

African Regional Spatial Data Infrastructure (ARSDI) A cooperative Geoinformation Management in Africa

United Nations Economic Commission for Africa

ICT and Sciences & Technology Division (ISTD)

E-Applications Section



UN-SPIDER Regional Workshop– Addis Ababa (Ethiopia) – 6-9 July 2010



Outlines

- Geoinformation Nexus issues
- Why Spatial Data Infrastructures
- What SDI is about
- Africa's Vision : ARSDI
- Priorities & Strategies
- Challenges & Conclusions





Why we need Geographies



Need for complex Information

Food Security	▀ Land cover, soil, topography, hydrography, rainfall, moisture, demographics, infrastructure, yield, production..
Water Supply	▀ Hydrography, topography, aquifers, waterbodies, land cover, soil types, vegetation, rainfall...
Resources Management	▀ Ecosystems, biodiversity, vegetation, land cover, soils, water, wetlands, biomass...
Drought	▀ Rainfall, temperature, evapo-transpiration, wind, aerosols...
Security and Emergency	▀ Land cover, soil chemistry, topography, geology, utilities, settlements, transport infrastructure....
Health Planning	▀ Hospitals locations, settlements and demographics, disease vectors, environmental factors distribution...
Etc..	▀ Etc..

- All the information products exemplified would not be complete without the location attribute
- They need to be localized:
 - Where are the features located?
 - Where are the population involved in an activity, vis-à-vis location of the activity?
 - Who will benefit from an activity or event ? Or at risk? Where are they?
 - Where are the markets for the products? The input factors?
 - Where are the infrastructure elements, utilities, etc?
 - What areas are suitable (or unsuitable) for specific activities or events?
 - How do we move (people, products, services) from source to destination?



African Geographies Nexus Issues



Core Data Poor Mapping Coverage	2.5 % of the Continent is Mapped at 1 /25.000 (Compare to Europe: 86.9% ; Ex-RSS : 100%)
Lack of consistency in data production	Poor Interoperability and Lack of Standardisation Non codified rules for data access
Duplication of efforts	Several applications build repetitively the same datasets
Absence of documentation on data	Data are not publicized.
Building and Retention of Human Capacities	Acceptable mass of GI Professionals. But... Extreme mobility of GI professionals
Governance Lack of Coordination	Different coding and classification schemes Few regional databases are integrated and harmonized



Why Spatial Data Infrastructures ?



- **Unlock the hidden potential in the data**
 - ▣ Arrange for widest possible dissemination of available information
- **Produce Once use Many Times**
 - ▣ Shift from mapping as standalone activity to mapping as component of information management
 - ▣ Move beyond single agency needs to community needs : No single agency can satisfy its geographic data needs on its own - Data collected for one purpose can be used for other purposes
- **Make information available** to decision makers and the community when they need it; where they need it; In a form they can use (almost) immediately
 - ▣ Empower users to do as much as possible by themselves
 - ▣ Put in place policies, resources and structures

Spatial Data Infrastructure (SDI)

Critical mass of processes, policies, standards, enabling technologies, mechanisms and key datasets required to make geospatial data readily available to the growing community of end-users

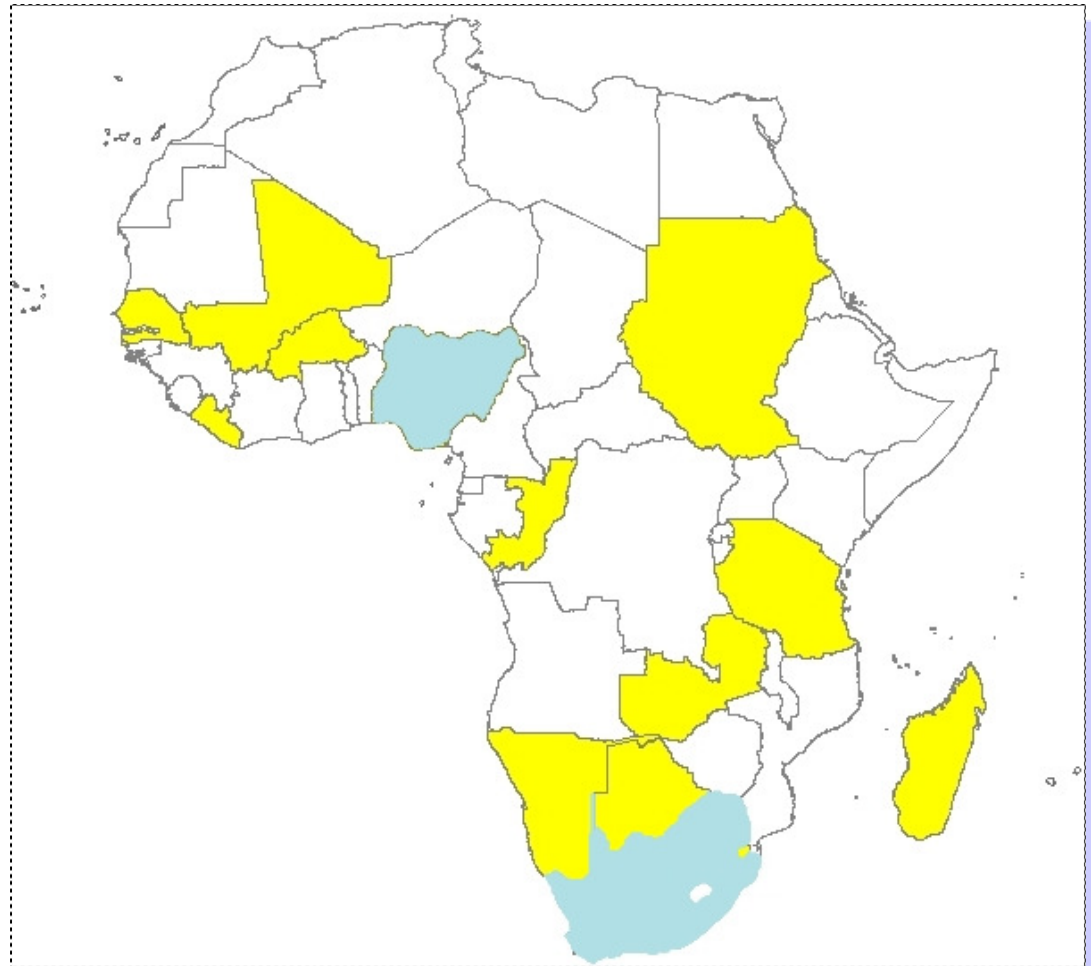
GSDI -- The SDI Cookbook (version 2.0)



