

Geospatial Data Application in the Assessment of Population Impact on a Tropical Lowland Rainforest of Southwest Nigeria

¹*B.O. Balogun, ²A.T. Salami and ³S.O.A. Oloyede-Kosoko*

¹Principal Scientific Officer, African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E), Ile-Ife, Nigeria (bo_balogun@yahoo.co.uk; balogun_arcsstee@oauife.edu.ng; www.arcsstee.org)

²Head, Space Application and Environmental Science Laboratory and Director, Institute of Ecology and Environmental Studies, Obafemi Awolowo University, Ile-Ife, Nigeria (asalami@oauife.edu.ng; ayobasalami@yahoo.com; www.spaeloauife.org)

³Head of Department, Geo-Informatics, Federal School of Surveying, Oyo, Oyo-State, Nigeria (gilab@fssoyo.anpa.net.ng; oloyedekosoko@yahoo.co.uk)

Overview of Presentation

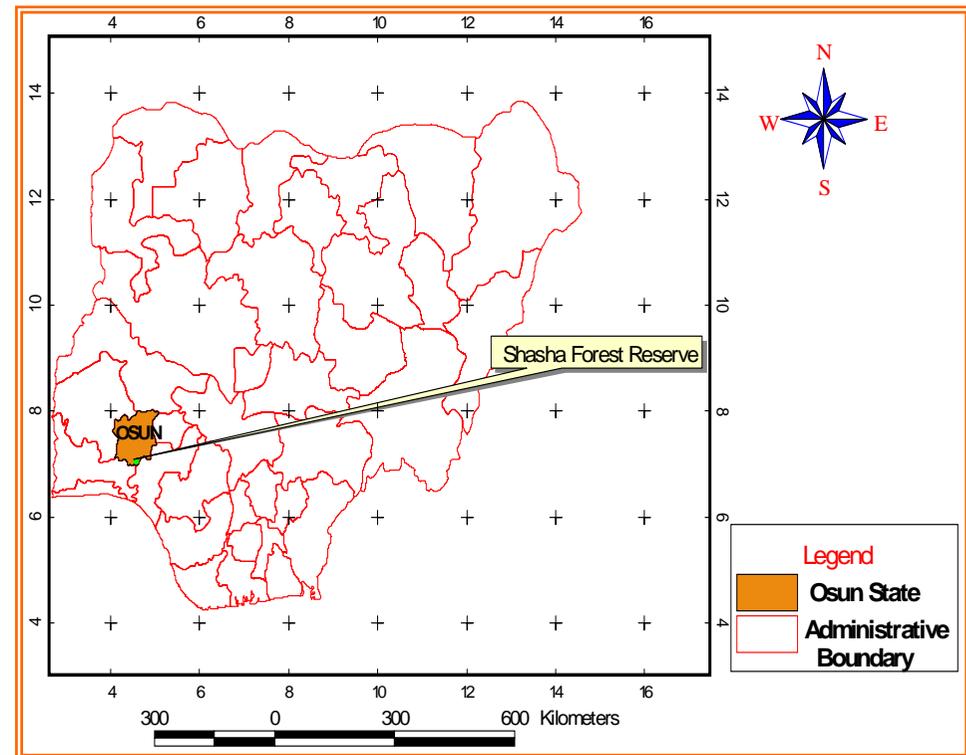
- Introduction
- Study Area
- Materials and Methods
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- Discussion and Conclusion

Introduction

- Nigeria lies between 4° and 14° N and 3° and 15° E
- Country population = 140 million and the most populous south of Sahara
- Total area = 923,768 km²
- Landed area = 910,768 km²
- Major vegetation types:
 - **Forest in the south**
 - **Savanna in the north**
- Forest reserves were established in Nigeria to combat structural and floristic degradation
- Consumption and supply data reveals that demand far outstrips the natural regeneration of the forestry stock
- Deforestation is widespread leaving no section untouched
- Most large diameter trees in all density classes have been heavily depleted and the health of the remaining forest is undoubtedly weak
- Systematic sustainable forest management of these resources must draw from remote sensing data organized in a GIS format for regular updating.

