

AN ASSESSMENT OF THE IMPACT OF CLIMATE CHANGE ON SOIL EROSION IN EKPOMA, EDO STATE, NIGERIA

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Abstract: This study assessed the impacts of climate change on soil erosion in Ekpoma, Edo State, Nigeria. The study identified the following regarding climate change and soil erosion in Ekpoma: the natural and anthropogenic causes, the impact of climate change on soil erosion, the socioeconomic consequences, and the mitigating and coping strategies. To achieve these objectives, this study employed both primary and secondary research methods to collect the required data: Four hundred and five (405) residents/respondents, representing point two three percent (.23%) of the entire population in the study area, were considered. Following the above, 405 questionnaires were administered across Ekpoma. The obtained data were analyzed using appropriate statistical techniques, such as tables, frequencies, and percentages. The results reveal the natural and anthropogenic causes of soil erosion, the impact of climate change on soil erosion, the socioeconomic consequences of soil erosion, and the mitigating and coping strategies of soil erosion in Ekpoma. The following actionable policy recommendations are made based on the above findings: effective and continuous creation and promotion of community awareness on the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria, climatic conditions should be monitored to help predict potential climate change-related hazards and how to avoid or overcome them, cover crop planting, all-season-green tree crops planting, soil conservation practices, reforestation, bush fallow/agricultural land abandonment, farmland tillage, terrace farming, environmental sanitation, permeable pavements, and building initiatives. Therefore, the paper concludes by urging the relevant authorities to ensure the effective implementation of the actionable policy recommendations.

Keywords: Assessment, impact, climate change, soil erosion.

1. INTRODUCTION

Extensive debates on climate change have taken place within the scientific community, the public and political spheres. The prevailing consensus among scientists today is that global warming is largely caused by human activities, particularly the burning of fossil fuels—a phenomenon referred to as anthropogenic climate change. Reports by the Intergovernmental Panel on Climate Change (IPCC, 2022) underscore this consensus,

highlighting its significant impacts on physical and biological systems across the globe. According to Adewole and Afusat (2017), climate change can be perceived as a change in the climate, which can be seen by changes in the variability of its properties, and that stayed for an extended period of time, simply decades or longer due to both anthropogenic and natural activities. In a similar vein, Okhakhu (2019) observed that climate change is the realistic increase in the average temperatures of the global environment (atmosphere, lithosphere, hydrosphere, biosphere, cryosphere) and other constituent elements of the Earth as a result of unguided human activities. From the foregoing, climate change can be described as the technical term used to denote significant and long-term alterations in the statistical distribution of weather patterns over decades to millions of years. Pimentel, (2006) conceives of soil erosion as a natural process that involves the detachment and transport of soil material by water, wind, or ice. Soil erosion is fundamentally a natural process, but it has been profoundly accelerated by human activities and, increasingly, by climate change. A significant and often-intensified consequence of climate change is accelerated soil erosion, particularly in vulnerable regions such as the tropics and subtropics (Mandal & Roy, 2024). This erosion is primarily driven by changes in the hydrological cycle, manifesting as more frequent and high-intensity rainfall events (Zhang *et al.*, 2012; Borrelli *et al.*, 2020). Globally, water-induced soil erosion is a major land degradation threat, diminishing soil fertility, reducing agricultural productivity, and causing substantial off-site damages, including siltation of water bodies (Borrelli *et al.*, 2020; Mandal & Roy, 2024). Climate change, coupled with socioeconomic factors affecting land use, could significantly increase global water erosion rates (Borrelli *et al.*, 2020).

