

**LEGON CENTRE FOR INTERNATIONAL AFFAIRS AND DIPLOMACY**

**UNIVERSITY OF GHANA**



**UNIVERSITY OF GHANA**

**WATER AS A POTENTIAL CAUSE OF INTERNATIONAL CONFLICT FOR GHANA**

**BY**

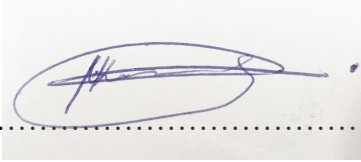
**KWAKU AKOTO OSEI (10938646)**

**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON,  
IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF  
MASTER OF ARTS IN INTERNATIONAL AFFAIRS**

**INTEGRI PROCEDAMUS**

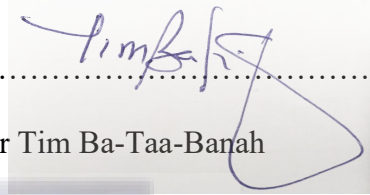
## DECLARATION

I hereby declare that this dissertation submitted to Legon Centre For International Affairs and Diplomacy as part of requirements to acquire a Master of Arts Degree in International affairs is an original work, supervised by Dr Tim Batabanah. This dissertation has not been submitted to any other institution by other persons for whatever reason. Duly following research guidelines, all other materials that were consulted have been given due credit.



Kwaku Akoto Osei

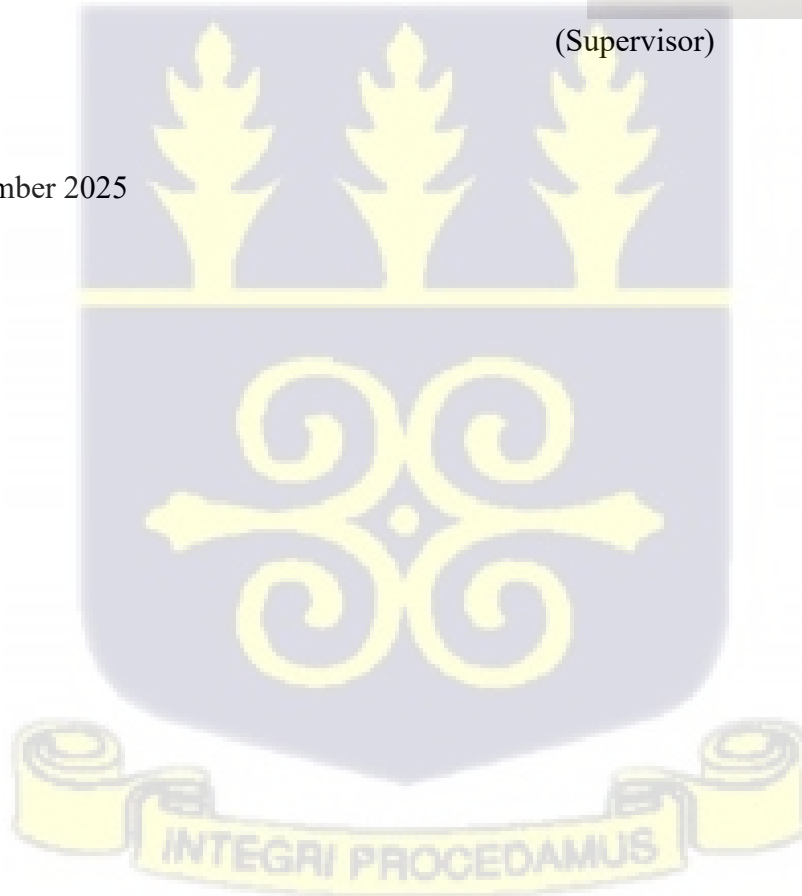
(Student)



Dr Tim Ba-Taa-Barah

(Supervisor)

Date: 28<sup>th</sup> November 2025



### **DEDICATION**

I dedicate this work to my late mum, Constance Ama Agyakomah Appiah-Kubi, and also to my family who have been very supportive through this journey.



### **ACKNOWLEDGEMENT**

I will like to express my gratitude to almighty God for making this work a success. I also appreciate the efforts of my supervisor through this journey. Also, I appreciate the efforts of my father Barima Osei Yaw Opoku who was very influential through this journey. I appreciate my course mates who made this journey a memorable one. Finally, I appreciate all other people who contributed in various ways to make this dream a reality.

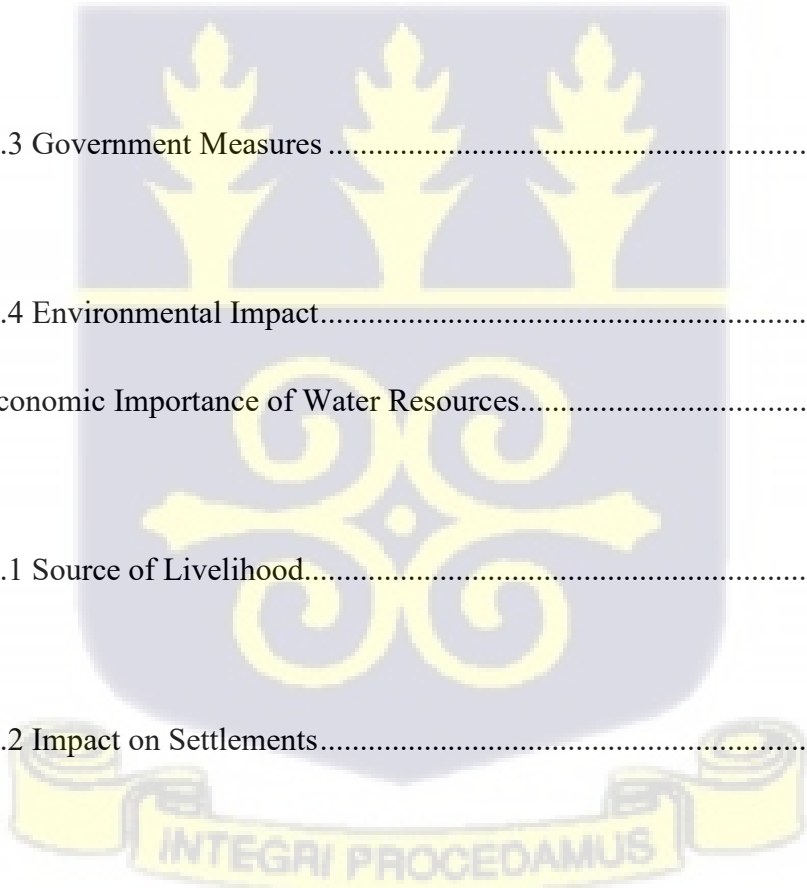


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### ABSTRACT

Water resources have been and will always continue to be a very important resource globally. Given the growing scarcity of the resource amid global phenomena such as climate change and population growth, it is important to study how availability of the resource affects relationships that exist among nations. Focusing on Ghana, this study sought to identify the possibility of how available freshwater resources amid current global issues may impact the diplomatic relations of Ghana resulting in conflicting goals. Using the qualitative method of research, the study sought to examine how the mismanagement of resources could negatively impact the relations between nations in the international system. However, some of these agreements need to be reviewed, in order to accommodate the challenges that growing global issues such as change in climate that affect the hydrological cycle. Furthermore, although Galamsey poses an internal threat to water security, it involves foreigners who do not have the permission to engage in small scale mining according to the country's legislation. The findings suggests that most international agreements need to be reviewed whereas the country also needs to enforce legislations that are meant to promote water security.



## CHAPTER 1

### Modern International Conflicts

#### 1.0 Introduction

International conflict has always exerted a profound influence on global politics, shaping historical trajectories and affecting the livelihoods of millions across the world. These conflicts range from large-scale wars between states to localized disputes, reflecting a spectrum of political, economic, and social complexities. Understanding the causes and dynamics of such conflicts remains essential for promoting peace, cooperation, and sustainable development in an increasingly interconnected world (Góes, 2022).

Historically, international conflicts have served as key drivers of geopolitical transformation, altering power structures and shaping the global order. Many of these conflicts have been rooted in competing national interests, ideological divergences, and historical animosities. In the aftermath of World War II, international organizations such as the United Nations were established to prevent and manage conflicts, highlighting the importance of collective security, diplomacy, and multilateralism in sustaining global peace (The Khan Academy, 2024).

However, the nature of international conflict has evolved. In recent decades, disputes increasingly revolve around natural resources, particularly water, which has emerged as a critical determinant of both cooperation and contention among nations. The growing global demand for freshwater, driven by population growth, industrialization, and climate change has heightened tensions in

many regions (UN-Water, 2023). For instance, in the Middle East, the Tigris-Euphrates and Jordan River basins have long been flashpoints of contention among riparian states, where control over water resources directly influences regional stability (Zeitoun & Warner, 2006). Similarly, disputes over the Indus River system between India and Pakistan demonstrate how transboundary water governance can become entangled with broader political rivalries.

In Africa, water scarcity and uneven distribution have increasingly shaped interstate and regional relations. The Nile River Basin offers a prominent example, where the construction of the Grand Ethiopian Renaissance Dam (GERD) has triggered tensions among Ethiopia, Egypt, and Sudan, each seeking to protect its national interests while ensuring access to shared water resources (Yihdego, Rieu-Clarke, & Cascão, 2017). The situation underscores how the management of shared water systems can influence diplomatic relations and regional integration efforts.

Within sub-Saharan Africa, where climatic variability and governance challenges are acute, water-related disputes often exacerbate existing political and ethnic tensions. Transboundary basins such as the Volta, Niger, and Senegal Rivers illustrate how competition for freshwater intersects with agricultural productivity, energy generation, and economic livelihoods (United Nations Economic Commission for Africa [UNECA], 2020). These conflicts, while sometimes localized, can have cross-border implications that demand cooperative water governance and institutional frameworks to prevent escalation.

In Ghana, water-related issues are increasingly recognized as central to sustainable development and international cooperation. While Ghana has largely maintained peaceful relations with its neighbours, episodes such as the maritime boundary dispute with Côte d'Ivoire highlight the potential for natural resource-related tensions to strain diplomatic relations. Although resolved through legal adjudication at the International Tribunal for the Law of the Sea (ITLOS), the case reflects how control over water-based resources (both freshwater and marine) can become intertwined with national sovereignty and economic interests.

In this broader context, the competition for water resources emerges as a significant catalyst for international and regional conflicts. Water scarcity not only threatens human security and livelihoods but also intensifies pre-existing socio-political and economic divisions. As such, examining the nexus between water and conflict at global, continental, and national levels is vital for understanding the evolving landscape of international relations. Through this understanding, policymakers and scholars can better identify pathways for sustainable resource management, regional cooperation, and peacebuilding in a world increasingly shaped by environmental and resource-based challenges.

### **1.1 Problem Statement**

The relationship between natural resources and conflict has become a prominent focus in contemporary research, particularly in the post-Cold War era. While existing studies have examined resource-related conflicts broadly, there is a significant gap in understanding the specific

challenges faced by countries like Ghana in managing their water resources effectively. This gap impedes the development of strategies to prevent and resolve conflicts in regions where water is a critical yet contested resource, thereby affecting both regional and global peace and security (Philip, 2010).

A key problem lies in the vulnerabilities inherent in Ghana's water governance system. Ghana's water resources face numerous challenges, including inadequate infrastructure, technological constraints, regulatory deficiencies, and environmental degradation caused by illegal small-scale gold mining activities, locally known as "galamsey" (Hilson, 2002). Galamsey operations often pollute rivers and degrade freshwater systems, reducing water quality and availability for communities and agriculture. These pressures compromise sustainable water management and increase the risk of conflict at both domestic and international levels. For example, mismanagement of water resources can indirectly exacerbate tensions with neighboring countries, such as in the case of Ghana's maritime boundary disputes with Côte d'Ivoire (ITLOS, 2017), illustrating how local resource issues can have broader geopolitical implications.

Moreover, insufficient attention has been given to the economic and political dimensions of shared transboundary water bodies, which can intensify interstate rivalry. Disparities in access, allocation, and management of water resources create tensions that undermine regional stability and cooperation (UNECA, 2020). Without a comprehensive understanding of these dynamics, policy interventions may fail to mitigate the risks of both local and cross-border conflict.

This study seeks to address these gaps by examining the challenges in Ghana's water resource management and exploring how these challenges may contribute to domestic and international conflicts. By analyzing the interplay between local governance, resource scarcity, and transboundary dynamics, the research aims to inform policy and diplomatic strategies that promote sustainable water management and reduce the potential for conflict. Ultimately, this study contributes to the pursuit of peace, stability, and cooperative resource governance in Ghana and the broader West African region.

### **1.2 Research Questions**

1. What are some challenges Ghana associated with management and control of water resources?
2. How does galamsey as an internal threat act as a potency for international conflict?
3. What is the economic importance of these water resources?

### **1.3 Research objectives**

1. To examine the key challenges in the management and governance of water resources in Ghana and their implications for stability.
2. To investigate the impact of illegal small-scale gold mining (“galamsey”) on water quality and its potential link to international conflict.

3. To assess the economic significance of Ghana's water resources and their role in shaping cross-border relations.

#### **1.4 The scope of the Research**

The scope of the study will be focused or encompassed on a comprehensive examination of internal threats to water security in Ghana, with a specific emphasis on the phenomenon of galamsey.

#### **1.5 Rationale of the research**

This study seeks to identify how Ghana as a country may possibly be involved in international conflict due to its transboundary water resources. These may include overlapping functions regarding management of these resources as well as legislations regarding these water resources. Also, the study will help to identify why galamsey as an internal threat has the potential to result in international dispute. Furthermore, the study will explore the economic importance of these water resources to countries that share these water resources with Ghana. Given the anarchic nature of the international community, countries tend to take actions that best suit their needs. Amid rising global concerns such as climate change and population growth, it is important to study how these phenomena impact relationships that exist among nations that share transboundary water resource amid changes in the political landscape.

#### **1.6 Research Methodology**

This study's research method of choice is qualitative case study approach. Tashakkori and Newman (2009) claim that qualitative researchers place a strong emphasis on acquiring descriptive and

narrative data, using emergent and structured designs, and doing content analysis for data interpretation. To ensure a thorough examination of the research issues, the study only uses qualitative methodologies in this study to analyse and interpret the descriptive findings of the study.

The case study method is acceptable and was used in this research for a number of reasons. It first enabled a thorough investigation of the event or situation, offering rich and in-depth insights. When researching complicated or unusual cases, where a broad perspective might not fully capture all the nuances, this is especially helpful. Second, the case study method enabled the researcher to look at actual events in their context, leading to a more comprehensive comprehension of the subject. Thirdly, it made it easier to combine various data sources, such as observations, interviews, and documents, resulting in a thorough and triangulated study. Last but not least, using a case study technique resulted in insightful theories, hypotheses, or applications that expand our understanding of the subject

### **1.6.1 Sources of Data**

For an in-depth analysis of the subject, both primary and secondary data were used in this study. Primary data were gathered through direct engagement with selected individuals with expandable insight on water resources and related conflict such as personnel from the Centre for Scientific and Industrial Research (CSIR), Water Resource Commission (WRC) through a well guided semi structured interview to provide descriptive non numerical information to understand experiences perceptions and behaviours while secondary data were gathered from scholarly articles, popular databases like JSTOR, ProQuest, and Google Scholar will be used. Also, Books written by experts in international relations, conflict studies, and environmental politics offered comprehensive

insights into the research topic. University libraries and digital platforms like Google Books were consulted. In addition, Reports and policy documents relating to conflicts and natural resources frequently published by international organizations, governments, and non-governmental organizations. These resources offered useful information on situations and international accords. Archives and historical documents provided context for the present by shedding light on past disputes with natural resources. When appropriate, national, and international archives were looked into. Finally, thoughts of some individuals with knowledge relevant to this study were sought through interviews.

### **1.6.2. Data Collection Procedure**

The researcher created and used a semi-structured interview guide to gather primary data, and the analysis was heavily dependent on primary data. This allowed the researcher to ask additional or follow-up questions to a respondent's original input. E-mails were sent to the participants prior to the interview sessions to explain the objective and get their consent to be interviewed. A maximum of 15 to 20 minutes was allotted for each interview in order to delve further into the topic. This method was chosen over unstructured interviews, which may lack direction, and focus groups, which are difficult to coordinate among geographically dispersed, high-level individuals. Semi-structured interviews allow for probing, clarification, and adaptation of questions based on each respondent's area of expertise.

#### **1.6.4 Data Analysis**

The collected data was analysed thematically to find major themes, patterns, and trends. The investigation concentrated on finding similarities and differences in conflict nature and the function of water resources across a range of international contexts. The accounts, views, and theories on water resource conflicts that are given by study participants and in the literature was examined using content analysis. This made it possible to investigate the constructivist elements of the study.

