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The Influence of Environmental Protection Interventions on Human Security in Muhanga District in Rwanda

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Abstract

Purpose: The purpose of this study was to examine the influence of environmental protection interventions on human security in Muhanga District in Rwanda. Though the government puts much effort into enhancing the living standards of citizens in the region, they face a huge kind of disaster which harm the surrounding environment.

Methodology: The study employed mixed methods, using both qualitative and quantitative approaches with a descriptive research design which was used. Questionnaire and interview guide, observation and focus group discussion were involved during data collection as the instruments of data collection. A target population of 14,464 individuals were used, with a sample size of 402 respondents selected using Yamane's formula. Quantitative data was analyzed using SPSS version 21 while qualitative data was thematically analyzed.

Findings: The findings revealed that Training on soil management control was notably lacking, with 52.2% strongly disagreeing on receiving adequate training. The use of terraces for soil erosion prevention was also not widely adopted, with 63.8% strongly disagreeing. Conservation practices such as rainwater harvesting and tree planting showed mixed responses. While there was strong support for preventing deforestation (91.8% strongly agree), practices like rainwater conservation and dam construction faced significant opposition. Satisfaction with water tank availability was low, with 74.2% strongly disagreeing, and 67.9% of respondents faced challenges in accessing or maintaining water tanks.

Unique Contribution to Theory, Practice and Policy: This paper indicates that there is a significant gap in environmental education, with 52.2% of respondents strongly disagreeing that they had received adequate training on soil management. Not only this it was noted that there is need for increased awareness and support for sustainable land management practices. This paper recommends that there should be development and implement comprehensive training programs focused on soil management, terrace construction, and sustainable agricultural practices.

Keywords: *Environment, Environmental Protection, Human Security, Influence, Intervention*

INTRODUCTION

Globally like in Canada, the Canadian Institute of Governance (2003) posits that governance is the process whereby societies make decisions and determine whom they involve for the purpose of strengthening security in the community.

The Human Settlement were logically in practices identified with view to ensure that human security concern is covered which existed with evolution of man, research had indicated that the governments continued to acknowledge that individuals and communities in general requires a protective agenda that is deliberate (Levy,2024). Research recognized that people live in vulnerability of all events that are beyond control their control because of financial constraints, conflicts that are recurring, pandemic like aids, terrorism, water shortage, which requires a national policy to address the matter (Levy, 2024). Such threats need to be recognized, acknowledged and be mitigated by establishing measures that would counter the negative effects before their occurrence.

Therefore, climate change, biodiversity loss, pollution, and resource depletion exacerbate food insecurity, health risks, displacement and conflict (IPCC, 2022 & UNEP, 2019). Environmental protection therefore functions as a preventive mechanism for human security by reducing exposure to environmental risks before they translate into humanitarian crises or violent conflict (Ferris& Weerasinghe, 2020).

Regionally, the determinants remain critical for the protection of public health and the integrity of ecosystems. African governments therefore recognized and committed to address the interlinked challenges of health and environment through the adoption of the Libreville Declaration. They created the Health and Environment Strategic Alliance (HESA) as the platform for strengthening linkages in countries. It is now 10 years since the endorsement of the landmark framework. While progress has been made to implement the agreed priorities, the scale of investment in preventive environment and health interlinked services lags significantly, compared to the needs in countries.

Consequently, the burden of disease attributed to the environment as well as the costs of degraded ecosystems remains significant, undermining the achievement of the Sustainable Development Goals. In the Region, WHO estimated that over a quarter of premature deaths and sickness is attributable to unhealthy environments. This exacerbates the already costly and double burden of communicable and noncommunicable diseases saddling health care systems in the Region. This is further compounded by the increased frequency of reported public health events in the region, which in 2017 totaled 152 against an average of 100 per year (WHO, 2018).

The connection between environmental protection and human security in Africa is more immediate and pronounced due to the continent's structural dependence on natural resources. A large proportion of African populations rely on climate-sensitive livelihoods such as rain-fed agriculture, pastoralism, and fishing (FAO, 2018). Environmental degradation manifested through land degradation, deforestation, water scarcity, and climate variability directly threatens food security, income and social stability (UNEP, 2016).

Climate-related shocks increase poverty, displacement, and competition over scarce resources, sometimes contributing to local conflicts (African Development Bank, 2021). Consequently, environmental protection in Africa is not merely an ecological concern but a core human security strategy, essential for safeguarding lives, livelihoods and social cohesion.

In Rwanda, The Environmental Management Framework (EMF) aims to identify the range of required environmental management measures that need to be taken during the planning, design, implementation and operation phases of Urban Infrastructure for Roads, Drainage and Sanitation facilities, to ensure compliance with the national and WB requirements. EMF provides general policies, guidelines, codes of practice and procedures to be integrated into the implementation of the Project. It defines the steps, processes, and procedures for screening, alternative analysis, assessment, monitoring and management of environmentally related issues. In addition, EMF presents overview of environmental policies and legal regime of Rwanda and WB safeguard policies; includes institutional and capacity assessment related to environmental management; and describes the principles, objectives and approach to be followed while designing the site-specific environmental mitigation measures.

People have been using land with its natural resources without considering the environmental consequences. However, today there is increasing concern about the effect of rapidly growing population upon the environment. Finite resources such as copper, oil, tin are rapidly becoming depleted and there is no way in which they can be replaced. Even renewable resources such as fish-stocks and timber are being overexploited at an alarming rate. The growth of human population and the environmental pressure imposed by economic development are posing great challenges for the environment.

For the relationship of environmental protection and human security at the national level, Rwanda illustrates how environmental protection is central to human security in densely populated and ecologically fragile contexts. Rwanda's high population density, hilly terrain, and dependence on land-based livelihoods make the country particularly vulnerable to soil erosion, floods and landslides (REMA, 2020). These environmental challenges directly affect food security, economic stability and physical safety.

Rwanda's policy emphasis on land use planning, soil conservation, reforestation, and climate resilience reflects recognition that environmental sustainability underpins poverty reduction and disaster risk reduction (Government of Rwanda, 2011). Protecting the environment thus strengthens food security, health security and economic security at the national level.

Muhanga District is characterized by steep slopes, erosion-prone soils, and heavy reliance on subsistence agriculture. Environmental degradation in the district particularly soil erosion and watershed degradation poses direct threats to agricultural productivity, household incomes, and physical safety through floods and landslides (MINEMA, 2018).

Soil conservation, terracing, and sustainable land management in Muhanga reduce disaster risks, stabilize food production, and enhance community resilience. At this level, environmental protection directly translates into everyday human security determining whether households can meet basic needs and withstand environmental shocks.

Problem Statement

The current human settlement policy in Rwanda integrates human security in rural and urban areas (MININFRA, 2010). However, despite the government's efforts and commitment to improving human settlements in a holistic manner, evidence shows a growing intensity of human security issues due to natural hazards causing more disasters. Human security, according to the United Nations (UN, 2018), should be free from fear, want, and uphold the dignity of citizens. It is seen as a strategy to help member states identify and address widespread

and cross-cutting problems related to the survival, livelihood, and dignity of their people (UN, 2017).

Ilcan and Rygiel (2015) revealed that the cost of disasters increased drastically in 2012, with an economic loss of 58,322,907,201 Rwf. This also led to the loss of land due to flooding in Rwanda, negatively affecting human security. Issues such as the absence of electricity, water, hunger, lack of access to basic health care, difficulties in land conservation, increased physical violence, and crime were observed, leading to violations of human rights (Ilcan & Rygiel, 2015). However, Alkire (2022) states that human security is people-centered, establishing prevention-oriented responses that strengthen the protection and empowerment of all people.