Study Area

- The study area is Shasha Forest Reserve
- Study area is situated in the Ife South Local Govt. Area of Osun-State, Nigeria
- Landed area coverage = 310.798 km² / 31079.857 ha
- Coordinate location = 7° and 7° 10' N and 4° 20' and 4° 40' E
- Annual rainfall is between 1000 and 1500 mm
- Vegetation of the area was classified by Keay (1959) as tropical lowland rainforest



Materials and Methods

- **Garmin GPS 72**
- **Clinometer**
- **Measuring tape**
- **Girth metre**
- **Site definition data sheet**
- **Digital camera**
- **Landsat images**
- **GIS software (i.e. Arcview and ERDAS Imagine)**

Materials and Methods Cont'd

- **10 settlement centres within the Shasha Forest Reserve (S.F.R) were chosen as reference points for enumeration**
- **Demarcation of 5 enumeration plots of 10m x 10m per reference centre**
- **A tree is regarded as a woody plant of erect posture with a minimum breast circumference of 7 cm and minimum height of 1.5 m (Adesina, 1989)**
- **Crown frequency percent was derived according to Heller and Aldrich (1967)**
- **Overstorey is taller than the main leafy layers, while understorey is the sub-canopy and undergrowth, the shrub layers**
- **Parameters enumerated**
 - **Foliage cover: estimated as described by Randall (1978)**

Materials and Methods Cont'd

- **Tree density: physically counted at each plot**
 - **Total tree height: measured by a clinometer**
 - **Tree girth: measured by girth tape**
 - **GPS locations: recorded for each enumerated plot**
 - **Distance to the nearest reference settlement**
 - **Census figures of settlement centres in and around the forest reserve**
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- **The GPS data and other attributes of the enumerated plots were used to run the supervised classification procedure on the Landsat satellite sub-images of 1986 and 2002 of the study area**
 - **Population data was obtained from the Federal and State Population Commission Offices**

Results

Census Figures

Population and projected figures for Ife South Local Government Area and Osun State from 1991 - 2010

Ife South

Osun State

1991	1999	2002	2006	2010	1991	1999	2002	2006	2010
88,170	110,749	121,306	X	160,802	2,158,143	2,710,813	2,969,206	3,423,535	3,755,384

- Figures marked in red show years that census actually took place while the others are projected
- Data for the year marked "X" of Ife South Local Government Area is not available

Field Enumeration Data (1)

Centres	Avg. TD/ Ha	10m x 10m Plots Average Values (m)										Overall Average Values (m)	
		A		B		C		D		E		TG	TTH
		TG	TTH	TG	TTH	TG	TTH	TG	TTH	TG	TTH		
R. House	1700	0.41	8.33	0.47	9.89	0.61	11.00	0.39	7.86	0.61	10.32	0.50	9.48
Odesanmi	600	0.30	8.44	0.74	12.40	0.65	8.00	1.17	28.00	<u>1.47</u>	<u>28.75</u>	0.87	<u>17.12</u>
Abegi	1800	0.39	8.10	0.35	7.24	0.48	11.81	0.84	15.55	0.58	10.53	0.53	10.65
Olorombo	1600	0.63	15.67	1.11	21.63	0.31	8.07	0.59	12.24	0.82	14.20	0.69	14.36
Agbele	1300	0.37	7.64	0.25	6.43	0.72	20.63	0.79	18.50	0.40	11.12	0.51	12.86
Molewuro	1700	0.29	7.41	0.41	10.00	0.48	11.42	0.74	12.70	0.72	12.01	0.53	10.71
Apoje	1300	0.48	10.89	0.44	9.14	1.07	22.44	0.69	15.57	0.33	13.33	0.60	14.27
Idi-Agba	1500	0.88	13.07	0.49	11.13	0.50	11.77	0.42	9.60	0.32	9.87	0.52	11.09
Idi-Ogun	1000	0.72	17.50	0.33	12.00	0.85	12.06	0.99	10.90	0.76	21.00	0.73	14.69
Onida	1400	0.55	9.31	0.88	10.82	1.14	12.63	0.32	8.95	0.45	10.25	0.69	8.54

Field Enumeration Data (2)

