Leveraging Food Security Challenges in South Eastern Nigeria Using GIS and Geospatial Education

Njike CHIGBU, NIGERIA, Daniel ONUKAOGU, NIGERIA.

Presentation outline

- Introduction
- Food security scenarios
- Causes of food insecurity in S/E Nigeria
- Geospatial techniques to food security issues
- Land use and land cover studies
- Analysis of results
- Mitigation measures
- Conclusion and Recommendation

MAP OF NIGERIA

MAP Showing South Eastern Nigeria

N

South Eastern Nigeria

Author : DANIEL ONUKAOGU

225   112.5   0   225 Kilometers
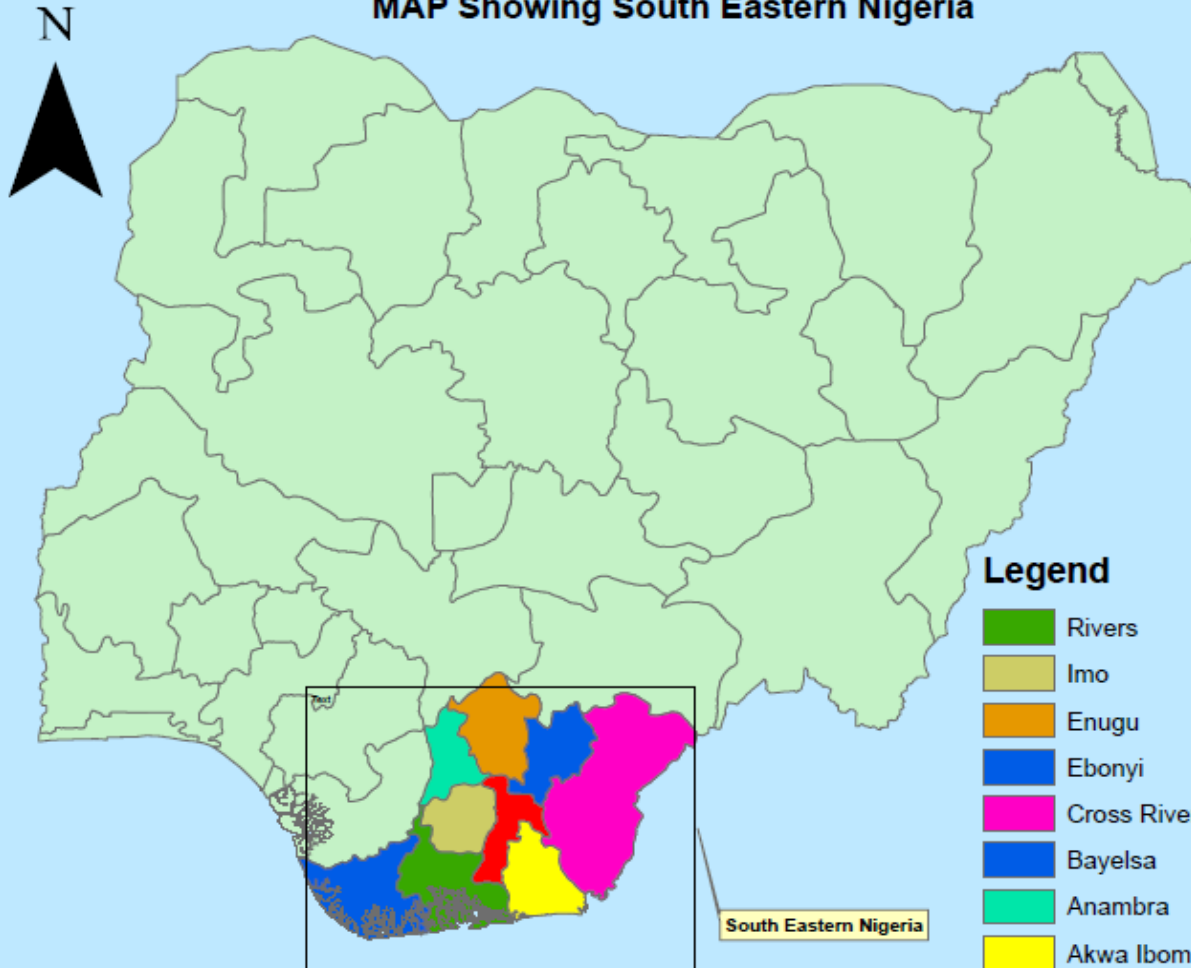
Legend

- Rivers
- Imo
- Enugu
- Ebonyi
- Cross River
- Bayelsa
- Anambra
- Akwa Ibom
- Abia
- Nigeria