Additionally, it is noted that in 2015, 2025 houses were destroyed, 131 deaths, 195 injuries, and 98 livestock died due to inadequate settlement policies in rural areas of Rwanda, which impacted people's health and food security, resulting in a lack of access to basic health care and hunger (MIDMAR, 2015).Despite the government of Rwanda stating that every citizen should be effectively secured, civil society and citizens in rural villages, who require daily human security, are complaining about the wide range of rural settlement policy implementations affecting their lives. The purpose of this paper therefore is to examine the influence of environmental protection interventions on human security in Muhanga District.

LITERATURE REVIEW

Theoretical Review

There are two concepts emerged in scientific community based on human security and environment and in international organizations more than a decade ago (Hans, 2015). These two concepts are closely interrelated and complex. Khagram, et al. (2013) described the relationships existing between environment and human security based on their subject matters. In view of that, Siloko (2024) believe that it is guanine to say human security without due consideration of the environment that human live in would be a disregard. The humans' access to resources becomes important to human security though the environment has been vulnerable to humans. The argument is that human security is a great part of people and human beings can live without environment specifically with full access to natural resources (Siloko, 2024).

It is wise to consider the effects that may be caused to environment that are either man made or even the natural disaster which effects the humans and not forgetting that those effects comes gradually and at end of the day either humans or environment becomes vulnerable to environmental changes. According to Siloko (2024), most effects of environmental change are directly and indirectly caused by activities and conflicts man is engaged in. In other words, the environment focuses in fact on the environmental dimension of security, while human security involves people as points of examination (Hans, 2015).

In the same perspective, human security is clearly understood as the role to safeguard the paramount center of all humanity in a manner that improve human fulfillment and human freedoms (CHS report, 2003). With this perspective, environmental security dimension is a pre-requisite to achieve the main goal of human security which is to safeguard the peoples' lives from a quite range of critical and pervasive threats. In this context, this subsection discusses how the rural village settlement policy protects the citizens and current reality on the field. In fact, it grasps the way environmental dimension of human security will be translated into actions and integrated in current rural village settlements. The debate on environmental dimensions of human security turns around the humanitarian strategies put in place to prevent

and or protect the inhabitants residing the rural settlements against different threats likely to hamper the full enjoyment of their basic human rights.

Security in humans should be conceptualized based on three pillars which can correspondingly match with the pillars of sustainable development (Bogardi & Brauch, 2015).

Security in local environment should indicate full freedom even if it comes from complicated situations. Therefore, this could be emphasized to support the vulnerability found in local society which can be confronted in natural manner and decrease the conflict and violence rate (Bogardi & Brauch, 2015). Similarly, discussion under this subsection focuses on this second pillar. In fact, the different studies conducted in line with human security and environmental studies (Brauch, 2022) discussed the relationship between environment and human security. In this context, environmental security challenges were contended to expose communal helplessness, which in return may produce an existence problem. These security environmental challenges include man-made or natural environmental hazards.

With this regards, different case studies of disasters recently happened, and particularly in Rwanda and their UNU-EHS subsequent impact on lives and country economy is a good example to illustrate an irrefutable relationship between environment and human security. Thus, this raises an issue to assess to which extent the current human settlement policy under implementation in Rwanda provides adequate facilities and infrastructure protecting the environment in rural villages.

In fact, human settlement is a complex web which integrates different components. Accordingly, the Comprehensive Remote Sensing (2018) disclosed that these include mainly the buildings for providing shelter and an assortment of constructed and regular spaces for commercial and communal events; the spots of service delivery endorsing economic exchange, nutrition, recreation, culture and health.

Thus, the protection of environment is an integral part of human security. These two concepts are also conceived inextricably linked in setting of people settlement in both rural and urban development. Indeed, the background and development of environmental studies showed that the development of cities in both rural and urban areas did not for long time have considered the environment and subsequent effect on human security of their communities in planning.

Study by Comprehensive Remote Sensing, (2018), content that viable human settlement should have these environmental components improving human security at large such as for example the buildings providing shelter and an assortment of constructed and regular spaces for commercial and communal events as well as service delivery spots promoting economic exchange, health, culture, education, nutrition, and recreation. In this perspective, environment plays its greater role.

In line with this argument, Munn alerted different actors to protect the environment against threats likely to destroy it. He advised to deal with continuous and progressive environmental degradation by focusing on future environmental challenges by adopting effective mechanisms better than assuming a forthcoming path. These strategies require to plot a comprehensive local community that forecasts in order to prove any various related to next environment which may be extremely larger compared to the experience of the previous numerous millennia" (Munn, 2000). Indeed, it is of great importance to lessen the environmental threats that can affect human security. In the same line, it could be difficult when the village settlements particularly in rural areas do not meet all the requirements for environmental protection such as basic

facilities and cultural change of residents vis-à-vis the environmental protection and subsequent effect on their lives (Siloko (2024). To counteract to these challenges, the village settlement policy implementation in Rwanda suggested the model village requirements (NISR, 2016).

The key requirements for rural village settlement model include the availability of necessary basic infrastructures, safe physical geographical conditions of sites (it should not be in high-risk zone, valleys or near swamps) and availability of land for farming, among others. In this perspective, different sites of IDP Village Models were planned by the Government countrywide. Particularly in Muhanga District, these sites include Horeze and Muyebe. However, the typical model given by the Government, other villages built countrywide do not meet the equipment suggested in the village settlement policy (NISR, 2016).

Therefore, this conceptual framework between environmental protection and human security explains how environmental protection influences human security by reducing vulnerability and stabilizing ecosystem services that sustain human well-being. Environmental protection is conceptualized through three key dimensions: land protection, pollution control, and flood control. Land protection, including soil conservation and sustainable land use, maintains soil fertility and prevents erosion, thereby sustaining agricultural productivity and food availability. This directly enhances livelihood security while indirectly improving health security by reducing malnutrition and poverty-related health risks, as well as strengthening physical safety by minimizing landslides and land degradation hazards (FAO, 2017 & REMA, 2020). Pollution control, encompassing air, water, and waste management, reduces human exposure to environmental contaminants that cause respiratory and waterborne diseases. Improved environmental quality strengthens health security and preserves natural resource–based livelihoods such as agriculture and fisheries, thus supporting livelihood security (WHO, 2018; UNEP, 2019). Flood control measures, including watershed management and drainage systems, reduce the frequency and severity of floods, which are major sources of injury, displacement, and asset loss. By minimizing disaster-related mortality, protecting infrastructure and crops, and preventing post-flood disease outbreaks, flood control enhances personal and community safety while reinforcing health and livelihood security (UNDRR, 2019; IPCC, 2022). Collectively, these environmental protection dimensions function as upstream risk-reduction mechanisms that decrease exposure to environmental hazards and safeguard ecosystem services, thereby strengthening health, livelihood, and safety components of human security as conceptualized in the human security framework (Millennium Ecosystem Assessment, 2005).

Empirical Review

Environmental Protection Interventions and Human Security

Overexploitation of mineral wealth has a negative impact on a country's employment creation. Thus, environmental management must consider ecological principles as well as macroeconomic demands of society, i.e., it entails socioeconomic growth on the one hand and main environmental preservation on the other. Different studies on human settlement in Rwanda divided the development of human settlement in three main timeframes ranged from pre- to post-colonial period. The pre-colonial human settlement will be generally centered on agro-pastoral activities carried out in concentric cultivation plot of the family house. The Rwanda National Human Settlement Policy, (2009) showed that the social life of Rwandan family during this period should be generally organized inside the family enclosure consisting of inzu (the house), urugo (front yard), igikali (the backyard located rear of the house), the

granaries for well-off families and a boundary made of an euphorbia hedge, or a fence designed out of reeds (Rwanda

National Human Settlement Policy, 2009). The construction materials of that time included mainly the clay soil, soil from ant hills and straw. Inside the house, partitions came to be developed from plant fiber-woven mats. During the colonial period, the physical appearance of human settlement underwent considerable modifications. Within this period, urban centers emerged because of colonization and evangelization. The small population clusters were born in vicinity of colonial administration and staff residences.

