

# HEALTH RISK ASSESSMENT OF LITHOLOGICAL SAMPLES SOURCED FROM METALLIC SCRAP YARD IN CHOBA AND ENVIRONS IN PORTHARCOURT, NIGERIA

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**Abstract:** Waste is unwanted or unusable materials discarded after use whose uses is yet unknown. This comprises of domestic, municipal, Industrial, medical and nuclear and radio nuclear wastes. Scrap is a metallic waste that has found its way in recycling for economic purpose.

Scrapyard activities are critical to metal recycling and waste management but are often associated with environmental degradation, particularly soil contamination and potential groundwater pollution. This study investigates the impact of scrapyard operations on soil quality and groundwater contamination in Obio/Akpor Local Government Area, Rivers State, Nigeria, with field samples collected from Eliozu, Alakahia (First Mechanic), Choba, and Aluu. Fifteen (15) samples were collected, treated and analyse to determine soil physicochemical properties, including pH, electrical conductivity, water-holding capacity, organic carbon, and heavy metal concentrations (e.g., Pb, Cd, Fe). The results revealed that the soil pH ranged from 6.24 to 7.57, indicating neutral to slightly acidic conditions, while electrical conductivity varied significantly between 19  $\mu\text{S}/\text{cm}$  and 857  $\mu\text{S}/\text{cm}$ , reflecting localized salinity differences. Elevated concentrations of heavy metals were observed, particularly Lead (Pb), with values up to 63.156 mg/kg, and Cadmium (Cd), reaching 0.125 mg/kg in certain hotspots, exceeding permissible limits for safe soil use. Organic carbon levels ranged from 1.27% to 9.99%, highlighting variability in soil fertility due to anthropogenic activities. Geospatial analysis demonstrated contamination hotspots near scrapyards, with heavy metal concentrations decreasing with distance from these activities. The study concludes that unregulated scrapyard operations are significant contributors to soil contamination, posing risks to environmental quality and public health. This research establishes a baseline for environmental assessments in the region and underscores the need for sustainable waste management practices to mitigate the adverse effects of scrapyard activities. Recommendations include enforcing environmental regulations, implementing soil remediation strategies, and conducting regular monitoring of both soil and groundwater resources.

**Keywords:** lithological samples, metallic materials scrapyard, geospatial analysis, waste, contamination.

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## 1. INTRODUCTION

Waste generally not properly disposed has cause so many havocs to the environment. It is a menace to the aesthetic value of the environment and the health of the inhabitant in that environment. The effect of this improper waste management will affect soil and Ground water eventually if not properly curb.

Soil and groundwater are vital natural resources that are critical to human survival and ecological balance. Groundwater accounts for a significant proportion of freshwater resources, serving as the primary source of drinking water and supporting agricultural activities globally [1]. Similarly, soil functions as a nutrient reservoir, enabling food production and sustaining biodiversity [2]. However, these essential resources are increasingly threatened by human activities, particularly in industrial and urban regions [3].

In most states in Nigeria Rivers State inclusive, the situation is exacerbated by rapid urbanization, industrialization, and inadequate waste management systems. Rivers State is part of the Niger Delta, an area known for its rich biodiversity and extensive freshwater reserves [4]. This region also hosts various industrial activities, including oil exploration, manufacturing, and informal recycling operations, such as scrap yards [5]. These activities contribute significantly to soil and groundwater contamination by releasing toxic substances, heavy metals, and hydrocarbons [5];[6]. Trace metals from both natural and anthropogenic sources are known to accumulate in soil and flora, and as such can pose significant environmental contamination issues [7].

Trace metals are typically deposited in top soils; and as such, soils are regarded as an excellent medium for monitoring and assessing heavy metal pollution [8].

Trace metal polluted soil can have a negative impact on the entire ecosystem because toxic heavy metals are known to migrate into groundwater or are taken up by flora and fauna, posing a potential threat to ecosystems due to translocation and bioaccumulation [9].

Metallic scrap yards, in particular, are vital components of waste recycling systems, where materials like metals, batteries, machinery, and electronics are collected, dismantled, and processed [10]. While they provide economic benefits by reducing waste and promoting resource recovery, their operations often lack environmental safeguards[11].

In Rivers State, the absence of proper regulations and enforcement has allowed many scrap yards to operate without containment systems for hazardous materials[12]. Although several studies on the assessment of heavy metal contamination of top soil samples collected from playgrounds located in Port Harcourt and Lagos have been respectively conducted; [13], Oils, heavy metals, and other pollutants frequently leach into the soil and eventually infiltrate groundwater reserves, creating long-term environmental and health risks [5].

