



## AN EXAMINATION OF CHANGES IN SOME FOREST RESERVES OF KANO STATE, NIGERIA

<sup>1</sup>Halima Abdulkadir Idris, <sup>2</sup>Mohammed Ahmed, <sup>1</sup>Umami Khalthum Mohammed, <sup>1</sup>Zainab Nuhu

<sup>1</sup>Department of Environmental Management, Bayero University Kano, Kano, Nigeria.

<sup>2</sup>Department of Geography, Bayero University Kano, Kano, Nigeria.

Corresponding author's [mahmad.geog@buk.edu.ng](mailto:mahmad.geog@buk.edu.ng), [haidris.geo@buk.edu.ng](mailto:haidris.geo@buk.edu.ng)

### ABSTRACT

Ecosystems in Nigeria are highly vulnerable to many adverse influences deliberate or inadvertent. The study examine the current status of the forest reserves in Kano State. Data collection was done using SPOT 5 (2012) satellite image of the area forest reserve and topographical maps were georeferenced in the Arc GIS 10.1 environment. Participatory Rural Appraisal Technique (PRA) was used to gather information on specie changes, dominance and available management practices using a purposive sampling technique drawn from the North central and southern Kano. The data were analysed in the GIS environment and Statistical Package for the Social Sciences (SPSS). The result shows changes of the boundaries of the reserves which indicated a reduction in the areal extents of the reserved areas, variation in tree species density, tree species type, management practices and human interference. Poverty, climate change and medicinal benefits were found to be reasons for encroachment. Parts of some of the reserves have been converted to farmlands for agriculture and settlements. Also, illiteracy and lack of awareness among the greater number of the populace around the protected areas their belief is that wildlife is gift from nature and is owned by everybody hence there is no need restricting its use. The study concluded that there are evidence of encroachment and loss of biodiversity in studied area and recommended for awareness on dangers of deforestation, proper monitoring and management of the reserve areas.

**Keywords:** Forests, Forest reserves, Species, Change

### INTRODUCTION

Forests provide vital ecosystem services and resources such as timber, medicinal plants, livelihood, protection of watersheds, and serves as a habitat for a number of important fauna and flora. Pressures on forest especially in the developing world, to provide economic resources have been on the increase with increasing population. This has led to massive deforestation and loss of biodiversity threatening the existence of the global ecological lung (Salami, 2006). Forest conversion is the second largest global source of anthropogenic carbon dioxide emissions, and is likely responsible for 10-25% of carbon dioxide emissions worldwide (Houghton 2003; Santilli *et al.*, 2005). According to FAO (1995) Forest Resource Assessment each year about 13 million hectares of the world's forests are lost due to deforestation, but the rate of net forest loss is slowing down, thanks to new planting and natural expansion of existing forests. From 1990 to 2000, the net forest loss was 8.9 million hectares per year. From 2000 to 2005, the net forest loss was 7.3 million hectares per year - an area the size of Sierra Leone or Panama and equivalent to 200 km<sup>2</sup> per day (FAO, 1995) Nigeria happens to be among the ten countries with the largest net forest loss per year between 2000 and 2005 while forest reserves in Nigeria were originally set up in recognition of the importance of many tree species and the associated flora and fauna around the country (FAO, 2006; USAID, 2008). As a result, as many as 58 (10.4%) of the tree species are listed as

endangered (FORMECU, 1999). This biodiversity loss occurs in spite of the establishment of forest reserves, protected areas and associated conservation and environment laws. A good example of this was reported by Greengrass (2006) which indicated that most of the forest reserves are not secured. While Ahmed (2006) indicated that forest reserves in Kano are under threat, so also Badamasi and Yelwa (2010) ascertained that Falgore Reserve suffers from encroachment. Despite the Agro-forestry (Maconachie, 2007), or farm parkland, other species are still endangered (Mohammed 2006).

A lot of methods have been applied in the determination change in vegetation of forests. Different approaches were applied in the assessment of vegetation cover changes across Northern Nigeria using Geographic Information System (GIS) and remote sensing especially the use of vegetation indicators like the Normalized Differential Vegetation Indices (NDVI) (Badamasi and Yelwa, 2010; Usman, Yelwa and Gulumbe, 2012; Okorie 2012; Olokeoguna, Iyiolab and Iyiola, 2014; Musa *et al.*, 2014; Ikusemoran and Olorok, 2014; Ayanlade 2016), while other approaches were applied using Focus Group Discussion (FGD) (Nuhu and Ahmed, 2013).

