



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



ROLE OF GEOSPATIAL TECHNOLOGY IN ENVIRONMENTAL SUSTAINABILITY IN NIGERIA

Njike CHIGBU and Daniel ONUKAOGU (Nigeria).

Presentation outline

- 1.0 Introduction
- 2.0 Relevance of Geospatial Technology to Environmental Sustainability
- 3.0 Application Areas
 - _land use and land cover studies
 - _Ground Water Potential and Contamination
 - _GIS Methods

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



PRESENTATION OUTLINE CONTD

- 4.0 Roles of Geospatial Technology
- 5.0 Challenges of Geospatial Technology in NIGERIA
- 6.0 Conclusion & Recommendation

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



INTRODUCTION

The geospatial technology industry is defined as an information technology field of practice that acquires, manages, interprets, integrates, displays, analyses, otherwise uses data focusing on the geographic, temporal, and spatial context. It also includes development and life cycle management of information technology tools to support the above. (Geospatial Work force Development Center, University of Southern Mississippi).

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- The progressively complex and accelerating pace of change in the geospatial industry offers dramatic possibilities for meeting the increasingly sophisticated geospatial information demands of government, private industry, scientists and the public. (U.S. Geological Surveys).
- The built industry occupational groups- engineering, architecture, surveyors, cartographers, photogrammetrists, and Surveying technicians, is One of the ten occupational groups projected to have the fastest growth in employment between 2002 and 2012 in U.S. (U.S. Bureau of Labour Statistics).
- Increasing demand for readily available, consistent, accurate, complete, and geographic information and the wide spread availability and use of advanced technologies for great job opportunities for people with many different talents and educational background (U.S Geological Survey and U.S Bureau of Labour Statistics)

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



INTRODUCTION

- Geospatial technology offers a wide range of innovative and cost effective solutions for environmental sustainability.
- The relevance of environmental information is based on the degree of reliability, accessibility and the level to which such information can be disseminated or shared by others.
- On a global scale, especially in the advanced economies, the role and use of Geospatial technology in solving almost all environmental challenges is on the high increase.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Geospatial technology has made giant strides in the area of information science and technology with respect to environmental sustainability and the use of several powerful information driven tools such as GIS, earth imaging satellite systems like LIDAR, Cloud computing, GPS and Remote sensing techniques, etc.

The thrust of this work is to emphasize the workability Geospatial technology in solving Nigerian nagging environmental challenges.

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



NIGERIA MAP



Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



GEOSPATIAL TECHNOLOGY AND ENV- SUSTAINABILITY

- Geospatial Technology is the specialized set of information technologies that include aerial photography, remote sensing, surveying, and global positioning systems ,etc., that support a wide variety of uses, from data acquisition to data storage and manipulation to image analysis to geo-visualization.

Platinum sponsors:



Gold sponsors:





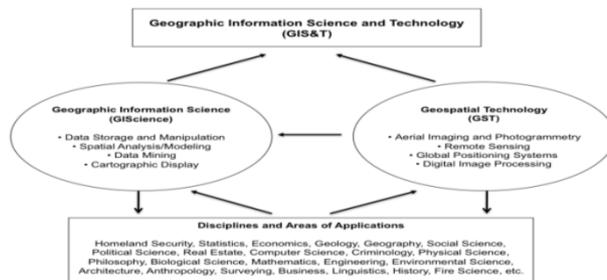
FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Geospatial technologies



GIS Science and technology adopted from ((Tsou and Yanow, 2010))

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Some Identified Application Areas of Geo-Spatial Technology

- These include:
- Flooding, environmental degradation and climate change studies
- Agriculture and precision farming
- Health and Paramedics sector
- Mining and extractive industries
- City planning, transportation, communication Networks
- Crime Mapping and Hot spots delineation
- Land use and Land cover studies for sustainability

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Application areas contd.

- General Developmental control and resource inventory and allocations
- Emergency planning and alternative route development
- Development of agronomical and early warning data/information.
- These application areas are vividly captured in Figure 2.0 above.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Specific Applications

- Land use and Land cover Studies for Sustainability.
- Urban growth is best measured in terms of its capacity to support the human populace without adverse effect to the whole system.
- A number of developments have had more expected adverse effects on the population.
- Land use and land cover studies play a vital role in determining the growth rate and trend in a given geographical location and the factors(anthropogenic or natural) pushing these changes. Thus, urban growth studies have indicated that land use and land cover types are constantly changing(Zhang,2009,Weng,2001).

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Specific Application Areas

The dynamics of change in land cover types of urban regions can be attributed to the expansion of residential and commercial/industrial facilities, which has resulted to structural challenges such as inadequate facilities, inefficient street layouts & transportation networks, less space for conservation and parks, low agricultural farm lands, high use of carbon energy, land and water.

