Assessment And Mapping Of Land Use/Land Cover, Using Remote Sensing And Gis Techniques; Case Study: Ahable And Wad Grabou Area, Whaite Nile State, Sudan

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ABSTRACT: -

THIS study focused on the assessment of and mapping of land use land cover change the White Nile state, Sudan. Through mapping and monitoring, the changes that occurred in land use land cover, due to drought, climate change and mismanagement. The study attempted also to update some information in the study area such vegetation cover and Vegetation density using different methods of data transformation and analysis such as statistical analysis, GIS and remote sensing techniques The Result showed that the White Nile State was rich of forest, agricultural lands and has extensive water resources of 26 million cubic meters from the White Nile water in addition to rain. The state plays a significant role in environmental, social and economic aspects of Sudan. The state has suffered from deforestation and degradation due to natural hazards and human activities. This research conducted by application of remote sensing and investigated the possibility of identification, monitoring and mapping of the land use land cover changes and dynamics in the White Nile state during the last 30 years. The result show that land use land cover structure in the White Nile has obvious Changes and there is strong relations between forest cover changes and land area clearance for agriculture.

INTRODUCTION:

The terms land cover and land uses used interchangeably in change detection studies, their actual meanings are quite distinct (Seto et al., 2002, Shao and Reynolds, 2006). Land cover refers to the surface cover on the ground, whether vegetation, urban infrastructure, water, bare soil or other. Identifying, delineating and Mapping of land cover are important for global monitoring studies, resource management, and planning activities (Foody and Atkinson, 2002; Aspinall and Hill, 2008).

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Land use applications involve both baseline mapping and subsequent monitoring, since timely information is required to know which current quantity of land and Which type of use and to identify the land use changes from year to year (Sabins, 1997;Read and Lam, 2002; Campbell, 2002).. Remote sensing techniques are important in acquiring useful data of the earth or its surface by mean of sensors. These remotely collected data will be analyzed to obtain information about the objects, areas or phenomena being investigated (Schowengerdt, 2007; Lillestand et al., 2008). In addition, it includes the analysis and interpretation of the acquired data and imagery, which are the most aspects for environmental scientists to provide relevant information for monitoring earth resources (Landgrebe, 2003; Chuviecoand Huete, 2010). Multi-spectral imagery used for quantification of resources and Monitoring resources during a period. Remote sensing techniques help in developing areas in studying deforestation of changes in vegetation cover. (Barredo and Sendra, 1998).The study objectives are Monitoring, mapping and modelling of land use, land cover change, and explore management tools for forests to maintain the tree component in the farming and the land use system.

STUDY AREA:

The study has lies in central Sudan, west Elduiem town in El Helba and Wad Gabour area in Elduiem locality, of the White Nile State. The area forms transitional zone between the bank of White Nile River and ElHelba, which is mainly composed of natural rangeland with few scattered relics of the remaining natural forests and few scattered villages and semi-settled areas. The population of the White Nile State in 1998 was around 1,401,895 persons, about 5.8% of the total country population .Those who live in rural centres were 474,682 (39%),those in the rural area were 900,437(64.2%) and the nomads 26,776 (1.9%). The most important tribes are Gemme, Bagara, Seliem, Hassania, Ahameda, Shekhnab, dar moharb (Sabaha and Bini Grare) Shwiahat, Most of the population practicing in the field of traditional farming and grazing, while a few of them practiced trade. The study area lies within two distinctive climatic seasons, the dry warm winter and hot moist summer. The Climate of the area is characterized by a relatively long dry season and a short wet season and the rain ranges from 150 mm/annum in north to 500mm/annum in south. The mean annual rainfall ranges between 200- 300mm and within this range, rainfall increases south words (Gaiballa and Farah, 2004).

METHODOLOGY:

Three false colour composite (FCC) subsets images from Landsat TM and ETM dated (1995, 1988 and 2008) covering the study area (400 Sq hectares for each zone) were used in this study. The fieldwork was conducted during the period 25 to 25th December 2008 aided by GPS receivers (Garmin 12XL). Radiometric and image to ground points geometric corrections were conducted. Global Positioning System (GPS) was used to locate the position of the check sites. Interpretation strategies were applied depending on satellite image interpretation and morphological and differences physical properties (colour, texture, structure…etc). Geo - referencing was used to correct and adapt the land sat image geometrically, so that they had comparable resolution and projection as the other data sets. The geometric correction was executed by a first order transformation (affined transformation). Image to image model was used to correct the other images. The Visual interpretation, Change detection, supervised and unsupervised classification was used to classify and define the feature on the satellite imagery. Contrast enhancement, global enhancement and linear Contrast Stretching were used. GIS analyses were used to analyze and recalculated the changes.

