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Evaluating geoscience campaigns in the conservation of water resources in the Western Region, Ghana

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Abstract

The Western Region of Ghana faces persistent water resource issues due to pollution, illegal mining, unsustainable land use, and degrading ecological integrity, public health, and livelihoods. Though geoscience-based water conservation campaigns have been initiated to remedy these issues, limited empirical data exist on their effectiveness in encouraging the conservation of water. This study assessed the impacts of these geoscience-based water conservation campaigns on water resource conservation in the area by evaluating their approaches, stakeholder involvement, and conservation results. A mixed-methods (quantitative and qualitative) design was used. Quantitative data from 250 survey respondents representing local communities, government agencies, NGOs, and industry stakeholders were collected. The qualitative data were obtained through 17 semi-structured interviews conducted both in person and online. The qualitative data were subjected to thematic analysis to discover major patterns and themes, whereas the quantitative data were analysed in SPSS version 27. Results demonstrated that geoscience-based water conservation campaigns led to significantly increased public awareness of water conservation, greater community engagement, and the shaping of policy dialogues. Nonetheless, they were limited in scope by poor finances, the enforcement of environmental codes and cooperation between sectors. The campaigns

with local knowledge and community-based monitoring yielded more sustainable behavioural changes, which was more sustainable. The research recommends integrating geoscience-based water conservation campaigns into the regional water governance framework, reinforcing coordinated planning among stakeholders and supporting regular financing. The findings could bolster the conservation and protection of water resources in the area and further improved by implementing stronger enforcement measures, expanding community surveillance, and integrating them into the national water policy.

Keywords: Geoscience, Geoscience-based water conservation campaigns, Water resources conservation, Water pollution and scarcity, Stakeholder engagement, Ghana.

1. Introduction

The current global population is expected to reach 9.8 billion by 2050, and currently more than 1.1 billion people do not have access to clean drinking water; hence, water scarcity has emerged as a significant worldwide concern (Alsharhan and Rizk, 2020; Abou-Shady et al., 2023). Penserini et al. (2024) reported a significant correlation between climate change and water scarcity. This is due to the fact that higher temperatures lead to alterations in the patterns of rainfall, longer times of drought, and increased rates of evapotranspiration and evaporation from bodies of water. In regions where industrial activities such as mining and agriculture are prevalent, the contamination of water resources poses a significant threat to the quality and safety of the water supply (Jurakulov, 2023).

In Ghana, water contamination caused by mining activities is a significant problem, with both large-scale and small-scale operations contributing to the deterioration of water quality (Baddianaah et al., 2023). Geoscience-based water conservation campaigns play an important role in addressing water conservation challenges by integrating scientific knowledge, policy advocacy, and community engagement. Zwoliński et al. (2023) indicate that these campaigns are designed not only to disseminate hydrological and environmental data but also to mobilise stakeholders towards sustainable behaviours and policies. For example, a South African study found that water conservation campaigns shape consumers' planned

and habitual conservation behaviour (Maduku, 2021). In Cape Town, sustained public communication around the city's "Day Zero" water crisis was associated with a reduction in average household water use from 540 to 280 litres per day over 36 months (Booysen et al., 2019).

The Western Region of Ghana has several issues arising from intensive human activities that have a substantial influence on its water resources. The Western Region of Ghana (now reorganised as the Western and Western North Regions) is about 23,921 km^2 in area and is bordered to the west by Cote d Ivoire, to the south by the Gulf of Guinea, and to the east by the Central and Ashanti Regions. The climate in the area is tropical rainforest with high rainfall, dense forests and a well-developed system of rivers, through which Ankobra, Tano, and Pra Rivers dominate the area, and are the main primary sources of freshwater to both the rural population and the urban centres like Sekondi-Takoradi. Figure 1 shows the location of the Western Region within Ghana and the Tano and Ankobra River basins, the two river systems most affected by the pollution problems described above. The region is economically among the most resource-intensive in Ghana, with a significant portion of the gold mining activity, cocoa production, and timber mining in the country taking place there (Agyei, 2022a; Kazapoe et al., 2023). However, even with this resource abundance, a good part of the population is left relying on surface water and unprotected wells to obtain domestic water, which is highly susceptible to pollution by industrial and agricultural activities (Owusu et al., 2016). The availability of potable water in most rural areas in the region is still below national averages, further exacerbating already existing socioeconomic inequalities (Asiamah, 2020). Artisanal mining, a popular activity in the region, includes the extraction of minerals using primitive methods, frequently resulting in severe environmental damage and pollution. The unrestricted discharge of mining waste and chemicals into water bodies such as the Ankobra, Tano, and Pra Rivers has led to significant pollution, presenting serious dangers to both the aquatic environment and the well-being of humans (Agyei, 2022b; Kazapoe et al., 2023). Moreover, according to Ankomah et al. (2022) the enlargement of agricultural areas and logging operations, motivated by the need for agricultural goods and wood resources, intensified the deterioration of water quality and ecological integrity. The consequences of deteriorating water quality have far-reaching effects, reaching into groundwater reserves that are vital supplies of drinkable water for rural populations (Owusu et al., 2016; Asiamah, 2020).

Various initiatives have been launched to address the growing environmental issues, aiming to advocate for conservation measures and enhance public understanding of the significance of sustainable water management methods. Such initiatives include the government's "Operation Stop Galamsey" campaign to address illicit mining and measures to combat illegal logging (Hilson, 2017; Dery Tuokuu et al., 2020). These

efforts are focused on reducing environmental degradation and protecting water resources. Nevertheless, the precise consequences and effectiveness of these geoscience-driven initiatives have not been well investigated, resulting in a significant lack of knowledge that hinders full understanding and well-informed decision-making in water resource management. Thus, given the persistent issues of contamination of the environment encountered in the Western Region of Ghana, it is essential to assess the effectiveness of geoscience initiatives in preserving water resources. Through the evaluation of the results and consequences of these interventions, anyone with an interest in the matter may determine successful approaches for maintaining water resources in a way that can be maintained over time.