#### **1.6.5 Ethical considerations**

In research, there should be principles that guide the entire process of research. In this study, all sources of data have been fully acknowledged and where permission is required to access certain information, the right procedures were diligently followed to acquire such information. Also consent of the individuals who participated were sought.

### **1.7 Literature Review**

The issue of water resource conflicts is beginning to gain prominence in Africa as a region. Although an issue that did not manifest only recently, current global trends such as climate change have triggered an interest in how water security may impact the relations that exist among states. This section reviews articles relevant to the issue of water security among nations. Also, it discusses Constructivism which has been adopted as the theoretical framework to guide this study.

#### **1.7.1 Control and management of water resources**

A quarter of the world's population, according to Yousef (2021), resides in regions with limited water supplies, despite the fact that most nations have at least one transboundary river. He created a model wherein nations can use force to resolve their issues with water allocation in an effort to

address how riparian states should react to the widespread water scarcity. He calculated the possibility that the upstream country would use force to retaliate against the downstream country's hostile conduct by using a backward induction technique. According to the study's findings, a lack of water raises the possibility that nations downstream will start a conflict, but it has no bearing on the likelihood that countries upstream will retaliate violently. Moreover, he asserts that if past events are any indication of what is to come, then armed conflicts between upstream and downstream nations are expected to escalate as water shortage becomes more widespread in riparian nations. This information suggests that a country like Ghana who has Burkina Faso as a riparian Neighbour to the north, should pay attention to hydropolitical interactions and should regularly research in order to identify potential new relationships in the face of water scarcity.

Kaysmov (2011: Karim, 2020) looked at previous freshwater conflicts in several global drainage basins. The study proved that international water-sharing treaties, political disputes, and controversies are all negatively impacted by unilateral water policy. The study's central claim is that because of the growing demand for freshwater, unilateral diversions of water flows would lead to conflict between riparian states. Unfair water distribution among nation-states within a basin is the outcome of unilateral water diversion practices, which is a surefire formula for protracted conflict. To maintain long-term peace and stability, state policy must work to end instances of unequal distribution and improve everyone's access to clean drinking water within a river basin, based on their needs.

According to (Green et al. 2013: Whaley, 2022), given the risks and difficulties facing water resource management and the increase in uncertainty brought on by climate change, there is a need for a flexible yet strong and legal environmental legislation. An innovative approach to managing sustainable water resources was introduced by the European Union in 2000 with the enactment of

the EU Water Framework Directive. By protecting the long-term availability of water resources, progressively lowering the discharge of hazardous chemicals into ground and surface waters, and lessening the consequences of floods and droughts, the Directive promotes sustainable water use. Given the significant level of uncertainty associated with water management, the ambitious aim of reaching excellent status for all waters necessitates considerable adaptive capacity. Promoting adaptive capacity in water governance requires striking the correct balance between local implementation flexibility and strong, enforced norms, but accomplishing these objectives at the same time is very challenging applied resilience science provides a conceptual framework for assessing how adaptable governance structures are. This structure included several overlapping layers of coordination or control, horizontal and vertical information flow, meaningful public participation, the development of local capability, the ability to adjust to changing circumstances, stringent monitoring, system feedback, and enforcement. By analysing the Directive through the lens of resilience science, they concluded that managing for resilience is not supported by the potential lack of enforcement and sufficient feedback of monitoring results, which highlighted important aspects of contemporary European water management and their contributions to the system's resilience. On the contrary, the EU approach's scale-appropriate governance features foster adaptive capacity by facilitating information flow both vertically and horizontally, building local competence, and distributing control across a range of pertinent scales.

Water security in the context of current and projected future global change refers to the availability of enough water, in both quantity and quality, to meet societal demands and support robust ecosystems. Achieving food and energy security, addressing serious climate change vulnerabilities and threats, safeguarding ecosystems, and securing water resources are all closely tied to one

another. Good water governance, especially transboundary collaboration, is essential to achieving water security. Water security is still a vague and broad concept, though. In an attempt to make the concept of water security relevant in practice, this study describes Turkish water security policy and practices through institutional and cross-sectoral (energy and food) analysis. Special attention is paid to Turkey's transboundary water security initiatives (Kibaroglu, 2022).

According to Ahmad (2018), eleven riparian nations struggle to meet their own water needs in the Nile River basin, which is situated in the water-scarce arid/semi-arid part of the African continent. Therefore, controlling and sharing Nile water fairly is a complicated issue, especially in light of the current power dynamics in the area. Numerous economic and political changes that have occurred in the Nile basin over the last decade are likely to induce changes in the power dynamic. Strong lower riparian nations like Egypt and Sudan, in particular, use their hegemony and historical claims to a greater portion of river water, while comparatively weaker upper riparian nations like Ethiopia work to increase their water share or even receive their just compensation.

Salik (2015) asserts that there is a clear correlation between human security and water security. Water security is a multifaceted problem with intricate undertones because it is essential to sustainable development and a growing source of concern. This study examined the problems with water security between India and Pakistan in the context of the Indus Water Treaty (IWT). The Indus Water Treaty, which was mediated by the World Bank, established a system for distributing water fairly between India and Pakistan. But in order to control the flow of water, India has been constructing a lot of dams under the guise of run-of-the-river hydroelectric projects. Unresolved grievances from Pakistan may turn into a major cause of contention between India and Pakistan.

This study suggests policy recommendations that could lead to a fair share of water and lessen the possibility of further conflict in the already difficult relationship between Pakistan and India.

Green et al. (2013: Whaley, 2022) state that when the availability of a vital resource alternates between times of remarkable abundance and shortage, management regimes must show they have the authority and flexibility to adjust while maintaining legitimacy. When the inevitable disruption occurs, laws that do not account for variability can result in conflict because the need for predictability in legal and regulatory frameworks often clashes with the need for adaptability. In addition, when the commons is shared among sovereign states, cooperation between and among institutions with the authority to act at various scales or with respect to various ecological system components, as well as collaboration between physical scientists, political actors, local leaders, and other stakeholders, are factors that contribute to resilience. By encouraging cooperation and taking change into account, certain treaty processes may reduce the likelihood of conflict at the size of transboundary river basins where water usage is regulated by treaties. One element that is necessary is a framework for coordination and cooperation at the basin-scale. But merely having a structure for cooperation at the basin size is not enough to ensure effective water management. This might be met by a variety of strategies, from unofficial networks to the establishment of a worldwide commission for the shared management of water resources.

Watson et al (2023) are of the view that scarcity of renewable resources is getting increasingly prevalent throughout time. There is mounting evidence that these shortages contribute to political unrest, particularly in developing countries. They provide a straightforward dynamic model of the interplay between population and renewable resources that includes the possibility of conflict

brought on by resource shortage per person. Conflict in the model raises mortality, takes resources away from resource gathering, and degrades the resource. The two earlier effects could hasten the transition back to a tranquil steady state. However, if fighting leads to the destruction of resources, it may destabilize the system, causing it to collapse. Conflict brought on by the lack of renewable resources may be cyclical, with conflict periods that repeat. Such confrontation, however, cannot continue indefinitely. Various policy scenarios involving population control, technological advancements in harvesting, and the expansion of natural resources are examined using the model. As opposed to the unidirectional idea that resource scarcity causes conflict, a crucial insight of the model is the significance of the bidirectional interaction between conflict and resource scarcity. Therefore, the model emphasizes the necessity of using simultaneous equation econometric models in empirical studies of resource shortage and conflict.

Best (2019) asserts that, as pressure on freshwater resources rises as a result of rising demand and rainfall variability, conflicts over these resources may become more frequent. Conflicts may occur between, within, or among nations as well as between users from rival sectors. This study focused on institutional strategies to improve international cooperation for the sustainable development of contributing basins and transboundary freshwater bodies. Given that dangers to the international seas are acknowledged and cooperative structures are put in place, it is expected that shared water resources can serve as bases for collaboration and benefit-sharing rather than becoming areas of conflict. The study makes use of lessons learned from the Global Environment Facility's international waters focal area, which is the primary funding source for nations to support the environmental management of transboundary water resources. To demonstrate lessons for promoting peaceful cooperation for environmental management, benefit-sharing, and sustainable

use of transboundary freshwater resources, cases from Africa, Central Asia, and Latin America are presented. Experience has shown the value of mechanisms that bring together all sectors and actors whose actions at the local, national, and regional levels affect the transboundary waterbody. The development of a science-based diagnostic diagnosis is required to pinpoint the threats to the transboundary ecosystem, break the issues down into manageable chunks, and create a strategic response plan. Achieving political commitment that can result in institutional, policy, and legal reforms in the participating countries is essential to guaranteeing the sustainable development of transboundary resources.

According to Schoeman et al (2017), important aspects of ethics and values are included in water governance. They show how a "values approach" enhances our understanding of global water governance and works well with other governance views like management, institutional competence, and social-ecological systems. They relate these alternative methods to their underlying ethical frameworks and value systems. They then provide a method for openly incorporating conflicting value systems into governance, and where appropriate, adjudicating those conflicts. How value systems are mirrored in water policies and how these values determine governance objectives, such as in environmental flows, is illustrated by the example of the Santa Fe River in New Mexico, USA. The values-based approach reveals implicit values and makes room for local values to be aligned with those required for efficient global water governance.

Mahlakeng (2019), in a study found that, the management of river basins must deal with difficult issues that are characterised by change and uncertainty. Historical, legal, and cultural disparities add to the complexity of transboundary river basins. Adaptive management literature offers a

number of recommendations for dealing with this complexity. There is no in-depth analysis of the elements of management regimes that promote adaptive management, despite the fact that it acknowledges the significance of management regimes in enabling or restricting adaptive management. Such an overview, with a focus on transboundary river basin management, is provided in this work. Using the literature on adaptive management, it first enumerates the components that have been shown to be necessary for effective transboundary river basin management and then clarifies them. After gathering these features, this framework discusses actor networks, policy protocols, information management, and legal and financial considerations. We then use this arrangement for the Rhine and Orange basins. The paper's conclusion states that the paradigm provides a comprehensive and consistent perspective on transboundary river basin management regimes and may be used to assess how well those regimes support adaptive management.

In a study conducted by Zakaria & Matsui (2021), found that the Volta Basin Authority is an example of recent attempts to govern a major transboundary river basin in West Africa collaboratively. The paper aimed to identify to what extent the cultural diversity in the local communities would influence mobilization for integrated water governance. The study found that 84% of respondents and 91% in Burkina Faso and Ghana respectively were oblivious of the Volta Basin Authority. Also, with regard to local needs and water governance, most Ghanaian respondents were bothered about the Bagre Dam spillage that destroyed their farms.

### **1.7.2 Galamsey as an internal threat to water security**

Addy and Adhikari (2021), published that, one of the largest producers of gold in both Africa and the entire world is Ghana. A major portion of Ghana's overall gold production comes from small-

scale mining, which also provides a significant source of income for many low-income people in Ghana. Small-scale gold mining is prohibited by Ghanaian law, but due to the 2000s gold price spike and Ghana's unprotected gold treasure, thousands of Chinese miners began operating illegally in Ghana. Illegal Chinese migrant gold mining in Ghana, commonly known as galamsey, has had disastrous impacts on the economy, the environment, communities, and women's security.

Andrews (2015), found that galamsey, a type of artisanal and small-scale mining (ASM), is prohibited in Ghana since its practitioners haven't registered their operations with the government. The government has created the Inter-Ministerial Task Force Against Illegal Mining to stop the industry's expansion in response to recent instances of non-Ghanaian people participating in this activity. The absence of socio-economic safety nets in the majority of mining villages has, however, forced many families, including children, into this line of work, which has not been taken into consideration in this endeavour. The paper makes the case that the effort to standardise these operations will remain elusive until the root reasons of socioeconomic marginalization and unemployment are adequately addressed by drawing on primary data collected at Abosso, a galamsey site in the Western Region of Ghana.

The Ministers of Lands and Natural Resources met with a high-ranking delegation from Cote D'Ivoire, headed by Laurent Tchagba, the Ivorian Minister for Water and Forest, to discuss ways the two countries (Ghana and Ivory Coast) can resolve transboundary issues on river pollution regarding the Tano and Bia rivers, which also flow through Ivorian waters. The ministries of Defense, Science, Technology, and Innovation, and Sanitation and Water Resources were also present at the event. Ghana's Minister of Lands and Natural Resources, Hon. Samuel A. Jinapor,

who co-chaired the meeting with the Minister of Sanitation and Water Resources, Hon. Cecilia Abena Dapaah, informed the Ivorian delegation that despite numerous challenges, the government has persevered in defending the country's river systems because President Nana Addo Dankwa Akufo-Addo is still fighting against illicit miners in the country (Okertchiri, 2023).

### **1.7.3 Economic value of water resources**

According to the African Development Bank (2022), Water resources in Africa have the power to boost economic development, guarantee livelihoods, and reduce poverty. In Africa, where 63 international transboundary river basins account for 90% of the region's total surface water and span around 62% of its land area, transboundary water (TBW) resources are particularly significant. The primary regulating mechanism for the use, development, and management of shared water resources frequently consists of water agreements between nations sharing a TBW resource. But according to the most recent SDG indicator 6.5.2 report, just 29% of transboundary river basins and less than 10% of transboundary aquifers in Africa are the subject of TBW agreements, and only 19% of these have any basin-wide agreements. Additionally, the majority of TBW agreements ignore growing climate-induced water variability in favor of making the assumption that future water supply and quality won't change. As a result, most TBW agreements are unable to adjust to variations in water amount that occur over time and in specific locations.

According to a different report from the United Nations Economic Commission for Europe (UNECE, 2020), Ghana's transboundary river basins—the Bia and Tano Rivers, which are shared with Côte d'Ivoire, the Volta River basin, which is shared with Benin, Burkina Faso, Côte d'Ivoire, Mali, and Togo—cover more than 75% of the country's land area. The country currently has over 30 million residents and is predicted to experience a population increase of more than 50% by

2050. These shared water resources meet demands for drinking, sanitation, electricity, agriculture (which provides 54–85% of jobs in Volta basin countries), and industry.

#### **1.7.4 Conceptual Framework**

Constructivist theory by Alexander Wendt is an innovative method for studying international relations. It differs from the traditional liberal or realist perspectives that give priority to material concerns and power relations. The importance of ideas, identities, norms, and social interactions in influencing state behaviour and the dynamics of the international system is instead emphasised by Wendt's constructivism. This approach to the study of international relations was initially proposed in his work, “Anarchy is What States Make of It: The Social Construction of Power Politics”, in 1992. The application of Wendt's constructivist theory to understanding how water resources may be a potential catalyst for international conflict (for Ghana) is examined in this study.

To begin with, the theory believes that anarchy in the international system is what states make of it. The theory perceives that the structures of human associations are primarily determined by shared ideas other than material forces.

From Wendt's perspective conventional wisdom that states only act in their interactions based on rational self-interest is challenged by constructivism. It makes the claim that how people perceive the world, the ideas they hold dear, and the social norms and values that govern their relationships all have a considerable impact on how people behave in states. Applying this constructivist viewpoint to the topic of water resources allows us to have a far deeper grasp of the many different variables that affect international relations.

According to Wendt's constructivist theory, states' perceptions, assumptions, and ideas have a significant impact on how they behave in international relations (Wendt, 1999). When considering water as a potential source of conflict, this principle is especially significant. For instance, how states view water scarcity can have a big impact on how they operate. States that see water as a limited and dwindling resource are more likely to pursue competitive strategies, which could result in disputes over who gets to use the water and how much.

Constructivism allows us to investigate how numerous factors, such as population trends, climate change, and resource management techniques, are used to construct and impact the sense of water scarcity. Depending on how they interpret these elements, states may construct water scarcity as either an imminent crisis or a manageable task. When it comes to resolving problems involving water, these created conceptions can lead states to choose collaboration or conflict.

Constructivism provides the idea of state identity, which has a significant influence on how a state act (Wendt, 1992). States that see themselves as cooperative players may be more inclined to engage in diplomatic discussions and look for cooperative solutions to problems with water. States that, on the other hand, see themselves primarily as rivals over water resources may be more likely to engage in behaviours that may not necessarily conform to international norms.

