim of the project was simply to report a gap as the non-existence of a fundamental geo-spatial dataset, the study team tried to move further by investigating the quality of existing data. It remains the responsibility of whoever executes decisions based on this report to consider that the quality of some existing geo-spatial datasets might not be suitable.

4.3 Future action

This study has illuminated the need for human capacity building. From responses received it could be concluded that respondents did not know about the existence of many geo-spatial datasets, because they were either not informed enough or the data was useless. To resolve this situation, one needs to consider building the human capacity on the continent. It is also an important factor to consider if international agencies are planning to fill the geo-spatial data gap in Africa.

If CODI wants to ensure the effective entrenchment of the fundamental geo-spatial datasets in national structures, it should place a priority on the development of those datasets which have a low representation on the continent (i.e. those which are available in less than 50% of the countries).

At the same time, CODI should discourage further development of fundamental geo-spatial datasets for which there is already a 100% coverage. This action would reduce expenditure on datasets which already cover the continent effectively.

Since CODI does not have enforcement power, the team can only recommend that CODI should place stronger emphasis on the role of national government structures to proactively enhance and collaborate with research in the geo-spatial information arena. By doing this, softer issues would hopefully enjoy lower priority and make future research in this field easier to conduct.

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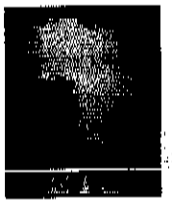
ANNEXURE 1

HSRC
Human Sciences Research Council



MAPPING AFRICA FOR AFRICA

CATALOGUE OF AVAILABLE FUNDAMENTAL GEO-SPATIAL DATASETS FOR AFRICA AND COUNTRY GAP ANALYSIS

INVENTORY QUESTIONNAIRE

INTRODUCTION

The "Mapping Africa for Africa" (MAFA) initiative seeks to address the lack of accurate, reliable and up-to-date fundamental geo-spatial datasets essential for effective and efficient decision making and development planning in Africa. The initiative was launched by the Committee for Development Information (CODI), Subcommittee on Geo-information (Geo) of the United Nations Economic Commission for Africa (UNECA). As part of this process a study to determine what constitutes *fundamental geo-spatial datasets* for Africa have been undertaken. The study identifies and defines the fundamental geo-spatial datasets and their attributes.

The next stage of the process is to identify and catalogue what fundamental datasets are currently available at national and regional level, both in-country and from external data holdings. A *gap analysis* is also to be done for each country indicating what dataset is/are lacking. In this regard a continent-wide inventory of fundamental geospatial datasets and gap analysis is to be undertaken to identify where future projects should focus their attention in closing the geoinformation gap in Africa.

The inventory and cataloguing will be undertaken through the use of a combination of a questionnaire, face-to-face, and telephonic interviews as the means to achieve the above objectives. This questionnaire is intended to be used as the main instrument for the inventory.

For Official Use Only

01. Questionnaire serial no.: __ __ __ __

02. Dispatch date: DD__MM__YY

03. Name of country:.....

04. Country ISO Alpha-3 Code:.....

05. First name(s):.....

06. Last name:.....

07. Tel:.....

08. Fax:.....

09. Email:.....

Section 1: Organisational Information

11. Person completing the questionnaire

111. First name(s): ..... 112.Family name:.....

113. Tel:..... 114.Email:.....

12. Organisational information

121. Name of organisation:.....

..... 122. Acronym:.....

123. Full physical address:.....

.....

124. Full postal address:.....

.....

125. Tel: ..... 126. Fax:.....

127. Email:..... 128. Web site:.....

129. Head of organisation:

1291. Title: (Please tick (☑) as appropriate) ☐ Prof ☐ Dr. ☐ Mr. ☐ Mrs. ☐ Ms.

1292. First name(s):..... 1293. Family Name:.....

1294. Designation of head of organisation:.....

13. Organisational Description

131. Which of the following best describes your organisation? (Put an "x" in the appropriate box (☒) as may apply.)

a ☐ Government ministry/department (national/sub-national)
b ☐ Local government authority
c ☐ Non-governmental organisation (NGO)
d ☐ Semi-governmental/Para-statal
d ☐ Academic/research institution
e ☐ Private company
f ☐ International/Multi-lateral
g ☐ Other

132. In the context of this project please indicate the area of jurisdiction or interest of your organisation? (Put an "x" in the appropriate box (☒) as may apply.))

a ☐ Regional (Africa-wide)
b ☐ Sub-regional (e.g. ECOWAS)
c ☐ National
d ☐ Provincial/State (or similar)
e ☐ District (or similar)
f ☐ Local government/authority

Section 2: Availability of fundamental geo-spatial datasets

Which of the following datasets does your organisation hold either as a custodian, OR hold as a result of its own functions (Please put an "x" in the appropriate box (☒) as may apply).

PLEASE CHECK ONLY ONE COLUMN PER DATASET.

Dataset	Custodian	Functional Holding
2-01 Geodetic control points	☐	☐
2-02 Height datum	☐	☐
2-03 Geoid model	☐	☐
2-04 Aerial photography	☐	☐
2-05 Satellite imagery	☐	☐
2-06 Digital elevation model	☐	☐
2-07 Spot heights	☐	☐
2-08 Bathymetry	☐	☐
2-09 Coastline	☐	☐
2-10 Natural water bodies	☐	☐
2-11 Governmental/Administrative units	☐	☐
2-12 Populated places	☐	☐
2-13 Census enumeration areas	☐	☐
2-14 Place Names	☐	☐
2-15 Feature Names	☐	☐
2-16 Land Parcels/Cadastre	☐	☐
2-17 Land Tenure	☐	☐
2-18 Street Address	☐	☐
2-19 Postal or zip code zones	☐	☐
2-20 Land use planning zones	☐	☐
2-21 Roads	☐	☐
2-22 Road centrelines	☐	☐
2-23 Railways	☐	☐
2-24 Airports and ports	☐	☐
2-25 Bridges and tunnels	☐	☐
2-26 Power infrastructure	☐	☐
2-27 Telecommunications	☐	☐
2-28 Land cover	☐	☐
2-29 Soils	☐	☐
2-30 Geology	☐	☐

Section 3: Data Characteristics

For <u>each fundamental dataset indicated in Section 2 as available</u> please indicate:

a) availability by scale/resolution (where applicable) by an "x" in the appropriate box (☒).
Be reminded that, in terms of scale, <u>the smaller the number representing the "ground distance", the larger the scale, and vice versa</u>.

b) completeness by % of applicable spatial coverage area of your responsibility/jurisdiction for which data is available: 1 = ≤ 25% 2 = 26-50% 3 = 51-75% 4 = 76-99% 5 = 100%

c) year when the dataset was first published

d) year of last update

e) by an "x" in the appropriate box (☒) whether metadata is available for <u>each scale/resolution of dataset</u>

Dataset	Scale (000)/ Resolution (m)	Completeness	Year 1st Published	Year Last Updated	Metadata
3-01 Geodetic control points	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-02 Height datum	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-03 Geoid model	N/A	.....	.....	.....	☐
3-04 Aerial photography	a ☐>10	.....	.....	.....	☐
	b ☐12	.....	.....	.....	☐
	c ☐20-50	.....	.....	.....	☐
3-05 Satellite imagery	a ☐≤ 2.5m	.....	.....	.....	☐
	b ☐5-20m	.....	.....	.....	☐
	c ☐20-80m	.....	.....	.....	☐
	d ☐≥ 1000m	.....	.....	.....	☐
3-06 Digital elevation model	a ☐≤ 2.5m	.....	.....	.....	☐
	b ☐5-50m	.....	.....	.....	☐
	c ☐50-125m	.....	.....	.....	☐
	d ☐125-1000m	.....	.....	.....	☐
	e ☐>1000m	.....	.....	.....	☐
3-07 Spot heights	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-08 Bathymetry	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐

Dataset	Scale (000)/ Resolution (m)	Completeness	Year 1st Published	Year Last Updated	Metadata
3-09 Coastline	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-10 Natural water bodies	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-11 Governmental/Administrative units	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-12 Populated places	a ☐12-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-13 Census enumeration areas	a ☐10	.....	.....	.....	☐
	b ☐50	.....	.....	.....	☐
3-14 Place names	a ☐12-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-15 Feature names	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	c ☐500-1000	.....	.....	.....	☐
3-16 Land parcels/cadastre	a ☐>10	.....	.....	.....	☐
	b ☐10-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-17 Land tenure	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐

Dataset	Scale (000)/ Resolution (m)	Completeness	Year 1st Published	Year Last Updated	Metadata
3-18 Street address	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐<62.5	.....	.....	.....	☐
3-19 Postal or zip code zones	a ☐>10	.....	.....	.....	☐
	b ☐12-50	.....	.....	.....	☐
	c ☐<62.5	.....	.....	.....	☐
3-20 Land use planning zones	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-21 Roads	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-22 Road centrelines	a ☐≥10	.....	.....	.....	☐
3-23 Railways	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-24 Airports and ports	a ☐10-50	.....	.....	.....	☐
	b ☐62.5-100	.....	.....	.....	☐
	c ☐125-250	.....	.....	.....	☐
	d ☐500-1000	.....	.....	.....	☐
3-25 Bridges and tunnels	a ☐>10	.....	.....	.....	☐
	b ☐10-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-26 Power infrastructure	a ☐>10	.....	.....	.....	☐
	b ☐10-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐
3-27 Telecommunications	a ☐>10	.....	.....	.....	☐
	b ☐10-50	.....	.....	.....	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐

Dataset	Scale (000)/ Resolution (m)	Completeness	Year 1st Published	Year Last Updated	Metadata
3-28 Land cover	a ☐ 10-50	.....	.....	.....	☐
	b ☐ 62.5-100	.....	.....	.....	☐
	c ☐ 125-250	.....	.....	.....	☐
	d ☐ 500-1000	.....	.....	.....	☐
3-29 Soils	a ☐ 10-50	.....	.....	.....	☐
	b ☐ 62.5-100	.....	.....	.....	☐
	c ☐ 125-250	.....	.....	.....	☐
	d ☐ 500-1000	.....	.....	.....	☐
3-30 Geology	a ☐ 10-50	.....	.....	.....	☐
	b ☐ 62.5-100	.....	.....	.....	☐
	c ☐ 125-250	.....	.....	.....	☐
	d ☐ 500-1000	.....	.....	.....	☐

Note:

For each documented dataset, additional relevant details should be provided in Section 6 on metadata.

Section 4: Data format

Please indicate by an "x" in the appropriate box (☒) the format(s) of <u>each available fundamental dataset</u> that is held by or available from your institution, whether as a custodian, or as a result of your functions.