RESULTS AND DISCUSSION:

Visual and digital image interpretation for Zone 1 showed clearly changing forest cover over the period 1988 – 2008. Vast clearance of forests occurred as from 1988 to 1995 indicated by observable difference between the results of year 1988 and year 1995(see figure 1). The major parts of forests extending over the north western and north eastern areas of Zone (I) showed in the classified image of year 1988 have disappeared in 1995 as indicated by the classified image of year 1995. However, some factors in favour of forest recovery might have taken place during the period 1995 – 2008. The forest area lost during 1988 – 1995 has recovered as forest during 1995 – 2008. Figure (1). Indicates that there was increasing areas of scattered trees and shrubs as from 1988 – 1995 and then the area of the scattered trees and shrubs category declined during 1995 – 2008 while Figures (2) and Table (1) showed that the forest cover category declined during 1988 – 1995 and then increased again during 1995 – 2008. The scattered trees and shrubs area was increasing over the period 1988 – 1995 and then decreased during 1995 – 2008. Figure (2) and table (1) show that the agriculture land use in Zone I increased during 1988 – 1995 and the decreased during 1995 – 2008 following the trend of scattered trees and shrubs. On the other hand the bare land decreased in area as from 1988 – 2008. The Result showed that the total area of forest and scattered trees and shrubs In Zone I in 1988 was (90.45 and 74.88 = 165.33 hectare) and at 2005 was (91.98 and 93.78 = 185.76). The net change in forest and scattered trees area during the period 1988 – 2008 was then a positive change of 20.33 hectares resulting from (185.76 - 165.33 = 20.43 hectares). The change in agricultural and bare land area was negative and equals to (20.43) hectares equivalent to the positive change in area of the forest and scattered trees and shrubs area. This compatibility in forest cover change and agricultural and bare land change is an indication of land use areas exchange between the two groups of categories. The trends of changes in Zone II is to some extent different from that of Zone I. Figure (3) and Figure (4) show that the forest cover change in Zone II increased during 1988 – 1995 and the slightly decreased during 1995 – 2008. On the other hand the scattered trees and shrubs indicate a continuous increase as from 1988 - 2008. Table (2.) confirmed these trends of forest and scattered trees and shrubs changes in Zone II. However, the forest cover area is very small compared with the area of the scattered trees and shrubs. The agricultural land area over the period 1988 – 2008 did not show large change, indicating a decrease from 181 hectares to 176 hectares during the period 1988 – 2008 but clearly obvious that the bare land area has decreased from 118 hectares in 1988 to 45 hectares in 2008. Figure (4) indicate the net change of cover of forests and scattered trees and shrubs categories is positive and is equal to (78.58 hectares) as obtained from table (2). The net change in the area of agricultural land and bare land is on the other hand negative and equals to (78.58 hectares) table (2). As shown for the case of Zone I, there is also compatibility in forest cover change and agricultural and bare land change and that is an indication of land use areas exchange between the two groups of categories. Result of Zone III is to some extent similar to that of Zone II. Figure (5) and Figure (6) showed that the forest cover change in Zone III increased during 1988 – 1995 and then decreased during 1995 – 2008. On the other hand the scattered trees and shrubs indicate a declining trend as from 1988 - 2008. Table (3) confirmed these trends of forest and scattered trees and shrubs changes in Zone III. The agricultural land area on the other hand indicates an increasing trend over the period 1988 – 2008 while the bare land area seems to show limited change. The net change of cover of forests and scattered trees and shrubs categories in Zone III is on the other hand negative and is equal to (25.39 hectares) as obtained from table (3). However, the net change in the area of agricultural land and bare land categories taken together is positive and is equals to (25.39 hectares) also obtained from table (3). For the case of Zone I and Zone II the net changes of forests and scattered trees and shrubs categories was in both categories a positive, but for the case of Zone III the change was negative. However, there is also compatibility in forest cover change and agricultural and bare land change and that is an indication of land use areas exchange between the two groups of categories. Table (3) indicates that forest cover changes in Zone III is different from that in Zone I and Zone II in that the forest and scattered trees and shrubs areas are declining and the lost area goes for agriculture.

CONCLUSION AND RECOMMENDATION:

The study revealed different signs of land degradation in the study area due to drought, climate change and miss managements. These changes indicated decrease in vegetation cover and trees productivity, decrease in vegetation cover, expansion bad management from the government around and inside the study area. These signs could be revised with the use of vegetation indicators. Land degradation as reduction in biological productivity can be interpreted from vegetation cover in the study area. The classified images and the represents clear indications of the land use exchanges. These analyses indicate the strong relations between forest cover changes and land area clearance for agriculture. The land area balance for forest and scattered trees and shrubs categories is in all cases equals to the land area balance for the agriculture and bare areas land.