Most of these approaches have to do with the use of NDVI (algorithms) from the satellite images which are attributed to problems of atmospheric gases, aerosols, and clouds scatter and absorption of the incoming solar radiation and the reflected

and/or emitted radiation from the surface (Liang, 2004). Therefore, there is need for ground information on the Forest reserves in Nigeria. In this view, this study aimed to assess changes in some forest reserves of Kano State, Nigeria

## METHODOLOGY

### Study Area

The Study was carried out in Kano State, North Western Nigeria. Kano State lies approximately between latitudes  $10^{\circ} 30' N$  and  $12^{\circ} 37' N$  of the Equator and longitudes  $7^{\circ} 40' E$  and  $9^{\circ} 23' E$  of the Greenwich Meridian. It has an estimated land size of 20,280 km<sup>2</sup> with 4,988,880 Acres (National Bureau of Statistics, 2010)

with a population of 9,401,288 (2006 census). The area is characterized by rocks of the Basement Complex of pre-Cambrian age to the west and south, and the Chad formation to the northeast (Olofin, 2014). The climate of the area were generally classified as Dry and Cold season (kaka), Dry and Hot season (bazara), Wet and Warm season (damina), Dry and warm season (rani), (Olofin 1987; Liman *et al* 2014; Usman, 2014). The soil of Kano according to Essiet (2014) is dominated by Ferruginous soils. The vegetation of Kano State is the semi-arid savannah. The Sudan Savannah is sandwiched by the Sahel Savannah in the north and the Guinea Savannah in the south (Kano State Government, 2007).

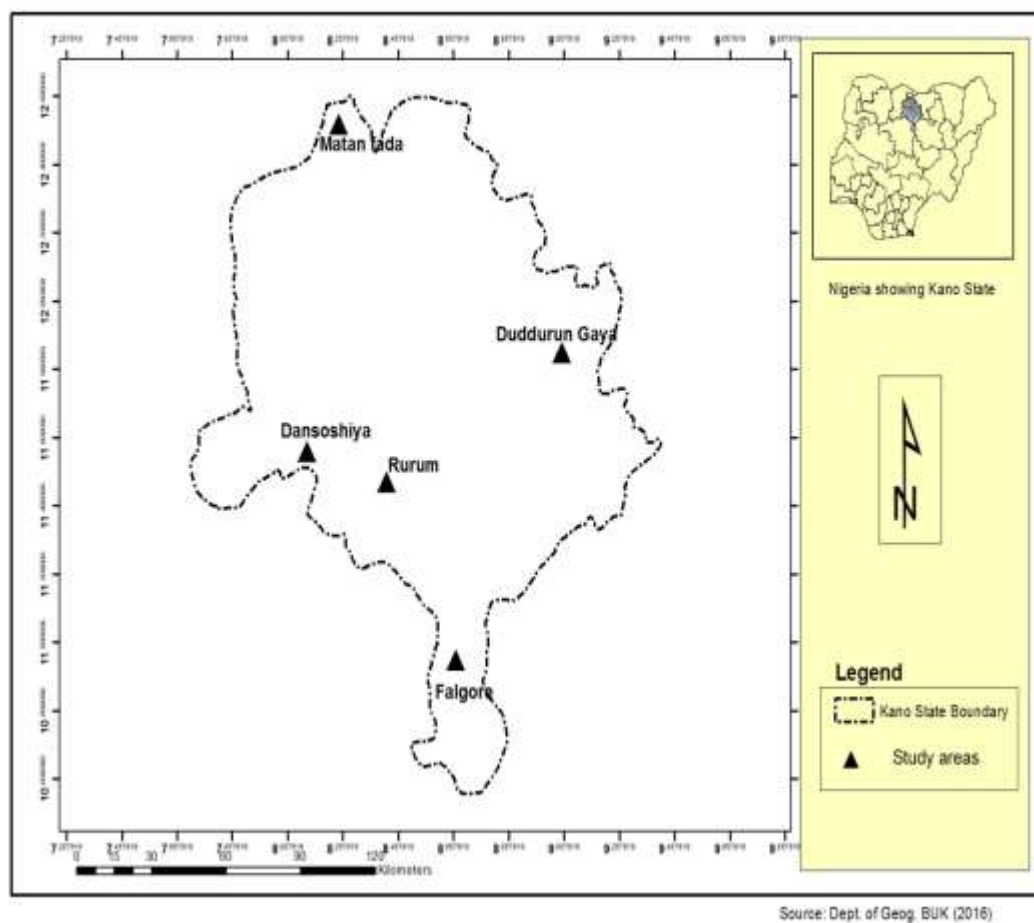


Fig. 1: Map of Kano State showing the locations of the selected Forest reserved areas

