Catalytic Impact of Natural Occurrence on Landscapes Degradation in Rural Communities a Threat to Biodiversity and Well-being

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Key Points:

- Most times the natural occurrences are difficult to curb but the man-made impacts are easy to control
- It was discovered that the causes of most of the erosion are both natural and man-made
- The findings give community legislators, environmentalists, and sustainability organizations fact-based knowledge.

Abstract

Most people mainly disadvantaged or lower-middle-income nations reside in the countryside. A resilient community is largely dependent on the physical growth of remote regions. This study aims to assess the catalyst effects of natural hazards like erosion on landscape degradation in rural communities. With a focus on the threat to biodiversity and well-being as it affects the people of Okitipupa, a rural community in Nigeria. To evaluate and handle environmental issues, the Driving Forces-Pressures-State-Impacts-Responses (DPSIR) framework is employed. The socio-economic and socio-cultural factors that propel human activity and either exacerbate or lessen environmental constraints are known as driving forces. A qualitative approach was deployed for this study using a geospatial analysis of the study area within a 1.5x1.5KM sample frame where there is a major gully erosion. The spot heights were taken to generate the soil elevation, the landforms, and the hydrology. There are not many researches that look at how biodiversity or natural resource management techniques and concepts affect mental health in the countryside and rural settlements. There is evidence that extreme weather events or climate have a detrimental effect on mental health, and well-being in rural places. The sustainable landscape design approaches are important due to the heterogeneous and predominant nature of the climate, socio-economy, and landscapes of the rural settlements. This understanding, which addresses the effects on the psychological wellness of the most disadvantaged individuals, can enhance government attempts towards comprehensive management and environmentally conscious preparedness to curb or prevent future reoccurrence.

Plain Language Summary

On the other hand, the preservation of the environment is being threatened by the existing methods of rural development, which puts the long-term viability of rural areas in greater danger. To create a sustainable environment in rural areas—one that supports both natural processes and rural production and living activities—multiple stakeholders must work together over an extended period.

1 Introduction

Landscape degradation, alteration, and degeneration must be stopped by patience and persistent work. Dependence on either active or passive rehabilitation to counteract the impacts of habitat deterioration has developed as a result of the understanding that maintaining existing, undisturbed ecological systems would not be adequate to meet global environmental concerns [1]. Restoring damaged ecosystems and preventing or at least decreasing erosion are the two main strategies needed to address the negative effects of land degradation [1,2]. The first strategy is known as terrestrial-degradation neutrality, and its goal is to preserve or enhance the state agricultural assets particularly the restoration of natural and seminatural ecosystems. The foundation of both routes is soil recovery, which entails minimizing soil loss and enhancing soil health and quality, particularly by preserving and growing biological material [3].

Both the physical and ecological surroundings of the neighborhood residents may have a significant impact on their comfort level and overall psychological well-being [3-5]. Few researchers have looked at this association in rural areas; most have looked at metropolitan surroundings. The purpose of this research is to evaluate how natural hazards such as erosion contribute to the deterioration of remote populations' landscapes. Concentrating on the danger to wellness and ecology as it impacts the residents of Okitipupa, a rural village in Ondo State, in the southwest of Nigeria. Although this region is rich in tropical rainforest and biodiversity, there has been evidence in recent years linking environmental factors—such as flooding, warming temperatures and severe thunderstorms, agricultural practices and depletion of habitats and trees and shrubs, and participation in conserving natural resources activities—to the quality of life in rural communities [4].

Nigerians are quite concerned about climate change since it is an abnormality in the climatic system. Nigeria's changing environment, including landslides, soil erosion, rising temperatures, flooding, and drought, are indicators of climate change [2, 4-5]. Amongst local and international stakeholders, the degradation of the climate and its effects on our surroundings is a topical and important problem. The depletion may result from tangible, individual, or purely environmental factors. The effects of climate change vary throughout the nation. These impacts fall into one of four categories: physical caused by heavy rainfall, social due to the gender, male or female, generations, socioeconomic status, as well as livelihood, industry-specific, and the administrative or political structure of the community [6]. Constant threats of the destruction of soil, mudslides, and eroded landscapes in Nigeria are the subject of this study. The difficulties noticed during the process of land safeguarding, include the absence of warnings, inadequate financing of projects, and lack of attention by the locals. Impact on strategies and opportunities for curbing these environmental issues were also reviewed with practical reports of specific happenings. If these problems remain unresolved, these variations could culminate in a rise in

global temperatures, changed rainfall patterns, destroyed agricultural land caused by catastrophes, and negatively impact buildings and livelihood as can be seen in Okitipupa.

2 Literature Review

Conditions, both synthetic and organic, can affect a person's physical and psychological well-being. There has been more research conducted in urban areas than in rural ones on this link [7]. While there have been documented strong correlations between mental disorders and flooding, previous evaluations have identified only marginal links in the formation of a sustainable community [7]. Agricultural environments are diversified land masses with a vast range of living and nonliving organisms that are interconnected and connected, each with their roles and purposes [7-9]. Thousands of decades of processes of evolution have produced an enormous array of organisms such as animals, plants, and living things all together in their natural habitat. The abundance and variety of ecological diversity are reflected in the wide range and unpredictability of species. Since the beginning of time, biological variety has been a cornerstone, offering several advantages and numerous ecological services to rural populations [10]. The ecological richness and variety of a given area are essential to human life and existence on Earth. The vast majority of impoverished rural populations are suffering from extreme poverty, starvation, and low quality of life. Approximately 80% of the world's impoverished are from rural areas [8,11].

