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Mapping and Predicting Urban Sprawl Using Remote Sensing and Geographic Information System Techniques: A Case Study of Eti-Osa Local Government Area, Lagos, Nigeria

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Remote Sensing

- Effectiveness as a tool in obtaining information on the nature and properties of objects on the earth surface and in the atmosphere through the use of data from sensors which record electromagnetic radiation reflected or emitted from those objects (Danson et al, 1995).
- A cost effective and technologically sound method of analysing urban sprawl unlike other conventional surveying & mapping methods(Jat et al., 2008, Ji et al., 2006, Martinuzzi et al., 2007, Yang and Liu, 2005, Haack and Rafter, 2006).

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Urban Sprawl

- Process through which the productive agricultural lands, forests, surface water bodies and groundwater prospects are being irretrievably lost due to urbanization (Pathan et al. (1989, 1991) and Kumar et al. (2007))
- Often uncoordinated and extends along the fringes of metropolitan areas with incredible speed.
- Requires successful land use change detection (Jain, 2009), a process that can be achieved using remotely sensed data.

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The Eti-Osa LGA (Study area)

Source: www.travel-images.com

Ring road and Victoria Island from the air – waterfront.

- Located within the southern area of Lagos state (6º26'34"N, 3º28'29"E), just below the Lagos lagoon
- Surrounded by water bodies, which has resulted in the occurrence of housing structures along the beaches, the lagoon, the natural water drainage channels, and sometimes extending as far as 50 – 100 meters beyond the shore into the water bodies.

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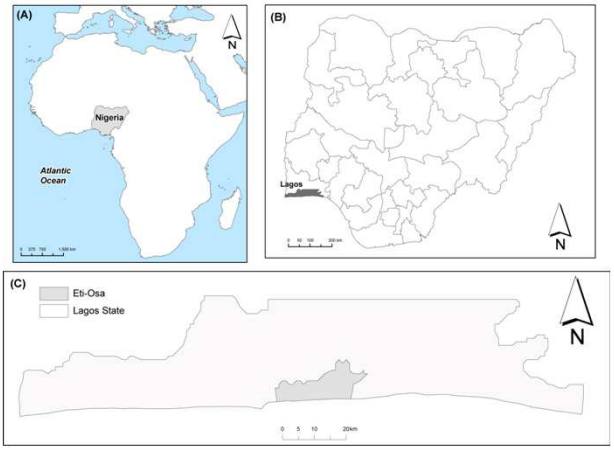

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Aim

To determine and predict the spatial extent of urban sprawls in Eti – Osa LGA using remote sensing

Objectives

- Determine the spatial extent of urban sprawl using satellite data from 1984 to 2006.
- Examine the causes and impacts of urban sprawl in the study area based on results generated.
- Predict the future extent of urban sprawl in Eti-Osa LGA (2016).
- Draw conclusions and make recommendations from results generated in the study.

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Methods

- Image pre-processing
- Classification of Landsat data
- Accuracy assessment
- Change detection and Urban Sprawl prediction : Multi-Layer Perceptron (MLP) neural network

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Classes and their Definitions

- **Urban:** All built up structures including residential and commercial, roads, shanties, make shift buildings, freight containers and all other structures containing Aluminium, zinc or asbestos
- **Water:** All water bodies including the ocean, lagoon, lakes creeks and rivers
- **Sand (bare):** All Sandy surfaces and deposits, Bare/ undeveloped surfaces which appear to be lightly vegetated
- **Vegetation:** All forms of vegetation including those growing on land, in between urban structures and on water

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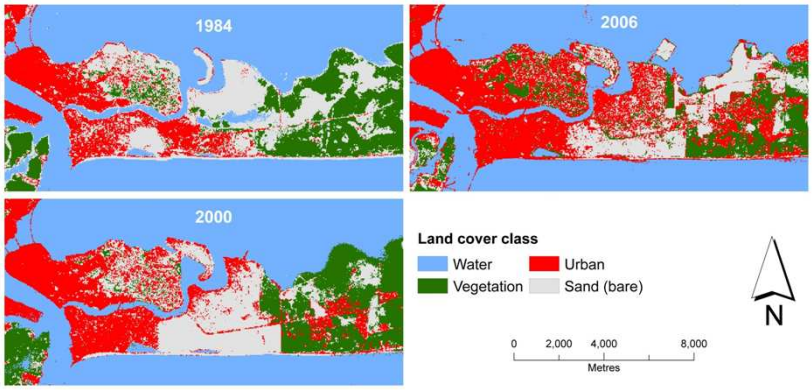
Results – Land Cover Classification



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Results of Accuracy Assessment

Results are displayed as Kappa coefficients (total number of pixels per class/ year used in the accuracy assessment matrix).