In the context of Ghana's shared water resources, water resources posing as a potential trigger for international conflict, as per the worldview of constructivism, Ghana and its neighbours must both have a shared idea of water as a very essential resource. This implies Ghana's transboundary water resources may bring about conflict if its neighbours also perceive water to be a valuable resource

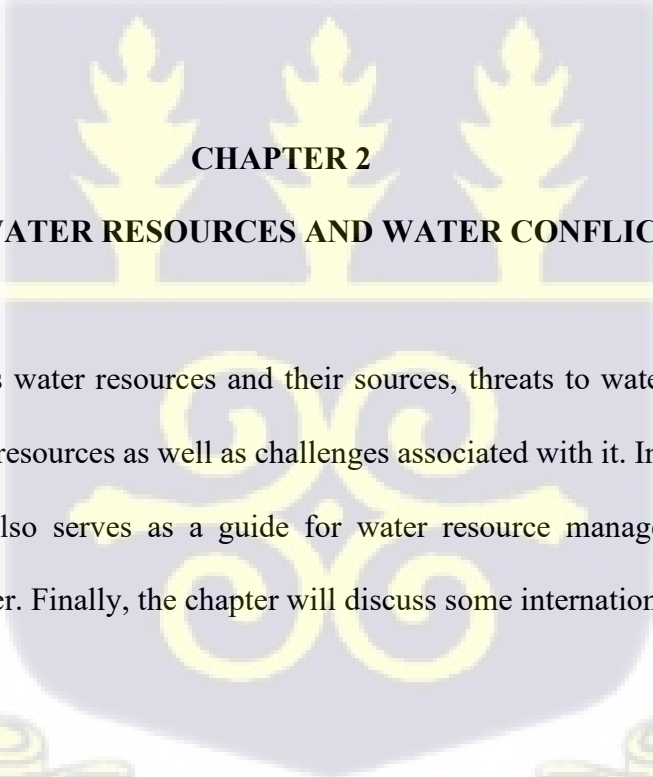
that needs to be managed efficiently due to growing global trends such as climate change that pose a threat to water security.

Also, from a constructivist perspective, conflict relating to water resources may be likely regarding control and management of these available resources, stemming from the political culture of the countries involved. Political culture includes political history, forms of government and the influence of domestic politics on foreign policy. In the case of Ghana and its neighbours, the political history and forms of government that exist in Ghana's riparian neighbours will influence the likelihood of conflict. For instance, in the Maritime case between Ghana and Ivory Coast that was settled in the International Tribunal for the Law of the Sea. This may be attributed to the fact that both countries as members of not just ECOWAS but of the United Nations who practice democracy, decided to settle a dispute regarding control of the offshore oil fields based on the common ideology that the tribunal was the best way to settle the dispute other than violent means.

In addition, factors such as the economic value of these water resources may also trigger conflict between Ghana and other countries like the maritime dispute between Ghana and Ivory coast. Regarding identities, Ghanaians as a group of people who may not be pleased with Galamsey as a national issue which also has foreigners involved may influence the country's foreign policy against the home countries of such individuals. Like in the case where Chinese are involved in illegal mining, Ghana as a nation may have its citizens demand actions against China and if not properly done, it might sour the diplomatic ties that exist between both countries.

## **1.8 Arrangement of chapters**

The study consists of four chapters. The first chapter consists of the introduction, which discusses the background of the study, the statement of the problem, the research objective and research questions, the rationale of the study and the methodology of the study. The second chapter discusses the literature in line with water resource conflict around the world. The third chapter will analyse data that was collected from secondary sources. The fourth and final chapter will discuss findings and recommendations, as well as conclude the study.



## **CHAPTER 2**

### **WATER RESOURCES AND WATER CONFLICTS**

#### **2.0 Introduction**

This chapter discusses water resources and their sources, threats to water security, control, and management of water resources as well as challenges associated with it. Integrated water resource Management which also serves as a guide for water resource management globally will be discussed in the chapter. Finally, the chapter will discuss some international water conflicts in the world.

#### **2.1 Water Resources**

Sources of water that people can use or may utilise are known as water resources. Water can be used by humans for many different things, such as home use, industry, irrigation, recreation, and environmental protection. Nearly the majority of these applications require fresh water.

Nevertheless, just 2.5 percent of Earth's water is fresh; the other 97.5 percent is salt water. More than two thirds of this freshwater have been frozen by the polar ice caps and glaciers. The remaining freshwater that hasn't frozen is mostly found below, with only a small amount above ground or in the air. Although freshwater is a renewable resource, its worldwide availability is continuously decreasing (WBG, 2022). According to World Bank (WBG, 2022) :

Most countries today are facing unprecedented strains on their water supplies. It is projected that the world's fast-growing population and current practices will cause a forty percent deficit of water by 2030. In addition, some of the biggest threats to global peace and prosperity are perceived to be ongoing water scarcity, hydrological ambiguity, and extreme weather (such as floods and droughts). More people are realizing how important drought and water scarcity are to the escalation of violence and fragility.

To feed 10 billion people by 2050, agricultural production—which presently consumes 70% of the resource—must expand by 50%, and water withdrawals must rise by 15%. In many parts of the world, there is already a shortage of the mineral in addition to the growing demand. Roughly one-fourth of the world's economy is impacted by the issue of water scarcity, which impacts over 40% of the world's population. By 2040, one in four children would presumably live in areas with acute water scarcity. Today, water security is a major - and often growing - concern for many countries.

Climate change will exacerbate the problem by altering hydrological cycles, making water more unpredictable, and increasing the frequency and intensity of floods and droughts. The approximately 1 billion people who live in monsoon basins and the 500 million people who live

in deltas are particularly vulnerable. The rural poor face a number of challenges, including droughts, as they rely mostly on the fluctuation of rainfall for their livelihood. The annual damage caused by floods is estimated to be around \$120 billion, solely in terms of property loss.

Water security is hampered by this resource's fragmentation. 276 transboundary basins, shared by 148 countries, are responsible for 60% of the freshwater flow worldwide. Similarly, there is a transboundary component to 300 aquifer systems, and 2.5 billion people globally rely on groundwater. Because the worries about fragmentation are often mirrored at the national level, cooperation is necessary to achieve the best solutions for the management and development of water resources for all riparian countries. To address these complex and interconnected water challenges, countries will need to improve the way they manage their water resources and related services.

Increased water security will need clients to make investments in information management, institutional strengthening, and the construction of both natural and man-made infrastructure in the face of challenges including fragmentation, larger extremes, growing uncertainty, and rising demand for water. Institutional systems such as water pricing, incentives, and legal and regulatory frameworks are necessary to distribute, control, and conserve water resources more effectively. Information systems are needed for resource monitoring, uncertain decision-making, system evaluations, and hydro-meteorological forecasting and warning. Investments in cutting-edge technologies for increasing productivity, preserving, and protecting resources, recycling stormwater and wastewater, and creating non-conventional water sources should be looked into in addition to searching for opportunities for improved water storage, including aquifer recharge and

recovery. Enhancing global water security will depend on how quickly these developments are spread and appropriately used or adapted.

### **2.1.1 Sources of Water**

The water cycle ensures that the world's water supplies are continually replenished. Water from the oceans, vegetation, wetlands, and surface waters evaporates into the atmosphere, where it condenses before precipitating back onto the earth's surface. Rainfall is then either absorbed by plants for dietary purposes or the runoff returns to the ocean or surface waterways (WOCATpedia,2023). The following paragraphs discuss the various sources of freshwater in general according to Unacademy.com(2023).

#### **Surface water**

Surface water is that which is present in a river, lake, or freshwater wetland. Surface water is replenished by precipitation, while it is depleted by evapotranspiration, evaporation, discharge to the oceans, and groundwater recharge. Although the primary natural input to any surface water system is precipitation within a watershed, a number of additional things can have an impact on how much water is there overall in that system at any given time. These factors include the ability of lakes, marshes, and man-made reservoirs to store water, the permeability of the soil that supports these storage areas, the nature of the land in the watershed's flow, the timing of precipitation, and local evaporation rates. The proportions of water loss are influenced by each of these factors.

#### **Under river flow**

A river's total downstream flow often includes both the easily observed free water flow and a significant quantity moving through rocks and sediments in the hyporheic zone, which is

underneath the river and its floodplain. This invisible component of flow may be much larger than the visible flow for many rivers in big valleys. Exchange flow between fully charged and depleted aquifers occurs at the dynamic interface called the hyporheic zone. This is especially true in karst environments, where subsurface rivers and potholes are common.

### **Groundwater**

Freshwater that is found underground in the pores of rocks and soil is known as groundwater. It also includes the water that seeps out of aquifers below the water table. It can be useful on occasion to distinguish between deep groundwater in an aquifer (sometimes known as "fossil water") and groundwater linked with surface water.

For the most part, groundwater and surface water share the same inputs, outputs, and storage. The key distinction is that, when compared to inputs, groundwater storage is frequently significantly larger (in volume) than surface water storage because of its slow turnover rate. This gap allows people to utilise groundwater in an unsustainable way for a long time without experiencing negative consequences. However, over the long term, the usual water intake from a groundwater source is limited by the average rate. Groundwater inflow occurs naturally as a result of surface water.

### **Frozen Water**

There are a number of ways to exploit icebergs as a source of water, but up until now, this has only been done for research. Glacier runoff is the name for surface water. The Himalayas, sometimes known as "The Roof of the World," are home to some of the world's most expansive and rocky

high-altitude terrain, as well as the largest glaciers and permafrost outside of the poles. There are the sources of ten of Asia's largest rivers, which are vital to the existence of more than a billion people. Even worse, the local temperature increase is outpacing the global average. While the Earth's temperature has warmed by roughly 0.7 °C globally over the past ten years, it has climbed by only 0.6 °C in Nepal.

### **Artificial Water Sources**

Two examples of artificial fresh water sources are desalinated saltwater and treated wastewater (reclaimed water). However, it is important to consider how these technologies will affect the economy and the environment.

It is worth noting that, rapid population growth and rising demand have put pressure on water supplies, which are spread out over both space and time. For efficient water resource management, it is crucial to have access to reliable data on the quantity, quality, and availability of water as well as its variability.

#### **2.1.2 Threats to water resources**

Numerous human activities, such as channelization, groundwater pumping, diversion, dam building, pollution, climate change, and resource overexploitation, pose a threat to freshwater systems. Threats to freshwater ecosystems can be divided into four categories: species composition changes, habitat loss, ecosystem loss, and habitat alteration. Below are a number of freshwater threats and their impacts as outlined by Climate policy Watcher.

Rapid growth in population, particularly in places with limited access to potable water, is a contributing factor in water stress. It is anticipated that by 2025, 2.8–3.3 billion people would be living in areas with high water stress, up from the present estimate of 1.8 billion.

**Ecosystem Loss and Habitat Alteration:** Urbanization, agriculture, and water demand all contribute to water extraction that frequently results in ecosystem loss. Habitat change results from instream actions (damming, channelization) and variables associated to the catchment (deforestation, unsuitable land use).

Changes in the chemistry of water chemistry varies as a result of pollution from sewage discharge, agricultural runoff, air inputs (acidification), and the introduction of chemicals (endocrine disruptors). Changes in species composition, extinctions, and the introduction of invasive species can be caused by human activity, which can impact the functionality and balance of ecosystems.

**Synergistic Effects and Complex Interactions:** Various stressors can work together to worsen their effects on freshwater ecosystems. For instance, eutrophication can amplify the impacts of metal poisoning, and changes to the habitat or water chemistry can encourage the invasion of new species.

**Ecosystem Variation:** Threats have varying effects on various freshwater ecosystems (lakes, wetlands, rivers). As opposed to rivers, which are vulnerable to pollution spreading downstream, lakes and wetlands with slow water turnover can accumulate toxins.

Threats differ regionally depending on economic activity and growth. In desert locations, water shortage is a problem, and both developed and undeveloped areas are affected by eutrophication, declining water tables, and invasions.

Sedimentation and disposal of waste both contribute to eutrophication and chemical contamination. This includes untreated household and industrial trash. Deforestation and excessive grazing are two examples of changing land uses that result in sedimentation and nonpoint source pollution.

Intensification of land use can lead to riparian zone degradation, which can change how the benthic ecosystem works and have an effect on the water supply.

Acidification caused by air pollution has an impact on freshwater systems in places like northern Europe, the northeastern United States, and Canada.

Anthropogenic influences that alter natural regulation include changes to energy supply, flow, hydrology, biogeochemical cycles, and water chemistry as a result of human activities. Sediment structure, temperature patterns, and other environmental factors are all impacted by these changes.

**Resilience and Resistance:** While certain species have characteristics that make them resistant to environmental changes or resilient to them, in general, anthropogenic stressors can upset the harmony and well-being of freshwater ecosystems.

Overall, risks to freshwater ecosystems result from a variety of human activities and have a variety of effects on ecosystem services, species composition, and ecosystem health. Freshwater resources may experience complex and frequently negative changes as a result of the interactions and amplified effects of these challenges.

### **2.1.3 Control and management of water resources**

Freshwater resource management and conservation at the local, national, and international levels are at a critical juncture. Many people have realized in recent years that conventional water strategies are unable to handle the challenges of the twenty-first century. Water managers and

politicians must contend with freshwater resources that are now under new pressures. These dangers include rising levels of surface and groundwater pollution from contaminants, already starting to impair water supply and demand, resurging water-related diseases, and the deterioration and loss of freshwater ecosystems. To handle these new dangers, however, water institutions and politicians have thus far mostly been unable to create new tools and strategies (Gleick et al, 2001). Given the increasing climatic and non-climatic uncertainties and the rapidly growing and urbanizing global population, it is not feasible to "predict and plan" a single path to water security. Planning and managing water resources in the future will need us to become more capable, adaptive, and resilient. (World Bank, 2022).

Water resources management (WRM) is the planning, development, and administration of water resources with regard to water quantity and quality across all water applications. It is made up of the institutions, infrastructure, financial assistance plans, and information networks that support and guide water management. Water resources management aims to maximize the benefits of water by ensuring there is enough water of sufficient quality for drinking water and sanitation services, food production, energy generation, inland water transport, and water-based recreation. It also aims to maintain healthy water-dependent ecosystems and protect the aesthetic and spiritual values of lakes, rivers, and estuaries. Water resources need to be managed, but so do the risks that come with them, such pollution, droughts, and floods. It takes integrated management to take into consideration the synergies and trade-offs of the many different uses and values of water because of the complexity of the relationships between water and families, economies, and ecosystems (World bank, 2022).

In contrast to notions of food or energy security, water security involves not only guaranteeing the provision of sufficient resources but also reducing the risks that water poses in areas where it is poorly managed. The term "water security" refers to the measures that can or have been implemented to guarantee the sustainable use of water resources, to provide dependable water services, and to control and lessen hazards associated with water. Water security is a dynamic concept that considers societies' expectations, decisions, and accomplishments with regard to water management more widely than narrowly focused objectives like pollution, water scarcity, or access to clean water and sanitation. It is a dynamic policy goal that adjusts to reflect changes in risk exposure, risk tolerance, economic prosperity, and societal values. It must address issues of fairness. (World Bank, 2022).

#### **2.1.4 Challenges with Control and Management of water resources**

According to Bruce Stewart (2008), examining the primary concerns that managers of water resources must deal with now and considering how they will change over time is a crucial first step in deciding on future directions and, consequently, the challenges we face. He identified the following as challenges are most likely to interfere with management and control of water resources.

**Climate change:** Most research, analysis, and management strategies have been predicated on the assumption that the hydrological series is stationary, meaning that despite potential changes, the mean value will largely remain constant. This is true even though humans have always had to adapt to a fluctuating climate. Hydrological series trends are showing up more and more these days. The climate is warmer and drier in many regions, which could result in less water being available.

Increasing susceptibility to extreme weather events: The possibility of increasingly frequent and severe weather events is highlighted in the Intergovernmental Panel on Climate Change Technical Paper on Climate Change and Water. Because there are more people at danger and there's a chance that the risk profile will shift in many places, safety of life and property will always be a top priority.

Growing urban demand: As a result of the population growth and the expansion of urban areas, there is a greater demand on water delivery systems, less arable land is accessible, and in certain cases, catchments for water supplies.

**Over-allocation of current supplies:** Rather than keeping in mind current or future availability, many supply systems have allocated water based on past availability or demand, which has led to over-allocation in many systems.

**Unrestricted extractions:** In many places, water extractions (such as pumping from rivers and groundwater extractions) are not subject to management plans or other regulations. These have reduced the amount of water accessible and, in some cases, have prompted resource mining. In some locations, the construction of new farm dams limits the amount of water entering river systems.

Changes in land use, such as clearing forests, expanding plantations, and allowing agriculture to expand into new areas, all have an effect on the water supply. Unexpected occurrences, such as bushfires, can result in a decrease in water availability and issues with water quality. Changes in land use even within agricultural areas affect the availability and usage of water.

## 2.2 Integrated water resources management

Discussion of water resources is often divided into several themes such as Economics, Water Quality, and the Environment in order to deal with the complexity of water management challenges. In actuality, though, each of these problems is linked to the others. For instance, subsidised water prices may cause rising water consumption, which could decrease the amount of water in the environment, increasing the concentration of pollutants and degrading water quality. Because water concerns are interconnected, using certain economic or policy tools may result in trade-offs. A cost-effective way to increase the amount of water in the environment, for instance, may be to buy water access rights, but smaller towns and villages that depend on irrigated agriculture might suffer if water extraction is curtailed.

