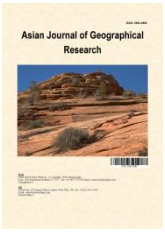

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The Impact of Community Participation Modes on Watershed Degradation in Upper Gucha, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. Author ZAK initiated the concept, developed methodology and literature review. He further collected data, interpreted and analyzed data and developed conclusions and recommendations. Author WOO contributed greatly in mapping and delineation of the watershed of the study area. Together with author NMN they assisted in editing the paper to ensure completeness and consistency with the journal's formatting guidelines. All authors read and approved the final manuscript.

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ABSTRACT

Community participation as a strategy has been successful in controlling watershed degradation. Despite this, there remains a lack of understanding on the mode of participation that influences positive community participation and enhancing proper watershed management. The objectives of the study were: to assess the modes of community participation on watershed management in upper Gucha, to examine the extent of degradation and to determine the relationship between the modes of participation and the extent of watershed degradation in the study area. Descriptive survey design was used. The study area is in Upper Gucha watershed, Kisii County, Kenya. The study was conducted between, February 2023, to March 2024. The methodology used included:

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Mapping and delineating the watershed boundaries using Google Earth satellite images of 2023, determining the sampling frame using Google Earth map and ArcGIS version 10.5 software, selecting the sample size of 354 household heads using simple random sampling with replacement method, collecting data using questionnaires and photograph taking, analyzing data using descriptive statistical methods such as mean, frequency, standard deviation and spearman's correlation analysis. Questionnaires return rate was 99.71%, representing an excellent response. 52.4% of the respondents were female while 47.6% were male. The results revealed that, the community rarely participated in the selected indicators of modes of community participation (M=2.0347, SD=0.89478). The extent of watershed degradation was moderate (M=3.056, SD=0.576). Further, a positive significant correlation was observed between the mode of community participation and the extent of watershed degradation (*P* =.00). In conclusion, the study results signifies lack of collaboration of all stakeholders and community engagement in watershed conservation efforts thus the cause of degradation in the study area.

Keywords: Household heads; collaboration; stakeholders; watershed; community; developments natural resources.

1. INTRODUCTION

Watersheds are critical sources of natural resources, underpinning the livelihoods of local communities. Consequently, they serve as key socio-economic indicators for designing and implementing resource conservation programs [1]. However, their degradation poses a significant threat to sustainable development [2]. Deforestation, rapid urbanization, changes in farming practices, and pollution are among the primary drivers of this degradation [3]. Furthermore, a lack of community participation in watershed management programs has been identified as a major contributing factor [4]. Ombogoh et al., [5] and Menge [6] documented similar challenges in the Mau and Mount Elgon forest and Nyantrago watersheds in Kenya, respectively. Their research underscores the negative impact of insufficient stakeholder collaboration and community engagement on participation levels, ultimately leading to increased degradation. Participation is demonstrably essential for the success of community-based watershed management projects [3, 7]. It fosters improved project design [8], ensures equitable distribution of benefits [9], and promotes better stewardship of natural resources alongside the development of a more informed and engaged citizenry. Additionally, participation enhances the cost-effectiveness of community development projects [10]. The 2030 Agenda for Sustainable Development [11], the African Union Agenda 2063 [12], and the East African Community Agenda 2050 [13] all emphasize the importance of stakeholder collaboration, including the community, in planning, decision-making, and implementation of policies and programs for sustainable watershed management and conservation. In line with these global and regional agendas, several countries, including India, Ethiopia, Uganda, and Kenya, have devolved the management of watersheds from national to community levels [14-17]. These countries have also established legal frameworks to guide the management, conservation, and protection of watershed resources [14-17].

Despite these efforts, the upper Gucha River watersheds in Kisii County, Kenya, continue to suffer from unsustainable practices. Uncontrolled deforestation, encroachment on riparian zones for agriculture, unplanned settlements, and pollution remain prevalent issues. This is concerning, as the community, in collaboration with other stakeholders, bears the responsibility for ensuring the effective conservation, protection, and management of these watersheds. If left unchecked, these problems will lead to further degradation, environmental pollution, and food insecurity, ultimately jeopardizing the achievement of the Sustainable Development Goals [11] and the African Union Agenda 2063. In light of these challenges, this study seeks to assess the current modes of community participation in the management of the upper Gucha watershed in Kisii County, Kenya.