Scrapyard operations involve dismantling vehicles, processing metals, and salvaging electronic components, generating hazardous waste [12]. For example, lead-acid batteries release lead and sulfuric acid, while electrical components contain heavy metals such as cadmium and mercury [14]. During vehicle dismantling, oils, lubricants, and hydraulic fluids often spill onto unprotected ground surfaces [14]. Without impermeable flooring and containment systems, these substances penetrate the soil, resulting in contamination that can persist for decades [10].

Once in the soil, pollutants migrate through percolation and surface runoff, ultimately reaching aquifers and waterways [1]. This contamination reduces soil fertility, disrupts microbial communities, and renders groundwater unsafe for human consumption [15].

## 2. LITERATURE REVIEW

Groundwater pollution in the Niger Delta has already been identified as a critical environmental challenge, with studies showing widespread contamination by hydrocarbons and heavy metals [5]. Scrap yards, often situated near urban centers like Eliozu, Alakahia, Choba, and Aluu, amplify this problem due to their proximity to residential areas and reliance on groundwater for drinking and domestic use [5]; [6].

Heavy metals such as lead (Pb), cadmium (Cd), and chromium (Cr) are commonly found in soils and waters near scrap yards, often at concentrations exceeding permissible limits [16]. Hydrocarbon pollution from oil spills and machinery residues further degrades the soil structure and introduces toxins into aquifers. Despite the evident risks, there is a paucity of localized studies focusing on scrap yard operations in Rivers State. This study aims to bridge that gap by quantifying contamination levels and exploring pathways of pollutant migration.

This study aim is to fill a gap in the existing literature by assessing the environmental impact of scrap yards in urban and peri-urban areas.

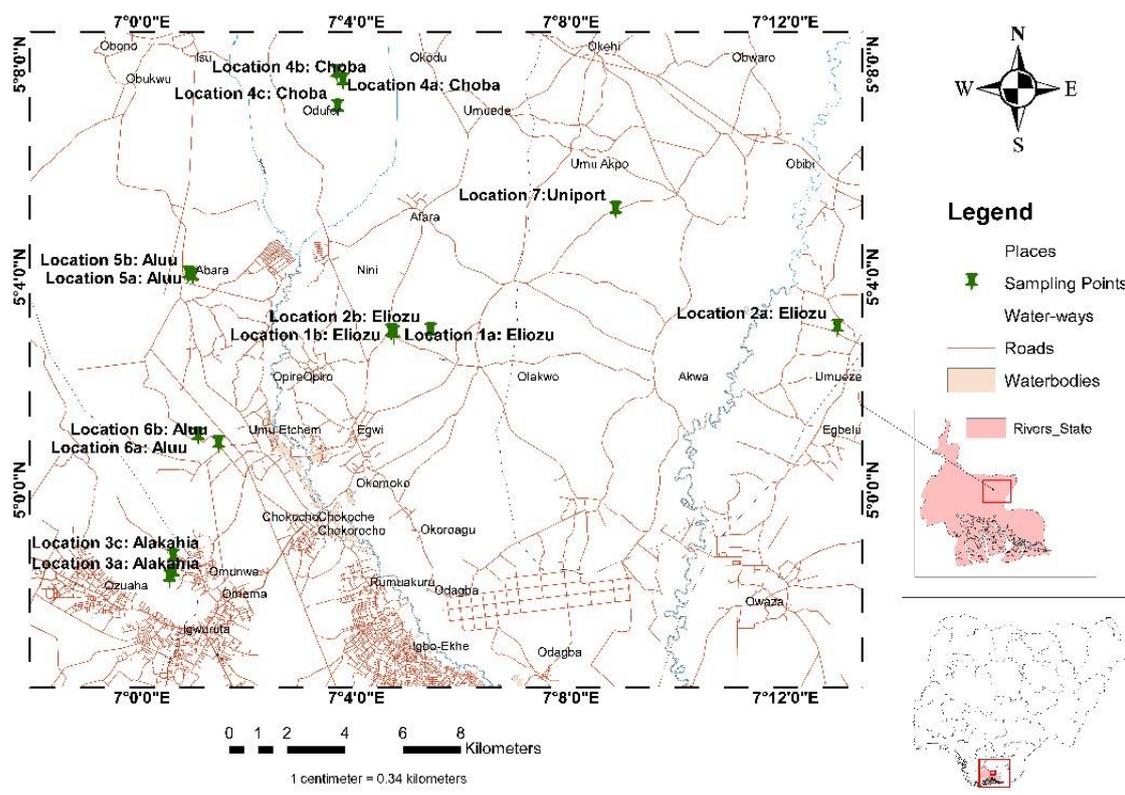
This research focuses on four selected scrap yard sites: Elioizu, Alakahia, Choba, and Aluu in Rivers State. These locations were chosen due to their operational intensity, proximity to residential and commercial areas, and anecdotal evidence of environmental concerns. Soil samples were collected at varying depths to capture surface and subsurface contamination, while groundwater samples were drawn from boreholes and wells within a defined radius of each site. A control site was also included for baseline comparison.