SDI Challenges in Africa



- Most of African countries face with challenges to put in place policies, resources and structures to make available geographic information technologies easily accessible to decision makers and the community.
- The main challenges in implementing SDI remain:
 - ▣ Financial resources mobilization;
 - ▣ Arousing political interest among decision-makers and policymakers.
- Many NSDI initiatives were stalled after setting up the management committee
 - ▣ Exceptions are South Africa and Nigeria

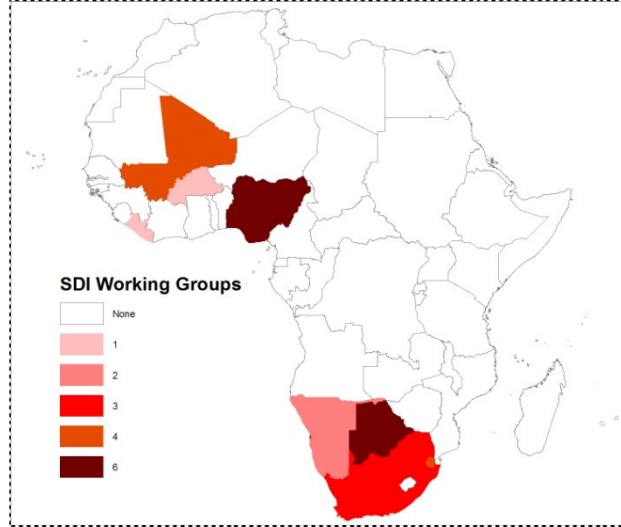




SDI Africa : National Governance



Few Countries with SDI Coordinating Bodies	Botswana, Burkina, Congo, Liberia, Madagascar, Mali, Namibia, Nigeria, Senegal, South Africa, Sudan, Swaziland, Tanzania, Zambia
Few Countries with SDI Committee, Sub-Committees, Working Groups	Botswana, Burkina, Liberia, Mali, Namibia, Nigeria, South Africa, Swaziland, Tanzania.

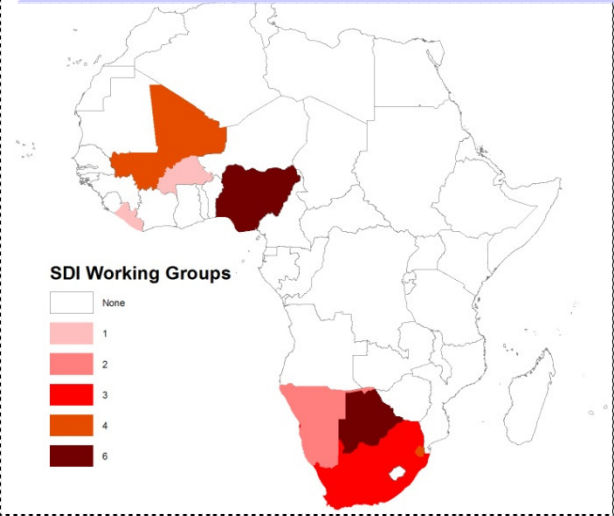
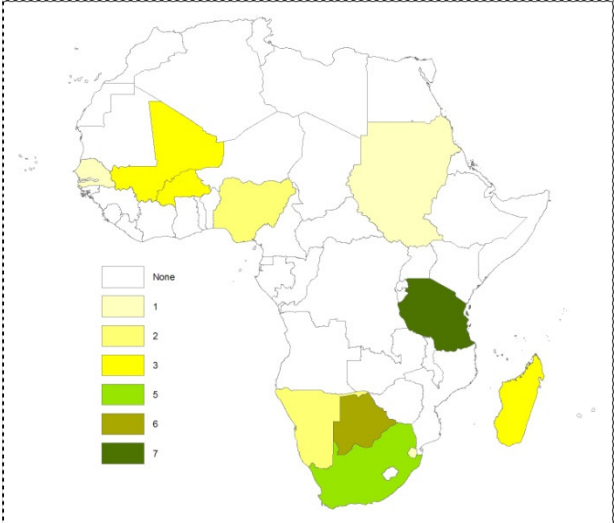




SDI Africa : National Implementation



Number of Meetings held (during a year)	Botswana, Burkina, Madagascar, Mali, Namibia, Nigeria, Senegal, South Africa, Sudan, Tanzania
Countries with Geographical Names Authority	Botswana, Burkina, Congo, Liberia, Madagascar, Mali, Namibia, Nigeria, Senegal, South Africa, Sudan, Tanzania, Zambia





SDI Africa : Maps Revision

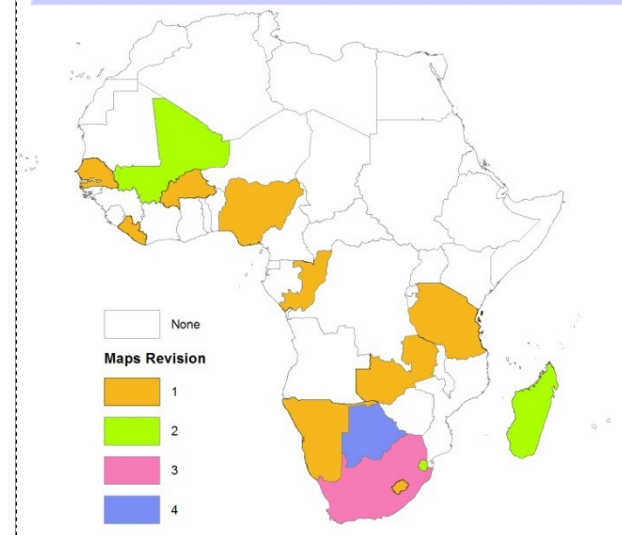
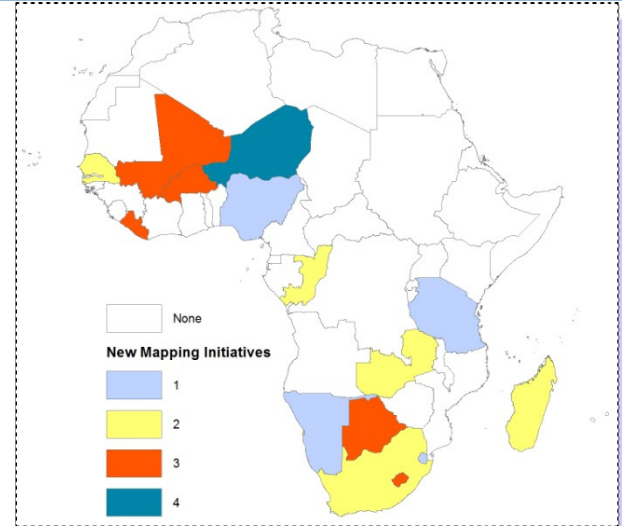


Countries with New Mapping Initiatives

Botswana, Burkina, Congo, Lesotho, Liberia, Madagascar, Mali, Namibia, Niger, Nigeria, Senegal, South Africa, Sudan, Swaziland, Tanzania, Zambia

Countries with Maps Revision

Botswana, Burkina, Congo, Lesotho, Liberia, Madagascar, Mali, Namibia, Nigeria, Senegal, South Africa, Sudan, Swaziland, Tanzania, Zambia





Let's Assume we do not have yet...