This colonial period was characterized also by the introduction of the new layout of architecture separating the enclosure with the main buildings such as main house, toilette and kitchen. In terms of constructional materials, the colonialists and the missionaries announced new resources such as the adobe brick, the burnt brick, the tiles and the grooved iron sheet, among others. The post-colonial period was generally characterized by the development of urban areas and the rural village settlements first introduced in 1978. The main rural settlement villages established with this period included the rural villages of Gashora and Sake, the pilot village of Rango in for Butare District. The government reports indicated that this rural settlement policy failed due to some factors such as the absence of supervision, monitoring and insufficient elementary structures.

After 1994 Genocide against Tutsi, the policy of rural village settlements will be revived as a response to the pressing needs of inadequate shelters to homeless Rwandans, security challenges and land management in the same context, *Imidugudu* villages' policy will be adopted and implemented by the government as an adequate resettlement policy propelling the development of human settlement. Accordingly, this policy helped to construct the houses for the people in need and speed up the process of accessibility to the different social and economic services. As well, the Imidugudu villages' policy will be used also by the government as a useful mechanism to create a social integration platform for Rwandans with different backgrounds and re-shape the Rwandan society image torn by the 1994 war and Genocide against Tutsi.

In 2010, the government of Rwanda introduced an Integrated Development Project (IDP) to support the implementation of current human settlement policy by creating planned settlement villages. IDP village model were constructed in different parts of Rwanda to improve the existing rural human settlement system to achieve sustainable socioeconomic development, slow down population growth and accelerate progress towards achievement of MDGs and EDPRS goals.

Management Control

Environmental management control refers to the structured oversight and governance of natural resources, land use, and environmental hazards to ensure sustainability. In Rwanda, environmental governance is centralized under the Ministry of Environment, which is responsible for implementing national policies aimed at preserving ecosystems while fostering economic growth.

In Muhanga District, local authorities collaborate with national entities to regulate and enforce environmental laws. These include zoning regulations, restrictions on deforestation, and guidelines for managing agricultural practices in environmentally sensitive areas. The

integration of community-based management practices is key to success, as it promotes local ownership and accountability in conservation efforts.

Natural Resources Protection

Natural resources such as forests, water bodies, and minerals are vital to the livelihoods of rural populations, including those in Muhanga. Rwanda has made strides in creating policies that ensure the sustainable use of these resources. Forests are critical for mitigating climate change, providing livelihoods, and maintaining biodiversity. The government's National Strategy for Transformation (NST1*)* emphasizes the importance of reforestation and sustainable agricultural practices to protect these ecosystems.

In Muhanga, community-led conservation efforts are supported by national policies such as the National Environment and Climate Change Policy, which includes initiatives like agroforestry and controlled grazing to prevent land degradation. Additionally, wetlands and water catchment areas are protected to maintain water quality and availability for both agriculture and domestic use.

Pollution Control

Pollution control is a central tenet of Rwanda's environmental strategy, particularly in rural areas where agricultural practices and informal industries can lead to significant environmental degradation. Air and water pollution pose threats to both human and environmental health. For instance, the overuse of fertilizers and pesticides in agriculture can result in runoff that contaminates water bodies, leading to a decline in water quality and biodiversity.

In Muhanga, pollution control initiatives include the promotion of organic farming practices, the enforcement of restrictions on industrial emissions, and the development of waste management infrastructure. The Rwanda Environmental Management Authority (REMA) works closely with local governments to implement national pollution control laws, ensuring that both rural industries and agricultural practices adhere to environmental standards.

Land Conservation

Land conservation involves sustainable use and management of land to prevent degradation and maintain productivity for future generations. This is especially important in hilly regions like Muhanga, where soil erosion poses a major threat to agriculture and settlements. Unchecked erosion can lead to reduced soil fertility, increased vulnerability to landslides, and loss of arable land.

To address these challenges, Rwanda has implemented terracing programs, reforestation, and agroforestry practices to stabilize soils and prevent erosion. The *Land Use Master Plan* outlines strategies for balancing agricultural productivity with environmental protection. In Muhanga, these efforts are further supported by initiatives that encourage sustainable farming techniques, such as intercropping and the use of organic fertilizers, to maintain soil health.

Flood Management

Flooding is a significant risk in rural areas of Rwanda, particularly during the rainy seasons, where heavy rains can cause landslides and severe damage to settlements and agricultural land. Muhanga District is particularly vulnerable due to its hilly terrain and limited drainage infrastructure. Flooding not only threatens human settlements but also undermines food security by destroying crops and livestock.

To mitigate these risks, flood management strategies have been implemented at both national and local levels. The *Rwanda Water Resources Board (RWB)* has developed comprehensive flood mapping and early warning systems to predict and respond to flood risks. In Muhanga, the construction of drainage systems, the planting of vegetation along riverbanks, and the development of flood-resilient infrastructure are key components of flood management efforts.

Research Gap

The literature reviewed in this chapter illustrates empirical accounts on existing relationships and impact of rural village settlement policy and human security. Different previous studies conducted in this field and literature reviewed human settlement and human security, but they did not evaluate the influence of the rural village settlement policies on human security in context of Rwanda (NISR, 2016). Thus, this remains an area to venture in and ascertain the influence that rural village settlement policies have on security, empirical findings of this study will cover this research gap of the relationship of influence that the rural village settlement policies have on human security.

Security as a concept and the connections between environmental policy gaps and human security From Kautiyla to Plato to Machiavelli and Hobbes, the concept of military security from external threats or the lack of harm to gained values has indeed been popular.

The scope of security has grown due to political divides, cybercrime, and cultural threats. Security now includes political, financial, social, human, ecological, national, territorial, community, home, and personal challenges.

Although there is a growing body of research linking environmental protection to human security in global and African contexts, existing literature does not specifically capture the unique environmental challenges and human security dynamics in Muhanga District in Rwanda. At the continental level, studies emphasize broad relations between environmental stressors such as climate change, land degradation, and human security across Africa, yet these analyses are generalized and do not focus on localized contexts such as Muhanga's complex socio-ecological system (Ayodele, 2025 & UNDP Africa Human Security Report, 2025).

Similarly, Rwanda's national environmental policy literature and broader sustainable development research often address general frameworks for land management or pollution control in Rwanda's policy documents, but they are not empirically grounded in Muhanga's specific environmental conditions or human security outcomes (Mukankubana, 2025 & Rwanda Environmental Policy, 2023).

Local research that does focus on Muhanga, such as studies of waste disposal site appropriateness and land degradation impacts on farmer livelihoods, provide insights into environmental concerns like pollution and soil erosion at the district level, but they stop short of linking these environmental protection dimensions to a broader human security framework encompassing health, livelihoods, and safety indicators (Hakorimana & Ndokoye, 2025; SiehTarpeh, 2025). These local studies typically focus on discrete environmental issues rather than integrating them into a holistic human security model, leaving gaps in understanding how multiple environmental protection dimensions including flood control, pollution management, and land protection collectively influence human security outcomes such as disease burden, economic stability, and physical safety in Muhanga.

Moreover, while erosion risk data highlight Muhanga's high susceptibility to soil degradation, these technical reports do not analyze implications for human security indicators like health

impacts, livelihood stability, or disaster risk reduction (RWB soil erosion status, 2025). Hence, the current literature fails to provide an integrated explanatory account of the environmental protection human security nexus within the specific socio-economic and ecological context of Muhanga District, underscoring a significant research gap that this study aims to address.

Theoretical Review

Understanding how public policies emerge and are adopted has long been a central concern in political science and public administration. One of the most influential frameworks in this regard is the Multiple Streams Policy Theory (MSPT), developed by John W. Kingdon in his seminal work Agendas, Alternatives, and Public Policies (1984) and argues that policy change occurs when three largely independent "streams" come together at critical moments known as policy windows (Kingdon, 1984; Kingdon, 2011). Multiple Streams Policy Theory (MSPT) is a public policy framework that explains how certain issues gain government attention and are translated into policy decisions.