The use of economic and policy tools must be considered in the context of their broader effects on society and the environment if water security is to be handled effectively. Therefore, in order to manage water security effectively, planners must consider the "triple bottom line" and assess the effects of their policies on the economy, the environment, and society. It is frequently maintained that economic and policy instruments should be used as part of a larger integrated water resource management (IWRM) framework in order to effectively manage this complexity.

Based on four key tenets accepted at the 1992 Dublin Water Conference and the Rio de Janeiro Summit on Sustainable Development, the IWRM framework was developed to improve the management of water resources. According to these principles, women should play a major role in the provision, management, and preservation of water; water has an economic value in all of its competing uses and should be recognized as an economic good; fresh water is a finite and

vulnerable resource that is necessary to sustain life, development, and the environment; and (2) water development and management should be based on a participatory approach, involving users, planners, and policy makers at all levels (ICWE, 1992).

IWRM, thus, is not a prescriptive definition of how water should be managed; rather, it is a wide framework within which decision-makers can jointly determine the objectives of water management and coordinate the use of various tools to achieve them (Lenton & Muller, 2009). There is no one-size-fits-all approach to IWRM because every country has a unique history, socioeconomic situation, cultural context, and environmental qualities. Instead, IWRM can be tailored to address the issues faced in each particular local setting (Pahl-Wostl et al, 2011).

As a result, depending on the nation, various weights are assigned to the significance of social, environmental, and economic impacts. For example, South Africa and the Netherlands prioritize social and environmental aims more than economic efficiency, while Chile traditionally emphasizes the importance of economic efficiency. It shouldn't be assumed, though, that these goals always have to be traded off. Rather, a more comprehensive strategy for managing water security can help achieve mutually beneficial outcomes that further a number of goals. For example, putting into practice a well-considered pricing strategy for water resources can increase economic efficiency, improve the environment by lowering water demand, and have positive social effects if the funds are used to expand service offerings or are coupled with initiatives that support low-income households (White, 2013).

IWRM can be difficult to define due to variations in implementation among nations, however it can be generically described by a number of major patterns. First, there has been a trend towards combining demand side management through the use of economic instruments, as opposed to command-and-control instruments that concentrate on supply-side water management, such as large-scale water infrastructure. This change in emphasis has made water management more adaptable and promoted the creation of a variety of cutting-edge tools to address local issues with water security (White, 2013).

The second benefit of IWRM is that it has raised awareness of the significance of sustainable development and the inclusion of social and environmental factors in water management. Additionally, IWRM has also tended to encourage the transition from rigid, top-down approaches to water security to more adaptable, decentralized systems that integrate a range of diverse governance structures at the local, regional, national, and international levels (Lenton & Muller, 2009).

Finally, the IWRM framework has placed a greater emphasis on stakeholder cooperation and local communities' participation in decision-making. Including specialized knowledge, encouraging more creative problem-solving due to a greater diversity of viewpoints, fostering cooperation and lowering the risk of conflicts over water resources, and developing more open, democratic, and inclusive solutions are some advantages of greater collaboration that could result in more sustainable outcomes (Loux, 2011).

Despite these concerns, IWRM's adaptability has a benefit in that it enables policies to be created for the specific local challenges. Any policy framework with clearly defined and prescriptive

solutions is likely to struggle to be applicable across all situations due to the complexity of water issues within and between countries, and there is growing evidence that implementing IWRM can offer significant, long-term benefits to water security and water management (White, 2013).

IWRM can result in more environmentally, socially, and economically sound solutions to challenging water challenges, but it's crucial to remember that this isn't always the case. IWRM-based programs can fail<sup>5</sup>, and analysing their successes and failures is essential to comprehending how water management can be improved. Therefore, even while some people may desire a set of prescribed methods to address water concerns, in reality, complicated problems call for complex answers. As a result, one of the primary motivations for adopting IWRM may be that its flexibility accepts and takes into consideration the difficulties of complexity (White, 2013).

### **2.3 Water resources conflict in the world**

Water is essential to human existence. Freshwater is scarce despite its abundance, and due to population growth and growing living standards, global demand for it has been increasing rapidly. Climate change and environmental degradation are causing regional and seasonal changes in the amount and quality of water. Scholars emphasize that although competition over water use can lead to conflict and even violence on occasion, conflict is more frequently caused by the governance and management of water. This section will address several global conflicts pertaining to water resources.

#### **2.3.1 Turkey, Syria and Iraq**

The Euphrates-Tigris basin is shared by Turkey, Syria, and Iraq; Iran comprises part of the Tigris basin. Since the 1960s, political disputes between the nations and unilateral irrigation projects that

altered the rivers' flows have caused tensions in the basin's relations. Disagreements have prevented the three nations from effectively managing the rivers in the basin. Despite increased cooperation in the 2000s, there hasn't been a formal agreement on basin water management as a result.

### **History of the conflict**

Both the Tigris and the Euphrates originate in Turkey and flow into the Shatt al-Arab basin in southern Iraq. 90% of the water flow in the Euphrates originates in Turkey and 10% in Syria, the two countries it passes through. On the other hand, the Tigris River runs from Turkey to Iraq, with 40%, 51%, and 9% of the river's flow coming from Iran, Turkey, and Iraq, respectively (Kibaroglu & Scheumann, 2013).

Despite Iran's contribution to Tigris flow, it is not typically regarded as a major co-riparian in the Euphrates-Tigris (ET) basin. As a result, this case study solely focused on the three major riparian states of Turkey, Syria, and Iraq.

### **Between conflict and cooperation**

Events that were both very cooperative and antagonistic have characterized relations between the three major co-riparian republics. The relationships between the three nations were regarded as "harmonious" up to 1960 because the co-riparians utilized less water (Kibaroglu, 2014). The states were unable to work together on the ET basin's water management at the start of the 1960s due to a number of factors that caused tensions between them.

**Tensions arise as a result of unilateral water development projects.**

At that time, uncoordinated large-scale water development projects were started by the co-riparian governments unilaterally, which had an impact on river flow. The main goal of these projects was to control river flow and prevent floods since the region's population development resulted in higher water demands (Gleick, 1994; Kibaroglu & Scheumann, 2013).

It quickly evolved into a strategy for hydropower generation, allowing Turkey to reduce its reliance on oil for energy. Co-riparian tensions were also made worse by environmental factors. For instance, during a drought in 1975, Turkey and Syria concurrently began to use the Keban (Turkey) and Taqba (Syria) dams. This dispute, which was settled through Saudi Arabia's mediation, came dangerously close to escalating into a war (Kibaroglu & Scheumann, 2013). Additionally, water disputes were made worse by seasonal changes in precipitation, extremely ineffective irrigation systems, and the growth of crops that required a lot of water (Lorenz & Erickson, 2013).

**External influences make the conflict more intense.**

In addition to these environmental considerations, other, unrelated, factors also played a significant effect. First, Syria and Iraq maintained tight connections with the USSR while Turkey joined NATO as tensions over water increased throughout the Cold War (Kibaroglu, 2014). Second, until the 2000s, the Kurdistan Workers' Party (PKK) problem was a significant point of dispute between Turkey and Iraq (Lorenz & Erickson, 2013). Last but not least, the Hatay Province territorial issue was a significant cause of friction between the two nations up until 2005 (Kibaroglu et al., 2005; Stern, 2005).

After a period of intense tensions between the co-riparian states during the 1980s and 1990s, relations between them significantly improved in the late 1990s and early 2000s, allowing for the reactivation of cooperation over water management (Kibaroglu, 2014).

### **Relationships among co-riparians have improved since the late 1990s and the early 2000s.**

In the late 1990s and early 2000s, there was a noticeable improvement in relations between the co-riparian republics. Politicians at the highest levels of decision-making enabled the shift in water policy from adversarial to cooperative (Kibaroglu & Scheumann, 2013). Following an abortive attempt to resume Joint Technical Committee meetings in 1983, Syria indicated in 1998 that it intended to do so again. The removal of the PKK commander from Syria was a major step in the right direction (Lorenz & Erickson, 2013).

### **Factors for increased cooperation**

This improved cooperation in managing water resources might be attributed to a number of things. These can be categorized into three groups: internal changes, external influences, and geographical context changes.

The first set of variables is related to Turkey's internal developments. Following their election victory in 2002, the Justice and Development Party (AKP) rose to power, and the first few years were marked by a "zero problems with neighbouring countries" policy (Djavadi, 2016), which helped to improve ties in the ET basin. Turkey's increased participation in international water forums and years of (failed) negotiations in the basin have also exposed it to the "benefit-sharing" idea, which is based on cooperation, efficient use of water, and pollution management. Turkish authorities are becoming increasingly aware of the unsustainable nature of large-scale regional

irrigation schemes on the Euphrates and the pressures associated with them (Lorenz & Erickson, 2013). In order to further explore water legislation, decision-makers also met with stakeholders, NGOs, universities, and water users (Kibaroglu, 2014). This increased the inclusivity of the decision-making process for Turkey's water legislation. The impact of Turkey's potential EU membership on its water policy is the second factor (Kibaroglu, 2014).

The final factor is the general improvement in the political environment at the time between the nations and their cooperation on non-water matters to create "win-win" scenarios, particularly those relating to more general security issues (Daoudy, 2008). Syria and Turkey partnered in their war against the PKK in northern Iraq after signing a trade agreement in 2003 (Emerson & Tocci, 2004). The co-riparian nations' development of complementary goals also made the revival of cooperation conceivable. For instance, Turkey desired to enhance commerce with its neighbors, whereas Iraq and Syria wanted to diversify their economies (Lorenz & Erickson, 2013). Though the potential is encouraging, there haven't been many efforts to create such "win-win" scenarios. For instance, Turkey may store water for Iraq on its soil where evaporation losses are low in exchange for Iraq providing Turkey with cheap electricity (Alwash, 2016).

### **Interrupting cooperation**

Despite the cooperative activities that have taken place since the start of the 2000s, cooperation on the ET basin has come to an end. Although high political levels of collaboration were attempted, neither MoU could be approved since it did not meet the legislative standards of the parliament of each respective country. As a result, both the Syrian and the Iraqi parliaments rejected it (Lorenz

& Erickson, 2013). The Iraqi parliament's decision to reject the MoU was also influenced by the populace's animosity and mistrust of Turkey on the upstream use of the Euphrates (Lorenz & Erickson, 2013; UPI, 2009).

Although co-riparian relationships have improved since the start of the 2000s, cooperation on the management of the ET Basin has subsequently come to a standstill. Therefore, there aren't any formal agreements or frameworks in place right now to assist the equitable distribution and sustainable management of water resources in the area (Hassan et al., 2018). In a region where agriculture is a major source of income, it is crucial to identify solutions to reduce the consequences of climate change and the worsening environmental degradation in the basin. The potential of inter-state conflict over the ET basin is still considered low by some observers (Lorenz & Erickson, 2013), but the lack of progress in cross-border water cooperation may result in "progressively growing fragility," particularly in Iraq and Syria (Mueller et al., 2021).

### **2.3.2 Water Conflict in the Nile Basin**

Who owns and has access to the water resources of the Nile is a contentious issue among the eleven riparian states that make up the Nile basin. With backing from major donor institutions, nine out of ten riparian nations launched the Nile Basin Initiative (NBI) in 1999, and it has had some success in promoting cooperation. Due to conflicting interests between upstream and downstream nations, which have pitted upstream riparian nations—especially Ethiopia—against Egypt (and, to a lesser extent, Sudan), negotiations have been on pause since 2007. A framework agreement that resulted from trilateral discussions between these nations in 2015 over a significant dam being constructed in Ethiopia may potentially pave the way for a more comprehensive accord.

### **History of conflict**

The Nile moves very little water, even though it may be the longest river in the world. The requirement to sustain the livelihoods of hundreds of millions of people in the region, coupled with the region's economic and demographic growth, has put more strain on a river basin that is shared by eleven countries. The fundamental conflict between Egypt's desire to maintain current downstream flows and upstream riparians insistence on their right to develop their water resources—which could have a significant impact on downstream river flows—still overshadows the basin's cooperation, despite significant advancements. Tensions peaked in 2011 when Ethiopia announced intentions to construct a 6,000 MW hydroelectric project on the Blue Nile, the basin's principal river.

### **The Nile basin's description**

Eleven nations share the Nile basin, which is home to the two major tributaries, the White and Blue Niles: the Democratic Republic of the Congo (DRC), Burundi, Rwanda, Ethiopia, Uganda, Kenya, Tanzania, Sudan, South Sudan, Eritrea, Ethiopia, and Egypt. The Great Lakes region of Central Africa is the source of the White Nile, which originates there and travels north via Tanzania, Uganda, and South Sudan. Ethiopia is the source of the Blue Nile, which flows southeast into Sudan. The two rivers meet at Khartoum, the capital of Sudan, from which the Nile flows through the country's desert and into Egypt. At almost 6,700 kilometres, the Nile shares the title of being the world's longest river with the Amazon River. It moves less water, nevertheless, than other rivers like the Amazon and the Congo River, moving only 84 km<sup>3</sup>/year compared to those rivers' respective flows of 5,518 km<sup>3</sup>/year and 1,250 km<sup>3</sup>/year (Swain, 2011). Furthermore, because the majority of the Nile's water comes from erratic rain brought on by the monsoon in the Ethiopian highlands, there is a notable inter-annual flow fluctuation in the Nile.

### **Upstream ambitions**

Egypt has profited immensely from the downstream water flow during the 20th century, as upstream nations in the Nile basin have been unable to exploit their water resources because of internal strife, external pressures, and economic limitations. In contrast, during the past 10 years, upstream nations have had considerable gains in political stability, economic growth, and population. Additionally, they have benefited from geopolitical shifts by obtaining new funding sources for significant infrastructure improvements (IDS, 2013). These nations have started massive development projects along the Nile and its tributaries in response to the increasing demand for energy and arable land, as well as better opportunities to use their water resources (Link et al., 2012).

Ethiopia is in a unique position among these nations because its highlands supply roughly 86% of the water for the Nile (Swain, 2011). Given the growing population and the rapidly expanding economy (which has grown by more than 8% on average over the last eight years), the country is motivated and has the means to take advantage of its mostly unrealized potential for irrigation and hydropower (Gebreluel, 2014). Egypt and Sudan are downstream and are extremely concerned about the possibility of increased water use in the near future, even though Ethiopia and other upstream countries' current water development plans only require a small portion of the Nile's water (Link et al., 2012; Pearce, 2015; Swain, 2011).

### **Downstream efforts to protect the status quo.**

The downstream countries' growing populations are also driving up their water demands. This is especially important for Egypt, where water use could reach 87 km<sup>3</sup>/year by 2025 (Farrag, 2005). Egypt's agricultural output is mostly dependent on irrigation from the Nile because it receives very little rain. It is therefore opposed to any upstream project that could lower river flow downstream. Although downstream flows are not necessarily reduced when hydroelectric facilities are developed on the Nile's tributaries, the Egyptian government is worried that future upstream damming projects may pave the way for irrigation projects and water diversion. Swain (2011) and Link et al. (2012).

Egypt's scepticism of upstream development programs is made worse by its declining political clout. Egypt has held a commanding position inside the Nile basin for most of the past century, using its economic, military, and political might to prevent efforts at upstream development. However, this will soon change. Power in the Nile basin is steadily moving south as other riparian countries gradually catch up economically and Egypt struggles with political turmoil. As such, Egypt finds it more challenging to counterbalance its vulnerable status as a downstream country (Gebreluel, 2014; IDS, 2013). Sharp drops in agricultural output and downstream flow are also a source of concern in the wake of the 2011 rebellion, as they could jeopardize Egypt's political stability and fuel unrest in the surrounding areas.

### **The role of climate change**

The situation in the Nile basin is made much more difficult by the high level of uncertainty around future water supply. Experts generally agree that the Nile region would undergo increased warming, with bigger increases in the north of the basin than in the south (Elshamy et al., 2009;

Kim & Kaluarachchi, 2009). A range of emission scenarios and models are utilized to provide detailed climate projections. In general, increased temperatures will require additional irrigation. Sea level rise will also put pressure on Egypt's breadbasket's crops in the Nile delta. Intense irrigation has already contributed to salinization and increased susceptibility of the delta to seawater intrusion, significantly restricting the natural flows of the Nile and adversely affecting agricultural productivity.

However, predicting changes in precipitation is more challenging, and the results of the research that has already been done remain contentious (Link et al., 2012; Niang et al., 2014). The entire discharge in the Nile basin could drop by the end of the century due to evaporation and rising temperatures. Higher humidity's cooling effect, rising precipitation levels, and a wider cloud cover, however, may counteract this effect (Conway & Hulme, 1993; Elshamy et al., 2009). Even though it's too early to tell how climate change will affect the Nile basin, the prospect of more Nile flow reductions already clouds riparian nations' relations.