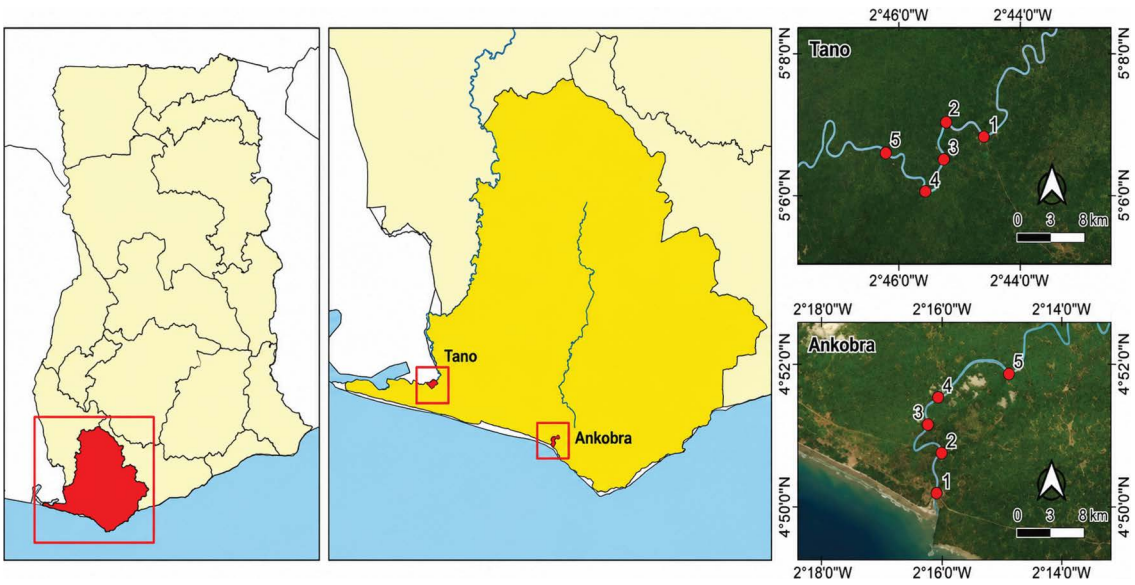

Figure 1. *A map showing the Western Region of Ghana with the Tano and Ankobra Rivers. The numbered points (1-5) on the Tano and Ankobra panels mark the water and sediment sampling stations used in the source study to assess heavy metal contamination along each river (Source: Awuah et al., 2020).*

2. Literature review

2.1. Theoretical review

2.1.1. Integrated Water Resources Management (IWRM)

IWRM is a process that promotes the coordinated development and management of water, land, and related resources to maximize economic and social welfare equitably without compromising the sustainability of vital ecosystems (Nagata et al., 2022). It is a cross-sectoral policy approach that replaces fragmented sectoral management and recognizes water as an integral part of the ecosystem, a natural resource, and a social and economic good. According to Ngene et al. (2021) the main objective of IWRM is to optimise economic and social well-being in a fair manner while ensuring the sustained existence of essential ecosystems. This approach acknowledges the interdependence of water resources and emphasises the need for comprehensive and inclusive management (Goyal et al., 2020; Ngene et al., 2021). The notion of sustainability emphasises the enduring sustainability of water resources in the long run (Zanotti et al., 2020). The goal of IWRM is to achieve a harmonious equilibrium between current demands and future necessities, guaranteeing the sustainable management of water resources without jeopardising their accessibility for future generations. Therefore, IWRM is an essential strategy for effectively and sustainably managing water resources. The findings of this study speak directly to the practical challenges of implementing IWRM in a resource-intensive context like the Western Region of Ghana. While IWRM calls for coordinated, cross-sectoral governance, the study reveals that current geoscience-based water conservation campaigns in the region fall short of this ideal, fragmented across agencies, unevenly funded, and weakened by political interference. The evidence of inconsistent stakeholder collaboration and limited follow-through on campaign activities highlights the structural gaps that must be addressed if IWRM principles are to move from policy aspiration to on-the-ground practice. In this respect, the study's findings offer empirical grounding for strengthening IWRM implementation in Ghana's Western Region.

2.1.2. Social Learning Theory

The Social Learning Theory, formulated by psychologists Bandura and Walters (1977), asserts that individuals acquire knowledge and skills by observing, imitating, and emulating others. Bandura and Walters (1977) posit that learning can take place

in a social setting and does not always depend on direct reinforcement or motor reproduction. Alternatively, individuals can acquire novel behaviours through the process of observing others and comprehending the consequences of their acts. The theory is founded on the concept that individuals are more inclined to mimic actions that are perceived as productive or rewarding (Rumjaun and Narod, 2020). Efficient learning takes place when individuals are given the chance to imitate or rehearse the behaviours they have witnessed (Olsson et al., 2020). Therefore, the Social Learning Theory offers a strong structure for encouraging water conservation through the utilisation of observation, imitation, modelling, and reinforcement. Water conservation campaigns can effectively promote the general adoption of water-saving behaviours by highlighting successful instances of sustainable water practices and facilitating knowledge sharing among community members.

2.2. Empirical review

2.2.1. Perspectives on geoscience-based water conservation campaigns for water conservation

Geoscience initiatives promoting water conservation have been executed in diverse places globally, each employing distinct strategies and yielding different results (Maduku, 2021; Dwivedi et al., 2022; Rastogi et al., 2024). These programmes utilise scientific data and community involvement to encourage the adoption of sustainable water management methods that are specifically designed for local circumstances. An instance of this is seen in Australia, where the Murray-Darling Basin Plan is specifically designed to ensure the sustainable management of water resources by implementing evidence-based policies and actively engaging the local population (Mallawaarachchi et al., 2020; Prosser et al., 2021). This strategy tackles the details of water distribution in one of Australia's agricultural areas, harmonising the requirements of farmers, people, and ecosystems. Similarly, the Colorado River Basin campaign in the United States employs geoscience data to achieve a fair and sustainable allocation of water resources among states (Robison et al., 2020; Herman-Mercer et al., 2023). This programme emphasises the significance of collaboration between states and the use of data-driven decision-making in the management of water resources that are shared between them.

2.2.2. Geoscience-based water conservation campaigns in Ghana

Geoscience initiatives in Ghana have been essential in tackling diverse water conservation and management challenges. These programmes usually combine scientific research with practical solutions to improve the sustainability of water supplies. Primary initiatives involve the cartography of subterranean water reserves, surveillance of water purity, and advocacy for ecologically sound farming methods to mitigate water consumption. This mapping facilitates the maintenance of sustainable water extraction practices and guarantees communities' access to dependable water resources. Ghana's water conservation efforts have been bolstered by international collaborations. Ghana has collaborated with the United Nations Development Programme (UNDP) to formulate water conservation policies and implement capacity-building initiatives. These partnerships offer specialised knowledge, financial support, and education to improve the capacity of local organisations and people in water resource management (UNDP, 2022). As an illustration, the UNDP's Capacity creation for Sustainable Water Management project has provided training to local officials and community leaders in water management techniques and policy creation, resulting in a substantial enhancement of the implementation of sustainable water practices.