The theory provides insight into why certain issues gain policy attention while others do not, emphasizing the role of timing, problem framing, and political dynamics. In recent years, MSPT has been applied beyond traditional policy arenas, including environmental governance and human security, where it helps explain how environmental protection interventions are prioritized and implemented to safeguard human well-being.

Kingdon's (1984) Multiple Streams Policy Theory posits that the policymaking process can be understood as the convergence of three independent but interrelated "streams": the problem stream, the policy stream, and the politics stream.

This theory challenges linear models of policymaking, instead presenting policy formulation as a dynamic, fluid, and often unpredictable process influenced by timing, opportunity, and agency. MSPT's flexibility has made it one of the most widely applied frameworks in public policy analysis, including fields such as health policy, education, environmental management, and security studies (Rawat & Morris, 2016).

Human security encompasses protection from critical and pervasive threats to people's lives, including environmental degradation, food insecurity, and natural disasters (United Nations Development Programme (UNDP, 1994). Environmental protection interventions such as climate change mitigation, pollution control, and sustainable resource management are therefore central to maintaining and enhancing human security (Ferris& Weerasinghe, 2020). MSPT provides a valuable framework for understanding how environmental protection policies emerge as governmental priorities that ultimately influence human security outcomes.

Multiple Streams Policy Theory offers a dynamic and context-sensitive lens for analyzing how environmental protection policies emerge and affect human security. It highlights the importance of aligning problem recognition, viable policy solutions, and favorable political conditions to open windows of opportunity for transformative action. By applying MSPT, scholars and policymakers can better understand how timing, advocacy, and political dynamics shape environmental interventions that safeguard human well-being and promote sustainable security for future generations.

Therefore, the Multiple Streams Policy Theory explains how environmental protection policies that enhance human security emerge when three streams converge, and this relationship can be summarized in a short conceptual diagram embedded in narrative form. problem stream recognized environmental threats such as land degradation, pollution, and flood risks

(Kingdon, 2011 & UNEP, 2019). Policy Stream which includes available solutions including land conservation, pollution control, and flood management measure while politics Stream includes political will, public pressure, and institutional support as well as policy Window which includes convergence of the three streams, leading to environmental protection actions that improve human security outcomes, specifically health security through reduced disease and environmental exposure, livelihood security through protected natural-resource-based incomes, and personal and community safety through reduced disaster risks. In this framework, environmental problems enter the policy agenda when they are framed as threats to human security, viable environmental protection options exist, and political conditions are favorable, allowing policy entrepreneurs to push for action that links environmental sustainability directly to human well-being (Kingdon, 2011 & UNEP, 2019).

METHODOLOGY

The study utilized a descriptive survey research design to make a concurrent triangulation model with descriptive survey research design. This design was employed to establish some descriptive statistics related to access to utilities and human security in Muhanga District in Rwanda and help to establish the extent through access to utilities can influence human security. Questionnaire, interview guide, observation and focus group discussion were taken as data collection instruments**.** The obtained quantitative data were analyzed using SPSS version 21. This involved the computation of frequencies and percentages while qualitative data was thematically analyzed.

RESULTS AND DISCUSSION

The findings of this paper are presented focusing of the specific research objective which was to examine the influence of environmental protection interventions on human security in Muhanga District in Rwanda.

Environmental protection interventions are crucial for safeguarding natural resources, ensuring ecological balance, and supporting sustainable development. In the Muhanga District, Rwanda, such interventions play a vital role in enhancing human security by protecting the environment from degradation and mitigating the impacts of climate change. These efforts are essential for preserving agricultural productivity, maintaining water quality, and preventing soil erosion, all of which are critical for the community's health, economic stability, and resilience. This study examines the influence of environmental protection interventions on human security in the Muhanga District, assessing the effectiveness of current measures and identifying opportunities for improvement to ensure long-term sustainability and well-being for the district's residents.

Environment Protection

The image below shows a rice plantation that was flooded, significantly impacting food security in Muhanga District.

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Figure 1: Rice Plantation that Was Flooded, Significantly Impacting Food Security in Muhanga District

Management Control

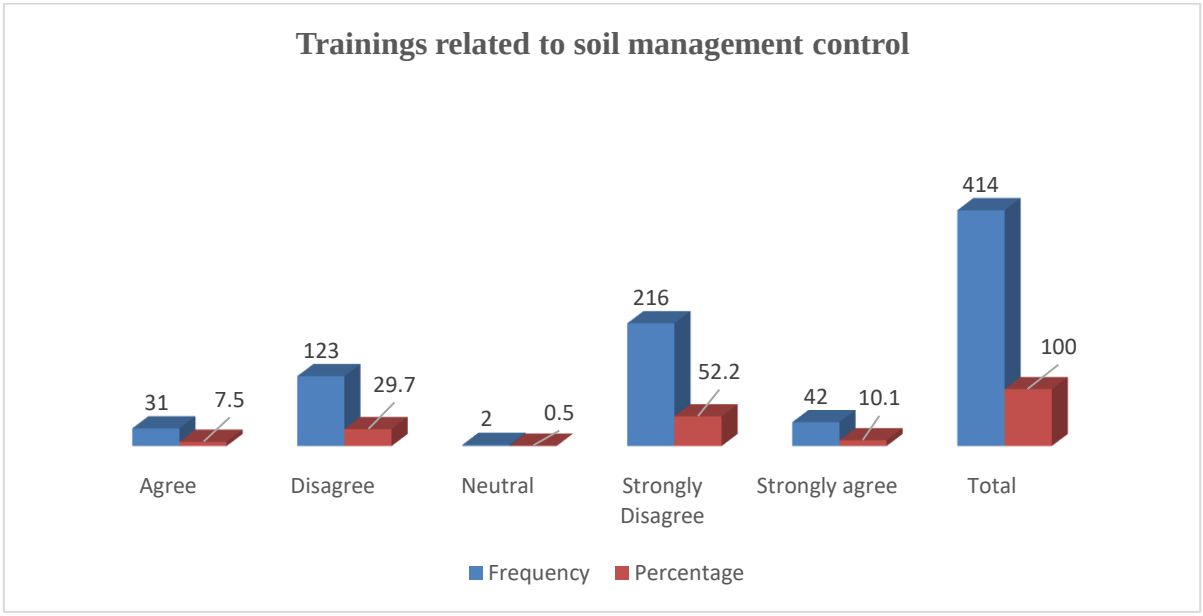

Figure 2: Trainings related to Soil Management Control

This Figure shows the distribution of responses regarding whether individuals have received training on soil management control. A significant portion, approximately 52.2%, strongly disagree with this statement, indicating that many people may not have had the opportunity to access training on proper soil management. This suggests potential gaps in the availability or accessibility of training programs in our context.

Lal (2001) discusses the significance of soil management training in enhancing agricultural productivity and sustainability. The lack of training can lead to improper practices, which can degrade soil quality and reduce crop yields. Ensuring widespread access to soil management

education is critical for maintaining soil health and promoting sustainable agricultural practices.

Trainings Related to Soil Management Control and Human Security

The data shows that 52.2% of respondents strongly disagree with having received training on soil management control, suggesting a significant gap in training opportunities. This lack of training can affect economic security as proper soil management is essential for maintaining agricultural productivity. Without adequate training, soil degradation may threaten food security and reduce agricultural output, impacting the economic stability of farming-dependent households.

Hajdu et al. (2020) explore the connection between soil degradation and economic security, finding that a lack of training in sustainable farming practices exacerbates soil erosion, leading to reduced agricultural productivity. This, in turn, increases poverty and food insecurity in rural areas. The authors advocate for enhanced educational programs and extension services to provide farmers with the knowledge needed to maintain soil fertility and secure long-term agricultural sustainability.