- ... functional “SDIs” in Africa.
 - ▣ *The technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data*
- What should we do?



HALFWAY THROUGH PHILIPPIANS 2,
REVERAND PAUL MATTHEWS REALIZED
HE WAS PREACHING TO THE CHOIR.





What to Do – (Justifying Geo-Spatial Data Infrastructures)

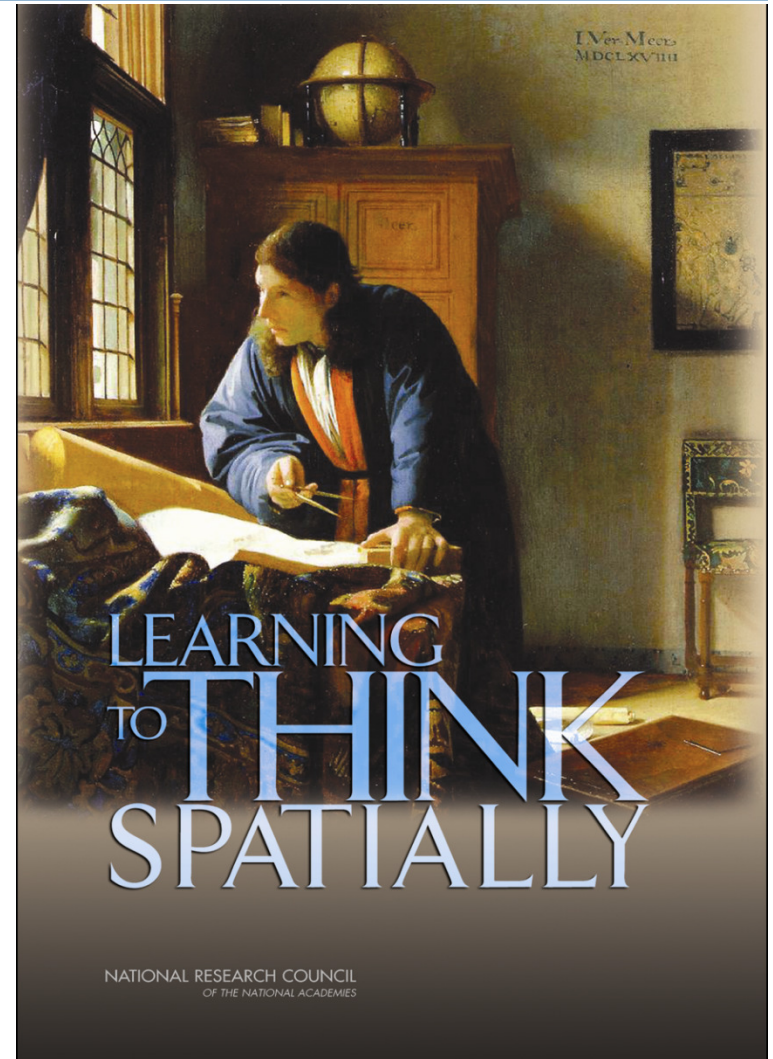


ECA Vision

- Ensure that spatial data permeates every aspect of society and that they are available to people who need them, when they need them, and in a form that they can use to make decisions with minimal pre-processing
- Also the collected data sets should be put to the maximum possible uses by publicising their existence and making them easily available to the widest possible audience

UNECA, 2000

www.unece.org

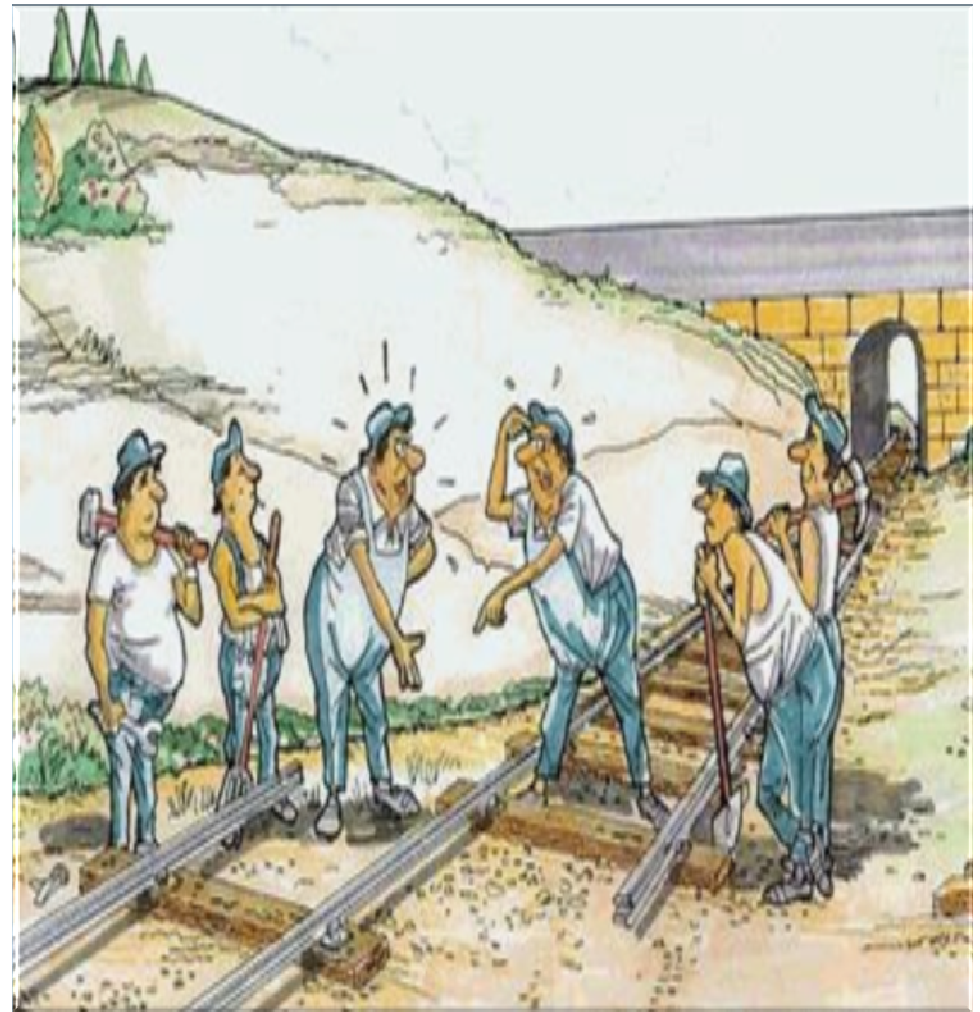




The African Regional Spatial Data Infrastructure



- **ARDSI Paradigm**
- Adopt cooperative, multi-stakeholder approach to production, management, and dissemination of spatially enabled data: Regional and National level
- Improve regional scale development decision-making
- Ensure that reliable information is easily available for policy, investment, planning, management and monitoring and evaluation purposes at the regional and sub regional scales:
 - Infrastructures, Agriculture, Environment, Health, Biodiversity, etc...
 - They all need to answer “where” questions from a regional perspective