MAP OF NIGERIA

N

Legend

Nigeria

40 20 0   40   80   120 160
Kilometers

MAP OF SOUTH EASTERN NIGERIA

N

Legend
- Rivers
- Imo
- Enugu
- Ebonyi
- Cross River
- Bayelsa
- Anambra
- Akwa Ibom
- Abia
- South Eastern Nigeria

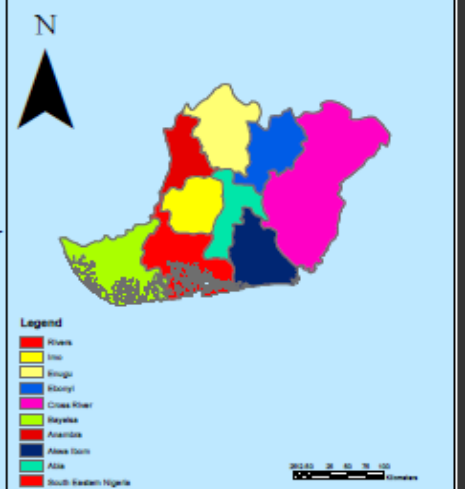# INTRODUCTION

- A number of food security issues recorded in the South Eastern states of Nigeria showed that there has been a variation in this geo-political zone in relation to the looming food scarcity issues(Information Nigeria, 2012).

- The persistent reliance on steady importation of food has however made Nigeria so vulnerable to fluctuations with respect to global food crisis issues which was one of the reasons Nigeria was affected by the global food crisis in 2007 and 2008 (West Africa Insight, 2010).

- Despite the heavy funds pumped into food importation, the grass-root production of food items within Nigeria seems to have collapsed and neglected and as such has steadily contributed to the alarming and wide spread rate of food insecurity in Nigeria today.

FOOD SECURITY ISSUES

FIG 1.0: A TYPICAL FOOD MARKET SCENE IN SOUTH EASTERN NIGERIA

- Since the emergence of crude oil explorations and rising revenue in Nigeria, the contributions gained from the agricultural sector have so much nose-dived and has been given little or no attention.
- Nigeria was once reckoned as self sufficient and sustaining in food production and was a heavy exporter of food to several geographical locations in the world back then in the 1950s and 1960s (West Africa Insight, 2010).
- Estimates recorded by the Federal Ministry of Agriculture in 2009 signified that Nigeria was spending over $3billion yearly in food importation.

- Food security is a term commonly linked to hunger and food access related issues (West Africa Insight, 2010).

- In southeastern Nigeria, the changing population densities, urbanization and poverty has resulted to variations in land use and land cover which has given rise to environmental problems such as gully erosion, landslide, flooding, air and water pollution and depletion of land with high agricultural potentials.

CAUSES OF FOOD INSECURITY IN SOUTH EASTERN NIGERIA.

FLOODING

Food insecurity could occur due to decreased farm land holding sizes due to population explosions, constant droughts & floods, etc.

Floods could arise from climatic change. Climate change affects agriculture in so many ways and this further result to food shortage.

For instance cases of floods have been on the increase in recent times in Nigeria and this would in no doubt affect farmland and also lead to crop failure.

FLOODING SCENARIO SOUTH EAST NIGERIA

FIG 2.0 : A south Eastern part affected by the recent flooding in Nigeria

Crude oil spillage in rural communities

Oil is the main stay of Nigeria's economy, but most residents in the oil producing communities still depend entirely on the environment for their sustenance; and so are likely to have problem of food security in the event of a deleterious impact on the environment by oil spillage

Crude oil spillage can increase household food insecurity and childhood malnutrition in the affected communities.

OIL SPILL IN THE NIGER-DELTA

FIG 3.0: (source:http://www.ncbi.nlm.nhi.gov/pubmed)

DEFORESTATION

Forests and trees make an essential contribution to food security by helping to maintain the environmental conditions needed for agricultural production.

They stabilize the soil, prevent erosion, enhance the land's capacity to store water, and moderate air and soil temperatures.

The importance of these effects has often been ignored in the past, with the clearance of tree vegetation and the subsequent loss of millions of hectares of productive land.

Furthermore, as forests continue to be cleared-exposing the land to direct attack from wind and rain-soil erosion and land degradation are still undermining agriculture's resource base.

