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The Application of Remote Sensing Technique to Verify Changes in Landscape due to Exploration Activities.

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Abstract
Detecting and analysing landscape changes is of great values firstly for environmental monitoring and secondly for huge administrative purposes. This study, gives an insight on how remote sensing can be used to ascertain the extent of mineral exploration in the said locality. Many remote sensing methods are presently adopted for analysing multi-temporal changes but the approach used here is simple and could be interpreted by anyone. The first approach is visual interpretation of two remotely sensed images after all correction and enhancement supported by manual digitized polygons and the second is the variations in the spectral attributes of selected features after image sharpening. The last approach used is the unsupervised classification of the selected features whose result is in consonance with the initial analysis conducted. The result shows that remote sensing is not merely scientific manipulations but also it is the realities of our daily human activities.
Keywords: Structural Deformation, Kinematic, Kalman Filter

1.0 Introduction:

Over the last two decades, Remote Sensing approach in accessing and addressing environmental issues have improved so much. The visual interpretation of several spectral characters is a possible way of interpreting geological features every band in the electromagnetic spectrum depicts a certain character [1]. Multi temporal radiometric rectification with a physically based reflectance analysis is practically adequate to interpret features as covered in the satellite imageries after all radiometric control spectral and spatial enhancement. Temporal changes in any physical domain exert the propensities to depict its features according to the influences as exert by reflections and absorptions [2].

For this study, Auchi in Edo State, Nigeria area was used. This areas under review are basically surrounded by heavy deposit of limestone and other mineral resources. There is both legal and illegal exploitation of these resources' especially the open cast blasting of limestone at the detriment of the communities in these areas. There are over 12 communities all on heavy mountainous terrain with so many companies including not licensed doing blasting. The resultant effect is a menace which calls for an urgent review.

Fig 1.0: Map of Nigeria Showing Edo state

2.0 An Overview of the Study area:

Since it was not possible to go to the study site, the goggle earth was used as an instrument in achieving the unsupervised classification. The land cover features of interest are: Areas of opencast blast, Settlements, Existing Roads and Rocks.

These features were identified on the Google earth and their geographical co-ordinates picked. Prominent point like the river Niger was also identified to be used for visual interpretation. Unsupervised classification is based mainly on the clustering ability of the Erdas Imagine software based on already identified features.

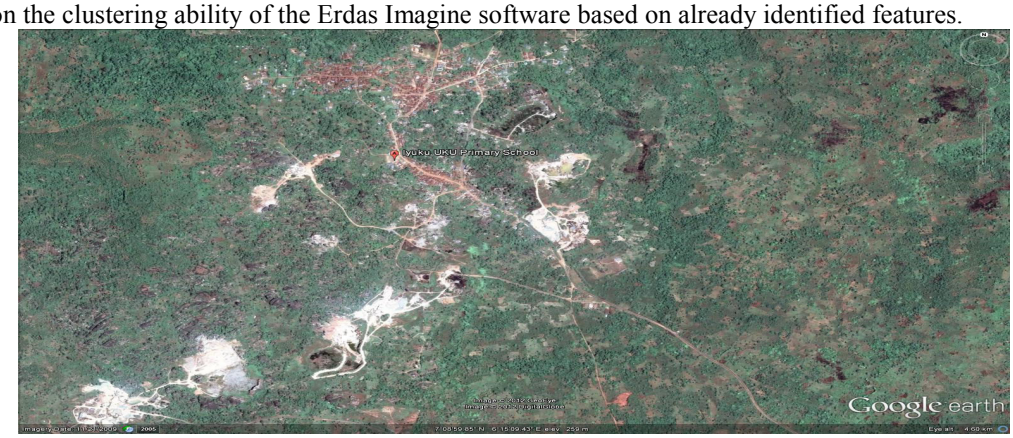

Fig 2.0: Download of Satellite Imagery:

Obtaining the satellite imagery for this area was actually a problem. I had to place an order from the USGS website which took three days to come. Two imageries used for the study are 1987 and 2001 respectively. Coincidentally, 1987 is about the period industrial activities actually commenced in the study area. The images were first copied to desktop and a new folder created in my university space.