Fundamental Data	Reports	Hardcopy Tables	Hardcopy Map	Electronic Spreadsheet	Database	GIS format	Other Digital Files
4-01 Geodetic control points	☐	☐	☐	☐	☐	☐	☐
4-02 Height datum	☐	☐	☐	☐	☐	☐	☐
4-03 Geoid model	☐	☐	☐	☐	☐	☐	☐
4-04 Aerial photography	☐	☐	☐	☐	☐	☐	☐
4-05 Satellite imagery	☐	☐	☐	☐	☐	☐	☐
4-06 Digital elevation model	☐	☐	☐	☐	☐	☐	☐
4-07 Spot heights	☐	☐	☐	☐	☐	☐	☐
4-08 Bathymetry	☐	☐	☐	☐	☐	☐	☐
4-09 Coastline	☐	☐	☐	☐	☐	☐	☐
4-10 Natural water bodies	☐	☐	☐	☐	☐	☐	☐
4-11 Governmental/ Administrative units	☐	☐	☐	☐	☐	☐	☐
4-12 Populated places	☐	☐	☐	☐	☐	☐	☐
4-13 Census enumeration areas	☐	☐	☐	☐	☐	☐	☐
4-14 Place Names	☐	☐	☐	☐	☐	☐	☐
4-15 Feature Names	☐	☐	☐	☐	☐	☐	☐
4-16 Land Parcels/Cadastre	☐	☐	☐	☐	☐	☐	☐
4-17 Land Tenure	☐	☐	☐	☐	☐	☐	☐
4-18 Street Address	☐	☐	☐	☐	☐	☐	☐
4-19 Postal or zip code zones	☐	☐	☐	☐	☐	☐	☐
4-20 Land use planning zones	☐	☐	☐	☐	☐	☐	☐
4-21 Roads	☐	☐	☐	☐	☐	☐	☐
4-22 Road centrelines	☐	☐	☐	☐	☐	☐	☐
4-23 Railways	☐	☐	☐	☐	☐	☐	☐
4-24 Airports and ports	☐	☐	☐	☐	☐	☐	☐
4-25 Bridges and tunnels	☐	☐	☐	☐	☐	☐	☐
4-26 Power infrastructure	☐	☐	☐	☐	☐	☐	☐
4-27 Telecommunications	☐	☐	☐	☐	☐	☐	☐
4-28 Land cover	☐	☐	☐	☐	☐	☐	☐
4-29 Soils	☐	☐	☐	☐	☐	☐	☐
4-30 Geology	☐	☐	☐	☐	☐	☐	☐

Section 5: Data accessibility

Please indicate how your organisation grants access to available fundamental geo-spatial data, and what access conditions apply. Please indicate by an "x" in the appropriate box (☒) as may be applicable.

Fundamental Data	Accessibility				Access conditions	
	Unrestricted access	Authorisation required	Scale-dependent	Restricted	Free	Against payment
5-01 Geodetic control points	☐	☐	☐	☐	☐	☐
5-02 Height datum	☐	☐	☐	☐	☐	☐
5-03 Geoid model	☐	☐	☐	☐	☐	☐
5-04 Aerial photography	☐	☐	☐	☐	☐	☐
5-05 Satellite imagery	☐	☐	☐	☐	☐	☐
5-06 Digital elevation model	☐	☐	☐	☐	☐	☐
5-07 Spot heights	☐	☐	☐	☐	☐	☐
5-08 Bathymetry	☐	☐	☐	☐	☐	☐
5-09 Coastline	☐	☐	☐	☐	☐	☐
5-10 Natural water bodies	☐	☐	☐	☐	☐	☐
5-11 Governmental/ Administrative units	☐	☐	☐	☐	☐	☐
5-12 Populated places	☐	☐	☐	☐	☐	☐
5-13 Census enumeration areas	☐	☐	☐	☐	☐	☐
5-14 Place Names	☐	☐	☐	☐	☐	☐
5-15 Feature Names	☐	☐	☐	☐	☐	☐
5-16 Land Parcels/Cadastre	☐	☐	☐	☐	☐	☐
5-17 Land Tenure	☐	☐	☐	☐	☐	☐
5-18 Street Address	☐	☐	☐	☐	☐	☐
5-19 Postal or zip code zones	☐	☐	☐	☐	☐	☐
5-20 Land use planning zones	☐	☐	☐	☐	☐	☐
5-21 Roads	☐	☐	☐	☐	☐	☐
5-22 Road centrelines	☐	☐	☐	☐	☐	☐
5-23 Railways	☐	☐	☐	☐	☐	☐
5-24 Airports and ports	☐	☐	☐	☐	☐	☐
5-25 Bridges and tunnels	☐	☐	☐	☐	☐	☐
5-26 Power infrastructure	☐	☐	☐	☐	☐	☐
5-27 Telecommunications	☐	☐	☐	☐	☐	☐
5-28 Land cover	☐	☐	☐	☐	☐	☐
5-29 Soils	☐	☐	☐	☐	☐	☐
5-30 Geology	☐	☐	☐	☐	☐	☐

Section 6: Metadata

For each dataset for which you have indicated in Section 3 that metadata exists please provide the following information. Please make copies of this section and complete for each dataset.

Notes:

1. **For "Questionnaire serial no." below please quote the serial number indicated on the front page of the questionnaire, (Item 01 under the "For Official Use Section).**
2. **For "Dataset reference" below please enter the full item reference from Section 3. For example, if the metadata is for bathymetry data corresponding to the scale range of 100 000 – 250 000, the Dataset reference will be 3-08e.**
3. **For "Title of dataset" please use the following convention: [Name of country_Official dataset name_scale or resolution]. For example, the title of the 1:250 000 national roads dataset for Ghana at will be "Ghana_National Roads_250K"**

Mandatory Elements:

Questionnaire serial no.: __ __ __ __

Dataset reference: __ __ __ __

Title of dataset: .....

Abstract: .....

Purpose: .....

Metadata date: .....

Originator(s): .....

Language of dataset: .....

Theme keywords: .....

Theme keyword thesaurus: .....

Bounding coordinates:

West bounding coordinate: .....

East bounding coordinate: .....

North bounding coordinate: .....

South bounding coordinate: .....

Coordinate system name: .....

Geodetic model:

Horizontal datum name: .....

Ellipsoid name: .....

Semi-major axis: .....

Semi-minor axis: .....

Denominator of flattening ratio: .....

Lineage:

Original source: .....

Process(es)/step(s): .....

Time period information: .....

Currentness reference:.....

Status:

Progress: .....

Maintenance and update frequency: .....

Access constraints: .....

Use constraints:.....

Conditional Elements:

Geo-spatial data presentation (vector, raster, grid)

For vector data:-

Scale or minimum mapping unit:.....

File format/data structure: .....

For raster data:-

Spatial resolution: .....

File format/data structure:.....

Online linkage (if dataset is available online): .....

Resource description: .....

Native dataset format: .....

Native dataset environment: .....

File or table name:.....

Dataset size: .....

Metadata date: .....

Language of metadata: .....

Metadata contact information (*if different from Item 12*):

Contact organization: .....

Contact person: .....

Contact address:.....

Address type (mailing/physical): .....

City: ..... Postal code (where available):.....

Country: .....

Contact telephone: ..... E-mail:.....

Metadata standard name:.....

Metadata standard version: .....

MAPPING AFRICA FOR AFRICA

Catalogue of Available Fundamental Geo-Spatial Datasets for Africa and Country Gap Analysis

Guidelines for Completing the INVENTORY QUESTIONNAIRE

1. Background

In 2005, the Chief Directorate: Surveys and Mapping of the Department (CDSM) of the South African Department of Land Affairs commissioned the Human Sciences Research Council (HSRC) and EIS-AFRICA to undertake a user needs assessment of fundamental geospatial datasets in Africa. The project was under the auspices of the "Mapping Africa for Africa" (MAFA) initiative, launched by the Committee for Development Information (CODI), Subcommittee on Geo-information (Geo) of the United Nations Economic Commission for Africa (UNECA), in collaboration with the International Cartographic Association (ICA). The main aim of MAFA is to address the lack of accurate, reliable and up-to-date fundamental geo-spatial datasets essential for effective and efficient decision making and development planning in Africa. The purpose of the user needs assessment was to determine what constitutes *fundamental geospatial datasets* in Africa from a user perspective.

As a follow up to the user needs assessment, the CDSM has commissioned a survey to catalogue available fundamental geo-spatial datasets, and to undertake gap analysis for all countries of Africa. The aim is to undertake a continent-wide inventory of fundamental geospatial datasets, and a gap analysis to identify where future projects should focus attention. The project has four specific objectives:

- Conduct an inventory and collect metadata for available fundamental geospatial datasets in Africa;
- Store the information in a catalogue that will be housed as part of the UNECA's metadata node;
- Conduct a gap analysis in respect of deficiencies in the fundamental geospatial datasets, including the extent to which countries in Africa have access to such data;
- Inventory existing land cover datasets in the SADC region.

The project team has decided to use a combination of a questionnaire, face-to-face, and telephonic interviews as the means to achieve the above objectives. This document targets national-level collaborators. It provides a context and guidance on the methodological approach to the inventory and cataloguing process, definitions of terminology, and how to complete the questionnaire. The inventory of existing land cover datasets in the SADC region is being managed separately and is not covered by these guidelines.

2. Fundamental datasets

The user needs assessment recommended that the following definition of ***fundamental dataset*** be adopted[1]:

> *Fundamental datasets are the **minimum primary sets** of data **that cannot be derived** from other datasets, and that are **required to spatially represent** phenomena, objects, or themes important for **the realisation of economic, social, and environmental benefits** consistently across Africa at the local, national, sub-regional and regional levels.*

[1] Determination of the fundamental geo-spatial datasets for Africa through a user needs analysis, Human Sciences Research Council/EIS-AFRICA, February 2006

In arriving at this definition a number of issues and criteria for identifying data as fundamental were considered. These included elements that have been highlighted in the statement above. Others included:

- Must contain sufficient level of detail appropriate for the intended applications;
- Must include, either explicitly or implicitly, a reference frame (geodetic or coordinate);
- Must be continuous, contain consistent information, and have complete coverage for the area of interest;
- Must conform to accepted standards and norms, ensuring that it can be combined with other groups of data of any sort to create value-added products.

Table 1 presents the datasets that were identified, and which form the basis of the current project.

Data Theme	**Dataset**
Geodetic Control Network	Geodetic control points Height datum Geoid model
Rectified Imagery	Aerial photography Satellite imagery
Hypsography	Digital elevation model Spot heights Bathymetry
Hydrography	Coastline Natural water bodies
Boundaries	Governmental/Administrative units Populated places Census enumeration areas
Geographic names	Place Names Feature Names
[Land management units/areas]	Land Parcels/Cadastre Land Tenure Street Address Postal/zip code zones Land use planning zones
Transportation	Roads Road centrelines Railways Airports and ports
Structures	[Bridges and tunnels]
Utilities and services	Power Telecommunications
Natural environment	Land cover Soils Geology

3. Approach and considerations

The overall project framework is shown in Figure 1 below.