GIS AS A DISCIPLINE –REMEDIAL ACTION

- GIS technology is an important tool for the advancement and sustainability of food production to support the survival of the human race (ESRI, 2008).

- Major benefit of studying GIS is due to its improved management techniques and its ability to give people the geographic advantage to become more productive and more spatially informed.

- Employing a functional GIS helps in the integration and analysis of data on population, climate, price, soil, and the various types of crops.IT also helps in assessment of the vulnerability of the food situation at the regional, national and local levels.

- Crop area can be determined and also the total field area and locations predicted as well as estimating crop yield.

A typical food security GIS Model (Adapted from Crop Crisis Control project, 2007)
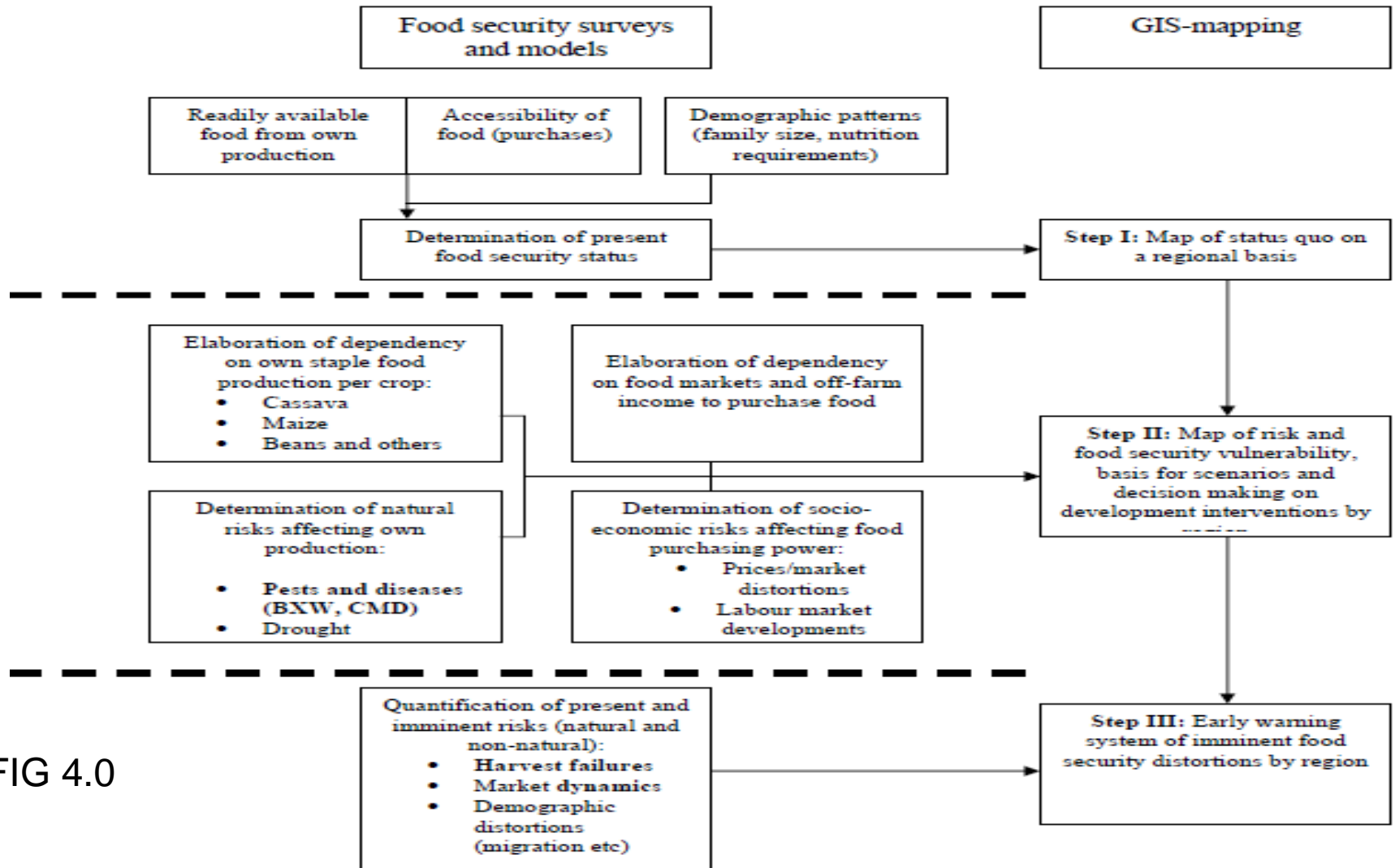
Food security surveys and models		GIS-mapping