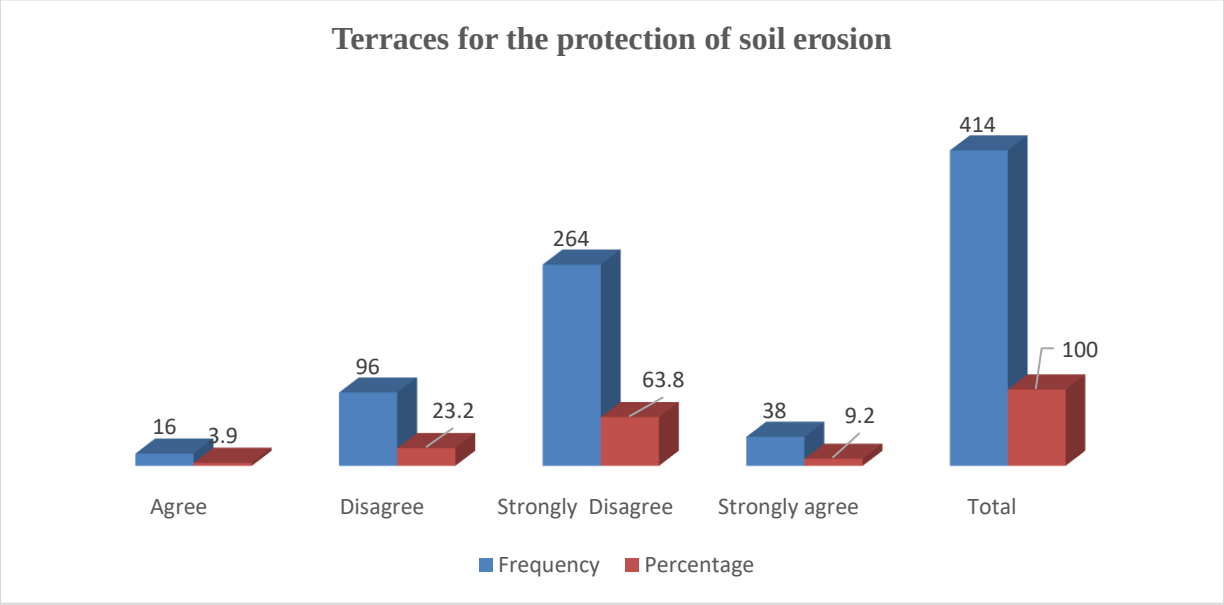

Figure 3: Terraces for the Protection of Soil Erosion

Moving on this Figure 3, which illustrates attitudes towards the use of terraces for soil erosion protection, we observe that the majority, about 63.8%, strongly disagree with this practice. This suggests that many people may not support the idea of using terraces to prevent soil erosion. It could be due to a lack of understanding of the benefits or other concerns surrounding the use of terraces.

Lal (2019) highlights the importance of terrace farming in controlling soil erosion, particularly in hilly areas. Terraces help to reduce runoff, increase water infiltration, and prevent soil loss. The lack of adoption of this practice may be due to limited awareness of these benefits or cultural resistance to changing traditional farming methods.

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Terraces for the Protection of Soil Erosion and Human Security

Most respondents (63.8%) strongly disagree with using terraces for soil erosion protection. This indicates a lack of support or understanding of the benefits of terraces. Effective use of terraces is crucial for preventing soil erosion and maintaining soil fertility. The absence of such practices could lead to soil degradation, negatively impacting land quality and agricultural productivity, thus affecting both environmental and economic security.

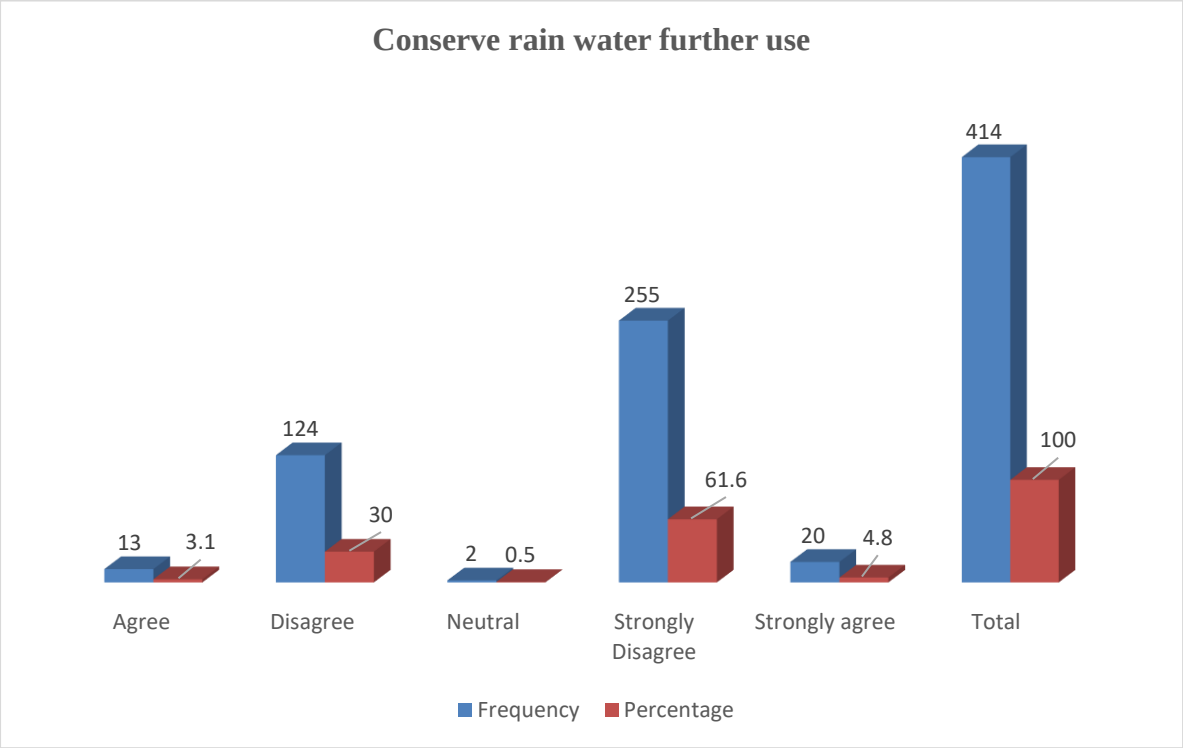

Figure 4: Conserve Rainwater for Further Use

Figure 4 addresses rainwater conservation for future use, we see a similar trend. A considerable number of people, around 61.6%, strongly disagree with this statement. This implies that there may be limited support for the idea of collecting rainwater for future use. It's crucial to investigate the reasons behind this strong disagreement, whether it's due to awareness gaps or other concerns preventing people from adopting such practices.

The photo shows a flooded road, a consequence of inadequate rainwater conservation in settlement areas. This increases water volumes, disrupting the movement of people and goods and causing infrastructure damage, which hinders economic development.