The ARSDI Features



1. Policies and Coordination

- Assign custodianship responsibilities as appropriate (NSDI & ARSDI)

2. Data and Information Products

- A series of federating geospatial and attribute databases
 - Fundamental, Core Datasets, Regional Thematic Data
- A data warehouse of common information products derived from the operational databases

3. Capacity Building and Retention

- Critical mass of awareness of EO (Producers & Users)

4. Standards and interoperability

- Common geodetic framework (AFREF) : A network of continuous GPS stations that will define the African geodetic reference frame
- Metadata Standard (Africa Metadata Profile)
- Common base themes

5. e-Services (find and share data)

- Streamlined electronic delivery of services to achieve improved user service, faster response times, efficient operations, lower transaction costs, more informed decisions.
- A registry of services and metadata clearinghouse system for documenting, searching and discovering geospatial data resource

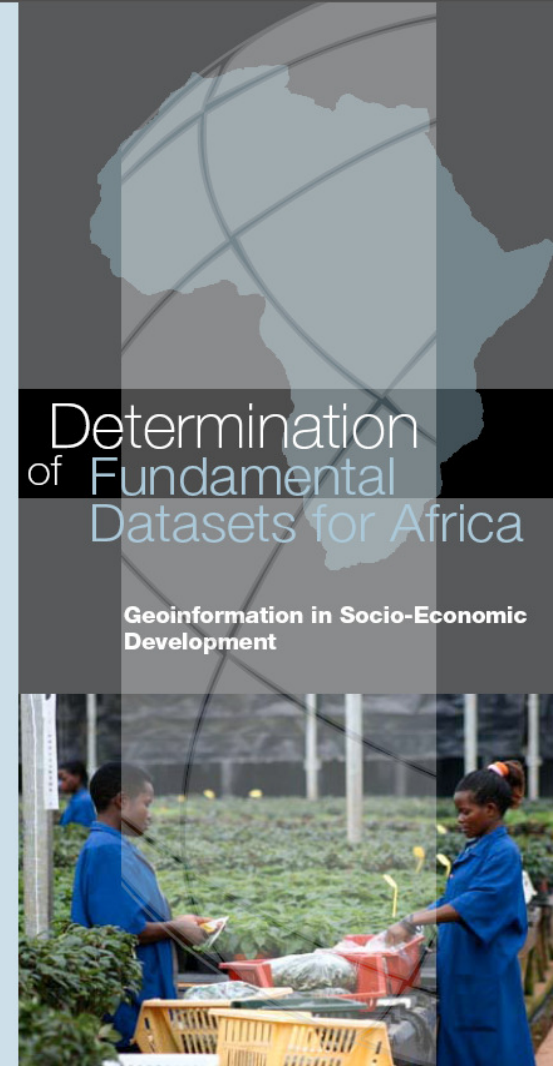


ARSDI Foundation : The Mapping Africa for Africa (MAfA) Initiative



- Initiative to accelerate the rate of geoinformation activities in Africa
- A plan of action to provide the fundamental geo-spatial information for sustainable development in support of regional projects
- Premised on the principle that Africa should be involved, if not lead, the production of maps of Africa
- Based on the Durban Statement
- In collaboration with the International Cartographic Association (ICA) and other global institutions
- Fundamental data sets definition document published by ECA

www.uneca.org





Definition of Fundamental Geospatial Datasets for Africa



Data Theme	Data Set
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 units
	Populated places
	Enumeration areas
Geographic names	Place Names
	Feature Names

Data Theme	Data Set
Land management units/ areas	Land Parcels/Cadastre
	Land Tenure
	Street Address
	Postal or 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



Creation of Regional Databases

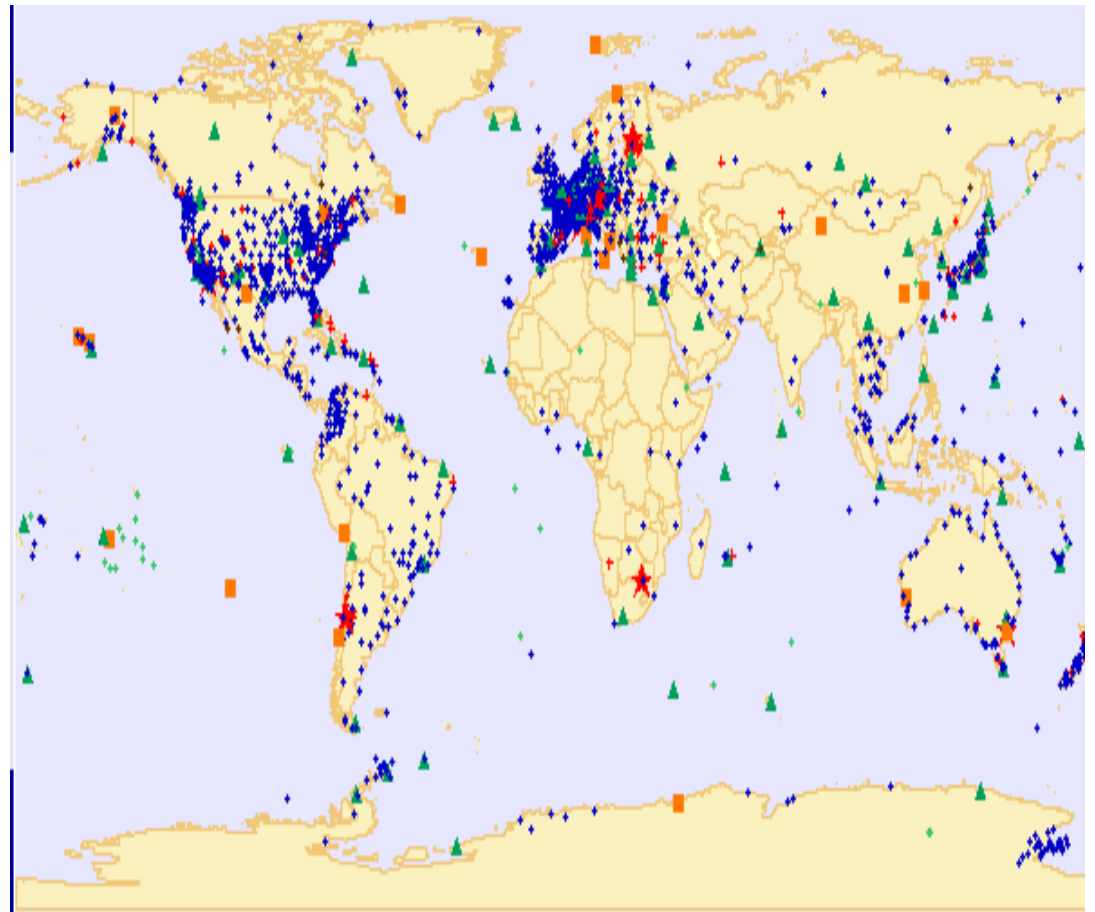
- Geospatial databases for regional use
- Infrastructures Development Database (Energy, Transport, Telecommunication...)
- African Climate Policy Development Database
- Agriculture Commodity Value Chain Database
- Disasters and Security Preparedness Database
- MDG Mapper Database