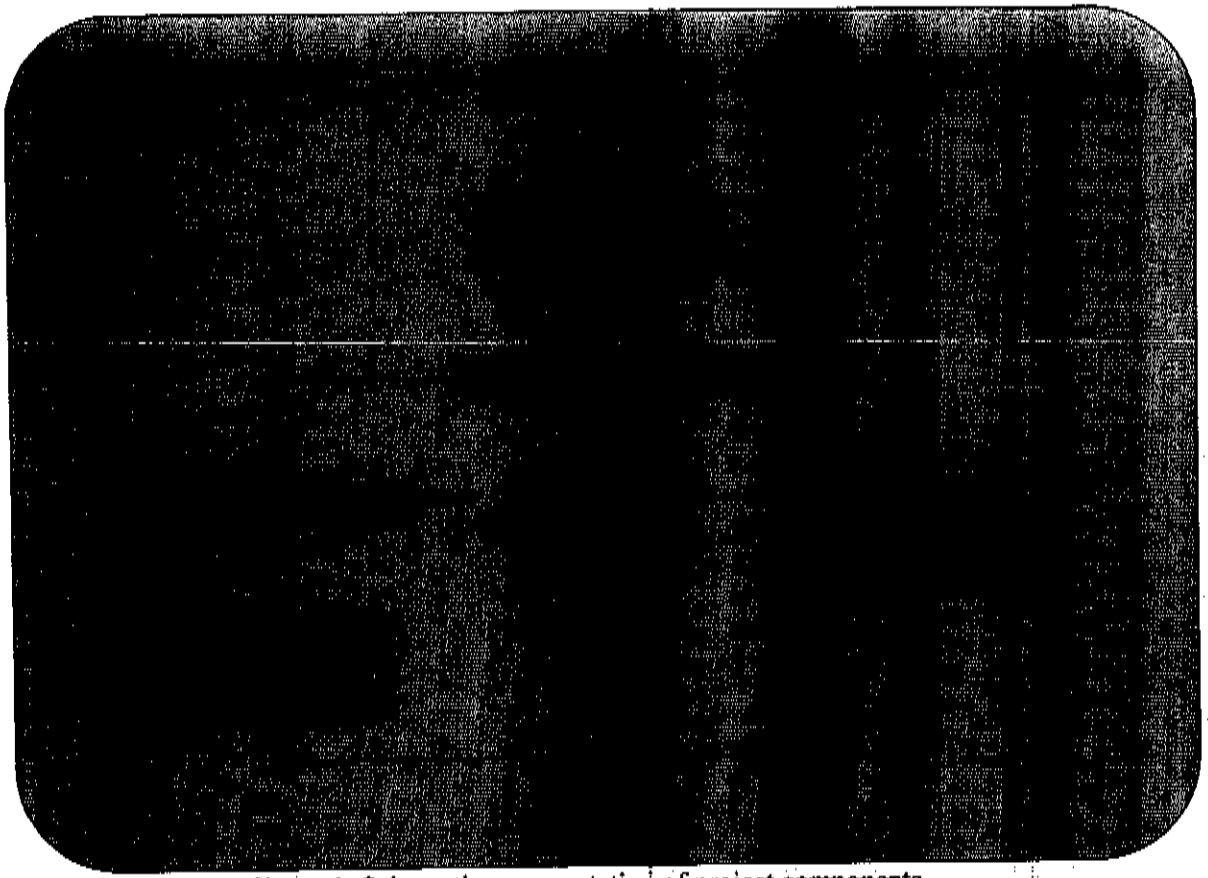


Figure 1: Schematic representation of project components

3.1 Project management

A project management team comprising the HSRC and EIS-AFRICA has been set up to guide the implementation of the project. Partner institutions have also been identified at the sub-regional and international levels.

3.2 Methodology

There are three key strands in the implementation approach adopted. These are:

- Identification of fundamental geospatial datasets ***available*** for each country through the process of collecting information on the available geospatial datasets
- Building a registry or ***catalogue*** that contains details of the available fundamental geospatial datasets, including metadata;
- Establishing what is ***lacking*** in terms of the fundamental datasets in each country.

A central question at the heart of the adopted methodological approach is, for ***each of the 30 datasets*** identified by the user needs assessment as being fundamental: ***does the dataset exist anywhere?*** If it exists the approach is then to establish where it can be found, its characteristics on the basis of selected criteria for fundamental datasets highlighted in Section 2 (also see full report on the determination of fundamental datasets for Africa), and then to provide a description of the dataset. If the dataset does not exist, then there is gap (see Figure 2).

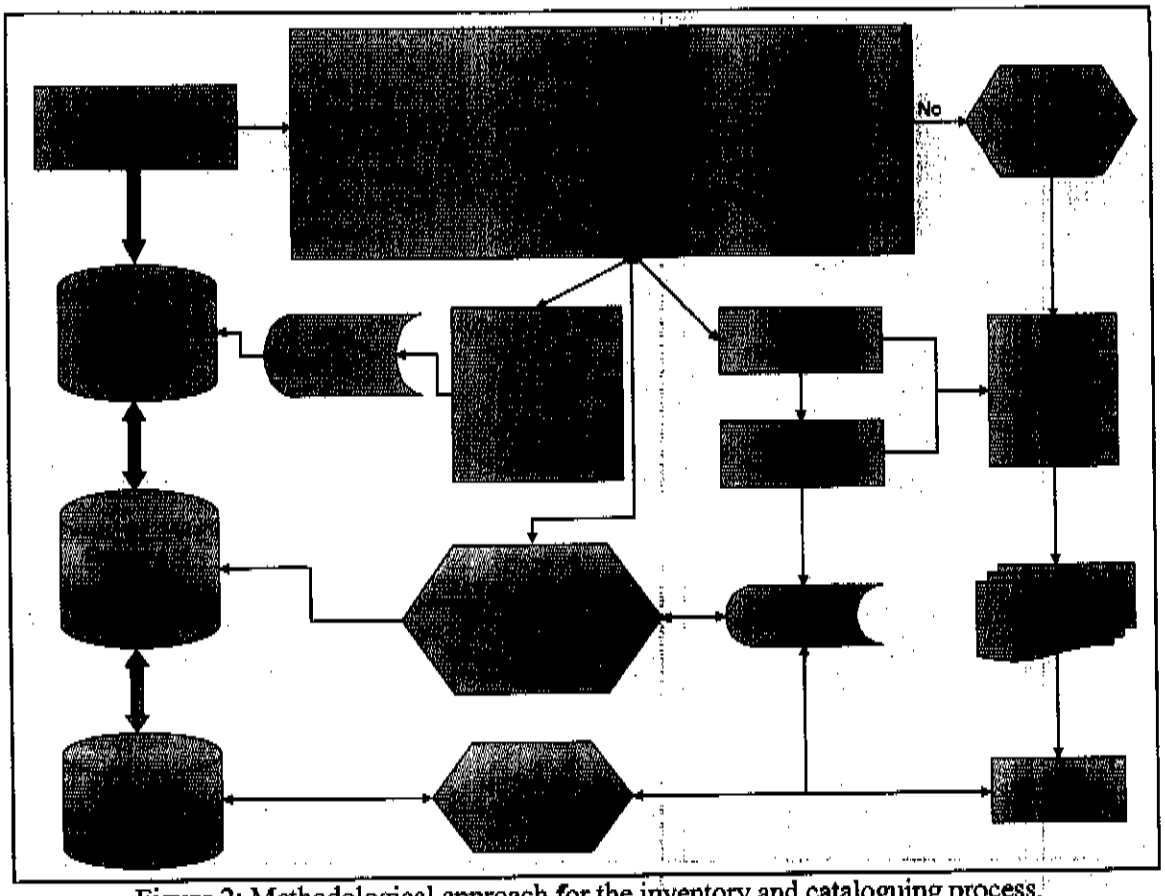


Figure 2: Methodological approach for the inventory and cataloguing process.

In establishing the existence of particular datasets a desktop study of inventories and catalogues of geospatial datasets in Africa and ***elsewhere in the world*** will be done. The primary purpose of the desktop study is to gather as much information on available fundamental geospatial datasets and to identify as many potential sources as possible. This will include literature search on inventories and catalogues that have been undertaken on geospatial datasets in Africa at the sub-regional and international levels. Part of this search will be to identify any international organizations that are custodians of the fundamental geospatial datasets.

The inventory will cover all 53 countries in Africa. A survey questionnaire approach has been adopted as the main tool for the systematic collection and cataloguing of the relevant information from countries. Data holding organisations to be surveyed will include government establishments (ministries, departments, semi-government institutions or para-statals), non-governmental organizations, and private-sector entities both the country and international levels, and multinational agencies (e.g. United Nations agencies and the World Bank).

Characteristics of identified datasets, e.g., formats, scales, age of the dataset, the application level, and various metadata descriptors, will also be documented. Since the approach is to establish the existence or otherwise of datasets, irrespective of *where* the dataset is held and *who* holds it, provision has been made to cater for the possibility that that some fundamental datasets may be held privately. For this reason it will be necessary to establish the conditions of access for each dataset to provide for the possibility of a negotiated access to the data when required.

Gap analysis will deal with two broad aspects:

i) the *non-existence* of the fundamental dataset *anywhere*, and

ii) issues relating to incompleteness in coverage, inconsistency, quality, etc., in the datasets.

Guidelines on how to undertake the gap analysis and write it up will be produced separately.

3.3 Questionnaire administration

Sub-regional partners will identify ***national collaborators*** to assist in the inventorying and cataloguing process. Such collaborators will be organisations or individuals in the public or private sectors that have a good standing in their countries, have a good network with geoinformation organisations, and have capacity to assist with the project. Partners involved in the project at the sub-regional and regional levels all have well-established networks with geoinformation institutions which will be leveraged to obtain as much information as possible. Apart from the benefit of covering a wide variety of potential sources this approach also strengthens critical networks that can be used in the future for other geospatial projects. Furthermore, it allows national partners the opportunity to participate in a pan-Africa project identifying fundamental geospatial datasets in African countries.

National collaborators will identify ***key institutions that potentially hold fundamental datasets***, either as ***custodians***, or by virtue of their own functions. The national collaborators are required to create a contact list of all the different agencies that they identify and associate with each of the various fundamental geospatial datasets. It is anticipated that the national collaborators may have to e-mail, courier, or fax copies of the questionnaire to data holders, for example, when they are in another city. Collaborators will follow up regularly with the data holders by the most appropriate means including e-mail and telephone. Where necessary they will organise and hold face-to-face interviews with holders of the datasets in their countries. If the national collaborator is an institution it is expected that specific individuals, for instance a GIS Technician, will be assigned to the exercise and "formal" time allocated for chasing up on the data holders to get them to return their questionnaires.

Completed questionnaires for respective countries will be collated and forwarded by the national collaborator ***via courier*** to the respective sub-regional partner. The sub-regional partner will collate and validate the returned questionnaires, including a check for completeness. Where necessary, the sub-regional partners will follow-up with national collaborating centres who have not completed their work. The contact lists produced by the national collaborating centres will be used to see what progress has been made in each country. The sub-regional partner will then forward the completed and validated questionnaires to the project management team.

The regional partner will prepare and submit a report on the inventory process, highlighting any salient issues, challenges, and significant outcomes.

