

ENVIRONMENTAL POLLUTION AND ITS ASSOCIATED HAZARD ON VEGETABLE GARDEN ON PUBLIC SECONDARY SCHOOLS IN RIVERS STATE.

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Abstract

The study investigated environmental pollution and its associated hazard in vegetable garden in public secondary schools in Rivers State. The study was guided by three research questions and three hypotheses. The study adopted a descriptive survey design. The population of the study was 132 teachers and students respectively, the sample size for the study was 132 respondents including agricultural science teachers and student in the study area. The target population comprises of (132) a total of 12 teachers, 120 students, the instrument for data collection was a self-structured questionnaire designed Titled Environmental pollution and its Hazard on Vegetables (EPAHVG) in a 4-point rating scale of low extent (1) High extent (4), face and content validity, three experts from Agricultural Education, Measurement and Evaluation review the instrument for clarity, coverage and relevance. The reliability of the instrument was established using the test-retest method which yielded 0.82. Data was analyzed using mean and standard deviation with a criterion mean value of 2.50 and above while a z-test statistical tool was used to test the null hypotheses at a significance level of 0.05. findings from the study revealed that soil and water used in the gardens were significantly affected by environmental contaminants with both students and teachers observing

health effects such as skin irritations and noting poor crop growth, also some pollution mitigation practices were in place the study found that formal sensitization and structured environment education were largely in adequate. The study concluded that environmental pollution poses a serious threat to school-based agricultural education and food safety it recommended regular soil testing, curriculum-based-environmental training, provision of clean water sources and stronger policy enforcement to support safe and sustainable school gardening practices in Rivers State.

Keywords: Environmental, Pollution, Hazard, Vegetable, Gardens, School.

Introduction

Environmental pollution remains one of the most critical environmental challenges affecting agricultural productivity and human health globally. According to World Health Organization (2018), environmental pollutants in soil and water pose serious risks to food safety and public health. In agricultural settings, especially vegetable production, contamination from industrial discharge, oil spillage, and improper waste disposal reduces soil fertility and crop yield. In Nigeria, particularly in oil-producing regions such as Rivers State, environmental degradation has significantly affected agricultural lands and water sources. The United Nations Environment Programme (2011) reported severe soil and groundwater contamination in the Niger Delta region due to petroleum-related activities. Similarly, Rattan (2010) emphasized that soil pollution reduces agricultural productivity and threatens sustainable crop production. Vegetable gardens in public secondary schools are vital for educational, nutritional and environmental objectives. However, rising environmental pollution from heavy metal agrochemical and urban run-off poses severe hazards to safe food production and student health for example, studies in Nigerian schools (Obio-Akpor LGA) identified heavy metals like cadmium, lead and mercury in playground soils areas often adjacent to school gardens other research from south-south Nigeria has documented air, noise and water pollution negatively affecting school environment and stakeholders. These findings underscore the necessity of investigating pollution risks on school – based vegetable cultivation in Rivers State. Chioma (2017) measured high levels of cadmium in topsoil of school play grounds in Obio-Akpor signaling contamination risk for edible plants and children. Edori (2025) found similarly concerns across Rivers State institutions, reinforcing the geographic spread of pollution Ucheje & Balarama (2025) established that air pollution, noise and flooding significantly disrupt academic and physical school environments a context likely influencing on site gardens Ndu-Ogbuji & Mbelegberi (2021) highlighted women’s vulnerability to environmental pollution in Rivers State affecting farming activities Agricultural pesticide misuse is documented Nigeria-wide, with farmers lacking safe