2. LITERATURE REVIEW

Collaborative modes of community participation in watershed management contribute to increased participation among all the stakeholders; better engagement in decision making; increased capacity building and awareness level on watershed conservation; consequently reducing degradation of natural

resources [18-20,5]. However, how best to involve the community in watershed management is still controversial. According to Webler and Tuler [21], there are four different perspectives on the best participation process. First, the participation process should be credible and legitimate in that it should be open in every step; it should seek out and value local knowledge; be unbiased; flexible to accommodate people's views and needs; and seek people's approval before moving to the implementation stage. The second perspective is that participation should be knowledgeable and data-driven. This involves educating people, sharing information on watershed management to enable better decision making, and providing fair and just opportunities to participate. Third, participation also should foster inclusive and democratic decision-making by allowing people representation in the process and giving people a chance to have influence in setting the agendas and outcomes of watershed management projects and programs. Fourth, a good participation process is also perceived to be one that emphasizes dialogue and education. This involves educating the community on watershed conservation, training, and empowering people to effectively manage the watershed's natural resources. In relation to this, Huber et al., [22] established that, there is a relationship between watershed conservation successes and genuine devolution of power to the local levels; involvement of diverse actors; long-term external support and devolution of rights. Communities should be central to watershed management, not merely another stakeholder group. Their involvement is crucial in all phases – planning, implementation, monitoring, and evaluation. Low participation levels hinder their ability to set priorities, assess project benefits, and oversee implementation and monitoring. As Teressa [23] suggests, the mode of participation directly influences the level of community engagement, ultimately impacting watershed degradation. Despite the acknowledged importance of participation, no studies have examined the specific modes of community participation in the upper Gucha watershed. Additionally, the relationship between these modes and degradation, along with the extent of degradation itself, remain unexplored. Furthermore, no prior studies have attempted to spatially delineate the watershed or map settlements within it. This research addresses these gaps through its first, second, and third objectives.

3. MATERIALS AND METHODS

3.1 Description of the Study Area

The study area, which is part of upper River Gucha watershed, is located within Kisii County, Ogembo municipality, approximately ten kilometers from Kisii town. The delineated watershed covers 16 km^2 and the river 8km as shown in Figs. 1 and 2. It falls within the jurisdiction of the County Government of Kisii (CGOK), one of Kenya's 47 counties. Since water and sanitation are devolved functions, the CGOK is entrusted with key responsibilities in managing water resources, providing water services, and implementing land reclamation services. Similarly, the Government of Kenya (GOK) through National Environment Management Authority is responsible for safeguarding watersheds through regulations, monitoring, stakeholder engagement, capacity building, research support, and international collaboration. This multifaceted approach ensures the conservation and sustainable use of these vital resource.

The study area lies between latitude 0˚47′39.58″ S and longitude 34˚42′37.77″E and latitudes 0˚47′12.15″ S and longitude 34˚45′47.10″ E. The altitude ranges between 1590 meters and 1710 meters above the mean sea level (see Fig. 2). As already demonstrated spatially (Fig. 1), the boundary of the watershed covers 16 km^2 of Ogembo municipality with a large portion extending in the rural area. The watershed is traversed by River Gucha whose source is at Kiabonyoru area in Nyamira County. The river is one of the tributaries of the great Gucha-Migori River which drains into the Lake Victoria. Fig. 2 shows the delineated watershed.

The following procedure was used to delineate the boundary of the upper Gucha watershed:

1. *Identification and Mapping of River Extent*: A 2023 Google Earth satellite image was used to identify and map the spatial extent of the upper Gucha River within Ogembo municipality's town centre.
2. *Elevation Profile and Slope Determination*: The path function in Google Earth was employed to determine the elevation profile and altitude surrounding the river. This step established the general slope direction towards the river.
3. *Watershed Boundary Delineation*: Based on the extracted elevation profile and altitude data from the Google Earth satellite image,