3.4 Data capture and analysis

The project management team will assume responsibility for the capture of data from each of the questionnaires. A database will be created for the purpose of data capture, querying, retrieval, and analysis of the survey data. It is expected that three databases with be established from the survey data. The first will be a ***register of all institutions*** holding any of the fundamental dataset of/on African countries. The second will be a ***database of available fundamental datasets*** including data characteristics (formats, scales, age, etc.). The third database will be the ***metadata catalogue*** structured on the basis of the *ESRI Profile* of the ***International Standards Organisation (ISO) 19115 Core Metadata Elements***. This is in recognition of the fact that many geo-data production institutions in Africa use one or more of the ESRI suite of products, and may already have metadata in this format.

It is intended that these "different" databases will be structured in such a manner that it would be possible to link and integrate elements.

4. Structure of the questionnaire

The questionnaire is based on the three key strands elaborated upon in Section 3.2, and focuses on the following "project deliverables":

a) an inventory of available fundamental datasets

b) gap analysis and report

c) a metadata catalogue

However, in order to produce the *project deliverables* the questionnaire is structured to provide vital information on several elements of the fundamental datasets available in each African country, as well as those held by "external" organisations.

The questionnaire has seven sections:

- The first section relates to information about the respondent of the questionnaire, and the data-holding institution.
- The second section establishes the existence or otherwise of the dataset, either by a *custodian* institution or by some other organisation that holds the dataset as a result of its own functions.
- The third section deals with characteristics of the data with respect to available scales, completeness of coverage, publishing year, last update year, and whether or not there is metadata for the dataset.
- The fourth section establishes the formats of available datasets. Data types/formats for the inventory include hard-copy maps, databases, digital spatial data (structured and unstructured).
- The fifth section deals with data accessibility.
- The sixth section deals with metadata based on the *ESRI Profile* of the ISO 19115 Core Metadata Elements.
- The seventh section is for (official) use, and is expected to be completed by the national collaborator.

The questionnaire is designed with a focus on ease of completion. For the most part it lists the 30 pre-determined datasets, and requires the respondent to indicate by checking boxes as may be appropriate. It is hoped that this format makes the completion of the questionnaire a straight forward activity not requiring a lot of time.

5. Explanation and definition of terms

Terminology used in the questionnaire is explained below:

Unique referencing

It should be noted that the numbering format adopted in the questionnaire (***s-nn***) is to facilitate ***sectional referencing while maintaining unique identifiers for the respective datasets***. The first part of the number (*s-*) is a "sectional flag" referring to the section of the questionnaire where the particular item of interest appears; the second part (***nn***) always refers to the same dataset throughout the questionnaire. For example, item *2-21* refers to the *roads dataset* in section 2, while *4-21* refers to the same dataset (roads) in section 4 of the questionnaire. In this way it would be possible to query the database for all or parts of, or extract information only pertaining to the roads dataset.

"Official Use Only" section

The Terms of Reference call for evidence that sufficient effort was made to obtain the required information to the satisfaction of the client. To this end regional partners must ensure that details of their respective national collaborators are available for possible follow-up by the project team.

Questionnaire serial no.

Before distributing the questionnaires the national collaborator is required to allocate a serial number to each questionnaire. The number should be 4 digits, from ***0001 to 9999***. Serial numbers

should be recorded against the recipient institution, as part of the details of the questionnaire distribution list.

Dispatch date

The date on which the questionnaire is dispatched to an institution should be recorded on each questionnaire dispatched using the ***DD-MM-YY*** format.

Name of country:

Name of the country for which the questionnaire represents.

ISO Alpha-3 Country Codes

The national collaborator is also required to fill in the ***ISO Alpha-3 Country Code***. This code will be used together with "*Item #122 Acronym*" to create unique identifiers in the database, e.g., ZAF-CDSM for the *South African Chief Directorate: Surveys and Mapping*.

The list of country codes are as follows[2]:

Algeria	DZA	Libyan Arab Jamahiriya	LBY
Angola	AGO	Madagascar	MDG
Benin	BEN	Malawi	MWI
Botswana	BWA	Mali	MLI
Burkina Faso	BFA	Mauritania	MRT
Burundi	BDI	Mauritius	MUS
Cameroon	CMR	Morocco	MAR
Cape Verde	CPV	Mozambique	MOZ
Central African Republic	CAF	Namibia	NAM
Chad	TCD	Niger	NER
Comoros	COM	Nigeria	NGA
Congo	COG	Rwanda	RWA
Côte d'Ivoire	CIV	Sao Tome and Principe	STP
Democratic Republic of the Congo	COD	Senegal	SEN
Djibouti	DJI	Seychelles	SYC
Egypt	EGY	Sierra Leone	SLE
Equatorial Guinea	GNQ	Somalia	SOM
Eritrea	ERI	South Africa	ZAF
Ethiopia	ETH	Sudan	SDN
Gabon	GAB	Swaziland	SWZ
Gambia	GMB	Togo	TGO
Ghana	GHA	Tunisia	TUN
Guinea	GIN	Uganda	UGA
Guinea Bissau	GNB	United Republic of Tanzania	TZA
Kenya	KEN	Western Sahara	ESH
Lesotho	LSO	Zambia	ZMB
Liberia	LBR	Zimbabwe	ZWE

First name(s):
First name or surname of the person administering the questionnaire.

Family name:
Last name or surname name of the person administering the questionnaire.

[2] Excerpted from Wikipedia, with country names and codes as designated by the International Standards Organisation (http://en.wikipedia.org/wiki/ISO_3166-1_alpha-3)

Tel./Fax/E-mail:
Contact details of of the person administering the questionnaire.

Section 1: Organisational Information

Part 11: Person completing questionnaire

The person given the responsibility within the data holding institution to fill the questionnaire should fill in details about himself/herself. "Family name" (***Item 112***) is the same as surname or last name, as used in certain cultures.

Telephone number (***Item 113***) should be provided **complete** with the country code, area or city code. If the person is on an **extension** this should also be indicated.

Part 12: Organisational information

The official name of the data holding institution should be provided (***Item 121***), together with the official acronym (***Item 122***). The acronym will be used as an **identifier** in the database. It is therefore critical that this piece of information is filled in.

Item 123 refers to the ***physical location*** or ***street address*** of the data holding entity. In case this entity is part of a larger organisation, the address of the place (unit, centre, department, etc.) where the dataset is kept should be provided here. ***Item 124*** refers to the ***address for delivering postal items or mail***. If this is the same as the physical address it should be indicated. If the institution has an official e-mail address (***Item 127***) or web site (***Item 128***) these should be provided.

Information about the head of the organisation (***Item 129***) is required to facilitate possible official communication at a later date. ***Item 1294*** requires the **official designation, title or position** of the head of the organisation, e.g., Director, Executive Secretary, etc.

Part 13: Organisational description

Item 131 requires the respondent to indicate the **type of organisation** that the holder of the geo-spatial data is.

In addition the **geographic scope, coverage or jurisdictional area** should be specified (***Item 132***). In terms of Item 132 *Provincial/State (or similar)* refers to the ***second-level*** of the national administrative structure; *District (or similar)* refers to the ***third level***; and *Local government/authority* refers to the ***city/municipality/town council level***.

Section 2: Availability of fundamental geo-spatial datasets

Dataset definitions:

The following definitions for the fundamental datasets are taken from the report on the *"Determination of the fundamental geo-spatial datasets for Africa through a user needs analysis"*:

Geodetic control points:	List of coordinates with information on the history of establishment of the network as well as network design in digital map/GIS format.
Height datum:	List of heights of primary height points in digital map/GIS form (vertical datum surface)
Geoid model:	Geoid-ellipsoid separations (heights at individual points) to convert from GPS observations to heights

Aerial photography:	Aerial photography
Satellite imagery:	Satellite imagery
Digital elevation model:	Vertical distance from the earth's surface to a base defined by the adopted height datum
Spot heights:	Heights of peaks
Bathymetry:	Vertical distance of earth's surface from base defined by Lowest Astronomical Tide
Coastline:	The limit of land features usually at mean high water level.
Natural water bodies:	Location of watercourses, drainage network, and all inland water bodies (streams, rivers, canals, ponds, lakes, etc.)
Governmental/Administrative units:	Limits of administrative and jurisdictional authority (International, national, sub-national boundaries, and local government areas)
Populated places:	Population centres including urban areas, towns, localities, and rural settlements
Census enumeration areas:	Boundaries of areas delineated for the purpose of collecting demographic census information
Place Names:	Official and local names of places
Feature Names	Official and local names of cultural and geographic features (including roads)
Land Parcels/Cadastre:	A consistent framework of land parcel/cadastre boundaries defined for land tenure purposes, referenced to a common datum
Land Tenure:	Current, proposed and historical details of all tenures, e.g., details of ownership, vesting, and including traditional forms of land holding.
Street Address:	Unique Street Address of parcels/properties
Postal/zip code zones:	Boundaries of post code areas
Land use planning zones:	Boundaries of areas of permitted/restricted land use defined by planning authorities (includes conservation areas, heritage sites, and restricted areas)
Roads:	Network of physical roads and carriageways
Road centrelines:	Centreline of roads and carriageways
Railways:	Network of railway lines
Airports and ports:	Location of airports, sea ports, and navigation aids
Bridges and tunnels:	*Bridges* are structures built to carry a road, path, railway, etc., across a gorge, valley, road, railway, river, body of water, or

	any other physical obstacle. *Tunnels* are artificial underground passages through a hill or under a road or river etc., esp. for railways or roads to pass through
Power infrastructure:	Locations of trunk or national grid power line networks and major assets/installations, and sources
Telecommunications:	Locations of trunk communication networks and major assets
Land cover:	Observed bio-physical cover over on the earth's surface
Soils:	Boundaries and classifications of soil resources
Geology:	Boundaries and classification of geological units

Custodian:

A custodian is an organisation (or other group, occasionally an individual) which is ***mandated by policy or legislation*** to be in the best position to produce the dataset and to ensure the quality and accessibility of a dataset, and to advise on appropriate uses thereof[3].

Functional holding:

In most cases, ***data owners or holders*** are also the custodians. However this may not always be the case. It is therefore important to recognise that data ***custodianship*** differs from data ***ownership***. Custodianship does not necessarily signify ownership. There are situations where a dataset that is needed for the execution of an organisation's functions may not exist and the organisation goes out on its own to create and hold it. In such a situation the owner retains ***intellectual property rights*** over the data. However this does not constitute custodianship, and the option of ***functional holding*** is provided to accommodate such a situation. The owner may choose to delegate usage and/or distibution rights to the mandated custodian of the dataset. In such a situation the custodian may be likened to a *trustee* in terms of its relationship with the data.

Section 3: Data Characteristics

Scale ('000)/Resolution (m):

Levels of detail required for a universal set of fundamental geospatial data for the whole of Africa vary, ranging from highest to lowest. This reflects the variety of features and the range of spatial attributes that may be represented at the respective scales. The recommended *levels of detail* of information and the corresponding application scales and data resolution set for the fundamental datasets are as indicated in the table below:

Level of Detail	Application Level	Scale	Resolution (m)
Highest	Site	>1:5 000	<2.5
High	Local/municipality level	1:10 000	≤ 5
Medium	Sub-national/provincial level	1:50 000	≤ 50
Low	National level	1:250 000	≤ 125
General	Regional	1:1 000 000	≥ 1,000

[3] World Conservation Monitoring Centre. 1998. WCMC Handbooks on Biodiversity Information Management. Volume 5: Data Custodianship and Access. Reynolds, J.H. (Series Editor). Commonwealth Secretariat, London. ix + 24pp.

