

United Nations International Conference in Space-based
Technologies for Disaster Management – “**Disaster risk
identification, assessment and monitoring**”

Beijing – CHINA, 23– 25 October, 2013

**Application of Space-Based
Technologies for Disaster Management
in West Africa – RECTAS Contribution**

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www.rectas.org

OUTLINE

- Introduction
- Major Disasters in West Africa
- Space-based Technologies and Disaster Management
- Geospatial solutions for efficient Disaster Management
- RECTAS contribution
- Conclusion - Recommendations

INTRODUCTION

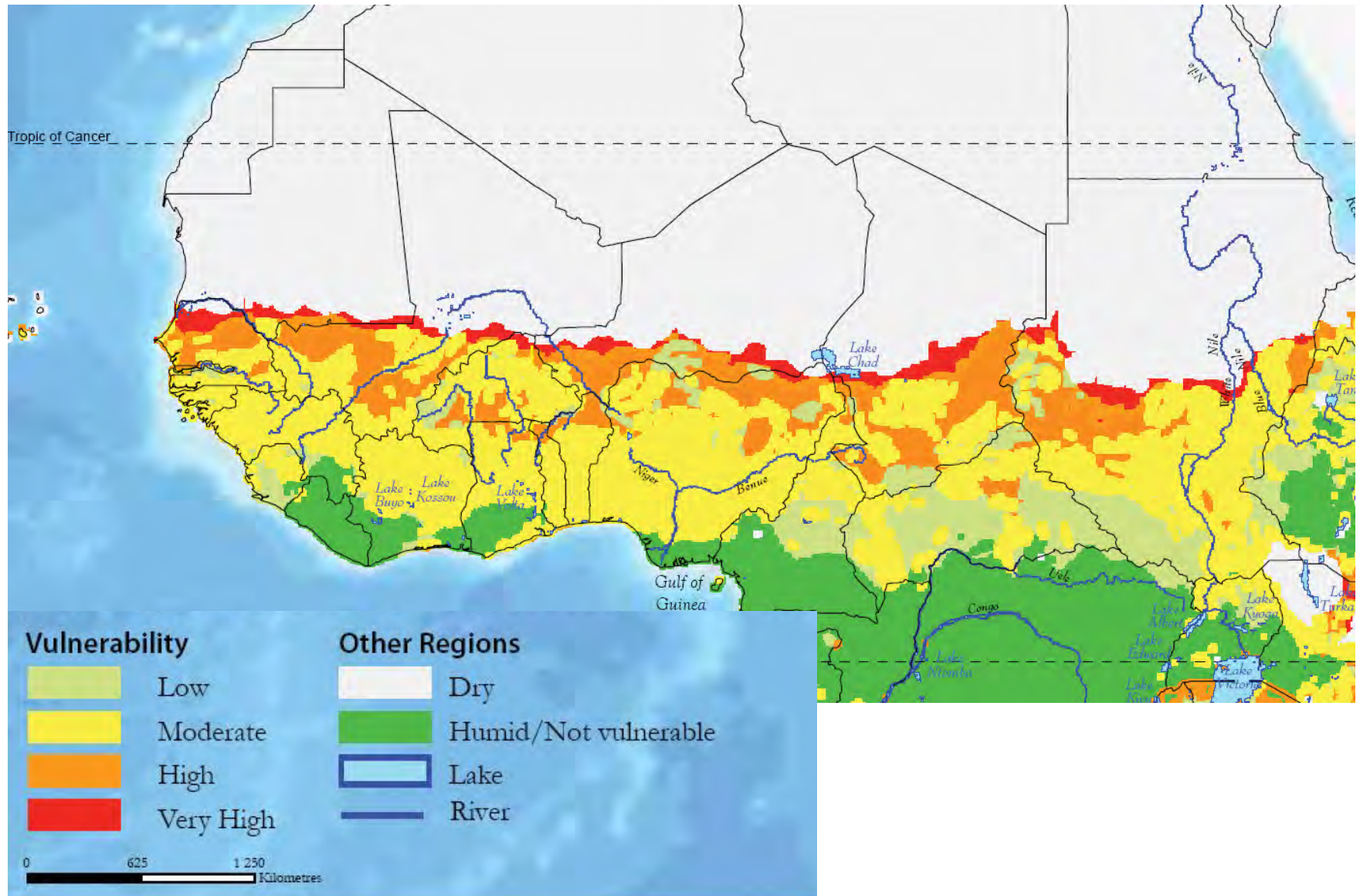
- The number of disasters reported in Africa has increased significantly (since the 1970s) and their economic impact on West African countries became more and more apparent.
- The disasters experienced by Sub-Saharan Africa during the last decades constitute a major threat to development, putting the population and the economic gains at serious risk.
- The main challenges in managing the disasters include the low capacities of local authorities and other key actors to respond, especially to conflicts causing displacements and multiplying the vulnerability of populations.
- The opportunity given by space-based technologies could be explored to identify, assess and monitor the risk of both natural and man-made disasters in the region.

MAJORS DISASTERS IN WEST AFRICA

All the countries in West Africa face recurrent complex emergencies causing serious challenges on the populations: frequent food insecurity, sustained prevalence of acute malnutrition, cyclical drought, seasonal floods, disease outbreaks, catastrophic accidents, wild fires, etc...

Desertification ranks among the greatest environmental challenges today. It occurs in all part of the African continent and affects the livelihood of millions of people in dry lands. It is also clear that the Sahara desert is already moving southward. That attracted the attention of authorities and specialists.

Areas Vulnerable to Desertification



Source: *Africa: Atlas of Our Changing Environment*, UNEP

DIFFERENT TYPES OF DISASTER

- Flooding/dam failure
- Coastal/Gully Erosion
- Drought
- Sand Storm
- Wild Fire
- Thunder/Wind Storm
- Pest Invasion
- Epidemics (HIV/AIDS)
- Geological Activities
- Accidents (marine, road, air)
- Collapsing Buildings/mine pits
- Ammunition/Bomb Explosion
- Oil Spillage (pipelines, LNG)
- Hazardous Materials
- Civil Disturbances
- War/Terrorism/Mass Refugees

DISASTERS



Flood



Wild Fire

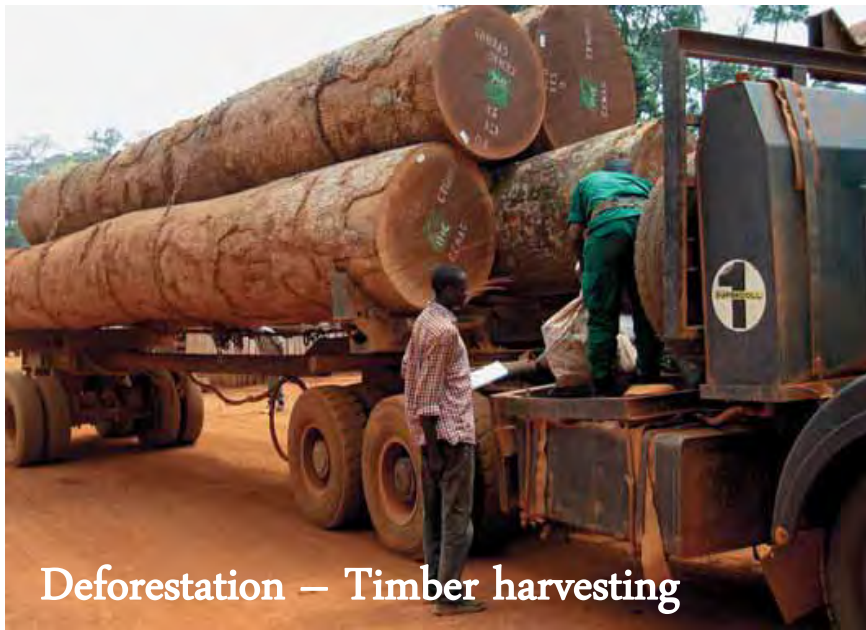


Refugees camp



Drought

DISASTERS



Deforestation – Timber harvesting



Deforestation



Deforestation – Fire woods



Coastal erosion



Catastrophic events reported in West-Africa – 2000/2008

	Drought	Epidemic	Extreme Temp.	Flood	Insect Infestation	Slides	Wild Fires	Wind Storm	Total
Benin	0	9	0	1	0	0	0	1	11
Burkina Faso	1	9	0	4	1	0	0	0	15
Cape Verde Is	1	0	0	0	1	0	0	0	2
Cote d'Ivoire	0	10	0	1	0	0	0	0	11
Gambia The	1	1	0	3	1	0	0	2	8
Ghana	0	3	0	4	0	0	0	0	7
Guinea	0	9	0	3	0	0	1	1	14
Guinea Bissau	2	2	0	2	0	0	0	0	6
Liberia	0	6	0	1	0	0	0	1	8
Mali	3	5	0	9	1	0	0	0	18
Mauritania	1	1	0	8	1	0	0	0	11
Niger	2	14	0	5	1	0	0	1	23
Nigeria	0	23	1	24	1	2	0	0	51
Senegal	1	5	0	5	1	0	0	1	13
Sierra Leone	0	5	0	3	0	0	0	0	8
St Helena	0	0	0	0	0	0	0	1	1
Togo	0	4	0	2	0	0	0	0	6
Total	12	106	1	75	8	2	1	8	213