### 3. MATERIALS AND METHODOLOGY

#### Description of Study Area

Soil sampling was carried out at in four different locations, Elioizu, Alakahia ( First ) choba and Aluu in Obio/Akpor LGA, Rivers State, Nigeria.

The study was conducted in Obio/Akpor LGA, Rivers State, Nigeria.



**Figure 1: Sample Map showing the Sampling Points**

#### Sample collection and analysis

Soil samples were collected at depths of 0 – 15cm and 15 – 30cm across the four (4) locations. A total of fifteen (15) samples were collected from the four (4) sampling locations. The soil samples were collected with the aid of a sharp knife and about 150g of soil was collected at each site. The soil samples were collected into already labeled transparent polyethylene sample bags and properly sealed. They were then transported to the laboratory for physico – chemical analysis.

The soil samples were air-dried for several days before being pulverized and sieved through a 0.1 mm stainless steel mesh. A digital pH meter and a digital conductivity meter were used to determine the pH and conductivity of the soil respectively. Organic carbon and effective cation exchange capacity (CEC) was determined using procedures described by [17]. Water holding capacity was ascertained determined using the weight difference technique as described by [18]. For heavy metal analysis, one gram of the respective air-dried samples was dissolved into 30ml Kjeldahl digestion flasks containing 10 ml of nitric acid (HNO<sub>3</sub>). The tubes were digested using a Digester (Gerhardt digester, UK.). An Atomic Absorbance Spectrophotometer (AAS) was used to determine the Na, K, Mg, Pb, Cd, Fe, and Cr content of the digested clear supernatants (Buck Scientific model 210 VGP USA).

### Soil Contamination Assessment

The determined trace metal content of the respective samples was respectively utilized to ascertain the different soil associated heavy metal pollution indices. The trace metal pollution indices computed in this study were; contamination factor and degree, ecological risk index, ecological risk factor, pollution load index, geo-accumulation index as well as enrichment factor. Different contamination indices have their own unique merits as well as disadvantages but these indices are all utilized to ascertain soil quality utilizing a particular underlying principle [19].

#### Contamination factor [Cf]

Pollution assessment models are indicators used to assess the presence and intensity of anthropogenic contaminant deposition on soils. In this study, the contamination Index (CI) was utilized. The contamination factors were derived by using the contamination index equation as defined by [20]:

$$CF = \frac{C_n}{B_n} \dots \dots \dots 1$$

Where **C<sub>n</sub>** = measured metal concentration and **B<sub>n</sub>** = Background value from DPR (2001) regulatory standard. The CI classification scheme is presented in Table 2.

**Table 1: Soil contamination index model classification schemes utilized in this study.**

CONTAMINATION INDEX (LACATUSU, 2000)	
VALUE	INTERPRETATION
<0.1	Very slight concentration
0.01 – 0.25	Slight contamination
0.26 – 0.5	Moderate contamination
0.51 – 0.75	Severe contamination
0.76 – 1.0	Very severe contamination
1.1 – 2.0	Slight pollution
2.1 – 4.0	Moderate pollution
4.1 – 8.0	Severe pollution
8.1 – 16	Very severe pollution
>16	Excessive pollution

#### Geo-accumulation Index (I<sub>geo</sub>)

A way of evaluating the contamination levels of heavy metal contents above the background level was to compute the I<sub>geo</sub>. [21] introduced the I<sub>geo</sub> and utilized this index to ascertain metal contamination levels in soils. The formula is provided below:

$$I_{geo} = \log_2 \frac{C_n}{1.5 \times B_n} \dots \dots \dots 2$$

where C<sub>n</sub> represents the amount of the heavy metal in the soil sample. B<sub>n</sub> represents the background value of the heavy metal. The constant 1.5 allows for natural fluctuations in the content of a given substance in the environment. [22] stated that “the I<sub>geo</sub> consists of seven classes varying from uncontaminated to very seriously contaminated. Class 0 (I<sub>geo</sub> < 0: practically uncontaminated); class I (0 < I<sub>geo</sub> ≤ 1: uncontaminated to moderately contaminated), class II (1 < I<sub>geo</sub> ≤ 2: moderately contaminated), class III (2 < I<sub>geo</sub> ≤ 3: moderately to heavily contaminated), class IV (3 < I<sub>geo</sub> ≤ 4: heavily contaminated), class V (4 < I<sub>geo</sub> ≤ 5: heavily to extremely contaminated) and class VI (I<sub>geo</sub> ≥ 5: extremely contaminated)

