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# THE ANTHROPOGENIC IMPACT OF RAILWAY OPERATION ON THE FLORA DIVERSITY ON RAIL EMBANKMENT IN TWO STATIONS, DELTA STATE, NIGERIA

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**ABSTRACT**
This study was carried out with the aim of anticipating the effects of anthropogenic activities on the plant species flora on railway embankment in Urhuovie-Abraka and Ujevwu-Warri train stations in Delta State, Nigeria. Quadrat sampling method using line transect was adopted for the collection of plant species along the designated embankment of the rail track. Twelve (12) plant species were encountered and documented within the designated rail track at Ujevwu train station, Warri. The species of plant encountered in the railway station cut across six (6) different families including Poaceae as the most dominant family with four (4) representative species, followed by Fabaceae which had three (3) species. Asteraceae family was represented by two (2) species while Cyperaceae, Malvaceae and Plantaginaceae families were represented by single species whereas in Urhuovie-Abraka train station, A total of ten (10) plant species were encountered which cut across five (5) different families including Asteraceae (2), Convolvulaceae (1), Fabaceae (4), Malvaceae (1) and Poaceae (2). Ujevwu-Warri rail track had more plant species (12) than that of Urhuovie-Abraka station (10). Activities around these rail tracks included open cattle grazing, emerging human communities and periodic cutting of plant species to prevent the plant species encroaching into the rail track which could hinder the smooth operation of the railway system.

**Keywords:** Anthropogenic, Diversity, Flora, Railway.

## INTRODUCTION

The recent development in railway construction as means of transportation in Nigeria has brought about ease and cheaper means of conveying people and goods. However, it has brought about several ecological disturbances and alteration of existing plant and soil ecosystems. Railways are usually constructed across forested areas causing destruction of plant communities and loss of species. It has also brought about the reduction in species diversity and dominance as species growing along the path is cleared with no possibility of regeneration.

As human population increases, there is a direct impact of such phenomenon on plant diversity and flora. Anthropogenic activities which vary from low impact to high impact on plant communities is associated with varying human needs from housing, road construction, transportation, utilities, grazing and other basic needs as a result of the expansion of the human frontier. Plant communities have been destroyed due to human exploration and exploitation although EIAs (Environmental Impact Assessments) are sometimes carried to mitigate the impact, many plant species diversity would have been greatly affected. Human activities often cause habitat loss and fragmentation, which may impact plant community composition, biodiversity and plant populations (Sheng-Lan *et al.,* 2012). For natural habitats to be conserved effectively, and semi natural habitats managed, it is crucial to know the relationship between natural communities and human activities (Vandvik *et al.,* 2005).

Construction of road and railway, traffic and maintenance are increasing and major human activities worldwide (Trombulak and Frissell 2010). Human activity like road or rail construction can change plant species communities transforming native vegetation to non-native plants dominated one (Forman *et al.,* 2002). The operation of railway tracks involves the presence of solid contaminants on the line. Plants within railway embankment are at the receiving ends of chemicals and petroleum pollution associated with these environments. The establishment of railway station is accompanied with the destruction of vegetation and further utilization of the station leads to more damage on plant communities as expansion of landmass for more activities will be required.

Fair *et al.* (2008) reported the impact of railway and road construction and maintenance can change or modify landscape of natural wetland which might results in many ecological risks or effects. The results of the study will provide information on the diversity and distribution of plant species within railway embankment in the study areas, which is the first of its kind in the study areas. The results will help to monitor and handle declining species and curb any environmental damage caused by anthropogenic activities around the rail embankments. Rail transportation can result to inorganic and organic contamination (Liu *et al.,* 2009) ranging from lubricate oils and condenser fluids, metal ores, different chemicals, fertilizers and application of herbicides. Alla *et al.* (2020) reported that railway transport as heavy metal source of pollution. The occurrence and diversity of plant species along railway lines have been reported by some researchers. Zenni (2021) reported the redistribution of plant species along railway lines from 2014 to 2017 as a result of railway construction.

