

ANALYSIS OF LANDUSE AND LANDCOVER CHANGES OF ABA URBAN

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. HIGHLIGHTS

- ▶ RESEARCH QUESTION ?
- ▶ INFLUENCE OF MAN'S ACTIVITIES ON THE ENVIRONMENT !
- ▶ NEED FOR LANDUSE AND LANDCOVER STUDIES!!
- ▶ METHODOLOGY , FINDINGS, SUMMARY AND RECOMMENDATIONS!!!



INTRODUCTION



- ▶ Problems associated with environmental monitoring and control persists through the history of mankind
- ▶ Man's increasing intervention on the environment (landuse) has increased the above problem hence altering the natural landlandscape(landcover).
- ▶ LULC studies are key components for managing natural resources and monitoring environmental changes for efficient planning and best practices.
- ▶ Most LULC changes such as water flooding, air pollution, urban sprawl, soil erosion, earthquake,deforestation, occur due to neglect by authorities and inability to keep track of these changes with notable consequences globally.

WHY LULC STUDY?

- ▶ Equalization of tax assessment
- ▶ Water resource inventory
- ▶ Flood control, water supply planning
- ▶ Waste-water treatment
- ▶ Environmental Impact assessment and control from energy sources.
- ▶ Management of wildlife
- ▶ Minimize man-wildlife ecosystem conflicts(biodiversity)
- ▶ National policy formulation based on established landuse patterns
- ▶ Environmental impact statement and assess future impacts.

RESEARCH AIM & OBJECTIVE

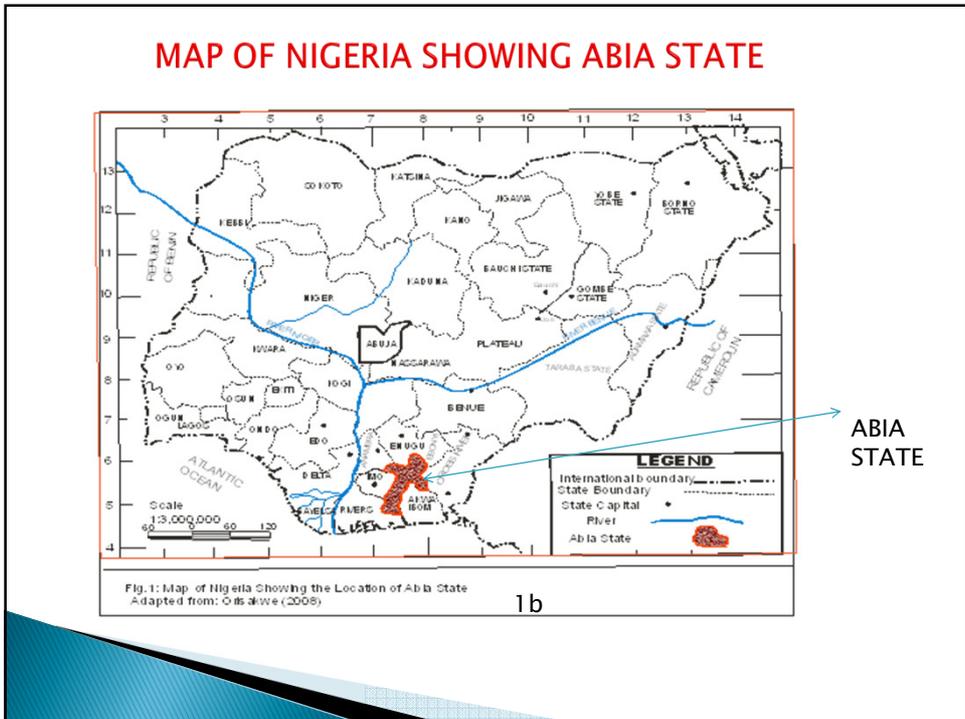
- ▶ **AIM:** comparative study/ analysis of the Landuse and Land cover changes of Aba main Town using RS and GIS tools.
- ▶ **OBJECTIVE:**
 - (i) Selection and extraction of a sub-scene covering of Aba Main Township from the full scene of Landsat ETM+ (2000) and Nigeria Sat-1 (2005) imageries of the area in question.
 - (ii) Co-registration, creation of a sub-map of the area and resampling of the imageries to one resolution to make the pixels coincide.
 - (iii) Classifying the imageries and the polygonising the base map of the study area.
 - (iv) Overlaying the classified datasets and obtain changes in Land uses and Land covers of the study area.

