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AUTOMATED DISCRIMINATION BETWEEN BUILT-UP AND NONBUILT-UP AS A SETTLEMENT DETECTION TECHNIQUE FOR POPULATION CENSUS BASE MAP REVISION

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ABSTRACT

Population Census of a country is ideally retaken every ten years, and base map revision for it is indispensable. Space data is improving in spatial and spectral resolution; this improvement offers a range of data processing possibilities with the ever improving software packages for map and image data integration, which offer possibilities for spectrally separating rural settlements from terrain features which are not settlements yet spectrally similar, for example: bare rock surfaces, excavations, fresh bush-clearings for agriculture, etc.

Imagery and map features interpretation of land cover features can be logically done by first establishing the relevant characteristics in map overlays, which could be queried to differentiate the different cover types with a purpose to identifying settlements and non-settlement areas. This will facilitate the use of satellite images for auomated settlement inventory of those which post-date the last census base map.

1 INTRODUCTION

Built-up is a global term which covers such man-made features as buildings, roads, and pavements, open spaces which are concrete floors, hard beaten laterite/clay grounds. The surface of roads ranges from asphalt, bitumen, to compacted laterite materials. The settlement as a whole usually shows an image of heterogeneous land surface condition which out across the spectral signatures of most typical earth surface features.

In the traditional African landscape farm plots, rural settlements appear spectrally similar with natural features like rock outcrops, eroded soils, excavated ground, exposed soils (freshly cleared for cultivation/harvested). Image identification of settlement in such circumstances will involve more than spectral analysis. Other image criteria such as shape, size, pattern/internal structure site, and associative information will be required to identify the particular feature. Computer-assisted image interpretation of the traditional African landscape will require that the collateral information be organised into geometrically restituted layers to facilitate selective overlaing of the restituted collateral information to assist in finding the clue to the identity of the feature.

One way for finding an automated way for separating non-settlement associated features from settlement features will involve among other things using digital base map, using the base map as reference for geometrically tranforming the satellite image to be used for the feature identification, using the map layers and the image as tiff for on-screen identification through the process of elimination keys.

The presentation here is the part which covered the conversion of the existing analogue base map to digital map and the use of the layers as the collateral information, thematic classification of the satellite image for settlement associated feature enhancement and use of all these as tiff layers for the automated interpretation.

The zone of the study has varied topography developed also on different rock types within the Basement complex. The humid tropical forest has been heavily modified by human activities. The complex traditional cultivation patterns, superimposed on the equally complex rock cum soil types, present incidents of high spectral confusion. The data used for the study were analogue base map, SPOT XS data.

2 GEOMETRIC TRANSFORMATION

The critical problem of this task was the selection twelve well distributed ground control points which appear in both the image and in the base map. The map, compiled in the 1960s is over thirty years out of date in relation to the SPOT data of the image. Roads (road intersections) which serve as the most dependable ground control points have changed over the thirty years as a result of rebuilding. Road and stream intersections are another class of reliable ground control points, however in the image the stream is not a line but a corridor of riparian vegetation, consisting of areal distributin of many pixels in the same spectral class making it difficult to select a precise location of one pixel value. Two alternative solutions are possible: one is the use of a Global Positioning System (GPS), to collect from the field the needed control points; the other is a manual approach in the use of photographic product of the image as an underlay to the topo map and manual transfer of the current information from the imge to the map. The manually revised map can the be used as the reference for selecting the ground control points for the transformation. The two methods were used on trial basis.

3 DIGITAL CONVERSION OF THE TOPOGRAPHIC MAP

The topo map which served as the collateral information was digitised using the ILWIS software (ITC). The work was limited to one standard topo sheet (Ilesha NE). The thematic layers digitised were the contours, the

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hydrographic, roads, transmission lines, and settlements (point and area features).