## MATERIALS AND METHODS

### Description of Study Areas

The first station was Ujevwu railway Station at Udu Local Government Area, Delta State (Figure 1). It is located geographically within latitude 5°27' 12" N and longitude 5$^0$ 52' 9" E of the equator. It is a commercial area with high rate of human activities (Ohwo *et al.,* 2018).

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**Figure 1**. Map of Udu showing the study area
**Source**: (Ohwo *et al.,* 2018)

The second station was Urhuovie-Abraka railway Sub-Station, Abraka in Ethiope East Local Government Area, Delta State (Figure 1). Abraka is an emerging urban area in the Niger Delta Region of Southern Nigeria. Abraka lies between Latitude $05^{0}47'N$ and Longitude $06^{0}06'E$ (Efe and Aruegodore, 2003).

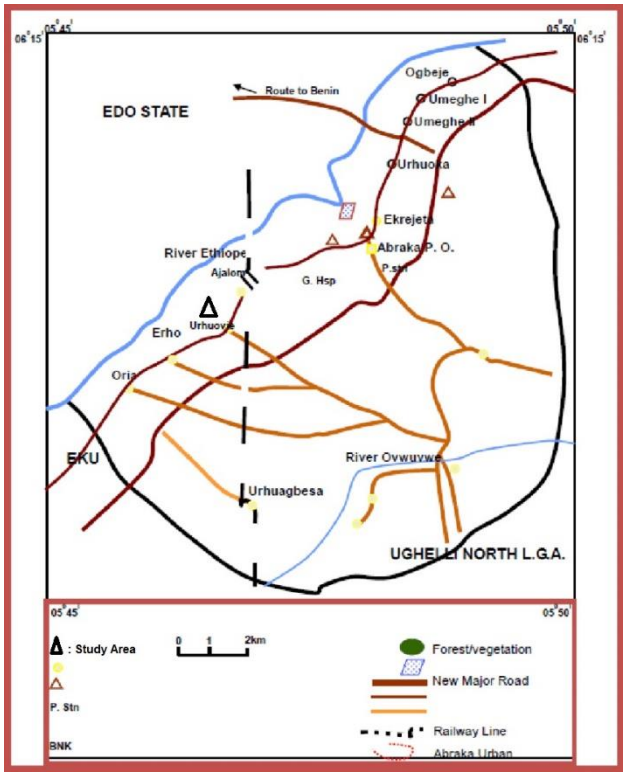


**Figure 2**: Map of Ethiope East Local Government Area showing study area
**Source**: (Efe and Aruegodore, 2003).

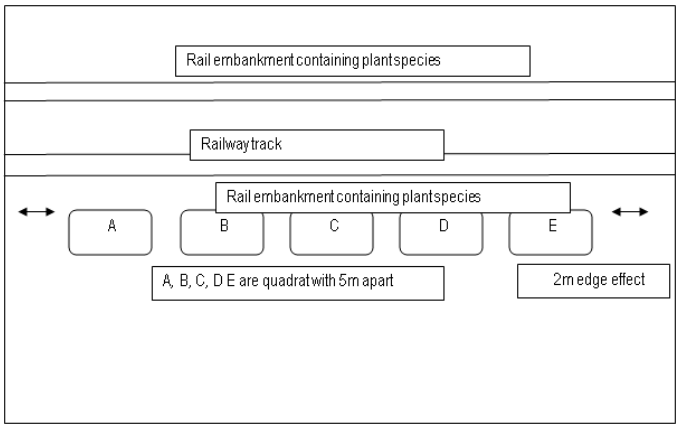


**Figure 3**: Outline of sampling method

A systematic quadrat sampling method using line transect was adopted for the collection of plant species within the study areas using the method of Tsechoe *et al.* (2014). A distance of 10 meters away from the railway track was measured at both sides within the vegetation cover and the sampling was pegged from the distance away. Fifty (50) meter transect was measured along the railway track within the vegetation cover and pegged at both end for the collection of plant species using sampling quadrat. A 100 x 100 cm square quadrat was used to sample along the transect within 5m apart. The plant species within the quadrat frame were documented. 2m was apportioned for edge effect.