practices suggesting potential contamination through runoff or drift, urban runoff introduces heavy metals and nutrient over loading into soils compounding contamination alongside industrial pollution others. Factors include heavy metal accumulation in school soils, environmental stressors in schools, pollution pathways effectiveness Gardens, soil and water pollutions in Agricultural environments, health implications of consuming polluted vegetables, environmental Hazards around school environments Environmental pollution is a key factor threatening the viability of vegetable production in urban and peri-urban areas Ogoko and Ijeoma (2020) reported that prolonged exposure of soil to crude oil and industrial waste significantly alters soil chemistry reducing its productivity and posing risks to crops cultivated for food purposes. This is consistent with findings by Olonoyo (2019) who documented elevated concentrations of heavy metals for example (lead, cadmium, zinc and chromium) in school garden soils located near high-traffic roads and industrial zones. In Rivers State Edori and Kpee (2020) conducted an ecological assessment of soils in areas affected by crude oil spillage and found bio-accumulative levels of hydro-carbons in leafy vegetables such as fluted pumpkin and water leaf. These vegetables are common in school gardens suggesting potential contamination pathways, exposure to pollutants through, vegetable consumption has been linked to serious health issues, oti and Nwachukwu (2021) analyzed urban farm produced in Port Harcourt and reported high levels of lead and arsenic in spinach and lettuce samples. The authors cautioned that ingestion of such contaminated vegetables could cause neurological and gastro – intestinal disorders among children, who are more vulnerable due to their developing physiology. Adekunle and Akinyemi (2020) emphasized that vegetables grown on contaminated soils can accumulate carcinogenic compounds that may not be visibly detected, these compounds, once ingested, pose a long-term health risk, particularly when consumed frequently by school children as part of their feeding programs or during agricultural practical's. Public secondary schools in urban Nigeria often face infrastructural and environmental challenges such as proximity to industrial facilities, illegal waste dumping and flooding. Ndu-Ogbuji and Mbelegberi (2021) observed that school gardens in Eleme and Obio-Akpor LGAs in Rivers State are prone to surface runoff from oil processing facilities, leading to severe contamination of school premises, Ucheje and Balarama (2022) also highlighted environmental stressors such as noise, fumes and ground water contamination as factors undermining school gardening activities and outdoor agricultural education. Ekpo and Ibekwe (2019) noted that many schools are located in ecologically compromised zones without adequate fencing, making their gardens vulnerable to illegal waste disposal and encroachment from nearby residential or industrial facilities.

Environmental pollution not only affects the biological quality of vegetables but also interrupts agricultural learning and practice in Secondary schools, Chikere and Nowoko (2021) found that students in polluted environments expressed lower interest in agricultural science due to concerns about safety and poor harvests. Furthermore, school principals cited poor yields, diseases and

damaged crops due to acidic soils and oil residues as demotivating factors for maintaining gardens, despite the challenges, a few studies advocate for eco-restoration and sustainable practices Owughara (2020) proposed phytoremediation using native grasses and legumes to detoxify polluted school garden. They also recommended teacher training in environmental safety and the integration of pollution-awareness programs into the curriculum Amadi and Udo (2023) stressed the role of government agencies in monitoring pollution levels and enforcing environmental regulations around school premises, they argued that without strong institutional support, school gardening will remain vulnerable to environmental degradation in recent years, environmental pollution has become a major global concern, particularly in urban and industrial regions of developing countries like Nigeria, Rivers State located in the oil-rich Niger Delta is one of the most environmentally burdened areas in the country due to extensive industrial activities, oil exploration, gas flaring and improper waste disposal. These activities have led to significant contamination of air, water and soil which inevitably affects the safety of agricultural practices including vegetable gardening in public institutions like secondary school's vegetable gardens in public secondary schools serve multiple purposes. They are educational tools for practical learning in agricultural science, promote food security and service as a source of income for schools. However, the presence of pollutants such as heavy metals (lead, cadmium, arsenic) pesticide residues and other toxic. Such stance in the soil and water used for cultivation threatens the safety and productivity of these gardens, this situation poses serious risks to student health, food safety and the overall success of school-based agricultural programs.