### Data Source and Acquisition

Primary data includes coordinates (latitude and Longitude) of all the forest reserves obtained using the GPS Garming 76csx. While the secondary data includes Topographical maps of the area (Gaya 82, Kunya 58, Kabo 80, Buruburum 104 and Wudil 81) indexed with the scale of 1:100,000) sourced at the department of Geography Bayero University Kano. Map of

Nigeria showing forest reserves produced by the Federal Surveys Nigeria (1966) was also source at the department to analyse the forest reserve boundaries. Google Earth pro of 2015 was downloaded and installed and the images of the reserved areas were saved which were used for the analyses of the present situation). Documents pertaining records of the forest reserve

areas and their coordinates were sourced at the Kano State Ministry of Forestry (Revised Forest Management Plan).

### Geo-referencing and Digitization

The map of Nigeria showing forest reserves was georeferenced in the GIS environment using the Minna UTM. Zone 32N (datum). Direct extraction (digitization) of the forest areas was done from the map. While the topographical maps were overlaid and geo-referenced by adopting the same datum systems of the map of Nigeria. The topographical maps were used in the identification and correction of the actual boundaries of the forest reserve areas that existed before (1966), while the Google Earth images were used for the identification of the present situation (2015) of the forest reserves. During the geo-referencing some corrections were made for image rectification using SPOT-5 (5 meter resolution). The two scenes (1966 and 2015) were overlaid during the digitization. The coding (1 and 0) were assigned to the identified forest reserves. 1 indicates not altered while 0 indicates altered in the database.

### Participatory Rural Appraisal

Participatory Rural Appraisal (PRA) technique was also employed to gather information on the extent of the reserves, plant and animal species and management practices in the area from residents around and within the reserve areas. This technique is typically used in the field to gather qualitative data, often to complement quantitative data. In this study the group

discussions and direct interviews and open-ended questions were employed and was done in a focused manner. Participants were led in discussions pertaining conditions and issues of the forest reserves. The discussions focused around a time frame of 30years, a checklist was prepared to cover the changes in the areal extent, plant and animal species in order to understand the present conditions and how they vary with the previous conditions.

### RESULT AND DISCUSSION

The result from the GIS analysis indicated that the area extent of the forest reserves have decreased greatly and this is mostly due to farming activities and the demand for fuel wood for domestic use and as means of livelihood for the people living within and around the reserves. The areal extents of *Rurum* has been lost by 35.45%, *Matan Fada* 53.0% and *Duddurun Gaya* 60.0%, while that of *Falgore* and *Dansoshiya* has been lost by 8.52% and 0.60% respectively (Table 1).

Farming activities were observed within and around the reserves with the exception of *Dansoshiya* and *Falgore*. This was due to the activities of the forest guards in and around the forest area (according to the inhabitants of the area) in *Dansoshiya*. While for *Falgore* it is largely because it has been a hide out for armed robbers (Ladan, 2014) and now insurgents as well. The participants also confirmed that they are allowed to cut down trees in a manner that provides for regeneration and that is not much change at *Dansoshiya* (see figure 2, Plate 1, 2 and 3).

**Table 1: Forest Reserves and Their Areal Extent**

Forest reserves/Period	1966 (Ha)	2015 (Ha)	Percentage Change (%)
Matan fada	1882	102.98	53.00
Duduru gaya	6416	1950.28	60.00
Dansashiya	6903	6871.32	0.60
Rurum	3617	2334.72	35.45
Falgore	101594.06	92934.78	8.52

Part of *Rurum* reserve (Figure 3) has almost been transformed to farmlands. The Tiga River runs through the *Rurum*. The tree species evident now are the *Azadiracta indica* (Darbejiya), *Tamarindus indica* (Tsamiya) and *Adansonia digitata* (Kuka). At *Matan Fada* (Figure 4 and Plate 4) most of the forest has been lost with few trees, shrubs and tall grasses left. The forest reserve extends into the *Ruggu* Forest. Part of the reason for the degradation is the drying up of the water source as a result of the

damming project and wood felling for domestic use. At *Duddurun Gaya*, (Figure 5) irrigation farming activities are taking place, mainly of perishable goods, fishing along the river (*Dudurun Gaya*) that cuts across the reserve. *Falgore* forest reserve (Figure 6) suffers similar exploitation such as high grazing intensity, excessive cutting down of trees from within the forest which is why the areal extent has not undergone much alteration