Source: *International Charter Space and Major Disasters*

Use of Space-based Technologies for Disaster Management



What is there in space ?



Since the launch of the first artificial satellite “*Sputnik*” on 4th October, 1957 many other satellites were launched.....

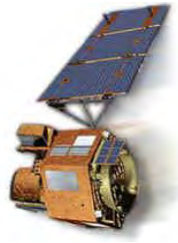
Currently, the following satellites are in Space

- **85** Earth resource and oceanographic satellites,
- **27** meteorological satellites,
- **250** communication satellites,
- **66** global positioning satellites (GPS),
- **21** search and rescue satellites; and
- **91** space and Earth science satellites

Some of the Current and Future Tools for Understanding the Earth and its Life Support Systems



• ENVISAT
• (ESA)



• EO-1
• (USA)



• EROS
• (Russia)



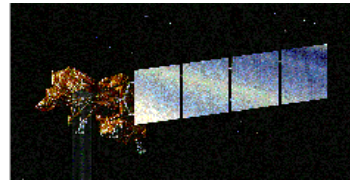
• IKONOS
• (USA-P)



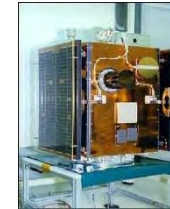
• IRS-1C
• (India)



• KVR-1000
• (Russia)

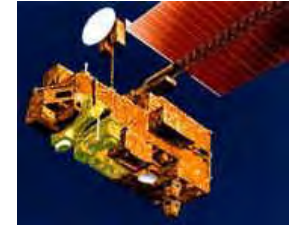


• Landsat 7
• (USA)

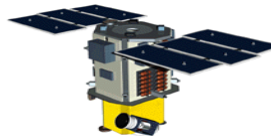
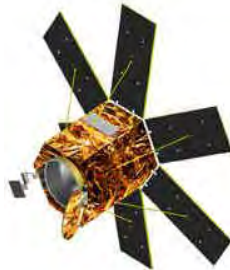


• KitSat-3

• (USA)



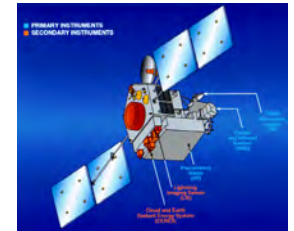
• OrbView-4
• (USA-P)



• QuickBird
• (USA-P)



• Spot-5
• (France)

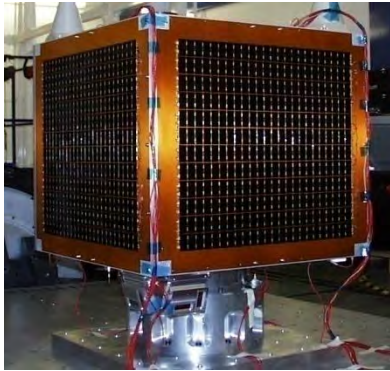


• TRIMM
• (USA & JAPAN)

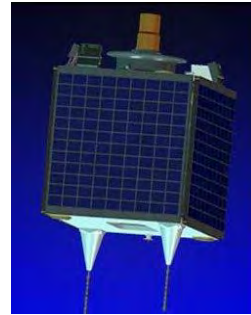


• METOP
• (ESA)

Africa's Remote Sensing Satellites

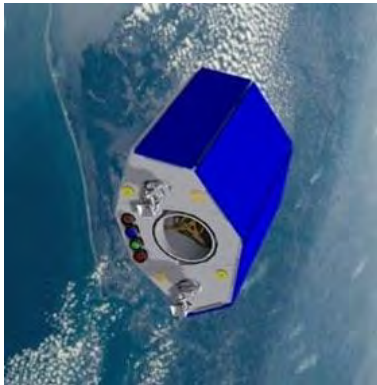
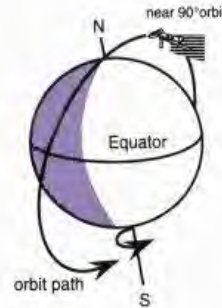
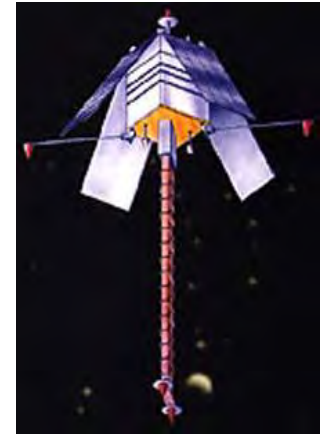


NigeriaSat-1

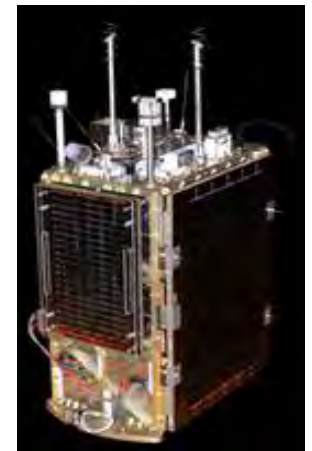
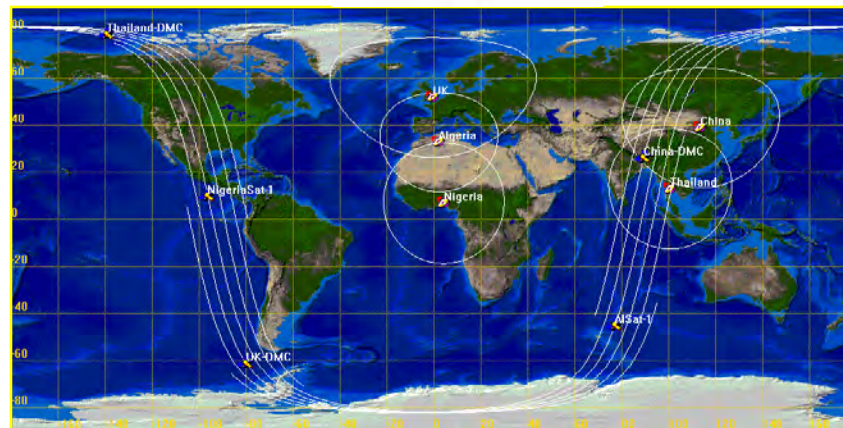


Alsat-1

EgyptSat-1



NigeriaSat-2

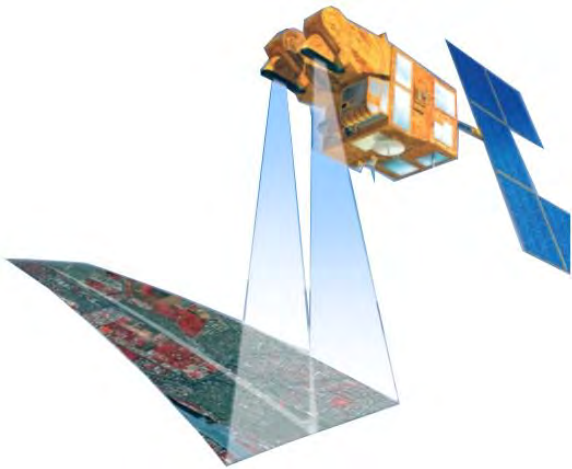


SumbandilaSat

International Charter on Space and Major Disasters

- The **International Charter on Space and Major Disasters** is a charter which provides for the charitable acquisition of and transmission of space satellite data to relief organizations in the event of major disasters.
- It officially came into operation on 1st November, 2000 and the Charter has since brought space assets into play for numerous disasters.
- It was activated for the flood disasters in Sokoto, Ibadan, Lokoja and Bayelsa in Nigeria.