Hence, monitoring the spatial- temporal changes is significant for advanced urban planning and development (Deng et al., 2008, Lu et al., 2004).

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Specific Application Areas

- Spatial Changes and monitoring can be accomplished using satellite imagery or Aerial photography, advance image processing techniques and GIS analysis to highlight land cover changes (Zhang 2009, Weng 2001).
- With the rapid advancement in RS techniques, new and improved change detection techniques are being developed and categorized by many researchers, thus making remote sensing a vibrant toolkit for environmental studies for sustainability.
- A number of studies on land use and land cover changes have been done in Nigeria especially in the south-eastern states (Igbokwe et al.,2012).

Platinum sponsors:



Gold sponsors:





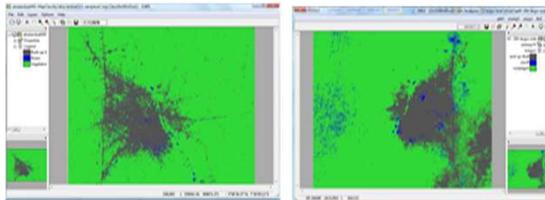
FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



specific Application Area contd.



Classified 2000 Landsat ETM+ (b) Classified 2005 NigeriaSat-1 (chigbu, 2010)

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



specific Application Areas

Analysis of the land use and land cover of Aba main Town for sustainability

Landuse	River			Built-up Area			Vegetation		
	1991	2000	2005	1991	2000	2005	1991	2000	2005
Area (Ha)	62	91	92	89	110	150	260	210	169
Covered (%)	15.1	22.1	22.4	21.7	26.8	36.5	63.2	51.1	41.1
% diff.	0	+7.0	+0.3	0	+5.1	+9.7	0	-12.1	-10.0

(Source: Chigbu, 2010).

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Specific Application contd.

- The Land use and land cover study of Aba (Abia State) using RS and GIS tools, was undertaken with the objectives of finding out the percentage /rate of vegetal consumption and its overall effect on food security and environmental sustainability.
- Based on the results and the analysis done in the study shown on table 1 above, it was concluded that remote sensing and Geographic Information System can be used as effective tool to analyze land use and detecting changes over the years
- The analysis of the result of the Land use pattern and dynamics in Aba (Abia State) showed phenomenal increase in the Built-up areas and the River body while the vegetation decreased tremendously.
- If this scenario is left unabated, this will impact negatively on the environment and have adverse effect on sustainable environmental development (Chigbu, 2010).

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Ground Water Potential and Contamination

- We all know that water is fundamental and required by all living things for cell metabolism. Continuous existence of man on this planet will definitely depend on the availability of good quality water. Several activities deter good water quality in Nigeria today.
- The problem of nitrate pollution in groundwater is a common global phenomenon and has been reported by various authors in many parts of Nigeria (Egboka & Ezeonu, 1990; Uma, 1993; Edet, 2000; Adelana & Olasehinde, 2003; Amadi, 2010).

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- Using a good GIS framework which incorporates the utilization of modern day geospatial technologies allows for a better visualization of ground water system and to also protect its quality.
- With the help of geospatial technology one is able to understand the ground/surface water interactions pattern and able to deduce appropriate sites or locations for any sort of construction.

Platinum sponsors:



Gold sponsors:



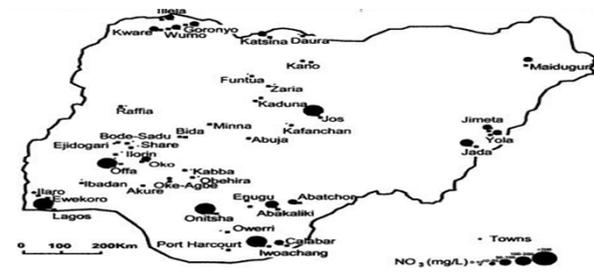
FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Water contamination map



Nigeria's Groundwater nitrate pollution status (source: Adelana, 2006)

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- With the help of geospatial technology one is able to understand the ground/surface water interactions pattern and able to deduce appropriate sites or locations for any sort of construction.
- Using the powerful spatial analyst embedded in Arc-toolbox within ArcGIS desktop application one is able to carry out such investigation.