In order to accommodate the possibility of deriving these "boundary" scales and/or resolutions from existing larger scale or higher resolution geospatial datasets, ***scale/resolution ranges*** are used in the questionnaire. Respondents should ***choose ranges that correspond to the available data***. For instance, if there are no 1:250,000-equivalent bathymetric data, but 1:125 000 scale data is available the "100 – 250" option should be checked. Since map scales are not "continuous" scale ranges corresponding to commonly available/used maps[4] have been adopted as the boundaries in the questionnaire. The following table should be used as a guide:

Scale Range (,000)	Typical available scales
>10	1:2,000; 1:5,000; 1:6,000; 1:9,000
10-50	1:10,000; 1:12,000; 1:20,000; 1:24,000; 1:25,000; 1:31,680; 1:50,000
62.5-100	1:62,500; 1:63,360; 1:80,000; 1:100,000
125-250	1:125,000; 1:126,720; 1:250,000
500-1000	1:500,000; 1:1,000,000

Respondents should be reminded that, in terms of scale, the smaller the number representing the "ground distance", the larger the scale, and vice versa. Therefore, although the use of the greater/less than signs (">" and "<") may not appear to be "logical", it is only used as a shorthand in the questionnaire. For instance, *">10"* is a shorthand for ***large scale maps or data sources of scales larger than 1:10,000***. Respondents should think of the numbers indicated for "scale" as the denominators of "representative fractions".

For datasets that are normally characterised in terms of ***data resolution***, commonly used resolutions are used as the range boundaries. Here the greater/less than signs (">" and "<") take on their logical meanings.

Completeness:

Completeness refers to the percentage of the spatial (geographic) and jurisdictional/responsibility area for which data is available.

Year 1st published/Year last updated:

In order to get a sense of the age of available geospatial data the year when the data was ***first published***, and the last known year when it was ***last updated*** should be indicated. If the dataset has ***not been updated*** since it was first published the corresponding space should be left ***blank***.

Metadata:

If there is information on how to locate the dataset, evaluate whether the dataset meets one's requirements, how to extract the relevant data, how to actually make full use of the data in an application, etc., this should be indicated by an "***X***".

Section 4: Data format

A core objective of the inventory process is to document the ***existence or otherwise*** of fundamental datasets. In this regard due cognisance is taken of the possibility that datasets may exist in formats other than digital.

Reports:

This format should be checked if the dataset is available in a report, whether published or unpublished.

[4] See, for example, http://jd.water.usgs.gov/reference/map_scales.html, accessed 31 May 2006.

Hardcopy tables:

This option should be selected if the dataset is available in tabular ***paper*** form in files, log books, archived paper records, etc. **Tables that are ouputs from word-processed documents** should not be included in this, unless the digital files are not available.

Hardcopy map:

This includes all analogue *"map"* formats, including paper prints and films.

Electronic spreadsheet:

Select this option if the data organised and held in ***digital tables***, such as Excel or Lotus 1-2-3 worksheets which can be directly ***manipulated***.

Database:

Select this option if the data organised, ***structured*** and held in a ***database management system*** such as Dbase, Access, Oracle, etc.

GIS format:

Select this option if the data is held as a ***GIS-readable format***, whether structured or otherwise, vector or raster format, irrespective of the software or system used to capture the data.

Other digital files:

Select this option if the data is available in ***some other digital format***, including word-processed tables, structured and unstructured lists, and scanned "maps".

Section 5: Data accessibility

Organisations generally have some form of *policy or practice* with regard to the release of data and information. This section of the questionnaire assesses the ways in which available fundamental datasets may be accessed. This is important particularly in respect of data that may be *privately held* by various entities.

Accessibility:

Where data is accessible to **all users** ***"Unrestricted access"*** option should be selected. Where some form of **requisition and approval** is required in order for data to be accessed ***"Authorisation required"*** should be selected. In some cases, accessibility may depend on the level of detail or scale of the data as, for example, in the case of census data where enumeration area data may not be released to users but generalised census data may be readily available. In such situations the ***"Scale-dependent"*** option should be indicated. Where data access is restricted, for instance where data is for internal uses only, the ***"Restricted"*** option should be selected.

Access conditions:

Conditions of access are grouped into two categories only. Where data is **made available freely, without any conditions whatsoever**, the ***"Free"*** option should be selected. If there is any form of payment, for instance for the media or, say, cost of reproduction, the ***"Against payment"*** option should be selected.

Section 6: Metadata

For each dataset that is documented (as per Section 3), additional information about the dataset is required. For the purpose of this project the profile of the ***ISO 19115 Core Metadata Elements*** as implemented within ***ESRI's ArcCatalog*** tool has been adopted[5]. This is in view of the vact that many geo-data producing organisations in Africa use the ESRI suite of products (i.e., Arc/Info or

[5] http://www.esri.com/metadata/esriprof80.html

ArcView GIS) which incorporates the *ArcCatalog* tool to capture metadata. Those more familiar with the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) should note that the main differences appear in how the elements are called and defined. To ease comprehension of terminology, especially for those familiar with the ISO 19115 Core Metadata Elements, the equivalent terms are indicated in *italics* and square brackets [xxxxx] in the following definition of terms.

It should be noted that some metadata elements which are ***conditional*** in the ISO 19115 have been made mandatory for the fundamental datasets. This is in view of peculiar conditions in Africa, including colonial history which has imposed different systems on countries, and data quality issues. To avoid duplication of questions, elements that are covered by the other sections of the questionnaire, e.g., metadata contact, publishing date of date, etc., are not repeated here. The relevant fields in the metadatabase will be populated using the information from other sections of the questionnaire.

For the purpose of the project it should be noted that ***complete metadata*** is required for the identified fundamental datasets. If metadata has been captured only partially, the missing/incomplete/additional information should be filled in.

Mandatory Elements:

Questionnaire serial no.:
The serial number indicated on the front page of the questionnaire, (*Item 01 under the "For Official Use Section*) should be quoted here.

Dataset reference:
The full item reference for the respective dataset from Section 3 should be quoted. For example, if the metadata is for *bathymetry data* corresponding to the scale range of 100 000 – 250 000, the Dataset reference will be 3-08e. This is to facilitate accurate referencing of the metadata to the respective dataset.

Title of dataset [*Dataset title*]:
Name by which the cited resource is known should be indicated. The following convention should be used: *Name of country_Official dataset name_scale or resolution* of the dataset. For example, the title of the 1:250 000 national roads dataset for Ghana at will be "Ghana_National Roads_250K"

Abstract:
A brief narrative summary of the dataset

Purpose:
A summary of the intentions with which the dataset was developed

Metadata date [*Metadata date stamp*]:
Date that the metadata was created

Originator [*Dataset responsible party]*:
The name of an organisation or individual that developed the dataset

Language of dataset:
Language(s) used within the dataset

Theme keywords [*Dataset topic category*]:
Main theme(s) or common-use word or phrase used to describe the subject of the dataset.

Theme keyword thesaurus:
A formally registered thesaurus or a similar authoritative source of theme keywords

Bounding coordinates [*Geographic location*]:
Geographic position of the dataset

Coordinate system name [*Reference system*]:
Name of the coordinate *reference* system used in the dataset

Geodetic model:
Parameters for the shape of the earth at the point of the dataset

Lineage:
Information about the source data, events or processes used in constructing the dataset

Time period of content/information:
The year (and optionally month, or month and day) for which the dataset corresponds to the ground

Currentness reference:
The basis on which the *Time Period of Content/Information* is determined

Currentness reference is indicative of how "up-to-date" the dataset is in relation to the "ground condition" (i.e., when the "real world" looked the way it is described in the data set). The *Currentness Reference* requires the data producer to identify if the *Time Period of Content* dates and times refer to the ground condition, derived from some source, or refer to some later time when the information was recorded, published, etc.[6] In other words, the *publication date* is not sufficient information regarding currentness. For instance, the ground condition, date of map that was digitized, etc., should be indicated in addition. Also if multiple dates or a range of dates apply, these should be listed and explained.

Status of the dataset:

Progress:
The state of the dataset, e.g., complete, under development, etc.

Maintenance and update frequency:
The frequency with which changes and additions are made to the dataset after the initial dataset is completed

Access constraints:
Restrictions and legal prerequisites for accessing the dataset

Use constraints:
Restrictions and legal prerequisites for using the dataset after access is granted

Conditional Elements:

Geo-spatial data presentation [*Spatial representation (ISO) or Direct Spatial Reference (CSDGM)*]:
Method used to spatially represent geographic information, i.e. vector or raster or grid

Online linkage [*On-line Resource*]:
Information about on-line sources from which the dataset can be obtained

Resource description:
Type of online resource, e.g., downloadable data

[6] MetaLite 1.7.5 Online Help - FGDC Standard, Section 1 - Identification Information, http://edcnts11.cr.usgs.gov/metalite/help/fgdcid.html

Native dataset format [*Distribution format(s)*]:
Description of the computer language construct that specifies the representation of data objects in a record, file, message, and storage device or transmission channel, e.g., ESRI Shapefile

Native dataset environment:
System platform (operating system, geo-information system/software) on which the dataset was created, e.g., Microsoft Windows 2000 Version 5.1 (Build 2600) Service Pack 2; ESRI ArcCatalog 8.2.0.700

File or table name [Metadata file identifier]:
Unique identifier for this metadata file

Dataset size:
Size of dataset on the storage device

Metadata date:
Date metadata was created

Language of metadata:
Language used for documenting metadata

Metadata contact information (*if different from Item 12*):

Contact organisation:
The organization responsible for the metadata information

Contact person:
The person responsible for the metadata information

Contact address:

Address type:
The mailing and/or physical address for the organization or individual

City:
The city of the address where the metadata is held

Country:
Country where the metadata is held

Postal code:
The ZIP or other postal code of the address where available

Contact telephone:
The telephone number by which individuals can speak to the organization or individual

Metadata standard name:
Name of the metadata standard (including profile name) used