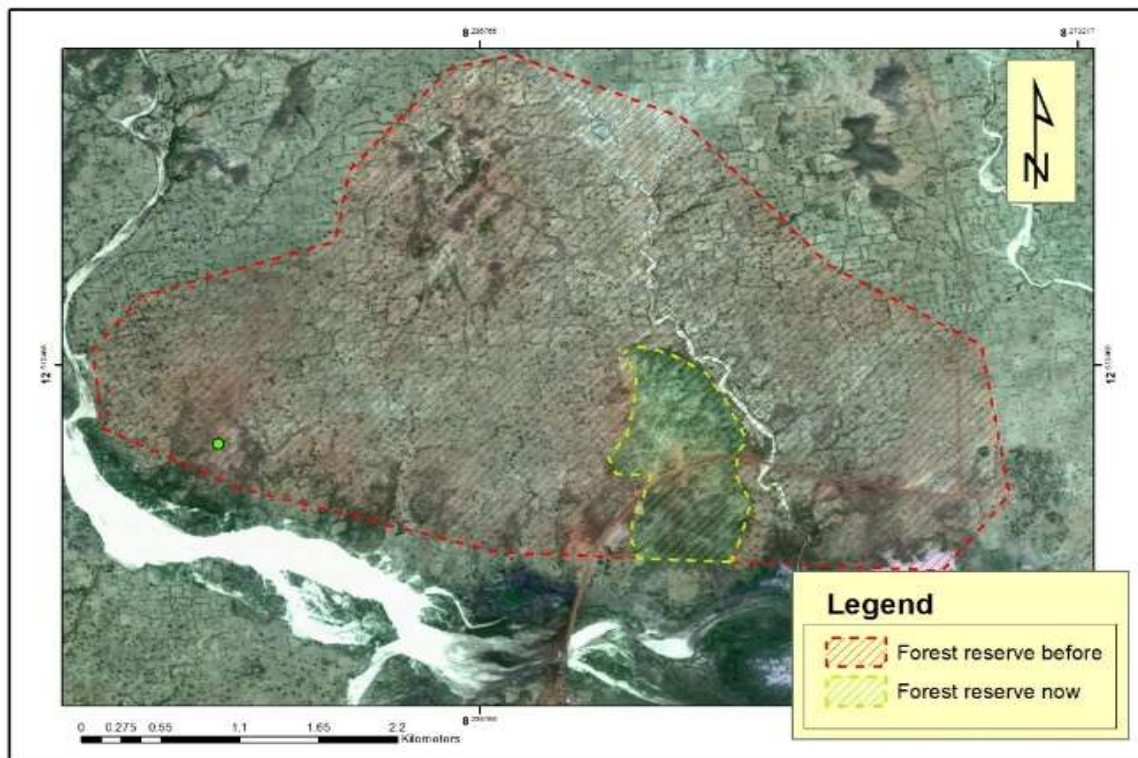


Fig. 4: Matan Fada Forest Reserve showing the only remaining Vegetation at the central part indicating conversion of reserved areas to farmlands.