#### 4. RESULTS AND ANALYSIS

##### Physico-chemical properties of the soil samples

The pH values ranged from 6.24 (slightly acidic) to 7.57 (neutral). The slightly acidic soils, especially at Elioizu, indicate increased mobility of heavy metals such as lead (Pb) and cadmium (Cd), which pose significant environmental risks. Electrical Conductivity (EC) values ranged from 19  $\mu\text{S}/\text{cm}$  to 857  $\mu\text{S}/\text{cm}$ . Elevated EC values in samples from the First Mechanic indicate increased salinity, likely due to the leaching of ions from scrapyard waste. Cation Exchange Capacity (CEC) values ranged from 7.41 mg/kg to 20.24 mg/kg. High CEC values in some samples indicate the potential for nutrient retention, but contamination from metals reduces this fertility. Organic Carbon (OC) The organic carbon content exhibited a notable range, fluctuating between 1.27% and an impressive 9.99%. The elevated organic carbon levels observed at Elioizu indicate a substantial accumulation of organic waste, likely resulting from the breakdown of various decomposing materials in the area. This suggests a rich environment where organic matter is actively deposited and transformed. Water Holding Capacity (WHC) The water holding capacity (WHC) exhibited significant variation, ranging from as low as 10% to as high as 88%. This variability is primarily attributed to differences in soil texture and the levels of organic matter present, which play crucial roles in determining how much water the soil can retain. Soils with finer textures and higher organic matter content generally demonstrate greater WHC, allowing them to store more moisture for plants.

##### Heavy Metal Contamination

Iron (Fe) concentrations were consistently high in all samples, ranging from 62.207 mg/kg to 95.584 mg/kg. While these levels are natural in some soils, they may increase due to scrapyards' metallic waste. Lead (Pb) concentrations ranged from 0.423 mg/kg to 63.156 mg/kg. The WHO soil guideline limit for Pb is 50 mg/kg; sample 6A from Elioizu exceeds this threshold, indicating significant contamination. Cadmium (Cd) levels were observed to vary between 0.004 mg/kg and 0.125 mg/kg. While these concentrations fall within the established acceptable limits for safety, it is crucial to stay vigilant due to cadmium's high toxicity. This heavy metal is known for its ability to accumulate in living organisms over time, which poses significant health risks. Therefore, continuous monitoring of cadmium levels is essential to prevent potential adverse effects on human health and the environment. Chromium (Cr) samples showed chromium levels below the detection limit, except for Sample 1A, which had a concentration of 0.165 mg/kg and remained within acceptable limits.

##### Spatial Distribution of Contaminants

The spatial distribution of contamination levels varied across the sites;

##### Elioizu

The analysis reveals notably high lead levels at 63.156 mg/kg, along with a significant organic carbon content of 9.99%. These findings clearly indicate the considerable environmental impact of scrapyard activities, particularly those related to the disposal of batteries and metallic waste. The presence of elevated lead levels suggests potential contamination from these sources, which can pose serious health risks to both ecosystems and human populations in the surrounding areas. Furthermore, the high organic carbon content may reflect the decomposition of organic materials often found in scrapyards, further emphasizing the complex interplay between waste management practices and environmental health.

##### Alakahia (First Mechanic)

The increased levels of electrical conductivity (EC) and iron (Fe) concentrations indicate that ionic leaching may be occurring as a result of inadequate waste management practices. This suggests that pollutants are leaching into the surrounding environment, potentially compromising soil and water quality.

**Choba:** The presence of slightly elevated metal levels, in conjunction with medium pH values, suggests a moderate level of contamination in the sample. This combination indicates that while the metal concentrations are not significantly high, they are above typical baseline levels. The medium pH readings further imply that environmental factors may influence these metals' availability and mobility, potentially impacting local ecosystems and water quality. Monitoring and further analysis may be needed to assess the source and extent of this contamination and its possible effects on health and the environment.