Development of Interoperability & Standards

- AU vision for Africa ...
“which asserts itself as a vibrant and dynamic force in the global arena”
- Not yet in Mapping..
 - ▣ Requires that data sets and services be interoperable
 - ▣ Only if we adhere to agreed standards :
Metadata, data models, encoding, presentation, transfer, naming conventions...





Development of Interoperability & Standards: The African Metadata Profile of ISO 19115



- The starting point for the African metadata profile is the set of core metadata elements in ISO 19115, whether they are mandatory, conditional or optional. All the entities in the core have been unraveled to identify what the actual metadata elements were.
- These core metadata elements have been included in a matrix to illustrate the structure of the core.
- All the metadata elements in the matrix have been illustrated using the metadata for South Africa's 1:50 000 national mapping series.



Key standards for future consideration support the development of Fundamental Datasets and (MAfA)

- ISO/TC 211 has begun developing standards for application domains, which will touch directly on the work of users, as these standards deal more with data issues than system issues.
- In considering the fundamental data sets for Africa, the following are key standards:
 - **The Metadata:** The best known ISO/TC 211 standard is ISO 19115:2003, Geographic information – Metadata
 - **Quality:** There are three standards from ISO/TC 211 dealing with quality: ISO 19113: 2002, Geographic information – Quality principles, ISO 19114:2003, Geographic information – Quality evaluation procedures, and ISO/TS 19138:2006, Geographic information – Data quality measures.
 - **Cataloguing or classification:** The two relevant standards are ISO 19110:2005, Geographic information – Methodology for feature cataloguing, and ISO 19126, Geographic information – Feature concept dictionaries and registers
 - **Essential climate variables (ECVs):** ISO 19144-1, Geographic information – Classification systems – Part 1: Classification system structure. ISO 19144-2, Geographic information – Classification Systems – Part 2: Land Cover Classification System LCCS.
 - **Land administration:** A new ISO/TC 211 project is ISO 19152, Geographic information – Land Administration Domain Model (LADM), which is developing common terminology and a framework model for land administration, bridging the cadastre, deeds, land ownership and land tenure, both formal and informal.

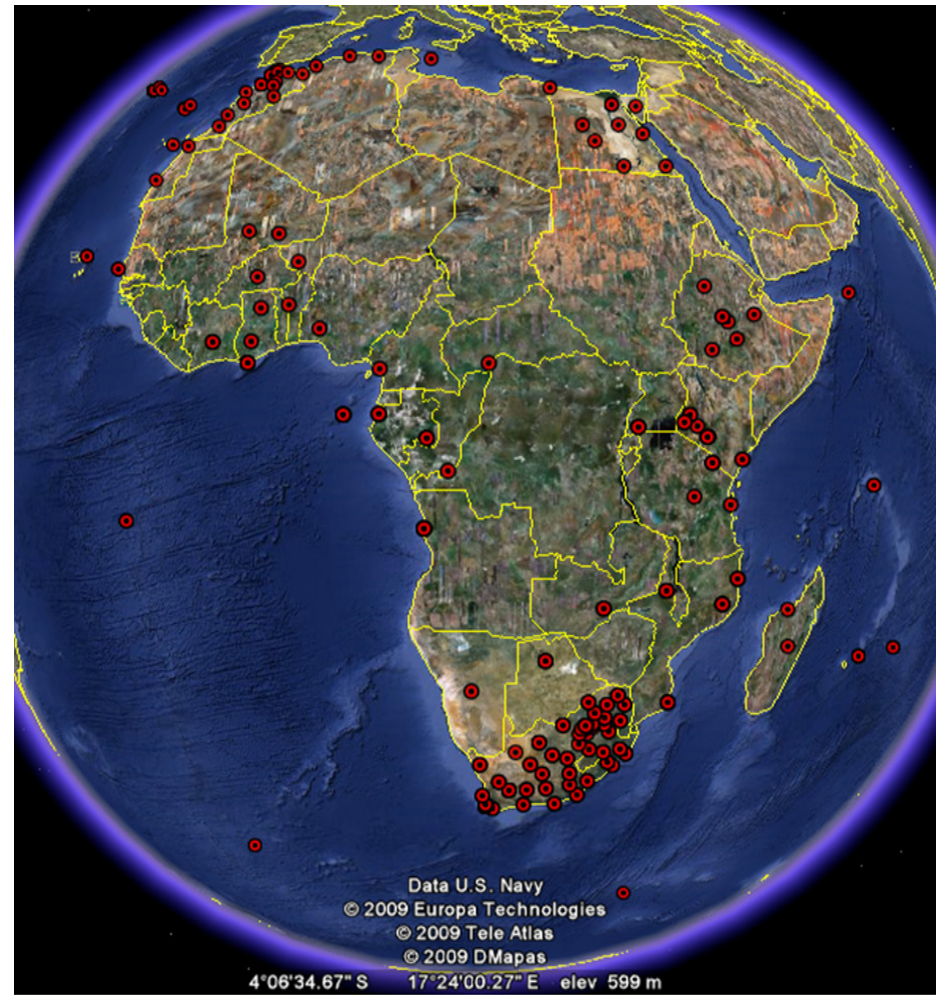


Development of Interoperability & Standards: The Common Geodetic Reference (AFREF)



- Network of permanent GNSS base stations (CORS) covering the whole continent
- At least one in every country
- Eventually, everywhere in Africa less than 1000 km from a base station.
- Salient Features
 - 5 GPS CORS Stations being installed in African Sub regions
 - 30 GPS Reference Stations to be installed
 - On-going inventory of existing and planned GNSS base stations in African countries
- <http://geoinfo.uneca.org/afref/>

www.uneca.org





Development of Interoperability & Standards: The Harmonized Administrative Boundary