The effects of climate change in Nigeria are manifested through rising temperatures, unpredictable rainfall patterns, and an increased frequency of extreme weather events such as floods and droughts (NiMet, 2022). These climatic variations exacerbate land degradation, with soil erosion—particularly gully erosion—emerging as a major environmental and socioeconomic challenge in many parts of the country, especially within the southeast and sections of the South-South regions (Ike & Emaziye, 2012; Nwagbara *et al.*, 2015). Studies suggested that Nigeria faces an escalating threat, with soil erosion rates potentially rising significantly under future climate scenarios (Giang *et al.*, 2016). The severity of gully erosion in Nigeria led to the initiation of large-scale intervention programs, such as the Nigeria Erosion and Watershed Management Project (NEWMAP), to build climate resilience (World Bank, 2022).

Ekpoma, located in Edo State, is a region prone to significant environmental challenges. The state contends with considerable gully and sheet-rill erosion, which is estimated to constitute a notable percentage of the state's degraded land (Ezezika & Adetona, 2011). While local factors such as poor land management, deforestation, and high population density contribute to the problem, the influence of changing climatic variables, specifically rainfall intensity and total amount, cannot be marginalized (Nwagbara *et al.*, 2015). Studies examining the local environment, such as those related to water flow and land use, indirectly point to erosion processes in the area. Climate change has become a major environmental challenge with widespread consequences for soil stability and land productivity, especially in vulnerable areas, such as Ekpoma, Edo State. Climate change intensifies soil erosion through increased surface runoff, loss of vegetation cover, and disruptions in hydrological cycles (Akanwa *et al.*, 2024). In Ekpoma, a region marked by undulating terrain and seasonal rainfall, these changes have led to the expansion of gully erosion sites, degradation of arable land, and threats to infrastructure and livelihoods.

Soil erosion in Ekpoma is not merely a natural phenomenon but a climate-driven hazard stultified by anthropogenic activities such as deforestation, poor land use practices, and unregulated urban expansion

(Eseigbe & Osawe, 2016). The rising occurrence of high-intensity rainfall events has exceeded the capacity of existing drainage systems, which are often inadequate, resulting in rapid topsoil loss and sediment buildup in low-lying areas. This erosion diminishes the land suitability for building and agricultural purposes while also worsening downstream flooding and water pollution.

Recent studies employing GIS remote sensing have modeled the susceptibility of regions like Ekpoma to erosion under future climate scenarios, revealing a projected increase in erosion rates due to rising rainfall erosivity and declining vegetation cover (Ifeanyichukwu *et al.*, 2025). These findings underscore the urgent need for climate-adaptive land management strategies, including reforestation and sustainable farming.

The nexus between the projected intensification of rainfall due to climate change and the localized erodibility of soils in Ekpoma warrants dedicated attention. Understanding how climate change specifically modulates soil erosion rate and spatial distribution in this locality is crucial for developing effective, targeted adaptation and mitigation strategies. Therefore, this study aims to assess this impact to provide the necessary data for sustainable land management and agricultural planning in Ekpoma.

2. STATEMENT OF THE PROBLEM

Ekpoma, located in Edo State, Nigeria, has witnessed an alarming increase in soil erosion over the past decades, threatening agricultural productivity, infrastructure, and human settlements. Although soil erosion is a naturally occurring process, its intensity and frequency in Ekpoma have been significantly amplified by climate change-induced factors such as erratic rainfall patterns, rising temperatures, strong winds, and other extreme weather events. These climatic shifts have disrupted the ecological balance, weakened soil structure, and accelerated runoff, especially in areas with poor vegetation cover and inadequate land management practices. Because of the wanton havoc caused by climate change-induced soil erosion over the past decades, many researchers, investigators, academia, and others have been drawn to it. Therefore, several studies have been conducted in the area of climate change and soil erosion. For instance, Segura *et al.*, (2014) investigated climate change and erosion activities in Benin-Owena River Basin in southwestern Nigeria and reported a clear link between a fluctuating, yet increasingly intense, rainfall pattern and rising temperatures, which together accelerate soil erosion activities. They also observed that anthropogenic factors such as deforestation, inadequate drainage systems, and poor land management compound this climatic pressure, which often act as direct triggers for the formation and rapid expansion of massive gullies that threaten infrastructure and agricultural land.