SPACE-BASED TECHNOLOGIES & DISASTER MANAGEMENT (cont'd)



DISASTER IDENTIFICATION & ASSESSMENT

For each type of Disaster, the following questions have to be answered:

- ⇒ Which observable features **precede** the disaster ?
- ⇒ Which observable features **accompany** the event ?
- ⇒ Which observable features can be used to **assess the damage** ?

DISASTER CHARACTERISATION & MONITORING

For each type of Disaster, the following questions have to be answered:

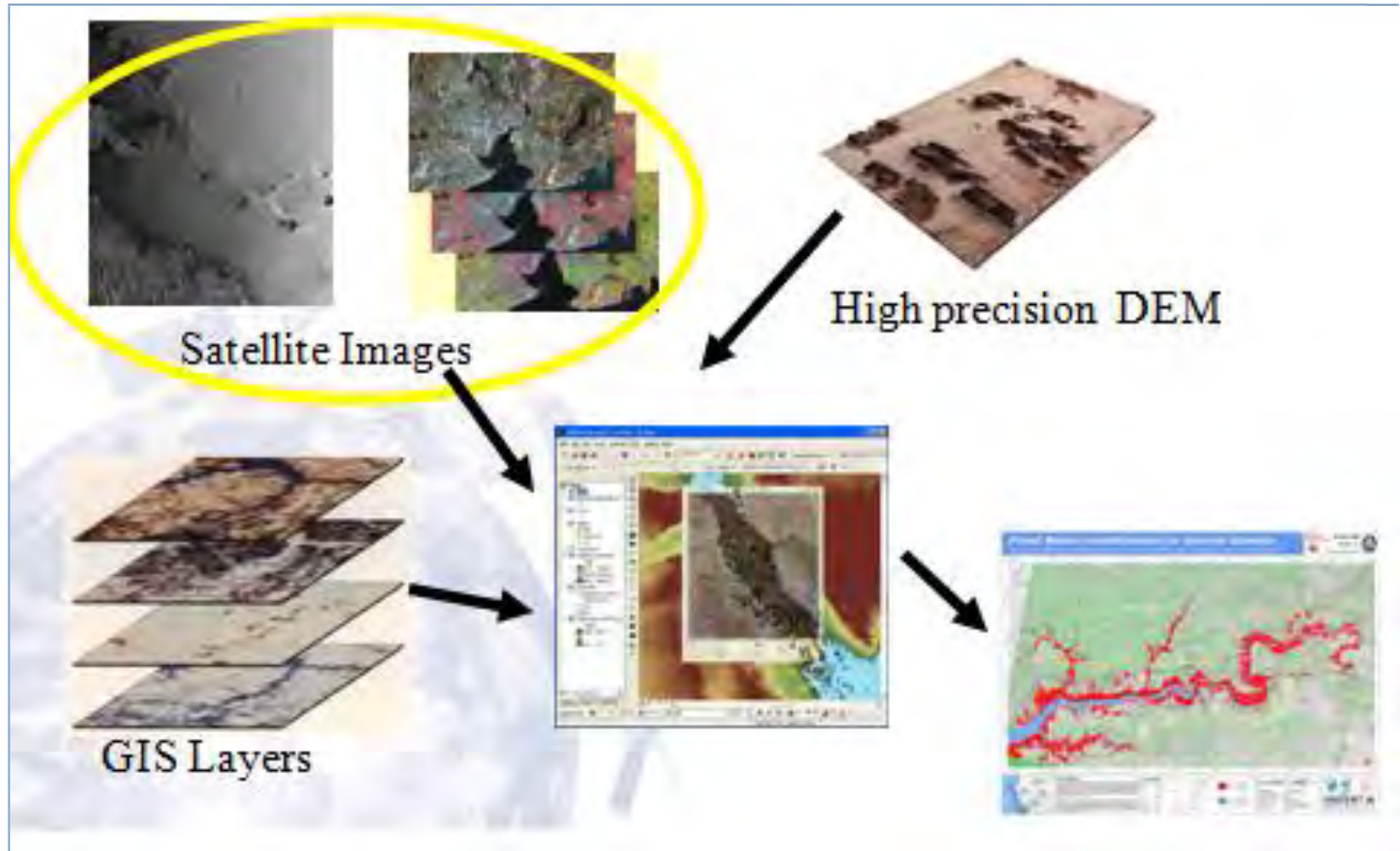
- ⇒ What is known about their speed of evolution ?
- ⇒ What is their return period ?
- ⇒ What is the area affected ?
- ⇒ What is the nature and extent of damage ?
- ⇒ What is the toll in loss of human life ?
- ⇒ Which forms of preparedness are practical ?
- ⇒ Which forms of mitigation/relief are practical?

GEOSPATIAL SOLUTIONS FOR DISASTER MANAGEMENT IN WEST- AFRICA

The solution to the numerous disaster challenges in African Nations (drought, volcanous, landslides floods, coastal erosion, wild fires, environmental degradation, etc) requires **integrated multidisciplinary approach.**

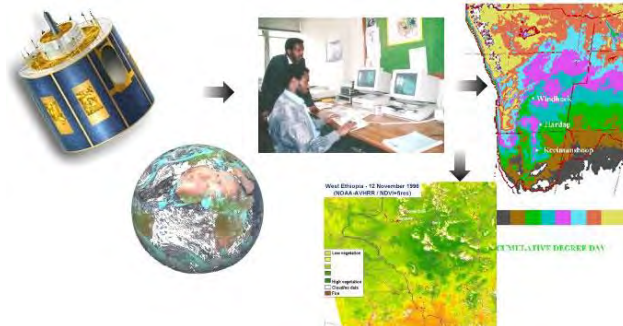
Geospatial technology supplies reliable, accurate and relevant information and services when and where-ever needed and improve decision making in disaster management. It is a strong backbone for disaster management strategies.