Readily available food from own production | **Accessibility of food (purchases)** | **Demographic patterns (family size, nutrition requirements)**

Determination of present food security status → **Step I: Map of status quo on a regional basis**

Elaboration of dependency on own staple food production per crop:
- Cassava
- Maize
- Beans and others

Elaboration of dependency on food markets and off-farm income to purchase food

Step II: Map of risk and food security vulnerability, basis for scenarios and decision making on development interventions by _____

Determination of natural risks affecting own production:
- **Pests and diseases (BXW, CMD)**
- Drought

Determination of socio-economic risks affecting food purchasing power:
- Prices/market distortions
- Labour market developments

Quantification of present and imminent risks (natural and non-natural):
- Harvest failures
- Market dynamics
- Demographic distortions (migration etc)

Step III: Early warning system of imminent food security distortions by region
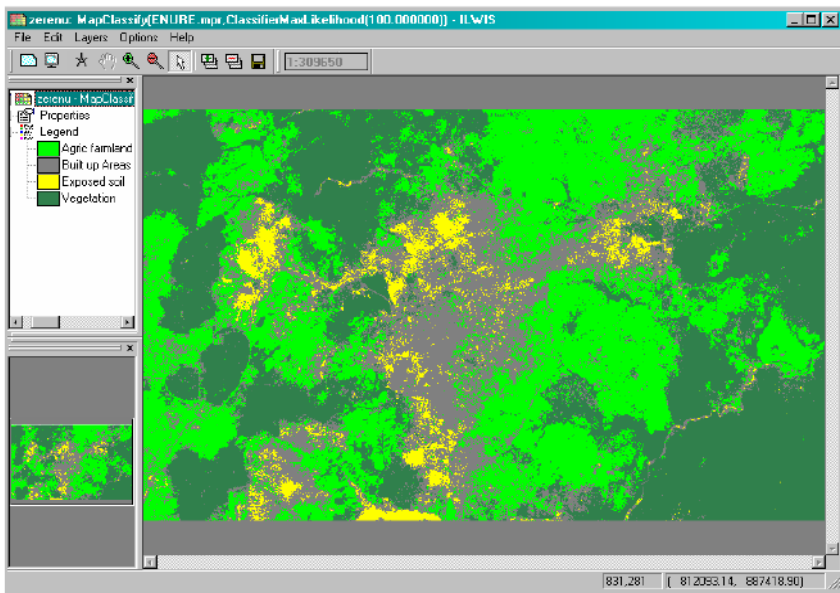
FIG 4.0

GEO-SPATIAL TECHNIQUES
(REMOTE SENSING)

- Remote sensing is of much significance in geospatial literacy and also with respect to food security and environmental issues .

- This is achieved through the acquisition, utilization and integration of remotely sensed data which help in good decision making processes which proffer a better observation, explanation, projection (forecasting) and finally its application to a particular situation.
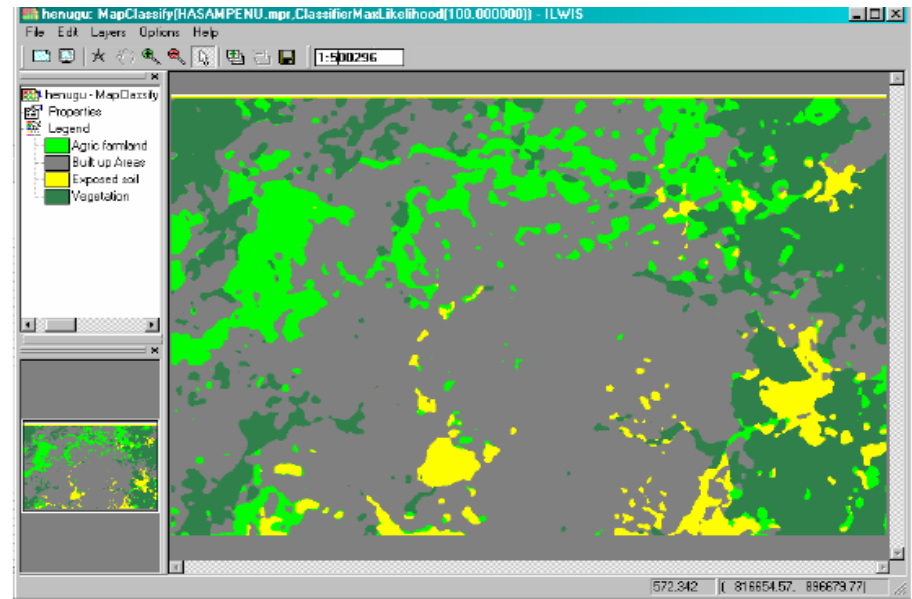
LAND USE AND LAND COVER STUDIES

- A lot of countries around the world have had their cities and town loose so much vegetation cover as urbanization sets into place.
- Land cover is therefore very essential in the conservation and preservation of agricultural farmland and the environment as a whole.
- This helps to prevent not only food security problems but also help curtail deforestation problems as this can lead to both natural and man-made made disasters.