2.2.3. Water resource management in Ghana

The Western Region of Ghana encounters numerous water resource difficulties, such as water scarcity, pollution, and competition among various water users. These problems are worsened by the rapid increase in population, industrial activity, and the effects of climate change. The rapid growth of cities and industries has caused a higher need for water, which often results in the excessive removal of existing water supplies. Climate change has additionally contributed to modified precipitation patterns and more frequent occurrences of extreme weather events, placing additional stress on water supplies (Owusu et al., 2016). Mining activities, especially those that are small-scale and conducted illegally, have a substantial influence on the quality of water in the Western Region. The utilisation of hazardous substances such as mercury and cyanide in the extraction procedures for gold results in the pollution of rivers and underground water sources, hence presenting significant health hazards to nearby communities (Haroon and Hayyat, 2025). Communities that consume fish from the Ankobra River, for example, are at risk of mercury exposure (Effah et al., 2021). In addition, the deposition of sediment from mining activities obstructs streams, so impacting the flow and accessibility

of water. Agriculture presents significant problems to water resources in the region, affecting both water quality through fertiliser and pesticide runoff, and water quantity through excessive abstraction for irrigation purposes.

Ghana's water governance rests on several separate legal mandates. The Water Resources Commission, established under the Water Resources Commission Act, 1996 (Act 522), holds the overall mandate to regulate and manage the country's water resources and to co-ordinate government water policy. Mining activity is regulated separately by the Minerals Commission, established under the Minerals Commission Act, 1993 (Act 450), and governed operationally by the Minerals and Mining Act, 2006 (Act 703, as amended). Under Act 703, a mining right holder must obtain separate approvals from the Forestry Commission and the environmental regulator before starting mining operations, which is the main formal coordination point between the mining and environmental sectors. At the local level, District Assemblies operate under the Local Governance Act, 2016 (Act 936), with responsibility for by-law enforcement and local environmental oversight. In practice, however, these mandates sit in separate institutions with no single body accountable for cross-sectoral enforcement, which is consistent with the fragmentation this study's qualitative findings describe.

2.2.4. Stakeholder involvement in geoscience-based water conservation campaigns

Active participation of stakeholders is an essential element of effective geoscience initiatives aimed at water conservation. Case studies from different regions of the globe emphasise the crucial role that stakeholders play in the planning, execution, and long-term viability of these efforts. An example of the participatory approach in the management of the Limpopo River Basin in Southern Africa illustrates how the inclusion of local communities, government agencies, and enterprises can result in more efficient water management solutions. In this instance, individuals with a legitimate interest collaborated to create comprehensive plans for managing water resources. Likewise, in the Mekong River Basin, including relevant parties has played a crucial role in dealing with water-related problems that cross-national boundaries.

2.2.5. Evaluation of geoscience-based water conservation campaigns

Assessing the effectiveness of geoscience-based water conservation campaigns is important for comprehending their influence and enhancing forthcoming endeavours.

These strategies facilitate the acquisition of the experiences, perceptions, and insights of individuals who are directly engaged in or impacted by the campaigns. Conducting interviews with local community people, government officials, and NGO representatives can provide useful insights on the achievements and difficulties encountered during the campaigns. Quantitative methods offer objective measurements to evaluate campaign results. The data collected from the campaigns includes measurements of water quality, statistics on usage, and ecological indicators. These provide specific information on the environmental effects of the initiatives. Regular monitoring of water quality indices, such as pH, turbidity, and pollutant levels, can serve as indicators of improvements in the health of water bodies.

3. Methodology

3.1. Research approach and design

A mixed-methods research approach was employed, integrating both qualitative and quantitative methods to explore the diverse perspectives of participants and provide a comprehensive understanding of the geoscience-based water conservation campaigns in the Western Region. This concurrent approach was suitable given the study's objective to understand both the subjective experiences and measurable outcomes associated with these campaigns (Creswell and Plano Clark, 2011). The research design adopted for this study was a case study design, which proved to be highly effective for an in-depth examination of specific geoscience-based water conservation campaigns related to water conservation. This design enabled the study to link statistical trends and patterns to the specific geoscience-based water conservation campaigns under investigation, offering a detailed understanding of their effectiveness.

3.2. Population, sample and sampling techniques

The target population for the study comprised a diverse group of stakeholders involved in water conservation efforts in the Western Region of Ghana. This non-probability sampling technique is effective for qualitative research, where the focus is on depth and detail rather than generalizability (Sukmawati et al., 2023). The selection criteria were based on the stakeholders' roles, expertise, and influence on water conservation initiatives, ensuring that the study captured a comprehensive range of perspectives and experiences. The sample for the qualitative aspect

of this study comprised seventeen (17) participants, selected to represent a range of institutional, community, and media perspectives on water resource conservation. The sample included one (1) Chief, two (2) clergy, one (1) Assemblyman, one (1) media representative (radio), one (1) military personnel, one (1) government worker, one (1) NGO director, one (1) Regional Director of the Minerals Commission, one (1) Regional Head of the Water Resources Commission, four (4) print media representatives, two (2) teachers, and one (1) Forestry Commission representative. Also, for the quantitative aspect, a stratified random sampling technique was employed to ensure that the sample accurately represented the diverse population involved in water conservation efforts in the Western Region of Ghana. For this, the sample for this study is 250 respondents.

3.3. Data collection instrument

The primary data collection instrument for the qualitative aspect was an interview guide, designed to facilitate in-depth, semi-structured interviews with stakeholders. The guide comprised open-ended questions, which were instrumental in encouraging participants to share their experiences and perspectives in their own words, thus capturing the richness and complexity of their views. For the quantitative aspect of the study, a structured, close-ended questionnaire was employed as the primary data collection instrument. This questionnaire was designed to systematically gather data from a larger sample of participants, ensuring consistency and ease of analysis. Items measuring the perceived presence of campaign characteristics (Table 2) used a three-point response scale (1 = No, 2 = Maybe, 3 = Yes) to capture respondents' certainty about whether specific campaign characteristics were present. Items measuring perceived effectiveness and stakeholder involvement (Tables [effectiveness table] and 7) used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to capture degree of agreement with evaluative statements.

3.4. Data analysis methods

The qualitative data collected were analysed using thematic analysis, a robust method for systematically identifying, organizing, and interpreting patterns of meaning (themes) across the dataset. As outlined by Braun and Clarke (2006), the process began with familiarization, involving repeated reading of the transcripts to immerse oneself in the data. Next, initial codes were generated to highlight significant features of the data relevant to the research questions. These codes were

then collated into potential themes, each representing a coherent pattern within the data. The themes were reviewed and refined to ensure they accurately captured the nuances and complexities of the stakeholders' responses. For the quantitative aspect of the study, data were analysed using Statistical Package for the Social Sciences (SPSS) version 27 software, which provided robust tools for handling and interpreting numerical data. The analysis began with data cleaning to ensure accuracy and completeness, followed by descriptive statistics to summarize the demographic information and general responses from the questionnaire. Coding was organized around the study's three core constructs (campaign characteristics, effectiveness, and stakeholder involvement), which formed the initial deductive framework for reviewing the seventeen transcripts. Within each construct, codes were assigned to recurring statements and examples raised by participants, and these were grouped inductively into subthemes based on shared patterns across accounts, for example, media-based campaigns, formal named campaigns, and awareness framing within the campaigns construct. Each subtheme was checked against the original transcript excerpts to confirm it accurately reflected participants' statements before being finalized in the presentation of findings.