GEOSPATIAL SOLUTION FOR DISASTER MANAGEMENT



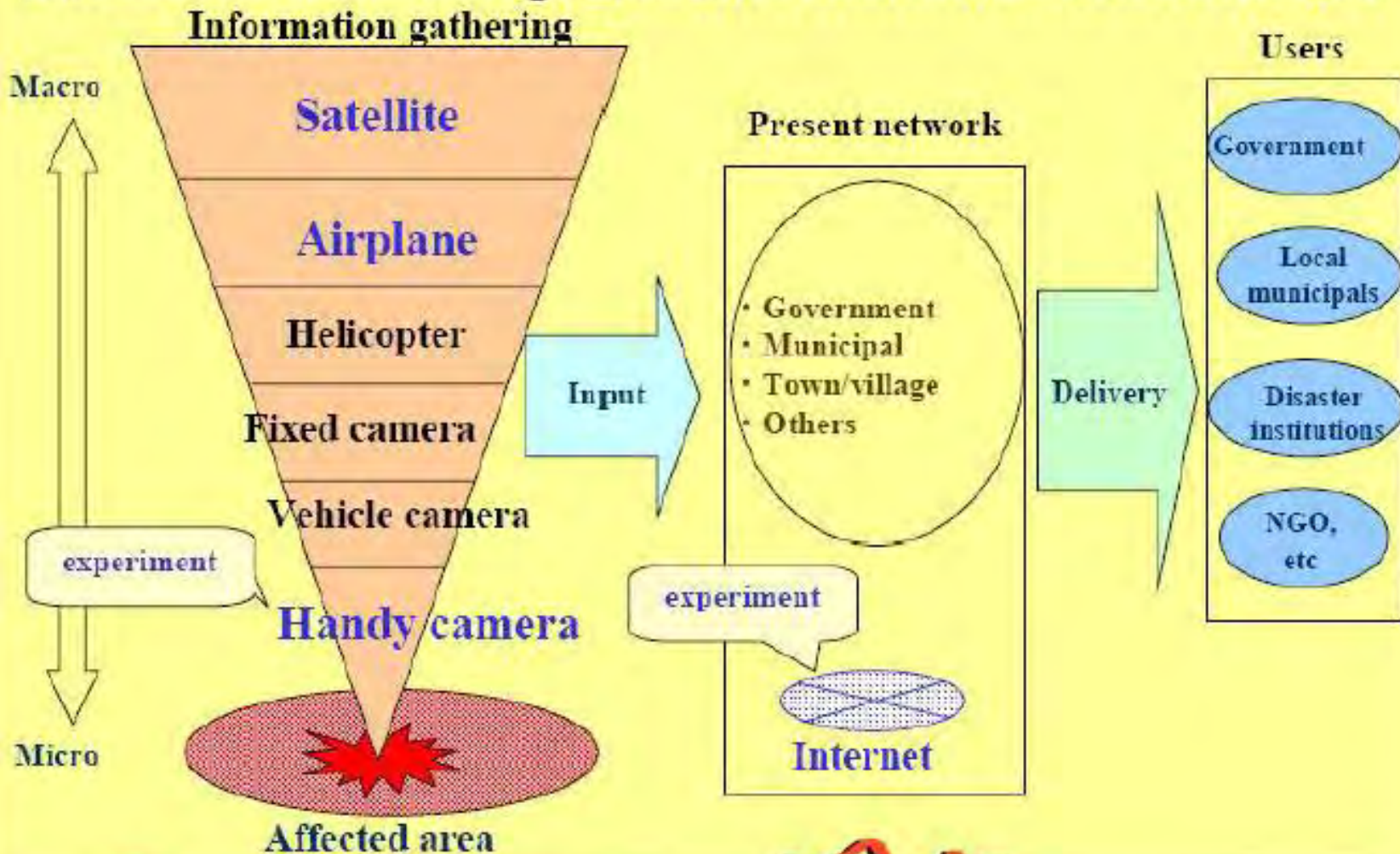
GEOSPATIAL SOLUTION =

- Synergy between stakeholders at all levels;
- Coordination;
- Data dissemination / sharing and
- Capacity Building of partners.





Disaster monitoring and information dissemination



**THE REGIONAL CENTRE FOR
TRAINING IN AEROSPACE
SURVEYS (RECTAS)**

**CONTRIBUTION /
ACHIVEMENTS**

RECTAS, Obafemi Awolowo University Campus, Ile-Ife - NIGERIA



THE CENTRE

- RECTAS was established on 21st October 1972 *under the auspices* of the United Nations Economic Commission for Africa (UNECA).
 - RECTAS is a joint Institution of African countries. The participating countries at the moment are Benin, Burkina, Cameroon, Ghana, Mali, Niger, Nigeria (host country) and Senegal.
- *Interested countries are to apply for admission***
in Africa.

RECTAS' MEMBER STATES

NIGER

MALI

SENEGAL

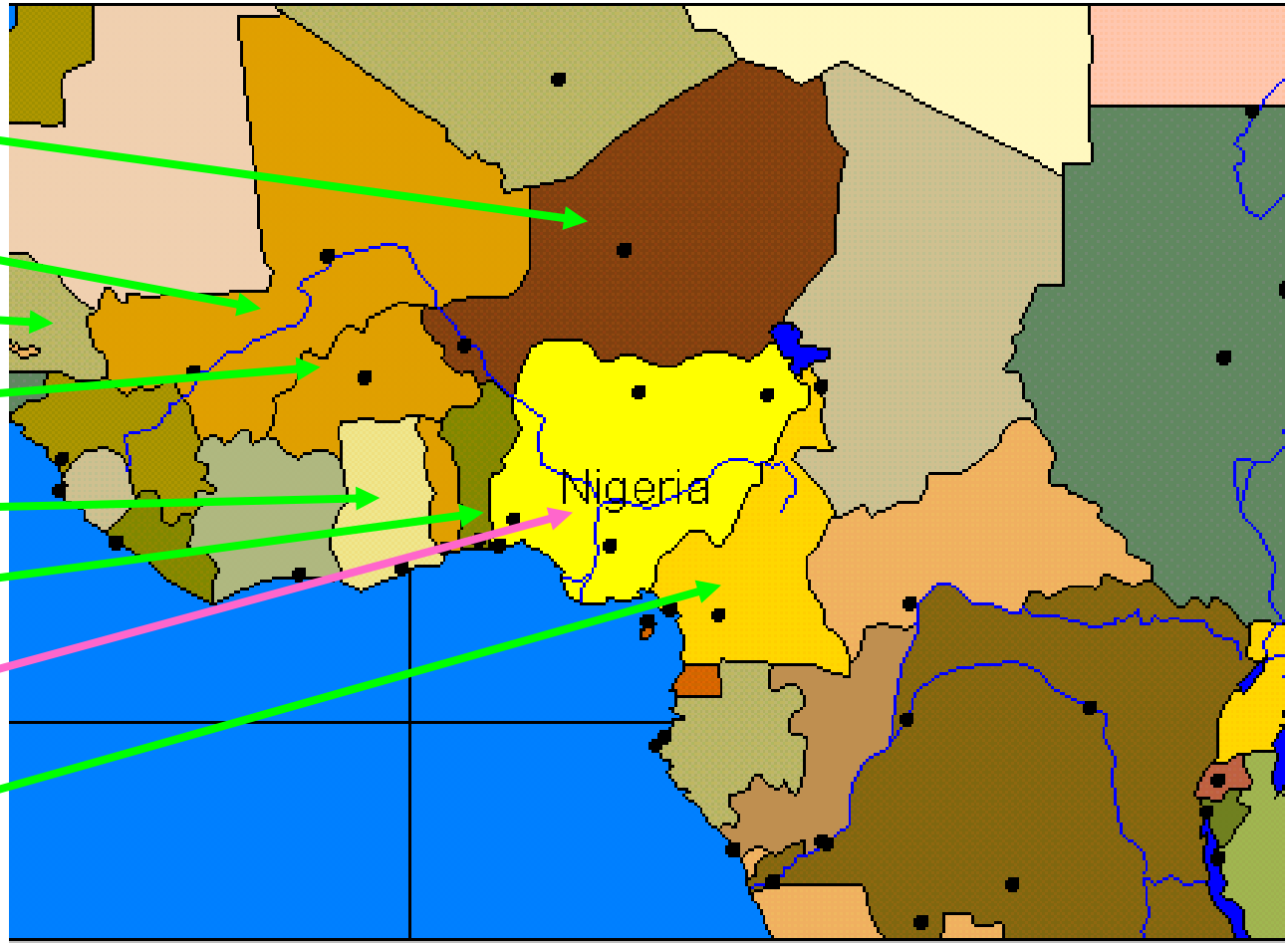
BURKINA

GHANA

BENIN

NIGERIA

CAMEROON



VISION OF RECTAS

To be a leading *Centre of Excellence* providing one-stop solution for quality geospatial science training, education and research and critical capacity for sustainable development in Africa.

MISSION OF RECTAS

To contribute to rapid development of member states in particular and Africa in general, through capacity building for timely delivery and responsible use of appropriate geospatial information.

OBJECTIVES

- Provide theoretical and practical training in Geoinformatics and applications
- Conduct seminars and workshops
- Undertake studies and research
- Provide consultancy and advisory services upon request



OBJECTIVES (cont'd)

Equip graduates of various disciplines with adequate technical capability in GIS, remote sensing and usage of geospatial technology in different areas of specialisation.