**Plant identification**
Plant species collected were sent to the University of Benin Herbarium, Benin City, and Edo State for identification and voucher numbers of plants so identified.

**RESULTS**
Twelve (12) plant species were sampled and obtained within the designated rail track at Ujevwu train station, Warri. The species of plant encountered in the railway station cut across six (6) different families while in Urhuovie-Abraka train station, A total of ten (10) plant species were sampled and obtained which cut across five (5) different families

**Table 1**: Plant species diversity at Ujevwu train station, Warri, Delta State

| S/N | Scientific Name | Common Name | Family | Herbarium Number |
|---|---|---|---|---|
| 1 | *Carex humilis* Leyss | Dwarf sedge | Cyperaceae | C579 |
| 2 | *Bromus carinatus* Hook | California brome | Poaceae | B578 |
| 3 | *Galinsoga quadriradiata* Ruiz | Peruvian daisy | Asteraceae | G580 |
| 4 | *Sporobolus pyramidalis* Beauv | Rat tail grass | Poaceae | S574 |
| 5 | *Scoparia dulcis* L | Goat weed | Plantaginaceae | S581 |
| 6 | *Mimosa pudica* L | Sensitive plant | Fabaceae | M426 |
| 7 | *Aspilia africana* (Pers) | Wild sunflower | Asteraceae | A044 |
| 8 | *Pennisetum violaceum* Rich | Elephant grass | Poaceae | P584 |
| 9 | *Pueraria phaseoloides* Benth | Tropical kudzu | Fabaceae | P582 |
| 10 | *Panicum maximum* Jacq | Guinea grass | Poaceae | C451 |
| 11 | *Amphicarpaea bracteata* L | Hog peanut | Fabaceae | A583 |
| 12 | *Sida acuta* Burmf. | Wire weed | Malvaceae | S454 |

Twelve plant species sampled ranged from Dwarf sedge, Goat weed, Elephant grass to Wire weed

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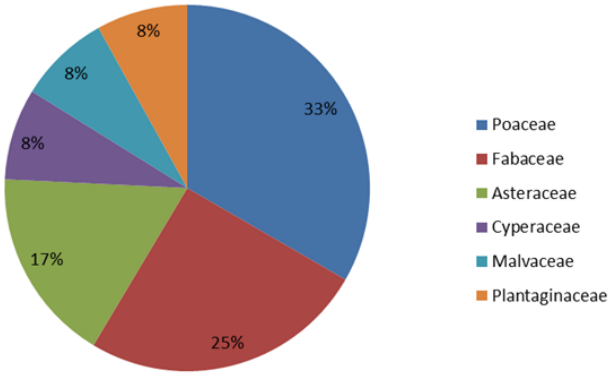


**Figure 4**. Family representative of plants collected
The plant encountered cut across six (6) different families including

Poaceae had the highest plant species (four species) representatives and closely followed by Fabaceae (three species), Asteraceae (two species) while Plantaginaceae, Cyperaceae and Malvaceae had one plant species representative respectively.

**Table 2**. Plant species diversity at Urhuovie railway substation, Abraka

| S/N | Scientific Name | Common Name | Family | Herbarium Number |
|---|---|---|---|---|
| 1 | *Acanthospermum australe* DC. | Spiny bur | Asteraceae | A571 |
| 2 | *Arundo donax* L | Giant cane | Poaceae | A573 |
| 3 | *Ageratum houstonianum* Mill | Floss flower | Asteraceae | A575 |
| 4 | *Ipomoea involucrata* L | Morning glory | Convolvulaceae | I576 |
| 5 | *Vigna luteola* Benth | Hairypod cowpea | Fabaceae | V577 |
| 6 | *Sporobolus pyramidalis* Beauv | Rat tail | Poaceae | S574 |
| 7 | *Desmodium triflorum* L | Cripping tick trefoil | Fabaceae | D570 |
| 8 | *Malvastrum coromandelianum* L. | False mallow | Malvaceae | M585 |
| 9 | *Mimosa pudica* L | Sensitive plant | Fabaceae | M426 |
| 10 | *Lathyrus pratensis* L. | Meadew pea | Fabaceae | L572 |