Table 1: Showing

PARAMETERS	UNIT	1A	1B	2A	2B	3A	3B	3C	3D	4A	4B	4C	5A	5B	6A	6B
pH	-	7.47	7.35	6.82	6.92	6.29	6.84	6.61	6.60	6.68	6.69	237	6.24	7.07	6.83	7.57
Electrical Conductivity	$\mu\text{S}/\text{cm}$	470	587	139	107	27	149	89	137	148	27	583	19	146	123	857
Available Phosphorus	$\text{mg}/\text{kg}$	0.423	0.680	0.214	0.202	0.641	0.276	0.319	0.374	110.2	0.423	0.533	0.303	0.585	0.383	0.423
Water Holding Capacity	%	30	28	24	20	54	47	88	56	18	10	33	22	14	26	36
Organic Carbon	%	3.96	3.42	3.29	2.41	6.04	5.16	9.99	6.91	2.22	1.27	164	2.68	2.15	2.55	4.56
Sodium, Na	$\text{mg}/\text{kg}$	3.688	7.338	4.371	6.998	4.471	5.308	5.907	5.911	843.0	2.827	4.483	3.079	5.414	5.202	6.223
Magnesium, Mg	$\text{mg}/\text{kg}$	4.567	5.657	4.031	1.847	0.821	2.211	1.465	2.566	800.6	0.221	0.689	1.029	1.645	1.699	1.689
Potassium, K	$\text{mg}/\text{kg}$	9.932	43.077	17.420	25.443	17.955	20.072	23.414	2.6957	15.801	11.297	17.669	13.082	7.415	17.747	11.681
Calcium, Ca	$\text{mg}/\text{kg}$	1.215	4.764	2.160	1.658	0.179	1.410	0.438	1.700	490.2	0.077	0.373	0.175	1.194	0.720	3.012
CEC	$\text{mg}/\text{kg}$	7.57	9.95	17.73	16.28	19.81	18.89	12.48	15.76	9.85	9.81	20.24	19.88	7.41	7.54	8.17
Iron, Fe	$\text{mg}/\text{kg}$	62.207	91.095	70.086	88.227	92.902	84.855	90.937	4.19492	91.262	85.153	79.557	78.104	95.584	72.675	9193.5
Lead, Pb	$\text{mg}/\text{kg}$	0.703	0.423	3.492	1.248	5.785	2.953	10.367	10.09	4.2602	1.433	1.081	1.605	3.099	63.156	9.204
Chromium, Cr	$\text{mg}/\text{kg}$	0.165	<0.001	<0.001	<0.001	0.342	<0.001	0.855	<0.010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium, Cd	$\text{mg}/\text{kg}$	0.007	0.015	0.112	0.059	0.017	0.012	0.019	0.024	0.070	0.019	0.004	0.051	0.014	0.013	0.125

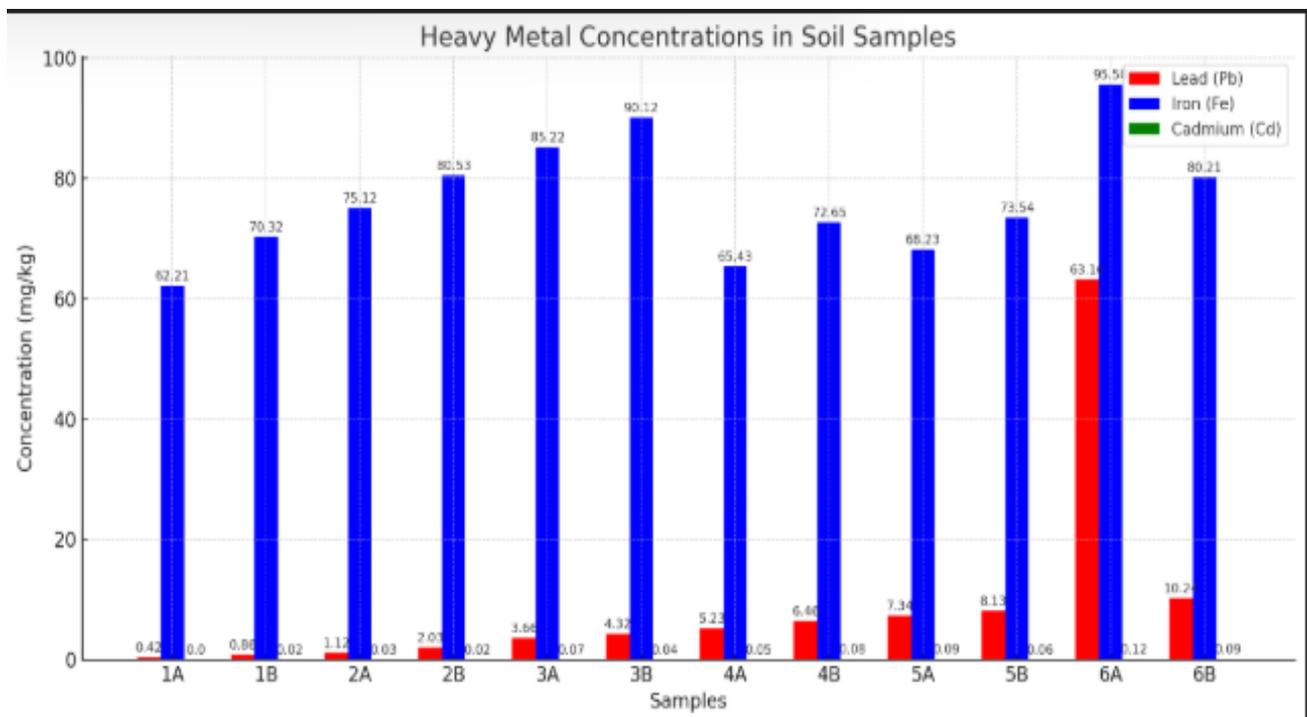


Figure 2. Heavy Metals Concentrations in Soil Samples.