- Patterns of future environmental losses such as agricultural farmland, vegetation, built-up areas and exposed soil surfaces and also disasters can be predicted from output maps generated by these analyses and this can be illustrated to local communities, governmental and non-governmental organizations (Linkie et al., 2003).
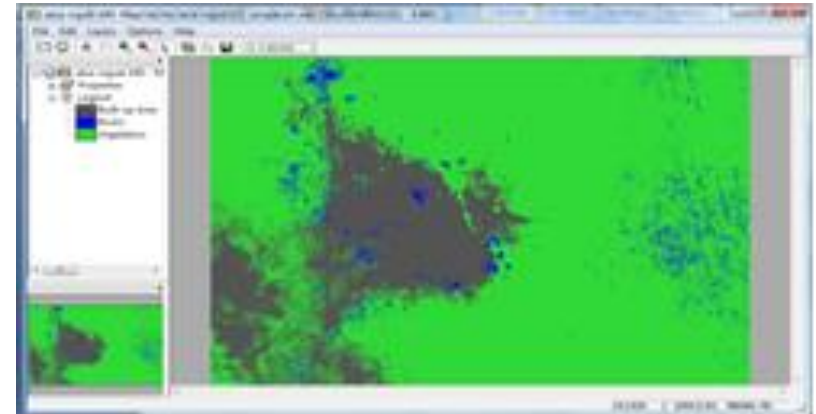
Classified 1986 Spot Image of Enugu (A)

Classified 2003 NigeriaSat-1 image of Enugu (B)
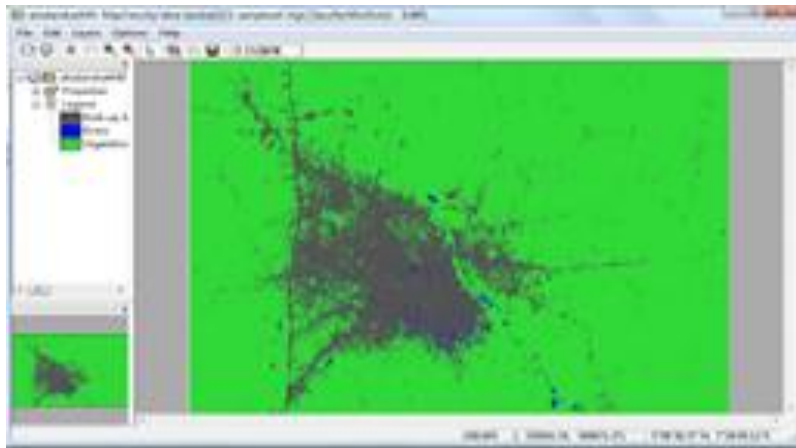
Classified 2000 Landsat ETM+ of Aba (C)

FIG 4.0(A-D)

Classified 2005 NigeriaSat1 of Aba (D)

- In the study depicted by figure 4(a & b),the land cover and land use changes in Enugu and environs were studied using images of from SPOT 4 Satellite of 1986 and NigeriaSat-1 of 2003.The total area studied was 345176.69 hectares. From the study, it was predicted that massive changes have taken place between 1986 an 2003(Onu & Igbokwe,2008)(see table 1.0 below)

Table 1 Classified Image statistics for 1986 and 2003.

Landcover/landuse	1986 coverage (hectares)	2003 coverage (hectares)
Vegetation	131792.6	42835.1
Agric farmland	124640.7	80296.6
Exposed soil surfaces	14735.2	2730.1
Built up areas.	74008.2	219314.9
Total	**345176.7**	**345176.7**

Source : Onu & Igbokwe,2008

Classified Image Statistics for Aba 2000 and 2005

Table2: Aba Land use/cover Change Analysis

Landuse	River			Built-up Area			Vegetation		
	1991 2005		2000	1991 2005		2000	1991	2000	2005
Area (Ha) Covered (%)	62	91	92	89	110	150	260	210	169
	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).