RECATS' Academic Departments

- ⇒ RECTAS has 3 academic Departments:
 - Photogrammetry & Remote Sensing (PRS)
 - Cartography (CAR)
 - Geographic Information Systems (GIS)

- ⇒ RECTAS is a bilingual centre and the programmes are run in **ENGLISH** and **FRENCH**

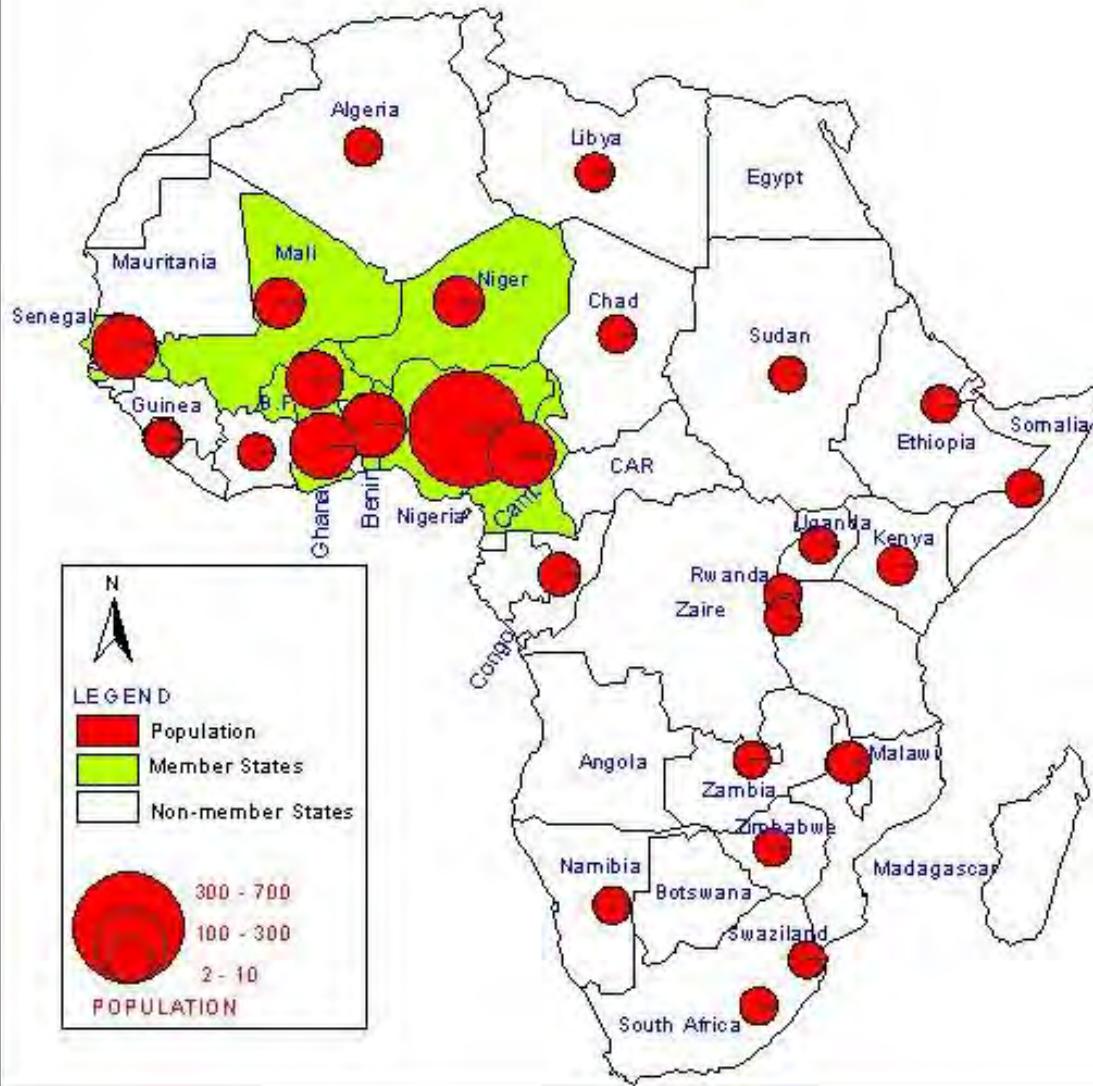
RECTAS' Academic Programmes

Dept	Programme	Duration
PRS	• Tgt Dipl. in GI Prod. & Mgt.	18 m
	• PM in GI Prod. & Mgt	12 m
	• PhD Remote Sensing	2-4 yrs
GIS	• Tech Dipl. in GI Prod. & Mgt.	18 m
	• M.Tech in GIT (with FUTA)	18 m
	• MSc. GI Science (with UAC)	18 m
	• PhD Geoinformation Science	2-4 yrs
CAR	• MSc. GI Science & Land Admin. (with UG)	18 m
	• PhD Cartography & Geovisualisation	2-4 yrs

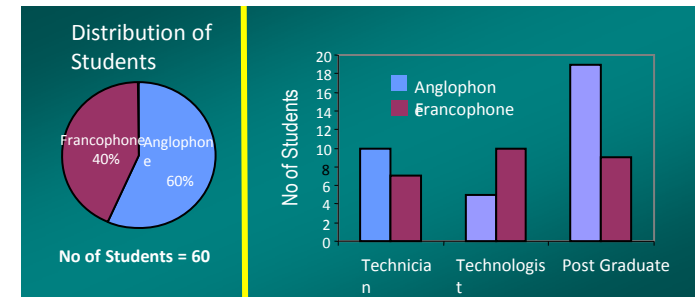
AREAS OF SPECIALISATION

- **Disaster management**
- Environmental management
- Land resource management
- Natural resource (oil & gas) dev.
- Hydrology & water resource mgt.
- Meteorology & climate change
- Soil survey and Agricultural Mgt
- Health and social development
- Crime Mapping, Peace and Security
- Military Intelligence
- Etc...

RECTAS TRAINEES FROM AFRICAN COUNTRIES



RECTAS has trained 1,732 students from 29 African countries (from 1973 to 2012)



Students enrolment at RECTAS



CONSULTANCY, RESEARCH & PROJECTS EXECUTION

Customised Short Term Courses

- Remote Sensing, GIS applications & Digital Cartography (NARSDA, NEMA, NPC, NGSA, ...)
- Remote Sensing & GIS applications in military operations
- Remote Sensing & GIS application in Geology and Mineral Resources Exploration (MMSD)
- Remote Sensing (CENATEL Benin Republic)
- etc...

CONSULTANCY, RESEARCH & PROJECTS EXECUTION (cont'd)

Seminars & Workshops

- Disaster Management Workshop (2007)
- GIS-Day Seminar (2008)
- AFREF Workshop (2009)
- AFREF Experts Meeting (2010)
- GSDI Regional Workshop (2011)
- GARNET-E Regional Workshop (2012)
- Joint NCA & GEOSIN Workshop and Conference (2013)

CONSULTANCY, RESEARCH & PROJECTS EXECUTION (cont'd)

Projects execution

- Topographic mapping projects
- Township/Cadastral mapping
- Large scale/Campus mapping
- Supply of Satellite imageries
- Installation of GIS Laboratories & Weather Stations
- Repair of equipment
- etc...

Research & Projects Execution (cont'd)

RECTAS has contributed jointly with national, regional and international organisations in the following disaster management related research /projects :