THE STUDY AREA

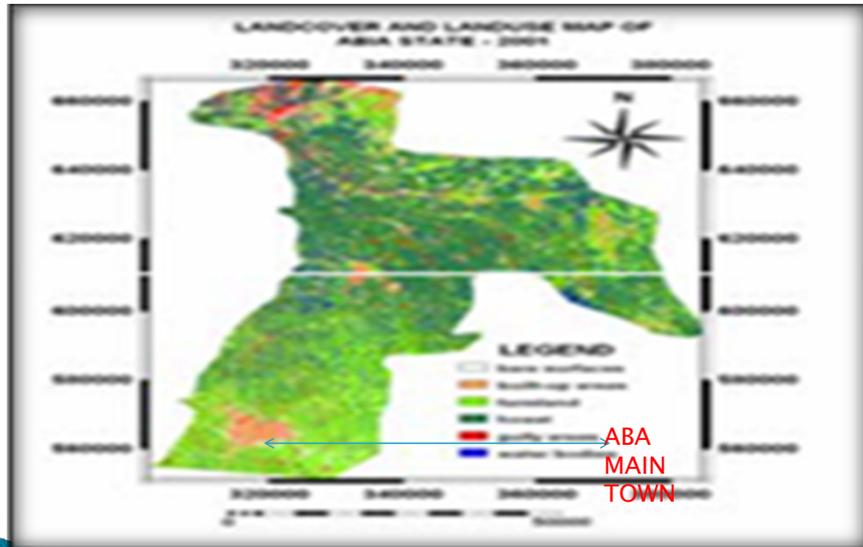
- ▶ Nigeria is the most populated black nation with about 140 million people (2006 census figure)
- ▶ Nigeria is located between latitude 4° N to 14° N of the Equator; and longitude 3° E to 15° E of the Greenwich Meridian. It has a land extent of about 923,769 km²; a north-south length of about 1,450-km and a west-east breadth of about 800 km. It is a country with diverse and complex ethnic nationalities, agro-ecological zones and promising socio-economy. The country has 36 states with 774 LGAs.(Angela, 2011).

THE STUDY AREA CONT.

- ▶ NAME OF PROJECT AREA: ABA URBAN IN ABIA STATE NIGERIA. ABIA HAS 17 L.G.A'S.
- ▶ LOCATION: LOCATED B/W between latitudes 05 2' 30" N and 5 08' 00" N of the equator and longitudes 07 20' 00" E and 07 26' 00" E of the Greenwich meridian.
- ▶ COMPOSITION OF MAIN TOWN: 2 MUNICIPAL COUNCILS(ABA NORTH AND ABA SOUTH L.G.A'S)
- ▶ POPULATION: ABOUT 820,900(2006 census).
- ▶ OCCUPATION: CRAFTS, TRADING (COMMERCIAL OF EASTERN NIGERIA) AND FARMING (SUBSISTENCE)

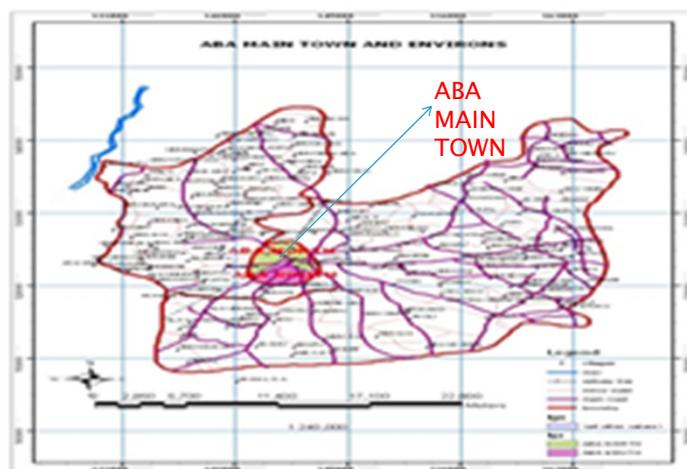


LOCATION MAP OF ABIA STATE



1c

LOCATION MAP OF STUDY AREA



1d

RESEARCH ISSUES

- ▶ According to statistics from the Abia Land Information System (ALIS), Aba Main Town has the highest land consumption rate in Abia State.(Abia land information system,2007)
- ▶ Despite this, fact no comprehensive effort has been made at detecting, evaluating and analyzing the changes in land use and land cover of the town over a period of time.
- ▶ This observed gap obviously necessitated this research work.