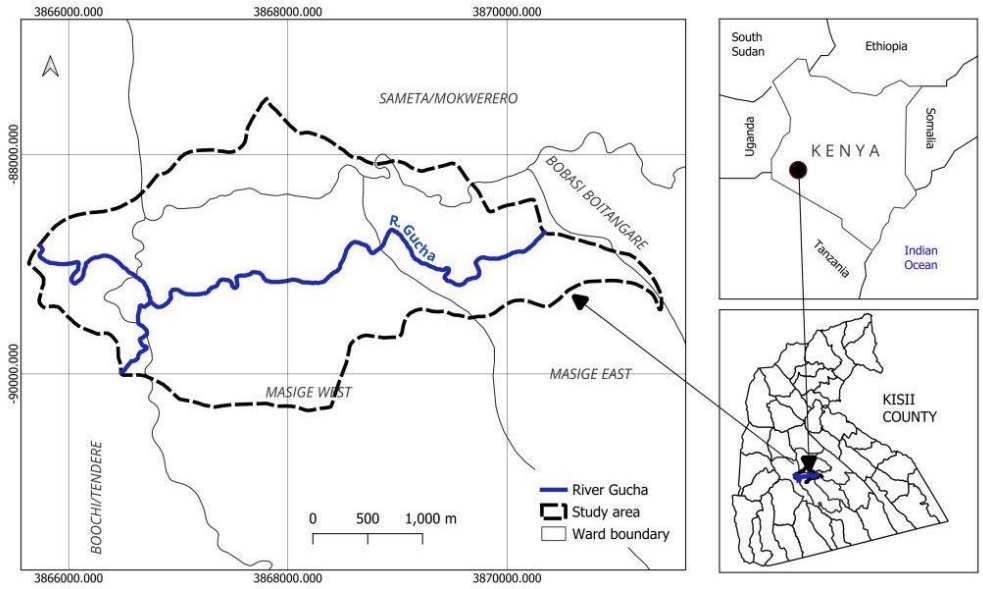

Fig. 1. Location of the study area in Kenya and Kisii County

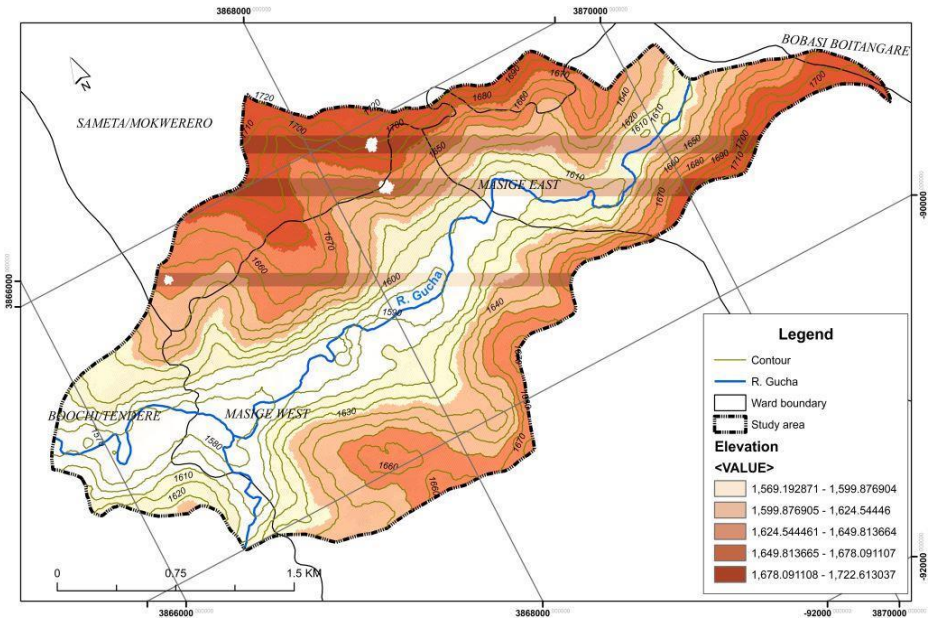

Fig. 2. Delineated boundary of the study area

the boundary of the watershed was delineated.

4. *Elevation Data Collection and Conversion*: Elevation point data was collected from within the delineated boundary. These points were then saved and converted to Keyhole Markup Language (KML) and GPX files using a GPS visualizer software.
5. *GPX Import and Shapefile Creation*: The GPX files containing elevation point data were imported into ArcMap and converted into feature shapefiles.
6. *Spatial Depiction of Elevation*: A raster surface was interpolated from the points using kriging. Subsequently, contours were extracted from this surface to spatially depict the elevation variations around the watershed. This process identified the land area directly draining into the river, thus delineating the watershed boundary. Areas with higher elevation relative to the river provided the basis for determining the watershed boundary, as shown in Fig. 2.

This study focuses on the Gucha River watershed within Ogembo municipality, a rapidly urbanizing center in Kisii County, Kenya. This selection reflects the growing concern regarding the potential negative impacts of unplanned urbanization on watershed conservation efforts.

3.2 Research Design, Target Population and Sampling Procedure

A descriptive survey design was chosen for this study. This approach was well-suited due to the large size of the population in the study area, making direct observation impractical. Additionally, surveys allow for collecting data from a large number of respondents relatively quickly and efficiently. Furthermore, a descriptive survey design provides the opportunity to incorporate both qualitative and quantitative data collection methods, enriching the overall analysis.

After demarcating the spatial extent of the study area (Figs. 1 and 2), the target population was determined by mapping the development within the upper Gucha watershed as shown in Fig. 3. In this case, 3,126 were successfully mapped from the 2023 satellite image obtained from Google Earth and digitized using ArcGIS version 10.5 software. This consequently provided the target population of 3,126 household heads that equally justified the sampling frame.

Mugenda [24], define sampling as a procedure of choosing a small group of elements to be a representative of a large group in any given inquiry. The study used a sample size of 354 household heads as calculated by [25] at 95 % confidence level

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size, N= Total population, e =error term (0.05). In this case, N= 3126. Therefore; n= 3126 /(1 + 3126(0.05)^2). n= 354

The sample size for this study was therefore be 354 household heads. To select the 354 household heads, a simple random sampling technique with replacement was applied.