In concordance, Eseigbe and Osawe (2016) studied the impact of climate change on landforms in Nigeria and noted that soil erosion is not merely a natural phenomenon but a climate-driven hazard worsened by anthropogenic activities such as deforestation, poor land use practices, and unregulated urban expansion. They further noted that the growing frequency of high-intensity rainfall events has overwhelmed the existing drainage systems, resulting in accelerated topsoil loss and sediment accumulation in low-lying areas. This phenomenon reduces agricultural productivity and contributes to downstream flooding and water pollution.

Akanwa *et al.*, (2024) used GIS/remote sensing analysis to assess the effects of climatic risks on soil erosion/desertification in Southern and Northern Nigeria and noted that climate change has emerged as a critical environmental challenge with far-reaching implications for soil stability and land productivity, particularly in vulnerable regions. Climate change accelerates soil erosion through intensified surface runoff, reduced vegetation cover, and altered hydrological cycles characterized by shifts in temperature, erratic rainfall patterns, and increased storm intensity

Similarly, Ifeanyichukwu *et al.*, (2025) used GIS and remote sensing techniques to map erosion hotspots in southern Nigeria (including Ekpoma). Their study demonstrated that integrating climate data with topographic and land use information can improve the accuracy of erosion risk assessments and inform targeted interventions. Their findings also underscore the urgent need for climate-adaptive land management strategies, including reforestation and sustainable farming. The study recommended adaptive land management strategies, such as agro-forestry, cover cropping, and terracing, to reduce erosion and enhance soil resilience. These practices not only mitigate the physical loss of soil but also improve water retention and biodiversity, contributing to long-term sustainability.

A closer examination of the foregoing reveals that, although several studies have explored climate change and its effects on soil erosion in various regions, there is a clear lack of research specifically assessing the impact of climate change on soil erosion in Ekpoma. This evident gap in the existing literature constitutes the research void that this study seeks to address scientifically.

3. AIM AND STUDY OBJECTIVES

The overall aim of this study is to assess the impact of climate change on soil erosion in Ekpoma. The specific objectives are as follows:

- (i) to examine the natural and anthropogenic causes of soil erosion in Ekpoma;
- (ii) assess the impact of climate change on soil erosion in Ekpoma;
- (iii) evaluate the socioeconomic consequences of soil erosion in Ekpoma; and
- (iv) assess the soil erosion mitigation and coping strategies in the study area.

4. STUDY AREA

The study area is Ekpoma. It is one of the seven clans that constitute the Esan West Local Government Area of Edo State, Nigeria (Eseigbe, 2011; Ehisuoria, 2012; Ehisuoria & Ilenre, 2018). Ekpoma lies approximately between latitudes $06^{\circ} 04^1$ and $06^{\circ} 45^1$ North of the Equator and longitudes $06^{\circ} 05^1$ and $06^{\circ} 10^1$ East of the Greenwich Meridian (Ojiefo, 2005; Eseigbe, 2011). The study area comprises 12 communities: Eguare, Emaudo, Ujoelen, Ukpenu, Uhiele, Illeh, Emuhi, Iruokpen, Uke, Ihumudumu, Idumebo, and Ujemen. Ekpoma is located in the humid tropics. It has the humid tropical climate characterized by wet and dry seasons. The climate is controlled by the position of the ITCZ. The northerly and southerly movements of the ITCZ throughout the year are marked by the outset of the wet and dry seasons (Eseigbe, 2011). The hottest period of the year in the study area is recorded from January to March (34°C), while the lowest temperature is recorded between June and July (24°C).

The soils in Ekpoma are ferri soils on loose sandy sediments. These soils are less leached and consequently retain water and encourage agricultural practices. The soils encourage and support the production of food and cash crops.