In 1986 the vegetation cover and agricultural cover for Enugu were denser compared to the visual image interpretation derived in 2003 which indicated that as time goes on there will be further reduction in both vegetation and agricultural farmland coverage except precautionary measures are underway.

The analysis carried out also on Aba in Abia state (see table 2.0) 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 to food production in the Southeastern Nigeria.

GIS IN FOOD SECURITY STUDIES

- Serves as an early warning system which helps with the prediction of flood, drought and other natural disasters that could arise and lead to loss in crop yield and destruction causing food insecurity.

- Accessibility measures which happens to be one of the three pillars of food security can also be estimated using network analysis embedded in Arc GIS desktop

- It serves as a good decision support system

- Information based on household compositions and surveys could be determined, mapped out and overlaid with other socio economic gradients.

- Better and more precise information can also be derived based on the availability of food in that region.

OTHER MITIGATIONAL MEASURES

·

- Adopting good forest policy and legislation
- Designing projects to meet local needs
- Capacity development and building
- Investing in Research and Geo-spatial training(Early Warning studies on food security challenges)
- Avoidance of bad cultural practices south Eastern Nigeria.
- Encouraging the local populace on best methods of agricultural practices through the use of mechanized farming, provision of loans, modern farming equipment and fertilizers.

- Avoidance of indiscriminate bush burning, oil spillage, and illegal mining operations.

- Precision agriculture and machine guidance agriculture should be practiced.

- Government of the day should be proactive and responsive in handling all environmental issues that might impact negatively or otherwise on food security issues in the region and the country at large.

CONCLUSION & RECOMMENDATIONS

- In a bid to eliminate the increasing dependence on food importation in Nigeria, it is essential that productivity enhancing measures be implemented in the agricultural sector not only in the south eastern part of the country but Nigeria as a whole.

- The south Eastern part should not just be solely dependent on the livestock ventures been introduced into the region but to also embrace the advancement of horticulture in order to preserve the environment and also combat the heavy/bad weather forecast that may arise soon.

- Taking into considerations all the benefits derived from GIS and geo-spatial utilization, it is therefore advisable and paramount to emphasize the adoption of precision farming methods knowing the fact that for any large farm management to record success stories, investment in equipment and labour is necessary .

- In Conclusion, it is evident that spatial enablement of our environment through GIS-based studies stand to place in the hands of individuals and professionals a ready and timely access to spatial information base which is an essential and critical tool for making informed decisions on their day-to-day activities and also on key economic, environmental and social issues for sustainability.

RECOMMENDATIONS

- Land holdings that support the usage of these vast technologies should be thoroughly revisited such that farmers can optimally utilize the variability that exist within their fields and thereby not be restricted to a particular mode of farming techniques.

- Considering the spatial relationship and constraints faced with respect to distance travelled from major suppliers of food to markets and also from residential areas to these retail points vice versa, there is need to reconstruct and improve on our road network/transport system not only in the south eastern part but throughout the nation Nigeria.

-

- Agricultural data and climate data should be made readily available to end users as this will help in making well informed decisions that can help increase production and reduce cost that could be expended in the event of any future disaster outbreak

- The government should set up policies that will help in the reformation of the agricultural sector and also pump in more funds such that the expansion and embracement of geospatial technology and infrastructure

- Producers (farmers) and suppliers (middle men) should be able to read climate risk maps, yield maps and profit maps as this will help in the production and dissemination of food items in the south eastern region as well as he entire nation in order to avert and form of shortage and loss with respect to distribution to end users.

- To develop a GIS-Based topographic database of the Study Area using GIS and Remote sensing technology that allows for easy updating, retrieval, manipulation, query and analysis in a problem solving environment.

- <u>BIBLIOGRAPHICAL NOTES</u>

SURV. CHIGBU, NJIKE (Msc,mnis)

Is the Head of Department and Principal Lecturer

Surveying & Geo-Informatics,School of Envronmental Design & Technology,Abia State Polytechnic Aba(An Academic Member of FIG)

Email:njikec@gmail.com.

DANIEL CHUKWUEMEKA ONUKAOGU(Msc GIS)

Is a staff of Department of surveying and Geo-Informatics of Abia State Polytechnic Aba,Abia State,Nigeria.

Email: danielonukaogu@yahoo.com

THANKS FOR LISTENING

NJIKE CHIGBU AND DANIEL ONUKAOGU