According to Chiroma (2019) exposure to polluted soils through gardening can lead to the bio-accumulation of toxic substance in vegetables, which when consumed. May result in Chronic health issues. Including neurological, reproductive and developmental disorders, Edori and Kpee (2020) further warned that continuous cultivation in contaminated soils can reduce soil fertility and affect plant physiology. Additionally, environmental hazards like oil spills and urban runoff in Rivers State create unsafe learning environments, disrupt agricultural activities and compromise the sustainability of school – based farming initiative, despite existing environmental laws enforcement is weak and public secondary schools are often neglected in monitoring and remediation efforts. Furthermore, Norman C. Brady and Ray R. Weil (2008) noted that soil contaminants interfere with plant nutrient uptake, leading to poor germination, stunted growth, and reduced yield. Exposure to contaminated soil and water also increases health risks among individuals involved in agricultural activities, particularly children and adolescents (WHO, 2018), Despite the strategic role of school gardens in the agricultural science. Curriculum and national food security goals there is limited empirical resources assessing the actual extent and impact of environmental pollution on these gardens within the school system in Rivers State. There is also a notable lack of preventive and remedial actions by school administrators, education, stakeholders and environmental protection

agencies to address the ongoing degradation of school garden environments, this situation raises critical questions to what extent is environmental pollution affecting the safety and productivity of vegetable gardens in public secondary schools? What types of hazards are students and teachers exposed to through these gardens? And what practical strategies can be put in place to ensure that school gardening remains a safe, educative sustainable activity? It is against this backdrop that this study seeks to investigate the level and nature of environmental pollution affecting vegetable gardens in public secondary schools in Rivers State, the associated health and ecological hazards and strategies for sustainable mitigation.

The purpose of the study is to examine the environmental pollution and its associated Hazards on vegetable Gardens in public secondary schools in Rivers State, specifically, the study seeks to:

1. Assess the level of environmental pollutants present in the soil and water used for vegetable gardening in public secondary schools in Rivers State.
2. determine the effects of environmental pollutants on the growth and yield of vegetables cultivated in public secondary schools in Rivers State.
3. examine the associated health hazards of environmental pollution on students and teachers involved in vegetable gardening activities in public secondary schools in Rivers State.

For the purpose of the study, the following research questions were considered to aid the study

1. What level of environmental pollutants are present in the soils and water used for vegetable gardening in public secondary schools in Rivers State?
2. What are the effects of environmental pollutants on the growth and yield of vegetables cultivated in public secondary schools in Rivers State?
3. What are the associated health hazards of environmental pollution on students and teachers involved in vegetable gardening in public secondary schools in Rivers State?

The following null hypothesis was postulated and tested at 0.05 level of significance to guide the study.

H₀₁: There is no significant level of environmental pollutants present in the soil and water used for vegetable gardening in public secondary schools in Rivers State.

H₀₂: Environmental pollutants have no significant effect on the growth and yield of vegetables cultivated in public secondary schools in Rivers State.

H₀₃: There are no significant health hazards associated with environmental pollution among students and teachers involved in vegetable gardening in public secondary schools in Rivers State.

The study is significant because it addresses the growing concern of environmental pollution and its negative implications on school-based agricultural practices, particularly vegetable gardening in public secondary schools in Rivers State. vegetable gardening is a practical component of agricultural science education and a source of nutrition, skill acquisition and income generation for students. However, pollution from oil exploration, gas flaring, industrial waste, indiscriminate refuse disposal and contaminated water sources poses serious threats to soil quality. crop yield and human health .by investigating these hazards, the study contributes to knowledge on sustainable school agriculture, environmental safety and food security within the educational system, the findings of the study will be beneficial to educational institutions, especially public secondary schools in rivers state, it will help school administrators and agricultural teachers identify pollution –related risks affecting school gardens and adopts safer farming practices. The study will also guide schools in selecting suitable sites for vegetable gardens improving soil management and integrating environmental safety measures into agricultural practical lessons. furthermore, the results will support curriculum planners and educational authorities in strengthening environmental education and practical agriculture programs in school , this study will benefit students, parents and surrounding communities, healthy school vegetable gardens can supplement school feeding programs, reduce food costs and enhance students nutrition.by highlighting the hazards of polluted soils and water, the study helps prevent the consumption of contaminated vegetables thereby reducing health risks and medical expenses. in the long run, students equipped with knowledge of safe and sustainable gardening practices can transfer these skills to household and community farming, contributing to food security, employment opportunities and sustainable livelihoods in Rivers state. Policymakers in the ministries of education, environment and agriculture can use the findings to develop guidelines for safe school farming practices, environmental monitoring of school lands and pollution control measures around educational institutions. the study also supports the enforcement of environmental regulations on industrial activities near schools and encourages the integration of environmental risk assessment into school agricultural programs,The study is delimited to the effects of environmental pollution and its associated hazards on vegetable gardening in public secondary schools in Rivers state, Nigeria, the study focuses on major forms of environmental pollution such as soil water and air pollution and their effects on vegetable growth, yield, soil fertility and health risks to students and teachers involved in school gardening activities, the population includes agricultural science teachers, students involved in vegetable gardening and