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Conserve Rainwater for Future Use and Human Security

Figure 5: A Flooded Road, a Consequence of Inadequate Rainwater Conservation in Settlement Areas

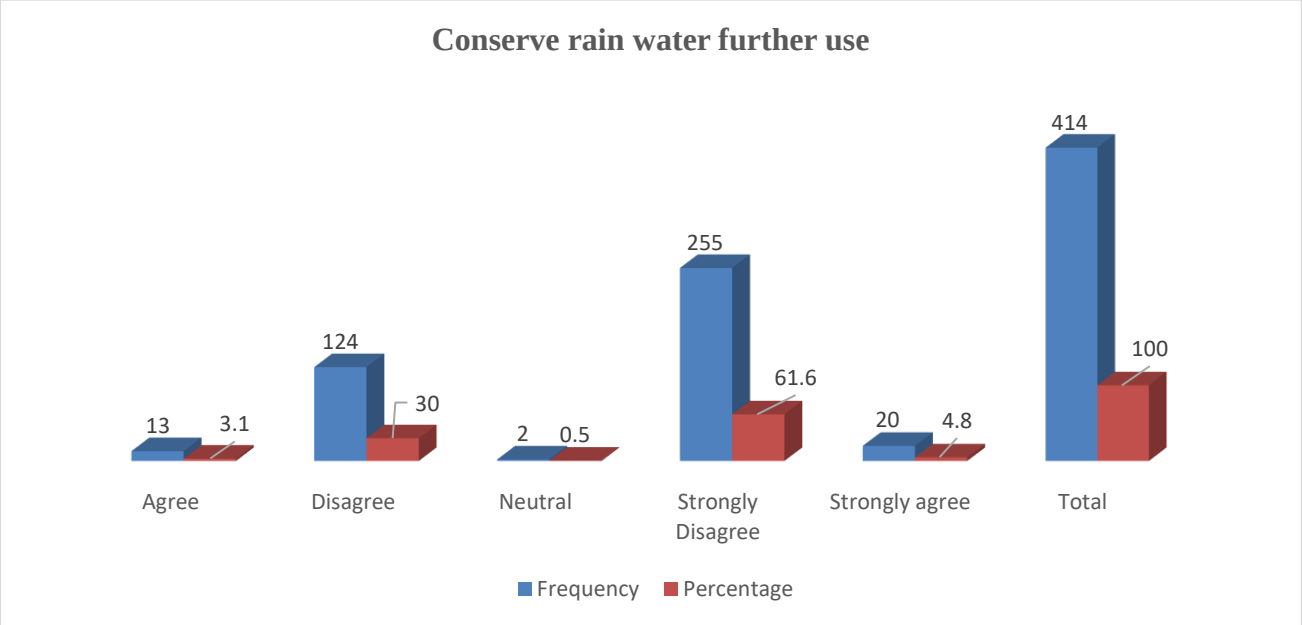

Figure 6: Conserve Rain Water Further Use

A significant portion of respondents (61.6%) strongly disagree with the practice of conserving rainwater for future use. This suggests limited support for our awareness of rainwater conservation. Rainwater conservation is vital for managing water resources and mitigating water shortages. Limited adoption of this practice can strain water availability and impact health security by affecting sanitation and overall health, particularly during dry periods.

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Rainwater harvesting plays a crucial role in health security by providing clean water for drinking, cooking, and sanitation, which is essential in preventing waterborne diseases. Worm & Hattum (2006) discuss how rainwater harvesting can improve public health outcomes by reducing dependence on contaminated surface water sources, which are often linked to outbreaks of diseases such as cholera and typhoid.

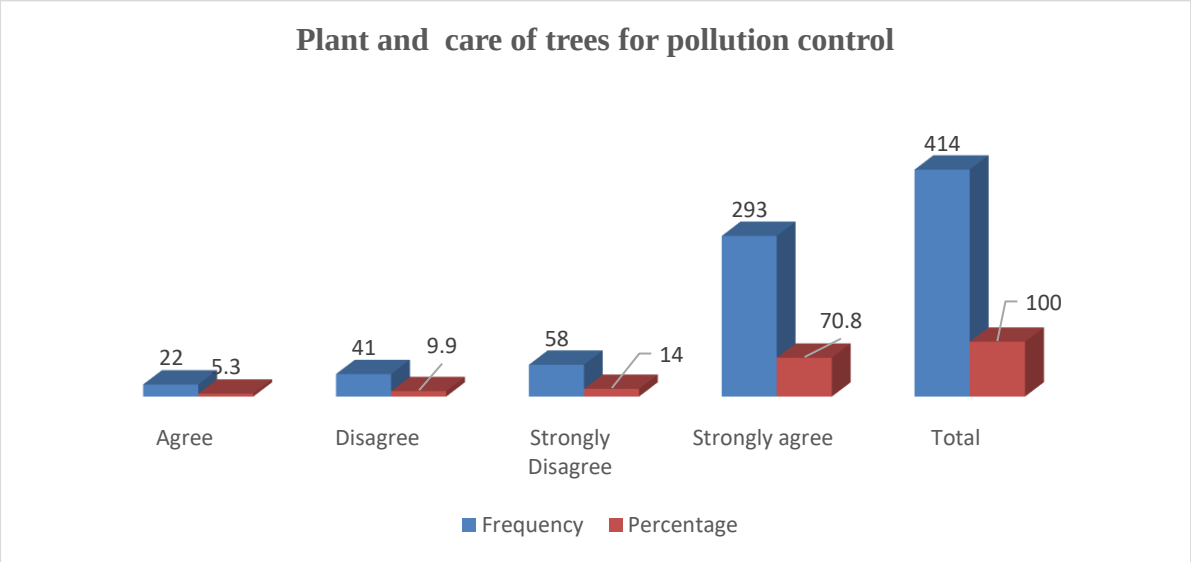

Figure 7: Plant and Care of Trees for Pollution Control

The data reveals the distribution of responses to a statement, with a total of 414 respondents participating in the survey. Among these respondents, the majority strongly agree with the statement, with 293 individuals accounting for 70.8% of the total responses. Conversely, there are notable proportions of respondents who express disagreement, with 41 respondents (9.9%) disagreeing and 58 respondents (14%) strongly disagreeing. Additionally, 22 respondents (5.3%) express agreement with the statement.

Plant and Care for Trees for Pollution Control and Human Security

Most respondents (70.8%) strongly agree with planting and caring for trees to control pollution. This strong support for tree planting enhances air quality and contributes to environmental health. Improved air quality reduces respiratory issues and promotes overall public health, thereby positively impacting health security.

Trees are vital for air purification, as they absorb pollutants like carbon dioxide, sulfur dioxide, and nitrogen oxides while producing oxygen. Nowak et al. (2006) emphasize that urban forests significantly reduce air pollution levels, thus improving public health by decreasing the incidence of respiratory diseases. The presence of trees in urban and rural areas is essential for maintaining air quality and supporting the well-being of communities.

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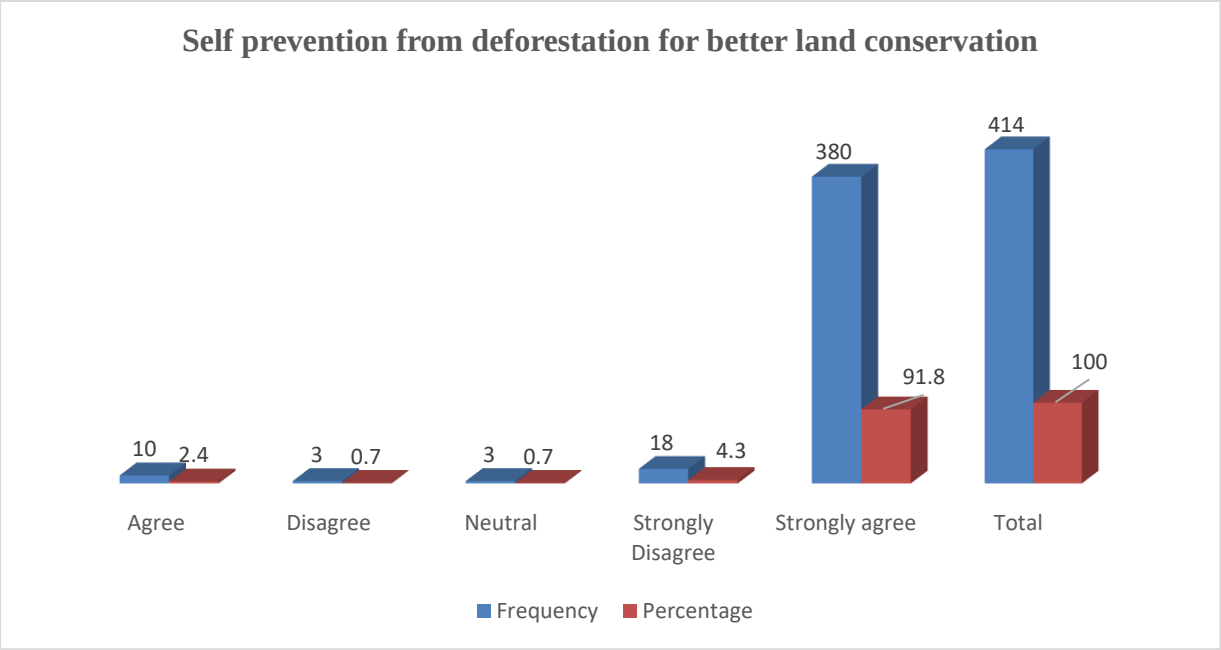