### **The Nile Basin Initiative**

The Nile Basin Initiative (NBI) was established by the riparians in 1999 in an effort to establish a mutually acceptable foundation for cooperation in the Nile basin. Development of the river "in a sustainable and equitable way to ensure prosperity, security, and peace for all its peoples" is the aim of the NBI, an intergovernmental collaboration (NBI, 2020). Nearly all of the basin countries joined the NBI with assistance from external institutions, most notably the World Bank, with the exception of Eritrea, which has observer status. The hope that a cooperative framework would enable significant investments in major (hydraulic) infrastructure projects in the basin drove the

majority of riparians. Rather than concentrating just on the hotly debated subject of water allocation, the NBI was purposefully designed with an extra benefit-sharing investment program (Mekonnen, 2010). The NBI was established to serve as a temporary body while discussions for a long-term Cooperative Framework Agreement (CFA) continued. The CFA sought to include all riparian communities in the decision-making process by choosing organizations, structures, and guiding principles for sharing management of the Nile's water resources (Mekonnen, 2010; Swain, 2011).

Years of negotiations have not resulted in the achievement of this goal. Since 2007, the Nile basin negotiations have been in limbo due to an ongoing dispute over the CFA. At the core of the disagreement over whether or not the CFA should acknowledge current water use by the downstream nations is a 1959 agreement between Egypt and Sudan that forbids upstream countries from using their water resources without the cooperation of downstream countries. Upstream nations have been fiercely resisting these accords to which they were not sovereign parties, while downstream nations have been demanding the explicit recognition of what they perceive to be their historical rights and uses of water (Mekonnen 2010; Swain 2011). Upstream countries stress the concept of "equitable use," which is also derived from the same UN convention, while downstream countries emphasize the more moderate principle of the "obligation not to cause significant harm," which is found in Article 7 of the same UN convention (Gebreluel, 2014).

Multilateral collaboration amongst the other riparian countries is still going strong, despite the fact that both countries have since resumed their participation in NBI activities. 2010 saw Egypt and Sudan withdraw from the NBI in opposition to the upstream nations' decision to start the CFA's ratification process without reaching a consensus on a "water security" clause (Knaepen & Byiers,

2017; Mwaura, 2017). However, the chance of a complete agreement could be adversely affected by the unilateral development of water projects concurrently (IDS, 2013; Link et al., 2012; Pearce, 2015).

### **Negotiations and mediation**

The riparian nations as well as external entities like the World Bank, the United States, the European Union, and Switzerland have made multiple attempts to break the impasse in the CFA and reengage Egypt (and Sudan). 2011 saw both official high-level negotiations and unofficial ministerial-level negotiations. Rewording the CFA's most problematic article has been the topic of numerous investigations. The contentious Grand Ethiopian Renaissance Dam (GERD) declaration of principles reached by Ethiopia, Sudan, and Egypt in March 2015 may pave the way for more extensive collaboration.

The conflict over the Nile flows is extremely symbolic, and internal constraints limit the scope of negotiations between leaders of upstream and downstream nations. On the one hand, the river is deeply ingrained in the histories and identities of many Egyptians. On the other hand, the recent ability of the upstream nations to utilize the Nile waters is a shining example of their revival after years of economic and political marginalization. GERD has played a significant role in Ethiopia's "nation-building" efforts. Since the Nile issue is a "political minefield," concessions that are too accommodating run the risk of inciting a severe backlash from the public (Gebreluel, 2014). In addition to the "basic war" between Ethiopia and Egypt, political factions in the area compete with one another for allegiance and supremacy. Despite Egyptian resistance, Ethiopia has made significant political capital investments and has successfully rallied upstream African nations,

which equally abhorred Egyptian rule, to support Ethiopia's ratification of the CFA. Finding a strategy that would enable Ethiopia and Egypt to simultaneously announce victory and defend a fictitious accord at home is consequently extremely difficult.

### **Opportunities for cooperation across the basin**

Despite these challenges, there are chances for collaboration and more effective water use in the Nile. Using water resources more effectively could be part of a basin-wide strategy where riparian countries fully leverage economic integration and comparative advantages in natural and societal conditions (e.g., Sudan's improved agricultural conditions and Ethiopia's more efficient hydro-energy production combined with Egypt's financial investment capabilities) (Whittington et al., 2014). By holding water upstream in colder climates as opposed to downstream in dryer climates, evaporation losses could be reduced. If Egypt's economy shifts from agriculture to other sectors, it may become less reliant on Nile water. Egypt may also be able to meet its growing energy needs, including air conditioning to counteract more severe heat waves, by utilizing Ethiopian hydropower.

Nevertheless, steps must also be taken to foster mutual confidence and the basin countries' genuine commitment to fostering interdependencies that are advantageous to all sides in order to increase regional integration. Furthermore, because irrigation projects and dam construction along the Nile and its tributaries are likely to have a significant impact on riparian ecosystems and the way of life of nearby communities who live along the riverbanks, civil society actors should be involved in basin-wide development strategies (Mbote-Kameri, 2007). By facilitating a multitrack debate that enables (important) basin countries to establish solutions that benefit both parties, third parties

may be able to support this process and/or offer these governments various sorts of guarantees (Subramanian et al., 2012). This issue could be supported by targeted expenditures that assess or encourage the development of cooperative ventures and encourage knowledgeable international discussion on this.

### **2.3.3 Ghana and Ivory Coast Maritime dispute**

This section briefly discusses the maritime dispute between Ghana and Ivory Coast, as narrated by Mirasola in his work “Maritime Dispute Resolution Project”.

#### **Background**

The arbitral proceedings brought by Ghana against Ivory Coast in the International Tribunal for the Law of The Sea may be traced to the region’s colonial history. Despite boundaries that were set by the British and French as part of demarcating colonial territories, the people of both countries share a substantial political and ethnic history. For instance, the Akan ethno-linguistic community forms part of dominant ethnic groups in either country.

#### **Dispute**

It is understandable that the discovery of hydrocarbon reserves in the Gulf of Guinea brought the issue of borders to the fore. Until 2007 when Kosmos Energy discovered substantial reserves that were called the Jubilee Oil Field. At the time it was projected that the field contained about 3 billion barrels of total proven reserves. In 2009 there was another discovery which would be known as the TEN development project.

Just about the time of discoveries, bilateral consultations that eventually led to an arbitration at the International Tribunal for the Law of the Sea commenced. A commission with members from either country was formed with the aim of both countries to find a negotiated solution to the

overlapping resource claims. After negotiations yielded no results, the matter was presented to the International Tribunal for the Law of The Sea. After proceedings, the resulting judgement aligned more with Ghana's interests as compared to that of Ivory Coast especially when Ghana was not guilty of violating the sovereign rights of Ivory Coast.

### **Implementation of Tribunal's Decision**

On September 23, 2017, when the decision was announced, both parties issued a joint statement expressing their gratitude as well as accepting the ruling of the tribunal. Before and after the ruling either president of the countries visited each other to commence negotiations on a new partnership. They further released a joint statement expressing their willingness to ensure ratification of the ruling by the tribunal. To this effect the statement established a joint committee for the implementation of the ruling by the International Tribunal for the Law of the Sea. Beyond the meetings held by the committee, in 2018, were able to sign a joint statement ratifying the coordinates as the maritime boundary, based on the Tribunal's decision. Further talks were planned to enable both parties to expand cooperation beyond the maritime boundary.

In summary, this chapter discussed what constitutes water resources, threats to water security, and management and control of water resources which briefly led to a discussion of integrated water resources management. The final section of this chapter examined some water resource conflicts that currently exist in the world and how they are handled, along with threats of escalation.



## CHAPTER 3

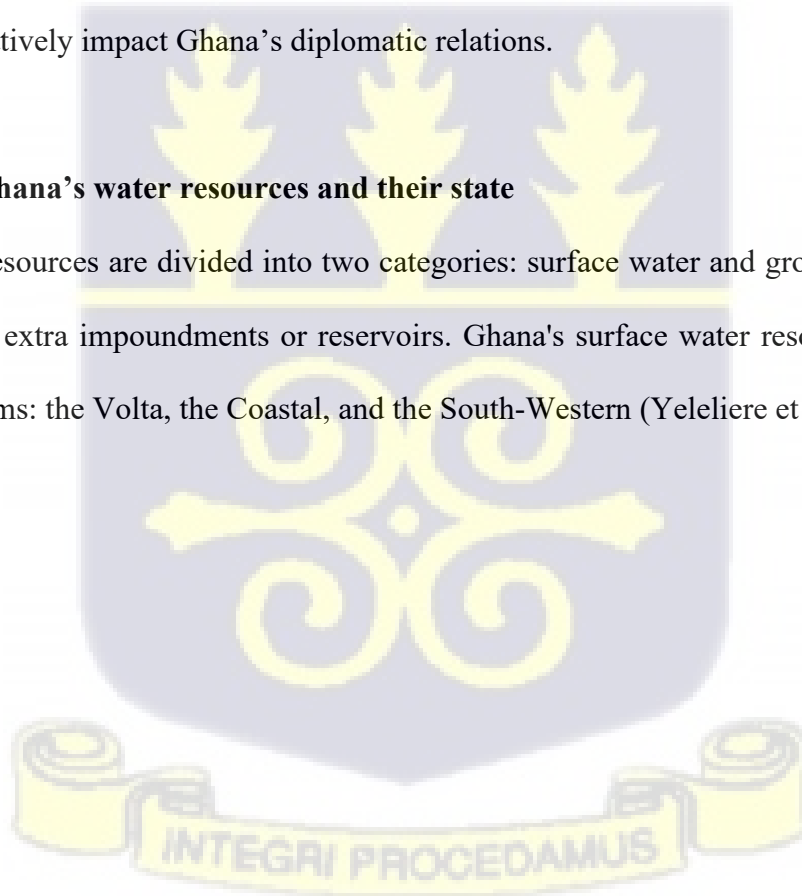
### HOW WATER RESOURCES MAY IMPACT GHANA'S INTERNATIONAL RELATIONS

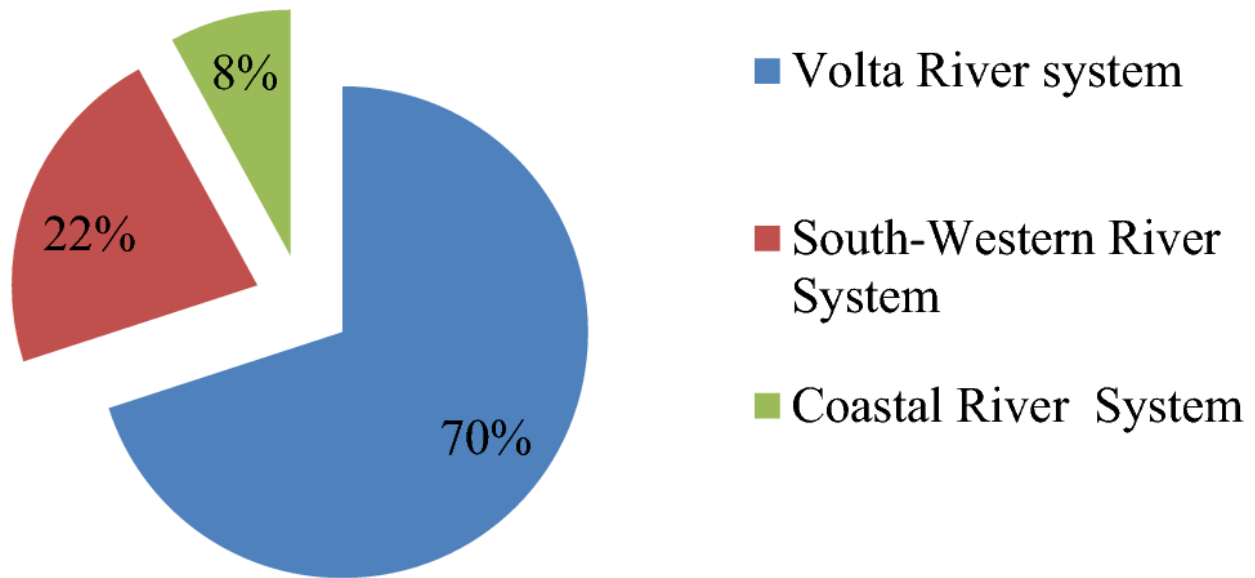
#### 3.0 Introduction

This chapter seeks to discuss Ghana's available freshwater resources amid challenges such as how management and control may result in diplomatic tensions between Ghana and other countries in response to research questions. However, before that, the chapter will outline Ghana's freshwater profile and the state of these freshwater resources. The chapter will discuss how factors such as, management and control, galamsey, and how the economic value of these resources have the potential to negatively impact Ghana's diplomatic relations.

#### 3.1 Profile of Ghana's water resources and their state

Ghana's water resources are divided into two categories: surface water and groundwater, despite the existence of extra impoundments or reservoirs. Ghana's surface water resources come from three river systems: the Volta, the Coastal, and the South-Western (Yeleliere et al., 2018).





## Surface water resources in Ghana

Fig. 1 Ghana's surface water resource distribution (Agodzo et al, 2023)

### Ghana's surface water resources

The Volta, South-Western, and Coastal River systems are the three primary river outputs from which Ghana derives the majority of its surface water resources. The Oti River and the Red, Black, and White Volta Rivers make form the Volta River systems. The Bia Tano, Ankobra, and Pra rivers are part of the South-Western River systems. The Tordzie/Aka, Densu, Ayensu, Ochi-Nakwa, and Ochi-Amissah are the components of the Coastal River Systems (Ghana National Water Policy, 2007). Approximately 240,000 km<sup>2</sup> of land are covered by these river systems, making up 70, 22, and 8% of the total land area. Furthermore, Ghana's sole naturally occurring freshwater lake is Lake Bosomtwi. Situated in the woodland zone, this meteoritic crater lake has a surface area of 50 km<sup>2</sup> and a maximum depth of 78 m.

### **Ghana's groundwater resources**

Ghana's groundwater resources are comprised of three geological formations: the consolidated sedimentary formations, the basement complex (metamorphic rocks and crystalline igneous), and the Cenozoic and Mesozoic sedimentary rocks. These geological formations account for 45, 1%, and 54 percent of the country's total groundwater resources, respectively (Ghana National Water Policy 2007). Groundwater presence in the basement complex is associated with the creation of secondary porosity, which causes fracture, jointing, shearing, and weathering. Aquifer yields usually varied from 10 to 60 metres in depth and seldom went above 6 metres cubic per hour. Extremely Eastern and Western regions of Ghana are often home to limestone aquifers, sometimes referred to as Cenozoic and Mesozoic formations, that span in depth from 120 to 300 meters. The limestone aquifers produce an average of 184 cubic metres of water every hour. (WRC Ghana 2007; Ghana National Water Policy, 2007).

### **Impoundments or reservoirs**

Dams, impoundments, and reservoirs have been built for irrigation, hydroelectric power production, water supply, and ecological support. The first hydroelectric power reservoir was built in 1964 at Akosombo, which was located about 100 kilometres from where the Sea and the Volta converge. Approximately 8500 km<sup>2</sup> is the surface area and 148 km<sup>3</sup> is the water volume capacity of Akosombo Dam, one of the largest artificial lakes in the world. A relatively smaller reservoir was constructed at Kpong, including an area of roughly 40 km<sup>2</sup>, approximately 17 years after the construction of the larger reservoir near Akosombo (Yankey, 2019). Another impoundment built for energy production is the 400 MW Bui hydropower project, which is situated in the Black Volta. We did generate 125 MW from the project if the nation were to use the Pra River as a hydroelectric

power source. Two more noteworthy impoundments in Ghana are the Barekese and Owabi supplies, which feed water to the Kumasi Metropolis, Weija, Nawuni, Accra, and Tamale Metropolitan Areas, respectively, on the Densu, Volta, and Offin rivers (Yeleliere et al., 2018).