The economic activities of the people of Ekpoma encompass agricultural and non-agricultural sectors. The agricultural sector includes crop cultivation and animal grazing. The crops cultivated include food crops (yams, maize, cocoyam, pepper, plantain, banana, and pineapple) and cash crops (oil palm, cocoa, cashew, pear, orange rubber, and ducanut). The domesticated animals are goats, dogs, cows, and sheep. Poultry farming is also a famous agricultural activity carried out by the people of Ekpoma. The non-agricultural sector is industrialized. The industrial sector of Ekpoma comprises both agro and non-agro-based industries. The agro-based industries include cassava grating and processing, rice processing and milling, vegetable oil processing, and palm oil milling. The non-agro-based industries in the study area include block molding, black smiting, welding,

Soil erosion is a critical global environmental challenge that is increasingly stifled by climate change and unsustainable land use practices. On a global scale, the literature consensus points to an expected increase in soil erosion rates toward the end of the 21st century, primarily driven by the intensification of the hydrological cycle (Tan *et al.*, 2020). Warmer temperatures increase the moisture-holding capacity of the atmosphere, leading to more frequent and intense extreme precipitation events, which significantly boost the R-factor, the key climatic driver of water erosion (Trenberth, 2011). Furthermore, rising temperatures and changes in soil moisture regimes complexly interact with vegetation, potentially reducing the protective biomass cover through faster residue decomposition, especially in semi-arid and poorly managed agricultural areas (Tan *et al.*, 2020).

The challenge is especially severe in developing regions, with Nigeria experiencing extensive land degradation—where soil erosion, particularly gully erosion, is the most prevalent and destructive threat (Nwosu & Okon, 2023). Studies within the Benin-Owena River Basin in southwestern Nigeria have documented a clear link between a fluctuating, yet increasingly intense, rainfall pattern and rising temperatures, which together accelerate erosional activities (Segura *et al.*, 2014). This climatic pressure is compounded by anthropogenic factors such as deforestation, inadequate drainage systems, and poor land management, which often act as direct triggers for the formation and rapid expansion of massive gullies that threaten infrastructure and agricultural land (Odemerho & Onokerhoraye, 1994). Despite the severity of the issue, research on advanced soil erosion modeling in Nigeria lags behind, limiting the ability to establish harmonized and proactive conservation strategies (Nwosu & Okon, 2023).

Within the Nigerian context, Edo State represents a hotspot for severe gully erosion due to a confluence of predisposing physical and climatic factors (Osaze & Odemerho, 2019). The state's geology features soils that are often highly sandy with low organic matter content, making them inherently susceptible to detachment and transport by water (Edo-FEWMA, 2023). From the hydrologic point of view, the region experiences high-intensity, short-duration rainfall events that generate large volumes of erosive runoff, carving deep V- and U-shaped gullies across the landscape, notably in densely populated urban and peri-urban centers like Benin City and Auchi (Osaze & Odemerho, 2019). Although local governments and international agencies have implemented structural and biological control measures, their effectiveness remains constrained by the sheer magnitude of the problem and the persistent challenge of managing surface runoff (Osaze & Odemerho, 2019).

Ekpoma, situated in Edo Central, exemplifies the state's erosion challenge, where soil degradation has been investigated in relation to topography and water management infrastructure. Research conducted around Ambrose Alli University's environment and nearby dam sites, such as Ukhun and Ibiekuma, revealed the destructive cycle of erosion: vegetation clearance for land use or infrastructure leads to the loss of fine soil particles (silt and clay) and organic matter, thereby increasing the soil's erodibility (Edosomwan *et al.*, 2013). The study of Alfisols, the predominant soil type in the region, underscores the importance of biological control, as demonstrated by the significant reduction in the erodibility factor when measures such as planting garbonensis (ducanut or bush mango) are used, advocating for the urgent need for site-specific, nature-based solutions to complement structural engineering in Ekpoma's erosion management efforts (Nwosu & Okon, 2023).

