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Deforestation Challenges in the Niger Delta Region: A Case Study on the Electrical and Communication Sectors

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Abstract
Illegal logging activities are causing significant deforestation in the Niger Delta region of Nigeria at an alarming rate. This study was carried out to appraise the forest vegetation status of the oil hub region of Nigeria which is already devastated by crude oil exploration and production. The purpose of this study was to evaluate the current forest vegetation status in the oil hub region of Nigeria, which has been heavily affected by crude oil exploration and production. The study involved visiting ten major forest communities in the region, where the vegetative cover and average tree girth size were assessed. The research findings indicate a significant absence of uppermost vegetation canopy in the forests, with shrubs dominating the forested areas. A visit to the major timber markets in the region also showed that 80% of the timber girth sizes were less than 0.5 meters. This anthropogenic deforestation action is likely to exacerbate the effects of climate change and environmental degradation. Additionally, this action may result in the removal of natural barriers, potentially leading to degradation in electrical and wireless communication networks. The results of this study emphasize the significance of afforestation within sustainable environmental management strategies, as well as the integration of advanced technological systems.

Keywords: Climate change, deforestation, infrastructure damage, telecommunication services, vegetative covers

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1.0 Introduction

The Niger Delta region in southern Nigeria has a richly diverse ecosystem characterized by rainforests, mangrove swamps, estuaries and intricate waterways. The arboreal and aquatic communities provide habitats for diverse species of flora and fauna, contributing to the equilibrium of ecosystems. The mangrove swamps, abundant with salt-tolerant trees and shrubs along the coastlines, serve as natural barriers against erosion and offer vital habitats for fish and other aquatic organisms. Mangrove forests are distinctive environments that are found at mainly at low latitudes in the tropical regions of the world, which are able to endure tidal alterations (Akpomrere and Uguru, 2020a; Asari *et al*., 2021). The dense vegetative cover and extensive water bodies in the Niger Delta region play a crucial role in mitigating the impacts of climate change by effectively capturing and storing carbon dioxide and other toxic compounds from the atmosphere (Okon et al., 2021).

Regrettably, the present condition of this area is marked by severe environmental degradation, primarily stemming from oil exploration activities and deforestation (Akpomrere and Uguru, 2020b). The loss of significant portions of the region's forests is primarily attributed to deforestation, fueled by activities such as illegal logging and urbanization. Likewise, industrial effluent discharge is playing a significant role in the region's environmental degradation, causing extensive contamination of water sources and habitat destruction (Lindén and Pålsson, 2013; Ogbaran and Uguru, 2021). Evaluating the scale of deforestation in the Niger Delta is essential for comprehending the issue and formulating suitable environmental conservation approaches.

Research has shown that deforestation significantly affects the telecommunications sector. Trees and other vegetation play a vital role in facilitating the propagation of radio and related waves, which are crucial for enhancing mobile network services and internet delivery (Savage *et al.*, 2003; Abba and Agajo, 2021). Though plant leaves index can cause attenuation and absorption of the wireless communication waves, excessive deforestation can disrupt telecommunication services. Primarily, this occurs due to fluctuations in environmental conditions and obstruction of radio wave transmission. Deforestation often leads to alterations in prevailing climatic conditions, such as changes in ambient temperature, wind patterns, and humidity levels. These changes can adversely affect telecommunication services by degrading signal quality and reliability (Helhel *et al*., 2008; Longobardi *et al*., 2016; Solomon and Ugwu, 2021). Deforestation can lead to significant alterations in local temperatures due to insufficient vegetative cover. These extreme temperature fluctuations resulting from climate modification can adversely affect electronic components, leading to malfunctions and reduced efficiency in electronic systems. Lumbering has the potential to create dry environmental conditions, which may result in the overheating of electronic components, thereby causing malfunctions of the electronic units (Lakshminarayanan and Sriraam, 2014; Adel *et al*., 2017).

Apart from ecological dilapidation and communication sector, the timbers harvested through the logging process are frequently immature with poor strength parameters. Consequently, the utilization of these inferior materials in construction can contribute significantly to building failures (Ajuziogu and Uju, 2007; Akpokodje *et al*., 2020; Rahmon *et al*., 2020). The utilization of low-quality building materials poses a significant challenge to the construction industry. Structures built with counterfeit materials are highly susceptible to failures and electrical fires (Engebø *et al.*, 2017; Obukoeroro and Uguru, 2021). While numerous studies have investigated the consequences of deforestation globally, there remains a scarcity of information regarding the current extent of deforestation in the Niger Delta province of

Nigeria. Hence, the aim of this research is to assess the current status of forest vegetation in the oil-rich Niger Delta district of Nigeria and to propose solutions to address the threat of deforestation, with a focus on safeguarding the construction and telecommunication industries.

2.0 Materials and methods

2.1 Study area

This study was carried out within the Delta and Bayelsa states of Nigeria. This area is situated in the oil-rich swampy region of Nigeria, where the annual rainfall reaches approximately 1800 mm. The area being examined encompasses both upland and wetland regions, which were once distinguished by dense forest vegetation (Figure 1).However, due to anthropogenic activities and urbanization, this region is experiencing rapid deforestation, causing the loss of its forest community to lighter vegetation (Idisi and Uguru, 2020).

Over the past decade, illegal logging activities have resulted in extensive tree felling, including economically valuable species, significantly exacerbating the levels of deforestation and environmental degradation in the region. This degradation is compounded by oil spills from oil production, further compromising the environmental integrity of the area. Urbanization in the region has sparked a surge in demand for electrical and communications services, which are foundational pillars of national development. Deforestation in the Niger Delta indirectly affects the telecommunications sector. Trees and vegetation play a vital role in the propagation of radio waves, which are essential for services such as mobile networks and the internet.