3.3 Data Collection, Analysis and Presentation

Nine indicators were used to assess the modes of community participation. They included: sharing of information on watershed management; watershed conservation; participating in planning of programs; financial and material contribution; provision of

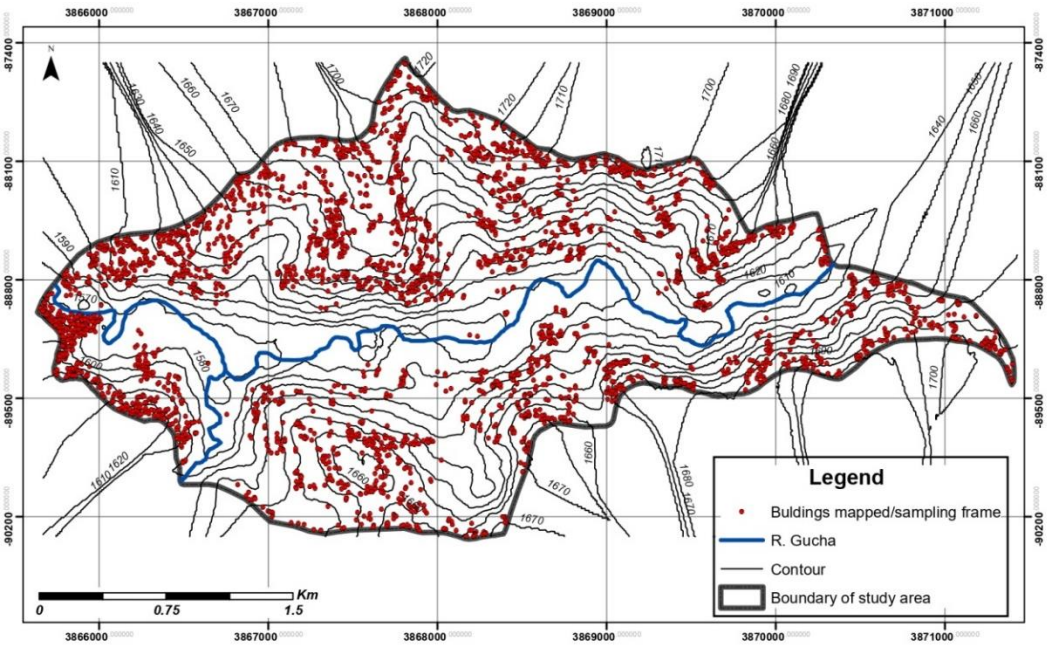

Fig. 3. Population of the study area

labour; participating in making legislation on watershed management; attending trainings; implementation of watershed management programs and monitoring and evaluation of such programs. The respondents were asked to rate their participation and were recorded as: 1-Never, 2-Rarely, 3-Sometimes, 4-Always and 5-Whenever. The questionnaires were given to the household heads to fill in and then collected by the research assistants. Photographs were taken to give evidence on water pollution, encroachment of the riparian land and deforestation in the study area. Data on community participation modes, collected through questionnaires, was analyzed using statistical methods including frequency, mean, standard deviations, and Pearson correlation analysis. Correlation analysis assessed the relationships between indicators of participation modes and the level of watershed degradation. Statistical analysis was performed using SPSS software. Qualitative data from questionnaires was organized thematically and discussed results were presented using bar graphs, pie charts, and tables.

4. RESULTS AND DISCUSSTION

4.1 Modes of Community Participation

The household heads were asked to rate their participation on various indicators of modes of community participation on watershed management presented to them using the questionnaires. The indicators are presented and discussed below.

4.1.1 Sharing information on watershed management

Sharing information about effective watershed management practices, such as soil erosion control measures, proper waste disposal methods, sustainable farming practices, and pollution reduction strategies, is crucial for successful watershed management. Fig. 4 illustrates the frequency of information sharing among respondents. Notably, 37.10% reported never sharing watershed management information. Additionally, 27.50% indicated they sometimes share such information, while 19.30% rarely do. Conversely, 14.20% reported always sharing this information, and a smaller percentage (2.00%) shared it whenever possible.

Further analysis revealed that household heads rarely participated in sharing information on watershed management (M = 2.2465, SD = 1.15498). This suggests low collaboration and engagement among stakeholders in conservation efforts. This lack of participation could be attributed to limited access to information and low awareness levels, ultimately contributing to increased watershed degradation in the study area. These findings align with those of Upadhaya and Arbuckler [26] who found that access to information and high awareness levels positively influenced farmers' participation in watershed management activities in Iowa, USA.

4.1.2 Participating in Watershed conservation programs

Household heads were surveyed to assess their participation in watershed management activities focused on soil, land, and water conservation. Table 1 summarizes the findings. Nearly 38.5% reported never participating, while 27.2% indicated attending sometimes. Less frequent participation was reported by 19.0% (rarely attending), while 11.0% responded as always attending, and 4.2% indicated attending whenever called upon.

Comparative descriptive analysis revealed that respondents rarely participated in community activities focused on soil, water, land, and forest conservation (M = 2.2351, SD = 1.19597). This suggests low collaboration among stakeholders in watershed management activities. Limited participation likely contributes to increased degradation within the study area. These findings align with Ombogoh et al., [5] who identified that a lack of community engagement decreased local participation in watershed management, ultimately increasing degradation in the Mau and Mount Elgon watersheds of Kenya

4.1.3 Participating in planning of watershed management programs

Household heads were further asked if they have ever participated in planning and implementation of watershed management programs within the study area. Results in Fig. 5 shows that, 51.60% reported that they have never participated in watershed planning and decision making, 21.80% reported that they sometimes participate, 19.00% revealed that, they rarely participated, 5.90% reported that, they always participated while 1.70% reported that they participate whenever they are called to.

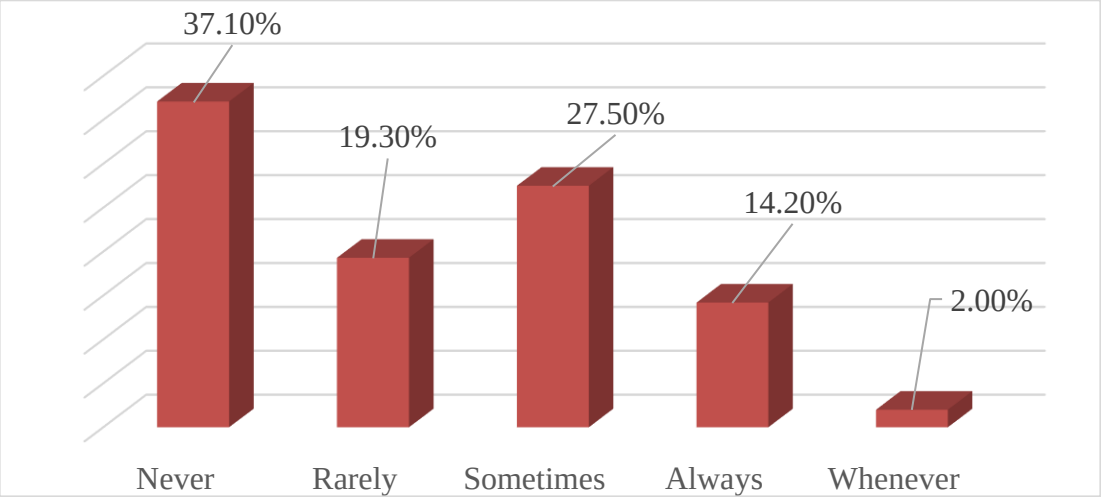

Fig. 4. Sharing of watershed management information
Source: field survey 2023

Table 1. Community participation in watershed management activities

Ratings	Frequency	Percent
Never	136	38.5
Rarely	67	19.0
Sometimes	96	27.2
Always	39	11.0
Whenever	15	4.2
Total	353	100.0

Source: field survey 2023

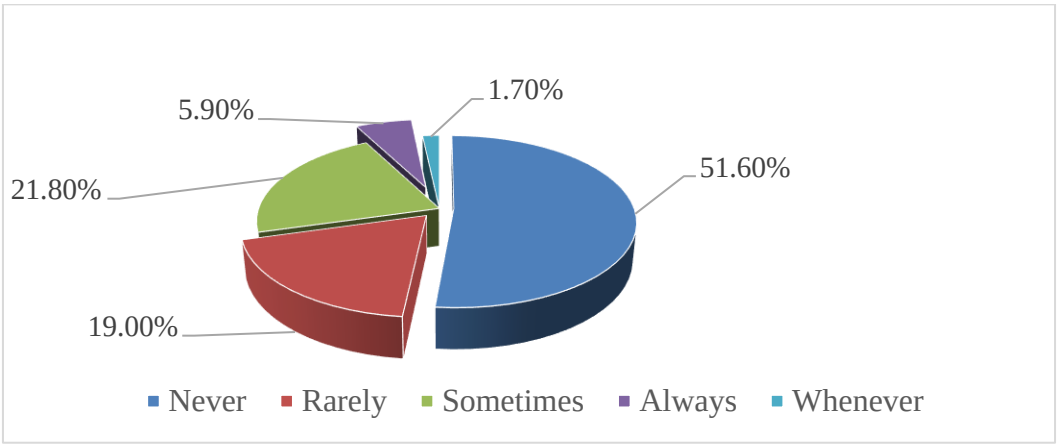

Fig. 5. Participation in planning of watershed management programs
Source: *Field survey 2024*

Further descriptive statistics showed that the respondents rarely participated in planning and decision making (M=1.8725, SD=1.05430). This implies that there was low collaboration among all the stakeholders during planning and decision making on watershed management activities. This could therefore explain the low levels of participation, thus contributing to high levels of environmental degradation in the study area. These findings are concurring with that of Wipperman [27] who established that collaborative modes ensured active participation of farmers in planning and decision making on watershed management and that this resulted to the success of resource conservation in the watersheds in Rwanda and Uganda.

4.1.4 Financial and material contribution towards watershed management

Household heads were also queried about their contributions of financial resources or materials towards watershed management activities and projects. Table 2 illustrates the results. The majority of respondents (44.5%) reported never contributing financially or with materials. Additionally, 20.1% indicated sometimes contributing both finances and materials, while 17.6% rarely contributed. A smaller percentage (13.0%) reported infrequent contributions, and 4.8% reported contributing whenever requested.

Statistical analysis (M = 2.1615, SD = 1.25657) confirmed that respondents rarely contributed financially or with materials towards watershed activities. This suggests a general lack of collaboration and shared control in watershed management. This could explain why the majority of household heads (44.5%) never contributed financially or with materials to these programs. These findings align with Collins and Jonson [18] who identified collaboration as a key factor in securing funding for watershed management programs, ultimately improving environmental conditions and resource management in England.

4.1.5 Provision of labour towards watershed management

Table 3 presents findings on resident contributions of labor towards watershed management activities. Among the respondents, 33.1% reported never providing labor, while 25.5% indicated sometimes providing labor. Less frequent contributions were reported by 18.1% (rarely providing labor) and another 18.1% (always providing labor). Lastly, 5.1% reported contributing labor whenever requested.

Further analysis revealed a low mean participation rate in labor contribution (M = 2.4391, SD = 1.25786). This suggests that a significant portion of the population may not fully appreciate the value of contributing labor towards watershed management projects. This lack of understanding could be attributed to low levels of awareness and a deficit in civic education regarding watershed conservation efforts.

4.1.6 Participating in making legislation on watershed management

Respondents were also queried about their participation in developing legislation on watershed natural resource management. Fig. 6 illustrates the results. A significant majority (59.20%) reported never participating in this process. Additionally, 20.70% indicated rarely participating, while 14.70% reported sometimes participating. Only a small percentage (4.80%) participated consistently, and a negligible number (0.60%) participated only when requested.

Corresponding descriptive analysis confirms that, the respondents never participated in making

Table 2. Finance and material contribution towards watershed management

Ratings	Frequency	Percent
Never	157	44.5
Rarely	62	17.6
Sometimes	71	20.1
Always	46	13.0
Whenever	17	4.8
Total	**353**	**100.0**

Source: Field survey 2024

Table 3. Labour contribution towards watershed activities

Ratings	Frequency	Percent
Never	117	33.1
Rarely	64	18.1
Sometimes	90	25.5
Always	64	18.1
Whenever	18	5.1
Total	353	100.0

Source: Field survey 2024

legislation and policies on watershed management (M= 1.6686, SD= 0.93575). This indicates a lack of community engagement and collaboration on issues relating to making legislation and policies on watershed management. As a result, their awareness is low thus explaining way they engage in unsustainable activities such as deforestation that causes degradation of watershed natural resources.

4.1.7 Attending trainings on watershed management

Concerning trainings, the household heads were asked if they do attend trainings on capacity building towards watershed management organized by the government and non-governmental organization. The results of the study in Table 4 below revealed that, 44.2% of the household heads have never attended any watershed management trainings, 26.9% reported that they sometimes attended the trainings, 14.2% reported that they rarely attended watershed management trainings, 10.8% indicated that they always attended the trainings on watershed conservation and management, while 4.0% revealed that they attended the trainings whenever they were invited.

Further analysis revealed that respondents rarely participated in attending trainings and meetings on watershed management (M = 2.1615, SD = 1.21519). This suggests that a majority of household heads likely possess limited knowledge on how to sustainably manage watershed resources. This lack of knowledge could be a contributing factor to the uncontrolled degradation observed in the study area. These findings align with Karambelkar and Gerlak [28], who argued that stakeholder involvement in watershed management, supported by capacity building through training, empowers communities to make informed decisions regarding sustainable resource management in the USA.

4.1.8 Implementation of watershed management programs

Household heads were also queried about their participation in implementing watershed management activities within the study area. Fig. 7 summarizes the results. Nearly half (45.00%) of respondents reported never participating in such programs. Less frequent participation was reported by 24.60% (rarely participating) and 21.80% (sometimes participating). Conversely, a smaller percentage indicated more frequent participation: 7.40% always participated and 1.10% participated whenever requested.

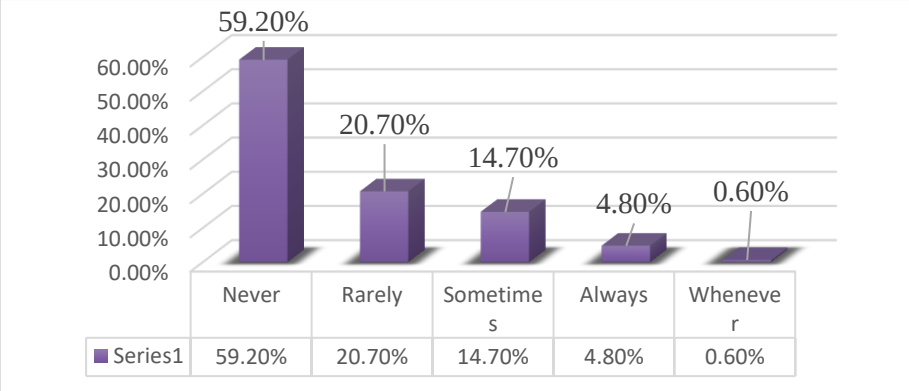

Fig. 6. Participating in making legislation on watershed management
Source: Field survey, 2024

Table 4. Attending trainings on watershed management

Ratings	Frequency	Percent
Never	156	44.2
Rarely	50	14.2
Sometimes	95	26.9
Always	38	10.8
Whenever	14	4.0
Total	**353**	**100.0**

Source: Field survey, 2024

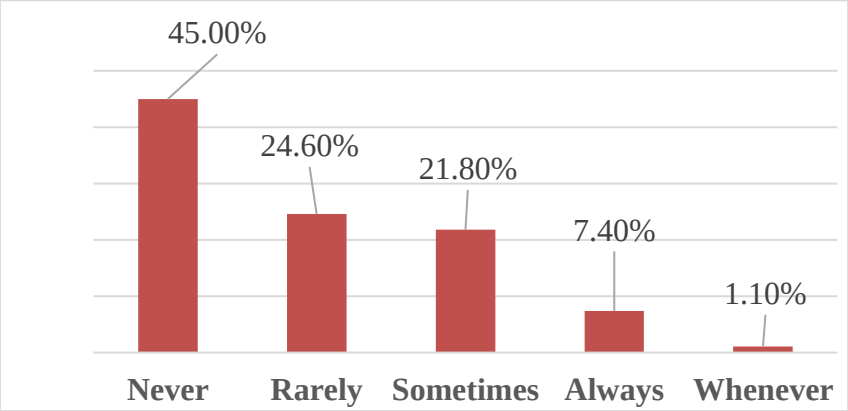

Fig. 7. Participating in implementing of watershed programs
Source: Field survey, 2024

Further descriptive analysis substantiated that: the respondents rarely participated in implementation of watershed management programs (M= 1.9490, SD=1.03227). This confirms that collaboration is lacking and that, majority of the household heads are not able to implement the use of the right strategies in conserving watershed natural resources. The challenge could be due to lack of training and engagement in watershed management programs organized by the institutions responsible for watershed management. The findings of this study are similar to that of Menge [6] who demonstrated that implementation of programs to restore wetlands in Nyantrago watershed in Kisii County, Kenya, failed because of lack of community engagement and collaboration

4.1.9 Monitoring and Evaluation of watershed management programs

Household heads were additionally asked to rate their participation in monitoring and evaluation of watershed management projects within their area. Table 5 presents the findings. Notably, a majority of respondents (62.6%) reported never participating in monitoring and evaluation programs. Participation rates were significantly lower compared to other categories: 13.9% rarely participated, 12.2% sometimes participated, and only 5.7% each reported always participating or participating whenever requested.

Further descriptive statistics showed that, the household heads participation in monitoring and evaluation of watershed activities was very low (M= 1.7790, SD=1.19986). The findings imply that the community was not engaged and that there was no collaboration of all the stakeholders in the study area on matters pertaining to monitoring and evaluation in the use of watershed natural resources and programs, therefore also explaining why degradation of the watershed continues unabated. These results are in agreement with that of Collins and Jonson [18] who noted that: lack of collaboration and engagement in monitoring of outcomes of watershed management programs is the major drawback of watershed management.

In conclusion, further descriptive analysis showed that the community rarely participated in all the indicators of modes of participation discussed (M=2.0347, SD= 0.89478). This clearly indicates lack of collaboration of all stakeholders including the community in the conservation and management efforts of the upper Gucha watershed natural resources. This consequently resulted to degradation of the natural resources in the watershed.

4.2 Extent of Watershed Degradation in Upper Gucha

Following the assessment of participation modes, the study examined the extent of watershed degradation. The majority of respondents (31%) perceived degradation to be high, while 24% felt it was low. An additional 20% considered degradation moderate, and 13% viewed it as very low. Only 12% believed degradation to be very high. Overall, statistical analysis (M = 3.056, SD = 0.567) indicated a moderate level of degradation. Photographs were captured to visually represent the degradation within the study area. Fig. 8 depicts cleared forest and riverine vegetation to accommodate agricultural activities. This practice disrupts biodiversity and

contributes to watershed degradation. Furthermore, Fig. 9 illustrates an inappropriate disposal of household waste along the river bank. This pollutes the water, consequently degrading the river's quality.

4.3 Relationship between Modes of Participation and Degradation

The study investigated potential correlations between the discussed community participation modes and the extent of degradation observed in Section 4.2 and supported by Figs. 8 and 9. Table 6 reveals a positive correlation between sharing information on watershed management and the extent of degradation (*P* =.02). This suggests that limited information sharing weakens conservation efforts, potentially leading to increased degradation. The results also show a positive and statistically significant correlation between community-provided labor for watershed management and degradation (*P* =.00). This indicates that lower community labor contributions coincide with weaker conservation efforts, potentially accelerating degradation.

Table 5. Participating in monitoring and evaluation of watershed management programs. N=354

Ratings	Frequency	Percent
Never	221	62.6
Rarely	49	13.9
Sometimes	43	12.2
Always	20	5.7
Whenever	20	5.7

Source: Field survey, 2024

Fig. 8. Forest and riverine vegetation cleared to pave way for agriculture

Fig. 9. Inappropriate disposal of household waste near the river banks.

Table 6. Correlation between Indicators of modes of participation and watershed degradation

		Extent of watershed degradation
Sharing information on watershed management	Correlation Coefficient	.125*
	Sig. (2-tailed)	.019
Participating in planning and decision making	Correlation Coefficient	.039
	Sig. (2-tailed)	.470
Finance and material contribution towards watershed projects	Correlation Coefficient	.053
	Sig. (2-tailed)	.323
Labour contribution towards watershed activities	Correlation Coefficient	.169**
	Sig. (2-tailed)	.001
Making legislation on watershed management	Correlation Coefficient	.077
	Sig. (2-tailed)	.151
Attending trainings on watershed management	Correlation Coefficient	.176**
	Sig. (2-tailed)	.001
Implementing watershed programs	Correlation Coefficient	.066
	Sig. (2-tailed)	.213
Monitoring and Evaluation of watershed programs	Correlation Coefficient	.117*
	Sig. (2-tailed)	.028

Source: Field survey data 2023

Table 7. Correlation between modes of community participation and extent of watershed degradation

		Modes of community participation	
Extent of watershed degradation	Correlation Coefficient	1.000	.154**
	Sig. (2-tailed)	.	.004
	N	353	353

***. Correlation is significant at the 0.01 level (2-tailed)*
Source: Field survey data 2023

The study results established a positive correlation between capacity training on watershed management and degradation (*P* =.00). This means that lower levels of training for the community in conservation efforts lead to lower conservation efforts, ultimately resulting in watershed degradation. These findings align with Surya et al., [29], who identified a correlation between natural resource conservation and community capacity building for watershed sustainability. Similarly, a positive correlation was found between community involvement in monitoring and evaluation of watershed programs and degradation (*P* =.03). Lower community involvement translates to lower conservation efforts, contributing to degradation.

Interestingly, no significant correlation was found between watershed degradation and participation in planning and decision-making (*P*=.47). This implies that participation in this stage may not have a substantial direct effect on conservation. These findings contradict Narendra et al., [30], who identified a lack of participation in planning as an obstacle to watershed management in Indonesia. The analysis in Table 6 also showed no significant correlations between watershed degradation and finance and material contribution (*P*=.32), making legislation (*P*=.15), and program implementation (*P*=.21). These results could indicate either a negligible effect on conservation or insufficient evidence to confirm a relationship.

Further descriptive analysis in Table 7 revealed a positive correlation between modes of participation and degradation (*P* =.00). This suggests that limited collaboration leads to lower conservation efforts, resulting in watershed degradation.

5. CONCLUSTION AND RECOMMENDATION

The results indicated that the community rarely participated in any aspect of watershed management, including sharing of watershed management information, watershed conservation programs, planning and decision making, financial and material contribution towards watershed management programs, provision of labour, attending capacity building trainings on watershed management and implementation of watershed management programs. The community also never participated in making legislation on watershed management and monitoring and evaluation of watershed management programs in the study area. Generally, participation of the community in

watershed management activities was low (M=2.0347, SD=0.89478). This signifies lack of collaboration of all the stakeholders and community engagement in conservation initiatives. This in turn resulted to moderate levels of degradation in the study area (M= 3.056, SD= 0.567). Finally, the positive significant correlation between the modes of community participation and the extent of watershed degradation (*P* =.00), indicates the need for collaboration of all the stakeholders and involvement of the community in watershed management programs thus enabling in reducing degradation of natural resources in the watershed. In light of these challenges, the study proposes the following recommendation for the County Government of Kisii, Government of Kenya and its agencies:

a) Raise awareness about climate change and natural resource conservation through education and social media.
b) Increase community participation in conservation activities to foster ownership and involvement.
c) Promote collaboration among all stakeholders, including planning, decision-making, and financial/material/labor support for programs.
d) Involve the community in developing relevant legislation.
e) Enhance capacity building by equipping the community with knowledge and skills in watershed management.
f) Integrate the community into implementing and monitoring conservation projects to increase their ownership and participation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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