4. Findings

4.1. Quantitative results

This section presents the statistical findings derived from survey responses.

4.1.1. Internal consistency

This section assesses the internal consistency of the measurement scales used in the study through Cronbach's Alpha values. A Cronbach's Alpha value of 0.70 or above is generally considered acceptable, indicating good internal consistency (Pavot et al., 1991).

Table 1 presents the Cronbach Alpha coefficients for the three main variables in the study. The scale measuring Various Geoscience-based water conservation campaigns Relating to Water Resources Conservation recorded a Cronbach's Alpha of 0.808, indicating strong internal consistency among its seven items. The scale for Effectiveness of the Geoscience-based water conservation campaigns produced a higher reliability score of 0.873, also based on seven items, demonstrating excellent internal consistency. The highest internal consistency was observed

in the scale assessing the Role of Stakeholders' Involvement, with a Cronbach's Alpha of 0.916 across ten items.

Variable	Cronbach's Alpha	Cronbach's Alpha based on Standardized Items	N of Items
Various Geoscience-based water conservation campaigns Relating to Water Resources Conservation	0.808	0.809	7
Effectiveness of The Geoscience-based water conservation campaignås in Promoting the Conservation of Water Resources	0.873	0.873	7
Role of Stakeholders' Involvement in Water-Related Geoscience-based water conservation campaigns	0.916	0.916	10

Table 1. *Internal consistency.*

4.1.2. The various geoscience-based water conservation campaigns relating to water resources conservation in the Western Region of Ghana

This sub-section presents the descriptive statistics related to respondents' awareness and perceptions of the various geoscience-based water conservation campaigns focused on water resources conservation in the Western Region of Ghana.

Table 2 shows the responses to seven items measuring the presence and characteristics of geoscience-based water conservation campaigns in the region. On a scale from 1 (No) to 3 (Yes), with 2 representing uncertainty (Maybe), the highest mean score was 2.40 for the item "These campaigns are designed to educate the community about water conservation", indicating a general agreement that education is a core component of the campaigns. This is closely followed by "The campaigns have clear objectives and goals" (Mean = 2.35) and "I am aware of geoscience-based water conservation campaigns…" and "Campaigns address key water issues" (both at 2.30), suggesting moderate awareness and perceived relevance. The item with the lowest mean score was "There is adequate funding and resources allocated to these campaigns" (Mean = 2.11), reflecting respondents' concerns about insufficient resourcing. Standard deviations for all items range from 0.697 to 0.799, indicating relatively consistent perceptions across the sample, though this consistency may partly reflect the constrained range of the three-point scale.

	N	Min	Max	Mean	Std. Deviation
I am aware of geoscience-based water conservation campaigns focused on water conservation in the Western Region of Ghana	250	1	3	2.30	0.799
Geoscience-based water conservation campaigns in the Western Region address key water conservation issues	250	1	3	2.30	0.746
These campaigns are designed to educate the community about water conservation	250	1	3	2.40	0.700
The campaigns include practical activities for water conservation	250	1	3	2.27	0.763
Various local organizations and NGOs are involved in these campaigns	250	1	3	2.25	0.697
The campaigns have clear objectives and goals for water conservation	250	1	3	2.35	0.736
There is adequate funding and resources allocated to these campaigns	250	1	3	2.11	0.747

Table 2. *Descriptive statistics on the various geoscience-based water conservation campaigns relating to water resources conservation (Source: authors' field data, 2025).*

4.1.3. The effectiveness of the geoscience-based water conservation campaigns in promoting the conservation of water resources in the Western Region of Ghana

This section aims to evaluate the perceived effectiveness of geoscience-based water conservation campaigns implemented to promote water conservation in the Western Region of Ghana.

Table 3 presents respondents' perceptions of how effective geoscience campaigns have been in promoting water conservation. Responses were measured on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The highest mean score (3.44) was recorded for the statement "Positive changes in water resource management can be attributed to these campaigns", indicating general agreement among respondents. Similarly, the items "The campaigns have successfully increased public awareness" (Mean = 3.43) and "The geoscience campaigns have effectively promoted water conservation" (Mean = 3.41) also received favourable ratings. In contrast, lower mean scores were observed for "There has been a noticeable reduction in water usage" (Mean = 3.27) and "The effectiveness of these campaigns has been consistent over time" (Mean = 3.28), suggesting that while some impact is acknowledged, consistency and behavioural change remain concerns. The standard deviations range from 1.090 to 1.200, indicating moderate variability in responses.

	N	Min	Max	Mean	Std. Deviation
The geoscience campaigns have effectively promoted water conservation	250	1	5	3.41	1.200
Positive changes in water resource management can be attributed to these campaigns	250	1	5	3.44	1.090
The campaigns have successfully increased public awareness about water conservation	250	1	5	3.43	1.161
The campaigns have led to improved water quality in the Western Region	250	1	5	3.31	1.158
There has been a noticeable reduction in water usage due to these campaigns	250	1	5	3.27	1.167
The effectiveness of these campaigns has been consistent over time	250	1	5	3.28	1.151
Feedback from the community has been used to improve the campaigns	250	1	5	3.38	1.146

Table 3. *Descriptive statistics on the effectiveness of the geoscience campaigns in promoting the conservation of water resources (Source: authors' field data, 2025).*

4.1.4. T-test results on the effectiveness of the geoscience-based water conservation campaigns and gender of the respondents

To determine whether perceptions of campaign effectiveness differ significantly between male and female respondents, an independent samples t-test was conducted. Table 4 shows that the mean effectiveness score for female respondents was 3.3825, slightly higher than the mean for male respondents (3.3467). However, the difference in standard deviations (males = 0.91605, females = 0.78816) suggests only minor variation in response consistency.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
ES	Male	157	3.3467	0.91605	0.07311
	Female	93	3.3825	0.78816	0.08173

Table 4. *Group statistics.*

The t-test results reveal no statistically significant difference between male and female perceptions of campaign effectiveness. The Levene's Test for Equality of Variances (Table 5) was not significant ($p = 0.205$), validating the use of equal variances assumed. The t-value was −0.314, with a significance level of 0.754 ($p > 0.05$), indicating no meaningful difference in perceptions by gender.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ES	Equal variances assumed	1.616	0.205	−0.314	248.0	0.754	−0.03581	0.11395	−0.26023	0.18861
	Equal variances not assumed			−0.327	216.4	0.744	−0.03581	0.10966	−0.25194	0.18032

Table 5. *Independent samples test.*

Effect size estimates (Cohen's d = −0.041) confirm the negligible difference between the two gender groups (Table 6). The 95% confidence intervals for all effect size estimates include zero, further supporting the conclusion that gender has no substantial influence on perceptions of geoscience campaign effectiveness.