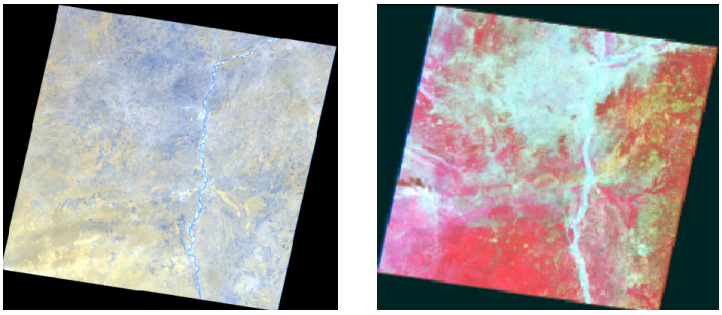

Fig 3.0 Satellite Image of the study area for year 1987, 2001

3.0 Image processing

Stack Laying was used to add the bands into one image. Images were left as dynamic subset to have a clearer view. In the image reduction, Haze reduction was used to bring out the particular area of interest as shown below:

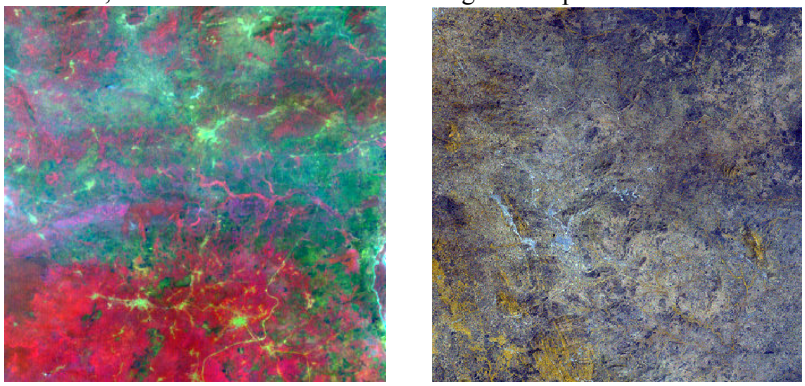

Fig 3.2: Reduced Image of the study for 2001 and 1987

3.1 Image Correction and Enhancement

This is to ensure that both satellite images are interpretable, making the areas of interest more visible for visualization. This is performed such that the areas of open cast blast are clearly understood. The characteristics of imaging remote sensing instruments operating in the visible and infrared spectrum region can be summarized

in terms of their spatial, spectral and radiometric resolutions.

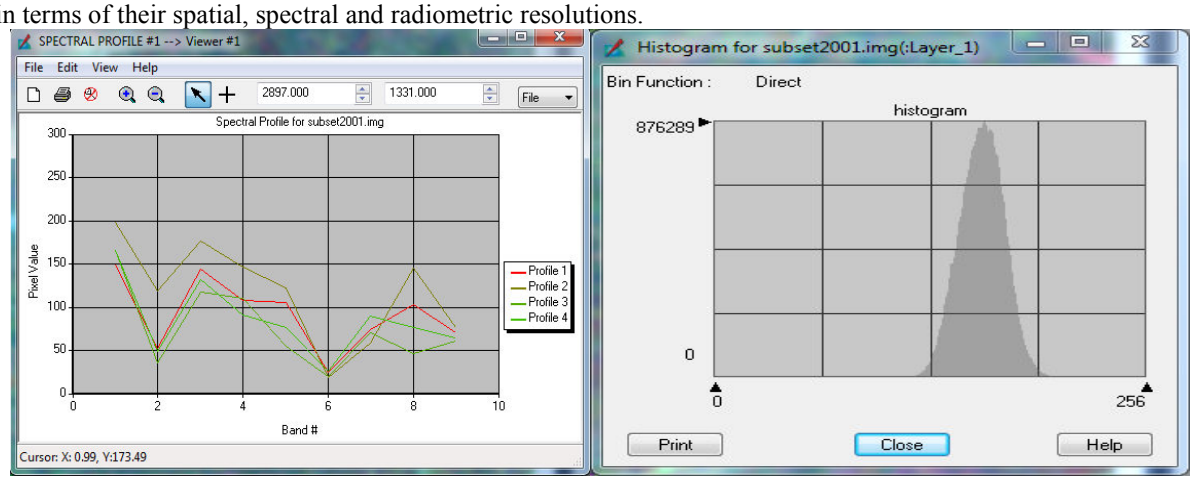

Fig. 4.0 Spectral Profile and Histogram for 2001 Satellite Image

The spectral value is the wavelength interval which helps to identify features through colour separation in the electromagnetic spectrum. It denotes the frequency of change of an object. Rebecca et al [3].