Metadata standard version:
Version (profile) of the metadata standard used

ANNEXURE 2

Regional Partner	Country	Contact person	From Organisation	Telephone (incl country code)	E-mail
CEDARE	Algeria	Khadidja EMBAREK	Ministère de l'Aménagement du Territoire et de l'Environnement	+213-21-432 868	kh_embarek@hotmail.com
EIS-AFRICA	Angola				
RECTAS	Benin	Abel FANNOU	Institut Géographique National	+229 21 31 2441/ 8943 OR +229 90 02 4914	a_fannou@yahoo.fr OR abelfannou@yahoo.com
EIS-AFRICA	Botswana	Dr Musisi Nkambwe	Dept of Environmental Sciences, University of Botswana	+267 355 2533/ 313901 (h)	musisin@mopipi.ub.bw
RECTAS	Burkina Faso	Claude Obin TAPSOBA	Institut Géographique du Burkina	(+226) 50 30 0959 OR (+226) 70 24 6534	institut.geog@fasonet.bf
RCMRD	Burundi	Prof. Loiu Nahimana	Universersite du Burundi	No tel nr available	lnahimana@yahoo.fr
RECTAS	Cameroon	Martin Binde GASU	University of Buea, Cameroon	+237 450 5433	gasumart@yahoo.com
CSE	Cape Verde	Dario Évora	Institut National de Développement de la Pêche (INDP)	+238 2321373/4 OR +238 9918037	dario@indp.cv
OSFAC	Central African Republic	Alfred Bertin Bangara	University of Bangui	+236 03 0057	abbangara1@yahoo.fr
CSE	Chad	Henri Ouya Bondoro	Centre National d'Appui à la Recherche (CNAR)	+235 52 2515 OR +235 999 3798	nabkoh@yahoo.fr
RCMRD	Comoros				
OSFAC	Congo	Gaspard Lembe	Centre National d'Inventaire et d'Aménagement Forestier (CNIAF)	+242 667 6748	lemgas@caramail.com
RCMRD	Djibuti	Mohamed Youssouf			mo_yo_ar@yahoo.com
OSFAC	Democratic Republic of Congo	Huguette Ngilambi	OSFAC	+ 243 81 012 7529	huguettenzebi@hotmail.com OR maniguetteae@yahoo.fr
CEDARE	Egypt	Khaled Ramadan	Egyptian Survey Authority	+202-5546784	ksiramadan@hotmail.com
OSFAC	Equatorial-Guinea	Edwige Eyang Effa	Wildlife Conservation Society (WCS) - Gabon	+241-0603 8362	erlymarjo@yahoo.fr
RCMRD	Eritrea	Zaid Ghebrekidan	Ministry of Public works	+291-1-122477	ligno44@yahoo.com
RCMRD	Ethiopia	Degelo Sendebo	Ethiopia Mapping Authority	+251-916825673	degelo@yahoo.com
OSFAC	Gabon	Edwige Eyang Effa	Wildlife Conservation Society (WCS) - Gabon	+241-0603 8362	erlymarjo@yahoo.fr
RECTAS	Ghana	Issah MAHAMA	Survey Department, Accra	+233 244 637 006	mahamai@yahoo.com
CSE	Guinea	Ibrahima Sorry Barry	Direction nationale des Eaux et Forêt	+224 6043 1099 OR 6421 3311	ibsobarry@yahoo.fr

Regional Partner	Country	Contact person	From Organistation	Telephone (incl country code)	E-mail
CSE	Guinea Bissau	Braima BIAI	Direction Gébérale de la cartographie et Cadastre	+245 206881	biab@yahoo.fr OR biai_braima@yahoo.com.br
RECTAS	Ivory Coast	Dr Kouadio KONAN	Centre de Cartographie et de Télédétection	+225 22 44 6410 OR +225 079 56 270	Kdio_konan@yahoo.fr OR kdkonan@bnetd.ci
RCMRD	Kenya	Dr Hussein Farah	RCMRD	+254-20-8560227	farah@rcmrd.org
EIS-AFRICA	Lesotho	Dr. Lehlohonolo D. Moeti	National Univewrsity of Lesotho	+266 58851464	ld.moeti@nul.ls
RECTAS	Liberia	Thomas L Davis	Liberia Institute for Statistics and Geo-Informaion Services (LISGIS)	+231 6 550 678	tcdavis@yahoo.com OR tomtdavis@yahoo.com
CEDARE	Libya	Dr Mohamed Hamouda	The Environment General Authority	(+218 21) 487 0266/218 913 75 9344	mshamouda@yahoo.com
EIS-AFRICA	Madagascar	Ms Lucie Noasilalaonomenjanahary	Direction du systeme d'Information, Ministere de l'Environnement, des Eaux et Forêts, Antanarivo	+261 20 22 413 59	foretmin@wanadoo.mg OR noasilalao@yahoo.fr
EIS-AFRICA	Malawi	Mkondo Moyo	Department of Surveys	+265 99 55 052	mkondodup@yahoo.com
CSE	Mali	Mahamadou Sékou KEITA	Institut Géographique du Mali (IGM)	+223 220 2840 OR +223 673 5645	Mskeita2002@yahoo.fr
CSE	Mauritania	Mohameden Abder	Service du Cadastre	+222 641 7914 OR 630 7638	safc_dpse@yahoo.fr
RCMRD	Mauritius	Vedacharya V.S.Chuckun	Ministry of Housing and Lands	+230-411 5139/ +230-750 0350	vschuckun@servihoo.com
CEDARE	Morocco	Amal Moufarreh	Ministère de l'Aménagement du Territoire, l'Eau et l'Environnement	+212 37 68 10 85 OR 064 14 9882	Moufamal2000@yahoo.fr
EIS-AFRICA	Mozambique	Afredo Ricarto Zunguze	MICOA		a_ricardo_z@yahoo.com.br
EIS-AFRICA	Namibia	Celeste Espach	Ministry of Agriculture, Water and Forestry	+264 61 208 7070	cespach@iway.na
CSE	Niger	Harouna FODI	Institut Géographique National du Niger (IGNN):	+227 72 3323 / 72 4214/ 72 2467 OR +227 9629 4155	harounafodi@yahoo.fr
RECTAS	Nigeria	Adewale Akingbade	RECTAS	(+234) 803 384 0581	a_akingbade@yahoo.co.uk

Regional Partner	Country	Contact person	From Organistation	Telephone (incl country code)	E-mail
RCMRD	Rwanda	Dr Michele A. Schilling	National University of Rwanda	+250 5 510 8551	cgisnur@yahoo.fr
RECTAS	Sao Tome & Principe				
CSE	Senegal	Monsieur Youssou NDONG	Direction des travaux cartographiques et geographique (DTGC)	+221 832 1182	dtgc@primature.sn OR dirdtgc@sentoo.sn
RCMRD	Seychelles	Mr.G. Hoareau	Ministry of Land use and housing	No tel nr available	ghoareau@mluh.gov.sc
RECTAS	Sierra Leone	Ansu Keifala (Mr)	Frank Satta Construction & Engineering Enterprise	+234 766 77252	ansu4eva@yahoo.com
RCMRD	Somalia	Dr Hussein Farah	RCMRD	+254-20-8560227	farah@rcmrd.org
EIS-AFRICA	South Africa	Pinky Dhlamini	National Spatial Information Framework	+082 339 4611	OPDhlamini@dla.gov.za
CEDARE	Sudan	Dr Balgis Ossman	Higher Council for Environment& Natural Resources (HCENR)	+249 183 786903	balgis@yahoo.com
EIS-AFRICA	Swaziland	Bheki Ginindza	Swaziland Water and Agricultural Development Enterprise	+268 602 4650	bheki@swade.co.sz
RCMRD	Tanzania	Abdi Bigangika	Survey and mapping Department	+255 22 212 3735 OR 71 355 6569	abigangika@yahoo.com
CSE	The Gambia	Abdoulaye Manneh	Secrétaire Général du ministère des terres et des communautés rurales	+220 996 1122	a.manneh@qanet.gm
RECTAS	Togo	Koffi Kouma Dakey	Direction Général de la Cartographie et du Cadastre	+228 223 1311 OR +228 935 8794	dakey_koffi@yahoo.fr
CEDARE	Tunisia	FOURTI Mohamed Chérif	Observatoire Tunisien de l'Environnement et du Développement Durable	(216) 71 782 128.	mcfourti@yahoo.fr
RCMRD	Uganda	John Kitaka	Survey and mapping Department	+256 772 68 1996	johnkitaka@yahoo.com
CSE	Western Sahara				
EIS-AFRICA	Zambia	Christopher Lungu	RuralNet Associates Limited	+260 99 457 901	clzambia@yahoo.co.uk
EIS-AFRICA	Zimbabwe	Dr Amon Murwira	University of Zimbabwe	+263 91 415 052	murwira@arts.uz.ac.zw

ANNEXURE 3

African Development Bank	African	Web	Ibrahim N'Diaye	Director: Information Management and Methods	216 7110 2030	i.ndiaye@afdb.org
African Geodetic Reference Frame (AFREF)	African	Web	Dr. Wilber Ottichilo	Director General: Regional Centre for Mapping of Resources for Development	254 20 860654	ottichilo@rcmrd.org
ALLM GeoData		Dooley 2005			44 1202 417 477	alan@allm-geodata.com
AusAID	International	Web			61 2 6206 4000	infoausaid@ausaid.gov.au
Bridges	International	Web	Sean O'Connor	Map Revolution project manager		seano@bridges.org
British Oceanographic Data Centre		Web	Prof Bob Whitmarsh	Member of GEBCO community/ National Oceanography Centre	44 23 80 596564 OR 01962 868862	bob.whitmarsh@noc.soton.ac.uk
Bundesamt für Kartographie und Geodäsie (Federal Agency for Cartography and Geodesy)	Germany	web				
Canadian Centre for Remote Sensing (CCRS)	International	Web	Thierry Toutin		1 613 9471293	thierry.toutin@ccrs.nrcan.gc.ca
Canadian International Development Agency (CIDA)	International	Web	Anna Bogdan-Thukral		1.819 997-5006	info@acdi-cida.gc.ca OR ANNA_BOGDANTHUKRAL@acdi-cida.gc.ca
Deutsche Gesellschaft für Technische Zusammenarbeit	International	EIS-Africa	François Menguelé	GTZ Advisor	27 12 421 1784/ 82 887 4177	Francois@housing.gov.za
Deutsche Gesellschaft für Technische Zusammenarbeit	International	François Menguelé	Klaus Brueckner	NEPAD issues		klaus.brueckner@gtz.de
Deutsche Gesellschaft für Technische Zusammenarbeit	International	François Menguelé	Thandisizwe Diko	Research issues		Thandisizwe@housing.gov.za
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)	International	Web			49 6196 79-0	info@gtz.de
DFID	International	Web			44 20 7023 0000	enquiry@dfid.gov.uk
EuroGI	Europe	Referred by Craig	Bruce McCormack			bruce.mccormack@environ.ie OR bmccor@gofree.indigo.ie
Europa Technologies		Dooley 2005	Warren Vick	Product Manager	44 20 8398 3955	wvick@europa-tech.com OR info@europa-tech.com
European Commission Humanitarian Aid	International	Web				