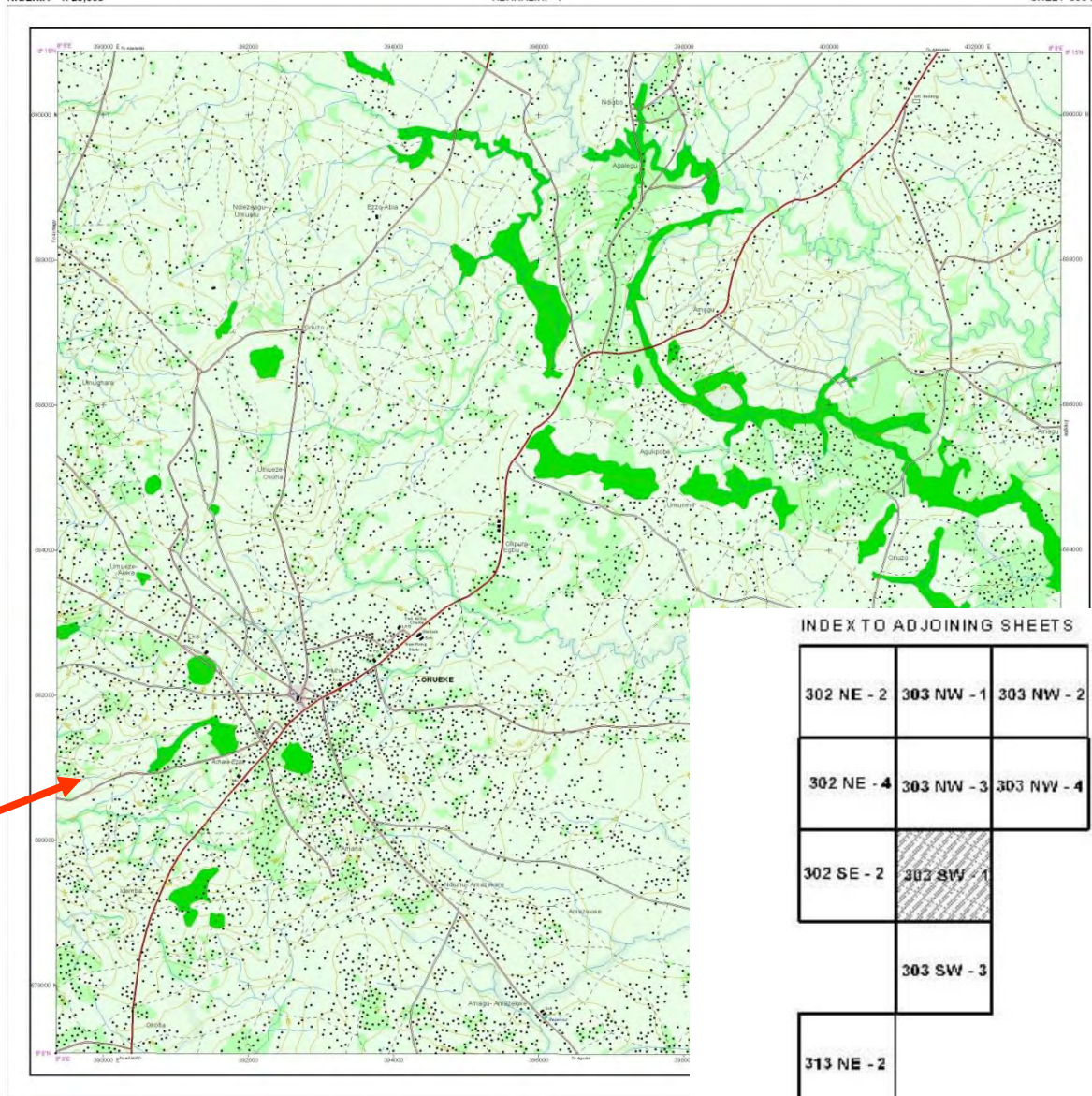
- Evaluation of Sokoto flood – September 2010
- Flood Hazard Mapping of Ona River Basin, Ibadan, Nigeria
- Evaluation of the extent of Lokoja flood disaster – 25th September 2012

Consultancy

RECTAS undertakes consultancy services in the application of Geoinformation in any field of endeavour.

Sheet 303 SW1

ONUKE
topo Map
1:25,000



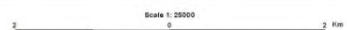
INDEX TO ADJOINING SHEETS

302 NE - 2	303 NW - 1	303 NW - 2
302 NE - 4	303 NW - 3	303 NW - 4
302 SE - 2	303 SW - 1	
	303 SW - 3	
	313 NE - 2	
313 NE - 3	313 NE - 4	

SHEET HISTORY

This work is sourced from -
 - Nigerian Topographic map sheet numbers Malagu 302 NE, Abakaliki 303 NW & SW and Akoko 313 NE First Edition, published in 1968
 - Satellite Imagery (SPOT Panchromatic Scene Level 1B)
 (a) Acquired on 15/12/1998
 (b) Scene 10762037
 - Contour interval: 5 m.

- Areas Liable to Flood
- Lake
- River
- Heavy Forest
- Sand/Curse/Mud
- Highway
- Light Forest
- Savanna/woodland
- Main Roads
- Mangrove & Marsh
- Settlement
- Secondary Roads
- Plantation
- Not covered by image
- Minor Road
- Flood Paths

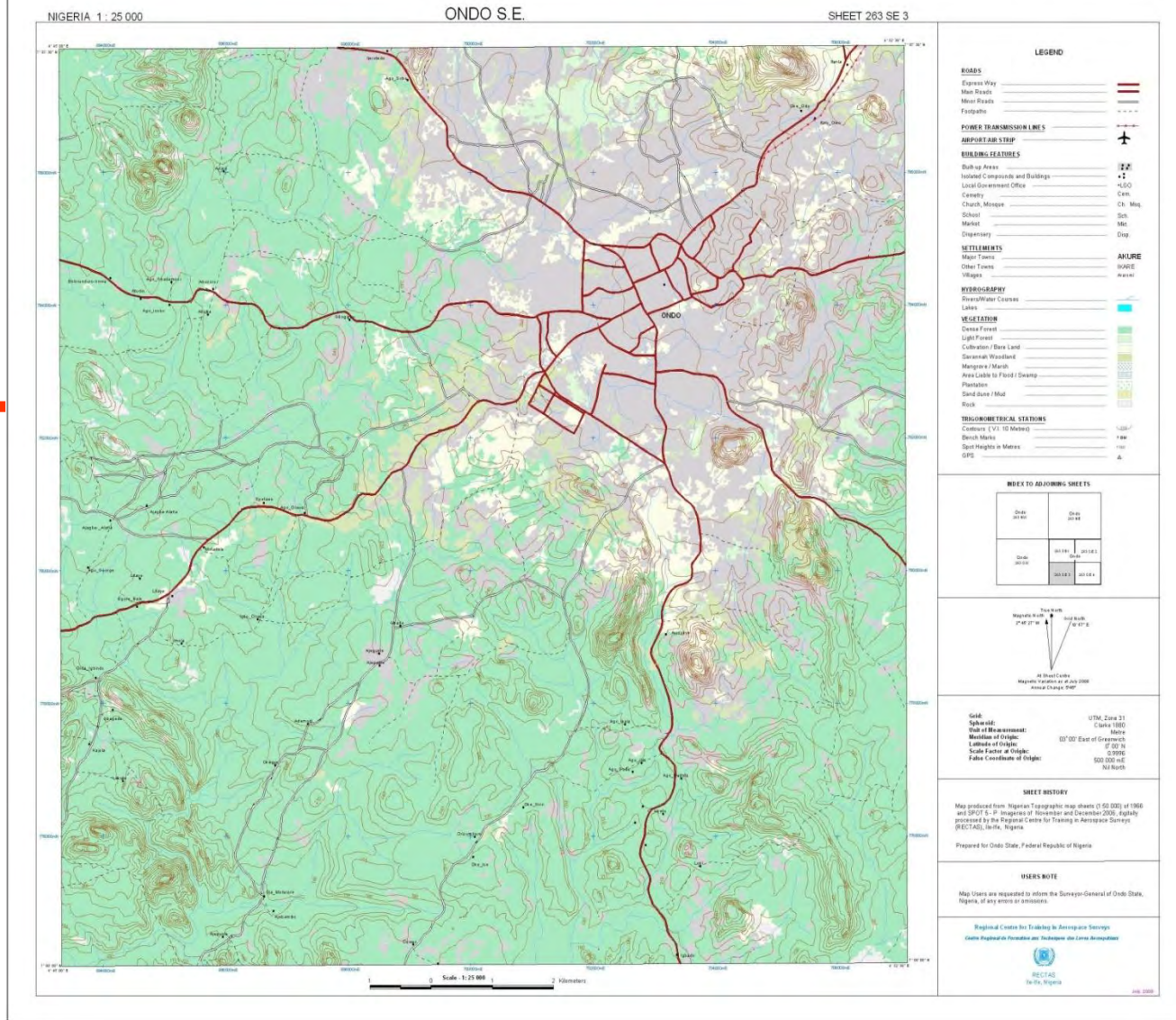


Date: 15/12/1998
 Project: Abakaliki
 Scale: 1:25,000
 Contour Interval: 5m
 Projection: UTM, Zone 12
 Datum: 1984
 Unit: Meter
 Author: RECTAS
 Date of Issue: 15/12/1998
 Date of Revision: 15/12/1998
 Date of Origin: 15/12/1998
 File Name: 303 SW 1
 File Size: 11.1 MB
 File Format: TIFF