- **Second Administrative Level Boundary (SALB)**
- Produce a comprehensive digital database of Second Administrative Level Boundaries
- Provide a flexible and intuitive coding scheme that can be applied to any country, independently from administrative structure.
 - an international borders template developed by the UN Cartographic Section in order to be able to create a global data set that is cross-boundary
 - an editing protocol in order to insure the comparability between the countries
 - a coding scheme for the identification of each administrative unit through time and space
 - a metadata profile that is associated with the information
 - a validation process of all the information by an official entity (generally the National Mapping Agency).
- www.salb.org





e-Services Delivery (Clearinghouse Services)



- To use data produced by another person/agency, potential users need to know:
 - That the data resource exists
 - How the data was produced
 - How to access the data
- The metadata collections are best maintained
 - By the producers of the data
 - As an integral part of the data production process
- But they should be accessible to potential users
 - Always available and easy to access
- Result: on-line metadata clearinghouse services
 - Search and discover what exists, where and how to access
 - Publish and advertise what you have and do
 - Field level, location and other criteria-based searches
- <http://geoinfo.uneca.org:8080/metadataexplorer/explorer.jsf>

United Nations
Economic Commission for Africa

United Nations

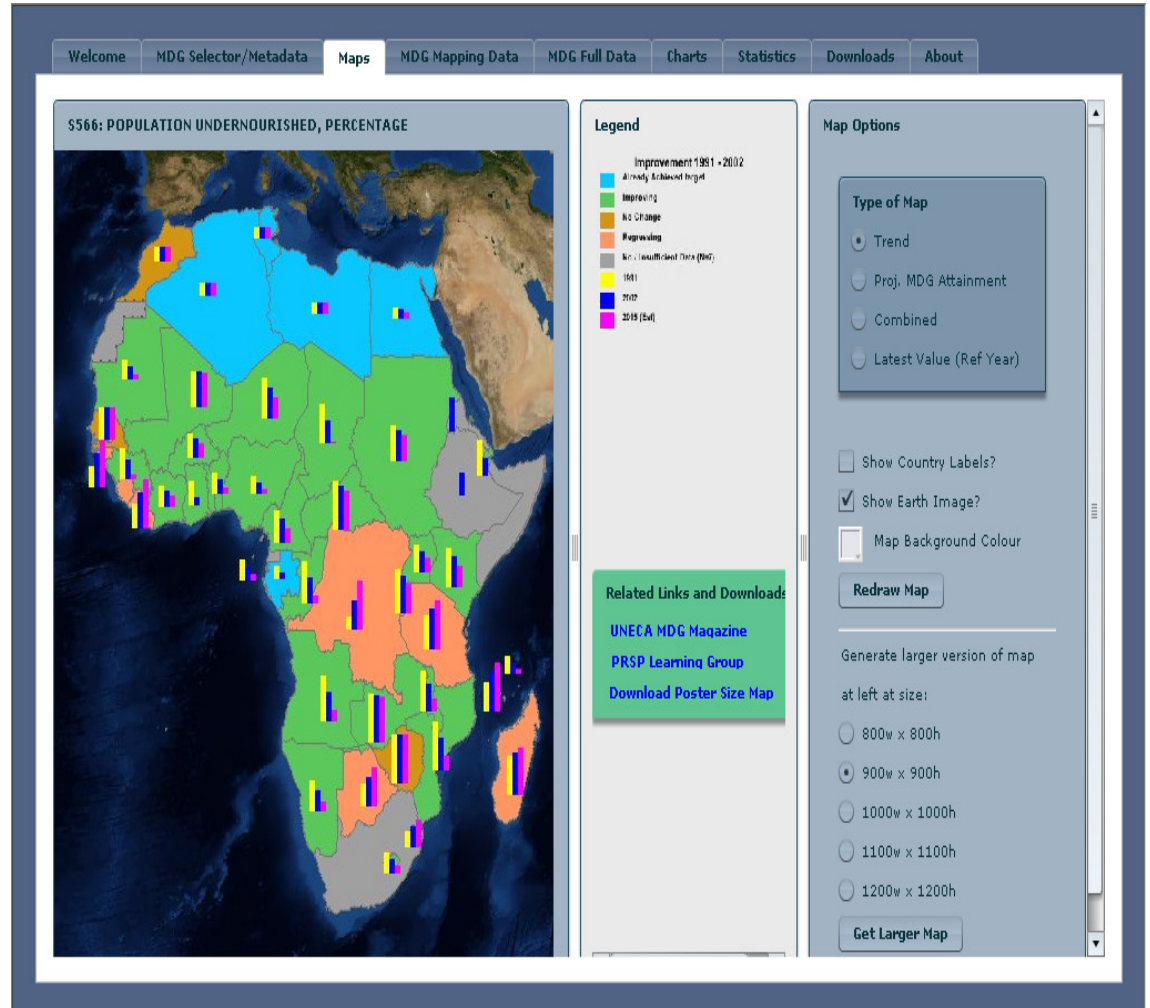
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e-Services Delivery (Online Mapping)



- **Exploit the vast opportunities provided by the Web**
 - Make it easy and rapid to search, and access geospatial information from multiple locations
 - Enable standards and interoperable web-based exploitation of Geodata
 - Develop value-add products and services
 - Decentralized Mapping...
- **Previously unthinkable map themes now common at demand:**
 - Visualizing MDG Progress
 - Dynamic maps and Statistics...
 - <http://geoinfo.uneca.org/mdg>