		Standardizer*	Point Estimate	95% Confidence Interval	
				Lower	Upper
ES	Cohen's d	0.87080	−0.041	−0.298	0.215
	Hedges' correction	0.87344	−0.041	−0.297	0.215
	Glass's delta	0.78816	−0.045	−0.302	0.211

* The denominator used in estimating the effect sizes. Cohen's d uses the pooled standard deviation. Hedges' correction uses the pooled standard deviation, plus a correction factor. Glass's delta uses the sample standard deviation of the control group.

Table 6. *Independent samples effect sizes.*

4.1.5. One-way ANOVA results on the effectiveness of the geoscience-based water conservation campaigns and age group of the respondents

The results of the ANOVA test (Table 7) indicate no statistically significant differences in perceived effectiveness across age groups ($F = 0.623$, $p = 0.647$). The between-group variance (Sum of Squares = 1.893) is considerably smaller than the within-group variance (186.237), suggesting homogeneous perceptions regardless of age.

ES	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.893	4	0.473	0.623	0.647
Within Groups	186.237	245	0.760		
Total	188.131	249			

Table 7. *ANOVA test.*

4.1.6. The role of stakeholders' involvement

This sub-section explores the extent and nature of stakeholder involvement in water-related geoscience-based water conservation campaigns. Table 8 presents descriptive statistics on stakeholder involvement based on responses from 250 participants. The results indicate generally favourable perceptions of stakeholder participation. The highest mean score (3.56) was recorded for "Local community leaders play a significant role in the campaigns", followed closely by "Key stakeholders are actively involved in the planning…" (Mean = 3.54) and "Stakeholders are well-informed about the campaign objectives…" (Mean = 3.46). These findings highlight a perceived strong presence and engagement of local and key stakeholders in planning and awareness efforts. Conversely, the lowest mean score (3.10) was for "These campaigns receive adequate funding from the government", reflecting concerns over limited financial support from state actors. Similarly, "Stakeholders provide significant financial or material support" (Mean = 3.27) and "Stakeholder feedback is regularly integrated" (Mean = 3.34) scored relatively lower, suggesting perceived gaps in funding contributions and participatory decision-making.

	N	Min	Max	Mean	Std. Deviation
Key stakeholders are actively involved in the planning of water-related geoscience-based water conservation campaigns	250	1	5	3.54	1.094
Stakeholders' involvement has positively impacted the effectiveness of these campaigns	250	1	5	3.42	1.173
There is effective collaboration among stakeholders in these campaigns	250	1	5	3.37	1.176
Stakeholder feedback is regularly integrated into campaign strategies	250	1	5	3.34	1.147
Local community leaders play a significant role in the campaigns	250	1	5	3.56	1.144
Stakeholders are well-informed about the campaign objectives and progress	250	1	5	3.46	1.123
The level of stakeholder engagement has been sufficient to drive successful outcomes	250	1	5	3.41	1.128
These campaigns receive adequate funding from the government	250	1	5	3.10	1.124
Stakeholders provide significant financial or material support for the campaigns	250	1	5	3.27	1.164
Alternative funding sources are actively utilized for these campaigns	250	1	5	3.39	1.101

Table 8. *Descriptive statistics on the role of stakeholders' involvement (Source: field study, 2025).*

4.2. Qualitative results

This section presents findings from the qualitative component of the study, which involved in-depth interviews with 17 key stakeholders across various sectors in the Western Region of Ghana.

4.2.1. Background information of respondents

The qualitative data were gathered from a diverse group of individuals who hold roles relevant to water resource management and community engagement. Respondents were selected based on their professional affiliation, community roles, and involvement or knowledge of geoscience-based water conservation campaigns.

Pseudonyms	Role	Years in Region
R1	Chief	64
R2	Clergy 1	10
R3	Assemblyman	48
R4	Media Representative (Radio)	20
R5	Military Personnel	20
R6	Government Worker	8
R7	NGO Director	10
R8	RD, Minerals Commission	7
R9	RH, Water Resources Commission	5
R10	Print Media Representative 1	Lifetime
R11	Print Media Representative 2	9
R12	Print Media Representative 3	6
R13	Print Media Representative 4	11
R14	Teacher 1	12
R15	Teacher 2	10
R16	Clergy 2	6
R17	Forestry Commission Representative	9

Table 9. *Background information of respondents (Source: field study, 2025).*

Table 9 presents the pseudonyms, roles, and length of residency or service in the region for each respondent. The sample includes a mix of traditional leaders (R1), religious figures (R2, R16), government officials (R6, R8, R9, R17), media personnel (R4, R10-R13), NGO and project directors (R7), educators (R14, R15), and local political representatives (R3). Years of experience or presence in the region range from 5 years to over 60 years, with some respondents (e.g., R10) having lived in the region their entire lives. This diversity enhances the richness and credibility of the findings by incorporating perspectives from grassroots to institutional levels.

4.2.2. The various geoscience-based water conservation campaigns

This section explores the range of geoscience-based water conservation campaigns implemented in the Western Region to promote water conservation.

4.2.2.1. Media and communication-based campaigns

Respondents consistently identified the media (radio), social media and religious institutions as a primary tool for disseminating geoscience campaign messages. Despite the value of media campaigns, concerns were raised about public mistrust due to politicization of messages and lack of follow-up. While media helped raise awareness, stakeholders stressed the need for coordinated efforts and sustained communication.

> *"As a radio presenter… we use these platforms to talk about the issues. When you speak on radio, people from everywhere hear you."* (R4)
> *"Even at church, pastors announce it. They talk about how we need to protect the environment and water bodies."* (R5)
> *"Yes, there were radio programs and posters. But even those sometimes end up being seen as political."* (R6)

4.2.2.2. Community-based engagement strategies

Community-based activities such as durbars (a formal ceremonial gathering where a traditional ruler meets with the public), school outreach, and drama performances were highlighted as powerful tools for engaging the public in geoscience-based water conservation campaigns. These strategies allowed direct interaction with residents, often using culturally familiar formats to communicate messages about water conservation.

> *"We use functions like community engagements, church and funeral activities to share these messages."* (R3)
> *"The problem is when you go there to tell them to stop, they can kill you… but we still try through local events."* (R1)
> *"Some schools are involved. But what they need is more engagement… more education."* (R6)

4.2.2.3. Formal and named campaigns

Several respondents mentioned structured, named geoscience-based water conservation campaigns led by government agencies and NGOs. These included initiatives such as the Protect Our Streams Project, Clean Rivers Initiative, and

Safe Streams Project (these are environmental conservation initiatives focused on improving water quality, reducing pollution, and restoring aquatic ecosystems). These campaigns were typically organized with defined goals, timelines, and stakeholder partnerships. Participants noted that while these campaigns brought visibility and structure to water conservation efforts, their reach was often limited to selected areas.