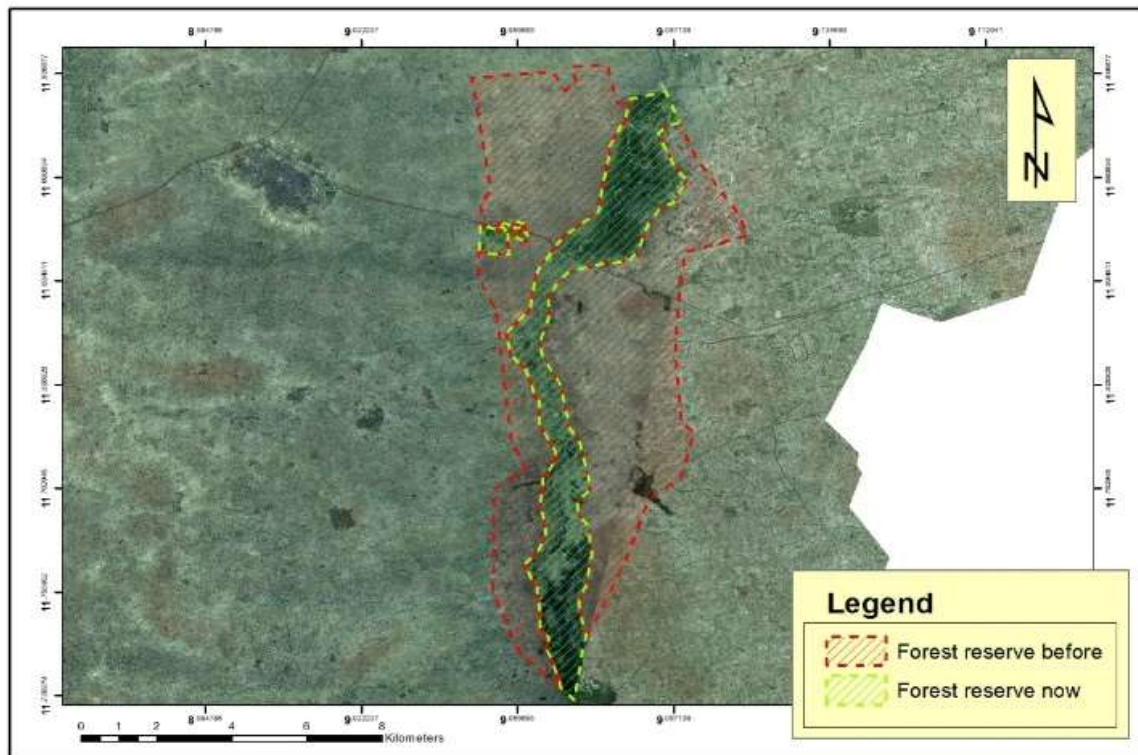


Fig. 5: Duddurun Gaya Forest Reserve showing the remaining forested areas along the river channel indicating the verse converted land to farmlands

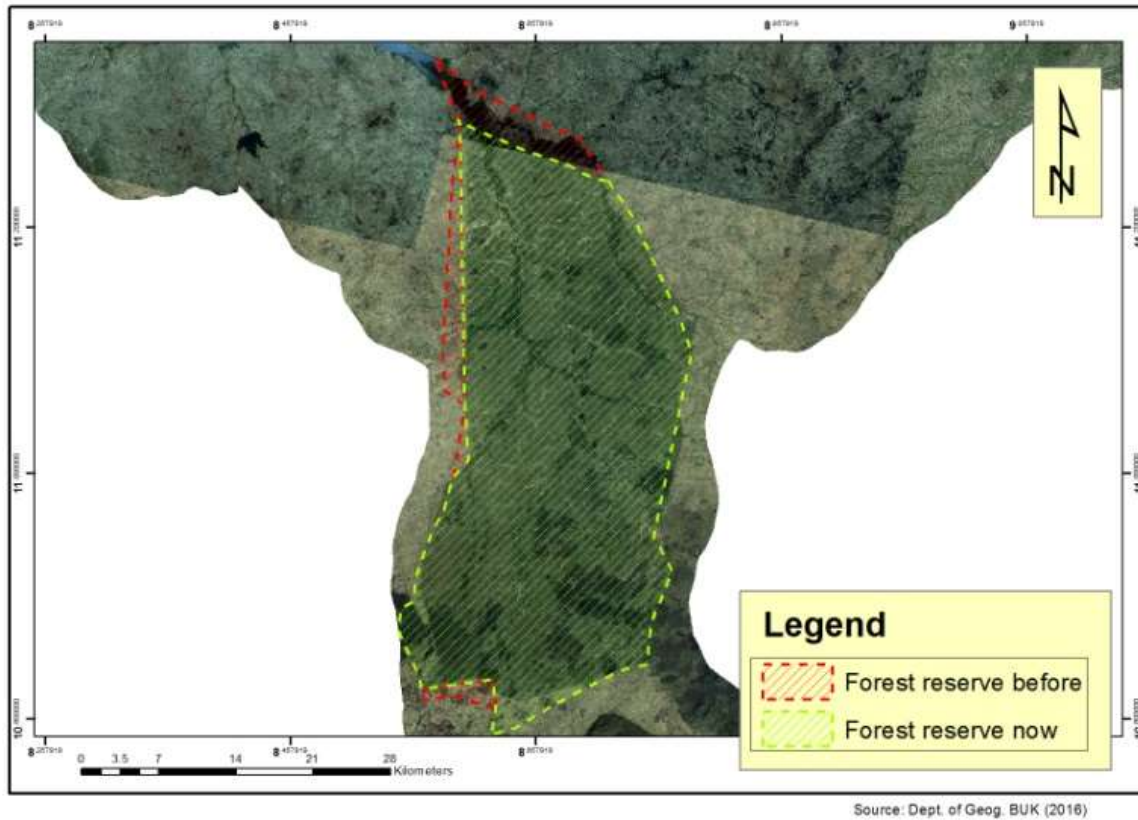


Fig. 6: Falgore Forest Reserve showing some of the affected areas at the edges especially at the Eastern and Southern fringe of the area.