Food and Agriculture Organisation (FAO)	International	Dooley	John Latham			john.latham@fao.org
Food and Agriculture Organisation (FAO)	International	Web	Reuben Sessa			reuben.sessa@fao.org
Food and Agriculture Organisation (FAO)	International	Web	Jeroen Ticheler		39 06 570 56041	Jeroen.Ticheler@fao.org
GeoTorrent	International	Web				info@geotorrent.org
Global Geodata	International	Web				info@globalgeodata.com
Global Land Cover Facility	Web		Matthew Smith			glcf@umiacs.umd.edu OR smithm@umiacs.umd.edu
GRID Arendal			Hugo Ahlenius	Project Officer	46 8 412 1427 OR mobile +46 733 467111	Mapmaster@grida.no OR hugo.ahlenius@grida.no
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)/ BNETD	International	François Menguelé	Pascal Rakotomalala	Street naming & addressing systems in Cote d' Ivoire		prakotomalala@yahoo.fr
International Association of Geodesy: Gravity Commission	International	Referred by International Association of Geodesy	Prof Charles Merry		27 21 650-3576	cmerry@ebe.uct.ac.za
International Association of Geodesy: Gravity Commission	International	Referred by International Association of Geodesy	Hussein Abd-Elmotaal			abdelmotaal@lycos.com
IDRC	International	Web			1 613 236 6163	idrinfo@idrc.ca
Institut Geographique National	France	Web			01 43 98 80 00 (general)	
Instituto Geográfico Nacional (National Centre for Geographic Information)	Spain	Web				
Instituto Geográfico Português	Portugal					
International Association of Geodesy		Web	Christopher Jekeli	Chairman	614-292-7117	jekeli.1@osu.edu
International Earth Rotation and Reference Systems Service	International					
International Geoid Services	International	Web			39 02 2399 6504	iges@polimi.it
International GNSS Service (through IGS Central Bureau)	International	Richard Wonnacot	Angelyn W. Moore	Deputy Director, IGS Central Bureau	818-354-2077 OR +1 818 354 5434	igscb@igscb.jpl.nasa.gov OR Angelyn.W.Moore@jpl.nasa.gov

International Gravimetric Bureau (Bureau Gravimetrique International)	International	Web			33 0 05 61 33 2893	bgi@cnes.fr
International Labour Organisation (ILO)	International	Dooley			41.22.799.6111	ilo@ilo.org
International Steering Committee for Global Mapping (ISCGM)	International	Web	Hiromichi Maruyama	Secretary-General ISCGM	09 81 29 864 2667	maruyama@gsi.go.jp
Japan International Cooperation Agency (JICA)	International	Web			81 3 5352 5311	jicagap-opinion@jica.go.jp
Landsat	I	Web			517 355-0181	samekjay@msu.edu
Map Library	International	Referred by Bridges	Eric Dudley	Director	44 1583 431 358	info@maplibrary.org
MapMart	International	Web	Rebecca J Murray		303-759-5050 #175	rjmurray@mapmart.com
Maps Geosystems	International	Web	Reem Lababidi OR Catherine		9716-5725411	info@maps-geosystems.com OR rel@mapsuae.com
NASA LPDAAC	International	Web		Land Processes Distributed Active Archive Center	605-594-6116	LPDAAC@eos.nasa.gov
Nationaal Geografisch Instituut	Belgium					Online e-mail box
National Geospatial Intelligence Agency	USA	Web			800-455-0899	chdesk@nga.mil.
NGA	International		Steve Kenoyn	NGA International and Policy Office for Africa	314-263-4059	kenyons@nga.mil
ODINAFRICA (Ocean Data and Information Network for Africa)	African	Web	Mika Odido	Project Manager	254 20 7623830	m.odido@unesco.org
ODINAFRICA OMAP (Marine Atlas Project)	African	E-mail through ODINAFRICA	Dr Murray Brown			m.brown@odinafrica.net
ODINAFRICA OMAP (Marine Atlas Project)	African	E-mail through ODINAFRICA	Dr Desiderius Masalu			masalu@ims.udsm.ac.tz
Ordnance Survey	UK	http://www.ordnancesurvey.co.uk/oswebsite/nmonetwork/links/index.html			44 23 8079 2912	customerservices@ordnancesurvey.co.uk
Oxfam Australia	International	Web				
Oxfam Canada	International	Web			1 613 237-5236	Web e-mail box only
Oxfam Great Britain	International	Web			44 (0) 1865 473727	enquiries@Oxfam.org.uk
Oxfam International	International	Web				

SEDAC (Socio-economic Data and Applications Center)	International	Web	Dr. Robert S. Chen	SEDAC Manager	845-365-8952	bchen@ciesin.columbia.edu
Southern Africa Humanitarian Information Management Network (SAHIMS)	Southern African	Web	George Tadonki		27 11 517 1568	
Spot Image	International	Sales Online	Vincent Garros	Area manager: Africa	33 5 62 19 4263	vincent.garros@spotimage.fr
Swede Survey	Sweden	Web	Ake Finnstrom	Marketing Director	46 26 63 3300	ake.finnstrom@swedesurvey.se
Swedish International Development Cooperation Agency (SIDA)	International	Web	Göran Holmqvist	Avdelningschef (Head of Department): Afrika	46 8 698 5000	sida@sida.se
UN Cartographic Section	International	Web	Hélène Bray		1 212 963 4986	bray@un.org
UN Cartographic Section	I	Hélène Bray	Kyoung-soo Eom			eom@un.org
UN Economic Commission for Africa	African	Web	Daniel Berhanu	Geoinformation Assistant	251-11-544 3426	dberhanu@uneca.org
UN Economic Commission for Africa	African	Web	Paul Belanger	GIS Officer	251 11 544 3217	PBelanger@uneca.org
UN Geographic Information Working Group (UNGIWG)	International	Web	Mr. Jeffrey B. Tschirley	Co-chair 2005/06		environment@fao.org
UN Geographic Information Working Group (UNGIWG)	International	Web	David Kaatrud			david.kaatrud@wfp.org OR secretariat@ungiwg.org
UN Oceans	International	Web	Dr Patricio Bernal	Executive Secretary	33 1 4568 3983	
UNESCO	International	Web	Prof Nourédini TIDJANI-SERPOS	Assistant Director-General	33 1 45 68 15 35	n.tidjani-serpos@unesco.org
United Nations Development Programme (UNDP)	International	Web	Mariana González		1 212 906-5000	mariana.gonzalez@undp.org
United Nations Environment Programme (UNEP)	International	Web	Charles Sebukeera	Ag. Regional Coordinator	254-20-7623785	unepinfo@unep.org OR charles.sebukeera@unep.org
United Nations Environment Programme (UNEP)	International	EIS-Africa	Chris Ambala	Associate Programme Officer	254-20 762 3818	chris.ambala@unep.org
United Nations Environment Programme (UNEP)	International	Referred by Chris Ambala	Johannes Akiwumi			Johannes.Akiwumi@unep.org
United Nations Group of Experts on Geographical Names	International	Web	Mr Amor Laaribi		212 963-3042	laaribi@un.org

United Nations Statistics Division (UNStats)	International	Web		Director: Statistics Division		statistics@un.org
US Department of State	USA	Business card	Michael Heerschap	Senior Geographer?	703 746 2450	acmheers@us-state.osis.gov
US National Geophysical Data Center	Internationa l	E-mail through ODINAFRICA				
USAID	International	Web				
USAID	International	Referred by USAID	Jorge Oliveira (at AGRHYMET?)			joliveria@usaid.gov
USAID	International	Referred by Sives	Carrie Stokes			CStokes@usaid.gov
USGS (United States Geological Survey)	International	Referred by USAID	Gray Tappan at USGS	SAIC Principal Scientist	+605 594 6037	tappan@usgs.gov
USGS/ US Board on Geographic Names (BGN)	International		Roger L. Payne		1-888-275-8747 OR 301-227-3059	gnis_manager@usgs.gov OR geonames@nga.mil OR rpayne@usgs.gov
WHO Afro	International	Web	Mrs M.J. Rafahelimanana	Regional Director	47 241 39 305	
WHO International	International	Web	Dr Steeve Ebener	Technical Officer	41 22 791.47.44	ebeners@who.int
WHO International	International	Referred by Steeve	Kathy O'Neill			oneillk@who.int
WHO International	International	Referred by Steeve	John Rawlinson			rawlinsonj@who.int
World Bank	International	Web	Dr Uwe Deichmann	Senior Environmental Specialist	1 202 473 6400	udeichmann@worldbank.org
World Meteorological Organisation	International	Web	Dr MVK Sivakumar	Chief: Agricultural Meteorology Division	41 22 730 8380	msivakumar@wmo.int
World Meteorological Organisation	International	Web	Robert Stefanski		41 22 730 8305	rstefanski@wmo.int
World Resources Institute (WRI)	International	Referred by Sives	Dan Tunstall			dan@wri.org

African Development Bank	http://www.afdb.org/portal/page?_pageid=473,1&_dad=portal&_schema=PORTAL
African Geodetic Reference Frame (AFREF)	http://geoinfo.uneca.org/afref/
ALLM GeoData	www.allm-geodata.com/field_stats.htm
AusAID	http://www.ausaid.gov.au/
Bridges	www.bridges.org
British Oceanographic Data Centre	http://www.ngdc.noaa.gov/mgg/gebco/grid/1mingrid.html
Bundesamt für Kartographie und Geodäsie (Federal Agency for Cartography and Geodesy)	http://www.bkg.bund.de/DE/Home/homepage__node.html__nnn=true
Canadian Centre for Remote Sensing (CCRS)	http://www.ccrs.nrcan.gc.ca/
Canadian International Development Agency (CIDA)	http://www.acdi-cida.gc.ca/index-e.htm
Deutsche Gesellschaft für Technische Zusammenarbeit	
Deutsche Gesellschaft für Technische Zusammenarbeit	
Deutsche Gesellschaft für Technische Zusammenarbeit	
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)	http://www.gtz.de/en/
DFID	http://www.dfid.gov.uk
EuroGI	
Europa Technologies	www.europa-tech.com
European Commission Humanitarian Aid	http://ec.europa.eu/echo/index_en.htm

Food and Agriculture Organisation (FAO)	http://www.fao.org/
Food and Agriculture Organisation (FAO)	
Food and Agriculture Organisation (FAO)	http://www.fao.org/geonetwork
GeoTorrent	www.geotorrent.org
Global Geodata	http://www.globalgeodata.com/products.htm
Global Land Cover Facility	http://glcf.umiacs.umd.edu/data/
GRID Arendal	www.maps.grida.no
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)/ BNETD	
International Association of Geodesy: Gravity Commission	http://www.geomatics.uct.ac.za
International Association of Geodesy: Gravity Commission	
IDRC	
Institut Geographique National	http://www.ign.fr/
Instituto Geográfico Nacional (National Centre for Geographic Information)	http://www.fomento.es/MFOM/LANG_CASTELLANO/DIRECCIONES_GENERALES/INSTITUTO_GEOGRAFICO/
Instituto Geográfico Português	http://www.igeo.pt/#
International Association of Geodesy	www.ceg.eng.ohio-state.edu OR http://www.iag-aig.org/
International Earth Rotation and Reference Systems Service	http://www.iers.org/
International Geoid Services	http://www.iges.polimi.it/
International GNSS Service (through IGS Central Bureau)	http://igscb.jpl.nasa.gov.