The earth's ecological balance, which includes a variety of ecosystems that provide a broad range of products and services to suit the requirements of both the region and the local people, is inextricably tied to the wellness and profitability of rural areas [12]. The majority of rural residents live in agricultural villages that are intricately connected with the various organic and artificial ecosystems that include forests, water from fresh sources, aquatic, pastures, and arid regions. Individuals directly profit from the extensive variety as a source of revenue for households and agricultural employment [13,14]. Nevertheless, declining quality living conditions and rapidly diminishing resources have made rural areas fewer desirable places to live in the past few decades. Especially in light of the procedures that are causing global warming, wildlife is essential to rural economy sustainability [14-16]. Agriculture and our food systems depend heavily on biodiversity, which is also essential to the survival of resource-poor populations facing poverty and joblessness in rural regions [16]. Vegetative and animal products are equally vital to small- and medium-sized farmers since they provide them with food, fuel, fiber, medicine, and other resources [16-18]. These assets enable households to meet their fundamental needs and augment their earnings. Biological variation found in farmed or uncultivated environments, such as swamps and woodlands are the foundation for the fortunes of the people [17].

2.1 Landscape Degradation and the Effect of Natural Occurrence

Anthropogenic climate change has an unprecedented impact on ecosystems and their services, with severe consequences for human well-being, particularly for the marginalized and vulnerable members of society in the Global South [18]. The well-being of communities relies not only on material and regulating services ecosystems provide but also on non-material services. Studies found that non-material services are generally more often associated with well-being effects[19,20]. Climate change degrades material and non-material services through sea level rise, biodiversity loss, drought, precipitation, and temperature variability, with consequences for

materials, companionship and labor, food and feed, and physical and psychological experiences. Loss of land and forests is expressed through ecological grief.

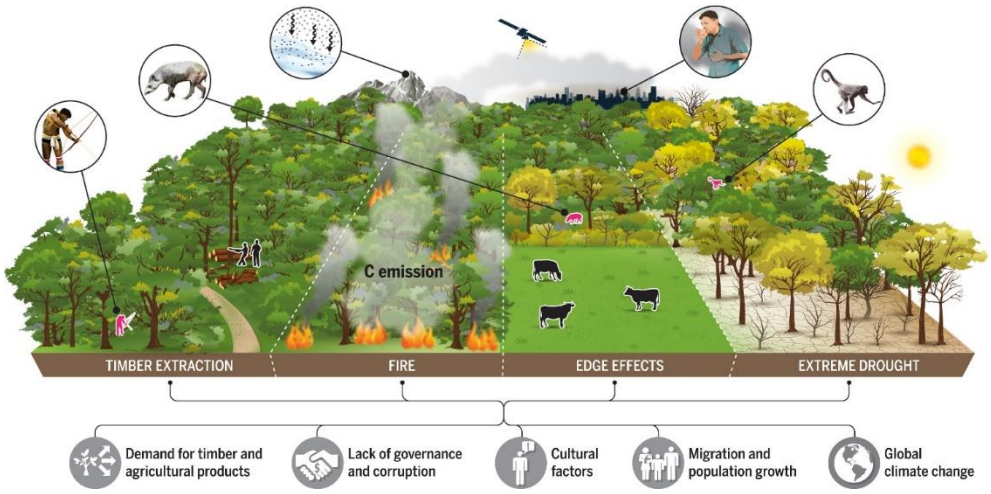


Figure 1. Picture showing human activities as they damage the rainforest. https://www.newswise.com/articles/human-activity-has-degraded-more-than-a-third-of-the-remaining-amazon-rainforest-scientists-find. **Source:** Alex Argozino [Access in April 2024].

Why is losing the Richness of the Okitipupa rural landscapes and biodiversity important to be studied? Similar to a few case studies around the world, the Amazon rainforest is a biodiversity hotspot under threat from ongoing land conversion and climate change. The tropical rainforest of the Amazon is a hotspot for biodiversity that is being threatened by ongoing land conversion and climate change [21]. Research has shown that human activity is causing changes in the jungle of the Amazon much more quickly than they did in the past, even though forest clearing has been extensively captured there [22]. The degradation of the Amazon Forest additionally has a significant negative impact on ecological diversity and the retention of the element carbon [20-22]. The underlying causes and impacts of deforestation have been the main focus of most investigations of changes in land-use and land-cover in the Amazon forest [21,22]. However human activities degrade the surviving Amazon forests and pose a threat to their survival. The primary causes of these disturbances are fire, edge effects, and severe droughts that have become worse as a result of human-caused climate change [23]. This research compile information on these disturbances, their effects, potential future extent, and some of the necessary measures to stop them, which contribute to the destruction of the Okitipupa rain forest. Changes can result in a loss of biodiversity equivalent to that caused by deforestation itself, and forests degraded by fire and timber extraction can reduce dry-season transpiration by 40%. The underlying drivers of disturbances, such as agricultural expansion or the demand for timber, provide material benefits for a limited number of local and international actors, while the consequences affect a wide range of scales and social groups [24]. First-order projections for 2050 show that each of the four primary

problems will continue to pose a significant threat and be a major source of carbon fluxes to the atmosphere regardless of forest loss pathways [24,25].

Over one-third of the Amazon rainforest that still exists has been damaged by human activities [3,19-25]. The loss of forests produces carbon emissions that are equal to or higher than those from degradation. Degradation has significant socioeconomic effects in addition to its effects on the climate and biodiversity [26]. According to projections for 2050, the primary drivers of carbon emissions from the Amazon will still be disturbances like fire and illicit logging. More than a third of the remaining forest in the Amazon has been impacted by human activity, indicating that the deteriorated state of the rainforest is far worse than previously thought by scientists [27].

2.2 Adopting the DPSIR Framework for Conservation

The above DPSIR structure, which stands for Driving Forces-Pressures-State-Impacts-Responses, is an established model used worldwide to analyze and examine the significant and interconnected interaction of environmental and social variables [28]. The drivers are the economic social and socio-cultural forces that drive human behavior, which boost or mitigate presses on the environment; forces are the burdens that people's actions place on the surroundings; state, or state of the environment, is the condition of the surroundings; they are impacts are the effects of societal deprivation of and reactions are how society responds to the state of nature. An effective analytical framework for evaluating intricate natural resource concerns is the DPSIR model. For instance, it is helpful to be able to assess the condition of and influence on these ecosystems throughout time, as freshwater management considers constantly shifting complex aquatic ecosystems and their link to neighboring populations [29].