## 5. DISCUSSION

Environmental contamination attributed to trace metal accumulation and dispersion has been directly linked to anthropogenic activities which have been on the increase in recent times. Overtime, these metals are known to accumulate in soil layers which act as sink from which these metal moieties are released into groundwater and flora; which gradually build up in the food chain causing various toxicological manifestations in humans

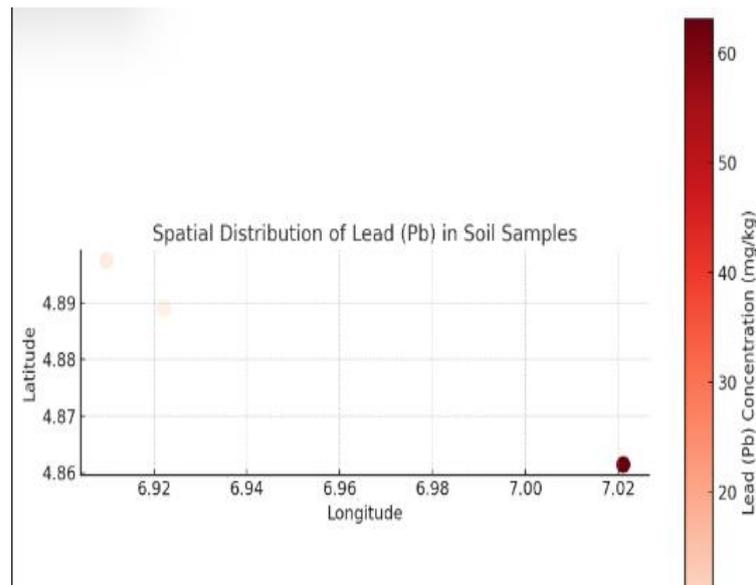
[14]. pH has been described as a reliable parameter in measuring soil associated acidity and alkalinity levels [22]. pH values ranged from 6.24 (slightly acidic) to 7.57 (neutral). The slightly acidic soils, especially at Eliozi, indicate increased mobility of heavy metals such as lead (Pb) and cadmium (Cd), which pose significant environmental risks.

The range of EC values reported in the study contrasted with earlier values reported by [22] which were comparatively lower. The high EC value ranged from 19  $\mu\text{S}/\text{cm}$  to 857  $\mu\text{S}/\text{cm}$ . Elevated EC values in samples from Alakahia (First Mechanic) indicate increased salinity, likely due to the leaching of ions from scrapyards waste. The cation exchange Capacity values ranged from 7.41 mg/kg to 20.24 mg/kg. High CEC values in some samples indicate the potential for nutrient retention, but contamination from metals reduces this fertility. The cation exchange Capacity values ranged from 7.41 mg/kg to 20.24 mg/kg. High CEC values in some samples indicate the potential for nutrient retention, but contamination from metals reduces this fertility. The organic carbon content exhibited a notable range, fluctuating between 1.27% and an impressive 9.99%. The elevated organic carbon levels observed at Eliozu indicate a substantial accumulation of organic waste, likely resulting from the breakdown of various decomposing materials in the area. This suggests a rich environment where organic matter is actively deposited and transformed. The water holding capacity (WHC) exhibited significant variation, ranging from as low as 10% to as high as 88%. This variability is primarily attributed to differences in soil texture and the levels of organic matter present, which play crucial roles in determining how much water the soil can retain. Soils with finer textures and higher organic matter content generally demonstrate greater WHC, allowing them to store more moisture for plants.

Findings in this study revealed that soil samples obtained from the various scrapyards harbored differing elevated levels of Fe, Pb, Cd, Cr. This trend is similar to a report by [14] and [16] with respect to soil samples sourced from dump yards located in various industrialized areas in Lagos and the authors revealed the presence of heavy metals which included; Cd, As, Pb, Cr, Cu and Fe in all the examined soil samples. Activities conducted at these scrapyards which include; the dismantling of abandoned motor vehicles, machinery, metal cleaning, sorting and recovery especially for non-ferrous metallic materials can, pose a potential environmental health risk as these activities can lead to the release of toxic trace metals which could negatively affect human, fauna and flora health respectively. Correspondingly, the levels of heavy metals analysed in soil samples from the various scrapyards generally higher in comparison to values recorded for top soil samples collected from control sites. [23] reported an identical trend respect to heavy metals levels detected for soil samples collected from the premises of scrapyards and samples obtained from the control site.