5.2.1 Climate Change and Soil Erosion

Globally, climate change has been widely recognized as a major driver of soil erosion, with increased rainfall intensity, temperature fluctuations, strong winds, and extreme weather events accelerating land degradation processes. Eekhout and de Vente (2022) conducted a systematic review of 224 modeling studies and found a

consistent global trend of increasing soil erosion, particularly in semi-arid regions, toward the end of the 21st century. Their findings emphasized that land use changes, especially deforestation and agricultural expansion, compound the erosive effects of climate change, while soil conservation practices such as reforestation and land abandonment can mitigate these impacts.

Chakraborty *et al.* (2025) further explored the intersection of climate change and land-use dynamics, proposing the RUSLE, the most effective model for predicting global-scale erosion. Their study highlighted the importance of integrating climate projections with land cover scenarios to assess future erosion risks. They also noted that rainfall erosivity and runoff are critical components in soil loss modeling under changing climatic conditions.

Soil erosion, the detachment and transport of soil material by water, wind, or ice, is fundamentally a natural process, but it has been profoundly accelerated by human activities and, increasingly, by climate change (Pimentel, 2006). The literature unarguably demonstrates that climate change is a major and critical driver, primarily by altering the key variables that govern erosion rates globally (Nearing *et al.*, 2004). The most direct and significant impact stems from changes in rainfall patterns and intensity. As the global atmosphere warms, its moisture-holding capacity increases, resulting in a more vigorous hydrological cycle and a greater frequency of extreme precipitation events (Trenberth, 2011). These high-intensity rainfall events possess far greater energy to detach and transport soil particles than gentle rain, making the Rainfall Erosivity Factor a major projected source of future erosion increase in models like the Universal Soil Loss Equation (USLE/RUSLE) (Pruski & Nearing, 2002). Studies have projected a global increasing trend in soil erosion toward the end of the century, with some regions facing the highest projected increases, particularly those already vulnerable, such as semi-arid areas (Tan *et al.*, 2020).

Temperature is another critical factor beyond rainfall. Higher temperatures can accelerate the decomposition of soil organic matter and plant residue, thereby reducing the protective surface cover that shields the soil from raindrop impact and increases its structural stability. While an increase in atmospheric CO₂ might promote increased biomass production in some areas, the combined stress of higher temperatures and altered moisture regimes often leads to a net decrease in effective ground cover, leaving the soil more exposed and susceptible to erosion (Nearing *et al.*, 2004). This is particularly evident in Nigeria, where high-intensity, sporadic rainfall combined with increasing temperatures has already intensified erosion activities, significantly contributing to widespread gully formation in areas such as Edo State (Segura *et al.*, 2014; Osaze & Odemerho, 2019). The interaction between climate-driven erosivity and human-driven land use change, such as deforestation and poor agricultural practices, creates a synergistic effect that accelerates land degradation far beyond what either factor alone could achieve, representing a grave threat to food security and ecosystem health worldwide (Borrelli *et al.*, 2017).

5.2.1 Climate Change and Nigerian Soil Conditions

In the Nigerian context, soil erosion has become increasingly problematic due to climate-induced changes and unsustainable land practices. Udoumoh *et al.*, (2023) reviewed the impacts of climate change on soil conditions and food security, noting that rising temperatures and erratic rainfall patterns are likely to reduce soil organic matter and increase wind and water erosion. Their work underscores the vulnerability of smallholder farmers reliant on rain-fed agriculture and lack access to climate-resilient technologies. Focusing specifically on Edo State, Esegbe and Osawe (2016) observed that climate variability has intensified gully erosion in towns like Ekpoma. They attributed this to poor urban planning, deforestation, and inadequate drainage systems, which fail

to cope with the increasing rainfall volume and intensity. Their findings suggest that localized assessments are essential for designing effective erosion control strategies.