school garden plots in public secondary schools the study is limited to the period during which data are collected, reflecting current environmental conditions and gardening practices in the selected schools.

Methodology

The study was carried out in Rivers State, Nigeria. Rivers State is a highly industrialized region and a major center for oil exploration and processing making it vulnerable to significant environmental pollution, including oil spills, industrial waste and air and water contamination. The state consists of 23 local government Areas (LGAs) many of which host numerous public secondary schools with school farm projects including vegetable gardens. Notable areas such as Port Harcourt, Obio Akpor, Eleme, Tai, Gokana and Oyigbo are particularly affected by industrial pollution and urban runoff.

The study adopted a descriptive survey research design, the population of the study comprises of teachers and students, the target population for this study comprises of, Agricultural science teacher of 12, 120 students respectively, a total sample size of 132 was used to select the respondents, the instrument for data collection was a self-structured questionnaire designed title Environmental Pollution and its Associated Hazards on Vegetables (EPAHVG) for both teachers and students, in a 4-point rating scale. (1) low extent (4) high extent, Face and content Validity, three experts from Agricultural Education, Measurement and evaluation review the instrument for clarity, coverage and relevance, the reliability of the instrument was tested using the test-retest. Method and a reliability co-efficient r achieved was 0.82 data was analyzed using mean and standard deviation with a criterion mean value of 2.50 above while a z-test was used to test the null hypotheses at a significance level of 0.05.

Results

Research Question 1

What types and levels of environmental pollutants present in the soils and water used for vegetable gardening in public secondary schools in Rivers State?

Table 1: mean score of respondents on levels of environmental pollutants present in the soils and water .

S/N	Statements	(N = 132-teachers -12, students -120)				
		$\bar{X}$	SD		$\bar{X}$	SD

							Decision
1	The soil used is affected by the presence of heavy metals in gardens soil	3.10	2.95		3.03	0.72	High extent
2	Oil contamination of soil	3.25	3.05		3.15	0.68.	High extent
3	industrial waste effects water quality	3.30	3.12		3.21	0.74	High extent
4	Foul smell from irrigation water	2.90	2.80		2.85	0.81	High extent
5	Presence of plastic and solid waste in garden area	3.40	3.20		3.30	0.65	High extent

Source: Field work 2025

Results from table 1 shows that environmental pollutants are present in the soil and water used for vegetable gardening in public secondary schools to a high extent. The mean of 3.11 indicates high extent agreement among respondents that pollution such as heavy metals, oil contamination, and industrial waste significantly affects gardening environments.

Research question 2

What are the effects of environmental pollutants on the growth and yield of vegetables cultivated in public secondary schools in Rivers State?

Table 2: Mean scores of respondents

on effects pollutants on vegetables growth yield

S/N	Statements	(N =132,teachers 12,students 120)				Decision
		$\bar{X}$	SD	$\bar{X}$	SD	
1	Poor germination of seeds	3.20	3.00	3.10	0.70	High extent
2	Stunted growth of vegetables.	3.35	3.10	3.23	0.69	High extent
3	Reduced crop yield	3.40	3.18	3.29	0.73	High extent
4	Discoloration of leaves	3.00	2.88	2.94	0.77	High extent
5	Increased pest and disease attack	3.15	3.05	3.10	0.75	High extent

Source: Field work 2025

Results from 2 shows that the environmental pollution significantly affects vegetable growth and yield. With a mean of 3.13, respondents agreed that pollution leads to poor germination, stunted growth, reduced yield, and increased pest attacks in school gardens.