THEORITICAL ISSUES

- ▶ Remote sensing is used in the study of Landuse and Landcover changes and analysis because of its ability to cover large are as in a single image scene (Singh, A, 1984).
- ▶ Over the past years, data from earth sensing satellites has become indispensable in mapping the earth's features, natural resources management and environmental change studies
- ▶ This technology has enabled the research into the land cover and land use changes in Aba main town using medium resolution satellite images of (Landsat ETM+ and NigeriaSat-1) images acquired in 2000 and 2005 respectively.

- ▶ A multispectral sensor acquires multiple images of the same target object at different wavelengths or bands ,each band measures unique spectral characteristics about the target.
- ▶ A spectral band is a data set collected by the sensor with information from discrete portion of the electromagnetic spectrum.
- ▶ LANDSAT ETM+ and NIGERIA SAT-1 imageries of 2000 and 2005 respetively were used.

FACTS ON LANDSAT PROGRAMME

- ▶ LANDSAT EM BANDS (Table 1)

NAME	RANGE	REMARKS
BAND 1	0,45-0.52Um	VISIBLE BLUE
BAND 2	0.52-0.60Um	VISIBLE GREEN
BAND 3	0.63-0.69Um	VISIBLE RED
BAND 4	0.76-0.90Um	REF. INFRARED
BAND 5	1.55-1.74Um	MID INFRA-RED
BAND 6	10.40-12.50CM	THER. INF. RED
BAND 7	2.08-2.35Um	MID INFRA RED

- ▶ NASA programme of July 23, 1972(ERTS-1)
- ▶ Jan.22, 1975 (ERTS-2)
- ▶ Landsat 3,4,5 (1978,1982,1984)
- ▶ Landsat 6, 7 (APR. 15,1999)

LANDSAT TECH. PARAMETERS

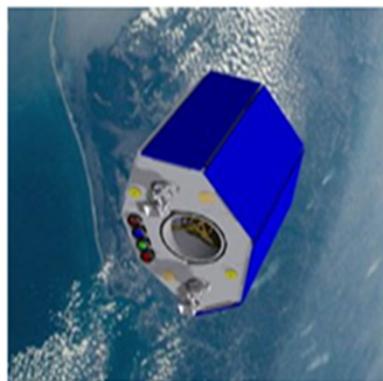
S/N	DESCRIPTION	REMARKS
1	LUNCH DATE	15-04-1999
2	SPATIAL RESOLUTION	30M
3	ORBIT	705+/-15
4	ORBIT INCLINATION	98.2 +/-15
6	GROUND TRACKING REPEAT CYCLE	16 DAYS
7	RADIOMETRIC RESOLUTION	15-19M

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Nigerian Space Programme: Nigerian Observation Satellite – NigeriaSat-2

Physical Configuration

- NigeriaSat-2 is an Earth-Observation Satellite
- 2.5m panchromatic (very high resolution)
- 5m Multispectral (High resolution)
- NIR, RED, GREEN & BLUE.
- 32m Multispectral (medium resolution)
- NIR, RED, GREEN & BLUE
- 7.2m Dish
- Design life span 7 years
- To be launched in 2009



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Fig. 2a.0

NIGERIA SAT-1 IMAGERY

S/N	DESCRIPTION	REMARKS
1.	LAUNCHING DATE	26-09-2003 RUSSIA
2.	SWATH WIDTH	600KM * 600KM
3.	REVISIT CYCLE	3.5 DAYS
4.	SPATIAL RESOLUTION	32M(MEDIUM RESOLUTION)
5	NO OF SPECTRAL BANDS	NIR,RED,GREEN AND BLUE (4)
6	LIFE SPAN	7 YEARS

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METHODOLOGY

DATASETS:

1. Administrative map of Abia State showing Aba North and South(SCALE 1:10000).
2. Landsat ETM+(2000) and Nigeria Sat-1(2005) imageries of the Area.
3. Computer Systems of Adeduate configuration and supporting peripherals.
4. Software(ILWIS 3.3 Academic version, Arcview 3.2a, AutoCad 2007 and AutoCad Map).