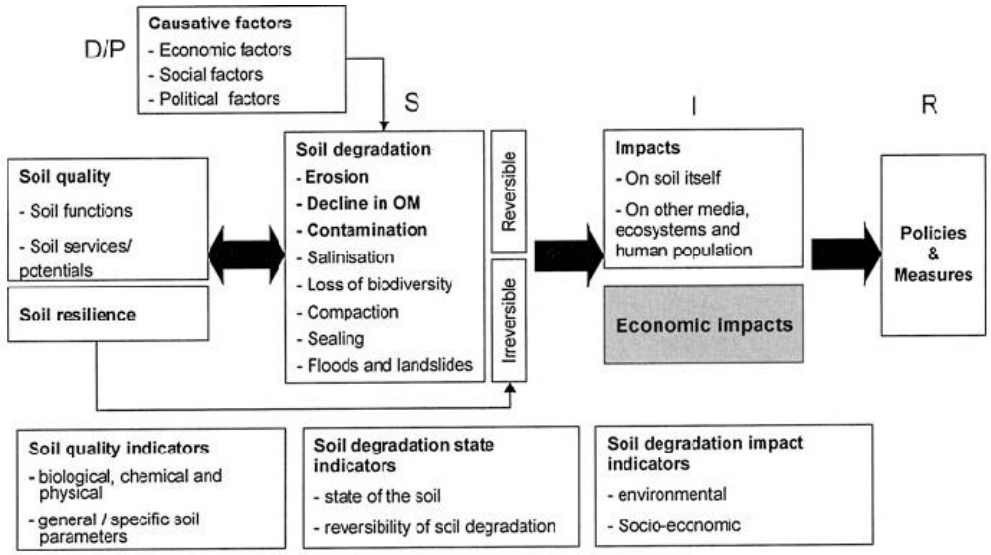


Figure 2. DPSIR Framework on Soil Degradation https://www.researchgate.net/figure/The-DPSIR-soil-degradation-assessment-framework-extract-from-Goerlach-et-al-2004_fig1_235218152. (Emadodin, Narita, & Bork, 2012).

The DPSIR framework offers a framework for presenting the indicators required to give policymakers feedback on environmental quality and the consequences of past and future political

decisions. It presupposes a series of causal relationships, beginning with "driving forces" (people activity, industrial fields), and ending with "pressures" (garbage, pollutants) 21,25-28].

The "states" (bodily, substance, and ecological) and "impacts" on natural systems, human well-being, and activities ultimately result in "reactions" on the governmental front (indicators, target-setting, prioritization). Since many different cause-effect linkages must be precisely specified and environmental changes are seldom attributable to a single cause, creating a DPSIR structure for a specific context is a challenging process [29]. To maintain long-term sustainability, it looks at how important it is to strike a balance between safeguarding the environment and development. The study addresses several ecological problems such as the availability of natural resources, the mitigation of climate change, the preservation of biodiversity, and the protection of ecosystems [30]. It emphasizes environmental conservation tactics such as community involvement, sustainable land management, policy and governance, and technical advancements. The study examines the difficulties in preserving the environment and offers ways to overcome them, such as international collaboration, capacity building, and awareness campaigns. In addition, it presents case studies and success stories from throughout the globe, with an emphasis on Nigeria specifically, illustrating the advantages of environmental preservation for people in cities as well as rural areas [31]. All things considered, this study highlights how important environmental preservation is to achieving sustainable rural and urban growth, which will help to create a sustainable, resilient, and peaceful environment.

2.3 Factors Contributing to Soil Degradation

The primary reason for soil deterioration is cultivating, wind power, and water all contribute to the breakdown of soil, which is one of the main causes of deterioration. The delicate balance required for plant growth is upset when topsoil, which is rich in nutrients, is lost. According to the Food and Agriculture Organization (FAO), erosion causes the loss of over 25 billion tons of productive soil annually, which has a big impact on global agricultural production [32]. Forest loss, which results from the fast growth of the urban and industrial processes and entails the loss of forests and disturbs the delicate equilibrium of ecosystems, closely correlates with the degradation of soil. This disruption exacerbates soil erosion, which lowers the soil's ability to hold rainwater and depletes organic matter, exacerbating the issues brought on by soil deterioration. Grazing excessively stands out as the third noticeable culprit, particularly in rural settlements. Uncontrolled cow grazing contributes significantly to erosion, compacts the soil, reduces the amount of vegetation cover, and is particularly problematic in dry and semi-arid regions. Overgrazing affects various natural systems and has a significant impact that extends beyond the nearby farming region [28]. Grazing excessively has a detrimental impact on agricultural yields and habitats' resilience to shocks, affecting more than one-quarter of the globe's surface, estimates of the World Bank [20-24, 29].

The study identifies industrial activities as the fourth component that exerts a driving force-pressure effect on rural landscapes. These activities typically take various forms and the release of hazardous materials into the soil by industrial effluent discharge hurts the biological activity function, efficiency, and makeup of the soil [33,34]. This is an important part of the larger problem

of deteriorating and degrading soil because it poses an obvious and acute danger to the health of ecosystems, the well-being/livelihood of the settlers and the productivity of farming.