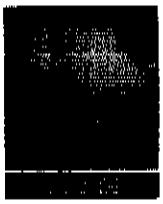
International Gravimetric Bureau (Bureau Gravimetrique International)	http://bgi.cnes.fr:8110/
International Labour Organisation (ILO)	http://www.ilo.org/
International Steering Committee for Global Mapping (ISCGM)	http://www.iscgm.org/cgi-bin/fswiki/wiki.cgi
Japan International Cooperation Agency (JICA)	www.jica.go.jp
Landsat	http://www.landsat.org/
Map Library	www.maplibrary.org
MapMart	http://www.mapmart.com/Topo/Raster.htm
Maps Geosystems	
NASA LPDAAC	http://lpdaac.usgs.gov/dataproducts.asp
Nationaal Geografisch Instituut	http://www.ngi.be/NL/NL0.shtm
National Geospatial-Intelligence Agency	http://www.nima.mil/portal/site/nga01/
NGA	http://geoengine.nima.mil OR http://store.usgs.gov OR http://earth-info.nima.mil/GandG/
ODINAFRICA (Ocean Data and Information Network for Africa)	http://www.odinafrica.net/
ODINAFRICA OMAP (Marine Atlas Project)	
ODINAFRICA OMAP (Marine Atlas Project)	
Ordnance Survey	http://www.ordnancesurvey.co.uk/oswebsite/
Oxfam Australia	http://www.oxfam.org.au/world/index.html
Oxfam Canada	http://www.oxfam.ca
Oxfam Great Britain	http://www.oxfam.org.uk/
Oxfam International	http://www.oxfam.org/

SEDAC (Socio-economic Data and Applications Center)	http://sedac.ciesin.columbia.edu/gpw/index.jsp OR http://sedac.ciesin.columbia.edu/
Southern Africa Humanitarian Information Management Network (SAHIMS)	www.sahims.net
Spot Image	www.spotimage.fr
Swede Survey	http://www.swedesurvey.se/aboutswedesurvey.html
Swedish International Development Cooperation Agency (SIDA)	www.sida.se
UN Cartographic Section	http://www.un.org/Depts/Cartographic/english/htmain.htm OR http://boundaries.ungiwg.org/
UN Cartographic Section	
UN Economic Commission for Africa	www.uneca.org
UN Economic Commission for Africa	
UN Geographic Information Working Group (UNGIWG)	http://www.ungiwg.org/
UN Geographic Information Working Group (UNGIWG)	http://www.ungiwg.org/
UN Oceans	http://www.oceansatlas.org/index.jsp
UNESCO	www.unesco.org
United Nations Development Programme (UNDP)	http://www.undp.org/rba
United Nations Environment Programme (UNEP)	http://www.unep.org/Dewa/africa
United Nations Environment Programme (UNEP)	
United Nations Environment Programme (UNEP)	
United Nations Group of Experts on Geographical Names	http://unstats.un.org/unsd/geoinfo/ungegn.htm

United Nations Statistics Division (UNStats)	http://millenniumindicators.un.org/unsd/default.htm
US Department of State	
US National Geophysical Data Center	http://www.ngdc.noaa.gov/mgg/gebco/gebco.html
USAID	www.usaid.gov
USAID	
USAID	
USGS (United States Geological Survey)	http://edcintl.cr.usgs.gov/
USGS/ US Board on Geographic Names (BGN)	www.geonames.usgs.gov
WHO Afro	http://www.afro.who.int/home/contact.html
WHO International	http://www.who.int/kms/initiatives/accessmod/en/index3.html AND http://www.who.int/geonetwork/srv/en/main.search
WHO International	
WHO International	
World Bank	http://www.worldbank.org/
World Meteorological Organisation	www.wmo.int
World Meteorological Organisation	www.wmo.int
World Resources Institute (WRI)	www.wri.org

ANNEXURE 4

HSRC
Human Sciences Research Council



Catalogue of Available Fundamental Geo-Spatial Datasets for Africa

Quality control survey

Good day

My name is ..... I am phoning on behalf of the Mapping Africa for Africa (MAFA) initiative. Your organisation/ company was surveyed by one of our national partners in the past six months and you had to complete a questionnaire about which of the 30 fundamental geo-spatial data sets your organisation have.

The reason for my phoning is that we are doing quality control of the original fieldwork and I would like to ask you a few questions about your organisation's questionnaire(s).

1. Do you have about 15 minutes' time to answer a few questions now?

Yes	Continue with interview
No	Arrange an agreed time within the next 24 hours to phone again

(If the respondent is not the most appropriate person to speak to, obtain the name and contact details of such a person and phone him/her. First prize is however to speak to the person who completed the questionnaire on behalf of the organisation).

2. Just to refresh your mind, here is a list of the thirty data sets (READ OUT ONLY NAME)

1	Geodetic control points	List of coordinates with information on the history of establishment of the network as well as network design in digital map/GIS format.
2	Height datum	List of heights of primary height points in digital map/GIS form (vertical datum surface)
3	Geoid model	Geoid-ellipsoid separations (heights at individual points) to convert from GPS observations to heights
4	Aerial photography	Aerial photography
5	Satellite imagery	Satellite imagery
6	Digital elevation model	Vertical distance from the earth's surface to a base defined by the adopted height datum

7	Spot heights	Heights of peaks
8	Bathymetry	Vertical distance of earth's surface from base defined by Lowest Astronomical Tide
9	Coastline	The limit of land features usually at mean high water level.
10	Natural water bodies	Location of watercourses, drainage network, and all inland water bodies (streams, rivers, canals, ponds, lakes, etc.)
11	Governmental/Administrative units	Limits of administrative and jurisdictional authority (International, national, sub-national boundaries, and local government areas)
12	Populated places	Population centres including urban areas, towns, localities, and rural settlements
13	Census enumeration areas	Boundaries of areas delineated for the purpose of collecting demographic census information
14	Place Names	Official and local names of places
15	Feature Names	Official and local names of cultural and geographic features (including roads)
16	Land Parcels/Cadastre	A consistent framework of land parcel/cadastre boundaries defined for land tenure purposes, referenced to a common datum
17	Land Tenure	Current, proposed and historical details of all tenures, e.g., details of ownership, vesting, and including traditional forms of land holding.
18	Street Address	Unique Street Address of parcels/properties
19	Postal or zip code zones	Boundaries of post code areas
20	Land use planning zones	Boundaries of areas of permitted/restricted land use defined by planning authorities (includes conservation areas, heritage sites, and restricted areas)
21	Roads	Network of physical roads and carriageways
22	Road centrelines	Centreline of roads and carriageways
23	Railways	Network of railway lines
24	Airports and ports	Location of airports, sea ports, and navigation aids
25	Bridges and tunnels	Bridges are structures built to carry a road, path, railway, etc., across a gorge, valley, road, railway, river, body of water, or any other physical obstacle. Tunnels are artificial underground passages through a hill or under a road or river etc., esp. for railways or roads to pass through
26	Power infrastructure	Locations of trunk or national grid power line networks and major assets/installations, and sources

27	Telecommunications	Locations of trunk communication networks and major assets
28	Land cover	Observed bio-physical cover over on the earth's surface
29	Soils	Boundaries and classifications of soil resources
30	Geology	Boundaries and classification of geological units

Looking at the completed questionnaire for your organisation, you indicateD that you hold the following datasets: (READ OUT from Questionnaire)

3. Are there any datasets which you hold, but was not listed in the questionnaire?

Yes	Ask person to list these – make a note
No	Continue with Question 4

4. Of the datasets which your organisation does not hold, do you perhaps know which organisation/company/institution in your country will hold such data? (PROBE FOR EACH DATASET)

Yes	Ask the name of the custodian organisation and note it
No	Continue with Question 5

		Other custodian(s)
1	Geodetic control points	
2	Height datum	
3	Geoid model	
4	Aerial photography	
5	Satellite Imagery	
6	Digital elevation model	
7	Spot heights	

8	Bathymetry	
9	Coastline	
10	Natural water bodies	
11	Governmental/Administrative units	
12	Populated places	
13	Census enumeration areas	
14	Place Names	
15	Feature Names	
16	Land Parcels/Cadastre	
17	Land Tenure	
18	Street Address	
19	Postal or zip code zones	

20	Land use planning zones	
21	Roads	
22	Road centrelines	
23	Railways	
24	Airports and ports	
25	Bridges and tunnels	
26	Power infrastructure	
27	Telecommunications	
28	Land cover	
29	Soils	
30	Geology	

5. Looking at Section 3 of your questionnaire:

(Page through the questionnaire and make sure for each of the datasets which they ticked in Section 2, the corresponding dataset in Section 3 was completed. Where information is

missing in Section 3 (e.g. Completeness, etc.), probe the respondent to obtain this information.)

Dataset	Scale (000)/ Resolution (m)	Completeness	Year 1st Published	Year Last Updated	Metadata
3-01 Geodetic control points	a ☐>10	.....	.....	.....	☐
	b ☒12-50	.....	...2001.....	...2002...	☐
	c ☐62.5-100	.....	.....	.....	☐
	d ☐125-250	.....	.....	.....	☐
	e ☐500-1000	.....	.....	.....	☐

6. Looking at Section 4 of your questionnaire:

(Page through the questionnaire and make sure for each of the datasets which they ticked in Section 2, the corresponding dataset in Section 4 was completed. Where information is missing in Section 4 probe the respondent to obtain this information.)

Fundamental Data	Reports	Hardcopy Tables	Hardcopy Map	Electronic Spreadsheet	Database	GIS format	Other Digital Files
4-01 Geodetic control points	☐	☐	☐	☐	☐	☐	☐
4-02 Height datum	☐	☐	☐	☐	☐	☐	☐
4-03 Geoid model	☐	☐	☐	☐	☐	☐	☐

7. Looking at Section 5 of your questionnaire:

(Page through the questionnaire and make sure for each of the datasets which they ticked in Section 2, the corresponding dataset in Section 5 was completed. The respondent had to complete both the "Accessibility" and "Access conditions" sides of the table. Where information is missing in Section 5 probe the respondent to obtain this information.)

Fundamental Data	Accessibility				Access conditions	
	Unrestricted access	Authorisation required	Scale-dependent	Restricted	Free	Against payment
5-01 Geodetic control points	☒	☐	☐	☐	☐	☐
5-02 Height datum	☐	☐	☐	☐	☒	☐
5-03 Geoid model	☐	☐	☐	☐	☐	☐

7. Looking at Section 6 of your questionnaire:

(Page through the questionnaire and make sure for each of the datasets which they ticked in Section 2, metadata in Section 6 was completed. For each dataset listed in Section 3 (e.g. 3-01a, 3-05b) metadata had to be completed. If metadata is missing, arrange that such data be e-mailed to you within the next day. Make sure that you obtain their e-mail address as well.)

Thank you for your valuable time – it is much appreciated.

For Official Use:

- For each interview conducted do the following calculation:

(Nr of datasets listed in Section 2 of the original questionnaire/ Total number of datasets listed after quality control) *100 = the original level of completeness

Example: (5/10) * 100 = 50% completeness

(5/5) * 100 = 100% completeness

- Then calculate the average for the country:

Add up the percentages/ the number of organizations interviewed.

Example: the percentage of each of four interviews (40 + 60 +50 + 70)/ 4 = 55% for the country.

Record of trying to establish contact