IMAGE PREPARATION

- ▶ The following steps were undertaken in above operations:

1. SCANNING AND DIGITIZING OF THE ANALOGUE MAP

2. GEOREFERENCING of the digitized base map in AutoCAD Map 2.0 environment using the Rubber Sheet method.

3. SUBMAP CREATION of the project area from the entire image scene of both imageries.

4. Resampling operation of the two imageries to bring them to one resolution for easy classification.

GEOREFERENCE POINTS COORDS.

S/N	PT NAME	ATT. NAME	N(M)	E(M)	REMARKS
1.	Railway/Road junction	Near Ohabiam/Asaeme	314625.55	560549.21	UTM
2.	Ariara Market Road Junction	Faulks Rd. junction	314627.55	564725.21	UTM
3.	River/Road Junction	Near World Bank Housing	314622.57	564657.12	UTM
4.	Enugu/Port-Harcourt Junction	Near Asa-Nnetu	320455.24	565628.97	UTM

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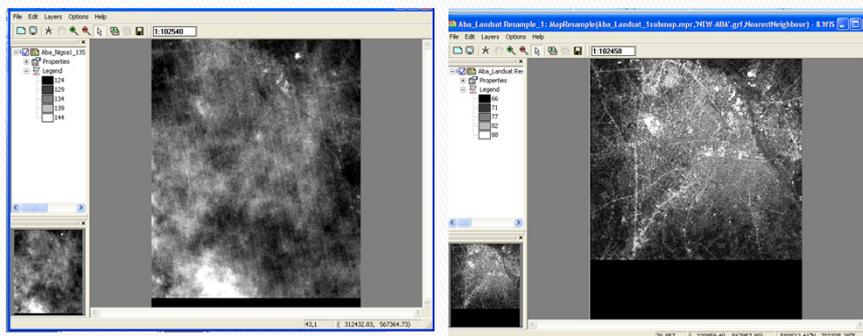
Table 3

SUBMAP CREATION

S/N	EASTING(M)	NORTHING(M)
1.	312128.519	556138.939
2.	312416.928	568697.524
3.	323222.019	568791.095
4.	322933.610	556232.510

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- ▶ The georeferenced base map offered the four points above needed in the creation of sub map in ILWIS environment for the satellite imageries.



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Submap of the project Area From
Landsat ETM+ (2000)

Fig 3

Submap of the project Area From
Nigeria sat-1 (2005)

4. Resampling operation of the two imageries to bring them to one resolution for easy classification.

5. Classification of the two resampled imageries and the polygonised sampled base map.

6. Development of three classification scheme (fig 4) using ILWIS image processing software, i.e,
(a) BUILT-UP AREA (b) RIVERS (c) VEGETATION

classification scheme showing Dormains

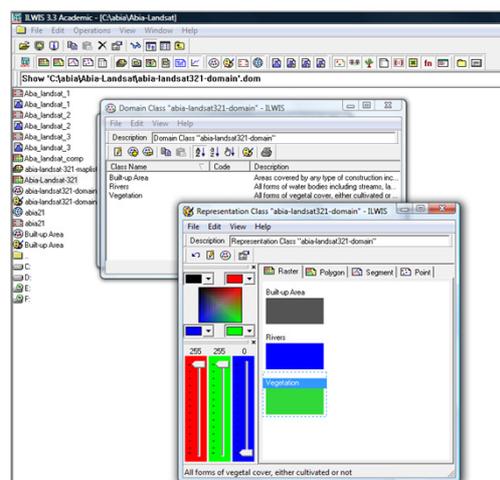


Fig. 4

CLASSIFICATION SCHEME

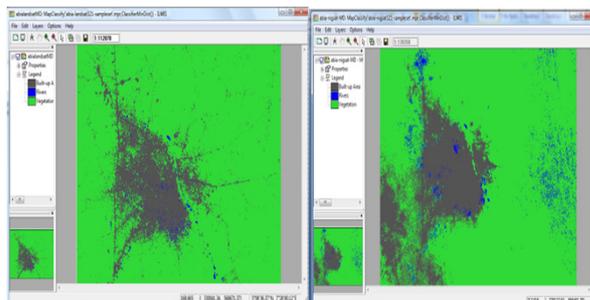


Fig.2: © Njike,c. 2010
 (a) Classified 2000 Landsat ETM+ (b) Classified 2005 NigeriaSat-1
 MD Comparative View of Supervised Classifications of Aba Landuse/cover
 SOURCE: AUTHORS LAB WORK