Plate 1: Remaining standing trees at Dansoshiya Forest Reserve



Plate 2: Converted Farmland at Duddurun Gaya Forest Reserve





Plate 3: A falling tree at Rurum Forest Reserve



Plate 4: Woodlots at Matan Fada Forest Reserve

The result of the PRA at *Dansoshiya* revealed that the flora species found within the reserve has remained the same which are *Anogeissus leocarpus* (Marke), *Diospyrus mespiliformis* (Kanya), *Balannites aegyptiaca* (Aduwa), *Tamarindus indica* (Tsamiya), *Combretum glutinosum* (Taramniya), *Cembretum glutinosum* (Kattakara), *Albezia chevalieri* (Gatsari), *Simerubacae danzieliis* (Ararrabi), *Guiera senegalensis* (Sabara), *Combretaceae sokodense* (Wuyan damo), and *Xemania americana* (Tsada). *Anogeissus leocarpus* (Marke) and *Diospyrus mespiliformis* (Kanya) are the dominant species, with *Cembretum glutinosum* (Kattakara), *Guiera senegalensis* (Sabara) and *Diospyrus mespiliformis* (Kanya) the most drought resistant in the group while *Simerubacae danzieliis* (Ararrabi) is completely extinct, this the participants attributed to its high demand for medicinal purpose. *Anogeissus leocarpus* (Marke), *Combretaceae sokodense* (Wuyan damo) and *Balannites aegyptiaca* (Aduwa) are most preferred for firewood. The fauna (birds/animals) that used to roam the forest in the past are; Hyena (Kura), Biri (Monkey), Antelope (*Gada*). Those that still roam the forest are; Egret (*Balbela*) and Hare (*Zomon daji*). The human activities within the forest reserve include; tree felling for firewood (see Plate 3 and 4), grazing of animals (cattle), clearing of land for shelter, brick making along the gullies and sand mining during the dry season in the river channel.

The extinct tree species include *Anogeissus leocarpus* (Marke). According to the participants, the *Rurum* forest used to be a very thick forest, as thick as *Falgore* Game Reserve. However excessive felling of trees for firewood and clearing for farm lands has completely changed it to a farmland area. The only animals found are the Monkeys that have gone into hiding in the rocks found within the forest. The participants have explained that there used to be Elephants, Jackal, Hyena, and the Lion and

they believe that these animals must have migrated to *Falgore* Game Reserve.

At *Matan Fada*, tree species common to the reserve are; *Faidherbia albida* (Gawo), *Tamarindus indica* (Tsamiya), *Anogeissus leocarpus* (Marke), *Ficus anomani* (Baure), *Parkia biglobosa* (Dorawa) and *Diospyrus mespiliformis* (Kanya). *Parkia biglobosa* (Dorawa) is now extinct while *Bauhinia thonniigss* (Kalgo) and *Azadiracta indica* (Darbejiya) have been introduced. Animals that have disappeared include Hyena (Kura), Honey badger (Dage) and Porcupine (Beguwa), Monkey (Biri) and Fox (Dila); birds extinct are the Kite (Shirwa), Wild Guinea fowl (*Zabun dawa*) and Vulture (Ungulu). The management practice was found to be weak as tree felling is allowed within the reserve.

The *Duddurun Gaya* reserve shows that the management practice is taken more seriously at this reserve, as the officials prohibit the felling of trees, however the locals still cut down trees for domestic use and as a means of livelihood according to the participants. Firewood selling is one of the main sources of livelihood during the dry season, until recent times, with the development of the irrigation scheme in the area, where, people moved into irrigation agriculture during the dry season. The trees species common to the reserve hardly regenerate after being cut. The most common specie now is the introduced *Azadiracta indica* (Darbejiya), which has replaced the indigenous species, this is because it grows faster and is extensively used for fuelwood and medicinal purposes.

The result of *Falgore* forest reserve indicated that majority of the inhabitant of the area depend directly or indirectly to the reserve. It could be economically or socially. River Kano dissects the reserve in a southeast-north direction which served

as drinking spots by the cattle that browse around. The people of the area lamented that farming and Firewood selling is one of the main sources of livelihood during the dry season, but this they do with great caution because of the robbers and other criminals that hide therein. According to the participant the reserve is under the care of Kano State Zoological and Wildlife Management Agency (KAZOWMA). The common trees found in the area includes *Adansonia digitata* (Kuka), *Tamarindus indica* (Tsamiya), *Acacia senegalensis* (Bagaruwa) and *Faidherbia albida* (Gawo), *Vitex doniana* (Dinya), *Pterocarpus erinaceus* (Madobiya) and *Vitellaria paradoxa* (Kadanya).

It is evident from the GIS analysis that area extent of the forest reserves have decreased greatly and this is mostly due to farming activities and the demand for fuel wood for domestic use and means of livelihood for the people living within and around the reserves similar to the report of Marguba (2002) who reported that natural ecosystems in Nigeria are highly vulnerable to many adverse influences deliberate or inadvertent. Other factors that contributed to decrease in forest reserves has been reported by Badamasi (2014) that population explosion, mismanagement of forest reserve and agricultural land intensification leads to alteration of the ecosystem. Indigenous tree species have been replaced by other exotic species in the study area and this is similar to other areas in Dagacheri according to Maconachie (2014).