Based on these finding the following recommendation can be stated:

1. Adoption of development policies popular landscaping.
2. Developing national policies for grazing and forest protection.
3. Encourage people to work for the protection of the natural environment
4. New policies and practices of in the field of forest monitoring and management should be adapted by the government.

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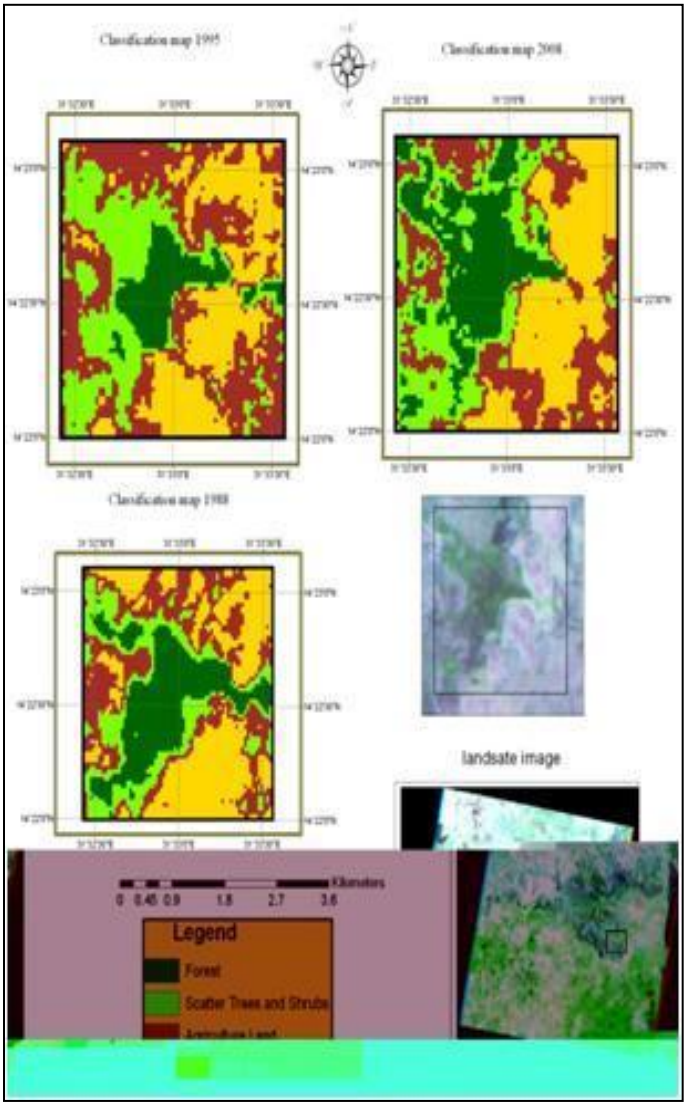