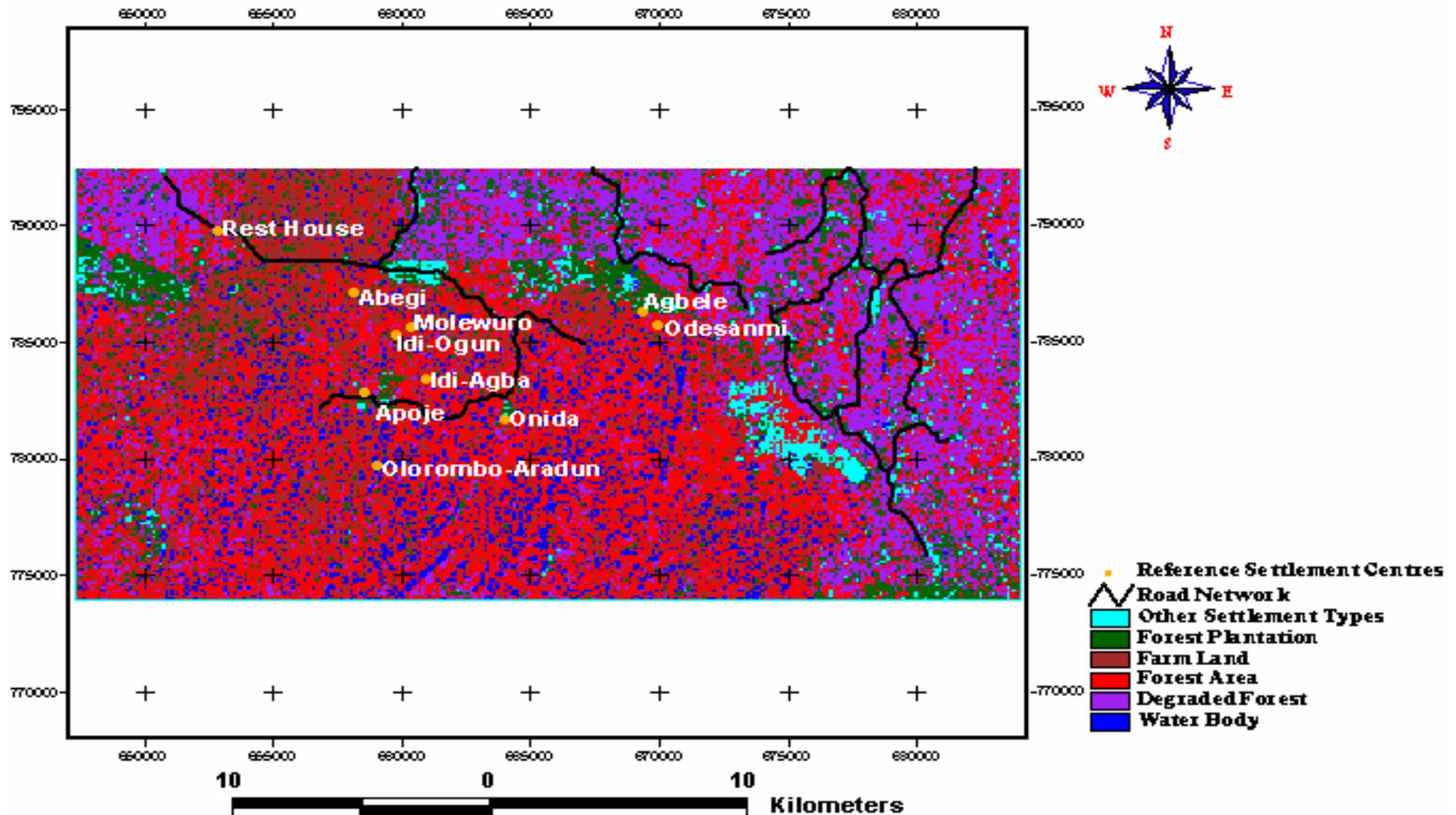
S/ N	Study Centres	OS %	US %	UG %	Foliage Cover %
1.	R. House	4.76	35.71	59.53	70
2.	Odesanmi	26.09	54.35	19.56	86
3.	Abegi	5.79	31.57	62.64	80
4.	Olorombo	17.50	30.50	52.00	80
5.	Agbele	16.67	48.33	35.00	65
6.	Molewuro	3.85	41.03	55.12	90
7.	Apoje	14.71	57.35	27.94	56
8.	Idi-Agba	3.85	51.54	44.61	84
9.	Idi-Ogun	12.86	40.00	47.14	60
10.	Onida	4.23	45.07	50.70	60
Total		110.31	435.45	454.24	731
Mean Total (%)		11.03	43.55	45.42	73.1