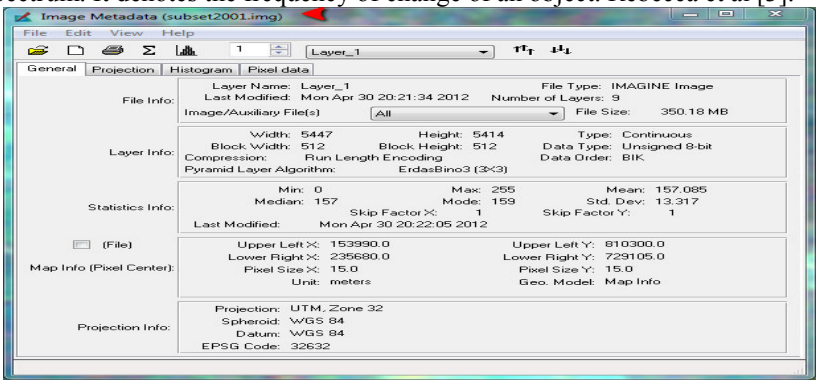

Fig 4.1 metadata for subset 2001 Image

Spectral profile, histogram and the metadata of layer 1 of the 2001 image showing the spectral properties of the 4 selected features in the study area on layer one.

3.2 Spatial Value:

This is the degree of change in the image DN value as relative to distance. It enables us to interpret the linear separation between pixels as they are in the real life perspective which will help me to differentiate between the areas of the open cast blast from other areas. Band 1 always had the highest values in all the features.

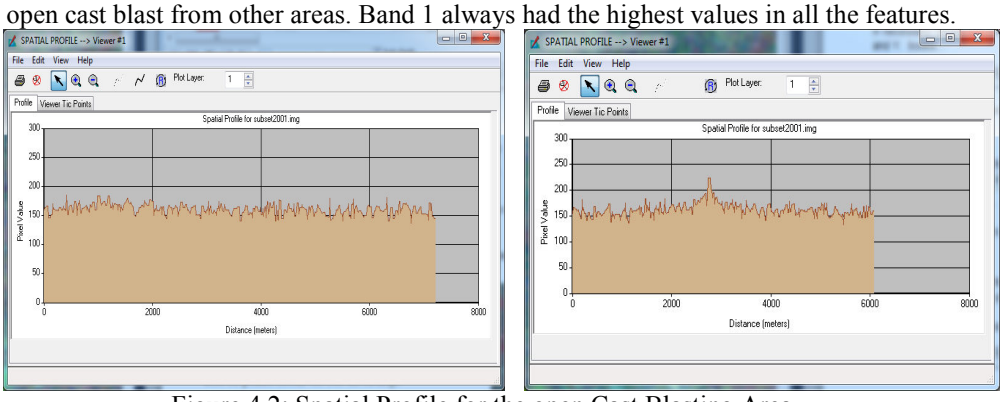

Figure 4.2: Spatial Profile for the open Cast Blasting Area

The original band combination of 4:3:2 (RGB) false colours were changed to 5:3:2. Increasing the Red by one band is to bring out the area of blast and rocks. The only spatial enhancement tool applied is the quick low-pass filter to reduce the high frequency noise. This is true because we analyse features with wide margin in contrast Ryo, Zhiben and Bing [4]. The was no any Normalised Difference Vegetation Index as all the vegetation is already covered by open cast blasting and rocks.

3.3 Visual Image Interpretation

From the digitized polygons and the side by side link of both images above, the following inferences is deduced. There is no evidence of industrial activities as at 1987 and Auchi town is expanding toward the North – east.

Areas of open cast blast appear as white on both satellite images and confirmed using coordinates from the Google earth. There is clear evidence of settlements right inside the areas of open cast blasting. What looks like yellow inside Auchi town in the 2001 and whitish in the 1987 is actually a mining site. This implies that as at 1987, mining was already going on in Auchi town. Arrows shows area characterised with mining acticities.