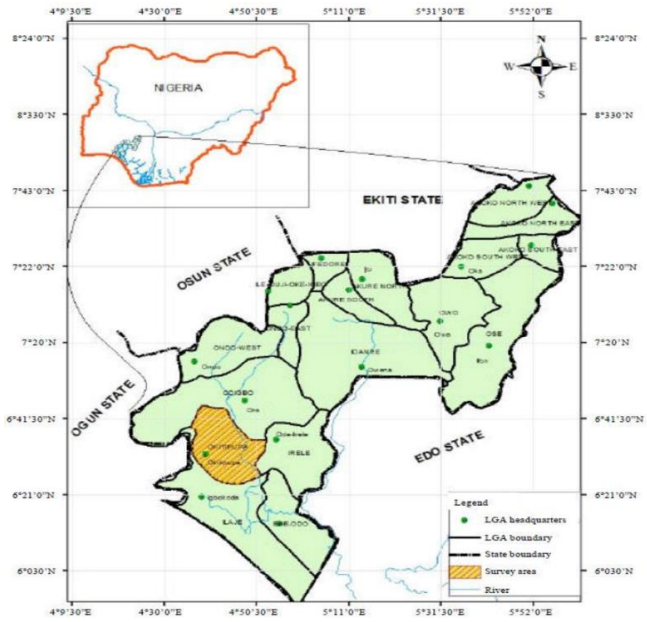
3 Methods

The Southwest area of the country is seeing an acceleration of soil degradation patterns owing to groundwater eroding caused by improper human behaviors and their complex relationships with environmental variables. This is especially true in vulnerable agricultural systems that do not have measures to conserve water and soil in place. Even though these shifting events have long-lasting effects, the danger of soil erosion has not yet been thoroughly evaluated at the level of the zone. On a global scale, forests are the biggest repositories of non-native trees and are vital to the survival of ecosystems. Nevertheless, cutting down trees actions brought about by industries like farming, development, and vegetation entering continue to put a strain on the remaining forest regions, resulting in significant changes in surface use and covering. The state of Okitipupa's rural landscapes has been alarmingly deteriorating. Considering trees are crucial for controlling worldwide temperatures, rainfall, oxygen, carbon, and environmental protection, identifying changes in land use cover and investigating the underlying causes can help guide policy and lower the risks associated with global warming. They offer safeguards against natural events including damage from erosion, drought, and thunderstorms. Using both primary and secondary data sources, the research investigated logging and environmental degradation activities in Okitipupa landscapes and their implications for climate change concerns in Nigeria. We employed qualitative techniques such as field observation, randomized in-depth interviews, and taking pictures of important informants while keeping an eye on environmental justice. In addition, aerial photographs, satellite photographs, and Geographic Information Systems (GIS) from a site that was eroded to a level of around 5 meters below in 2023.

3.1 The Study Area: Okitipupa, Nigeria

Figures 3 and 4 shows the position of Ondo State and Okitipupa. In Nigeria's Ondo State, Okitipupa is a component of the Ikale-speaking nation. Okitipupa Major Town, home to a

university, is home to the Okitipupa Local Government headquarters. situated in the following geographic coordinates- 6°33′N 4°43′E.



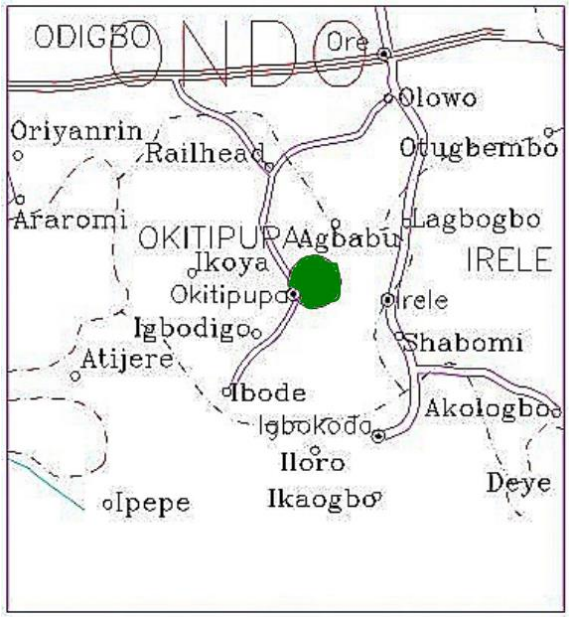


Figure 3 (right). Map of Ondo State Showing Okitipupa
Figure 4 (left). Road layout of Okitipupa Showing the study area.
Source: Gilbert et al, 2018. Map retrieved from https://www.researchgate.net/figure/Geological-map-of-Nigeria-showing-the-study-area-Okitipupa_fig1_327802568 [Access in April 2024].

The Yoruba tribe of Ondo state in Nigeria includes Ìkálè, also known as Old Ìkálè. Many of the town's indigenous residents still refer to "Okitipupa" town as Ode-Idepe, as it was known in the past. Due to the town's relative height, the more recent name "Okitipupa" has a different meaning. The population's relocation to the uninhabited area and the soil's red color (Pupa in Ikale/Yoruba). The name Okitipupa is a combination of the Ikale (Yoruba terms Okiti (hilly) and Pupa (red), which were used by individuals traveling from various areas to trade in the town of Idepe's main marketplace. Besides predominating strong winds that have reduced the vegetation cover, we found clear evidence(s) of environmental degrading actions that have reduced the number of woody bamboo trees to 30%, heightening erosion and flooding activities, and a low crop yield of 20%. About 35% of the harvested bamboo trees and other tree species were majorly cut for fuel wood, construction materials, and trading, 30% was used for farming activities, 20% were used for building construction activities, and 10% and 5% were employed for hunting and

dumping of refuse, respectively. Findings from satellite images showed drastic changes in the land-use/land-cover of Okitipupa rural landscapes.