Figure 8: Self-prevention from Deforestation for Better Land Conservation

The data shows that out of 414 respondents, a significant majority of 389 individuals (94.9%) strongly agree with the statement about preventing deforestation for better conservation of land. Additionally, 10 respondents (2.4%) agree, while 3 respondents (0.7%) each are either neutral or disagree. Finally, 18 respondents (4.3%) strongly disagree. This indicates a strong commitment among respondents to avoiding deforestation for land conservation purposes.

Self-Prevention from Deforestation for Better Land Conservation and Human Security

An overwhelming majority (91.8%) strongly agrees with preventing deforestation for better land conservation. This high level of commitment supports maintaining biodiversity, soil quality, and ecosystem stability. Preventing deforestation helps ensure sustainable land use, which supports both environmental health and economic resilience.

Deforestation has significant consequences for ecosystem stability, affecting biodiversity, water cycles, and soil integrity. Myers (1988) discusses how deforestation leads to habitat loss, which is a major driver of species extinction. This loss of biodiversity can destabilize ecosystems, reducing their ability to provide essential services such as pollination, water purification, and carbon sequestration.

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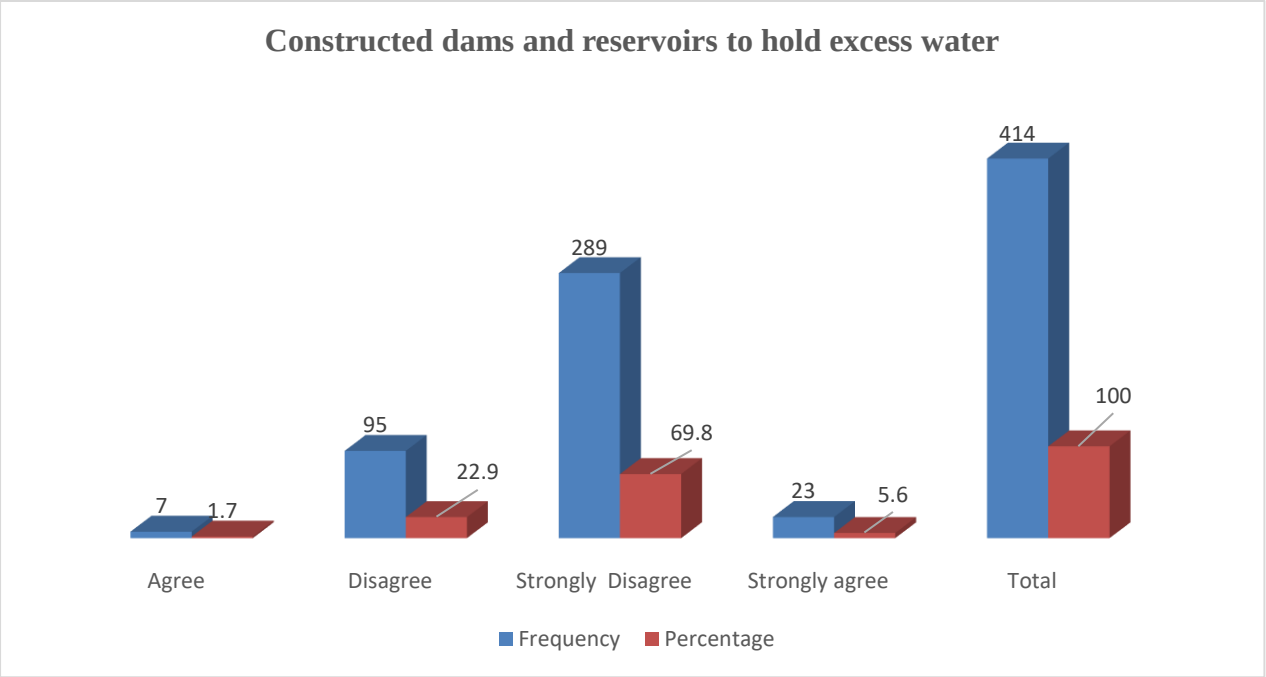

Figure 9: Constructed Dams and Reservoirs to Hold Excess Water

The survey results reveal that among the 414 respondents, only 23 respondents (5.6%) strongly agree with constructing dams and reservoirs to hold excess water, and 7 respondents (1.7%) agree. However, a large portion of respondents, 289 individuals (69.8%), strongly disagree with the practice, and 95 respondents (22.9%) disagree. This indicates a significant opposition or lack of engagement in constructing dams and reservoirs for water management among the respondents.

Constructed Dams and Reservoirs to Hold Excess Water and Human Security

A large proportion of respondents (69.8%) strongly disagree with constructing dams and reservoirs to manage excess water. This indicates a lack of support for or engagement with water management infrastructure. Dams and reservoirs are crucial for managing water resources, mitigating flood risks, and supporting irrigation. The absence of such infrastructure could lead to inefficient water management and increased flood risks, affecting environmental and food security.

Dams and reservoirs are vital components of water resource management, particularly in regions prone to water scarcity or seasonal flooding. McCully (2001) discusses how dams serve as critical infrastructure for water storage, flood control, and hydroelectric power generation. However, the construction of dams is often met with resistance due to concerns about environmental impact and displacement of local communities.

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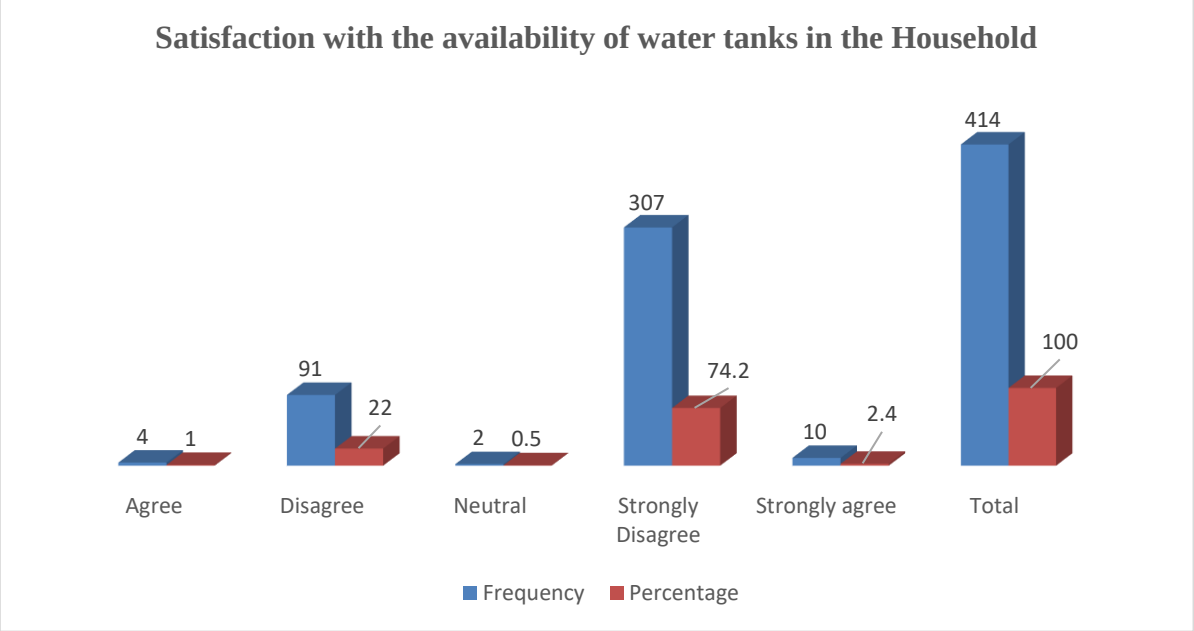