**Summary of
the spatial and
attribute data
used for
thematic
classification
of the sub-
images of
Shasha Forest
Reserve (S.F.R)**

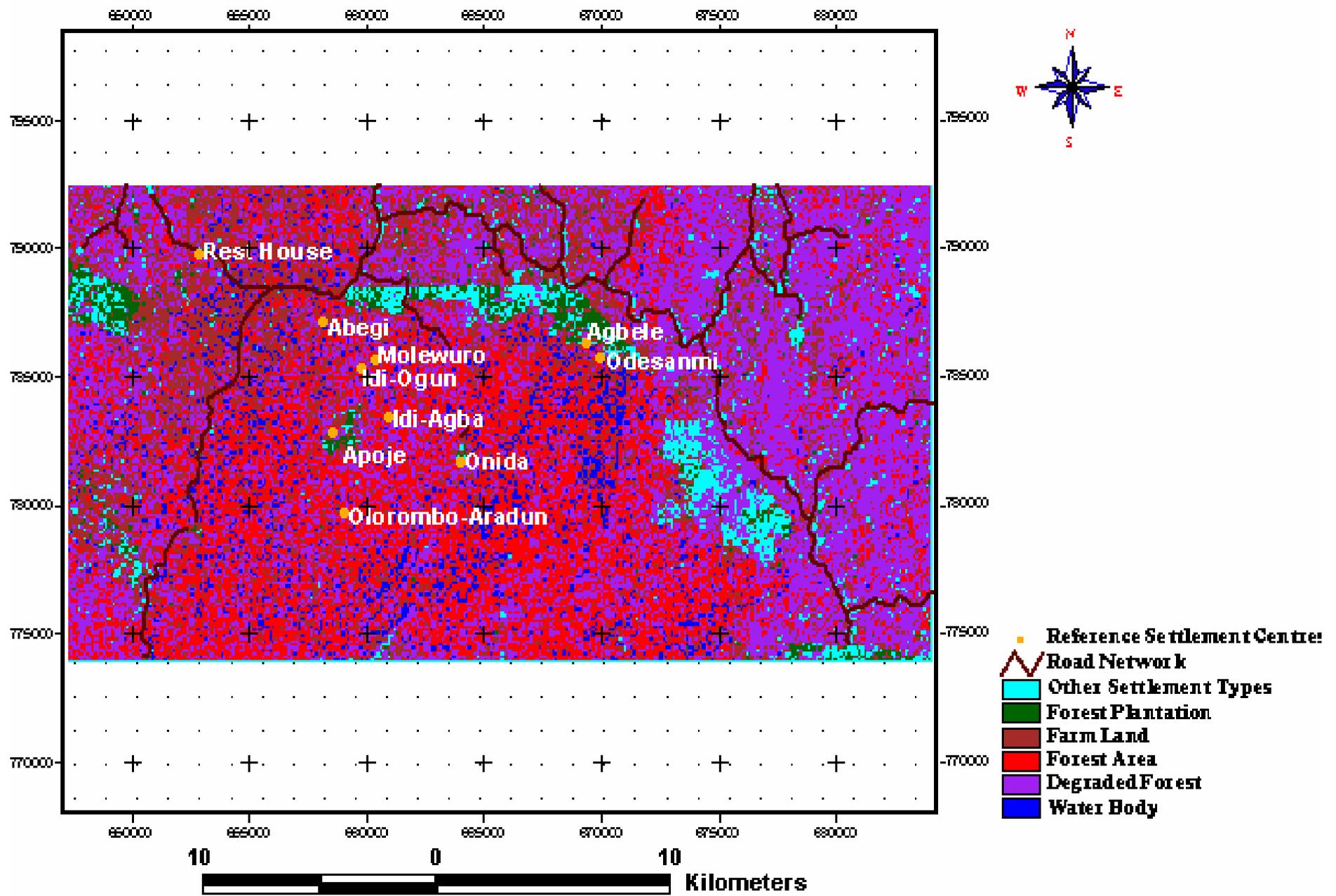
Centres	Activity types	Coordinates	
		X	Y
Rest House	Farm Land	653556	789580
	Settlement	652850	789701
Odesanmi	Farm Land	675018	785164
	Plantation Forest	671273	785674
	Settlement	669944	785674
Abegi	Farm Land	658167	787014
	Farm Settlement	658105	787044
	Forest Area	658197	786983
Olorombo	Farm Settlement	659019	779644
	Forest Area	658864	779736
Agbele	Farm Settlement	669369	786251
	Plantation Forest	669025	788155
Molewuro	Farm Land	659920	785606
	Farm Settlement	660350	785577
	Forest Area	660410	785761
Apoje	Farm Land	658118	782836
	Plantation Forest	659220	783577
	Farm Settlement	658517	782807
Idi-Agba	Farm Settlement	660970	783336
	Farm Land	661710	782356
Idi-Ogun	Farm Settlement	659798	785299
Onida	Farm Land	664904	781598
	Plantation Forest	663981	782117
	Farm Settlement	663952	781595
	Forest Area	663493	781225