> *"Environmental Protection Agency came to us, gave us a talk about it and charged us to go to our various electoral areas and talk to our electorates."* (R3)
> *"I heard of the blue water, and then the river guards. River Guards… but they don't reach everywhere."* (R5)

4.2.2.4. Framing and perceptions: "galamsey" awareness

A dominant theme in participants' responses was the widespread association of geoscience-based water conservation campaigns with the fight against "galamsey" (illegal small-scale gold mining in Ghana: Owusu-Nimo et al., 2018). For many respondents, water conservation efforts were viewed almost exclusively through this lens. Campaigns were often framed around the environmental destruction caused by illegal mining, especially its impact on river bodies.

> *"There were campaigns to fight against galamsey operations because what we hear is that what causes the water pollution is the galamsey, and thus, if it is solved, we won't hear it. When we started hearing about fighting for galamsey, it has been a long, but our water bodies are still in a bad state up till now."* (R1)
> *"Most of what we hear is about stopping galamsey. That's how people understand it."* (R4)

4.2.3. The effectiveness of the geoscience-based water conservation campaigns

This section examines stakeholder perceptions of the effectiveness of geoscience-based water conservation campaigns in achieving water conservation outcomes.

4.2.3.1. Mixed perceptions of campaign effectiveness

Respondents expressed varying views on how effective geoscience-based water conservation campaigns have been in achieving their intended outcomes. While

some stakeholders observed notable improvements in awareness and behaviour change within certain communities, others believed the campaigns had not led to any meaningful or sustained impact.

> *"The water bodies are still not in a good shape, so the campaigns are in place, but they are not effective at all"* (R3)
> *"Yes, to some extent, to a very large extent, it's very low. Because if it is, it is very effective. Like by this time, we've seen changes in the colours of our waters, but it's very low."* (R6)
> *"We are not seeing the effectiveness of the campaigns, why, because of some of the reasons I have stated earlier…Over here, I would say I have not realised any positive outcomes. What shows is that we get a little bit of pipe-borne water for a few days, and we are back to normal times. Even this pipe-born water is not that clear, so it cannot be used for cooking or drinking."* (R1)
> *"Yes, in terms of awareness. People were moved. But we've not seen much follow-up. It came, it touched hearts, and then… it vanished."* (R16)

4.2.3.2. Isolated positive outcomes and local behaviour change

Despite the concerns about inconsistency, several respondents pointed to localized successes in community behaviour change and environmental awareness. These successes were often tied to community-led initiatives that complemented the official campaigns, resulting in cleaner surroundings, reduced waste dumping, and the formation of informal watchdog groups.

> *"Consulting community members and engaging the community helped to reduce the pollution of our water bodies. Throwing rubbish and others are also not being done to the water bodies because of the campaigns we do. I can say that there has been a positive change in my area."* (R3)
> *"So even you as a person, telling somebody not to pollute the water alone, I think is something that you are trying to make sure these things are being prevented. In my small corner, in my small way, I make sure that sometimes I prompt some people, don't do this, don't do that. My own children, even if you go closer to some gutters, don't urinate into it, don't try it, and I think it's part of saying that I'm trying to do something. And if there are other people who make sure to do these things, it's trying to help. But I'm saying it's a major issue that we have to all make sure to do something about."* (R5)

4.2.3.3. Lack of continuity and follow-up

A common concern raised by respondents was the lack of continuity and sustained effort in geoscience-based water conservation campaigns. Many initiatives were described as one-off events with little or no follow-up. After initial awareness-raising activities, there were rarely any mechanisms to reinforce messages, track progress, or evaluate impact.

> *"Only if someone keeps reminding them. I mean, if we vanish, everything fades. So maybe if schools or churches keep talking about it, it'll stick."* (R7)
> *"The challenges they are facing is the unwillingness of governments to solve the problem. There is no will from the government. The government is not finding a way to solve it. That is the simple thing I can say."* (R6)
> *"Hmm… I'd say message fatigue. People hear it over and over and tune out. Also, some campaigns don't have follow-ups. They come once and disappear."* (R10)

4.2.3.4. Uneven impact across communities

Respondents emphasized that the impact of geoscience-based water conservation campaigns varied significantly from one community to another. In some areas, the campaigns led to noticeable awareness and modest behaviour change, while in others, they were barely known or had little influence. This uneven distribution of impact was attributed to differences in leadership, access to resources, community interest, and the level of engagement by implementing agencies.

> *"Hmm… mixed results, to be honest. Some communities really took it up. You'd see them doing cleanups or forming water clubs. Others… not so much. Sometimes they just enjoy the drama and forget the message."* (R7)
> *"Our local community have come to understand it. I included stakeholders like pastors, imams and other functions. I have made them aware that we need to protect our water bodies."* (R3)
> *"I can tell you it's not effective in the way that, for example, if we talk and we talk and we talk, at times it enters this issue. And if you go into it, you become a third person. This issue, my brother, you have a village that you are coming from."* (R5)
> *"Chiefs, schools, NGOs, and local Assemblies. Without them, we can't do much"* (R9)

4.2.4. The role of stakeholders' involvement

This section evaluates the roles played by various stakeholders in the planning, execution, and sustainability of geoscience-based water conservation campaigns.

4.2.4.1. Chiefs and traditional leaders as key enablers or barriers

Traditional authorities were identified as influential actors in the success or failure of geoscience-based water conservation campaigns. In many communities, chiefs were viewed as gatekeepers of community values, with the authority to mobilize people and legitimize external interventions. Nevertheless, their role was not always positive as some respondents noted that certain chiefs were perceived to be compromised by illegal mining interests, either through direct involvement or passive acceptance.

> *"Two, the chiefs must not depend on what they can get to allow their land to be given. And then three, the opinion leaders that are also within the terrain, where those are done, must see the damage. In fact, this damage is futuristic."* (R2)
> *"Chiefs, schools, NGOs, and local Assemblies. Without them, we can't do much"* (R9)
> *"The key stakeholders are pastors, imams, unit committee members, traders, opinion leaders, etc. With what we have been doing, we see the success of the campaigns."* (R3)

4.2.4.2. Government and local assemblies: present but underfunded

Government agencies and local assemblies were frequently mentioned as key stakeholders in the implementation of geoscience-based water conservation campaigns. Their involvement was particularly visible during the launch of initiatives, stakeholder meetings, and initial awareness drives. Respondents acknowledged the role of institutions such as the Environmental Protection Agency (EPA) and Water Resources Commission (WRC) in shaping policy, coordinating activities, and mobilizing technical expertise.