Climate change is profoundly altering soil conditions across Nigeria, stultifying existing vulnerabilities and creating new challenges that threaten the nation's agricultural backbone and infrastructure (World Bank, 2022). The heterogeneity of Nigeria's climate, ranging from the humid south to the arid north, means that the impacts are geographically distinct but uniformly harmful to soil health (Akande *et al.*, 2017). The degradation of the soil organic matter (SOM) pool has a major, unifying impact. Rising air and soil temperatures accelerate the microbial decomposition rate of SOM, leading to a significant reduction in SOC stocks (Lal, 2009; Akamigbo and Nnaji, 2011). This loss of organic matter directly translates into a decline in soil fertility, reduced water-holding capacity, and poorer soil structure, which subsequently makes the soil more susceptible to crusting and erosion.

In the humid South of Nigeria, including Edo State, the increasing intensity and volume of rainfall (even if the total number of rainy days decreases) lead to severe surface runoff and leaching of vital soluble nutrients, such as nitrogen and phosphorus, from the topsoil (Enete, 2014; World Bank, 2022). This intense rainfall erodes the topsoil, decreasing the rooting depth and available water reserves, which is particularly devastating for the region's highly weathered Alfisols and Ultisols. Furthermore, high rainfall often leads to increased soil acidity in the south-south and southeast regions, which further limits the bioavailability of nutrients such as phosphorus, even when fertilizers are used.

Conversely, the defining climatic impact in the arid and semi-arid North is the rise in temperature combined with a predicted decline in total precipitation and increased frequency of droughts (Amanchukwu *et al.*, 2015). This scenario drives desertification and wind erosion as vegetation cover diminishes (World Bank, 2022). High temperatures increase the rate of evapotranspiration, leading to rapid depletion of soil moisture and, in some cases, contributing to salinization on irrigated lands where water evaporates and salt accumulates on the soil surface. The cumulative effect of these climate-driven changes across Nigeria is a decline in overall soil quality, which critically hampers agricultural productivity and threatens national food security (Onyeneke *et al.*, 2019).

6. Research Methods

The data required and used in this study were obtained from both primary and secondary sources. The primary source formed the major data source required for this study. The primary data were collected through questionnaire administration, oral interview, and personal observation in the field. The projected population of Ekpoma in 2025 at a 2.5% growth rate is 176,089. Out of this population, 405 respondents (sample population), representing .23% of the entire population in the study area, were considered. Following the above, 405 questionnaires were administered in six selected communities in the study area. The 405 questionnaires were retrieved and used for the paper. The communities where the questionnaires were administered were Iruokpen, Idumebo, Emaudo, Eguare, Uhiele, and Illeh. The stratified sampling method was used to select the communities, whereas the random sampling technique was used to select the respondents for interview. Questions were asked about the natural and anthropogenic causes of soil erosion, the impact of climate change on soil erosion, the socioeconomic consequences of soil erosion, and the coping and mitigating strategies of soil erosion in Ekpoma, Edo State, Nigeria.

Secondary data were collected from related and relevant published textbooks, relevant articles in journal publications, students' original essays, dissertations, theses, and the Internet. Other sources include the data generated by the Esan West Local Government Council and the National Population Commission. Simple

random sampling techniques were used to select respondents from each of the selected communities. Questions were asked in line with the objectives of the paper and other relevant areas that helped achieve the study’s aim. The field data were analyzed using descriptive and simple statistical methods, such as frequency tables and percentages.

7. Results and Discussions

The field survey carried out on the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria, shows that climate change has a profound impact on soil erosion in the study area, and the impacts are critical to land, infrastructure, settlement, agricultural productivity, and the overall socioeconomic development of the people and the general environment of Ekpoma.