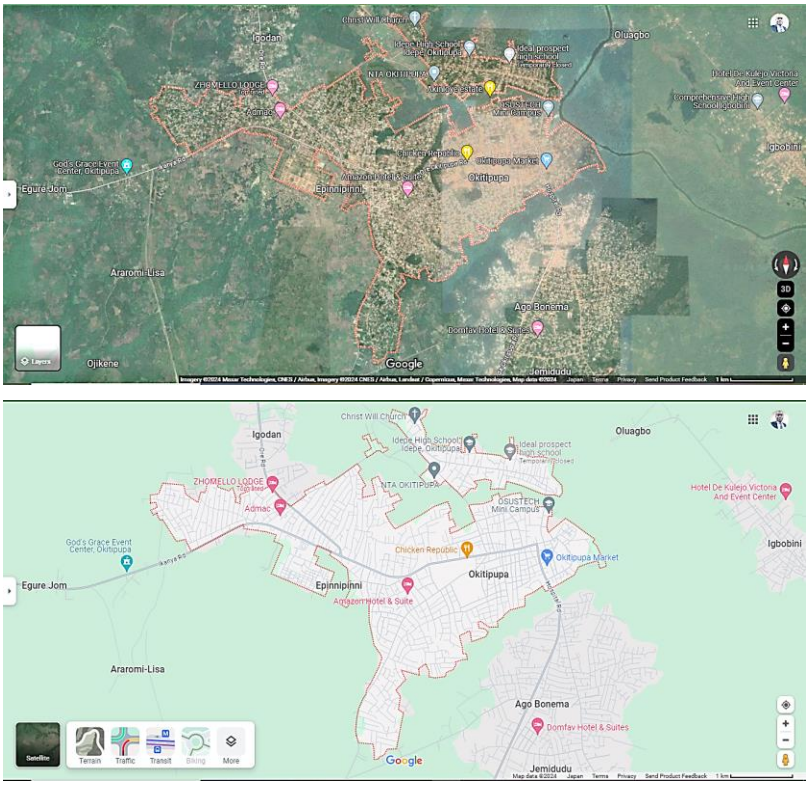


Figure 5 (right). Map of Okitipupa and surrounding villages.
Figure 6 (left). Road layout of Okitipupa.

This study deployed the use of remote sensing and geographic information systems (GIS), to estimate annual soil erosion rates, analyze the temporal-spatial patterns of erosion risk, and evaluate the potential of standard conservation practices to reduce soil loss in croplands.

The interview was also conducted randomly amongst some of the dwellers in the affected areas and it was revealed that since 2010 the rate of degradation has doubled which implies that the erosion has increased by 200% in about 10 years (2010-2020). This suggests an overall 20% every year. The low areas in the community are more susceptible to erosion risk. While the mountainous areas have limited or less risk of erosion. One of the community leaders interviewed stated that over 20 families have been homeless and more homes and landlords still stand the risk of losing their properties in the coming years. Another respondent stated that there has been a huge loss of trees and natural farmlands given to them by their father due to exploration by a certain foreign industry that came to the communities to explore some resources about two decades ago unknown to them that the act would adversely affect their community, twenty years after they have lost over 50% of the farm settlement and their homes.

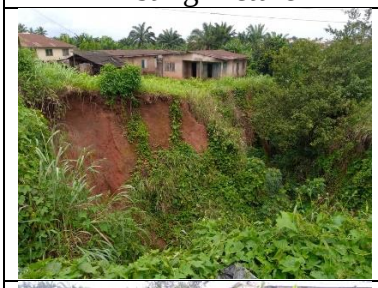
Some of the respondents lamented that they usually fear for their lives whenever it rains and the whole community gets flooded. Farmlands, schools, religious worship centers, and community playgrounds are not left out of the hazardous effects of erosion and the worst of all is the link road connecting the communities is currently been washed away. Table 1 revealed some

of the existing pictures and the current state of the impact on the communities with remarks stating the feedback from the on-site investigation and possible regeneration suggested by some experts amongst which are Geologist, Surveyor, Town/City Planners, Urban Designers Landscape Architects and Civil Engineers.

4 Findings and Discussions

According to the results, typical soil degradation may be decreased by putting supporting techniques such as stone pitching, landscaping, removal, and remodeling into use. Since stone pitching offers cover at tunnel headwalls—where damage frequently arises from concentrated road runoff—some respondents suggested it. It can preserve soils and lower the overall quantity of suspended material downstream. Furthermore, less expensive ongoing upkeep and correction are required. We recognize the investigation's weaknesses, which include its analytical algorithm's failure to take into consideration all types of degradation and its primary dependence on additional information, both of which might have an impact on how accurately the results are anticipated.

Table 1. Showing the existing conditions of the study area

Existing Picture	Current Situation	Remarks and recommendations
	Pictures show an abandoned community school currently on the verge of total collapse. This part is a bit shallow when compared to the part of the gully downstream. It is about 7m deep below the natural ground level	Total relocation of the community school and immediate intervention project to restore the degraded land.
	Picture showing the deepest section of approximately 15m below the natural ground level.	This point is unsafe. This area has to be restricted from community access and should be declared a high-risk zone.
	Picture showing parts of the road concrete felt/pavers still visible but now below and refuse been dumped into the gully by residents (8-10m depth).	The villagers must immediately stop dumping refuse there so as not to block the flow of the water which can have a ripple effect back into their community.

	Picture showing electricity power poles also within the proximity of the degraded section of the land.	Immediate relocation of all services (electrical and mechanic).

Table 2. Table showing the Cross Sections of the Eroded Gully

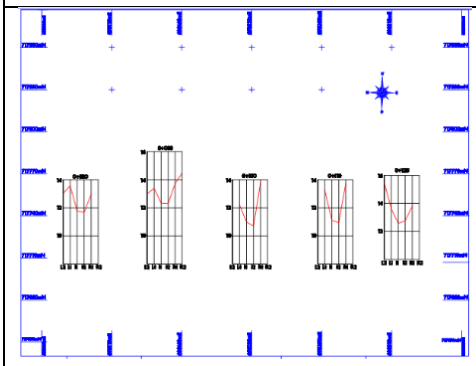
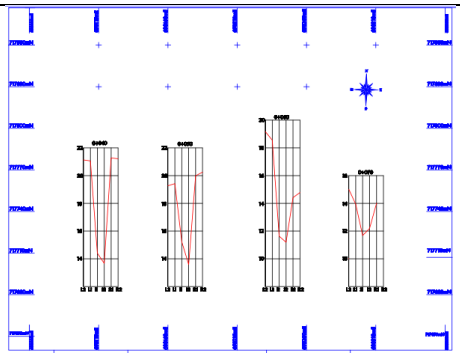
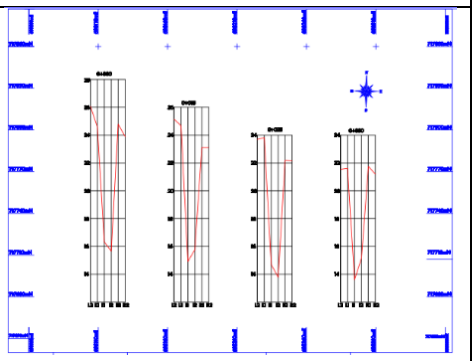
Cross Section 1	Cross Section 2	Cross Section 3
		
The cross-section shows the shallow part of the gully which is the area closest to the community. It has a 4-6m depth below the natural ground level.	This part is not the deepest but it has uneven depth of an average depth of 10m below. It's quite deep but not the deepest.	The part is the deepest section with an average depth of 15m below the natural ground level. This is the highest risk zone.