Output of the Classified Sub-images

Classified Landsat 1986 sub-image of S.F.R.



Classified Landsat 2002 sub-image of S.F.R.



Results of the supervised classification

Activity Types	Area Covered (Ha)		Difference (Ha)	Increase/Decline (%)	Annual Rate of Increase/Decline (%)
	1986	2002	1986-2002	1986-2002	1986-2002
Other Settlement	1,957.52	3,184.75	+ 1,227.23	+ 62.69	+ 3.92
Forest Plantation	7,749.27	1,802.87	- 5,946.4	- 76.73	- 4.80
Farm Land	12,927.4	13,777.5	+ 850.1	+ 6.58	+ 0.41
Forest Area	23,141.9	18,721.5	- 4,420.4	- 19.10	- 1.19
Degraded Forest	16,703.8	26,822.4	+ 10,118.6	+ 60.58	+ 3.79
Water Body	5,783.95	3,954.82	- 1,829.13	- 31.62	- 1.98

Discussion

- **Both the actual and projected population figures for State and the local Government area where the S.F.R is situated show an upward surge**
- **Half of the trees enumerated are found in the lower girth class of 0.25 – 0.50 m**
- **Plot average dominant tree emergent layer = 28.75 m**
- **Plot overall dominant average = 17.12 m**

Discussion Cont'd

- **Overstorey, which depicts the leafy layer that is the topmost has a meagre % total of 11.03 while that of the understorey and undergrowth are 43.55% and 45.42% respectively. The foliage cover has dropped to 73.1% against the 78% found for the area by Salami (1998)**
- **Results derived from the classification procedure strengthened the output of the field sampling and enumeration, which show an increase/hectare in farm land, degraded forest, and settlement areas**
- **Anthropogenic activities remain the single most significant factor in the degradation of the S.F.R. with the indications of human activities all over the entire forest reserve**

Conclusion

- **Ground data collection is one important element of data acquisition in remote sensing**
- **Ground data collection is important for qualitative and quantitative interpretation of satellite remote sensing data**
- **Human interferences remain the most dominant factor responsible for the degradation of Shasha Forest Reserve (the study area)**
- **A satellite-based monitoring system of our forest estate is very essential for making sustainable Forest Management Plan**
- **Real-time knowledge only derivable from satellite-based monitoring system will enforce rational and sustainable allocation of forest resources for future development**

Conclusion Cont'd

- **The predominant lower tree girth class shows that the forest if given sufficient time could regrow significantly**
- **The observed massive clearing of this forest reserve further exposes the soil surface thereby increasing local evapotranspiration**
- **The effect is a possible permanent loss of this forest and alteration of the microclimate of the environment**
- **With the projected increase in Nigeria census figures, only a timely and reconstructive intervention strategy will be able to save the imminent complete loss of this forest estate**

**Thank you very much for
your kind patience and
attention**