Figure (1). Classified Images, Zone I

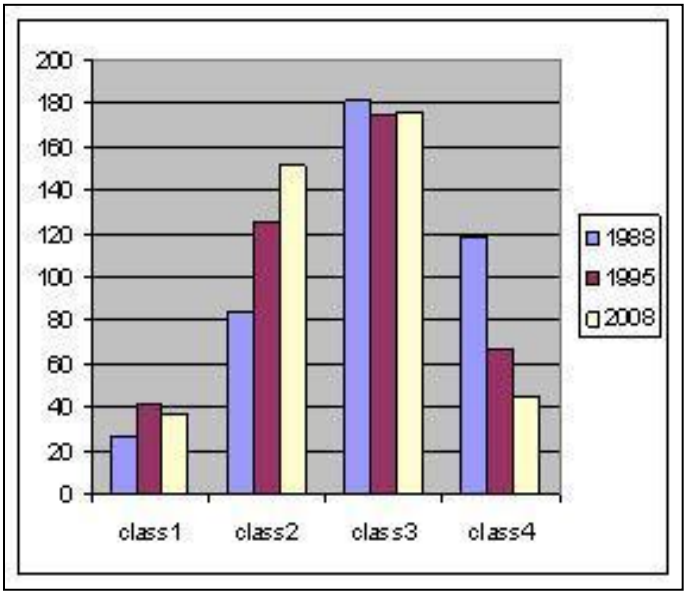

Figure (2) land use areas 1988 – 2009 Zone I

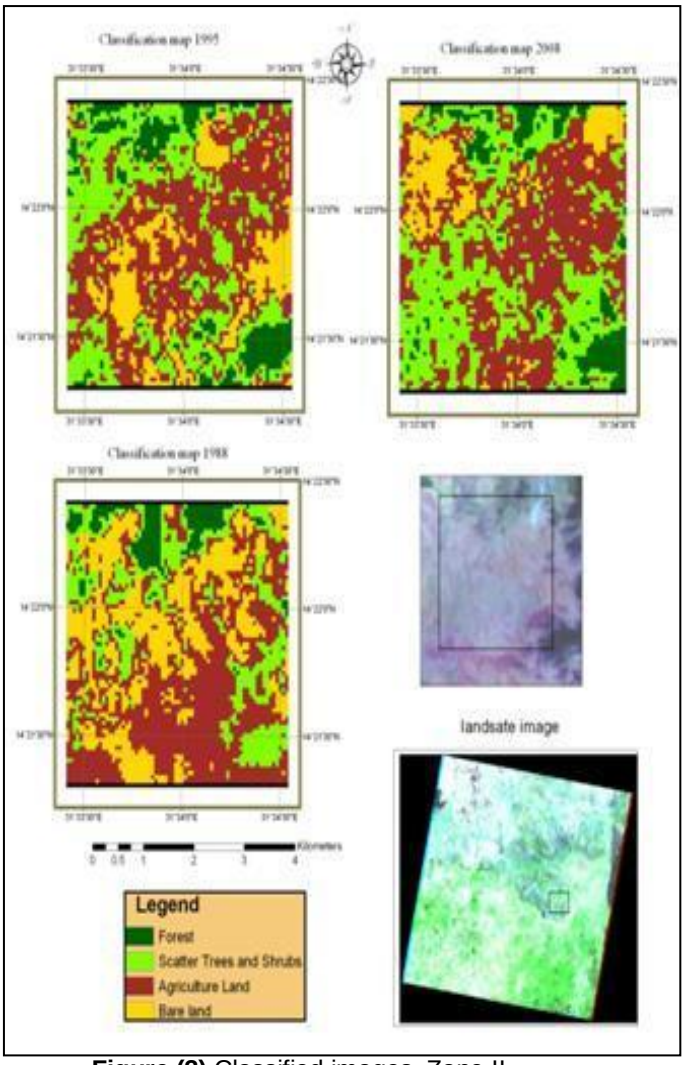

Figure (3) Classified images, Zone II

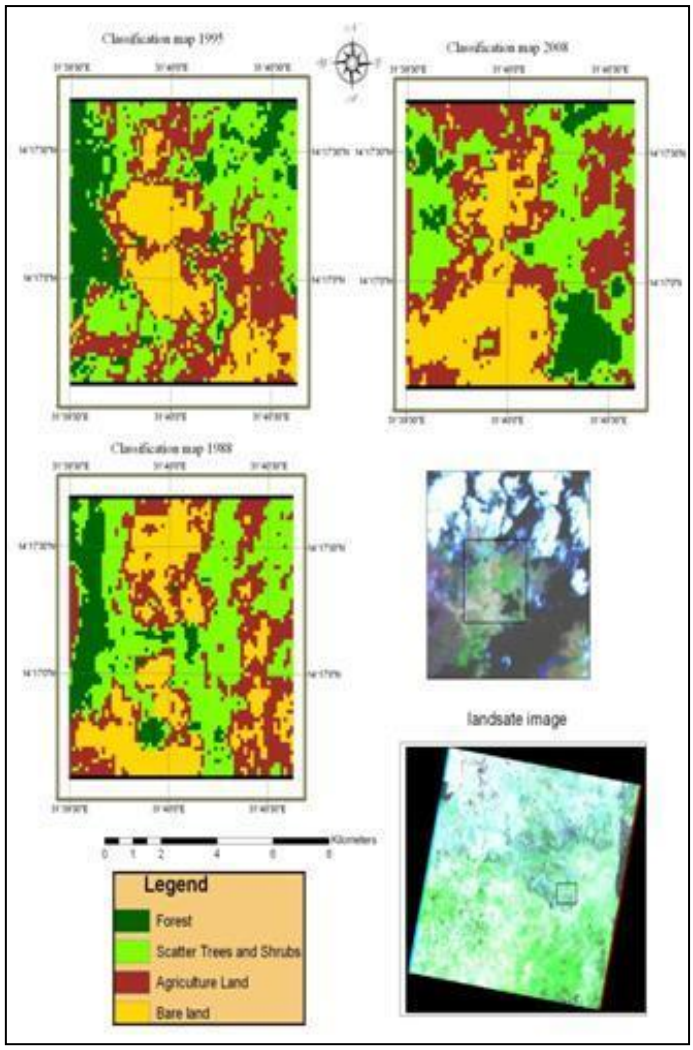

Figure (5) Classified image, Zone III

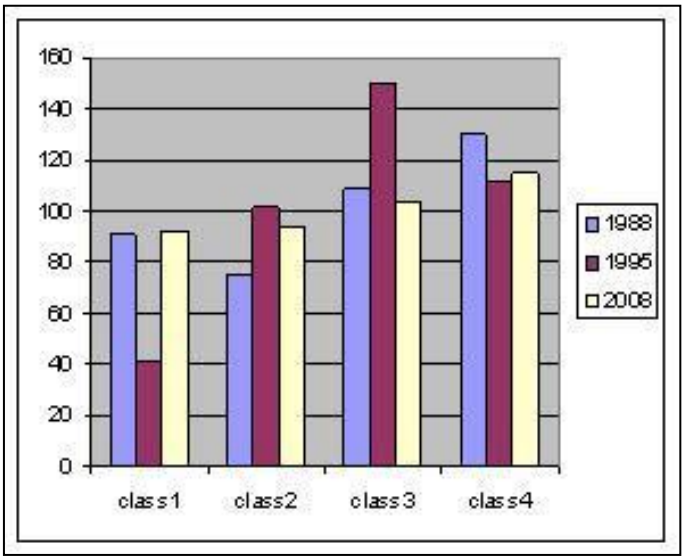

Figure (4) land use areas (1988 – 2009) Zone II

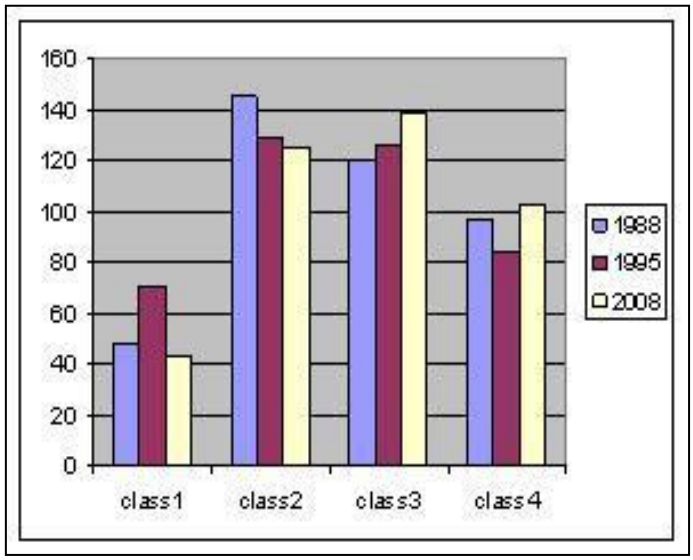

Figure (6) land use areas 1988 – 2009 Zone III

TABLE 1.
LAND USE CHANGES OVER THE PERIOD 1988 – 2008, ZONE I

	1988	1995	2008	
Class 1, forest, area in hectares	26.46	42.3	37.35	
Class 2, Scattered trees and shrubs in hectares	83.88	125.64	151.56	
Sub-total class 1 and 2 areas	**110.34**		**188.91**	**+ 78.58**
Class 3, Agricultural land in hectares	181.35	174.87	176.04	
Class 4, Bare land in hectares	118.35	67.23	45.09	
	299.70		**221.13**	**- 78.58**

TABLE (2)
LAND USE CHANGES OVER THE PERIOD 1988 – 2008, ZONE II

	1988	1995	2008	difference
Class 1, forest, area in hectares	90.45	41.13	91.98	
Class 2, Scattered trees and shrubs in hectares	74.88	101.34	93.78	
Sub-total class 1 and 2 areas	165.33		185.76	+ 20.43
Class 3, Agricultural land in hectares	108.63	150.12	103.41	
Class 4, Bare land in hectares	130.05	111.42	114.84	
Sub-total class 3 and 4 areas	**238.68**		**218.25**	- 20.43

TABLE (3)
LAND USE CHANGES OVER THE PERIOD 1988 – 2008, ZONE III

	1988	1995	2008	difference
Class 1. forest, area in hectares	48.06	70.47	43.92	
Class 2, Scattered trees and shrubs	145.35	129.6	125.10	
	193.41		**168.02**	**- 25.39**
Class 3, Agricultural land in hectares	119.79	125.82	138.51	
Class 4, Bare land in hectares	96.84	84.15	102.51	
	216.63		**241.02**	**+ 25.39**