Table 2 illustrates the extent and depth of soil degradation. Additional investigation reveals that the forest resources surrounding Okitipupa have been severely impacted by human interference; land use changes brought about by increased commercial agriculture, rising demand of population community centers, and increased infrastructure growth have resulted in a reduction in the amount of woodland, which has an immediate impact on people's quality of life. Additionally, a significant portion of the lost forest is also attributed to environmental factors like lack of rainfall and vegetation conditions, and this varies in severity among territories. The diminishing woodland area has had a detrimental effect on our natural systems by reducing ecological diversity due to disappearing habitats and diminishing the supply of food products and supplements.

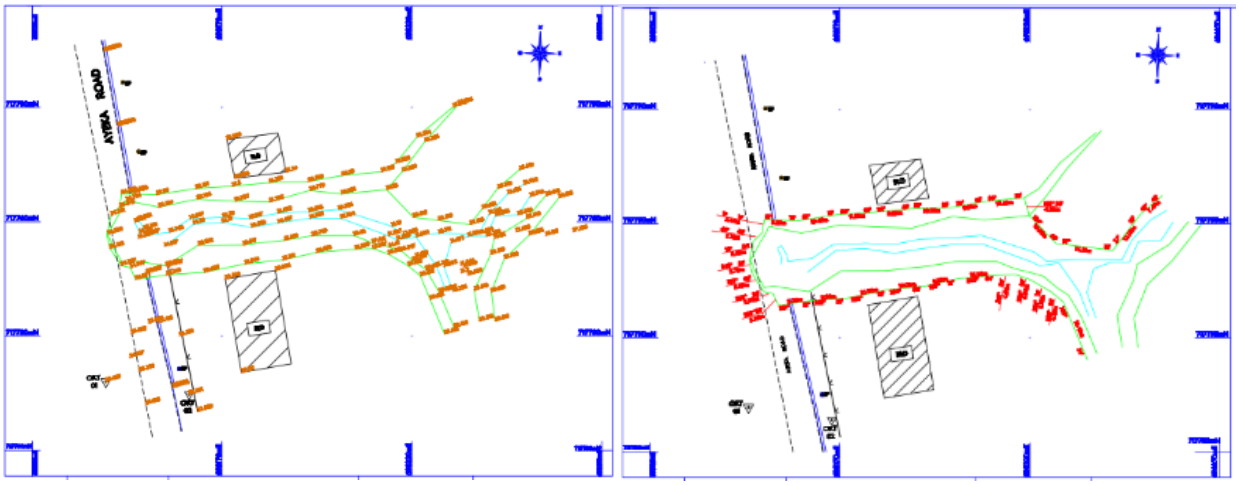


Figure 7 (right). Site layout showing the spot heights.
Figure 8 (left). Site layout showing the site boundary details.

Findings from the spatial analysis (see Table 2 and Figure 7) revealed that the well-being of the people, the surroundings, and agribusiness are all impacted by soil deterioration. Flooding, pollutants from chemicals, logging, excessive grazing, and industrialization are the main causes of soil deterioration. Reduced agricultural output, problems with water quality, a decline in ecology, and the production of greenhouse gases are all caused by poor soil. Each year, cultivating, the breeze, and precipitation degrade a large amount of productive ground. Combating soil erosion is essential to addressing both the impact of climate change and the worldwide shortage of food. As shown in the contour and terrain profile of the subject site (Figures 9 & 10) because of the quantum volume of damage to the site a comprehensive approach involving innovations in technology, environmentally friendly land use, and legislative measures is needed to address this problem.

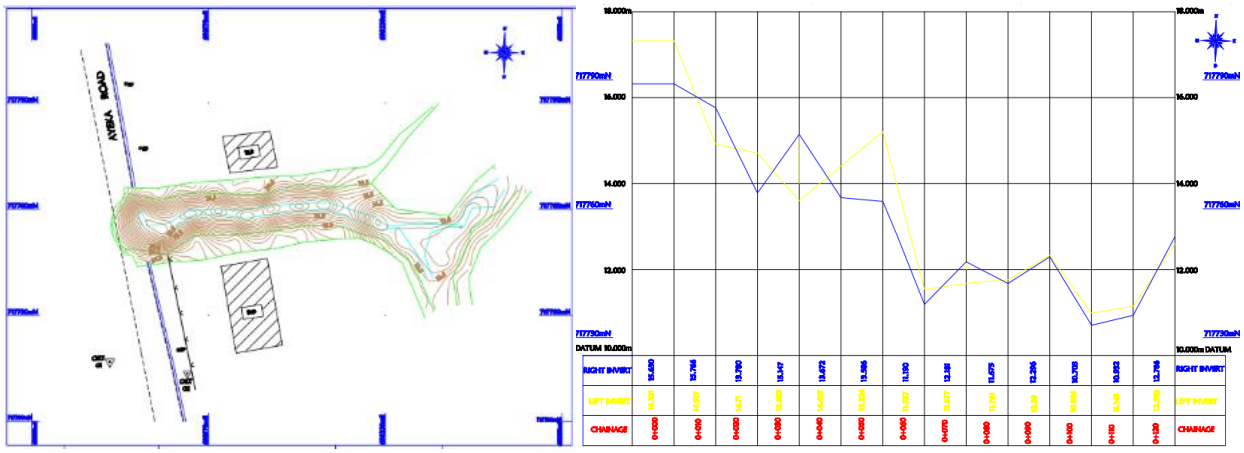


Figure 9 (right). Site layout showing the contours.
Figure 10 (left). Site layout showing the contour profile of the degraded soil.