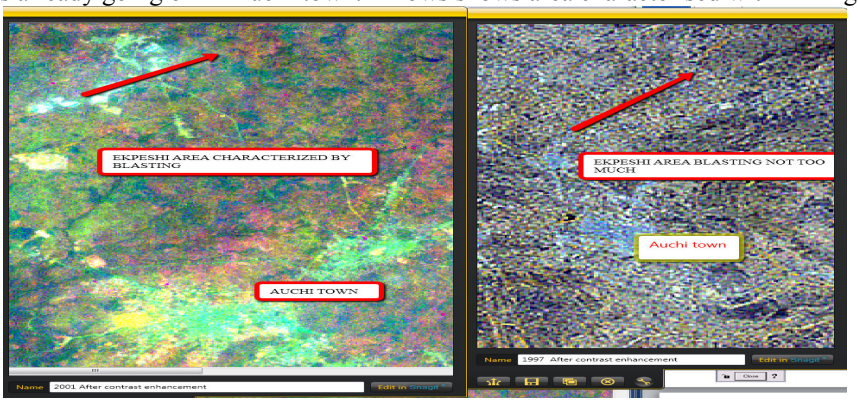

Figure 4.3: Visual Image

3.4 Image Sharpening

To investigate the fact presented above, image sharpening was carried out which helps to enhance the temporal, spatial, radiometric and spectral qualities of features. We performed the IHS –RGB transformation as it helps to reveal more details not easily understood in the previous image formats. Compares is made between the transformed image and the original image.

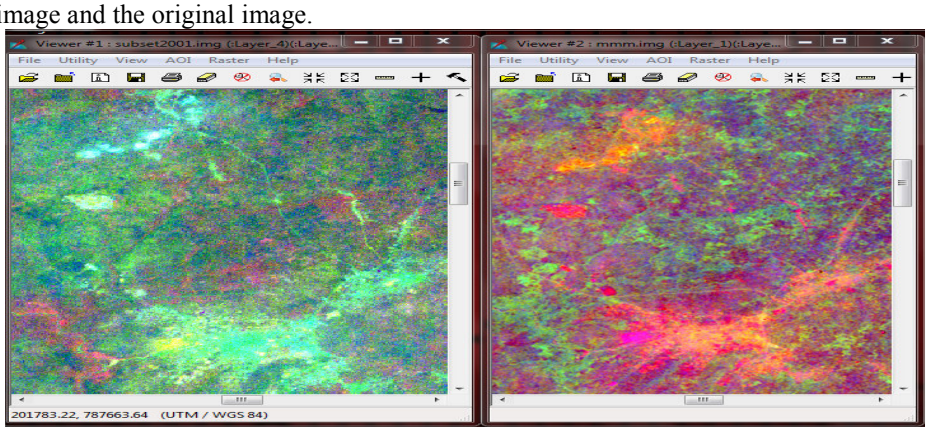

Figure 4.4: Image sharpening

It is very obvious that the area of interest (open cast blast) is evidently more pronounced on these false colours. These areas now appear as whitish yellow against the red background. The 2:3:4: layers were layed.

3.5 The Unsupervised Classification

Digital numbers of features gives similarity according to their spectral classes. Results from the unsupervised classification approach is estimated from the categorization of land cover features; thereby rendering it for possible evaluations Sylvie [5]

Both the gray and the approximate true colours for both years were supervised. For 2001, 4:3:2 on 4 classes on gray and 5:3:2 on 6 classes for approximate true colours. 1987 has 4:3:2 combinations on 4 lasses and 6 classes respectively.