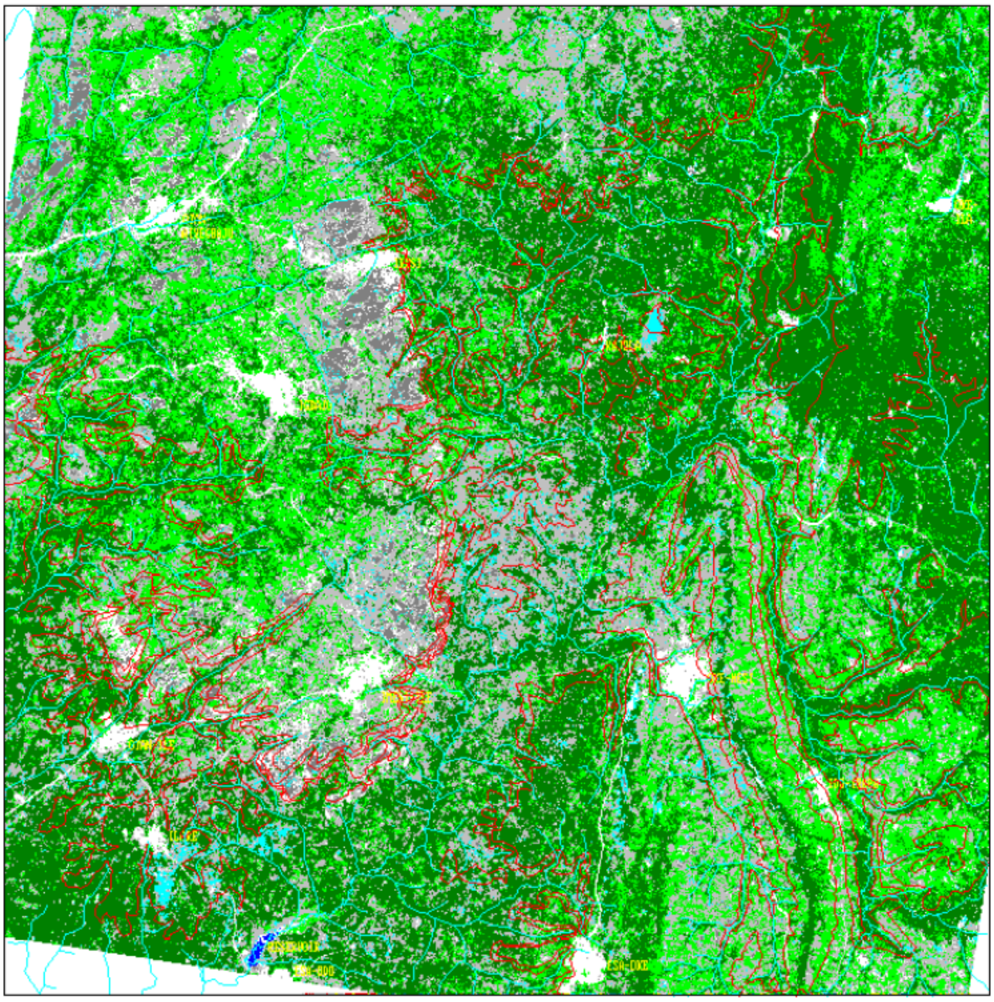
4 PROCESSING OF THE SATELLITE IMAGE

Using the Desk-Top equipment as the most practical outfit in the African conditions, a project of this type can be at the level of a map sheet (27.5 x 27.5 km) of the 1/50,000 scale. This takes approximately 3 x 3 subscenes of SPOT or LANDSAT TM for mosaic of prints on A4 format at 20 cm x 20 cm. The 9 subscenes could then be mosaicked to fit the frame of the map sheet. This is the document which serves as the underlay for the manual revision referred to above.

There is however the need for more regourous digital processing techniques such as band ratioing, filtering, and pixel classification for separating the objective features from the ones not needed. For this work the pixel classification presented visually a better rendition of the settlement and associated features. The classified image served as the tiff image ovelaid with the digitised base map layers. Having achieved this vector and raster data overlaying and integration the result was imported into Freehand environment for the automated interpretation using the zooming function for close-viewing for clue finding.

Map Sheet Scene of Ilesha NE (Nigeria)

Vector Data: Contour and Hydrography digitized from the Topo Map of Ilesha NE
Raster Data: Geometrically transformed SPOT-XS



Scale: 1/150,000