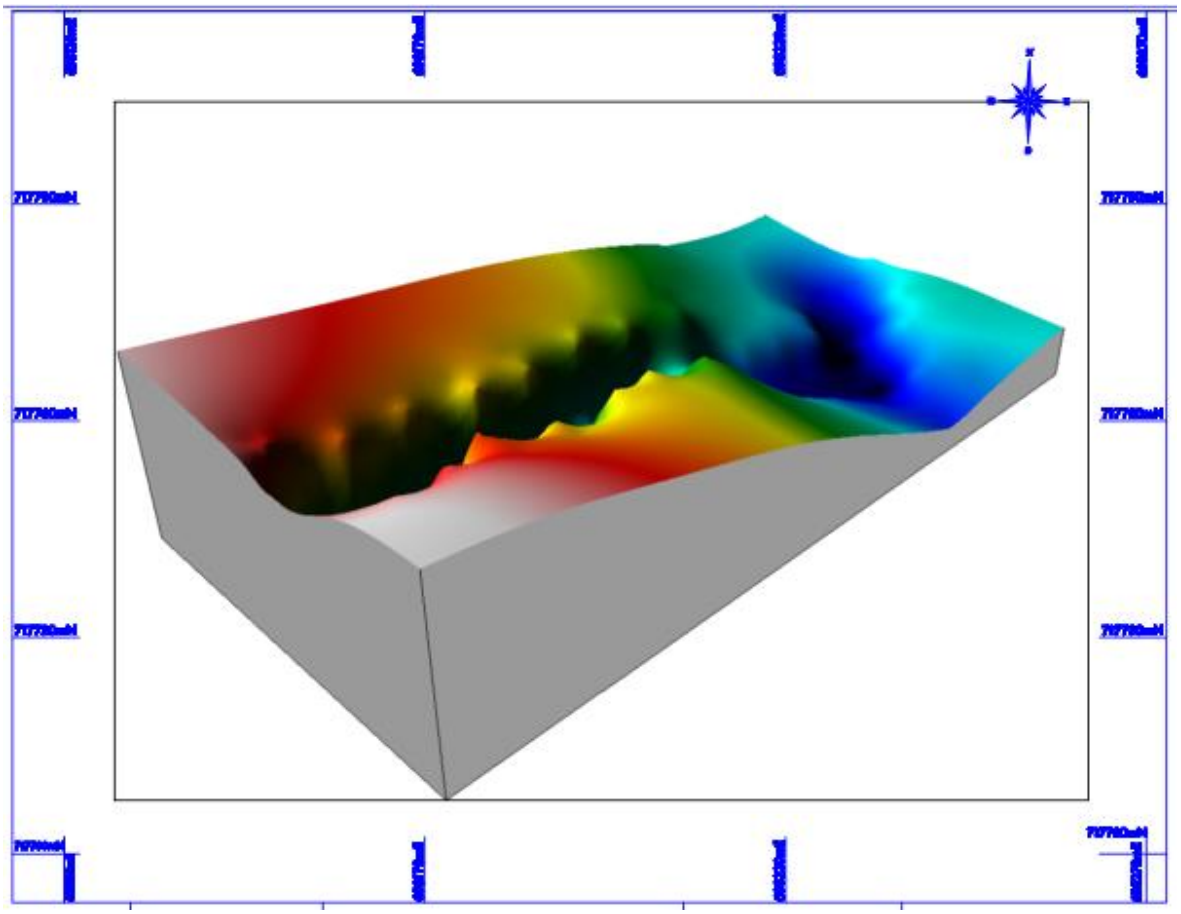


Figure 11. Digital Terrain Model (DTM) of the areas showing the real-life illustration of the site.

The 3D illustration (Figure 11) of the site expresses a key issue threatening rural societies due to the depletion of vital resources. In particular, rural areas focused on conventional agricultural activities are facing relevant difficulties. The uplands are the red and yellow patches while the lowlands are the blue and sky-blue patches. The survey revealed that the deepest point is in an average depth of 15m while the shallowest point is about an average of 4m depth below the natural ground level. However, there is a need for immediate concerns since the social, economic, and environmental well-being of the people of the place are greatly affected, and some of the known factors

4.1 Consequences of Soil Degradation

a. Reduction in Diversity Richness: Destruction of the earth causes diminished habitat and decreases the amount of food available to various organisms, which has a detrimental impact on richness in both terrestrial and subsurface ecosystems. The intricate web of interrelated connections that sustains life on the earth is also affected by the decline in life on earth, with implications for resilience to disturbances and sustainability.
b. Lower Farming Performance: The soil decline, which at first is marked by a decline in the amount of nutrients, a reduction in reservoir capability, and an overall reduction in reproduction, leads to lower harvest rates. The financial implications are substantial, affecting growers globally and contributing to the growing concern about the worldwide

availability of food. FAO projections that roughly thirty-three percent of the world's land is suffering from a medium to dramatic decline, which has a major influence on the lives of countless farming communities.

c. Questions about Groundwater Condition: Impairment of lakes and rivers stems from the decomposition of soil fragments and the infiltration of pollutants like the application of fertilizers and this results in a reduction in the quality of the water. The interconnectedness of water supply and the state of soil emphasizes how urgent it is to address declines in the soil as part of larger preservation of the environment initiatives. According to statistics from the World Health Organization, approximately two billion individuals globally get diarrhea and vomiting yearly as a result of water quality issues.
d. Increased emission of greenhouse gasses: One major factor contributing to the production of greenhouse gases is disturbed soils, which release stored carbon into the atmosphere. The relationship between soil degradation and climate change emphasizes how urgent it is to implement effective remediation techniques. Approximately twenty-five percent of all greenhouse gases caused by humans are attributed to soil destruction, approaches for restoration of degrading the soil remediation call for an intricate and all-encompassing approach involving technological developments, healthy management of land techniques, with governmental initiatives.