Figure 10: Satisfaction with the Availability of Water Tanks in the Household

In this survey, 414 respondents were asked about their satisfaction with the availability of water tanks in their households. The majority, 307 respondents (74.2%), strongly disagree with being satisfied, and 91 respondents (22%) disagree. Only a small fraction of respondents, 10 individuals (2.4%), strongly agree with being satisfied, and 4 respondents (1%) agree. Additionally, 2 respondents (0.5%) remain neutral. This highlights a general dissatisfaction with the availability of water tanks among the respondents.

Satisfaction with the Availability of Water Tanks in the Household and Human Security

Most respondents (74.2%) strongly disagree with being satisfied with the availability of water tanks. This dissatisfaction highlights issues with water storage infrastructure. Adequate water storage is essential for ensuring reliable access to clean water. Poor availability and dissatisfaction with water tanks can impact health security by affecting sanitation and overall public health.

Water storage infrastructure, such as household water tanks, plays a crucial role in maintaining health security by providing a buffer against water supply disruptions. Gleick (1996) emphasizes that reliable access to clean water is essential for public health, particularly in areas with irregular water supply. Insufficient water storage capacity can lead to increased exposure to waterborne diseases, which are often exacerbated during periods of water scarcity.

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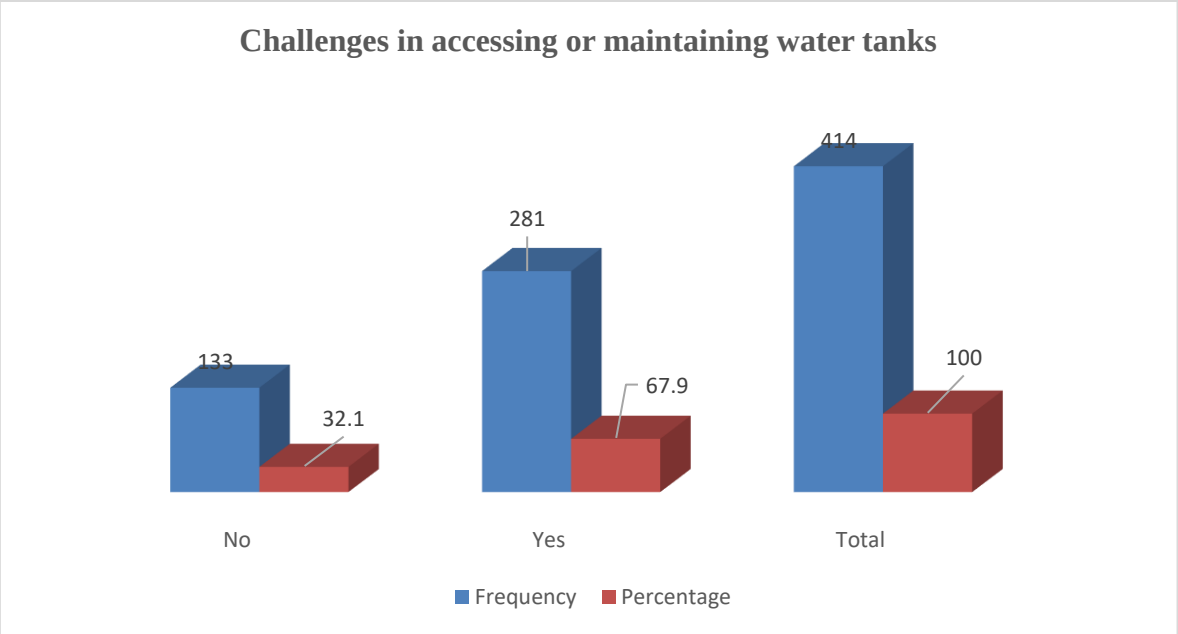

Figure 11: Challenges in Accessing or Maintaining Water Tanks

The data indicates that out of 414 respondents, 281 individuals (67.9%) have faced challenges in accessing or maintaining water tanks, while 133 respondents (32.1%) have faced such challenges. This suggests that most of the respondents' experience difficulties related to water tank access or maintenance.

Challenges in Accessing or Maintaining Water Tanks and Human Security

A significant portion of respondents (67.9%) have faced challenges in accessing or maintaining water tanks. These difficulties can lead to water scarcity, which affects sanitation and health. Addressing these challenges is crucial for ensuring reliable access to clean water and supporting overall health security.

Graham and Polizzotto (2013) discuss the importance of proper maintenance of water storage systems to prevent the spread of waterborne diseases. They highlight those challenges in maintaining water tanks, such as contamination and insufficient capacity, can lead to severe public health issues, particularly in areas with limited water resources. Effective management of water storage facilities is essential for ensuring that stored water remains safe and accessible.

District leadership emphasizes proactive management control by informing residents about disaster prevention and sustainable land use, such as planting trees and maintaining level terraces. They also stress the importance of justifying actions with natural resources, protecting against pollution, and guiding land conservation. This approach helps ensure responsible resource use, promotes environmental health, and supports community well-being. By integrating these practices into local governance, the district aims to enhance economic stability, food security, environmental health, and public health. According to UNDRR (2020), effective disaster risk reduction (DRR) depends significantly on community participation and awareness, which can only be achieved through consistent local government engagement and education.

Residents are proactively informed about disaster prevention measures. They are advised to plant trees and maintain level terraces to prevent soil erosion and promote sustainable land use.

For natural resources protection, we emphasize the importance of justifying every action taken with natural resources. This approach ensures that activities such as farming, and construction do not harm the environment and that resources are used responsibly. For instance, encouraging tree planting contributes to slope stabilization and improves water retention, while maintaining terraces minimizes runoff and enhances agricultural productivity (World Bank, 2019).

In terms of efforts to control air pollution include educating residents on best practices. Training sessions are held to raise awareness and teach methods to minimize emissions and other pollutants. According to World Health Organization (WHO, 2021), raising public awareness about air pollution sources and impacts is one of the most cost-effective interventions for improving air quality and public health outcomes. Land conservation is a priority, and residents are guided by techniques to preserve soil quality. Planting trees and constructing terraces are key strategies employed to prevent erosion and maintain fertile land. As noted by the Food and Agriculture Organization (FAO, 2021), sustainable land management practices like afforestation, terracing, and crop rotation are vital for preventing erosion, enhancing water retention, and sustaining agricultural productivity.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The lack of sufficient training and the low adoption of key environmental practices such as terrace construction and rainwater harvesting reveal a critical gap in environmental management. Enhancing training programs and promoting sustainable land use practices are vital for protecting natural resources and ensuring long-term agricultural productivity. It was also concluded that efforts to restore degraded ecosystems, such as reforestation and soil conservation, can enhance the natural resilience of the environment to disasters. Healthy ecosystems, including forests and wetlands, can act as natural buffers against floods and landslides, reducing the impact of these disasters on communities.

Recommendations

It was recommended that there should be a develop and implement comprehensive training programs focused on soil management, terrace construction, and sustainable agricultural practices. These programs should be accessible to all community members and tailored to local conditions.

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