Research Question 3

what are the associated health hazards of environmental pollution on students and teachers involved in vegetable gardening in public secondary schools in Rivers State?

Table 3: Mean score of respondents on health hazards associated with environmental pollution in school vegetable gardens

S/N	Statements	(N = 132 ,teachers 12,students 120)				Decision
		Mean		Mean		
		$\bar{X}$	SD	$\bar{X}$	SD	
1	skin irrigation after gardening	3.05	2.90	2.98	0.82	High extent
2	Respiratory problems from polluted air	3.30	3.10	3.20	0.71	High extent
3	water borne diseases from irrigation water	3.25	3.05	3.15	0.74	High extent
4	Headaches and fatigue	2.95	2.85	2.90	0.79	High extent
5	risk of long –term health complications	3.40	3.20	3.30	0.68	High extent

Source: Field work 2025

Results from table 3 shows that environmental pollution poses significant health hazards to students and teachers involved in vegetable gardening. The mean of 3.11 suggests that respondents agree that pollution contributes to skin irritation, respiratory problems, waterborne diseases, and potential long-term health complications.

Hypotheses Testing

Hypothesis 1: There is no significant difference between the mean responses of teachers and students on the level of environmental pollutants present in soil and water.

Table 4: z-test analysis on mean response of teachers and students on the level of environmental pollutant

Category	N	$\bar{X}$	SD	Df	z-cal	z-crit	Decision
(a = 0.05)							
Teachers	12	3.11	0.72	130	0.42	±1.96	Accept H ₀
students	120	3.02	0.75				

Finding from table 4 revealed that Since the calculated Z-value (0.42) is less than the critical Z-value (1.96), the null hypothesis is accepted. This indicates that there is no significant difference between teachers and students in their assessment of environmental pollutants in school gardens.

Hypothesis 2

There is no significant difference between the mean responses of teachers and students on the effects of environmental pollutants on vegetable growth and yield.

Table 5: z-test analysis on mean response of teachers and students on the effects of environmental pollutants on vegetable growth and yield.

Category	N	Mean	SD	Df	z-cal	z-crit	Decision
(a = 0.05)							
Teachers	12	3.22	0.70	130	0.88	±1.96	Accept H ₀
students	120	3.04	0.73				

The calculated Z-value (0.88) is less than the critical value (1.96). Therefore, the null hypothesis is accepted. This shows that teachers and students do not significantly differ in their views on the effects of environmental pollution on vegetable growth and yield.

Hypothesis 3

There is no significant difference between the mean responses of teachers and students on the health hazards associated with environmental pollution.

Table 5: z-test analysis on mean response of teachers and students on the health hazards associated with environmental pollution.

Category	N	Mean	SD	Df	z-cal	z-crit	Decision
		$\bar{X}$				($\alpha = 0.05$)	
Teachers	12	3.19	0.74				
students	120	3.03	0.76	130	0.76	± 1.96	Accept H_0

Since the calculated Z-value (0.76) is less than the critical value (1.96), the null hypothesis is accepted. This implies that there is no statistically significant difference between teachers and students regarding the health hazards of environmental pollution in school vegetable gardens.