### **Use of Ghana's water resources**

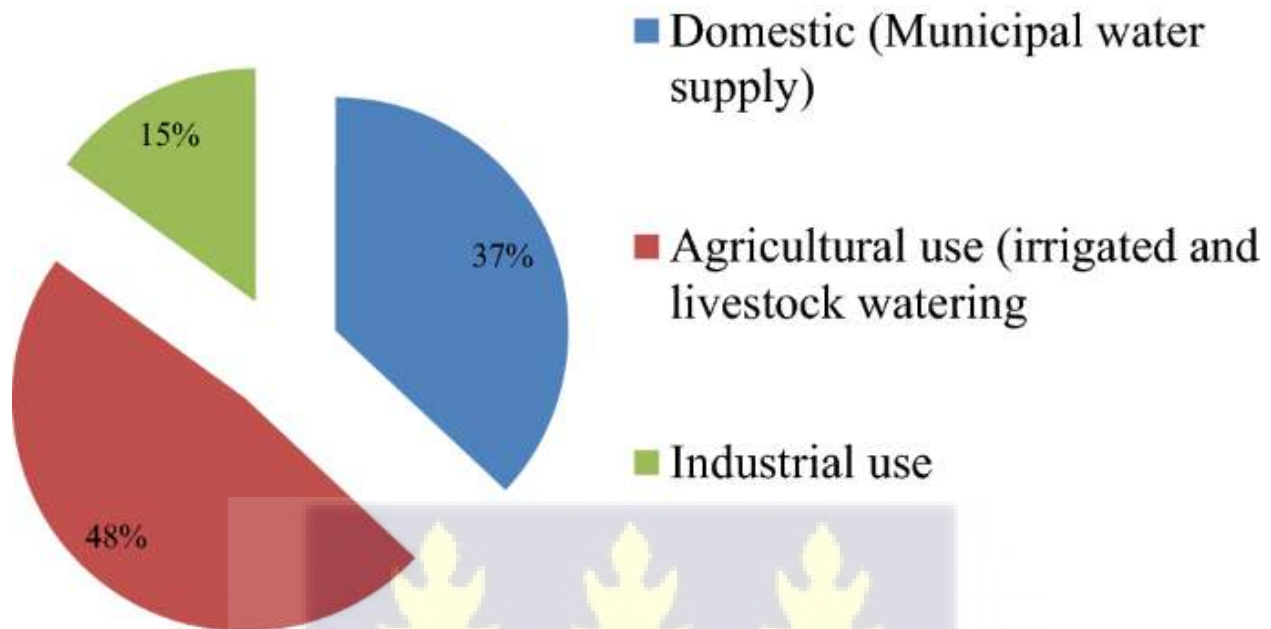
53.20 km<sup>3</sup> of genuine renewable water resources are estimated to be available annually, with 30.30 km<sup>3</sup> of that amount coming from internal sources. All rivers contribute to the annual runoff of 56.4 billion m<sup>3</sup>, but the Volta River makes up a staggering 41.6 billion m<sup>3</sup> of that total. Ghana's Volta basin provides an average of 38.7 billion m<sup>3</sup>, or 64.70 percent, of the nation's yearly runoff. Of Ghana's annual runoff, the coastal system provides 6.10%, the South-Western system 29.20%, and the Volta system 64.70%. Ex situ, or extraction use, and in situ, or in-stream use, commonly referred to as consumptive and non-consumptive uses, are the two main categories of exploiting freshwater resources.

### **Consumptive use or ex situ use**

Water is essentially drawn from its primary source when it is consumed. The amount that is extracted is referred to as "water intake"; normally, part of it is wasted or consumed and the remainder seeps back into the original source. The amount of water that is not replenished in the water body is referred to as "water consumption".

Ghana uses 37% of its water resources for urban purposes (water delivery), 48% for agricultural purposes (irrigation and livestock watering), and 15% for industrial purposes. By 2020,

consumptive water demand for surface water resources alone is predicted to exceed 5 billion m<sup>3</sup>, or 12% of all surface water resources (WRC 2005).



### Percentage distribution of consumptive use of water

Fig 2 Distribution of freshwater resource consumption or ex situ use (Yeleliere et al, 2018: Agodzo et al, 2023)

### In situ or non-consumptive use

Non-consumptive water use, also known as in situ use, refers to practices that don't involve taking water directly from its source.

Transportation, inland fishing, the production of hydroelectricity, tourism (including leisure activities like visiting waterfalls), and ecosystem support services are the main uses of water. In order to promote the production of drinkable water, a platform for irrigation, and hydroelectric power, reservoirs and impoundments are built. It is nearly difficult to estimate the exact amount

of water required because water is not removed for these purposes. However, according to projections, Ghana would need to supply 1,733,380 cubic meters of non-consumptive water by 2020, of which 378,430 cubic meters will be utilized to produce hydropower.

### **Quality of freshwater**

The quality of naturally occurring surface waters and groundwater was generally good prior to the recent phenomenon of localized pollution caused by the discharge of sewage into water bodies from industrial and domestic activities, the leaching of fertilizers and pesticides used in agriculture, with the most recent and alarming canker being illegal artisanal mining, denoted ('galamsey') (USAID 2011). This has become a recurring threat due to the significant contamination of almost all water supplies in mining sites. Because of the alarming rate of deterioration, the Ghanaian government has formed a special task force, headed by the Ministry of Lands and Natural Resources, to tackle this menace and safeguard our water resources. Our water supplies are now completely unmanageable due to the usage of pesticides in fishing and rapid population increase (Nsubuga et al. 2014). In most urban areas, sewage discharges from municipal trash have caused major water pollution. Untreated waste generated from households and companies is being dumped into lagoons and rivers close to industrial regions, which is gradually killing the places due to stench and nutrient enrichment that creates algae blooms. The Korle Lagoon near Accra is one instance of a polluted lagoon in Ghana (WRC 2015). Every facet of physical, chemical, and biological properties can be found in water quality. According to Owusu et al. (2016), the physical, chemical, and biological aspects of streams, rivers, and lakes are what most affect their water quality.

### 3.1.2 Looming crises and pollution of Ghana's freshwater resources

A greater proportion of the population may have access to facilities for safe drinking water if the continuous anthropogenic operations in Ghana are compared with the noteworthy efforts made by the traditional and local government agencies in Ghana. In Ghana, the majority of the water bodies are in critical condition and about 60% of them are polluted (Ampomah et al, 2017). Fresh water supply and quality are still major problems in Ghana since the majority of the country's rural communities get their drinking water from surface water, shallow groundwater, and precipitation. Water sources in Ghana are primarily contaminated due to the ongoing, widespread illegal mining activity in the south-western regions. Ampomah (2017) asserts that the main sources of water pollution in Ghana are industrial waste, illegal mining, farming, and home disposals. As a result, traditional and local government officials must assist in the conservation of water bodies. The quality of freshwater bodies there needs to be improved immediately.

It is undeniable that Ghana's fresh water supplies are in danger since they are drying up and getting harder to find every day. Due to pollution, which is driving up the cost of treating water bodies, managers of water treatment plants in Ghana are compelled to close (Yeleliere et al, 2018). With over 70 decentralised treatment plants in the country, less than 10 of these plants are functional (Agodzo et al, 2023) who The latest of such plants to shut down are

According to Mantey (2017), illegal mining has affected fresh water sources in the following regions of Ghana. The Rivers Pra, Daboase, and Ankobra, the main waterways in the Western Region, are tainted. Birim, the Eastern Region's principal body of water, is tainted. The river was too contaminated to be processed, forcing Kyebi's water treatment facilities to close. This

challenge compelled the Ghana Water Company to construct boreholes that will serve fewer inhabitants (Yeleliere et al, 2018).

Freshwater bodies around those settlements have been affected by fishing operations; Koforidua and the newly established Juaben communities are also impacted by this problem. According to Mantey (2017), a lot more chemicals are currently required to clean the water from the Volta River than were used in the past because of the slow but steady increase in pollution. The Densu River in the Greater Accra Region, which receives its water from Western Accra, which is near the Weija dam, has been contaminated by industrial and agricultural waste. Because of this, the Ghana Water Company has decided to use chemicals to treat the pollution issue.

Galamsey activities have caused pollution in a few water bodies in the Central Region, especially along Cape Coast (Mantey 2017). Similar, if not worse, circumstances may be found in Brong Ahafo, where residents have been regularly blocking the river's flow to keep water from getting to certain areas of the Region (Mantey 2017). Locals stopped using the river to irrigate agriculture, which resulted in a recent water deficit in Sunyani, which was not caused by machines (Mantey 2017).

The Black Volta in the Upper West Region is also poisoned. Ghana Water Company made the decision to construct a new water treatment facility in order to assist the production of safe drinking water as a result of this as well as the nation's rapid population growth (Mantey 2017). The Ashanti Region faces a comparable environmental problem. According to Mantey (2017), illegal mining operations have tainted the Enu River, which supplies water to the Konongo people in the Ashanti

Region. In the Northern Region, sand mining is the main cause of water body pollution; however, galamsey activities are also responsible in some other regions (Mantey 2017). Massive sand mining operations have taken place along the Nawuni River in Ghana's northern area, which has permanently changed the river's colour (Mantey 2017). Water contamination has recently become a concern on a global scale, necessitating an assessment of water resource policy.

### 3.2 Data Analysis

#### 3.2.1 Primary Data

This section is dedicated to the analysis of primary data obtained from the field. Due to the nature and objective of the study, data obtained was analyzed qualitatively and thematically using NVivo

14. The following themes were generated;

Research Question	Themes
What are some challenges Ghana associated with management and control of water resources?	<ol style="list-style-type: none"> <li>1. Policy Formulation and Implementation</li> <li>2. Monitoring and Enforcement</li> <li>3. Institutional Challenges</li> <li>4. Ineffectiveness of Current Laws and Regulations</li> </ol>
How does galamsey as an internal threat act as a potency for international conflict?	<ol style="list-style-type: none"> <li>1. Socio-Economic Impact</li> <li>2. Health and Safety Concerns</li> <li>3. Government Measures</li> <li>4. Environmental Impact</li> </ol>
What is the economic importance of these water resources?	<ol style="list-style-type: none"> <li>1. Source of Livelihood</li> <li>2. Impact on Settlements</li> <li>3. Government Expenditure</li> <li>4. Economic Benefits vs. Environmental Costs Challenges</li> </ol>

### 3.2.1.1 Challenges Associated With Management And Control Of Water Resources

This section and theme investigate some of the challenges associated with management and control of water resources in Ghana. The subthemes generated under this theme include; Policy Formulation and Implementation, Monitoring and Enforcement, Institutional Challenges and Ineffectiveness of Current Laws and Regulations

#### 3.2.1.1.1 Policy Formulation and Implementation

Interaction with the participants revealed that policy formulation and implementation was a major challenge as far as the challenges Ghana associated with management and control of water resources. It was found that the effectiveness of policy formulation and implementation in managing water resources in Ghana is hindered by several issues. One significant challenge is the disconnect between those who formulate policies and those who implement them. This gap leads to inefficiencies and ineffective water management practices. As noted in the interviews, the problem lies in the comprehension and relevance of these rules to local contexts. Some of the comments made by the participants included;

*"The main issue here with these rules and regulations is who is formulating the rules and who is implementing it is a big problem. And you realize that it is government that is formulating the rules and some people are supposed to implement it" (Participant 1).*

*"Currently as I speak the water policy the laws we have in the country have not been implemented. It has not gone to Parliament"(Participant 3).*

### 3.2.1.1.2 Monitoring and Enforcement

Another major challenge associated with management and control of water resources was issues of monitoring and enforcement. The participants iterated that monitoring and enforcement mechanisms are crucial for the effective management of water resources. However, in Ghana, these mechanisms are weak due to various reasons, including lack of understanding of the rules by those responsible for enforcement and insufficient resources for comprehensive monitoring. One participant stated that

*"The question is do those people who are supposed to do the implementation understand these rules? Can they comprehend what is in there to be able to try to implement it?"(Participant 5).*

Another participant also stated that;

*"All because the effectiveness of the law in the nation is not working"(Participant 8).*

### 3.2.1.1.3 Institutional Challenges

Further interaction with the participants again revealed that Institutional challenges was another critical challenge associated with the management and control of water resources. It was found that these challenges associated with institutions managing water resources include the lack of sustained funding, inadequate capacity, and poor coordination among various institutions. These challenges impede the effective implementation of integrated water resource management plans.

Some comments by the participants included;

*"Sustained Funding for IWRM implementation Relevant and adequate capacity, Weak enforcement of laws"(Participant 4).*

*"So, if you come to the race institutions where Water Research Institute is part you also have Hydrological Services. So, if you talk of challenges do we have funds to do all this kind of work? That is the problem"(Participant 3).*

#### **3.2.1.1.4 Ineffectiveness of Current Laws and Regulations**

The findings revealed that despite having comprehensive laws and regulations on paper regarding management and control of water resources in the country, their effectiveness is compromised by poor implementation and enforcement. The lack of legislative approval for these policies further aggravates the issue. Some participants mentioned that

*"The laws are written but it has not gone to Parliament to be accepted"(Participant 2).*

*"Laws and regulations for managing water in Ghana are effective and comprehensive except for enforcement"(Participant 5).*

#### **3.2.1.2 Galamsey As An Internal Threat Act as a Potency for International Conflict**

This theme investigates Galamsey as an internal threat Act as a potency for international conflict. Achieving this, the following sub-themes were generated; Socio-Economic Impact, Health and Safety Concerns, Government Measures and Environmental Impact.

##### **3.2.1.2.1 Socio-Economic Impact**

The finding revealed that Galamsey, or illegal mining, over the years has had profound socio-economic impacts. These impacts ranges from increases in the cost of water resource management to affecting the livelihoods dependent on clean water. It further found that the economic benefits

of Galamsey are overshadowed by the long-term costs of environmental degradation and health issues:

One participant stated that;

*"It's going to cost us a lot of money if I have to say that or resources to manage muddy waters"(Participant 9).*

Another also stated that;

*"Galamsey is bringing us money. But we realize that we are all drinking bottled water"(Participant 7).*

### **3.2.1.2.2 Health and Safety Concerns**

Another issue revealed by the findings was health and safety. The pollution caused by Galamsey activities poses significant health risks and increases the cost of water treatment. Contaminated water sources threaten the well-being of communities and the overall safety of water resources:

One participant stated that;

*"Pollution of water bodies increases water resources management and treatment cost"(Participant 3).*

Another also mentioned that;

*"When this muddy water moves into another country's water can we pay the cost?"(Participant 1).*

### **3.2.1.2.3 Government Measures**

Also, findings revealed that attempts by government to combat galamsey haven't been effective. Government measures to combat Galamsey have been limited and sometimes ineffective. Reliance

on military interventions is not a sustainable solution, and there is a need for more comprehensive and long-term strategies:

One of the participants mentioned that;

*"Currently the measure that I see the government is using is the army should I say? The military"(Participant 7).*

#### **3.2.1.2.4 Environmental Impact**

Furthermore, findings revealed that galamsey negatively impact our environment. Galamsey activities severely degrade water ecosystems, reducing water availability and quality. This degradation poses potential conflicts with neighboring countries over shared water resources, as polluted waters do not respect national boundaries:

A participant stated that;

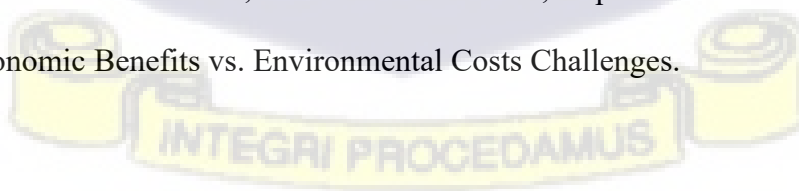
*"You muddy the waters and then it flows into someone else's... Water bodies"(Participant 4).*

Another also said;

*"The moment it dries up we don't have the water body again"(Participant 6).*

#### **3.2.1.3 Economic Importance of Water Resources**

This session investigates the economic relevance of these water resources. The subthemes generated under this theme include, Source of Livelihood, Impact on Settlements, Government Expenditure, Economic Benefits vs. Environmental Costs Challenges.



### 3.2.1.3.1 Source of Livelihood

Water resources are crucial for livelihoods, particularly for those dependent on fishing and agriculture. The degradation of these resources directly impacts the economic stability and food security of many communities:

A participant mentioned that;

*"A lot of people are dependent on fish. We know it's one of the best sources of protein"(Participant 7).*

### 3.2.1.3.2 Impact on Settlements

The encroachment of settlements into water catchment areas exacerbates flooding and degrades water resources. These activities not only affect the natural flow of water but also increase the risk of natural disasters, leading to higher costs for the government and affected communities:

One of the participants said;

*"People have turned most of these catchment areas into settlements. And the water does not have anywhere to go"(Participant 3).*

### 3.2.1.3.3 Government Expenditure

The government incurs significant costs in managing water resources and addressing the impacts of mismanagement and environmental degradation. These expenditures could be mitigated with better management and conservation practices:

A participant stated;

*"The government will have to spend a lot of money. They go around to support people. It's a lot of money"(Participant 5).*

#### **3.2.1.3.4 Economic Benefits vs. Environmental Costs**

While water resources provide economic benefits, their mismanagement and pollution result in high environmental and economic costs. Balancing these benefits with sustainable practices is essential for long-term economic stability:

One participant stated;

*"It's going to cost the country a lot. Not just the country but we as individuals"(Participant 6).*

Another participant also said;

*"Improving water resources management financing through watershed investment planning"(Participant 4).*

#### **3.2.2 Secondary Data Analysis**

This section is dedicated to the analysis of secondary data.