Distribution land use for classified Basemap of 1991

LANDUSES	AREA OCCUPIED(HA)	PERCENTAGE
RIVER	89	21.7
VEGETATION	260	63.7
BUILT-UP AREA	62	15.1
TOTAL	411	100

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Table 5

LAND DISTRIBUTION OF CLASSIFIED LANDSAT IMAGE 2000

LANDUSES	AREA OCCUPIED(HA)	PERCENTAGE
RIVER	91	22.1%
VEGETATION	210	51.1%
BUILT-UP	110	26.8%
TOTAL	411	100%

© Njike,c. 2010 Table 6

AREA OF CLASSIFIED IMAGE OF NIGERIA SAT-1(2005)

LANDUSES	AREA OCCUPIED (HA)	PERCENTAGE
RIVER	92	22.4
VEGETATION	169	41.1
BUILT-UP	150	36.5
TOTAL	411	100

© Njike,C. 2010 Table 7

The overlay operation was done using three classified imageries and the result of the overlay showed the following classified theme distribution. DISTRIBUTION OF LANDUSE CHANGES 1991-2005

Table 8

LANDUSES	PERIOD OF CHANGE	AMOUNT OF CHANGE	PERCENTAGE CHANGE (%)
RIVER	1991 -2000	+2 Ha	+1.1%
	2000 -2005	+1 Ha	+0.5%
	1991 -2005	+ 3 Ha	+1.6%
VEGETATION	1991 – 2000	- 50 Ha	-27.5%
	2000 – 2005	- 41 Ha	-22.5%
	1991 - 2005	- 91 Ha	-50.0%
BUILT-UP AREA	1991 – 2000	+48 Ha	+26.4%
	2000 – 2005	+ 40 Ha	+22.0%
	1991 - 2005	+ 88 Ha	+48.4%

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ACCURACY ASSESSMENT

Table 9.0

LAND USE	B UP	VEG	RIV	TOTAL	ERROR C	LAND USE	B UP	VEG	RIV	TOTAL	ERROR C
BUP	5966	42	1	6009	0.7%	BUP	6972	5375	0	12347	43.5%
VEG	20	28997	14	29031	0.05%	VEG	0	45831	0	45831	0%
RIV	126	6	134	266	4.5%	RIV	50	598	63	711	8.9%
TOT	6112	29045	149	70612	99.41%	TOT	7022	51804	63	58889	89.77%
ERROR	2.7	0.02	0			ERROR	0.7	1.2	0		

ERROR TABLE FOR
ETM+(2000) © Njike,C 2010

ERROR TABLE FOR
NIGERIA SAT-1 (2005)

RESULTS OF LANDSAT ETM+ IMAGE AND NIGERIA SAT-1

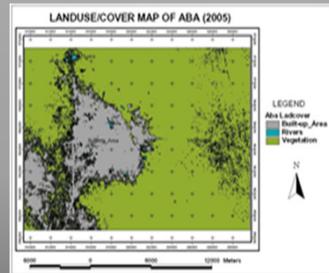
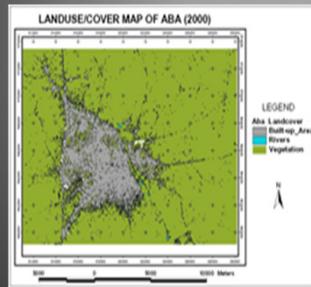


Fig 6

LANDSAT ETM+
2000 CLASSIFIED

NIGERIASAT-1 IMAGE
OF 2005

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LULC OVERLAYS OF ABA MAIN TOWNSHIP(2000 ON 2005)

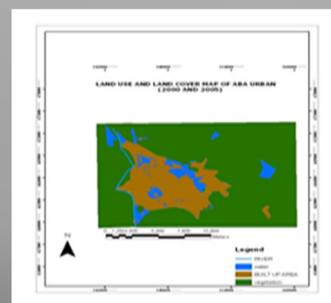
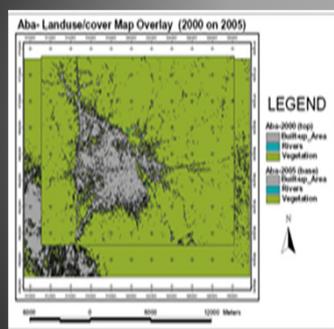