Discussion of findings

Table 1 revealed a mean of 3.11, indicating that environmental pollutants present in the soil and water used for vegetable gardening in public secondary schools to a high extent. Respondents agreed that heavy metals, oil contamination, industrial waste, and solid waste significantly affect gardening environments, the finding aligns with the position of Miller (2007), who stated that soil and water pollution are major environmental challenges in developing regions due to industrial discharge, improper waste disposal, and oil-related activities. Miller emphasized that pollutants such as hydrocarbons and heavy metals reduce soil fertility and contaminate irrigation sources, Similarly, Babatunde O. Omotoso (2013) reported that environmental degradation in oil-producing regions contributes significantly to soil contamination, thereby affecting agricultural productivity. This is consistent with the work of Edori and Kpee (2020) who reported the presence of heavy metals and hydrocarbons in garden soils in Rivers state due to oil-related activities similarly, Olowoyo (2019) found high levels of pollutants in school soils, the present finding is also consistent with the report of United Nations Environment Programme (2011), which highlighted severe soil and groundwater contamination in oil-producing areas of southern Nigeria.

Table 2 showed a mean of 3.13, indicating that environmental pollution significantly affects vegetable growth and yield. Respondents agreed that pollution leads to poor germination, stunted growth, reduced yield, discoloration of leaves, and increased pest and disease attacks, this finding supports the work of Norman C. Brady and Ray R. Weil (2008), who explained that contaminated soils alter nutrient availability and hinder plant metabolic processes, leading to reduced crop performance. They emphasized that heavy metals and toxic substances disrupt root development and photosynthesis. In addition, Food and Agriculture Organization (2015) reported that polluted irrigation water negatively impacts vegetable production by reducing yield and increasing susceptibility to pests and diseases, these findings align with Oti and Nwachukwu (2021) who reported that vegetables grown in polluted soils may cause poisoning and other health, This finding supports the work of Norman C. Brady and Ray R. Weil (2008), who explained that contaminated soils alter nutrient availability and hinder plant metabolic processes, leading to reduced crop performance. They emphasized that heavy metals and toxic substances disrupt root development and photosynthesis, the findings also corroborate Rattan Lal (2010), who noted that environmental degradation leads to declining soil productivity and threatens sustainable crop production.

Table 3 revealed a mean of 3.11, indicating that environmental pollution poses significant health hazards to students and teachers involved in vegetable gardening. Respondents agreed that pollution contributes to skin irritation, respiratory problems, waterborne diseases, headaches, and long-term health risks, The soil and water can cause dermatological infections, respiratory complications, and chronic health conditions, Similarly, David Suzuki (2008) emphasized that prolonged exposure to environmental contaminants increases health risks, particularly among young people who are more vulnerable to toxic substances. These findings align with those of chikere and Nwoko (2021) who emphasized that student participation in agricultural practices is enhanced by teacher-led environmental management initiatives. Similarly, Onwughara (2020) advocate for practical environmental education as a key strategy in achieving sustainable school gardening. Furthermore, United Nations Children's Fund (2019) reported that children exposed to polluted environments are at greater risk of infections and long-term developmental challenges.

Conclusion

From the background and findings revealed that environmental pollution is present to a high extent in the soil and water used for vegetable gardening in public secondary schools in Rivers State. The presence of pollutants such as oil residues, solid waste materials, and possible heavy metal contamination negatively affects soil quality and irrigation water, the study further concluded that environmental pollution significantly affects the growth and yield of vegetables cultivated in school gardens. Poor germination, stunted growth, leaf discoloration, and reduced crop yield were identified

as major consequences of polluted agricultural environments, Additionally, the study established that environmental pollution poses health hazards to students and teachers involved in vegetable gardening activities. Exposure to contaminated soil and water may lead to skin irritation, respiratory problems, waterborne diseases, and other long-term health complications.

Recommendations

Based on the findings, the following recommendation are made.

- 1.Regular Soil and Water Testing, Government agencies and school authorities should conduct periodic laboratory testing of soil and irrigation water used in school gardens to detect and control pollution levels.
- 2.Environmental Monitoring and Regulation, Environmental protection agencies should strengthen monitoring and enforcement of regulations to prevent industrial waste disposal and oil contamination near school environments.
- 3.Provision of Clean Irrigation Water, Schools should be provided with safe and treated water sources for vegetable gardening to reduce contamination risks.
- 4.Environmental Education and Awareness, Agricultural education curricula should incorporate environmental pollution awareness and sustainable farming practices to equip students with proper environmental stewardship skills.

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