So also most of the animal species are said to have migrated or been hunted which was found to be as a result of illiteracy and lack of awareness on the importance of the reserves and most of the people around the areas are unemployed and as reported by Ejidike and Ajayi (2013) the area is surrounded by soils of low nutrients and therefore left with the option of natural resource exploitation. Other authors reported the effect of deforestation leads to soil degradation, erosion and desert encroachment continue in various parts of the country especially in the dryland areas (Mohammed, 2006; Ahmed, 2006).

There is a very weak system of protecting the forest in the study area. According to the participants, the only activity they prevent is farming, but the result indicated that only in *Dansoshiya* Forest has been protected by the settlers but they cut the trees in the reserve area also, the herdsmen that are living in the forest reserve assist in the protection of the forest (*Dansoshiya*) as they said "it served as a security to their settlement". Even though, other findings in similar study shows that there is a negative effect of people living around the forest areas as this allows for continuous exploitation of the reserves (Yelwa and Gulumbe, 2012; Maigari, 2014; Usman and Ayanlade, 2016).

#### CONCLUSION AND RECOMMENDATION

The study find out that there is high degrees of forest exploitation in all the reserve areas. It concluded that almost all

the Forest reserved areas has been drastically altered especially *Matan fada*, *Duddurun Gaya*, and *Rurum* affected due to farming activities, sand mining, hunting, grazing activities and demand for fuel wood. Farming, in and around the Forest reserve areas were found to be the most existing problems besides cutting down of trees. Most of the indigenous trees species in the area is greatly being depleted such as the *Anogeissus leocarpus* (*Marke*) that is being used for medicinal, fuelwood and fodder purposes, exotic species like the *Azadiracta indica* (*Darbejia*) has been introduced and dominating the area. It indicated that high that there is high loss of biodiversity which will resulted to reduction of fauna (birds/animals) population in the reserve areas.

The study recommend for government to put a policy that will bring the stakeholders and the indigenous people (neighbouring the Forest reserves) to monitor and conserve them. Threshold or buffer zones should be created around the Forest reserves so as to avoid encroachment. There is need for further studies on the changes using correlation of ground data (quadrant) with cloud free images using Normalized Differential Vegetation Index (NDVI) to detect changes in terms of the present density of the reserves.

#### REFERENCES

- Ahmed, K. (2006) The Physical Environment of Kano State, [www.kanostate.net/physicalenvironment.html](http://www.kanostate.net/physicalenvironment.html). (Accessed 80/08/2013)
- Ayanlade, A (2016) Landuse change within Okomu and Gilli-Gilli Forest Reserves, southwestern Nigeria: its climatic and societal implications. *Tropical Ecology* 57(2): 193-203.
- Badamasi, M. M. and Yelwa, S. A. (2010) Change Detection and Classification of Land Cover at Falgore Game Reserve: A Preliminary Assessment. *Biological and Environmental Sciences Journal for the Tropics*, 7 (1): 75-83.
- Badamasi, M., M (2014), Vegetation and Forestry. In A.I Tanko and S.B. Momale (Eds.) Kano Environment, Society and Development. London and Abuja, Adonis and Abbey Publishers. pp. 43-64
- Ejidike, B. N. and Ajayi S. R. (2013), Trends in wildlife conservation practices in Nigeria *International Journal of Biodiversity and Conservation* Vol. 5(4), pp. 185-191
- Essiet, U. E. (2014), Soils. In Tanko A. I. and Momale S. B (eds). *Kano Environment, Society and Development*. Adonis and Abbey Publishers Ltd.

Food and Agriculture Organization–FAO (1995) Planning for Sustainable use of Land Resources: Towards a new