Consultancy

Topographic mapping of Ondo State

Sheet 263 SE 3
ONDO Township
 1:25,000



RECTAS

Consultancy:

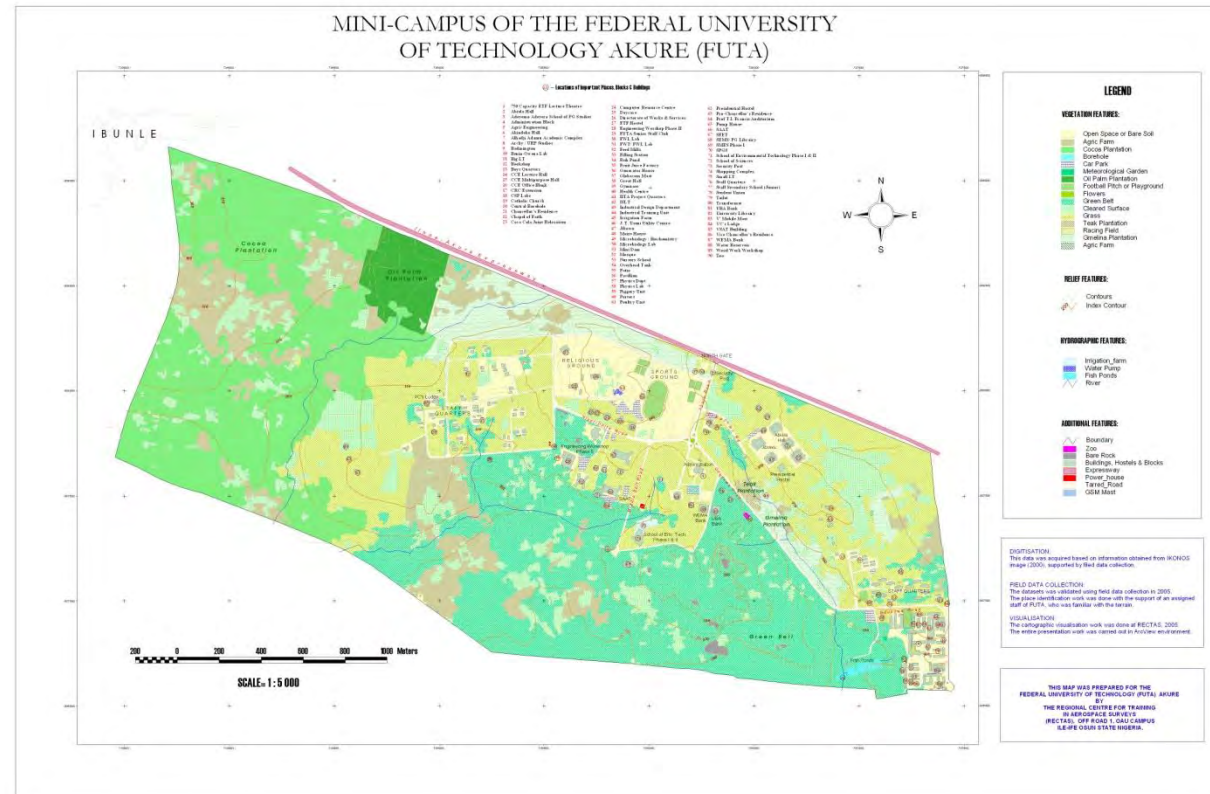
provision of
Satellite data –
imageries, digital
photos, etc

Quickbird
image of
Akure



Consultancy:

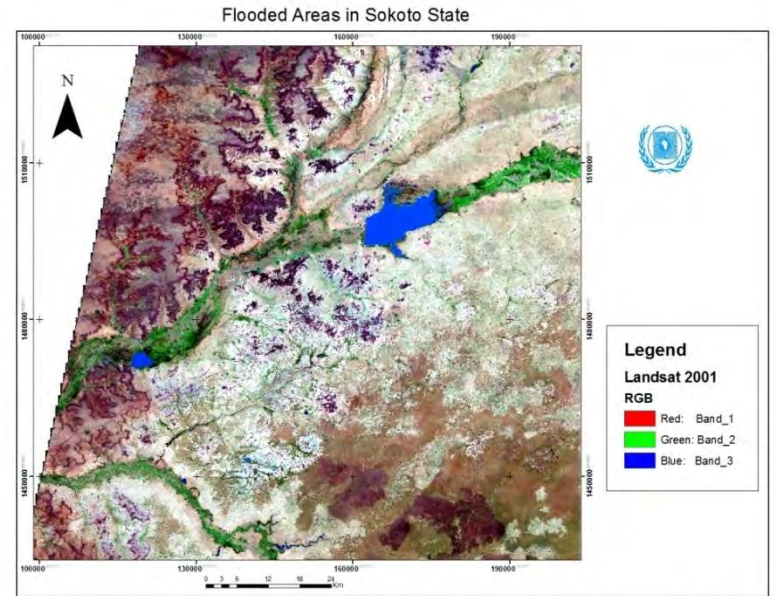
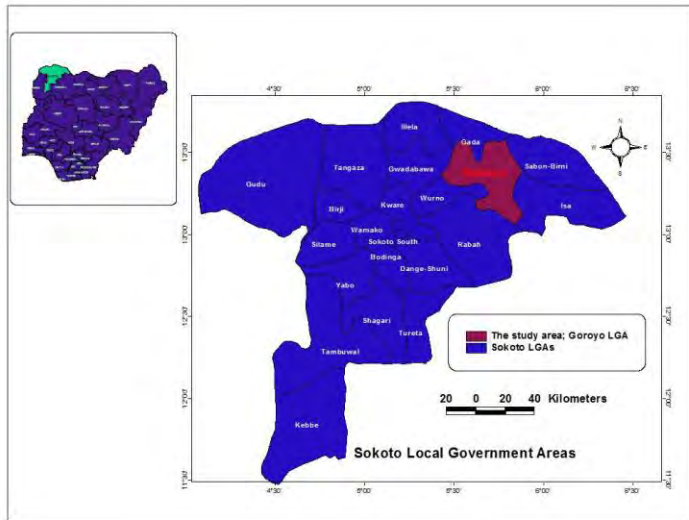
Topographic mapping of a University campus



Flood mapping activities

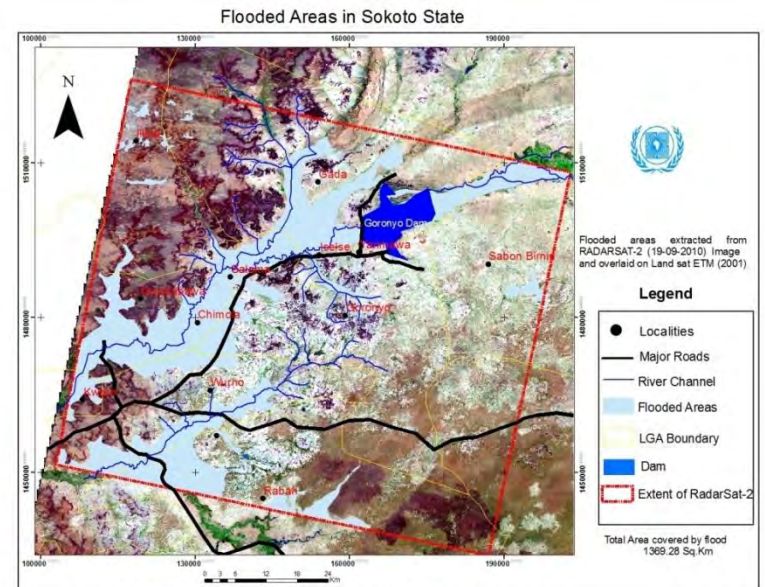
- Creation of digital databases with existing data
- Flood mapping was performed for Charter Call 324 & 326.
- Call activated by National Emergency Management Agency (NEMA)
- Digital Mapping was performed by RECTAS (Project Manager)

FLOOD DISASTER MAPPING AND RISK ANALYSIS OF FLOODED AREAS IN SOKOTO STATE - NIGERIA



Processed at RECTAS with assistance from International Charter for Space and Major Disasters (charter call 324)

September, 2010



Processed at RECTAS with assistance from International Charter for Space and Major Disasters (charter call 324)

September, 2010

Assessment of Eleyele Dam Flood Disaster – Ibadan, NIGERIA

Area impacted

= 22, 616, 260m²
(2,262 hectares)

Communities:

UI, Apete, Ajibode,
Oke Ayo, Elewe &
New Garage.

