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Mapping of Soils of Ikot Ekpene Area of Akwa-Ibom State: A Remote Sensing Perspective

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Abstract: Information on soil characteristics and terrain form is essential in the description and mapping of soils within identifiable mapping units. A total of 8 pendons were prepared and sampled, in the study area, using the USDA guide lines. Topographic maps of scale 1:1000 and colour aerial photographs at a scale of 1:7000 were used. Field observations recorded roots, soil texture and organic matter. An inventory of the land forms which included topography, slope vegetation and land use, was also carried out. Clay contentes increased with depth, while this was the reverse with sand. ECEC ranged from 3.50-12.05. There was a general decrease of organic components from the top to the bottom of the profiles.

Key words: Mapping of soils, characteristics, USDA, ECEC, Ikot Ekpene, Akwa-Ibom State

INTRODUCTION

Soil survey is one of a group of activities collectively known as natural resource survey (Young, 1976). Soil survey equips the user by means of a soil map and report, to answer questions about the soils of an area with less trouble than one would have done without them (Eswaram, 1989). In Ikot Ekpene area of Akwa-Ibom State, there is a dearth of soil information, consequently most of the needed soil data are not available. Remote Sensing technique, is one of the most important new and emerging technologies, which are rapidly expanding and will greatly enhance the productive capabilities and wealth of those nations making appropriate investment of them. Remote sensing techniques in soil survey, aid in the production of maps of areas of land, in such good detail that involves physiographic features, i.e., field boundaries, isolated tree clumps, clumps of bushes, rock out crops, buildings and plant cover, which cannot be shown on base maps in infinite details. Eepema and Ben (1994), used spatial variabiltiy of field reflectance as a basis for deriving soil surface characterisitics in an area, during intensive observations at 3 characterisitic locations, from multistage remote sensing data in Nigeria.

Lekwa used Remote Sensing tools to determine farm size holdings in rural areas of Sokoto state. For this study panchromatic aerial photographs of scale 1:25,000 and maps of scale 1:50,000 were used. In another study, Bethel (2003) used remote sensing tools for identifying sodic and calcerous soils, in Southern Idaho, wheat fields. The research tested the effectiveness of remote sensing in soil studies and also developed an image based technique for soil sampling, that was more accurate, effective and efficient than traditional grid sampling. In Iowa, soils were noted to be highly variable, with wide ranges in clay content and soil drainage classses, Meyer and Lyons (1975) and for this study, remote sensing tools (Geonics E.38), were used to obtain readings from soils. FAO (1999), carried out a geomorphological investigation of the Chad Basin, North Eastern Nigeria. This was done using the analysis of panchromatic aerial photographs. Soil analysis of these areas showed very low infiltration capacity.

The deflation basins were well discriminated. Through visual interpretation of aerial photographs, maps of the study area were produced. Using Digital Terrain Moels (DTM), Harmsworth (1995), carried out an automated mapping of soils in a hilly terrain, in New Zealand. Medium Resolution Digital Terraing Models were combined with Soil Land Scape Models to map land forms and soils automatically, by exploiting the close relationship between soils and topography. It was noted that this reduced the times spent in the field. It was also rapid and cost effective, especially for large areas.

The soils of the Ikot Ekpene area of Akwa-Ibom State are loose and highly weathered, but support intensive agricultural activities in the agroecological zone. Some other problems which could result in low productivity, can be ameliorated through the application of both organic and inorganic fertilizer. Structural and other physical limitations can only be ameliorated through proper management practices.

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The objective of this study was to, apply remote sensing in the survey of soils of the study area. The aim is to, produce a soil map of the study area and characterize representative soils in the study area. Well executed soil surveys, needs to be seen in relation to the over all developtment of a project. The perceived expense of soil surveys causes the exercise to be over looked leading to costly mistakes. The ultimate purpose of a soil survey is to supply information, which assists in decision making.

