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Assessment of rainstorm induced sediment deposition, gully development at Ikot Ekpene, Nigeria and the devastating effect on the environment

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HIGHLIGHTS

- Gully development at Ikot Ekpene Nigeria was studied.
- Field measurements were carried out in the watershed.
- The results were tabulated and analysed using erosion models.
- Soil loss and sediment detachment were estimated for different rainstorms on the catchment.

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ABSTRACT

This work focused on the assessment of rainstorm induced sediment deposition, gully development and the devastating effect on Ikot Ekpene watershed through the observation and measurement of rainstorm events and the physical parameters; rainstorm intensity, flow velocity, flow duration, kinetic energy of the storm, runoff flow discharge, etc. which are variables of soil erosion. This was carried out for eight (8) events recorded, measured and tabulated accordingly. Results showed that the degree of sediment deposition in the studied watershed was a function of the rainfall intensity and the speed at which the runoff cuts through the watershed, which is also a function of the slope of the catchment. These variables inadvertently built up the kinetic energy of the flow within the watershed for every event and affected the detachment, deposition and total soil loss of the studied gully area. The highest amount of storm was recorded on the 18/06 with the highest storm duration. Eventually this day recorded the highest of the other factors which included kinetic which was analysed with the energy equation proposed with Marshall and Palmer. These phenomena affect the environmental Geotechnics of the studied area and the other adjoining suburban and rural hubs within the state because the erosion rips into the major roads connecting the Ikot Ekpene to Umuahia, Aba, Uyo, Eket and Calabar as well as the cities accommodating the multinational business life in Akwa Ibo state.

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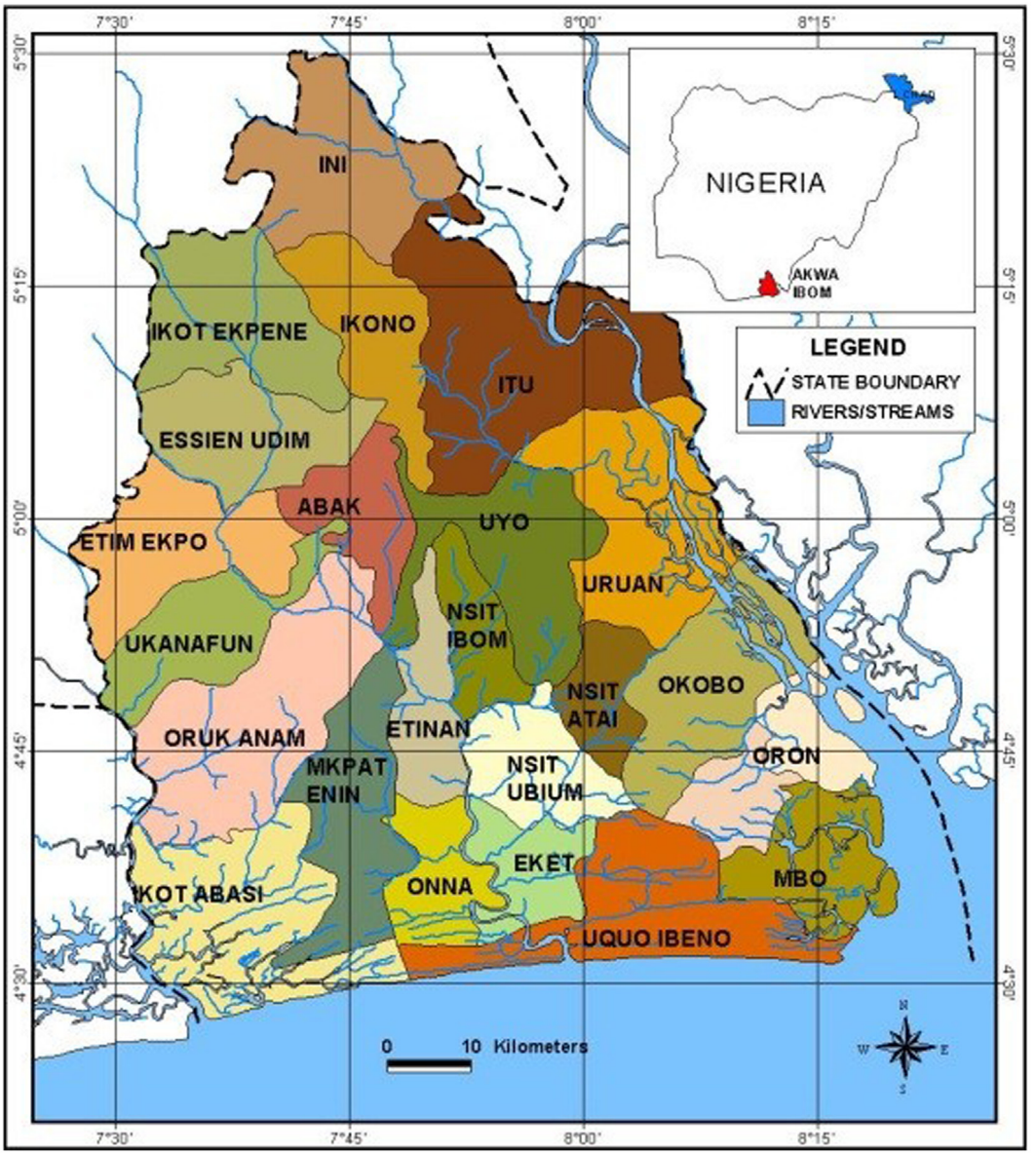

Fig. 1. GIS map location of Ikot Ekpene and the connecting urban centres in Akwa Ibom State.

1. Introduction

The susceptibility of the land areas in and around Ikot Ekpene to erosion and its devastating factors are responsible for the decision to study their effects on the socioeconomic and environmental outcry from the people living and doing business within and the connecting cities and suburbs (Ekong, 2017; Ezeabasili et al., 2014; Eludoyin et al., 2012; Obot and Abasifreke, 2014). Ikot Ekpene has a hub of agricultural, transportation link and industrial activities, which make the city a very important attraction for its environmental conditions, more importantly the development of gullies and channels around the city to be studied. Plane soil erosion development during rainstorm events is a multidimensional phenomenon resulting from particle dislodgement by raindrop force and plane surface flow and deposition (Salako, 2003; Ajebade, 2008; Nwilo et al., 2011), and sediment displacement, deposition and transport by rainstorm splashes and surface and overland runoff within a watershed (Zhang et al., 2017a, b; Zhang and Wang, 2017; Subramanya, 2008; Onyelowe, 2017; Saliu et al., 2006). Soil erosion minor-processes of detachment by rainfall and detachment by overland flow have been identified. Also, transport by rainfall, and transport by overland flow were equally identified by Meyer and Wischmeier (1969) as upland–lowland