> *"Environmental Protection Agency came to us, gave us a talk about it and charged us to go to our various electoral areas and talk to our electorates."* (R3)

"The government is not funding them because they are supposed to do those kinds of education. But they are not being funded by the state." (R6)
"Chiefs, schools, NGOs, and local Assemblies. Without them, we can't do much" (R9)

4.2.4.3. Media and civil society as informal frontliners

In the absence of sustained government support, media personnel and civil society organizations (CSOs) often filled the gap by championing geoscience and water conservation campaigns. These actors were described as consistent, visible, and community-centred, using radio shows, clean-up initiatives, and advocacy to push the conservation agenda forward.

"I remember there was a program that we have on the radio, and we are trying to make sure, I think the most specific thing we have to fight against is this Ghanaian thing." (R4)[1]
"We used those community forums, and uhm, also distributed posters and made a couple of radio announcements." (R8)
"Chiefs, Assemblies, the media of course, and sometimes schools. The schools really help shape behaviour early." (R11)

4.2.4.4. Limited corporate and donor engagement

Respondents pointed out that while some corporate bodies and donors contributed to geoscience-based water conservation campaigns, their involvement was often infrequent, symbolic, or project-based. A few mining and cocoa companies were said to have supported activities through the provision of logistics, publicity materials, or funding for one-time events. Likewise, some international organizations such as GIZ and DANIDA[2] were mentioned as sponsors of select initiatives. Yet, many stakeholders believed that corporate support was largely driven by public relations rather than long-term environmental commitment.

[1] The most specific point requiring clarification concerns the reference by R4 to the "Ghanaian" context, which appears to describe a localized pattern of civic disengagement or scepticism towards government-led environmental messaging. This issue may therefore be interpreted primarily within its specific cultural and socio-political context.
[2] GIZ is Deutsche Gesellschaft für Internationale Zusammenarbeit and DANIDA is Danish International Development Agency.

"Hmm… not really. Some promises, but no cash. Most of our support came from donors. GIZ helped once. Oh, and one cocoa company gave us t-shirts and food…Churches gave us venues for free. And sometimes individuals gave small donations. Not much, but it helped." (R7)
"Uhm, yes. We've had support from GIZ and DANIDA in the past." (R9)

4.2.4.5. Power struggles and political interference undermining campaigns

A major barrier to effective stakeholder engagement identified by respondents was political interference. Many stakeholders expressed frustration that geoscience-based water conservation campaigns were often influenced by political interests, leading to favouritism in campaign delivery, misallocation of resources, and reluctance to act against environmentally harmful practices.

"When you report galamsey, the authorities turn against you. They say you're causing trouble." (R2)
"In Ghana, everything turns into politics… even water." (R5)
"Government puts the wrong people in charge… that's why it fails." (R6)

4.3. Discussion

From a theoretical standpoint, the findings affirm core principles of Social Learning Theory (Bandura and Walters, 1977), which posits that behaviour change occurs through observation, imitation, and reinforcement. The use of familiar role models, such as teachers, pastors, or radio presenters, to communicate campaign messages aligns with the theory's emphasis on modelling and social interaction (Chuang, 2021; Rumjaun and Narod, 2020). Nevertheless, qualitative responses also indicated limited reinforcement and follow-up, which weakened long-term behavioural change. This aligns with Olsson et al. (2020), who argue that for social learning to be effective, behaviours must be consistently modelled and reinforced across time and contexts. The findings indicate a lack of integration and continuity in campaign planning and delivery. Campaigns were often fragmented, donor-dependent, and unevenly distributed across communities, contradicting IWRM's call for holistic and inclusive water governance. Unlike global case studies such as the Murray-Darling Basin in Australia (Mallawaarachchi et al., 2020) or the Rhine River Restoration Project (Wantzen et al., 2022), which employed structured and data-driven outreach, the Ghanaian context suffers from weak stakeholder

synergy and insufficient resources. The findings are consistent with Social Learning Theory (Bandura and Walters, 1977), which emphasizes that awareness alone is insufficient for sustained behaviour change. While the campaigns provided observational learning through media and social models, the absence of consistent reinforcement, local role modelling, and feedback mechanisms weakened long-term behavioural adoption (Wenger-Trayner et al., 2020). Yet, the qualitative data point to fragmented implementation, minimal monitoring, and donor-driven activities with limited institutional backing. These mirror concerns raised by Barbier (2020) and Mishra et al. (2023), who noted that resource limitations and political will often hinder the translation of environmental campaigns into measurable outcomes. A significant contribution of this study is the identification of a disconnect between awareness and behavioural outcomes. While prior studies emphasized campaign visibility or stakeholder roles (Brettschneider et al., 2023), this study reveals that effectiveness remains compromised by structural gaps such as weak feedback mechanisms, lack of funding, and low community follow-up. These findings strongly align with the IWRM framework, particularly its emphasis on inclusive, coordinated stakeholder engagement (Nagata et al., 2022; Ngene et al., 2021). IWRM stresses that sustainable water governance depends on the active involvement of all relevant actors, government, civil society, and community members. However, the study demonstrates that in Ghana's context, stakeholder collaboration is fragmented and occasionally undermined by political interference and lack of capacity. However, negative modelling, where leaders failed to act or were complicit in illegal practices, diminished campaign credibility and community trust. According to Chuang (2021), the consistency and visibility of behavioural modelling are essential to cultivating collective responsibility. The variability of stakeholder behaviour in this study highlights the risks of inconsistent leadership in shaping social norms. A key contribution of this study is the revelation of stakeholder duality, that is, actors who can either enable or hinder geoscience-based water conservation campaigns depending on their values, incentives, and political positioning. This adds new depth to the literature by showing that mere presence of stakeholders is not sufficient; their integrity and influence are critical to success. To enhance outcomes, future campaigns must invest in transparent partnerships, sustained local engagement, and political neutrality to ensure genuine and equitable stakeholder involvement.

5. Conclusions

The study concludes that while geoscience-based water conservation campaigns in the Western Region of Ghana are relatively visible and moderately successful

in raising public awareness, they fall short in achieving sustainable and measurable water conservation outcomes. Quantitative findings showed that most respondents were aware of the campaigns and acknowledged their educational value. However, both survey data and qualitative interviews revealed that these campaigns are often short-term, thematically narrow, and lack sufficient follow-up. A prominent limitation observed was the overemphasis on anti-galamsey narratives, which, while important, overshadowed other equally critical issues such as pollution from agriculture, poor sanitation, and unsustainable household water practices. This thematic imbalance restricts the public's comprehensive understanding of water-related challenges in the region. The study also found that stakeholder involvement, although active, is inconsistent and often hindered by political interference, weak institutional collaboration, and inadequate funding. While chiefs, NGOs, media, and district assemblies were identified as key players, their contributions were not always well-coordinated or sustained. These gaps undermine the continuity and effectiveness of campaign activities. The theoretical frameworks guiding the study, IWRM and Social Learning Theory, were used as interpretive lenses to examine the findings. Similarly, Social Learning Theory's emphasis on modelling and reinforcement was not fully realized, as many campaigns lacked consistent role modelling and behaviour reinforcement mechanisms.