7.1 Climatic and Anthropogenic Causes of Ekpoma Soil Erosion

The field survey reveals the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria. The survey also reveals that these climatic and anthropogenic causes of soil erosion in Ekpoma are not of equal impacts and vary considerably from one area and season to another. Table 1 shows that the climatic factors are heavy and erratic rainfall, high temperature, and strong winds, while deforestation, wildfires, urbanization, improper agricultural, and construction activities are the anthropogenic factors. Out of the 405 questionnaires administered in the study area, 138 (34.07%) respondents settled for heavy and erratic rainfall, 62 (15.31%) for strong winds, 48 (11.85%) for high temperature, 46 (11.36%) for urbanization, 45 (11.11%) for deforestation, 38 (9.39%) for improper agricultural activities, 22 (5.43%) for wildfires, and 06 (1.48%) for construction activities. This finding aligns with the earlier studies by Esegbe and Osawe (2016) and Akanwa *et al.*, (2024), which identified climate change as a major environmental challenge with profound impacts on soil stability and land productivity, especially in vulnerable regions. Climate change, characterized by temperature shifts, erratic rainfall patterns, and increased storm intensity, accelerates soil erosion through intensified surface runoff, reduced vegetation cover, and altered hydrological cycles. Soil erosion in Ekpoma is not merely a natural phenomenon but a climate-driven hazard stultified by anthropogenic activities such as deforestation, poor land use practices, and unregulated urban expansion. See Table 1 for further explanations.

Table 1: Climatic and anthropogenic causes of soil erosion in Ekpoma

Climatic and Anthropogenic Causes of Ekpoma’s Soil Erosion	Frequency	Percentage (%)
heavy and erratic rainfall	138	34.07
high temperature	48	11.85
strong winds	62	15.31
Deforestation	45	11.11
Wildfires	22	5.43
Urbanization	46	11.36
Improper agricultural activities	38	9.39
construction activities	06	1.48
Total	405	100

Source: Fieldwork, 2025.

7.2 Impact of climate change on soil erosion in Ekpoma

The field survey reveals the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria. Table 2 reveals that the impacts of climate change on soil erosion in Ekpoma include accelerated gully erosion development, soil impoverishment, shortage of available arable land, and soil carbon loss. Table 2 shows that out of the 405 questionnaires administered in the study area, 189 respondents (46.77%) identified soil impoverishment as the most significant impact of climate change on soil erosion within the area. Shortage of available arable land has 95 (23.46%) respondents, accelerated gully erosion development has 78 (19.23%) respondents, and soil carbon loss has 43 (10.62%) respondents of the sample population in the study area. The above findings are in crystal clear agreement with the previous findings of Segura *et al.* (2014), Borrelli *et al.* (2017), and Osaze and Odemerho (2019) that the impact of climate change on soil erosion is evident in Nigeria, where high-intensity, sporadic rainfall combined with increasing temperatures has already intensified erosion activities, contributing significantly to widespread gully formation in areas such as Edo State. The interaction between climate-driven erosivity and human-driven land use change—such as deforestation and poor agricultural practices create a synergistic effect that accelerates land degradation far beyond what either factor alone could achieve, representing a grave threat to food security and ecosystem health worldwide.

Table 2: Impact of climate change on soil erosion in Ekpoma

Impact of Climate Change on Ekpoma Soil Erosion	Frequency	Percentage (%)
Accelerated gully erosion	78	19.23
Soil impoverishment	189	46.67
Shortage of available arable land	95	23.46
Soil carbon loss	43	10.62
Total	405	100

Source: Fieldwork, 2025.

7.3 Socioeconomic Consequences of Ekpoma Soil Erosion

The conducted field survey revealed the socioeconomic consequences of soil erosion in Ekpoma, Edo State, Nigeria. The survey clearly reveals from Table 3 that the socioeconomic consequences of soil erosion in Ekpoma are shortage of food, reduced income, loss of man hours, selective soils, loss of property, shortage of potable water, high cost of living, and living in suspense of fear. Table 3 shows that shortage of food ranked highest out of the 405 questionnaires administered to respondents in the study area, with 93 (22.96%) respondents. Reduced income has 78 (19.26%) respondents, high cost of living has 62 (15.31%) respondents, loss of man hour has 61 (15.06%), selective soil damage/loss of property and shortage of potable water both have 38 (9.38%) respondents each, and finally, living in suspense of fear/psychological problem has 7 (1.7%) respondents of the sample population in the study area. This finding further corroborates the earlier studies by Borrelli *et al.*, (2020) and Mandal and Roy (2024), which established that water-induced soil erosion is a major cause of land degradation on a global scale, leading to reduced soil fertility, decreased agricultural productivity, and significant off-site impacts such as the siltation of water bodies.