- **0.9744** for the 1984 classification
- **0.9514** for the 2000 classification
- **0.9101** for the 2006 classification

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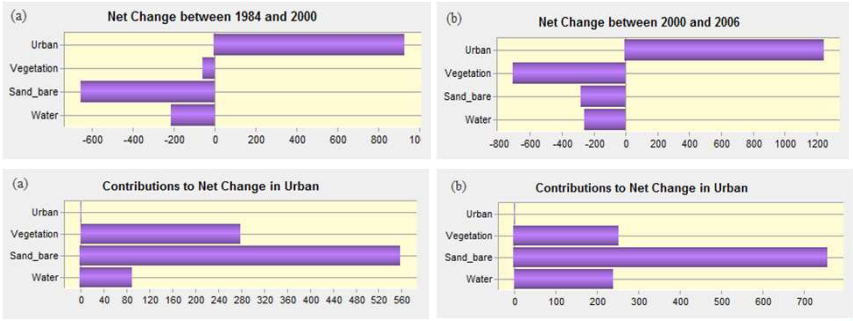
Change Analysis



•Changes displayed in Hectares

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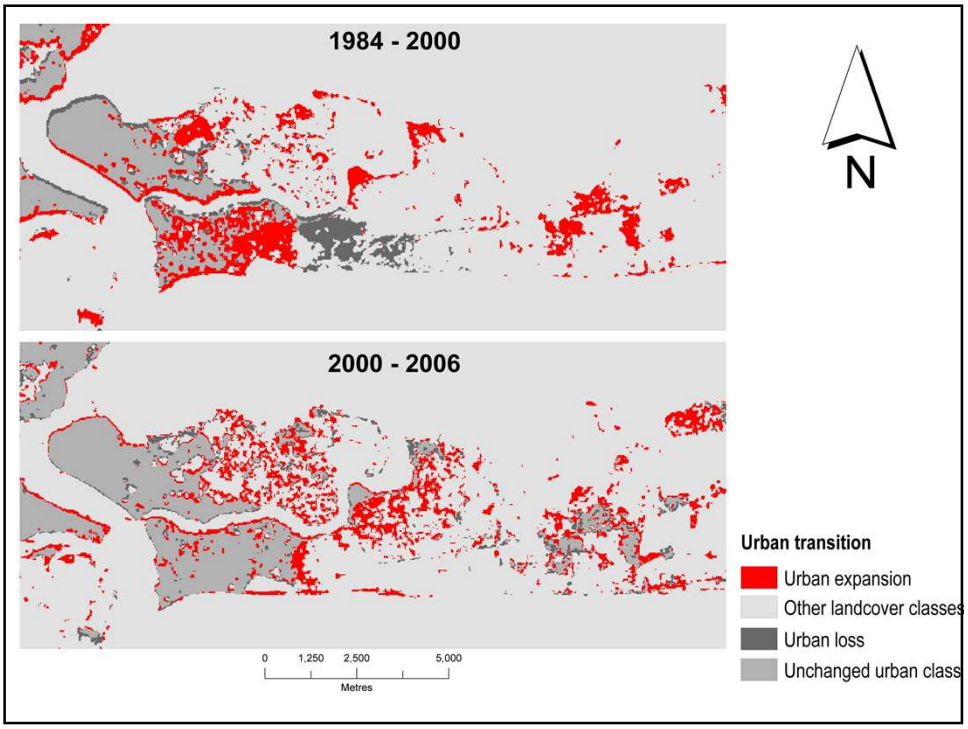

Urban Sprawl Prediction - Methodology

- Prediction based on Change Trend between 2000 and 2006.
- Idrisi Land change modeller featuring Markov chain modelling and Multi layer Neural Network Perception used.
- Done as hard and soft prediction.
- Road layer added as a sub model.

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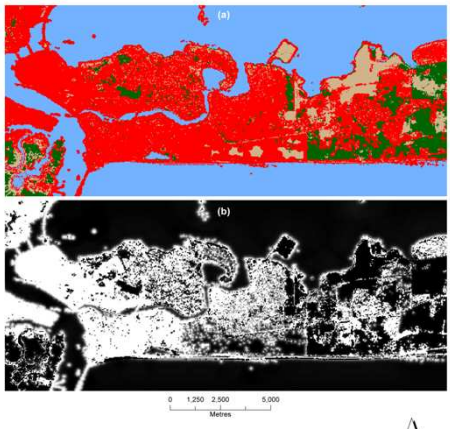

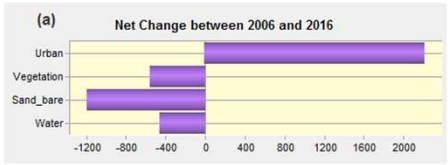

Urban class would have increased by 2220 hectares with most of it as a result of a loss of 1192 hectares from the Sand (bare) class.

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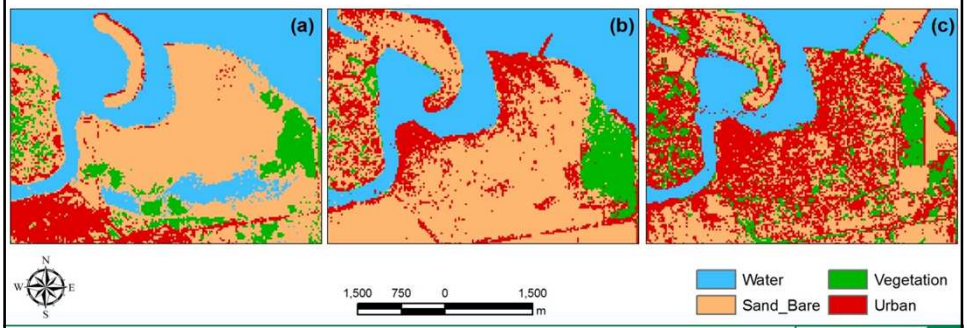
Discussion

Transition from water to sand (bare) and urban class through (a) 1984, (b) 2000 & (c) 2006



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Conclusion

- Urban sprawl occurred in a frog leaping pattern from 1986 – 2000 and poly-nucleated pattern from 2000 – 2006.
- Area prone to flooding
- Unpredictability of a natural disaster
- Changes in land use policies that could alter the trend of sprawl
- Unavailability of population data on ward and community levels.
- Non-availability of high resolution imagery

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