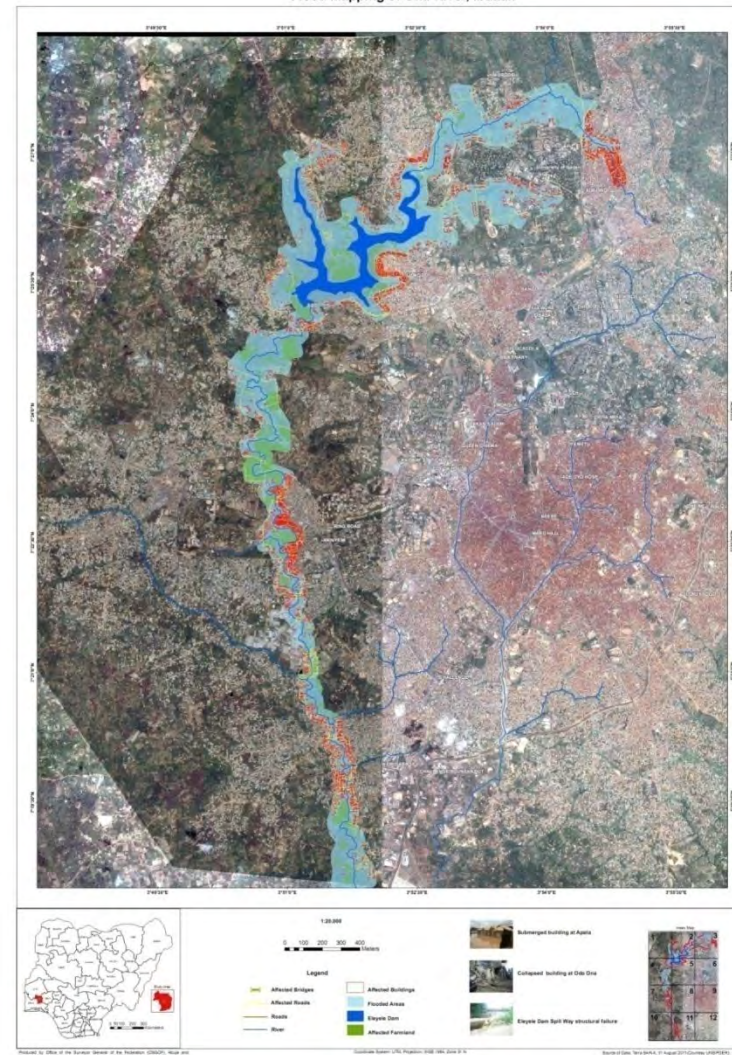
Roads = 129.3 km

Bridges = 10

Buildings = 5,751

Agriculture crops:
maize, vegetables,
etc

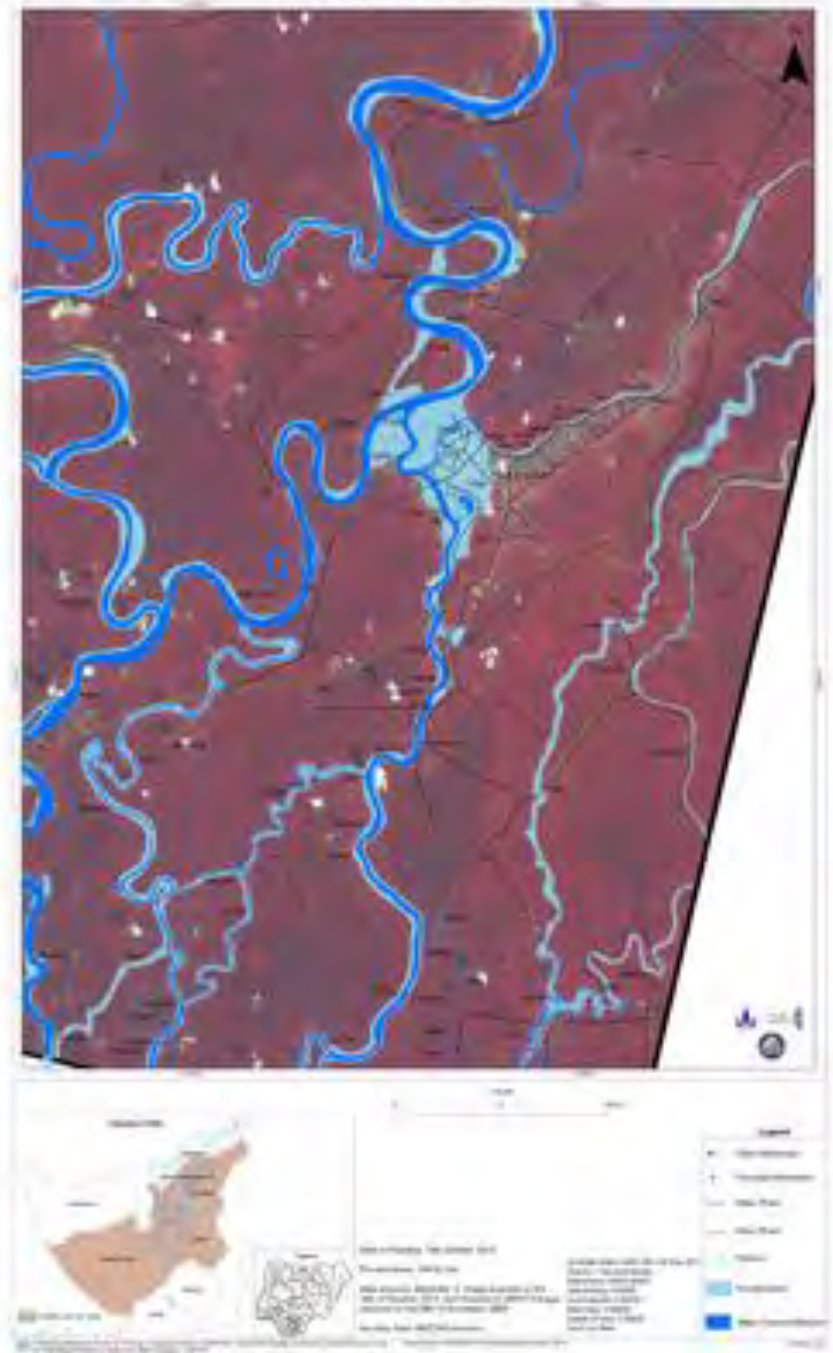
Flood Mapping of Ona River, Ibadan



**Identification
of the
localities
affected by
the Flood
Disaster in
Lokoja – Kogi
State, NIGERIA**



Identification of flooded areas in Bayelsa – NIGERIA



Other Activities

- Marine Environment Monitoring in Nigeria project (2009-2010)
- Regional workshop on the “use of Space-based technologies for Disaster Management for professionals of West and Central Africa” (2011)
- Participation in UN-SPIDER TAMs and Training/Capacity building activities (Togo, Cameroon, Abuja, Burkina Faso)
- Participation in the Development of ECOWAS Spatial Data Infrastructure (EGDI)
-

CONCLUSION & RECOMMENDATIONS

In view of above , the importance of Space based-technologies for efficient disaster management cannot be overemphasised. The assistance given by the International Charter Space and Major Disasters has greatly eased the acquisition of satellite imageries for disaster management operations.

- There is need to do proper capacity building of the key actors involved in disaster management
- There is also urgent need to develop a synergy between stakeholders to develop national and regional disaster management strategies (opportunities are given by ECOWAS Early Warning GDI, UNSPIDER, etc...).

THANK YOU