Table 3: Socio-economic consequences of soil erosion in Ekpoma

Socioeconomic Consequences of Soil Erosion in Ekpoma	Frequency	Percentage (%)
Food shortage	93	22.96
Reduced income,	78	19.26
Loss of man hours	61	15.06

Selective soils,	28	6.91
Damage or loss of property	38	9.38
Potable water shortage	38	9.38
The high cost of living	62	15.31
Living in suspense of fear/psychological problems	7	1.73
Total	405	100

Source: Fieldwork, 2025.

7.4 Mitigating and Coping Strategies for Soil Erosion in Ekpoma

Soil erosion, a natural process, has occurred in Ekpoma since prehistoric times. However, the form linked to climate change is relatively recent and has reached a new intensity and scale. Likewise, efforts to mitigate and cope with soil erosion have long existed, with the strategies adopted in Ekpoma over the years reflecting the prevailing era, level of awareness, and technological advancement. The mitigating and coping strategies adopted in Ekpoma over the past years include: creating and promoting community awareness, planting cover crops, planting all-season green tropical tree crops, practicing soil conservation, reforestation, bush fallow/agricultural land abandonment, farmland tillage, terrace farming, environmental sanitation, permeable pavements, and implementation of green building initiatives.

8. Conclusion

Climate change is one of the most pressing environmental challenges of the 21st century, exerting profound effects on physical and biological systems—including soil erosion—across the globe. Specifically, Ekpoma faces significant threats to its soils and the general environment due to its unique and peculiar geographical and climatic characteristics and rapid urbanization. Unarguably, these unique and peculiar characteristics make Ekpoma highly vulnerable and susceptible to the effects of climate change on soil erosion. To mitigate or at least assuage the impact of climate change on soil erosion in Ekpoma, different mitigation and coping strategies have been put in place. These mitigating and coping strategies include creating and promoting community awareness, planting cover crops, planting all-season-green tree crops, practicing soil conservation, reforestation, bush fallow/agricultural land abandonment, farmland tillage, terrace farming, environmental sanitation, permeable pavements, and implementation of green building initiatives in Ekpoma, Edo State, Nigeria. This paper concludes by advocating for the implementation of the actionable policy recommendations, policy interventions, and further research that would ensure the resilience of the people of Ekpoma in the face of the impact of climate change on soil erosion.

9. Recommendations

Despite the growing awareness of climate change, localized data and targeted interventions addressing its specific impact on soil erosion in Ekpoma are lacking. Most existing studies focus on broader regional trends, leaving a gap in understanding the micro level interactions between climate variables and soil erosion (land degradation) in Ekpoma. Without a clear assessment of these dynamics, policymakers and stakeholders are ill-equipped to implement effective mitigating and coping strategies, thereby risking further environmental degradation and socioeconomic losses. Therefore, this study assessed the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria. Based on the findings of this paper, the following actionable policy recommendations are made: effective and continuous creation and promotion of community awareness on the impact of climate change on soil erosion in Ekpoma, Edo State, Nigeria; monitoring of climatic conditions to

help predict potential climate change-related hazards and how to circumvent them; planting of cover crops, planting of all-season green tree crops, practicing soil conservation, reforestation, bush fallow/agricultural land abandonment, farmland tillage, terrace farming, environmental sanitation, permeable pavements, and the implementation of green building initiatives. The concerned authorities should ensure that the above actionable policy recommendations are appropriately implemented.

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