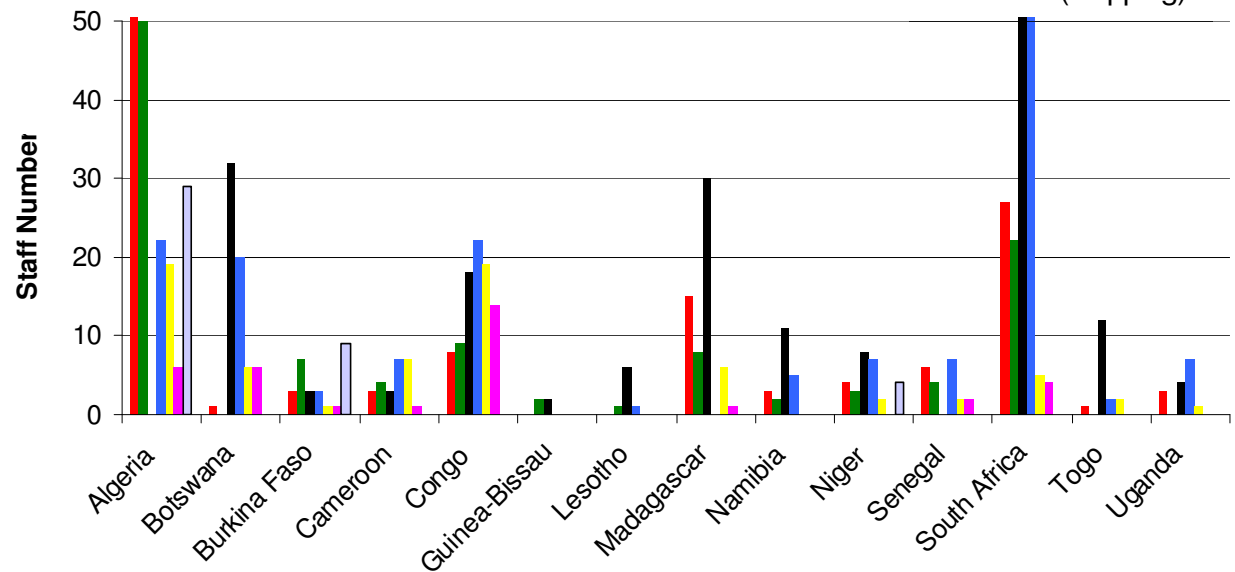
Capacity Building - Individuals

Professional Skills ...

- Large spectrum of geospatial science fields
- Example : Algeria, Botswana, Burkina, Cameroun, Congo, Guinea Bissau, Lesotho, Madagascar, Namibia, Niger, Senegal, South Africa, Togo, Uganda...

- Photogrammetry
- Geodesy
- Cadastral
- GIS
- Remote Sensing
- Database
- Others (Mapping)

Photogrammetry	15%	151
Geodesy	11%	112
Cadastral	41%	424
GIS	19%	197
Remote Sensing	7%	70
Database	3%	35
Others (Mapping)	4%	42
Total	100%	1031