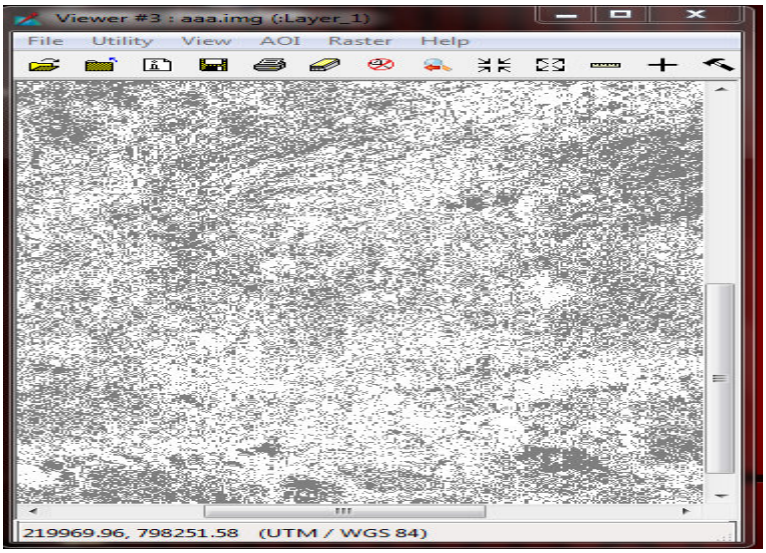

Figure 4.5: 1987 Image on greyscale colour scheme

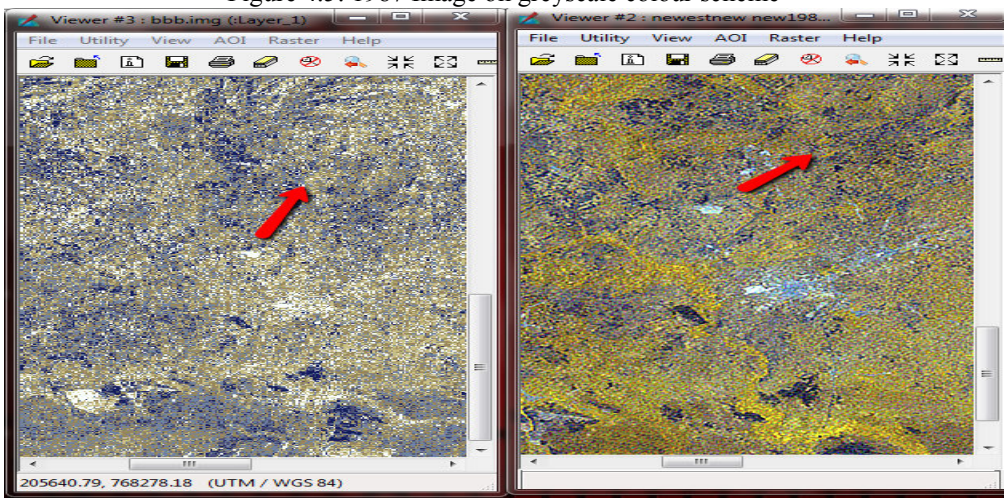

Figure 4.6: 1987 grey scale colour on initial colour combination.