MATERIALS AND METHODS

Location and physical features: The study area is located between longtitude 7°33[1] East and Latitude 5° and 35[1] North. The physical relief of the area is basically flat, though places as high as 300 m above sea level exist. Climatic conditions are those typical of South Eastern, Nigeria and charactrerised by bimodal rainfall. Annula rainfall ranges from 1712-2000 mm. Average daily temperature is about 32°C. Vegetation is of the heavy rain forest type. What is left in most places is secondary forest and derived savannah. Dorminant vegetation is herbaceous plants, greeen trees, foliage, shrubs and oil palms.

Maps: Aerial photographs of scale 1:7000 of 1986 and Topographical maps of scale 1:1000 of the same year were used.

Field work: The study area was subdivided into relatively homogenous ecological units each characterised by vegetation type. The criteria used for soil boundary delineation were those that were visible in stereo images, that have relation to soil conditions. Sample Area Technique was adopted to check the adequacy of air photo interpretation in the field. Field survey operations carried out included auguring to 150 cm depth. Random auguring was carried out. Eight profile pits were dug and 39 soil samples were taken. The profile pits were examined on the fields.

Laboratory analyses: Thirty nine soil samples were collected from 8 profile pits. The horizons of each profile were quantitatively sampled in the field. Soil samples were air dried and passed through a 2 mm sieve. Parameters analysed include the following: particle size and analysis, soil ph, electrical conductivity, caiton exchange capacity, N, P and total K, mg, total carbon, OC and OM. Routine lab analysyis was carried out at the soil laboratory of the National Root Crop Research Institute, Umudike, in Abia State.

Air photo interpretation: This involved visual analysis of air photos at a scale of 1:7000. These photographs were arranged in over lays and a transperency placed over them. Soil unit boundaries were traced out using the contrast method. In this method soil units adjoining one another were contrasted for boundary recognotion based on the reflectance of features identified. The principal operation was to differentiate between soil units and the basis of the criteria were those feature observable on the imagery.

The study area occupies 92 ha of land. Three mapping units, 1, 2 and 3 were deliniated in the study area. In general all the pits were deep and at the time of sampling, were poorly drained. Colour differences were not high in the horizons. Only soils of the top horizon (0-20 cm) were noted to be darker, this was because the top soils were areas of microbial activities. i.e., growth, rooting and organic matter decay. From observations, structural variations in all the mapping units are not significant. The little number of microbes that occurred below the top horizon suggested poor aeration, thus low fauna activities in the soils. All the soil mapping units were located on topography that is almost flat and thus falls into flat or concave relief and which according to Soil Survey Staff (1999), is characterised by very low run off or non-at all. The soils showed increasing clay content with depth in the subsoils. The surface horizons is the most clay deficient layer while the other profiles have been undergoing clay illuviation and developing argillic horizons. No coarse inclusions such as gravels or stones were encountered in the soils. All the soils were formed in loamy, fine loamy materials. The soils all had Ustic moisture regimes and CEC <24 cmol kg^{-1} clay, between 25 and 100 cm depth. Base saturation for the soils was 60%. The soils according to their mapping units 1, 2 and 3, were classified as imperfectly drained Udic kandiustalfs, imperfectly drained Kandic Plediustalfs and imperfectly drained Oxic Hapleustalfs.

CONCLUSION

Soils of the study area are moist for most parts of the year and in the rainy seasons they are water logged and flooded. The soils have been severly degraded by slash and burn agriculture, which is now practiced with shortened fallow periods due to high population growth. The efficient and effective management of these soils will ensure that the nutrient staus of the soils are maintained. The use of mole or perforated pipes could be used to drain excess water from the surface of the soils. Since, macro activity is absent in the lower horizon of the soils, ventilates could be used to introduce air into the soils,

thus making soil moisture available to the rooting zone. Other benefits that are derivable from proper drainage is an increase in the length of crop growing season and also making ploughing and planting easy. Delineation of soils was done based on air photo interpretation. It may be difficult to determine accurately soil types by using devices that are not in physical contact with the soils. The use of remote sensing technique and topographic maps proved to be a quick and effective means of conducting soil surveys.

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