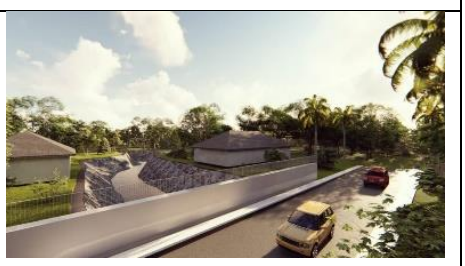
4.2 Landscape Design Preventive Approach Against Erosion Impacts

The measures to avoid it developed by this investigation are connected to environmentally friendly landscape architecture. Planning and managing a landscape are crucial for halting the ongoing deterioration of the land, groundwater, and crop yield. The multidimensional issue of soil degradation has a big impact on ecological systems, agriculture, and human well-being. Concerning the intricate relationship among reasons and repercussions that result from understanding DPSIR, a thorough and collaborative approach is necessary. By combining empirical studies, technological advancement, and governmental measures, you can implement restoration approaches and address the root causes of soil damage.

Being able to preserve our landscapes' wellness and effectiveness for posterity to come underscores the significance of this endeavor. We can ensure a sustainable future for all people and safeguard the essential components of the natural environment by putting in place a concerted global effort. Table 3 illustrates the two landscape design alternatives that relate to the existing site conditions and can recommend preventive solutions for the existing site. The proposal came to the fore after careful consideration and synthesis of the data obtained from the site, participatory meetings with the community stakeholders, and the technical best approach for a successful ecological restoration of the abused site.

Table 3. Showing proposed design strategies and the landscape construction materials

Landscape Design Option 1	**Landscape Design Option 2**

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>The proposed option 1 gives adopted stone pitching along the channel with smaller stones. It can control the water and the water collected is a little cleaner before the final disposal and storage</td><td>This proposed option 2 also recommended stone pitching but this time around with the bigger stones. The water is collected and dammed for onward channeling out the dirt in the right direction.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Underground channels for cross-water movement to avoid stagnant water right on the opposite side of the road. The drainage connects to other waterways to aid the continuous flow of water runoff.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>This illustration proposes a 2m walkways and activities zone right beside the canal.</td><td>This illustration proposes a 2m walkways and activities zone right beside the canal.</td><td>This illustration proposes a 2m walkways and activities zone right beside the canal.</td></tr>
<tr><td colspan="3">Rural landscape road infrastructure and beautification/streetscaping and a cross-over bridge with an underground high-volume water pipe for continuous dewatering of the canal.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
</table>

12m road and 1.2m pedestrian walkways on both sides. Streetscaping along the link road.	12m road and 1.2m pedestrian walkways on both sides. Streetscaping along the link road.	12m road and 1.2m pedestrian walkways on both sides. Streetscaping along the link road.
Alternative Landscape Design (Option 2)		
		
Aerial photograph of the showing the canal. The canal here is without the influx of human activities as it might pose continuous dumping of refuse and the fear of little kids falling into it.	Trees and hedge plants are to be planted at the edges of the canal. The stones used here are bigger compared to the first option.	Trees and hedge plants are to be planted at the edges of the canal. The stones used here are bigger compared to the first option.

5 Conclusions

Several proposals for legislation are put forth to improve the long-term viability and efficacy of soil deterioration in light of the study's findings. The data showed that the loss of biodiversity had not been a recent development, but had been occurring for more than 20 years. The primary causes of this degeneration are human disturbances of the environment and complete disregard on the part of all parties involved. This is a sign of severe deforestation that has occurred over time. It is crucial to aim for quick environment-climate-based initiatives instead of environmental justice and societal change. According to some of the responders, annual circumstances get worse and keep getting worse as a result of administrative indifference.

Thus, community involvement is essential for the restoration of soil and regeneration, and policies that support community-led restoration initiatives should be put in place. This research suggests that new ideas and tools for rural-urban areas should be developed to develop sustainable landscape designs in urban as well as rural areas; the practice of landscape planning, as well as design in rural areas, should evolve; that landscape sustainability science should be applied; that spatial analysis and landscape simulation should be used; demonstration projects that highlight sustainable site design and landscape planning; and that ecological rehabilitation of rural landscapes should be carried out.

Improving the built environment and health in rural regions, as well as promoting tourism and rural development, are all benefits of effective biodiversity conservation. The parties concerned ought to be in favor of bringing traditional communities back to life; Only the most remote areas of the planet are unaffected by human activity, and human influence is felt throughout most of the planet's terrestrial ecosystems. The following are continuous processes linked to

environmental destruction: contamination, erosion of soil, forest clearing, drought, loss of ecosystems, and decreased capacity for economy.

When taking into account the practice of agricultural forestry, which involves the incorporation of trees into agricultural areas and considerably enhances the makeup of the soil, sustainable landscape planning, design, and construction are veritable strategies for rural reconstruction and rejuvenation. Forests contribute to the cycle of nutrients and prevent erosion, offering a comprehensive approach to sustainable agriculture that blends forestry and traditional farming practices. The rehabilitation of degraded rural landscapes depends on afforestation and reforestation projects. By improving soil structure and encouraging biodiversity, these initiatives help restore ecosystems that have been negatively harmed by degradation.

On sloping terrain, erosion can be efficiently reduced by using physical methods like contouring and gardening. These technological fixes, which usually draw on traditional farming methods, offer effective ways to mitigate the effects of soil erosion. Accurately managing water and nutrients using technology is a creative way to improve agricultural resource use. To minimize its negative effects on the environment and maximize its effectiveness, precision farming supports environmentally friendly soil treatment. Possibilities for varied livelihoods and improved economic resilience have been made possible by the regrowth of forest assets. Communities that were formerly impacted by lower crop yields and regular catastrophes now have better economic circumstances owing to the efforts of the rural settlers, the majority of whom are farmers. However, these settlers still should perform. Allowing locals to participate in replanting projects, giving them the ability to utilize forest assets, and encouraging sustainable land management techniques, will foster community empowerment and engagement in the restoration efforts. Appropriate techniques for managing land also improve incomes and increase resiliency among communities.

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Conflict of Interest

The authors declare no conflict of interest. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

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