It is recommended that policymakers should strengthen the coordination between government agencies, traditional authorities, and NGOs in line with IWRM principles to ensure holistic and equitable planning. Campaign content should extend beyond illegal mining to include threats such as agricultural runoff, poor sanitation, and plastic waste, thereby fostering a more comprehensive water conservation agenda. Establish local-level structures to monitor campaign outcomes and collect feedback for continuous improvement and accountability. Community leaders, educators, and media figures should be trained and supported to consistently model water-saving behaviours to strengthen social learning. NGOs and district assemblies should prioritize follow-up activities, community-led engagement, and sustained funding to maintain momentum and deepen impact. Provide technical training and logistical support for local actors to lead context-specific water initiatives effectively. Future research should track behavioural and changes in river turbidity, sediment load, and aquatic biodiversity over time to better assess the long-term impact of geoscience-based water conservation campaigns. Investigate how power relations, incentives, and political affiliations influence stakeholder participation in environmental campaigns. Scholars should test and document the effectiveness of various educational tools and media formats in different community contexts.

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Appendix – Research Questionnaire and Interview Guide

Questionnaire

Thank you for participating in this survey. My name is Benjamin Ankamah, and I am conducting research on geoscience campaigns related to water resources conservation in the Western Region of Ghana. The purpose of this questionnaire is to gather insights into the various campaigns, assess their effectiveness, and evaluate the role of stakeholder involvement. Your responses will provide information to help understand how these campaigns are addressing water conservation issues and identify opportunities for improvement. Please note that all responses will be kept confidential and used only for research purposes. Your participation is greatly appreciated, and the information you provide will contribute to enhancing water resource management in the region. The questionnaire consists of several sections, including demographic questions and statements related to the objectives of this research. For each statement, please select the response that best reflects your opinion or experience. Thank you for your time and valuable input.

SECTION A: DEMOGRAPHIC SECTION

Demographic Question	Options
Age	☐ Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50+
Gender	☐ Male ☐ Female
Education Level	☐ High School ☐ Undergraduate ☐ Graduate ☐ Other
Occupation	☐ Student ☐ Professional ☐ Researcher ☐ Other
Years of Experience in Field	☐ 0-2 ☐ 3-5 ☐ 6-10 ☐ 11-15 ☐ 16+

SECTION B: VARIOUS GEOSCIENCE CAMPAIGNS RELATING TO WATER RESOURCES CONSERVATION

Please indicate your level of agreement with the following statements regarding various Geoscience campaigns relating to water resources conservation.

NB: 1 – No, 2 – Maybe, 3 – Yes

Statement	1	2	3
I am aware of geoscience campaigns focused on water conservation in the Western Region of Ghana.			
Geoscience campaigns in the Western Region address key water conservation issues.			
These campaigns are designed to educate the community about water conservation.			
The campaigns include practical activities for water conservation.			
Various local organizations and NGOs are involved in these campaigns.			
The campaigns have clear objectives and goals for water conservation.			
There is adequate funding and resources allocated to these campaigns.			

SECTION C: EFFECTIVENESS OF THE GEOSCIENCE CAMPAIGNS

Please indicate your level of agreement with the following statements regarding the effectiveness of the Geoscience Campaigns

NB: 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly Agree

Statement	1	2	3	4	5
The geoscience campaigns have effectively promoted water conservation.					
Positive changes in water resource management can be attributed to these campaigns.					
The campaigns have successfully increased public awareness about water conservation.					
The campaigns have led to improved water quality in the Western Region.					
There has been a noticeable reduction in water usage due to these campaigns.					
The effectiveness of these campaigns has been consistent over time.					
Feedback from the community has been used to improve the campaigns.					

SECTION D: ROLE OF STAKEHOLDERS' INVOLVEMENT

Please indicate your level of agreement with the following statements regarding the role of stakeholder's involvement in Geoscience Campaigns

NB: 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly Agree

Statement	1	2	3	4	5
Key stakeholders are actively involved in the planning of water-related geoscience campaigns.					
Stakeholders' involvement has positively impacted the effectiveness of these campaigns.					
There is effective collaboration among stakeholders in these campaigns.					
Stakeholder feedback is regularly integrated into campaign strategies.					
Local community leaders play a significant role in the campaigns.					
Stakeholders are well-informed about the campaign objectives and progress.					
The level of stakeholder engagement has been sufficient to drive successful outcomes.					
These campaigns receive adequate funding from the government.					
Stakeholders provide significant financial or material support for the campaigns.					
Alternative funding sources are actively utilized for these campaigns.					

Interview Guide

Hello,
Thank you for taking the time to speak with me today. My name is Benjamin Ankamah, and I am conducting research on geoscience campaigns related to water resources conservation in the Western Region of Ghana. The purpose of this interview is to gather insights into the various campaigns, assess their effectiveness, and evaluate the role of stakeholder involvement. Your responses will be kept confidential and used solely for research purposes. With your permission, I would like to record our conversation to ensure accuracy. I will provide an overview of the interview structure, which will include questions about your awareness of the campaigns, their effectiveness, and stakeholder involvement.
Shall we begin?

Introduction

1) Can you tell me something about yourself?
2) How long have you been in the region?

Exploring Geoscience Campaigns on Water Resources Conservation

3) Can you describe your awareness of any geoscience campaigns aimed at water resource conservation in the Western Region of Ghana?
4) What are some specific geoscience campaigns you are familiar with, and what are their goals or objectives?
5) Which organizations or groups were involved in initiating these campaigns, and how were these campaigns implemented?
6) What strategies were employed to engage the community in these campaigns?

Assessing the Effectiveness of Geoscience Campaigns

7) In your opinion, how effective have these geoscience campaigns been in promoting water conservation in the Western Region?
8) Can you provide examples of positive outcomes or changes observed as a result of these campaigns?
9) What challenges have these campaigns faced, and how have these challenges been addressed?
10) Do you believe the impact of these campaigns will be long-lasting, and what factors are necessary to ensure their sustainability?
11) How has the local community responded to these campaigns, and have there been notable changes in behavior or attitudes towards water conservation?

Evaluating Stakeholder Involvement

12) Who are the key stakeholders involved in these campaigns, and how has their involvement influenced the success or failure of the campaigns?
13) Do these campaigns receive funding from the government? If yes, could you describe the nature of this funding?
14) Are there any stakeholders providing financial or other forms of support? Could you elaborate on their contributions?
15) Aside from government and stakeholders, are there alternative sources of funding for these campaigns? If yes, please provide details.

Thank you for speaking with me.

Age Distribution of Respondents (Source: Field study, 2025).

	Frequency	Percent
Under 20 years	27	10.8
20 – 29 years	65	26.0
30 – 39 years	108	43.2
40 – 49 years	35	14.0
50 years and above	15	6.0
Total	250	100.0

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