

Ecological indicators in a derived savanna disturbed by oil spillage and vegetation fire in Nigeria

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Introduction Guinea and Sudan savannas covering about 546,400 sq. km., representing 60% of the entire Nigeria's land mass, harbor a significant proportion of Nigeria's population who are engaged mainly in nomadic and arable farming and are where a larger proportion of Nigeria's domestically grown food is produced. Oil pipelines that transverse these grasslands are frequently subjected to vandalization by restive youths which cause oil spillage and vegetation fire (NEST, 1991). This study examined the indicators of this growing ecological problem in Nigeria's savannah ecosystem.

Materials and methods The investigation was carried out in a community with a derived savanna vegetation near Ovim, Abia State, Nigeria where there was oil spillage and vegetation fire on a land area covering about 3 ha in 2003. Starting from the point of punctured pipeline 2 transects were cut perpendicular to each other and transversing the fire burnt area passing through a border area and reaching the unaffected adjacent plot. Along each transect, sample plots with size of 5m × 5m were created and replicated at 3 points using an interval 20 m on both the affected, border and unaffected areas. In each sample plot vegetation survey was done to identify, enumerate and classify species according to families and lifeforms. Twenty gram soil samples were also collected at 0-15 cm and 15-30 cm soil layers from all the sample plots and analyzed in a laboratory for N; P, K; Organic Carbon; pH; Fe and Pb using appropriate analytical methods. The data collected from soil were later statistically analyzed.

Results and discussions The mean total population of plant species in the unaffected, border and affected plots were 5406.25, 5007.5 and 6435 plants/ha respectively. In terms of family representation 7, 10 and 16 families were encountered in the affected plot, border and the control plots respectively. Although the area affected by oil spillage and vegetation fire had higher plant population density than the other 2 areas surveyed yet it had less species diversity. *Bracharia deflexi*, *Ipomea involucrata* and *Pennisetum polystachion* were the most abundant species but they existed in the 3 plots. *Andropogon gayanus*, *Perotis indica*, *Acliatum caudatum* and *Schizachyrum exile* were 4 plant species with occurrence only in the land area affected by oil spillage and vegetation fire, and they appear to be adapted to the changed environment which could have significance in any planned land resuscitation. Re-growths of wood species were not encountered in the area affected by both oil spillage and vegetation fire unlike where the savanna disturbance was vegetation fire alone. Chamaephytes dominated the affected area. The soil pH was reduced to 6.01 in the affected plots compared to the unaffected plots and this continued to the deeper soil level (5.43). Magnesium level was significantly lower in both 0-15 and 15-30 cm soil depths. The pattern would have been the reverse if the disturbance was from vegetation fire alone which releases Mg from the ash products into the soil. The N and K levels were 0.044% and 0.071 Cmol/kg respectively at 0-15 cm in the area affected by oil spillage and fire; and these were significantly lower than that of unaffected plots. The reduction in N content by oil spillage and vegetation fire was not limited to 0-15 cm alone but extended deeper into soil (15-30 cm). Levels of P and organic carbon were significantly low in both the border and control plots when compared with the area affected by oil spillage and vegetation fire. The oil products, which in itself contained hydrocarbons, spilled in the disturbed area apparently contributed to the observed increase in the level of organic carbon. The observed impacts on most soil parameters manifested at 15-30 cm which were different from reports of ordinary vegetation fire alone whose effects were restricted to the initial 0-10 cm depth (Tongway and Hodgkinson, 2000) but that of oil-fueled fire penetrates deeper and persists for a longer period in the soil (Al-sawari et al, 1998). The concentrations of Fe and Pb (mg/kg) at both 0-15 and 15-30 cm soil depths were all significantly higher in the disturbed area than either the border or control plots. Fe and Pb in the affected plot were 76% and 400% higher than the control plot at 0-15 cm soil depth. The involvement of oil spillage in the fire disturbance of the derived savanna of a community near Ovim in Abia State Nigeria, made the vegetation and soil to respond differently in terms of reach and they need to be accommodated in subsequent land use management.

References

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