##### **3.2.2.1 Challenges with Management and Control of Water Resources**

###### **The Water Resources Commission Act**

Although these laws do not specify any formation of an institutional structure for the regulation of water resources, the 1992 constitution's emergence prepared the path for the creation of legislative instruments and their enactment. On the other hand, commissions for fisheries, minerals, and lands were set up to oversee and plan policies concerning related resources such as land, forests, and fisheries. However, in accordance with the Water Resources Commission Act of 1996 for the proper management of Ghana's water resources, among other things, these Commission actions have an effect on the water resources domain. The primary tool used in Ghana to control how water resources are used and managed is the Act (Yeleliere et al, 2018).

To better fulfill its roles and responsibilities, the Water Resources Commission has developed partnerships with various international organizations over the years, including:

- Africa Water Facility of the Africa Development Bank
- Global Water Partnership (GWP)
- World Bank
- Volta Basin Authority
- ECOWAS Water Resources Coordination Centre

The mandate of the Water Resources Commission includes:

- Managing and controlling the use of water resources: Coordinate relevant government policies related to water resources management.
- Proposing integrated water resources management strategies: Aid in the exploitation, conservation, development, and enhancement of water resources.
- Initiating, overseeing, and planning activities: Related to the exploitation and development of water resources.

**Allocating water rights:** Ensure fair and sustainable distribution of water resources.

**Collecting, compiling, storing, and disseminating information:** Pertaining to water resources.

Engaging with organizations in the water sector: Conduct scientific studies, tests, or research on water resources.

**Monitoring and evaluating programs:** For the operation and maintenance of water resources.

**Advising the government:** On any matters that could negatively impact water resources.

**Providing guidance to pollution control organizations in Ghana:** On managing and preventing water resource pollution.

**Performing additional ancillary tasks:** Related to the above responsibilities.

### 3.2.2.2.1 Current State of Affairs in the Implementation of IWRM in Ghana

#### **Progress and Achievements**

Ghana has made significant strides in implementing Integrated Water Resources Management (IWRM) as part of its national planning, adhering to ECOWAS's international conventions and the World Summit on Sustainable Development (WSSD) Plan of Implementation. Since the inception of IWRM in the 1990s, Ghana has developed robust institutional, political, and legal frameworks to support water resource management.

The current state of IWRM implementation in Ghana is characterized by:

- **Baseline Conditions:** Detailed documentation of the biophysical and socioeconomic contexts, water demands, potential water resources, and the sharing of water among neighbouring countries.
- **Institutional and Legal Frameworks:** Establishment of roles and functions for water institutions as outlined by legal instruments, ensuring a structured approach to water resource management.
- **Stakeholder Participation:** High levels of engagement from stakeholders and agencies, which are maintained and strengthened to ensure broad-based support and effective implementation.

### 3.2.2.2.2 Water Resources Commission (WRC)'s implementation of IWRM in Ghana

Ghana implemented national planning in accordance with the ECOWAS's formal international conventions on the development of integrated water resources management (WSSD, or World Summit on Sustainable Development) Plan of Implementation. However, Ghana has made

admirable efforts to create supportive institutional, political, and legal frameworks since IWRM started to take shape in 1990.

The current baseline conditions for the biophysical context, the socioeconomic context, the water demands, the potential of the water resources, the sharing of water among neighbouring countries, and the current framework management as outlined by the legal instruments and roles and functions of water institutions are all summarized in the document for the IWRM Plan.

Concerns about managing water resources are interconnected, thus influencing certain other sectors will be necessary to meet the plan's objectives. Without a question, the institutions and mechanisms that are already in place will play a key role in the IWRM plan's success. This gives the insight that, in regions with water scarcity, the struggle for limited water resources can lead to conflicts among different groups. That is to say, when water resources are scarce, various sectors such as agriculture, industry, and communities vie for access. This competition can strain relationships and create conflicts as each group seeks to secure enough water to meet its needs. Effective water resource management is crucial to prevent such conflicts and ensure equitable distribution.

Furthermore, WRC has already achieved high levels of stakeholder and agency participation; this will be preserved and strengthened. The management of water resources is typically delegated to NGOs/Community-Based Organizations, Metropolitan, Municipal, and District Assemblies, and other civil society groups that collaborate at the decentralized level. These groups are typically tasked with taking charge and coordinating management of water resources operations. Finally, monitoring and evaluation are crucial components of the IWRM implementation plan, in order to pursue objectives, goals and draw conclusions for performance enhancement (Yeleeiere et al, 2018).

### 3.2.2.2.3 Ghana's WRM challenges

It is essential to recognize the significant efforts made to create a legal, political, and institutional framework for the management of water resources in Ghana and other areas. The country still faces many challenges in meeting its needs, both immediate and long-term. (Yeleeiere et al, 2018).

These challenges include;

The threats are not addressed by current water rules and regulations since they are not effectively implemented.

The acts do not offer ways to bring statutory laws and customary law and practice into constitutional discourse. As a result, the mandate has been completely denied to traditional authorities by the passage of these laws. The constitutional authority and mandate to enforce or implement prevailing customary rules and practices in the management of water resources should be granted to local authorities. This clearly gives the implication that the conflicts surrounding water resource management in Ghana are multifaceted, stemming from various factors. Ambiguities in regulations contribute significantly, as unclear guidelines create confusion among stakeholders, intensifying competition for scarce water resources. Moreover, inadequate enforcement aggravates these conflicts, as stakeholders engage in disputes without facing consequences, fostering a culture of confrontation. Compounding this, competing interests among different stakeholders further fuel disagreements over water usage, leading to disputes over allocation and rights. Ultimately, the absence of effective enforcement mechanisms and clear guidelines results in the escalation of conflicts, potentially leading to legal battles or even physical confrontations, further heightening tensions within the community.

Furthermore, the lack of community involvement in decision-making since the top-down method is still more common. Since these resources are located in these communities, managing them requires a bottom-up strategy that includes people and traditional authorities in the decision-making process on the management of water resources. One major element of conflict that is likely to rise include, conflicts between governmental agencies, local authorities, and communities as a result of differing interpretations and implementations of water resource management laws and policies. Traditional authorities are often excluded from decision-making processes, leading to friction between them and governmental bodies.

Additionally, the lack of surface water regulations, especially those pertaining to dam safety, controlling the discharge of industrial and domestic wastewater, and managing sewage outfalls.

According to the National IWRM Plan-Water Resources Commission (2015), sectoral water management policies frequently fail to adequately account for the effects of climate change and variability on water resources.

The National IWRM Plan-Water Resources Commission (2015) states that there are not enough early warning systems or ways to mitigate the effects of drought and flooding.

Wendt's constructivism holds that people's perceptions of water resources are shaped by society. Regarding Ghana, the Water Resources Commission Act and its global collaborations mirror the socially created perception of water's significance. The collaborations and legislative tools show that coordinated management is necessary on a national and international level.

Given the responsibility of managing and controlling water resources, one important entity is the Water Resources Commission (WRC). Ghana's identity as a state that understands the importance of water resources for its sustainable development is reflected in the Act. Ghana's affiliations with

international organizations provide as another evidence of its status as a conscientious participant in the international community, actively seeking collaboration to tackle water-related issues.

Ghana's adherence to international cooperation rules is demonstrated by its relationships with organizations such as the Africa Water Facility, Global Water Partnership, and others. The cooperation reflects a common normative understanding that transboundary water concerns call for group efforts to be addressed. This supports Wendt's theory that the behavior of the state is influenced by shared norms.

Constructivism's notion of interconnection is consistent with Ghana's application of Integrated Water Resources Management (IWRM). The interconnectedness of water resources with biophysical and socioeconomic environments is acknowledged in the IWRM plan. The engagement of civil society organizations, local government agencies, and non-governmental organizations demonstrates a bottom-up strategy and a recognition of the significance of community involvement.

It is possible to view the problems with Ghana's water resource management as socially created, given the poor execution, low levels of community involvement, and inadequate legal frameworks. These difficulties result from the interaction of historical practices, legislative frameworks, and societal norms that influence the management of water resources.

According to Wendt's constructivism, behavioural changes can result from modifications in concepts and identities. It could be necessary to adopt new perspectives in order to address issues with Ghana's water resource management, such as appreciating the value of community involvement, incorporating customary practices, and adjusting to climate change.

Also, given political instability in some neighbouring countries like Burkina Faso that has been characterized by military coups, future negotiations concerning reforms of Ghana's international

water management conventions may appear difficult. This is because in such instances, the country witnessing the coup may be sanctioned by regional blocks such as ECOWAS. This may lead to diplomatic tensions when there is a need to further negotiate to amend international conventions, since political ideologies which sometimes brew tensions are usually different. Furthermore, when there is a coup, due to suspension of the constitution, other countries enactments on the existing convention may not function fully, which hinders cooperation among riparian states.

### **3.2.2.2 Internal threats to water resource security, focusing on galamsey**

As according to Mantey et al. (2016), “galamsey” is the term used to describe the illicit mining and/or extraction of gold from Ghanaian soil and water that is either at or below the surface. It is an unregulated form of artisanal small-scale gold mining (ASM) that can be carried out in addition to gold extraction. Galamsey is illegal because the people who engage in it lack the required authorizations from government agencies (like the Ghana Minerals Commission, the Environmental Protection Agency, the Water Resources Commission, the Forestry Commission, or the host Municipal Assembly); they fail to pay taxes or other fees; they operate in areas that are restricted or forbidden (like residential areas, forest reserves, bodies of water, or areas that are sacred or have significant cultural significance); and they pay little to no attention to human rights (Owusu-Nimo et al, 2018).

Galamsey is mostly found near major rivers like the Tano, Ankobra, Ofin, and Pra in Ghana, and it is primarily concentrated in the towns, villages, and woodland areas of mineralized regions. In addition to attracting foreigners (Italian, Togolese, Indian, Malay, Chinese, Nigeriens, Nigerians, Burkinabes, Ivorians, Germans, and Indians), this illicit mining activity has attracted and continues to draw Ghanaians, (Owusu-Nimo et al, 2016).

### 3.2.2.2.1 Granting of a mining license in Ghana

A mineral right in Ghana may only be awarded to corporate organisations incorporated in Ghana in accordance with the laws of the Republic of Ghana, with the exception of small-scale mining rights that may be granted to an individual under Act 703. However, a license for small-scale mining is only given to a Ghanaian resident who has reached the age of 18 and has been registered with the Minerals Commission office in a location known as the District Office. The small-scale mining sector is not open to participation by foreigners under any conditions (Danquah, 2019).

### 3.2.2.2.2 Galamsey Actors

Despite regulations regarding small scale mining in Ghana, there country still has challenges controlling galamsey which is a menace in Ghana. The phenomenon of galamsey includes women and children at mining sites. Adams (2023) reported the engagement of 5677 children in illegal mining activities. Also, of 164 apprehended foreigners from neighbouring West African Countries, five were women. These foreigners suspected to be small scale miners were mostly from, Nigeria, Burkina Faso, Niger, Mali and Ivory Coast. Also, there is the involvement of other nationals from other parts of the world like India, China, Italy, and Germany (Owusu-Nimo et al,2016).

### 3.2.2.2.3 Effects of Galamsey

As a source of income and livelihood, small-scale mining and Galamsey may benefit certain people, but its negative effects on the environment include deforestation, land degradation, water pollution, and other types of environmental harm. It is linked to various health risks like mercury exposure, child labour, poor working conditions, and displacement, among others. The following were captured by B&FT online (2023) as effects of galamsey.

**Water pollution:** One of the most serious consequences of unlawful mining in Ghana is the contamination of water resources. The adage “water is life” perfectly sums up how essential this

resource is to us. SDG 6 states that “by 2030, nations must achieve universal and equitable access to safe and affordable water for all.” Ghana is required to meet this goal as a signatory to the SDGs. Nevertheless, despite the fact that the need for water is widely acknowledged, the resource has frequently caused the most severe environmental damage, and it is widely acknowledged that water is the most typical victim of mining operations. Ghana is getting further away from attaining SDG 6 with each passing day.

Rivers like the Densu, Ankobra, Pra, and Butre have declined from being clean, safe rivers to becoming filthy, poisonous, and unattractive water systems. People who reside in areas where these water bodies are located are at a disadvantage since they are forced to utilize the dirty water or travel long distances to other towns in search of clean, potable water.

The major element of conflict emanating from the effects of these galamsey activities leading to water pollution lies on the premise that these activities pose a significant threat to water resources in Ghana. The indiscriminate use of chemicals such as mercury and cyanide during mining contaminates rivers and water bodies, endangering both aquatic life and human health. This pollution sparks conflicts between various stakeholders. Environmentalists and local communities express concerns about the degradation of their water sources, impacting their livelihoods and health. Mining companies may face opposition from affected communities and regulatory bodies, leading to conflicts over the responsibility for mitigating pollution and enforcing regulations.

**Land degradation:** To make the digging of pits and trenches easier at the beginning of mining operations, the topsoil, trees, and vegetation are removed either mechanically or manually. These actions, together with the use of explosives, dangerous substances like cyanide and arsenic, and toxic chemicals, make the ground infertile and unusable for farming.

Further converting the area into pits for the disposal of trash and other hazardous materials. This is demonstrated in Kenyasi and Tarkwa, where pits have been dug, making the land unfit for other uses. The availability of very little farmland for farming activities is a direct result of these activities, which forces the locals to turn to illicit mining as a means of survival.

In addition to the loss of farmland that may be used for agriculture, the loss of vegetation cover also results in the loss of ecological advantages such the regulation of river flow, biodiversity, and carbon sequestration. Degradation of the soil and a loss of wildlife habitat are made possible by the removal of trees and the digging of pits.

One of the important forest reserves impacted by illegal mining is Ghana's Atewa Forest Reserve. The forest reserve is renowned for having a high biodiversity and supplies water to a number of Ghanaian towns. Some uncommon and endangered plant and animal species can be found in the forest. However, unauthorized mining operations in the forest have resulted in the eradication of huge areas of forest cover, seriously harming the ecosystem.

This degradation triggers conflicts between conservationists advocating for the protection of natural habitats and local communities dependent on the land for sustenance. Displaced farmers and indigenous communities often clash with miners and authorities over land rights and the conservation of ecological resources.

**Noise and air pollution:** Mining operations result in the production of chemical gases, fumes, smoke, as well as dust cover brought on by explosions. Depending on the victim's health, chemicals and dust released into the atmosphere have been connected to respiratory problems and even death.

Along with air pollution, there is annoyance in the form of noise emissions from heavy equipment use, sporadic dynamite use, etc. Sleep disruption, hearing loss, and other related health issues can

all be a result of noise pollution. The disruption of their native habitat caused by noise pollution forces wildlife to relocate to other less favourable areas.

**Human Impact:** In the short term and over time, illegal mining has a negative effect on people's health. Cancer, mercury poisoning, silica-induced pneumoconiosis, and other respiratory disorders are a few of the health issues brought on by exposure to toxic substances like mercury and arsenic as well as dust pollution. In Africa, mosquitoes breed in abandoned mining pits with runoff water that was dug for mining.

Furthermore, crops and human health when ingested are seriously impacted by the soil contamination brought on by mining activities. Water supplies become contaminated by mercury and other chemicals used in illegal mining, making them unfit for use in agriculture and human consumption.

**Communal Impact:** Local communities are significantly impacted by mining in general, including lawful mining. While mining can have positive economic effects, such as increased employment and income, it can also have negative social and cultural effects on the residents of a community.

The living conditions of the locals in those areas who rely primarily on the land for their livelihood are known to be negatively impacted by mining operations. The majority of the native population makes their living mostly from farming and the selling of farm products. However, mining enterprises frequently dispossess and evict landowners, depriving them of their sole source of support. For instance, farmers in Tarkwa have lost their fields to mining operations as a result of mining operations.

It becomes difficult for the former landowners to make ends meet because they are left in poverty.

The community as a whole, which is reliant on farmland for its food supply, is likewise threatened

by eviction and displacement. The loss of fertile and arable land has increased the demand for food, which has resulted in a rise in food prices and a high cost of living. All local residents suffer in these intolerable circumstances brought on by the loss of land rights, but women and children suffer more than any other group.

In communities where particular geographical regions, sacred groves, or forests have special spiritual or cultural importance, mining operations may also have a negative influence on the history of such communities. Native inhabitants of those regions may completely lose their sense of cultural and social identity as a result of the ensuing displacement.