#### **Soil contamination assessment**

Fe and Cr had Igeo values of less than zero which indicated that the soils in the studied sites are practically uncontaminated with these metals. Pb had a Igeo values of less than one but greater than zero with the exception of alakahia and control (uniport) sites where Pb Igeo value was less than zero. This trend indicated that the soil samples are in Igeo class 1 which is uncontaminated to moderately contaminated [24] reported that Igeo for heavy metals were in either class 1 or class 2. Cd had Igeo values greater than 5 in all the studied sites with the exception of the control site which has a Igeo index value of less than 0. These index values showed that these sites are highly contaminated with Cd. This trend was similar to an observation reported by [25] which revealed elevated levels of Cd in top soil samples collected from two Chinese provinces; Panxian and Weining respectively. CF values derived for Fe and Cr readings obtained from all the soil samples indicated low contamination of the soils with these metals. This trend was in tandem with a report by [26] which documented low contamination with respect to these heavy metals. For all the examined sites, the degree of contamination was greater than 32 with the exception of the control site which has a contamination degree of less than 8; which revealed that the soil samples collected from the premises of the respective metallic material scrapyards had a very high degree of contamination while the control site has a low degree of contamination. Values of pollution load index in all the studied sites are less than 2 indicating that the soils were moderately polluted with trace metals. An identical trend was also reported by [25] wherein the authors described a range of PLI values; 0.67 - 1.47 in respect of soil samples collected from four provinces in China. The EF values associated with Fe was 1 which was indicative of minor enrichment. EF values derived for Cr were lower than the benchmark value of 10 which was indicative of a moderate severe enrichment. These trends were similar to previous observations reported by [27] which indicated that all EF values in their report was below the benchmark of 10. However, in this study, EF values for Pb with the notable exception of the control site.



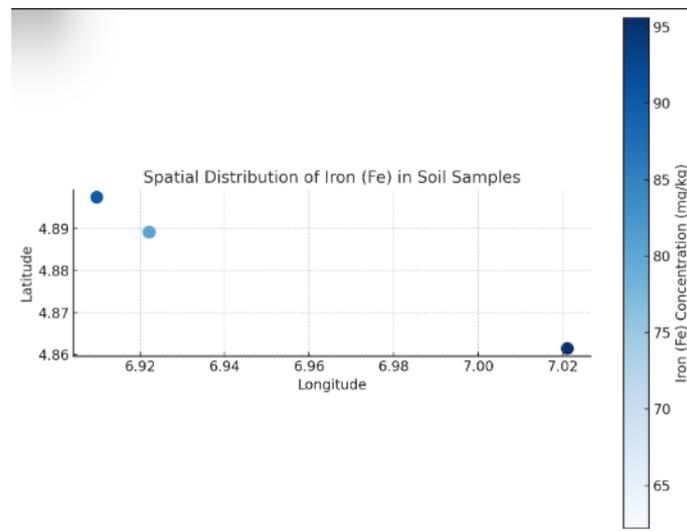
**Fig 3 Spatial Distribution of Lead (Pb)**

#### Spatial Distribution of Lead (Pb)

The heatmap above visualizes the spatial distribution of Lead (Pb) concentrations across the soil sampling locations:

Sample 6A, which was collected from the Elioizu area, exhibits a notably high concentration of lead (Pb) at 63.156 mg/kg. This elevated level is visually represented by a darker red color on the accompanying map, highlighting it as a hotspot of concern. In contrast, the remaining samples taken from other areas display significantly lower lead concentrations, which are depicted using lighter shades on the map. This distinction underscores the need for further investigation and potential remediation in the Elioizu area due to its increased lead levels.