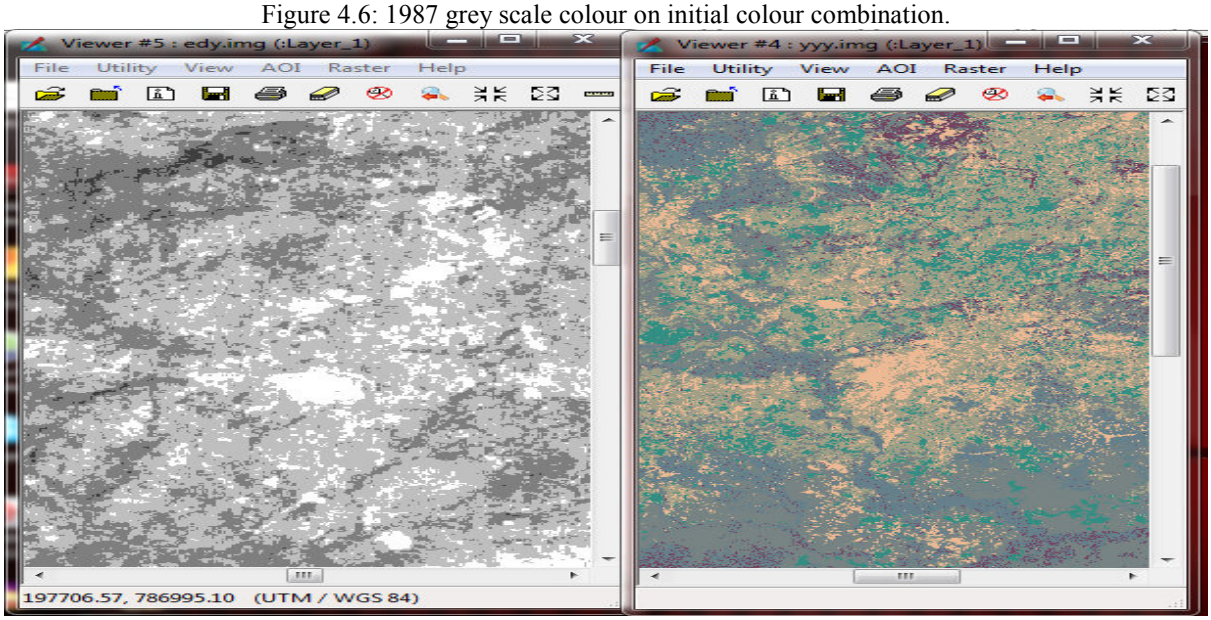

Figure 4.7: 2001 Image Grey Scale/ Approximate True Colour

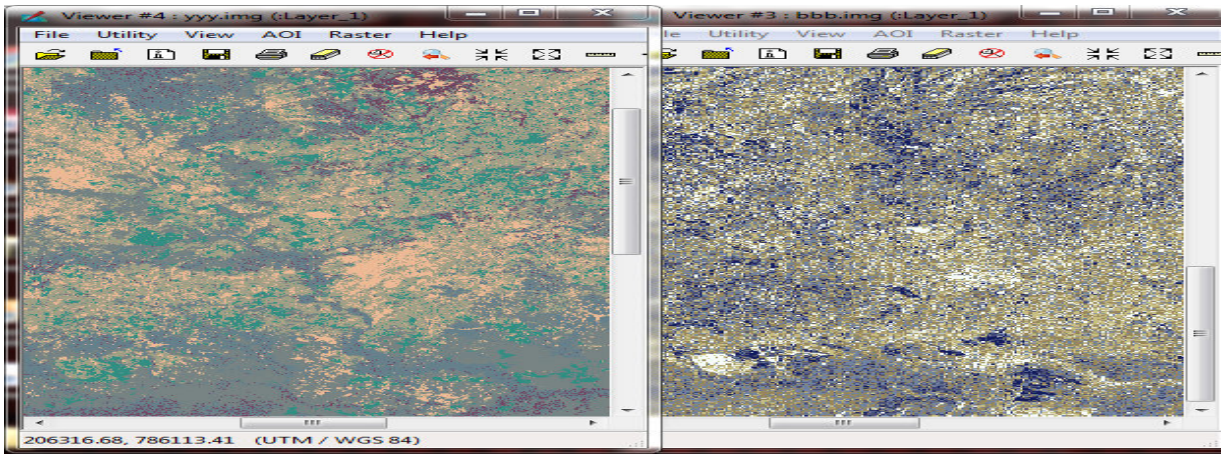

Figure 4.8: Compares on both years on their approximate true colours.

3.6 Discussion

In 1987, there is an almost clustering of features out of the spectral order as compared to the 2001. In closeness, the colour signature indicates it is not as a result of contrast or variations in the colour combination. This analysis would have been clearer assuming the Landsat 7+ was used for both years. Even with the band difference, there is still clarity in the features display but a sharp variance on their surface properties. This further proves that a very big change has occurred in the area of study. Also in 2001, there is an inward clustering which depicts the fact that there is common activity going on. We all know that in areas of open cast blast, there are always particles in the air. The colour of this particle depends on the kind of material been removed. At this instance, limestone is very whitish which has an overwhelming effect in the neighbouring community. The unsupervised classification has also confirmed the mean spectral values as initially displayed before all corrections and enhancement. Despite this success by the unsupervised classification, we still strongly believe that it did not give a strong deviation between the mining areas from other surfaces. In future I hope to carry out this study again with the following inputs:

Conclusion

From all the results as obtained above, it is now very clear that open cast blast activities in the study area is on a high rate. We have been able to show too how close these activities are to human settlements. Judging from the unsupervised classifications, there are likely hood that these substances remitted into the air can have a proportional interface with any close surface.

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