It is important to note that stronger institutional mechanisms are required to handle the menace of galamsey which poses a great threat to Ghana's fresh water resources among others. The involvement of foreign nationals in activities which are viewed as criminal from a Ghanaian perspective may brew diplomatic tensions if foreigners keep worsening the fight against galamsey. Although Ghana has good relations with countries of these foreigners, the fight against galamsey might be the source of diplomatic tension between Ghana and the home countries of these foreigners. For instance, Ghanaian and Chinese bilateral relations which date back to 1960 and where cooperation between the two countries have seen quite a number of Chinese businesses in Ghana as well as quite a number of Ghanaian students getting the chance to study in China on scholarships (Myjoyonline, 2021).

Given that the effects of galamsey amid global trends such as concerns about climate change poses a serious environmental threat to Ghana as a country. The right mechanisms must be implemented to ensure diplomatic relations are not negatively impacted by galamsey.

### 3.2.2.3 Economic Importance of these resources

As earlier shown in this chapter (Fig 2), profiling of Ghana's water resources showed that there are a variety of economic contributions that fresh water resources make towards the national, economy to enable the country trade internationally. For instance, a look at fig 2, that displays the distribution of water resources indicate that the greatest proportion of available water resources goes to agricultural activities which is a major contributor to Ghana's Gross Domestic Product. Commodities like cocoa and coffee are major exports of Ghana's economy. Some economic benefits of fresh water resources to the Ghanaian economy as outlined by some writers (Yeleliere et al, 2018; Agodzo et al, 2023) include the following:

**Agriculture and Food Security:** Freshwater irrigation is crucial to Ghana's agricultural industry, which considerably boosts food production and security. Reliable water sources are essential for irrigation-based agriculture, including the production of grains and vegetables. The main rivers of Ghana, especially the Volta River, provide irrigation water, allowing for cultivation of crops even during dry seasons. The main element of conflict that is likely to occur here bores down to farmers needing significant amounts of water for irrigation. If water is scarce or misallocated, agricultural output can suffer, leading to food insecurity and livelihood challenges, leading to disputes with other water users. That is to say, the agricultural sector's dependence on water for irrigation makes it vulnerable to conflicts when water is insufficient or redirected to other uses. This can lead to reduced crop yields and impact food security, causing tension between farmers and other sectors.

**Hydropower Production:** The Volta River and other freshwater bodies are crucial for the production of hydropower. Hydropower is used to generate a sizable amount of Ghana's electricity at the Akosombo Dam on the Volta River. Generation of hydropower

The three hydroelectric facilities, Akosombo (1,020 MW), Kpong (160 MW), and Bui (404 MW), have a combined installed capacity of almost 40% hydropower. After Akosombo Dam was completed in 1964, an artificial lake covering around 8,300 km<sup>2</sup> was created. About 71% of the world's renewable surface water resources are used in hydropower generation, according to the Ministry of Water Resources, Works, and Housing (MWRWH), 2012.

Hydropower helps the industrial sector expand, domestically supply electricity, and lessen dependency on pricey imported fossil fuels.

**Industrial Activities:** Freshwater is essential to many activities in the mining, industrial, and textile industries, including cooling, cleaning, and production. Access to dependable freshwater sources promotes industrial expansion and helps to create jobs. One major element of conflict that arises from these activities lies with industries requiring large quantities of water for operations. This can lead to shortages for other users and pollution of water sources, causing conflicts with communities and the agricultural sector. In other words, industrial activities often consume substantial amounts of water, leading to potential shortages for other users. Additionally, industrial processes can contaminate water sources, exacerbating conflicts with communities and farmers who rely on clean water for their livelihoods and daily needs.

Nevertheless, tourism and recreation opportunities include boating, fishing, and other water sports in freshwater bodies of water like Lake Volta and the various rivers. Freshwater resource-related tourism can boost local economies, bring in money, and create jobs. Ghana's 550 km of shoreline, which includes about 90 lagoons in addition to estuaries and associated floodplains, is threatened by sea erosion in some areas, but it also offers opulent hotels, opportunities for water sports, and bird watching (Yankson and Obodai, 1999; Ansa-Asare et al., 2012). The Volta Lake, the lower Volta River at Sogakope and Ada, and a few smaller inland lakes (such Lake Bosomtwi) offer

brehtaking scenery as well as opportunities for boat rides and water sports. Waterfalls are a prominent tourist attraction in Ghana. There are over 10 of them, with the majority located in Ghana's Eastern and Volta Regions. Such waterfalls are appropriate for the Mampong—Akwapim—Togo ranges, which are supported by the landforms in these two locations. The waterfalls in the Eastern Region at Boti, the Volta Region at Tagbo, the Bono East Region at Fuller, the Bono East Region at Kintampo, and the Volta Region at Wli are noteworthy. The highest waterfall in Ghana and all of West Africa is the Wli waterfall, which rises to a height of about 80 meters.

**Fisheries and aquaculture:** Ghana's freshwater resources provide a favourable environment for significant fisheries and aquaculture operations, which feed both domestic and international demand for fish products. A sizable section of the population is employed by the fishing sector, which also generates revenue. The most significant inland fishing source is the Volta Lake, which has up to 32 landing locations and frequently doubles as a marketing hub. Among them are Kwamekrom, Tepa Abotoase, Dzemeni, Akateng, Dambai, and Kpando Torkor. An estimated 16% of all fish caught in Ghana come from the Volta Lake. Other sources of fish include diverse surface waters and coastal lagoons, in addition to fish aquaculture.

**Water Supply for Domestic usage, Sanitation, and Municipal Services:** Consistent availability to safe, clean, and freshwater is crucial for domestic usage, sanitation, and municipal services.

A sufficient quantity of water increases general quality of life, lowers healthcare expenses, and promotes public health.

Given the economic importance of water resources to Ghana's economy, fresh water bodies such as the Volta River that are transboundary in nature require continued diplomatic cooperation

among riparian states. Stronger water governance mechanisms in addition to the existence of the Volta basin authority as a regulatory institution such as continuous assessments to embrace future changes that may alter availability of water resources.

Furthermore, fellow riparian states such as Ghana and Ivory coast that are the two main exporters of cocoa require constant cooperation due to previous water resources issues regarding territory. After the maritime dispute was settled, it is important to ensure that other water resources such as the Bia River (which has been destroyed by mining activities) that flows into Ivory coast doesn't brew any future tensions between the West African neighbours (Tetteh, 2021).

This clearly gives the indication that communities need water for basic needs such as drinking, cooking, and sanitation. Competition with agricultural and industrial users can lead to conflicts, impacting public health and quality of life. Thus, the basic necessity of water for daily life means that any shortage or contamination caused by agricultural or industrial use can significantly affect communities. This can lead to disputes as communities fight to protect their access to clean, safe water for health and sanitation.

## **CHAPTER 4**

### **SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

#### **4.0 Summary of Findings**

Following review of literature, and analysis of content from secondary sources in relation to the research topic and its objectives, the study was able to come up with the following findings.

First of all, the term conflict doesn't necessarily refer to the use of violent means in a case of disagreement to iron out the differences of the parties involved as usually perceived. It may involve incompatible goals of parties which may be resolved via non-violent means. However improper management of the situation may result in the use of violence by either side which may result in a corresponding response.

Also, the study identified that water resources though abundant, is a finite resource based on availability of fresh natural resources. These fresh water resources constitute just 2.5% of water on earth with the rest being salt water. However, it is worth noting that two thirds of the freshwater resources are frozen in polar ice caps and glaciers. The remainder that is available is located above the ground or in the air and the majority being groundwater.

Furthermore, the study also revealed the increasing pressure on water resources available for use. These resources are mostly declining in quantity and quality due to issues like pollution, climate change and population growth among others. Water is also becoming increasingly unpredictable due to shifting hydrological cycles.

In addition, the study found that the available freshwater resources are mainly from surface water, under river flow, ground water and frozen water. However artificial sources may also be a source of water.

The study also found that there is a certain mechanism that help to manage available water resources. Although these are usually able to address water management issues at a given time, they fail to factor in prospective future issues such as climate change, extreme weather events and growing urban demand which directly influence water supply.

Also, the study found that, the decline in the availability of water may result in conflict which is usually triggered by a lack of efficient governance and management of these resources. It is worth noting that there are quite a number of water conflicts around the world. This study identified that of the Nile basin, the Euphrates - Tigris basin, and the Arpacay river which is a shared boundary between Turkey and Armenia.

The study identified that Ghana's surface water resources are derived from three river systems, which include; the coastal river system forming 8% of surface water, south – western river system

forming 22% of surface water and the Volta river system which is the largest, contributing 70% of surface water in Ghana. However, there are other sources of water which include impoundments or reservoirs and ground water sources.

Also, the study found that agriculture uses water the most, consuming 48%. Next is Domestic use which utilizes 37% of our fresh water resources and then 15% consumed by industrial use.

The study found that Ghana is signatory to some international agreements and a member of international bodies that seek to achieve cooperation on international water bodies, among riparian West African states.

In addition, galamsey is a major threat to water security that has a lot of foreigners involved in the menace which continues to be problematic for Ghana. It galamsey does not only destroy water resources but other related resources such as land for agricultural purposes. It also has an impact on the Ghanaian society where women and children are most vulnerable.

Finally, the study identified that the Ghanaian economy is heavily reliant on these available natural resources. Aside from them being the major source of electricity, they serve agricultural purposes as well as recreational purposes such as tourism.

#### **4.1 Conclusions**

Based on the findings of the study, the following conclusions can be drawn.

Despite Ghana being a signatory or member of international conventions or organisations that seek to achieve cooperation on the use, it hasn't been able to effectively manage available water resources. There is still much to be desired in terms of Ghana's responsibilities regarding water governance. This is because Ghana has not been able to effect mechanisms to deal with internal threats to water security such as pollution.

Also, there are overlapping roles or responsibilities of institutions involved in the management and control of these transboundary water resources. Institutions such as the Volta Basin Authority and the Water Resources Commission, tend to perform the roles advisory bodies other than the role of enforcement agencies. Most often, their roles do not allow them to effectively ensure that parties involved in management of transboundary water bodies fulfil mandates that have been assigned them.

In addition, galamsey which is a national issue may tend to affect Ghana's diplomatic relations. Besides the obvious destruction of the environment and other resources that are shared by Ghana and its neighbours, The practice involves foreigners who are immigrants of countries with whom Ghana has diplomatic ties if the issues of foreign nationals' involvement in a criminal act is not properly handled.

Furthermore, if galamsey as a national threat to water security is not properly handled and dealt with, tensions may develop between Ghana and its neighbours especially Ivory Coast. It is essentially important that it is prioritized due to the history of the Maritime issue that led both countries to engage in a legal battle. Ghana needs to work more efficiently to restore rivers such as Bia to their natural state to avoid flowing into Ivory Coast to pollute Ivorian river systems.

It is also important to note that galamsey has a menacing effect on other natural resources like forest reserves and other land resources which exposes Ghana's biosafety to danger.

The study also proved that Ghana's available water resources are a major contributor to the country's economy. Aside non – consumptive uses such as generation of hydroelectric power which powers most industries in Ghana, these water bodies serve as a source of employment for fisher folks as well as the hospitality industry. A reduction in the quality and quantity of these water resources imply a threat to the country's economic development.

To conclude, Ghana's water resources are facing a major decline in quality and quantity. As a result, Ghana as a country must effectively manage these resources to help sustain water resources for the future amid threats of climate change, population growth and galamsey which has foreigners involved being a criminal offence. In other words, regimes must be strong enough to embrace increasing scarcity of fresh water resources.

#### **4.2 Recommendations**

**Improve Water Governance:** Establish and implement thorough frameworks for water governance to efficiently handle internal risks to water security, like pollution. This could entail more stringent laws, procedures for enforcing them, and public awareness initiatives.

**Encourage Regional Cooperation:** To solve shared difficulties pertaining to water resources, foster closer cooperation with neighbouring nations, particularly Ivory Coast. Create joint committees or forums with a focus on collaboration rather than rivalry to manage transboundary water bodies effectively.

**Improve Institutional Cooperation:** Clearly define and simplify the functions and duties of the institutions in charge of managing transboundary water resources. Make that organizations with the power to implement restrictions, such as the Water Resources Commission and the Volta Basin Authority, exist.

Engage in diplomatic activities with neighbouring nations to address common environmental concerns. To combat the involvement of foreign nationals in illicit activities impacting water resources, diplomatic channels can be used.

**Economic Diversification:** Adopt measures to diversify the economy and lessen reliance on water-intensive industries while acknowledging the economic significance of water resources.

Encourage environmentally friendly methods in industries and agriculture to reduce water consumption.

**Invest in Technology and Research:** Provide funding for the creation of technologies and research related to the management of water resources. This comprises early warning systems, creative approaches to sustainable water use, and tools for assessment and monitoring.

In conclusion, in order to preserve the long-term survival of water resources, resolving the possible international conflict over Ghana's water resources necessitates a multifaceted approach that incorporates efficient government, regional collaboration, diplomatic involvement, and sustainable practices.

#### **4.3 Areas for further research**

**Impact of Climate Change on Water Resources:** Examine how Ghana's water resources are specifically affected by climate change, taking into account modifications to precipitation patterns, fluctuations in temperature, and the frequency and severity of extreme weather events. Examine the effects on the availability and quality of water.

**Water Resources and International Legal Frameworks:** Assess the efficacy of international agreements and legal frameworks pertaining to water resources, including transboundary rivers. Analyse their effect on Ghana's capacity to control shared water resources and avert confrontations.

**Technological Solutions for Water Treatment and Conservation:** Conduct cutting-edge research and create cutting-edge technology to treat and conserve water. Evaluate practical, affordable, and sustainable ways to lower pollution, improve water quality, and increase water-use efficiency.

Examine how environmental diplomacy can help to reduce the likelihood of disputes related to water resources. Examine effective instances of international cooperation in tackling common environmental issues and their relevance to the West African region.

These fields of study can provide important new perspectives on how to manage Ghana's water resources in a sustainable and collaborative manner.



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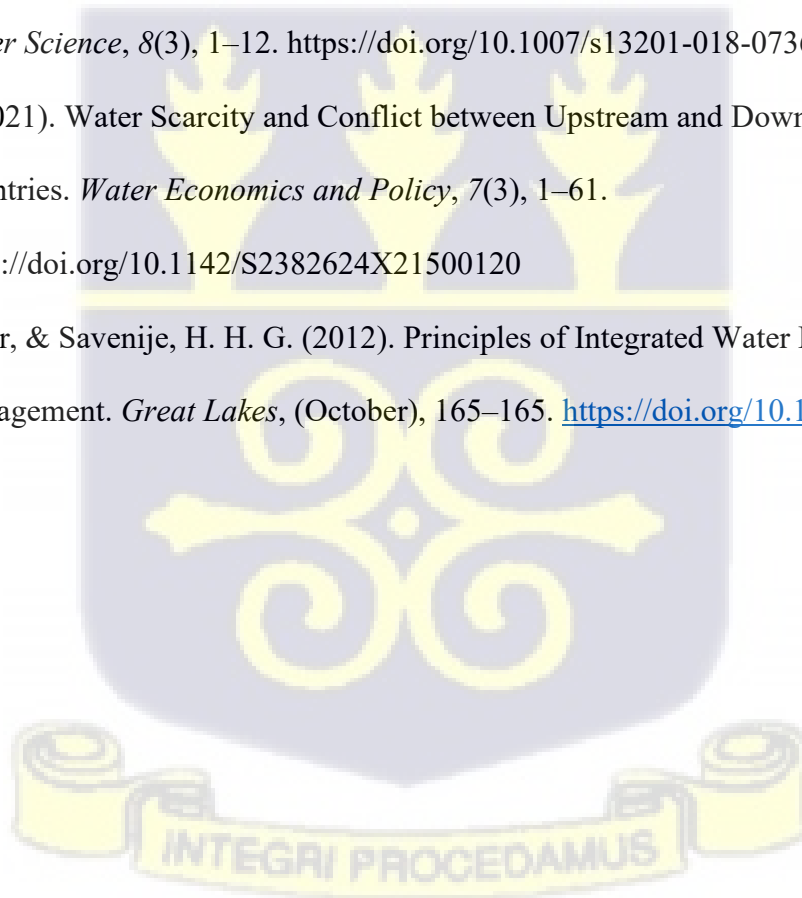
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### Appendix A: Interview Guide

1. In your opinion how effective do you think current laws and regulations are in managing water resources?
2. What are the main institutional challenges in managing and controlling water resources in Ghana?
3. How do environmental factors such as climate change and pollution impact water security?
4. In your opinion, to what extent does Galamsey impact Ghana's water security?
5. How effective are the measures taken to combat Galamsey?
6. How significant are water resources to Ghana's economy?
7. What strategies are being implemented to ensure the sustainable use of water resources for economic development