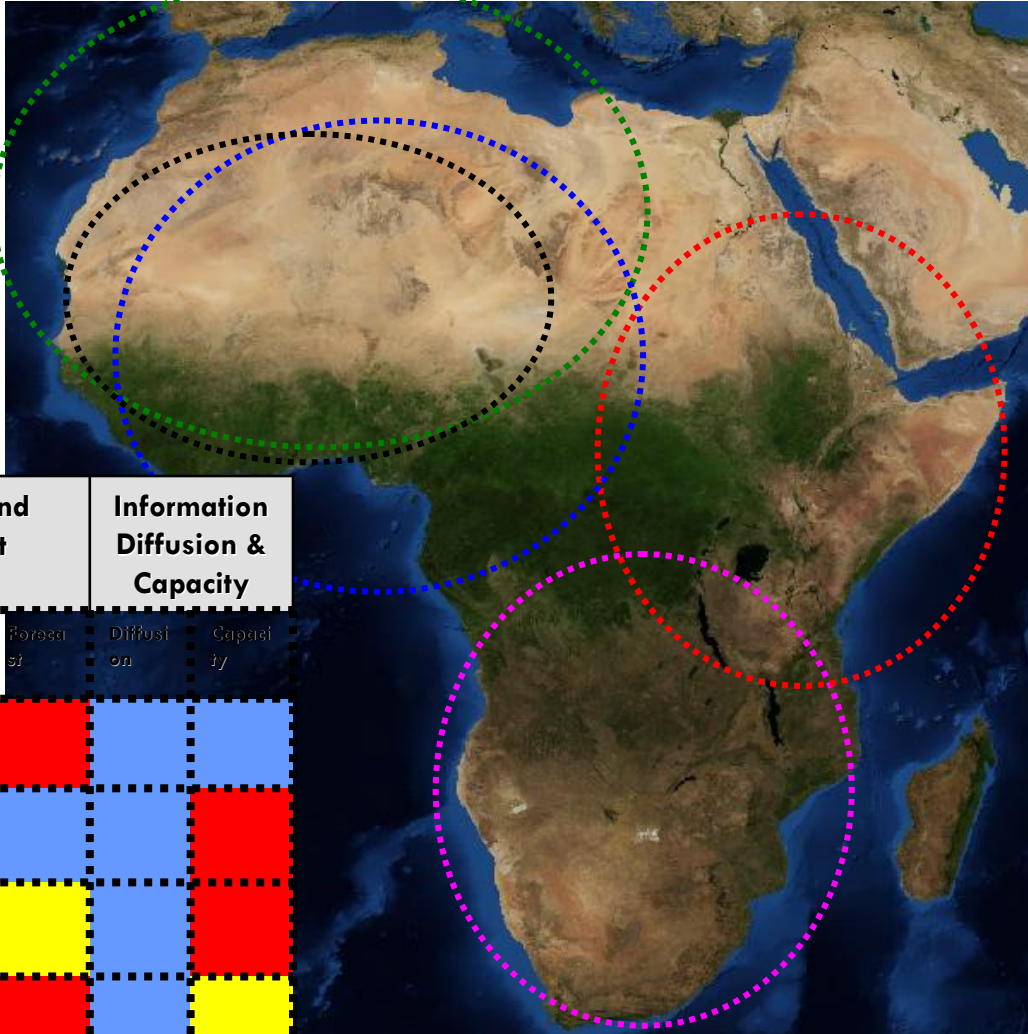


African Status : Infrastructures – Enabling Environment

Existence of many Operational Centres of Excellence

- ▣ AGRHYMET
- ▣ RECTAS
- ▣ RCMRD
- ▣ RSAU
- ▣ CRASTE
- ▣ National Agencies

- ▣ Yes
- ▣ Yes/No
- ▣ No

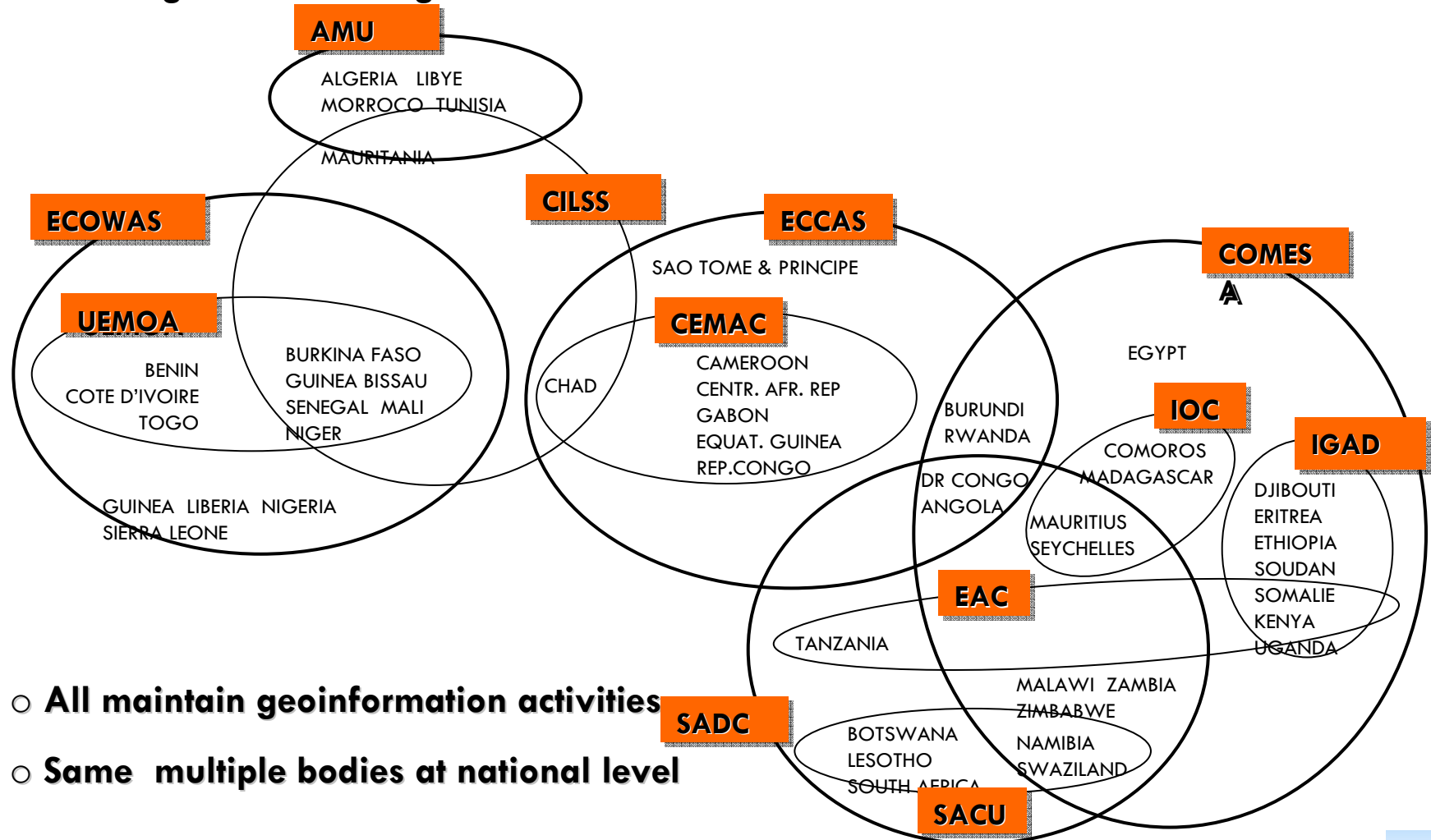


Institutions	Data collection, accessibility and integration			Monitoring and Assessment		Information Diffusion & Capacity		
	Collection	Access	Integration	Assessment	Monitoring	Forecast	Diffusion	Capacity
AGRHYMET	Yes	Yes/No	Yes	Yes/No	Yes	No	Yes	Yes
RSAU	Yes	No	No	Yes/No	No	Yes	Yes	No
CRTEAN	Yes	No	Yes/No	No	No	Yes/No	Yes	No
RCMRD	Yes	Yes	No	Yes	Yes/No	No	Yes	Yes/No



Institutional Capacity

Partnering Numerous Regional and Continental Bodies



- All maintain geoinformation activities
- Same multiple bodies at national level



Geoinformation Governance in Africa

□ Institutional Frameworks

□ Objective

- To put in place a cooperative, multi-stakeholder approach to production, management, and dissemination of spatially enabled data: Regional and National level

□ Committee on Development Information, Science and Technology

- ECA's parliamentary body to provide technical advice on, and oversight over the information science and technology including Geospatial Science (GSS) and Geospatial Information Technology (GIT).
- Open to delegates from government and various observers

□ CODIST-Geo Executive Working Groups :

- Fundamental Datasets (Chair: South Africa)
- AFREF (Chair: RCMRD)
- Capacity Building (Chair: RECTAS)
- Standards (Chair: EIS Africa)





Networking with Others SDIs....



- United Nations Spatial Data Infrastructure (UNSDI)
 - Vision for comprehensive, decentralized geospatial information framework that facilitates decision-making at various levels by enabling access, retrieval and dissemination of geospatial data and services in a rapid and secure way
 - UNSDI initiative recognizes common interests with national, nongovernmental and multilateral development efforts
 - Coordination of activities and services
 - ECA role in coordinating African countries
 - ARSDI therefore overlaps with UNSDI in content and methodology
 - UN belongs to its members, and some UN agencies may have more data about some countries than the national agencies
 - Allow access to data and services from ARSDI/UNSDI where needed for national objectives



Networking with Others SDIs....



- Global Spatial Data Infrastructure (GSDI)
 - Inclusive organization of organizations promoting international cooperation and collaboration in support of local, national and international spatial data infrastructure developments.
- GEO - GEOSS
 - Participating Organization of GEO
 - Advocating for sustained Earth Observing Systems in Africa
 - Lobbying to increase the rate of African countries Participation in GEO.



Way Forward : Getting there Without Getting Lost

- Our Role in developing ARSDI? What can we do?
- Liaise with other substantive regional organizations to determine priority areas of need
 - Demand pull, rather than supply push
- Identify specialized agencies and other stakeholders with relevant data
 - Including national sources where facilities exist
 - Assist in developing national capacity where necessary and feasible
- Identify data gaps that are not currently being met
 - Such data would be stored in locally if warranted
- Agree on mutual access to data and services remotely



Strategies and Priorities



□ **Strategy...** Indigenous African capabilities

- Coordinate with other regional bodies a continental vision to foster the development of an indigenous African capability in Geospatial Science and Technology where all the technical capacities are maintained and shared by Africans.

□ **Priorities...** African Holistic Geoinformation Vision

- Build an African Geospatial policy and champion sound research and technology programmes development, where activities will be significantly expanded to cover the fostering of innovation, product and service development, and applications (linking global to local, based on prevailing social, economic and technological realities in the continent)



Announcement



- **The 8th Conference of the African Association of Remote Sensing of the Environment**
www.aarse2010.org
- **25-29 October 2010**





Contacting Us



- ICT, Science & Technology Division
- E-Application Section
 - Andre Nonguierma, GIS Officer
ANonguierma@uneca.org
 - <http://geoinfo.uneca.org/sdiafrica/>
 - <http://www.uneca.org>