Ten plant species sampled ranged from Giant cane, Morning glory, False mallow to sensitive plant

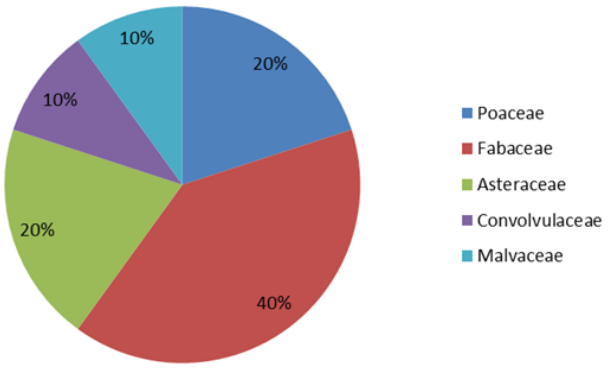


**Figure 5**. Family representative of plants collected

The plant encountered cut across five (5) different families including Fabaceae had the highest plant species (four species) representatives and closely followed by Asteraceae (two species) and Poaceae (two species) while Convolvulaceae and Malvaceae had one plant species representative respectively.

## DISCUSSION

Families represented showed a rich diversity of plant species on the railway embankments with regard to the area sampled as either as a pilot or experimental phase which can be replicated to larger areas along the railway path. The major anthropogenic factors involved in sampled areas included cattle grazing, emerging human settlements, periodic cutting of the plant species in the rail embankment to prevent over growth to the rail tracks. Eshaghi *et al.* (2018) reported the decrease in plant diversity, plant composition, and soil quality along the disturbance gradient. Many plant species could be lost with these prevailing factors in addition to oil pollution leaked from components of the train as well as the prolong soil weathering due to the train periodic operation which would have adverse impact on the soil fertility with time. Yunzhao *et al.* (2014) reported several ecological effects of railways to include loss of vegetation, habitat loss, soil chemical alteration, soil structure disturbance, barrier and behavior modification. Native plants can greatly be affected thereby creating room for invasive weeds to take over thereby reducing the flora diversity of the plant species in the embankments along the rail tracks which may eventually lead to soil erosion the micro ecosystem. Contrary to Slamet and Poerna (2017) studied the flora of Trans Sumatra Railway project in Indonesia using the Quadrat Nest Plot method, the study reported that construction of the railway line does not have a significant impact on the flora and fauna around the project footprint.

A total of 58 invasive alien species were identified, belonging to 18 families and 42 genera was reported by Hengning *et al.* (2020) that studied the species composition and distributional characteristics of plant species growing along the new Sichuan-Tibet railway in China. The diversity and species occurrence reported in this study is similar to that of Eilu *et al.* (2007) previously reported that the focal communities are selective in their plant exploitation as reported due to anthropogenic activities. Okita-Ouma *et al.* (*2017*) has reported on the emergent of new calls to quantify, identify and mitigate the impacts of railway operation on the ecosystem. Mishra *et al.* (2004) reported on how the influence of human based disturbance on three subtropical areas resulted in the decrease of species diversity and richness of shrubs and trees. Shaheen *et al.* (2001) reported that species number was less compared to similar undisturbed condition in Indian subtropical forests.

## Conclusion

The results of the study showed that the study areas currently have some species with high abundance and species diversity. There is the need for the environmental agency to carryout periodic surveillance to prevent open grazing along the trail embankments of plant species, less frequent cutting of plant species at the embankments, create some restriction zones for the emerging communities around specific railway track areas, take inventory of existing plant species and deposit some samples in the herbarium in case of any shift in speciation or species extinction in future. Environmental experts and plant ecologists should compose of the environmental team to carry out periodic monitoring of the prevailing anthropogenic activities in the rail micro ecosystem to mitigate the negative impact on the flora diversity.

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