Figure 1a



Figure 1b
Figure 1: Dense vegetation of the Niger Delta

2.2 Data collection and evaluation

The data utilized in this study were gathered through on-site field observations. During the field work, photographs were taken and analyzed to ascertain the environmental impact of the logging activities.

3.0 Results and discussion

3.1 Deforestation pattern

Field observations indicate that many of the dense swamp forests have become sparse, characterized by a limited diversity of trees with substantial girth. Lumbering activities were prevalent, with trees of all sizes and ages being indiscriminately cut, indicating a significant presence in the area as shown in Figures 1. The sparse tree diversity is an indication of disrupted habitat degradation, and retarded regeneration process of the trees. An imbalance between tree planting, natural regeneration, and the rate of tree cutting results in deforestation, which poses adverse effects on ecosystems. This action contributes to biodiversity disruption and contributes to climate change by releasing stored carbon into the atmosphere (Bodo *et al*., 2021).



Figure 2a



Figure 2b



Figure 2c



Figure 2d

Figure 2: The forests in the Niger Delta is experiencing deforestation

3.2 Soil erosion

Furthermore, it was observed that the excessive logging activities have led to the emergence of active soil erosion sites, compounded by heavy rainfall the region witnesses (Figure 2). This poses a considerable threat to both the ecological well-being of the area and the communities dependent on it. Piacentini *et al*. (2018) reported that heavy rainfall exacerbates soil erosion, particularly in regions where there is inadequate vegetative cover and poor soil

conditions. This erosion menace poses a great threat to telecommunication and electrical infrastructure and equipment. Instances have arisen where the foundations of electrical and telecommunication towers were jeopardized, and underground fiber optic lines were washed away in the area. Erosion can expose underground cables and destabilize electrical/communication installations foundation, compromising their integrity in the process. This can result in disruptions to electrical connectivity and signal transmission (Al-Khalidi and Kalam, 2006; Hewett *et al*., 2018). Moreover, excessive sedimentation occurring due to erosion action has the capability of interfering with the performance of submerged communication cables and fiber optic lines; hence, disrupting connectivity and signal transmission.



Figure 3a



Figure 3b

Figure 3: Active erosion sites

3.3 Wind Patterns

The field observation reveals evidence of destruction to electrical poles and communication antennas, attributed to high wind velocity, which may be linked to deforestation. This issue poses a significant challenge in the region, resulting in frequent electric power outages and poor signal transmission and reception. The vibrations induced by high-speed winds can compromise the structural stability of communication and power transmission apparatus, thereby affecting the reliability and performance of both electrical and telecommunication infrastructure (Gan and Peng, 2009; Roy and Kundu, 2021). The canopies of trees play a crucial role in moderating wind patterns and velocity, thereby reducing the risk of physical damage to towers, antennas, and other sensitive electronic components. This contributes to the stability and reliability of electrical and communication systems. According to Obukoeroro and Uguru (2021b), the frequent occurrence of fallen electric poles and crossbars, often attributed to windstorms, stands as one of the principal causes of epileptic power supply observed across much of Nigeria.

3.4 Temperature and landscape pattern

Deforestation alters the initial humidity and localized landscape patterns, which can disrupt radio wave propagation (multipath fading), leading to significant instabilities in signal quality. This instability is detrimental to telecommunication services reliability. Insufficient leaf coverage has a detrimental effect on the temperature and humidity levels of a region because of the reduction in the vegetation transpiration rate. This scenario has consequences for the performance of electronic equipment, as high temperatures are considered one of the premier causes of failure in electronic systems. Humidity influences electronic equipment performance by encouraging corrosion and condensation actions. This will result in signal attenuation, equipment failure, and compromised services (Mayrhofer and Bäck, 2016; Nassar et al., 2016; Conseil-Gudla *et al.*, 2017). Dwindling plants population diminishes the effectiveness of natural barriers that typically attenuate and absorb radio waves. This results in an upsurge in signal propagation, possibly impacting wireless communication services quality.

3.5 Construction sector

Besides the communication industry, the majority of timber sourced from forests is often immature, resulting in the production of planks and plywood with inferior mechanical qualities (Figure 3). This can result in the construction of structures using substandard materials, which is a significant contributor to structural failures, since the structural integrity of the infrastructure have been compromised (Tanko, 2013; Uguru *et al.*, 2022). Structural failures not only pose severe hazards to human safety, but also result in serious socio-economic losses and environmental impacts. Apart from the immediate consequences, buildings failures have numerous long-term implications, such as high cost of corrective maintenance, loss of confidence in the building sector, and substantial influence on community welfare.



Figure 4: A timber market

4.0 Conclusion

The purpose of this research was to investigate the effects of lumbering activities on the environmental and infrastructural development of the Niger Delta. The study involved meticulous field visits and observations of the forest communities within the region. Discoveries from the fieldwork indicated that most of the forests lack tall trees with substantial girth size and dense leaf canopies. The field survey findings also unveiled numerous active soil erosion sites, attributed to deforestation activities, which pose a significant threat to wireless communication and electrical facilities. The deforestation-induced alterations in climatic and environmental conditions can have multifaceted impacts on electrical and telecommunication sectors, ranging from infrastructural damage to service quality degradation. This research outcome highlights the importance of afforestation, as a vital characteristic of sustainable ecological management practices.

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