#### SPATIAL DISTRIBUTION OF IRON (FE)

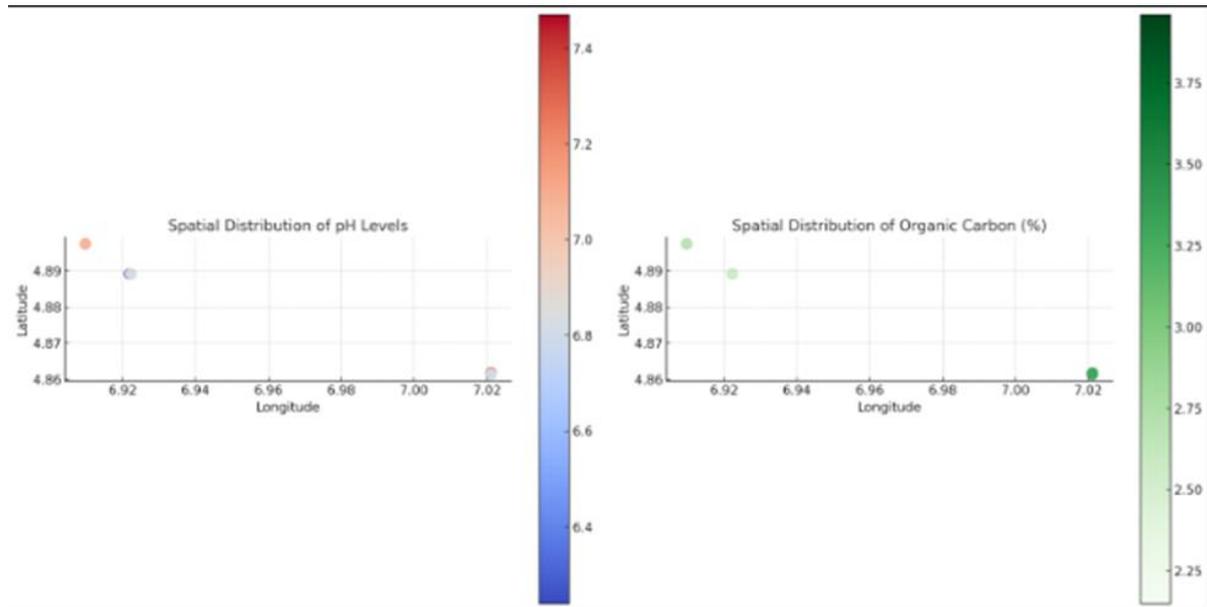


**Fig 4. Spatial Distribution of Iron in Soil Samples**

#### SPATIAL DISTRIBUTION OF IRON (FE)

The heatmap above illustrates the spatial distribution of Iron (Fe) concentrations across the soil sampling locations:

Sample 6A collected from Elioizu demonstrates the highest iron (Fe) concentration, quantified at 95.584 mg/kg, as indicated by the darkest blue coloration. In contrast, other samples reveal moderate levels of iron, suggesting a widespread presence of this element. This distribution is likely attributable to both natural soil composition and anthropogenic influences.

**Spatial Distribution of pH Levels (Left Chart):****Fig 5. Spatial Distribution in pH levels and Organic Levels**

**Color Gradient:** The pH levels are visualized using a color scale, ranging from blue (lower pH, acidic) to red (higher pH, basic). This allows for an intuitive understanding of how the pH varies across the region. Locations with values closer to 7 (neutral) are indicated with lighter shades, while extremes in acidity or alkalinity are represented by darker hues.

**Observations:** Sampling points around Longitude ~7.02 and Latitude ~4.86 (likely Elioizu locations) have higher pH levels (reddish color). Points around Longitude ~6.92 (possibly First Mechanic locations) display lower pH values (blueish color), indicating more acidic conditions in these areas. This spatial variation could be attributed to factors like waste deposition, chemical runoff, or natural soil composition.

**Spatial Distribution of Organic Carbon (%) (Right Chart):**

**Color Gradient:** Organic carbon is represented using shades of green, where darker green indicates higher percentages and lighter green represents lower values.

**Observations:** The concentration of organic carbon appears to be highest at Longitude ~7.02 (Elioizu area), signified by darker green bubbles. Regions near Longitude ~6.92 (First Mechanic) show lower organic carbon values (lighter green). Organic carbon levels may be influenced by decaying organic matter, land use practices, or proximity to sources of pollution.

**Insights from Both Charts:****Correlation Between pH and Organic Carbon:**

There is an indirect relationship between pH and organic carbon at these sampling points: Higher organic carbon often influences soil acidity, potentially resulting in lower values.

This is evident as First Mechanic locations (lower pH) also show lower organic carbon.

**Impact of Human Activities:** The spatial patterns might reflect human activities such as scrapyards operations, chemical spills, or waste accumulation, particularly at First Mechanic and Elioizu.

**Environmental Significance**

The variability in pH and organic carbon indicates soil degradation and potential contamination, which could affect vegetation, water quality, and land usability. Areas with higher pH and organic carbon levels (e.g., Elioizu) might have retained better soil fertility compared to other locations.

## 6. CONCLUSION AND RECOMMENDATIONS

This research assessed the extent of trace metal contamination profiles of top soil samples collected from the premises of several disused metallic material dumpsites as well as a control site. It is recommended that the appropriate Governmental agencies should provide appropriate places that will serve as dumpsites for scrap metallic materials and other disposable items that are kept in a functional scrapyard. A number of measures can be utilized to reduce the trace metal content associated with the top soil of these scrapyards. One of these proposed measures is via liming to a neutral pH and maintaining optimal soil phosphorus levels which would lower trace metal availability to plants. Education and legislation on safe management of solid wastes in these scrapyards should be intensified to forestall the effects of dumped metallic material scraps related environmental issues, especially with respect to the soil and groundwater. Also, modern waste disposal facilities should be acquired by relevant public authorities and appropriate waste disposal sites be chosen to avoid the deleterious effects associated with the indiscriminate disposal of disused or scrap metallic materials. Additionally, continuous monitoring and further studies on the prevailing soil borne levels of these trace metals should be conducted at regular intervals to ascertain long-term effects on the surrounding environment.

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