FIG 4B
CLASSIFIED
OVERLAY

FIG 4C LULC MAP OF ABA

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ANALYSIS OF RESULTS

- ▶ on the results obtained from the classified images and the base map shown above, tables 5, 6, 7 and 8 showed the distribution of the Landuses within the period under review.
- ▶ In the year 1991, the distribution of the Landuses showed that vegetation had the highest area of about 260 hectares out of 411 hectares considered. (Table5)
- ▶ This represents about 63.2% of the entire area of study. Also, the river occupied an area of about 89 hectares which represent 21.7% of the area of survey.
- ▶ In addition, the built-up area occupied about 62 hectares which represents about 15.1% of the area under consideration.
- ▶ This may be attributed to the fact that Abia State was yet to be created out of the old Imo State.
- ▶ Table 6 showed the Landuse distribution of the year 2000 Landsat image. In this case, vegetation still ranked highest in the area occupied with about 210 hectares which represent 51.1% of the total Landuses considered.
- ▶ The built-up area increased from 62 hectares to about 110 hectares representing 26.8% of the total area within the period of nine (9) years.
- ▶ Also, the river also increased from 89 hectares to 91 hectares representing about 22.1%.

- ▶ The histogram of Figure 5 captured the scenario very vividly as the vegetation plunged below the abscissa line.

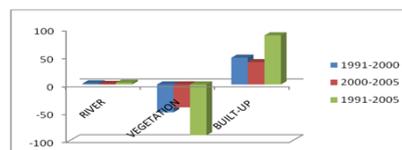


Fig. 5: Histogram of the Landuse changes from 1991 -2005
SOURCE: AUTHORS LAB WORK

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SUMMARY

- ▶ Two multi-date datasets and analogue base map of 1991 (Landsat ETM+ image of 2000 and NigeriaSat-1 image of 2005) were used and analysed.
- ▶ The result reveals that from 1991, 2000 to 2005, the River increased from 15.1% to 22.1% and finally to 22.4% due partly to increasing activities within and around the waterways and increase in global warming thus giving rise to increase in water level.
- ▶ Within the same years under review (1991 to 2005), Built-up area on the other hand increased from 21.7% to 26.8% and finally to 36.5%. Unlike river and built-up area, there is a significant disparity and trend in vegetation Land cover due to rapid urbanization and other socio-economic activities as explained earlier.
- ▶ Thus, vegetal cover decreased from 63.2% in 1991 to 51.1% in 2000 and in 2005 it further decreased to 41.1%.
- ▶ The observed changes attest to the importance of the ABA as a commercial nexus of South-Eastern Nigeria and the need for efficient planning and order environmental use.

CONCLUSION

- ▶ Any developing nation needs adequate information on many complex and closely connected activities for decision making.
- ▶ Having identified land as a critical factor, knowledge of land use and land cover is important to overcome uncontrolled development, degrading environmental standards, extinction of wild life, destruction of important agricultural land.
- ▶ Information on the existing land patterns and changes overtime is of prime importance. This will help the planners, authorities to determine better land policy, transportation and utility, determine development pressure points and areas and implement effective plan for regional development.

RECOMMENDATIONS

- ▶ We are advocating proactiveness on the part of the government and municipal authorities in Aba Main Town, the state and Country generally.
- ▶ Comprehensive landuse and landcover mapping for ordered or planned development and best environmental practices.
- ▶ Provision of enabling environment and institutional framework to address critical environmental issues in the state.
- ▶ Urgent need for establishment of standard classification scheme in Nigeria and harmonization of enabling laws especially NGDI POLICY thrust on digital imagery acquisition.

APPRECIATION

- ▶ THANKS TO NIGERIAN SPACE AGENCY (NASRDA ABUJA) FOR PROVIDING THE IMAGERIES AND ASSISTANCE.
- ▶ THANKS TO ELD. ONUKAOGU, ALWELL, RECTOR ABIA POLYTECHIC ABA, NIGERIA FOR HIS SUPPORT AND ENCOURAGEMENT
- ▶ THANKS TO SURVEY REGULATORY BODY IN NIGERIA(SURCON) FOR SHOWING THE RIGHT WAY FORWARD FOR YOUNG SURVEYORS

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THANKS

FOR LISTENING

GOOD-BYE