- approach. Land and Water Bulletin No. 2. Background paper to FAO's task manager ship for chapter 10 of Agenda 21 (1995).
- FAO (2006) Global Forest Resources Assessment (2005). FAO Forestry Paper 147, Rome.
- Federal Survey Nigeria (1968) Topographical Map produce reviewed by Federal Polytechnic Kaduna 3000/580/10-68.
- FORMECU (1999) Forest Resources Study, Nigeria. Revised National Report Vol. 2. Prepared for FORMECU by Beak and Geomatics International, 87-99.
- Greengrass, E. J. (2006) A survey of Chimpanzees in South-west Nigeria. NCF-WCS Biodiversity
- Houghton, R. A. (2003) Revised estimates of the annual net flux of carbon to the atmosphere from changes in land use and land management 1850-2000: *Tellus* 55B: 378-390.
- Ikusemoran, M and Olorok, J. O. (2014) Monitoring the land-use and vegetation cover changes in the Kainji Lake Basin, Nigeria (1975-2006) *African Journal of Environmental Science and Technology* Vol. 8(2), pp. 129-142
- Ladan, S. I., (2014) Forests and Forest Reserves As Security Threats In Northern Nigeria *European Scientific Journal* December 2014 Edition Vol.10, No.35 Issn: 1857 – 7881 (Print) E - Issn 1857- 7431
- Liang, S. (2004) Quantitative Remote Sensing of Land Surfaces. *John Wiley Kr Sons, Inc. Hoboken. New Jersey* ISBN 0-471-28166-2
- Liman, M. Idris, H. A., Mohammed, U. K. (2014) Weather and Climate. In A.I Tanko and S.B. Mumale (Eds.) *Kano Environment, Society and Development*. London and Abuja, Adonis and Abbey Publishers
- Maconachie, R. (2014) Urban Pressure and Tree cover Change. In A.I Tanko and S.B. Mumale (Eds.) *Kano Environment, Society and Development*. London and Abuja, Adonis and Abbey Publishers
- Maigari, A., I. (2014) Drought and Desertification. In A.I Tanko and S.B. Mumale (Eds.) *Kano Environment, Society and Development*. London and Abuja, Adonis and Abbey Publishers
- Marguba, L. B. (2002) National parks and their benefits to local communities in Nigeria. Published by Nigeria National Park Service, p. 48.
- Mohammed, S. (2006) Adaptive Management of of Cultivar Diversity in semi arid Northern Eastern Nigeria. Unpublished Ph.D Thesis, Bayero University, Kano, Nigeria
- Musa, I., T, Yakubu M., T., Ya'U, Muhammad Z., S, Ishaya M and Vivan E., L. (2014) Analysis of Forest Cover Changes in Nimbria Forest Reserve, Kaduna State, Nigeria using Geographic Information System and Remote Sensing Techniques *Journal of Environment and Earth Science* Vol.4, No.21
- Nuhu Z. and Ahmed M. (2013) Agricultural landuse in Lafiya Nassarawa State. Part-II: *Social Sciences and Humanities: 2223-9944* Vol. 4 No. 4.
- Okorie, F., C. (2012) A spatio-temporal Analysis of Deforestation in EPE and its environs Lagos, Nigeria. *International Journal of Science, Environment and Technology*, Vol. 1, No 5, 548 – 562
- Olofin, E. A. (2014) Landforms. In Tanko A. I. and Momale S. B (eds). *Kano Environment, Society and Development*. Adonis and Abbey Publishers Ltd, 21-33
- Olofin, E. A. (1987). *Some Aspect of Physical Geography Kano Region*: Department of Geography Lecture Series BUK: Dabis Standard Printers 73A, Zaria Road, Kano.
- Olokeoguna, O. S., Iyiola, O. F., and Iyiola, K. (2014) Application of remote sensing and GIS in landuse/land cover Mapping and change detection in shasha forest reserve, Nigeria. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Volume XL-8, 2014 ISPRS Technical Commission VIII Symposium, 09 – 12 December 2014, Hyderabad, India.
- Salami, A.T., (2006) Towards a Geo- Information System based forest Monitoring in Nigeria. In: Salami, A.T. (Ed.), *Imperatives of Space Technology for Sustainable Forest Management in Nigeria*. Proceedings of an International Stakeholders Workshop Sponsored by National Space Research and Development Agency (NASRDA), Abuja. pp: 146-160
- Santilli, M., Moutinho P., Schwartzman, S. Nepstad D., Curran L. and Nobre C. (2005) Tropical Deforestation and the Kyoto Protocol, *Climatic Change* 71: 267-276.
- USAID (2008) Nigeria Biodiversity and Tropical Forestry Assessment Maximizing Agricultural
- Usman, B. A. and Adefalu, L. L. (2010) Nigerian forestry, wildlife and protected areas: Status report, Tropical Conservancy, Biodiversity II (3 & 4) Research Programme.

Unpublished report. Revenue In Key Enterprises For Targeted Sites (Markets).

Usman, A. (2014) Rainfall variability in Kano region. Unpublished Msc. Theses submitted to the Department of Geography Bayero University Kano, Nigeria

Usman, U., Yelwa, A. S., and Gulumbe, U. S. (2012) Assessment of vegetation cover Changes across Northern Nigeria (2012) *Journal of Agriculture and Environmental Sciences* 1(1); December 2012 pp. 01-18