Platinum sponsors:



Gold sponsors:



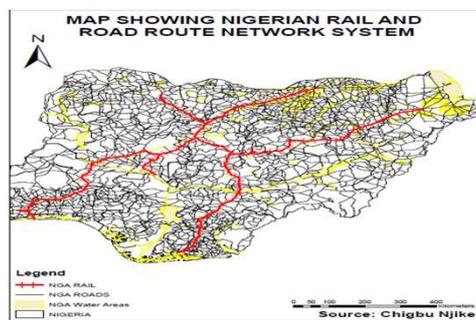
FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Spatial planning and Route Optimization



Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- GIS has been used in several studies around the globe for land use planning which cuts across all aspects of both urban planning and Industrial Township planning etc.
- GIS aids in the mapping and visualizations of route optimization which play a significant role in identifying potential deprived areas that don't have equal accessibility to these route network system.
- One of the strength of GIS is that it allows for real time visualization and interactions which brings the realization of your geospatial data to a more unique expression.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



ROLES OF GEOSPATIAL TECHNOLOGY IN ENVIRONMENTAL SUSTAINABILITY

- Serves as a good decision support system for policy makers and agencies of government
- Help end-users and government in gathering the necessary information in order to make informed decisions on what actions to take to address environmental problems.
- Helps to mitigate environmental challenges due to human and non human actions
- Assures ready availability of environmental data for planning and re-planning purposes.
- This tools help in the overall assessment of environmental impacts and also play important roles in physical planning of the environment in Nigeria(geo-visualization).

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



CHALLENGES FACING GEOSPATIAL TECHNOLOGICAL ADVANCEMENT IN NIGERIA

- Availability and Access to Geospatial data
- Lack of standards and interoperable platforms
- Poor capacity built and low technological development
- Influence of inconsistent and conflicting government policies on geo-information and mapping(substituting surveyors with Para/Quasi technicians).
- Problem of our developmental efforts as a nation which has been built on mutual distrust and suspicion.
- Poor educational development(poor curriculum development),etc.
- Lack of encouragement For Research and Development.
- Less than enough budgetary allocation to Education.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



Conclusion and Recommendation

- **CONCLUSION:** In order for Nigerians to be able to predict the effects, positive or otherwise, of economic developments on our environment, there is the need for us to embrace and emphasize the compulsory adoption of geospatial technology and also not to limit it to private practice or government alone.
- There should be an awareness creation on public participatory GIS(crowd source) as well in the decision making process which would involve the citizens and their environment.
- Adoption of geospatial technology in all national endeavors such as Environmental Monitoring and Mitigation, Agriculture, Climate change studies, Land use and Land cover studies will help foster Environmental sustainability.

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- If the government of the day employs and uses the avalanche of opportunities readily provided by geospatial science, most environmental challenges will be overcome. This will lead to a sustained growth and development in Nigeria.
- Efforts of the National Space Research and Development Agency (NASRDA) Abuja, the National agency responsible for all space applications in Nigeria is highly commendable in terms of the recent strides in making available the Nigerian Sat-x image data sets for good environmental inventory, monitoring and mitigation and early detection of environmental challenges and treats.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



RECOMMENDATION

- For Nigeria to harness the gains of geospatial science in solving most environmental problems, the following recommendations are necessary:
- There must be a well-developed surveying and mapping policy for the country
- There is urgent need to increase the capacity of expertise especially in Surveying and Geoinformatics and other Built professional disciplines.
- There need for all stakeholders to support the Federal Government strive to ensure that the Geoinformation policy on the establishment of National Geospatial Data infrastructure stands.

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- The space agency of Nigeria NARSDA must live up to her bidding as the national clearing house or hub of geospatial data in the country.
- The Federal Government agency responsible for Surveying, Mapping and co-ordination of all Surveying activities-The office of the surveyor General must live up to the challenges of the age.
- Equally, the Surveyors' Council of Nigeria (SURCON) must continue to play her oversight functions in training and in practice throughout the control.

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- More tertiary institution, Universities and Polytechnic running Geoinformatics and surveying must be encouraged to continue to exist by providing necessary funding and interventions to such schools and colleges by the concern government and agencies.
- The Nigerian Institution of Surveying must remain proactive political and should be ready to initiate bills at the National Assembly. This will enhance the practice of Surveying the profession in Nigeria.
- Professionalism must be the focal point of National Development Agenda. A paradigm shift from the old concepts which has not taken us far.
- Efforts of FIG and her commissions is commendable in advocating Global Best Practices in the profession.

Platinum sponsors:



Gold sponsors:





FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



CONTACTS

- Chigbu Njike (M.Sc. Mnis)
- Dept. of Surveying and Geoinformatics
- Abia State Polytechnic, Aba.
- P.M.B 7166, Aba, Abia State, Nigeria.
- E-mail: njikec@gmail.com

- Onukaogu Daniel Chukwuemeka
- Dept. of Surveying and Geoinformatics
- Abia State Polytechnic, Aba.
- P.M.B 7166, Aba, Abia State, Nigeria.
- E-mail: danonukaogu@yahoo.com

Platinum sponsors:



Gold sponsors:



FIG Working Week 2013

Abuja, Nigeria 6–10 May

ENVIRONMENT FOR SUSTAINABILITY



- THANKS

- FOR

- LISTENING

Platinum sponsors:



Gold sponsors:

