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EXPLORING STAKEHOLDERS' PERCEPTIONS OF THE QUALITY AND GOVERNANCE OF WATER RESOURCES IN THE WENCHI MUNICIPALITY

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ABSTRACT

Despite increasing evidence that understanding and integrating local people's perceptions of water quality and governance helps improve water governance processes, only a limited volume of research addresses this topic in developing countries. Therefore, using in-depth interviews and content analysis, the goal of this paper is to explore stakeholders' perceptions of the quality and governance of water resources in Wenchi, Ghana. Results show that stakeholders perceive river water quality to be deteriorating. Stakeholders' judgement of river quality is influenced by water use value, pollution sources, organoleptic properties and sanitary conditions of the riverbank. Stakeholders highlighted key areas that require authorities' efforts: formulation and enforcement of bye-laws, awareness raising, provision of financial, logistic and technical support, conducting research and community mobilisation. These findings need to be carefully reviewed and systematically integrated into expert views to advance our understanding of the problem, how best to address it and who to target during interventions.

KEYWORDS: River Water Quality; Water Pollution; Water Resource Governance; Wenchi; Ghana.

1. BACKGROUND

The complexity of water resource governance requires that policymakers understand and integrate stakeholders' views into policy design and implementation. Stakeholders' perception of the physical and ecological status of a river and factors influencing river water quality may be useful in water governance processes and for gaining their support (Bohnet, 2015). Past studies have found that stakeholders' perceptions are associated with actual water quality (Jeon et al., 2005; Steinwender et al., 2008) therefore, in the absence of scientifically measured data, opinions of local actors on the state of water resources can be a useful source of information.

Moreover, subjective data on water quality may be easier and more cost-efficient to obtain than scientifically measured data (Artell et al., 2013), therefore, relying on subjective data may be useful for many developing countries who are already financially constrained. Further, insider information may provide insights into the peculiarities of a community and how best to respond to water pollution problems through policy design and implementation. While these views may not be representative of the entire population, they provide insights into whether a water policy may receive support or not, and who to target as agents of change. Therefore, while policymakers can rely on scientifically measured data on the state of water resources, the views of the people who are directly or indirectly impacted by water pollution, and are also influential in causing a change, need to be recognized, evaluated and systematically integrated into policymaking, especially because behaviour is founded on preferences derived from perceptions (Poor et al., 2001; Bockstael and McConnell, 2007).

While these benefits of understanding people's perceptions of water quality and motivations for water resources protection are widely acknowledged in the environmental valuation and management scholarship, only a limited research (e.g., Withanachchi et al., 2018) addresses people's perceptions of water quality. In developed countries such as the United States (e.g., Anadu, and Harding, 2000; Jones et al., 2018), and Denmark (e.g., Gachango et al., 2015), a considerable volume of studies explore people's perceptions of water quality and risk factors, while a few studies (e.g., Steinwender et al., 2008; Artell et al., 2013; Ochoo et al., 2017) explore associations and differences between perceptions and objectively measured evaluations of water quality. However, within the developing country context, existing studies tend to focus on perceptions on the quality of wastewater. For instance, some studies investigate risk perceptions of low quality water in the farm environment in Ethiopia (e.g., Woldetsadik et al., 2018), Kenya (e.g., Ndunda and Mungatana, 2013), Ghana (e.g., Amponsah et al., 2016) and Tanzania (e.g., Mayilla et al., 2017). On the other hand, only a few studies explore perceptions regarding the quality of fresh/surface water resources such as rivers and streams; views on what could be done to improve the quality of water resources and the role of different actors (Francis et al., 2015; Tarannum et al., 2018).

This knowledge gap may hinder our understanding of beliefs, attitudes and how they shape people's behaviours in relation to water resources pollution and management (Poor et al., 2001; Bockstael and McConnell, 2007; Okumah et al., 2019). We address this knowledge gap by exploring local perceptions on the quality and governance of three rivers in Ghana.

Specifically, the research addresses the following research questions: 1) what are stakeholders' perceptions regarding river quality? 2) Is river protection a priority in the Wenchi municipality? 3) How can key institutions support water resources protection?

2. AN OVERVIEW OF THE LITERATURE

2.1 Water Resource Governance and the Roles of Stakeholders

Water resource governance is a process that entails the promotion, development, management and coordination of water resource that optimises the economic and social welfare in a manner that is equitable and does not compromise the sustainability of vital eco-systems (Global Water Partnership, 2000). Berry et al. (2018) note that water quality governance is more complex than it appears to be because water quality and governance rely heavily upon a complex human-environmental interaction. The authors argue that water quality governance may be embedded in spatial entities, cultures, technologies, histories and even politics, to the extent that addressing one demands paying attention to the other (Berry et al., 2018).

Wuijts et al., (2018) highlights three perspectives on water quality governance, these are; ecological, legal and socio-economic. In terms of the ecological perspective, water quality governance is effective when the eco-system is prioritized and preserved. The legal aspect of water quality is deemed effective if the aims and targets of the legal framework in terms of water governance is achieved. The socio-economic aspect is also achieved when water quality governance is effective and efficient in terms of the society's capacity to make decision on water quality enhancement are regarded as legitimate. In the work of Withanachchi et al. (2018), three other dimensions of water quality governance are highlighted. These are standardization (i.e., observing the nature of water resources such that they conform to quality standards), mitigation and protection (i.e., setting and evaluating biological, hydrological and physicochemical standards to reduce water pollution) and enforcement (i.e., identifying actors that will be involved in water quality governance, the typology of governance, institutional processes and the prevailing political dynamics). Withanachchi et al.'s (2018) view of enforcement aligns with that of Kraemer et al. (2001), who looks at water governance as setting out and enforcing laws and norms, and their subsequent imposition on communities. While the details of the water resource governance approaches may vary across states (depending on the roles of stakeholders), the responsibility to prioritise and effectively govern water resources

appears to be ascribed to both local and national governments (e.g., Agarwal et al., 2000; De Loe and Kreutzwiser, 2007). However, it is worthy to point out that the protection of water resources by the state is characterised by sectoral and top-down approaches and may result in fragmented, uncontrolled and inefficient water management strategies (Agarwal et al., 2000).

To make the governance of water quality more effective, there is the need to actively engage local governments to enhance local community participation. Local governance hinges on the principles of plurality and inclusivity and as such, gives room for active community involvement in the water quality governance efforts. Local government's involvement in water quality is critical in view of the fact that addressing issues of water pollution at the local level has shown to achieve effective outcomes. Local governments are much closer to the issues of water contamination at the community level and are much more appropriate to take immediate corrective measures. Further, effective collaboration enhances coordination, increases trust and transparency and also helps to avoid duplication of efforts (Kayser et al., 2015; Withanachchi et al., 2018). Furthermore, in situations where communities have long-standing customs or agreements regarding resource use and governance, communication and transaction costs may be considerably lower than a top-down governance approach (Ayer, 1997). In other circumstances, regulations from external authorities may be incompatible with local resource governance practices, and this may result in local people rejecting such regulations or policies (Thomson, 1977; Ostrom, 1999; Ostrom et al., 1999).

Boelens et al. (2006) argue that the prioritisation of water resources is an issue of concern with regards to traditional knowledge, laws and ways of life. These traditions teach people to be responsible in caring for the sacred natural gift [water resources] that connects all life. The roles outlined in managing and/or protecting water resources by traditional knowledge is an indication that water resource protection is a matter of priority. They are based on natural and spiritual laws and thus ensure that water resources are used sustainably (Boelens et al., 2006). The authors further argue that traditional norms and values regarding the environment and water resources are extremely valuable and have been very effective. Therefore, the rampant and single application of scientific tools in protecting water resources may have led to the degradation of water resources (Boelens et al., 2006).

Consequently, indigenous people around the world have devised strategies geared towards managing surface water quality. Indigenous people's efforts to manage water quality involves

a collective attempt to initiate processes, rules and institutions for the protection of water resources. Some indigenous people may enact their own water policies with the aim of protecting and enhancing water quality (Hoekstra, 2015). McGregor (2012) also found that indigenous people institute measures at enhancing water quality because they assume the full responsibility to care for, sustain and manage waters, which constitute a basis for their survival and represents a continuation of life. Indigenous people prioritise the protection of water resources as they seek to sustain and fortify their distinct spiritual relationship with water bodies. Additionally, indigenes want to further uphold their responsibilities to future generations (United Nations General Assembly [UNGA], 2007). As a result, indigenous people have attempted, for decades, to have a voice in natural resource management at the local, national and global levels (UNGA, 2007). For example, resolution by the UN, which made access to clean water and sanitation a human right was grounded on declarations made by indigenous people (Berry et al., 2018). Similarly, non-governmental organisations have and continue to contribute to sustaining water resources through activism, logistical, financial and technical support.

Given the complex nature of water resource governance, it is important that the different actors in water governance such as community members, industrialists, local government officials and NGOs collaborate. Water resources flow across several geographical jurisdictions and thus justifies the need for local, regional, national and international actors to work together. Moreover, the actors in water governance have varied uses of water resources and different levels of influence in decisions regarding water policy design and implementation. As a result, there is the need for these actors to manage, monitor, regulate and utilise the resource for productive benefits (Camkin and Neto, 2016). However, this collaboration may prove difficult sometimes because the actors in water resources may fall into conflict over water use as interests and influences may vary. Additionally, the different values and institutional structures of the actors may render the collaboration complex. It is worthy to indicate that the financial, logistical and time constraints associated with such collaborative efforts are demanding. Nonetheless, actors need to work together to achieve greater results.

2.2. Perception of Stakeholders on Water Quality and Factors Influencing Perceptions

An important aspect of water governance involves the perception of stakeholders (e.g., local people, regulators and polluters) about the quality of water. In this light, stakeholders'

perception about the quality of water is regarded an integral component of every water resource management scheme (Bohnet, 2015). Integrating stakeholders' views in policymaking is increasingly recognised as a means of gaining support for interventions and improving sustainability goals. This has contributed to an increasing interest in the study of water quality perceptions and exploring factors that influence people's response to environmental problems (Howel et al., 2003; Brody et al., 2004; El-zein et al., 2006).

Recent studies in the water pollution and management domain explore the different ways in which people describe water quality as well as factors influencing people's judgement. One of the key descriptors of water quality is use value and risk perception of stakeholders. Evidence suggests that people's judgement of the quality of water resources is expressed in the value they attach to it and perceptions of risks associated with its use. For instance, direct access to and/or use of rivers for recreational purposes demonstrates stakeholders' trust in water sources and this reflects water users' perception of the quality of such resources (McDaniel's et al., 1999; Jones et al., 2018). Furthermore, organoleptic properties of water such as taste, smell, colour and clarity are influential in judging the quality of water among stakeholders who use the resource for recreational purposes (Smith et al., 1995; Steinwender et al., 2008). Similar attributes may form the basis for people's evaluation of water that is used for drinking, cooking and other consumption purposes (Al-Khalidi, 2008; Nauges and Van Den Berg, 2009).

Perceptions of water quality may be influenced by geo-spatial factors. Physical proximity to water sources and/or the pollution source may shape perception of water quality and risk (McDaniels et al., 1996; Bickerstaff, 2004; Brody et al., 2004). Evidence shows that people who reside or work near water sources are more likely to be concerned about the quality of water (Gachango, 2015). Socio-cultural factors are also important determining factors of water quality judgements. Socio-cultural conditions influence people's beliefs, attitudes, norms and concerns regarding water resources which shape their judgements regarding such resources (Pidgeon, 1998; Artell et al., 2013). Some long-held ecosystem values, norms and cultural symbols may represent the quality of water. Williams et al. (1999) argue that cultural factors do not only influence perceptions about environmental quality; the formal and informal flow of information may significantly affect perceptions at the community level. Ultimately, impressions and knowledge of the quality of water could constitute the value a community assigns to water resources (Berry et al., 2018).

Additionally, socio-demographic factors such as gender, age, family composition, employment, income and locality of dwelling have been identified as key variables that influence people's perception of water quality assessment (Slovic, 1999; Bickerstaff, 2004). Some studies show that women are more likely to be more concerned about risks and environmental quality (Davidson and Freudenburg, 1996; Hitchcock, 2001). The individual's experience with environmental issues and concerns may shape how this individual evaluates an environmental resource (Barnett and Breakwell, 2001; Dogaru et al., 2009).

In all the scholarship reviewed in this section, it is clear that research on stakeholder perceptions of water quality and governance remains limited. This study therefore examines the topic from a qualitative perspective.

3. CASE STUDY AREA, MATERIALS AND METHODS

3.1 Study Area

The research was conducted in the Wenchi Municipality in the Brong-Ahafo Region of Ghana. Geographically, the municipality shares boundary to the south with Sunyani Municipality, the north with Kintampo South District, to the west with Tain District and to the east with the Techiman Municipality (Figure 1). The Wenchi Municipal Assembly (2014) reports that a vast majority (68.2%) of the total land area of the Municipality is dedicated to agricultural use whereas the remaining is used for residential and commercial purposes. Agricultural activities are an important source of income in the Municipality owing to the involvement of about 57.8% of people in farming activities. Industry and commerce also constitute an equally important income source. The Wenchi Municipality is situated within latitudes 7^{o} 30' South and 7^{o} 15' North and longitudes 2^{o} 17' West and 1^{o} 55' East. The Municipality covers an area of 1,296.6 km^2 with regards to its physical expanse.

The Wenchi Municipality was selected for this research because the area is endowed with many major rivers such as Tekyerebete, Tain, Subin, Yoyo and Atwene. Further, a significant proportion of the rural dwellers depend on these rivers to undertake domestic, agricultural and industrial activities (Wenchi Municipal Assembly, 2014). Recent reports from the Municipal Assembly suggest that some rivers e.g., Tain, Subin and Yoyo are deteriorating in quality owing to certain anthropogenic factors. Moreover, The Wenchi Municipal Assembly (2014),

indicated that water-related diseases such as Cholera and Intestinal worms were among the top ten most common diseases in the Municipality. The heavy dependence of rural dwellers on water resources, the strong human-environmental interrelationship, and the potentially deteriorating state of the rivers makes it prudent to investigate local stakeholders' perceptions of the quality and governance of River Tain, Subin and Yoyo. This case study provides a basis for deeper insights into stakeholders' perceptions in relation to water pollution and governance and how best to respond to water problems from a policy perspective.

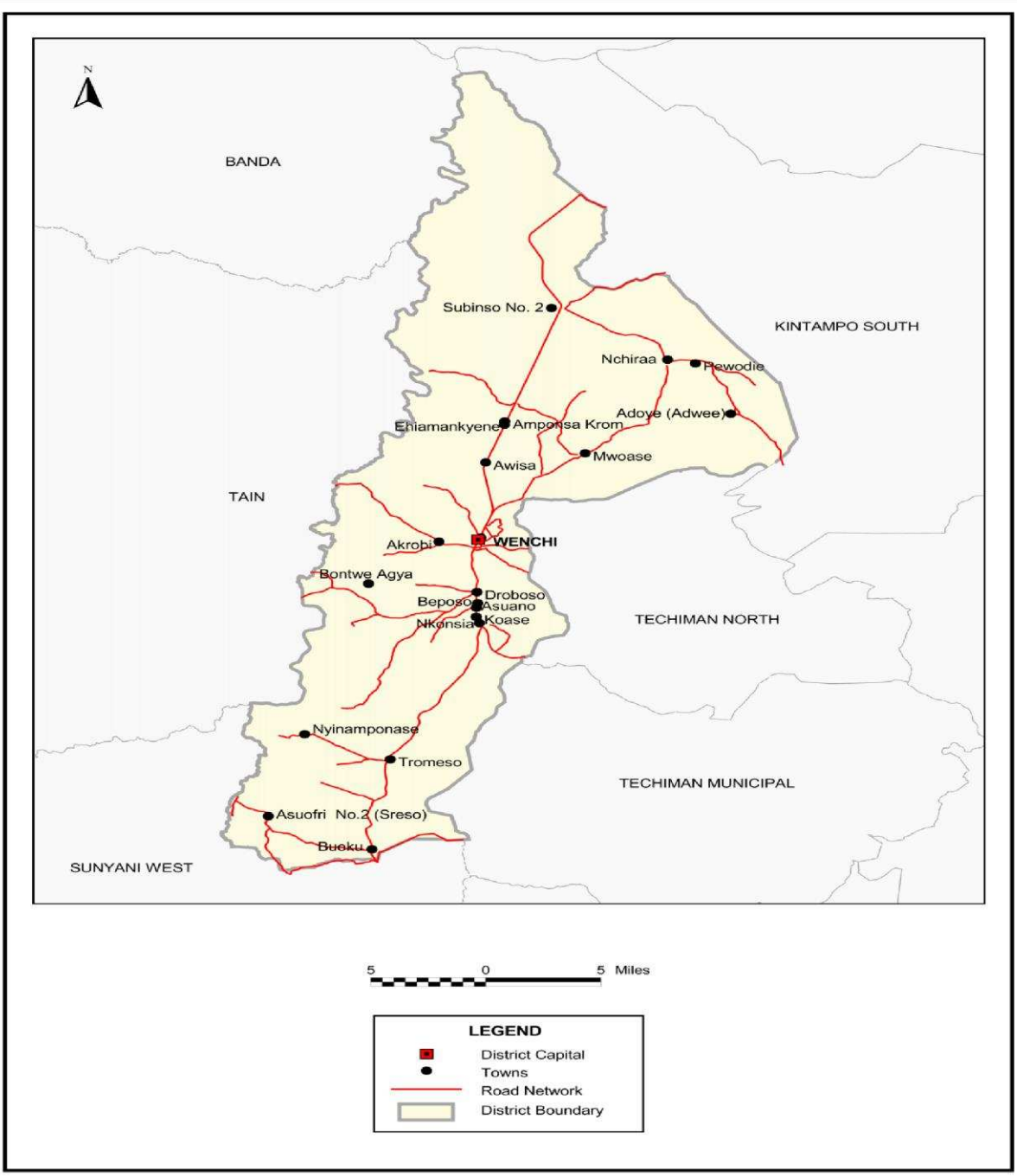

Figure 1: Map of the Wenchi Municipality in Ghana
Source: Wenchi Municipal Assembly, 2014

3.2 In-depth Interviews

Qualitative in-depth interviews were selected for this study as the technique enables researchers inductively or retroductively explore complex social issues (Marshall, 1996) and gain insights into their complexes (Sieber, 1973; Wichmann and Köbbing, 2015). To conduct interviews, we relied on our research questions as a guide which provided the framework within which conversations were held with interview participants (see Appendix 1 for the interview guide). Interviews were therefore aimed at answering the following questions: What are stakeholders' perceptions regarding river quality? Is river protection a priority in the wenchi municipality? How can key institutions support water resources protection? By holding conversations around these questions, we expect to find data that will help achieve our research objectives, and also contribute to addressing existing knowledge gaps.

We recruited interview participants through exponential non-discriminative snowball sampling (Wichmann and Köbbing, 2015). This involved interviewing stakeholders from the Municipal Assembly and the Traditional Council who then referred us to other potential participants. Stakeholders from the Municipal Assembly and the Traditional Council were selected for interviews because of their stake and extensive knowledge regarding water resource pollution and governance in the study area. For instance, authorities at the Municipal Assembly (e.g., Deputy Municipal Planning Officer) are involved in the regulation of activities that affect the quality of rivers and other water resources in the study area. The Traditional Authorities on the other hand are custodians of the land and are therefore involved in activities aimed at protecting water resources. These roles and stake in water resources governance make these stakeholders more likely to have extensive knowledge of the state of water resources and issues of water governance, thus, making them an important source of information for this research. Following this, we randomly contacted some residents of the community and asked if they were happy to be interviewed. The random selection therefore excluded strangers, travellers and visitors in the community at the time of the study. We focused on residents because their activities are a key source of river pollution and they have a role to play in water policy design (Wenchi Municipal Assembly, 2014) and were better placed to provide information on water resources pollution and governance in the area.

Each potential participant was contacted and a meeting arranged for the interview. About 13 people did not want to participate because they were 'busy' or in the case of 4 women, they wanted their husbands to be interviewed instead. Additional five were travellers who had

visited for various activities including business and consultancy. Overall, 11 face-to-face in-depth interviews were conducted between 7th and 18th April, 2019 (see Table 1 for a profile of interview participants), with each interview lasting for about 18 minutes. Interview participants were categorised into two main groups: the first group consists of institutions and the second group consists of households. The household category comprises farmers, teachers, civil servants, artisans and industrialists. Evidence suggests that poor agricultural practices and effluents from industrial activities are significant sources of river pollution (e.g., Hutchins 2012; Novotny, 2013; OECD, 2012, 2017). An obvious characteristic of the 11 interviewees is their higher educational attainment. The higher level of educational attainment might be a reflection of the situation in the Municipality where majority of the populace have at least Senior High School qualification (Wenchi Municipal Assembly, 2014). On the other hand, this may be due in part, to the convenience sampling strategy applied in this study which affects the scope of participants being recruited as the technique might be prone to biases arising from self-selection (Hedt and Pagano, 2011).

To enhance the accuracy of note taking, ensure an interactive and engaging process, interviews were recorded (following the consent of participants) and transcribed after the interview (Cohen and Crabtree, 2006). All interviews were conducted using the English Language, except for three cases where Twi, the predominantly/widely spoken Ghanaian Language was used, due to participants' low proficiency in the English Language. In those cases, the interview content was translated to English during the transcription process. We applied the intelligent verbatim transcription method to transcribe the interviews as this enabled the removal of fillers, 'irrelevant' and repetitive statements (Golota, 2018) thus facilitating analysis of transcripts. Interview participants were anonymised.

Table 1: Interview Participants' Profile

#		Gender	Age	Educational Attainment	Position/Occupation/Profession	Years lived in community
Institutional						
1		Male	33	BSc. Degree	Local assembly member	33
2		Male	61	Ph.D.	Community chief	42
3		Female	34	BSc. Degree	Deputy municipal planning officer	3
Household						
1	-	Female	27	BSc. Degree	High school teacher	14
2	-	Female	31	High school	Farmer	31
3	-	Female	62	Post-Secondary	Farmer	48
4	-	Female	54	No Formal Education	Farmer	50
5	-	Male	32	MSc. Degree	Hydrologist	12
6	-	Male	28	BSc. Degree	Accountant	10
7	-	Male	53	High school	Welder	48
8	-	Male	42	No Formal Education	Farmer	42

Average age of interviewees = 41.55; Average number of years lived in community = 30.27

3.3 Analytical Methods

We applied content analysis to explore the interview transcripts. A retroductive method was applied because the method helps us to overcome the limitations of using either a purely inductive or deductive approach. Whilst inductive research assumes that evidence could be gathered without links to theory, deductive research on the other assumes that theories without facts are possible (Sæther, 1998). However, as Ragin (1994) notes, the question is not whether to employ theory or not, but to identify key links between theory and empirical evidence as this represents a comprehensive approach to understanding social life. Consequently, social research is guided by theoretical ideas and the interactions between evidence and theory may lead to the refinement of existing ideas and/or production of new knowledge (Ragin (1994). For further details on application of the retroductive research approach, see (Ragin 1994; Hartig, 2011).

Each transcript was analysed through hand coding. To do this, first, we skimmed through all sections of the transcripts, to get a fair idea of the content of the interviews. This was followed by a close reading of each transcript. With our research objectives in mind, we applied a ground approach (Strauss and Corbin, 1998) to code relevant phrases, sentences and sections (using colour codes or notations). Next, we carefully read through the interview transcripts severally to identify recurring topics that emerge from the texts rather than on the basis of pre-defined topics. Repeated statements, paragraphs and sections were highlighted and closely examined. Next, we established links between codes and categorised them to identify themes, while

ensuring that the content of each code was maintained for reference. To ensure validity of our results, the process was reviewed in an iterative process until the results became stable. Results for each research question were presented using a manifest analysis (e.g., Bengtsson, 2016), where each theme was considered, key nodes used and reference made back to interview participants' statements. Specifically, we describe what the interview participants actually reported, stay very close to the text, use key quotes, and describe the text and their meanings. These results were further discussed in relation to existing literature on the topic, considering the context; this aided interpretation as well as drawing implications.

4. RESULTS

4.1 What Are Stakeholders' Perceptions Regarding River Quality?

In this section, we explore participants' perceptions on the quality of the three rivers and reasons for their judgements. When asked about the state of River Yooyo, Tain and Subin**,** all interview participants indicated that the rivers were in a bad state and deteriorating in quality. Interview participants provided a wide range of reasons why they perceive the rivers to be deteriorating or have poor quality (Table 2). These wide-ranging views fall under four themes: belief or knowledge of pollution source, water use value and risk perception, sanitation or physical conditions of the riverbank and water organoleptic properties.

The most commonly identified variable used to describe the deteriorating state of the rivers is belief or knowledge of pollution source. Almost all (10 out of 11) interview participants indicated that the rivers are of a poor and deteriorating quality because of the accumulation of plastic waste, human excreta and poisonous farming chemicals from individual and household activities. One interviewee noted that:

> "…the rivers have now become a dumping site for all kinds of waste materials. People usually dispose their household waste anywhere…all these waste materials are channelled into the rivers. Our regard for water resources in contemporary times have declined to the extent that people now use chemicals to farm near the rivers" [H4].

Another interviewee was noted to have said:

> "The reduction in the quality of the rivers is basically attributable to agricultural activities carried out near the rivers and climate change" [I3].

The second frequently identified attribution factor was water use value and risk perception, which was mentioned by four interviewees. Their views reflect the value of the rivers to the

community and how they depend on these resources for various purposes such as swimming, fishing and consumption (e.g., drinking and cooking), however, these use values have either declined or are nearly non-existent. The following statements reflect these concerns:

> "The farmers nurse their seeds around the river and subsequently apply chemicals on their vegetable farms. When the rains come, it washes the poisonous chemicals into the river and this is causing a serious threat to people drinking from the river" [H3]

> "Growing up as a boy, we use to swim in the rivers and these rivers were very clean and strong in terms of the quality… The enthusiasm with which we use to swim in this rivers during our boyhood ages has declined tremendously…" [I1].

> "Some 40 years ago, whilst I was a school boy, we fished and drew water for consumption out of the Yooyo River. I am asking, will you drink or eat any fish from the river? [I2].

The third variable used to describe the deteriorating state of the rivers was sanitation or physical conditions of the riverbank, which was highlighted by two interviewees. They claim to have observed poor sanitary conditions at the riverbank, which, in their opinion, demonstrates a deteriorating quality of the rivers. One interviewee for instance, recounted that:

> "…Just a few days ago, I was driving along the main Wenchi-Techiman route and saw a huge pile of rubbish along the riverbank after a heavy downpour. This dirty scene around the river is enough to say the river has deteriorated in terms of its quality. It was very rare to find even a piece of rubbish around the river during our childhood ages but it appears things have changed significantly" [I2].

The last factor attributed to river quality deterioration was a water organoleptic property as one interviewee mentioned the changing colour of River Yooyo and Tain (H2, Table 2).

Table 2: Indications of bad state or deteriorating quality of rivers

#	Gender	Age	Educational Attainment	Years in community	Key Statement(s)	Theme (s)
I1	Male	33	BSc. Degree	33	"Growing up as a boy, we use to swim in the rivers and these rivers were very clean and strong in terms of the quality… The enthusiasm with which we use to swim in this rivers during our boyhood ages has declined tremendously…"	Use value Risk perception
I2	Male	61	Ph.D.	42	"Some 40 years ago, whilst I was a school boy, we fished and drew water for consumption out of the Yooyo River. I am asking, will you drink or eat any fish from the river? The accumulation of plastic waste, human excreta and poisonous farming chemicals have piled up in the river. Just a few days ago, I was driving along the main Wenchi-Techiman route and saw a huge pile of rubbish along the riverbank after a heavy downpour. This dirty scene around the river is enough to say the river has deteriorated in terms of its quality. It was very rare to find even a piece of rubbish around the river during our childhood ages but there appears to be a significant change now".	Use value Risk perception Pollution source Physical/sanitation
I3	Female	34	BSc. Degree	3	"The reduction in the quality of the rivers is basically attributable to agricultural activities carried out near the rivers and climate change".	Pollution source
H1	Female	27	BSc. Degree	14	"…the deposition and accumulation of plastic waste materials are in the rivers. On several occasions, you would find people washing along the Yooyo River...Some people also fish with poisons in the river and this has seriously affected the quality of the river".	Pollution source
H2	Female	31	High school	31	"Look at the colour and state of huge and vibrant rivers like Yooyo and Tain in this community. We could drink from these rivers some decades ago, but now, nobody even dreams about that. The dumping of refuse, washing with chemicals and cutting down of trees around the water bodies has resulted in the decline…Waste materials and sand have washed down the river and filled it. Swimming no longer looks attractive again"	Water organoleptic factors (e.g., colour). Use value Risk perception Pollution source
H3	Female	62	Post-Secondary	48	"The farmers nurse their seeds around the river and subsequently apply chemicals on their vegetable farms. When the rains come, it washes the poisonous chemicals into the river and this is causing a serious threat to people drinking from the river".	Pollution source Use value Risk perception
H4	Female	54	No Formal Education	50	"…the rivers have now become a dumping site for all kinds of waste materials. People usually dispose their household waste anywhere…all these waste materials are channelled into the rivers. Our regard for water resources in contemporary times have declined to the extent that people now use chemicals to farm near the rivers"	Pollution source
H5	Male	32	MSc. Degree	12	"People throw rubbish and defecate into the water bodies and this causes a serious deterioration of the resource"	Pollution source
H6	Male	28	BSc. Degree	10	"The rivers like Yooyo and Tain had big trees around them. The trees were able to provide adequate shade for the rivers and these conserved the volume of water in the river. But when you go there now, all the trees have been cut and thereby exposing the water to the scorching sun"	Pollution source
H7	Male	53	High school	48	"It is deteriorating because the residents here drop refuse and defecate in the river. These activities have rendered the river unfit for consumption"	Pollution source
H8	Male	42	No Formal Education	42	"Because of the quantum of filth deposited in the rivers".	Pollution source Physical factors

Note: I = Institutional Interviewee; H = Household Interviewee

4.2 Is River Protection a Priority in the Wenchi Municipality?

Here, two key issues are explored: perceptions on whether water resources protection is (not) a priority, and reasons for interview participants' judgements. On whether protection of water resources is a priority in the community, almost all responses were negative, as ten out of 11 interview participants indicated that river protection is not a priority in their communities. The main reason for this judgement was that community leaders (such as chiefs), municipal and national authorities have not undertaken any measures to demonstrate that water resource protection was a priority (Table 3).

While almost all interview participants mentioned a general lack of efforts to protect water resources, interviewee's expectations varied. The first and most commonly stated theme to have emerged is the lack of enforcement of laws and regulations regarding water resource use. Some interview participants mentioned that local and municipal leaders do not sanction people who pollute rivers as well as individuals who fell trees along the riverbank (I2, H1, H2, H3 and H8). When asked whether river protection is a priority in the municipality, an interviewee was noted to have said:

> "No, my son. I have not seen a single agency or institution taking steps to preserve the water resources…The Yooyo river is situated on the Wenchi-Kumasi road. Lots of prominent personalities in government ply the road every day, they see people washing and throwing rubbish in the river. I have not heard any government official question these people, likewise the traditional authorities" [H8].

Others claim the leaders do not organise communal work targeted at protecting water resources (e.g., H4 and H7). To show that river protection is a priority, they expect leaders to organise communal work to clean up and plant trees along the riverbank. However, leaders do not organise such activities thus signalling that river protection is not a priority to community leaders. As one interviewee noted:

> "It is not a priority. Because the river here is already filled and choked with waste materials, no authority or community leader has taken up the initiative to curtail such unhealthy and unacceptable practises. The leaders have never organised or embarked on a communal work targeted at protecting the water resource…They also allow livestock like cows and sheep to drink from the river. If it was a priority, no one would have defecated or dumped rubbish into the river" [H7].

The third theme was leaders' focus on their selfish interest to the neglect of river protection (H1, H4 and H5). These interviewees claim that, some authorities even engage in practices that hinder the realisation of the goals of sustainable water resources management. For instance, an interview participant mentioned that:

> "…some chiefs who are supposed to be the custodians of the land even sell trees and lands along waterways. This is evident that this [water protection] is not a priority" [H1].

Another stated that:

> "Nobody cares about the state of our rivers. What the chiefs know is to sell the land and other royalties for money. They have disregarded the protection of water bodies" [H4].

The fourth and last theme was lack of efforts to create awareness (H6). One interview participant mentioned that leaders do not undertake any awareness creation on the deteriorating state of water resources. According to this interviewee, one of the signs that leaders consider river protection to be important, is their effort to create local people's awareness on river pollution and sustainable river use. According to the interviewee, this role was duly carried out (by government agencies) in the past. However, no government agency has been seen doing this in the past five years, suggesting that river protection is not an important issue to them (the government).

The message is therefore clear: local people are of the view that water resources protection is not a priority, as this is justified by the lack of commitment from authorities. Surprisingly, some community leaders (such as the chief) also mentioned that authorities do not enforce regulations thereby suggesting that water resource protection is not a priority in contemporary times. Only one participant among the institutional interviewees, opined that water resources protection is a priority. However, the reason for this judgement was based on strategies outlined in the Municipality's Medium-Term Development Plan, not actions on the 'ground'. This participant mentioned that:

> "Oh yes, it [water resource protection] is a priority. Even in the Municipal Development Plan, we have activities set to be undertaken to protect these water bodies. Water resources protection is of much concern to us as an Assembly" [I3, Table 3].

It is therefore clear that local people's judgement of authorities' efforts to protect water resources is based on concrete actions taken by community, municipal and national authorities to protect water resources. Where leaders fail to carry out these roles or expectations, people tend to see river protection as a less important issue on community, municipal and/or national development agenda.

Table 3: Reasons why River Protection is (not) a Priority in the Community

#	Gender	Age	Educational Attainment	Years in community	Key Statement(s)	Theme (s)
I1	Male	33	BSc. Degree	33	For now, I will say no…Before the advent of pipe and other modern sources of water, communities heavily relied on drinking water from these rivers. Water for drinking, washing our clothes, bathing and performing all other domestic activities were obtained from the river. However, in these recent times, we are developing as a country and we have sophisticated water technology like boreholes, small-town water supply systems and the likes. No leader or authority is seeking to protect these water resources because they believe these water resources have outlived their usefulness.	No effort seen
I2	Male	61	Ph.D.	42	We being leaders do not prioritise the protection of water bodies. There is this river down my home. I heard a chainsaw operator felling about 4 trees near the river and no authority or leader from the neighbourhood attempted to stop the man from felling. If the protection of water resources was a matter of concern, an attempt would have been made to stop the guy and prosecute him…The leaders of the community some 50 years ago dealt drastically with the perpetrators of such kind of offences…We observe people wash, bath and litter around the river and nothing happens to them. This is clear to suggest that the community no longer prioritise the protection of water bodies.	Do not enforce laws
I3	Female	34	BSc. Degree	3	Oh yes, it is a priority. Even in the Municipal Development Plan, we have activities set to be undertaken to protect these water bodies. Water resources protection is of much concern to us as an Assembly.	Strategies contained in plans.
H1	Female	27	BSc. Degree	14	"…Narrowing it down to the community level, although, there exist bye-laws that seek to protect water resources, I have never heard or seen any authority apply such sanctions…Also, some chiefs who are supposed to be the custodians of the land even sell trees and lands along waterways. This is evident that this is not a priority".	Do not enforce laws. Selfish interest
H2	Female	31	High school	31	No please. No one cares about the protection of water resources. The rivers did not just lose their quality [overnight]. This phenomenon occurred over space and time. The authorities see the rivers deteriorating and watched it deteriorate further till this state. If it was indeed a priority, they would have taken steps or measures to protect them.	Do not enforce laws
H3	Female	62	Post-Secondary	48	They do not. They have always been saying that they would protect water resources but I have not witnessed any concrete preventive measures by the authorities to halt the deterioration of water resources. The chainsaw operators have been felling trees around the river and nobody cares or stops them.	Do not enforce laws
H4	Female	54	No Formal Education	50	No of course, it isn't. When was the last time the community organised communal work to clean up the river? All we do is to rather pollute it. Nobody cares about the state of our rivers. What the chiefs know is to sell the land and other royalties for money. They have disregarded the protection of water bodies.	No cleaning and tree planting exercise. Selfish interest
H5	Male	32	MSc. Degree	12	"It is not an issue of concern to the authorities. They pay more attention to other things more than they do to river bodies. They have neglected the protection of water bodies".	Selfish interest
H6	Male	28	BSc. Degree	10	No please. Of late, they pay less attention to the protection of water resources. Some of the leaders are even ignorant about the essence of conserving water resources. They do not undertake any awareness creation on the deteriorating state of water resources, let alone efforts at conserving them.	Lack of awareness creation
H7	Male	53	High school	48	It is not a priority. Because the river here is already filled and chokes with waste materials, no authority or community leader has taken up the initiative to curtail such unhealthy and unacceptable practises. The leaders have never organised or embarked on *a communal work targeted at protecting the water resource…They also allow livestock like cows and sheep to drink from the* river. If it was a priority, no one would have defecated or dumped rubbish into the river.	No cleaning and tree planting exercise.
H8	Male	42	No Formal Education	42	No, my son. I have not seen a single agency or institution taking steps to preserve the water resources…The Yooyo river is situated on the Wenchi-Kumasi road. Lots of prominent personalities in government ply the road every day, they see people washing and throwing rubbish in the river. I have not heard any government official question these people, likewise the traditional authorities.	Do not enforce laws

4.3 How can key institutions support water resources protection?

A key commonality observed from stakeholders' responses in section 4.2, Table 3 is that, people ascribe the responsibility to protect water resources to authorities; not necessarily an individual's role. In this section, we are interested in identifying the specific initiatives that these stakeholders expect authorities to take in order to address river pollution.

When asked about how key institutions can support water resources protection, interviewees highlighted a number of initiatives (Table 4). These wide-ranging views fall under six themes: formulation and enforcement of bye-laws (N=10), awareness raising and sensitisation (N = 7), financial, logistic and technical support (N=6), community mobilisation (N= 4), mounting pressure on government (N=3), and research and innovation (N=1). While almost all (10 out of 11) interview participants, mentioned law formulation and enforcement, their views varied slightly: four interviewees indicated that laws must be formulated and enforced (I1, H1, H4 and H5) while the remaining six believe that there are existing laws to protect water resources, what is needed is the enforcement of those laws (I1, I3, H2, H3, H6, and H8). Interview participants believe that laws and bye-laws that regulate access and use of water resources in their communities are enacted by the (central and local) government and community authorities. These institutions have the mandate to formulate, implement and ensure compliance with all laws regarding water resources protection. Community leaders and government are therefore expected to enact laws and ensure compliance, if rivers are to be protected and used sustainably.

The next role, awareness raising was ascribed to non-governmental organisations. Some interviewees believe that NGOs have the capacity to carry out advocacy and sensitization programmes to raise people's awareness on water resource protection, and how best to manage water sustainably. This, they believe, would help reduce river water pollution.

Financing and provision of logistics were ascribed to the central and local governments, owing to their roles in financing activities aimed at protecting the environment in their municipalities. Some local people were of the view that large scale NGOs are financially resourced and can commit substantial financial resources to protecting water resources. NGOs also carry out research and have the competent personnel that will be able to offer useful technical support and assistance. Aside providing technical and financial support, NGOs are expected to mount pressure on government to initiate and implement relevant water resource protection measures.

They believe that NGOs can negotiate, lobby and provide incentives to facilitate the implementation of river protection measures.

The next important role identified is, community mobilisation. Community mobilisation involves bringing community members together to undertake river protection measures. Community leaders (traditional authorities), acting as custodians of the land, they have the power to mobilize their subjects to undertake activities such as cleaning the riverbank, planting trees along rivers, among others. Some interview participants are hopeful that such initiatives could help address river pollution in their communities.

Further, there seem to be a greater responsibility ascribed to some institutions (Table 5) as interview participants ascribe four of the six roles to Non-Governmental Organisations, and two to the government and community leaders (e.g., chiefs).

Table 4: What Authorities Should Do To Protect Water Resources?

#	Gender	Age	Educational Attainment	Years in community	Key Statement(s)	Theme (s)
I1	Male	33	BSc. Degree	33	The traditional authorities in collaboration with the Municipal Assembly can formulate bye-laws and conventions to prevent farmers from polluting water resources with chemicals. These bye-laws must ban farmers from farming close to these water resources…Also, certain activities like mining deteriorate rivers, as a matter of fact, there must be bye-laws instituted by the Municipal Assembly and the Traditional Authorities to halt all such unhealthy environmental practises. NGOs are much resourced to come to our aid to help us financially and technically to undertake these protection measures.	Establish and enforce Byelaws Financial and technical support
I2	Male	61	Ph.D.	42	As the traditional council, we have to collaborate with the Municipal Assembly to educate citizens on the need to protect water resources. The government can also supply us with improved tree crops to be planted along these water bodies…there are environmental laws that regulate actions on the management and use of natural resources…the government must strengthen enforcement of such laws…NGOs can mount pressure on the government to protect these water bodies. Again, the NGOs can also embark on public sensitization on the need to protect water resources.	Education Logistic support Law enforcement Pressure government
I3	Female	34	BSc. Degree	3	NGOs can mount pressure on the MMDAs and the government. Because when these NGOs give us pressure, they force us to ensure that we stick to our roles in protecting water resources and they must ensure that we carry out all such duties...For the traditional authorities, they have to dialogue and liaise with the MMDAs and educate their subjects. The traditional authorities are the custodians of the community and must ensure enforcement of all these management practises.	Pressure government Education Law enforcement
H1	Female	27	BSc. Degree	14	For the government with the legislative and executive powers, I think it should be proactive in formulating, strengthening and enforcing existing laws towards the protection of water resources. Also, the security agencies should be up and doing in the protection of water resources. Persons caught polluting the rivers must be prosecuted. On the part of the traditional authorities, they must also revive ancient customs, laws and practises *that regulate the use of water resources…* The NGOs must also undertake research into innovative ways of protecting water resources and disseminate such findings to the public and government to inform water-related protection measures.	Law formulation and enforcement Research
H2	Female	31	High school	31	…the government must provide logistical, financial and technical support towards the protection of water resources. Also, the government must enforce laws on water resource protection and empower the security forces and the courts to punish culprits of water pollution. The traditional authorities have to mobilise their community members to protect and support these [water resources] protection measures. They can also write proposal to the government and other non-state actors to solicit funding towards the protection of water resources. The NGOs and the civil society have to play an advocacy role. They must exert their influence on the citizens and the government to conserve our rivers.	Logistical, financial and technical support Law enforcement Community mobilisation Advocacy/education Pressure government
H3	Female	62	Post-Secondary	48	The traditional authorities should select committed people to monitor the protection of water resources. These volunteers must be deployed around the rivers to check the pollution of the resource. The government must also embark on tree planting exercise around the water bodies. Also, the hunters setting fire to burn the bush must be punished. The NGOs can also educate and again help in restoring lost tress around the water bodies.	Law enforcement Education

H4	Female	54	No Formal Education	50	The traditional authorities and the Assembly can also formulate and enforce bye-laws to enhance the protection of water resources. The NGOs can also embark on mass sensitization on the relevance to protect water bodies. The NGOs may also fund these protection *efforts…*The chiefs and the assembly can thus mobilize the youth for these protection measures.	Law formulation and enforcement Financial support Education/sensitization Community mobilisation
H5	Male	32	MSc. Degree	12	For the traditional leaders, I think they can enact bye-laws to protect these rivers. They can make it a ban to drop litter or defecate into the rivers…The government equally can organise clean-ups around the river. The government can initiate dredging along the rivers and plant trees around the river... The NGOs too can organise educational conferences and educate the local people on the need to preserve the water bodies.	Law formulation and enforcement Community mobilisation Education/sensitization
H6	Male	28	BSc. Degree	10	Previously, people had to obtain license before fishing in the rivers and this was strictly checked by the chiefs, we seem to have neglected these things. The traditional authorities have to rekindle these duties to help restore the rivers to their previous state. The government has to provide adequate financial resources to support these protection measures. For the NGOs that are into the protection of water resources, they must collaborate with the traditional authorities and the government to undertake t*ree planting exercises…*	Law enforcement Financial support
H7	Male	53	High school	48	The traditional authorities must actually mobilise the community members in carrying out the protection measures. The government must also supply us with basic tools and equipment like mattocks, shovels and rakes to help us clean the water up.	Community mobilisation Logistical support
H8	Male	42	No Formal Education	42	The government must first enforce existing laws on water protection strictly. The traditional authorities must also collaborate with the MMDAs to enact context-specific bye-laws to regulate the use of water resources. The NGOs who are the white people can also educate people on the need to protect water resources.	Law enforcement Education/sensitization

Table 5: Roles and Authorities

Roles	Authorities		
	Local and National Government	Community Leaders	Non-Governmental Organisations
Formulation and enforcement of bye-laws	x	x	
Awareness raising and sensitisation			x
Financial, logistic and technical support	x		x
Community mobilisation		x	
Mounting pressure on government			x
Research and innovation			x

Notes: x = role commonly ascribed to institution

5. DISCUSSION

The goal of this paper is to explore stakeholders' perceptions on water resource quality, water resource protection prioritization and the role of different actors in water resource protection. To achieve this goal, we conducted in-depth interviews with stakeholders and applied content analysis to explore interview transcripts. Here, we present potential limitations of our study, before a detailed discussion of our key findings. First, three interviews were conducted in Twi, a Ghanaian language, after which we translated the content to English Language. This, like any cross-language qualitative research, has the potential to pose inconsistencies in the data due to untranslatability of certain words and expression, which will lead to the precise meaning to get lost in translation (Squires, 2008). However, in this research, this limitation has been partly resolved as the researchers – who are proficient in both languages – conducted the interviews and translated it; i.e., we did not rely on a third party as an interpreter and/or translator. Moreover, other attempts such as member check by confirming the authors' understanding of interview participants' views were carried out; this helps to limit potential problems such as confusing responses, and/or misunderstandings (Bengtsson, 2016). Another potential limitation involves the application of the intelligent verbatim transcription method, which may result in the loss of key information because the actions and reactions of interview participants are not captured. For instance, the passion with which an individual talks about river pollution may reflect or reveal the relevance of the problem in reality, and this information may be useful in trying to understand emotions attached to socio-environmental problems.

Lastly, like many qualitative interviews, this study relied on the views of a limited number of interview participants. This does not allow for exploring data across institutional and socio-demographic dimensions. Evidence suggests that people's knowledge of the problem, personal

experience (e.g., Tarannum et al., 2018), institutional roles or social position (e.g., Haeffner et al., 2018), and socio-demographic characteristics (e.g., Fobil et al., 2010; Ndunda and Mungatana, 2013; Withanachchi et al., 2018) may influence their evaluation of the state of an environmental resource (e.g., rivers), as well as their motivations to support water protection interventions (e.g., Francis et al., 2015). Therefore, the potential role of social position, socio-demographics and other factors on people's perceptions of environmental quality needs further research. Exploring perceptions along these dimensions may provide further insights needed for the design and implementation of well targeted environmental policies. Despite this limitation, the application of in-depth interviews helps to provide deep and rich data that helps in understanding the complexities of the topic understudy (Sieber, 1973; Marshall, 1996).

5.1 What are Stakeholders' Perceptions Regarding River Quality?

A critical reflection on the interview responses revealed that almost all stakeholders (both authorities and subjects) perceive rivers in the Wenchi Municipality to be in a poor state, with a declining quality. While factors such as water use value and risk perception, sanitary conditions of the riverbank and water organoleptic properties (e.g., colour) were mentioned, perceptions regarding pollution source was the most commonly identified reason for stakeholders' judgement of river quality. Interview participants were emphatic on the deposition and accumulation of pollutants from agricultural activities, open defecation and household wastes as the main sources of water pollution and the poor river water quality. This perception falls in line with findings of past empirical studies that show that diffuse pollution from agriculture is a major source of water pollution (Hutchins, 2012; OECD., 2012, 2017; Novotny, 2013; United Nations World Water Assessment Programme, 2015). Further, evidence shows that one of the major challenges in encouraging positive environmental attitudes and fostering behavioural change is the lack of scientific evidence and stakeholders' awareness of pollution sources and mitigation measures (Blackstock et al., 2010; Environment Agency, 2011, 2014; OECD., 2012, 2017). The evidence that these stakeholders perceive rivers to be deteriorating and are aware of the potential pollution sources is a positive factor. This indicates their awareness of the problem, which can facilitate uptake of behaviours that promote sustainable water resources management (Blackstock et al., 2010, OECD., 2012, 2017; Okumah et al., 2018; Okumah et al., 2019a, Okumah et al., 2019b). This finding may be useful in promoting interventions as this may imply that local stakeholders acknowledge the

deteriorating state of water resources and more importantly, they have knowledge of the sources of the problem.

With water use value and risk perception as the second commonly cited factor, it is obvious that local people recognise the importance of water resources (e.g., for recreation, fishing and consumption), and potential risks associated with river pollution. This finding corroborates the assertion that people's judgement of the quality of water resources is expressed in the value they attach to it and perceptions of risks associated with the use of such resources (McDaniels et al., 1996; Ndunda and Mungatana, 2013; Jones et al., 2018). Indeed, poor sanitary condition is of serious concern to river water users because as the amount of filth in and/or around the river increases, there is a low valuation by users in terms of river use for picnicking, scenic beauty and domestic consumption. As found in this study and in line with Smith and Davies-Colley (1992), the presence of filth and discoloration of rivers may suggest to users, the possibility of toxicity. When the river environment is littered, is discoloured and has odour, river users are more likely to rate such rivers as polluted, even if the river's quality in terms of PH, temperature, turbidity and presence of dissolved oxygen are good (Dinius, 1981). However, in the work of Dinius (1981), the discoloration of rivers was considered not harmful when river water was used for industrial activities. Therefore, while sanitary conditions of the river environment and organoleptic properties (such as colour) may constitute important measures of river water quality evaluations, this depends on what the river is used for and the perceived risks.

5.2 Is River Protection a Priority in the Wenchi Municipality?

Regarding stakeholders' views on the prioritisation of water resources in the community, nearly all interview participants indicated that the protection of water resources is not a priority in their communities. The main reason for this judgement was that community and municipal authorities do not undertake any interventions to demonstrate that water resource protection is a priority. Their expectations are that government and community leaders initiate programmes such as tree planting, cleaning the riverbank, embarking on awareness raising campaigns and formulating and enforcing water protection laws. However, their observations are contrary to these expectations. As Agarwal et al. (2000) noted, whether authorities prioritise the protection of water resources is determined by their efforts: formulation and enforcement of laws, conventions and the application of traditional knowledge and practices in the management of

water resources (see also Boelens et al., 2006; De Loe and Kreutzwiser, 2007; UNGA, 2007). Additionally, indigenous people (particularly community leaders) prioritise the protection of water resources by way of getting their voices heard at the local, national and global levels. Therefore, the results from this study suggest that authorities do not prioritise the protection of water resources (given that these expectations have not been met) and this may imply continuous deterioration of water resources if initiatives are not taken.

Another striking finding is that only one interview participant, the deputy district development planning officer, indicated that river protection is a priority in the municipality. The divergent views on this issue may be a reflection of the potential impact of social position. As noted by Haeffner et al. (2018), municipal authorities (e.g., mayors and city council persons) differ from the general public on matters concerning water resource governance, a finding that has been attributed to their roles. That is, people working with institutions that have a direct or indirect role in water governance may have clear responsibilities within the institutional context. Their roles may give them the opportunity to access information that may not be readily accessible to the general public. Furthermore, consistent engagement in their roles may deepen their understanding of water pollution and action strategies, which may further shape their perceptions (Armstrong and Mahmud, 2008).

5.3 How can key institutions support water resources protection?

From the viewpoint of the stakeholders interviewed, various roles were ascribed to relevant actors in respect of the protection of water resources: formulation and enforcement of bye-laws, awareness raising and sensitisation, financial, logistic and technical support, community mobilisation, mounting pressure on government, and research and innovation. While the limited number of interview participants does not allow for generalisations, the results suggest that certain responsibilities are attributed to specific authorities. For instance, interview participants mentioned that the traditional authorities, as custodians of the land, could support water protection efforts by initiating bye-laws and mobilizing community members to engage in tree planting and cleaning exercises around the riverbank. Additionally, the inhabitants of the community expect non-governmental organisations to support water resources protection measures by rolling out awareness raising campaigns, mounting pressure on government, conducting research and providing technical and logistical support. The government, on the other hand, is expected to contribute to water protection efforts by enacting and enforcing laws

on the protection of water resources. Similarly, the government, like Non-Governmental Organisations, is expected to provide financial and logistical support in the protection of water resources.

These results show that residents of the municipality ascribe responsibility (to protect water resources) to community leaders, municipal and national authorities; not necessarily an individual's role. This, coupled with the previous finding (i.e., the perception that water resources protection is not a priority, due to perceived lack of commitment from authorities), may suggest a potential barrier in adoption of sustainable practices among residents of the municipality. Blake (1999) argues that some people feel they should not take responsibility for pro-environmental behaviours because government ought to have provided the necessary conditions for undertaking these behaviours. Moreover, as evidence suggests, when people feel they are not responsible for an environmental problem, they are less likely to engage in practices that help in addressing the problem, especially when this comes at a significant cost (e.g., Schwartz, 1968, 1970, 1977; Blake, 1999; Macgregor and Warren, 2006). Therefore, whereas residents' awareness of water pollution and sources of the problem may facilitate uptake of sustainable behaviours, adoption of such behaviours may be hindered by ascription of responsibility to authorities and leaders' lack of commitment to river protection.

The top-down perspective to water governance observed in this study reflects the views of Agarwal et al. (2000) and De Loe and Kreutzwiser (2007) that indigenes tend to ascribe the role of water resource governance to governments. It is worthy to note that while some responsibilities (e.g., formulation and enforcement of regulatory frameworks) appear to be the mandate of the government, specific activities within households and water catchments may be undertaken by individuals and private entities. For instance, local people (e.g., farmers and industrialists) have a preventive role to play by adopting best management practices in their activities. Furthermore, local people may have a better understand of the socio-ecological systems within which water governance policies are design and implemented. Therefore, their participation in policy design and implementation could contribute to achieving better water governance outcomes (Thomson, 1977; Ostrom, 1999; Ostrom et al., 1999; Kayser et al., 2015; Withanachchi et al., 2018). Policymakers and regulators therefore have a responsibility of sensitising local people; making them feel they are part of the problem and have a role to play in addressing it.

Authorities should also demonstrate that water protection is a priority by carrying out convincing initiatives that meet the expectations of the general public and key segments of the society (e.g., farmers and miners) whose actions significantly impact water quality. Additionally, authorities should enact and enforce water resource protection laws (Appiah and Asomani-Boateng, 2018). Again, the fact that interview participants ascribe some responsibilities to more than one stakeholder or authority may suggest that the different actors in water governance need to work collaboratively to address major water resource problems. Stakeholders could share financial, technical and other resources to address similar challenges or problems. Effective collaborative efforts could increase trust, transparency and may help to avoid duplication of efforts (Ostrom, 1999; Ostrom et al., 1999; Kayser et al., 2015; Withanachchi et al., 2018).

6. CONCLUDING REMARKS

Although there is increasing evidence that understanding and integrating local people's perceptions of water quality and governance helps improve water governance processes, only a limited volume of research addresses this topic in developing countries. Using qualitative in-depth interviews and content analysis, we address this knowledge gap by exploring local perceptions of the quality and governance of three rivers in the Wenchi municipality in Ghana. Results show that local people (including community leaders and residents) perceive rivers to be deteriorating. Stakeholders' judgement of river quality is influenced by water use value and risk perception, perception of pollution sources, organoleptic properties and observed sanitary conditions of the riverbank. Stakeholders highlighted key areas that require authorities' efforts: formulation and enforcement of bye-laws, awareness raising, provision of financial, logistic and technical support, conducting research and community mobilisation.

The results of this study offer useful insights into the complexities of water quality, governance, and the different factors that affect the evaluation, pollution and management of rivers. Our findings untangle the different ways in which people describe the quality of water resources and provide insights into what policymakers and regulators should highlight when attempting to influence residents' behaviours in relation to water pollution. Evidence suggests that stakeholders' perceptions are strongly allied with actual water quality (Jeon et al., 2005, Steinwender et al., 2008). This suggests that policymakers can rely on the subjective views of

community residents when there is limited data on scientifically measured estimations of water quality. Furthermore, this 'insider information' provides contextual insights into the uniqueness of the community's perspectives on water pollution and governance as well as how best to respond to the problem. These views, however, need to be carefully reviewed and systematically integrated into expert views to advance our understanding of the problem, how best to address it, stakeholder support for water policy, and who to target during interventions (Poor et al., 2001; Bockstael and McConnell, 2007). Ultimately, this is expected to support the design of policies that can effectively foster behavioural changes and contribute to reducing water pollution (Steinwender et al., 2008; Okumah et al., 2019a).

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8. APPENDIX: INTERVIEW GUIDE

1. Do you think River [name] is clean/pure?
2. Please are you able to explain why you believe it is (not) clean/pure?
3. Do you think there are changes in the conditions/state of the river/riverbank?
4. Why do you say so?
5. What do you think is responsible for the current state of the river? Why?
6. Do you think protecting rivers is a priority in this community/municipality?
7. Please explain your answer.
8. Are there things you expect to see to believe that river protection is a priority?
9. Do you believe river protection is a particular institution, individual or authority's responsibility? If yes, who? And Why?
10. What do you expect these actors to do?
11. Any further comments?