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TRADITIONAL MECHANISMS IN MANAGING THE IMPACT OF CLIMATE CHANGE ON WATERSHEDS IN GHANA: A REVIEW

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Abstract

Purpose — This review article aims to provide an analysis of traditional mechanisms in managing the impact of climate change on watersheds in Ghana which will influence projected adaptation.
Methods — A literature search was undertaken to identify pertinent empirical studies published in scholarly journals.
Findings — The study identified that a watershed is more than just a hydrological unit; it is also a socio-political and ecological system vital to rural communities' survival by influencing their access to food, social services, and economic opportunities. Concerns about climate change have, for the most part in literature, been focused on vulnerability and mitigation, while adaptation at the community level has been largely ignored.
Conclusion & Recommendation — This study recommends that traditional indigenous knowledge be included in formal watershed management policies and practices for effective conservation.
Keywords — Watersheds, traditional mechanisms, climate change, indigenous knowledge

Introduction

Due to the prevalent poverty and already inadequate development levels, climate change is having a negative impact on rural landscapes as a result of a severely limited capacity for adaptation. In rural parts, the implications of changes in climate on water availability and food security are felt (IPCC, 2014). Changing patterns of rainfall, which leads to a decrease in agricultural production, is one of the most significant long-term effects of climate change (Asante and Amuakwa-Mensah, 2014). In 1992, at the Earth Summit in Brazil, Ghana became one of the countries to put its name to the United Nations Framework Convention on Climate Change (UNFCCC) (Mensah, 2022).

The inability of the Ghanaian government to implement adaptive measures to address environmental issues and the socio-economic consequences of climate change is the root cause of the negative

effects that climate change is having on the Ghanaian economy. (Asante and Amuakwa-Mensah, 2014). Due to the role watersheds play in the lives of rural communities, over the years, they have developed conventional systems for regulating the effects of climate change to derive maximum benefits for the watershed without destroying them. These traditional mechanisms are in the form of knowledge and practices of rural people gained over time through experience as well as verbally handed them from past generations. Because rural people live close to natural resources such as watersheds They frequently watch the activities going on in their environment and are the first to recognize and build methods to adjust to any changes that may occur.

Climate changes have both direct and indirect impacts on watersheds as well as other natural resources which also affect human activities and wellbeing. According to Huntington T. (2008), the increasing atmospheric carbon dioxide concentration affects the water balance through climatic changes and changes in hydrological conditions. Climate change, therefore, induces major changes in the earth's water cycle. Literature (Ficklin *et al*, 2022; Massari *et al*, 2022; Kahaduwa and Rajapakse, 2022; IPCC, 2014) attest to the fact that an increase iin evaporation would significantly affect water resources. Climate change also has a potential effect on vegetation (Cameron *et al*, 2021; Del Río *et al*, 2018; IPCC, 2014). Vegetation cover is very important for the health of watersheds as well as the quality of water. A vegetative cover helps to prevent the erosion of valuable soil as well as provide food and protection for many small mechanisms. According to Soliman *et al* (2023), as these vegetative covers change due to climate changes, there is an important impact on the amount of water intercepted and the underground water recharge.

Lyra and Loukas *et al* (2022) have noted that the hydrological effect of climate change will have an important impact on watersheds and many other areas due to predicted changes in precipitation. Countries in West Africa such as Ghana have been predicted to experience a decrease in rainfall. Watersheds derive their major water source from rainfall therefore a decrease in rainfall will affect them negatively and its ripple effect on agricultural activities, forestry and fisheries, the mainstay of rural communities. Human settlements, both urban and rural will also be affected. Ultimately groundwater recharge and storage will also be affected. According to Gomez *et al* (2022) in Northern Ghana, for instance, high temperatures are continually being recorded while rainfall has become more difficult to predict. In recent years extremely, heavy rainfall has frequently ended abruptly, leading to circumstances of drought. These floods have been responsible for the destruction of crops, as well as humans and properties. People in rural communities have over the years identified and has been exposed to the effect of changes in climate on their maintenance and habitat. They have vital expertise in acclimatizing to changes in climate, but the severity of future threats may surpass their potential for adaptation, particularly given the marginalized situations in which they currently find themselves (Macchi M. *et al* 2008). The possible effects of climate change on the livelihoods and cultures of indigenous and traditional groups are still little understood, according to Macchi M. *et al*. (2008). This study therefore will examine and understand the existing coping mechanisms, what their limits are and how they can be modified to adapt adequately to the consequences that climate change will have on them.

The health of a watershed is intrinsically linked to the availability of trees and forests. There is a positive correlation between watersheds and land use (Tang 2005). Ideally, the best condition for a watershed is when there is no development. However, due to the need for resources to satisfy

human needs, this ideal situation is not possible. Climate change has had three (3) major impacts in Ghana in the form of changes in temperature, sea level rise and change in rainfall (Owusu *et al*, 2008). According to Carson (1992), a variety of human activities, including the spread of agriculture, the inappropriate collection of fuel wood and lumber, the ignition of brushfires, and the construction of cities and other infrastructures, are to blame for the degradation of watersheds. Watersheds in most Ghanaian communities were managed solely by the inhabitants within the catchment areas based on traditional belief systems (Bullock, 2008). The use of these belief systems such as sacred groves and taboos deterred individuals from impinging on watersheds (Opoku- Agyemang, 2008). People who resided within the catchment area had respect for the traditional beliefs because they were dependent on their local and cultural structures and so it helped in protecting the watersheds. The effect of these beliefs is reduced due to the advent of urbanization, western education and Christianity, coupled with a strong motivation to improve the country's overall resource situation (Opoku-Agyemang, 2008).

The advent of climate change and its implications for the environment further erode the capacity of local communities to effectively manage the watershed. Concerns about climate change have, in general, been centred on concerns of susceptibility and mitigation, to the neglect of adaptation efforts in local communities. As a result, the objective of this study is to do a review of traditional mechanisms in managing the impact of climate change on watersheds in Ghana. Within the context of planned adaptation, the significance of this research cannot be overstated. The study will be especially beneficial and valuable in terms of increasing one's knowledge and capabilities. Now that people all over the world are feeling the effects of climate change, it is the responsibility of governments, businesses, NGOs, and CBOs to devise plans to mitigate the damage, starting at the grassroots level, where communities are suffering the most. This study would provide policymakers with the necessary, pertinent, and most up-to-date knowledge to enact sound laws about the adaptation to climate and management of watersheds.

Methods and Materials

This study reviewed literature in peer-reviewd journals on watersheds management through traditional mechanisms. Using internet databases including Web of Science, Scopus, and Google Scholar, a search of the existing research was carried out to compile the information for this review. The search terms used were: "watershed management", "traditional watershed conservation", "watersheds in Ghana", "sacred groves", "climate change' and "indigenous knowledge". After conducting a preliminary analysis to determine whether or not the search engine results met my criteria, I went back through the remaining articles and selected the ones that included the data that would be most beneficial to the study.

Review of Related Studies

Katusiime and Schütt (2020) examined and compiled studies that addressed watershed concerns, integrating elements of land tenure to determine the significant roles, complexities, and factors that influence land tenure on integrated watershed management. This was done to investigate the impact that land tenure has on natural resource management in watersheds. They observed that land tenure plays a variety of functions in watersheds and, consequently, in integrated watershed management as

a methodology—as a change agent, a factor in investment options, a motivator for the implementation of strategies, and a factor in promoting sustainability. They, therefore, propose that to manage all resources and interests in drainage basins for both environmental and socioeconomic goals, an integrated approach is ensured by the method.

Supangat *et al* (2021) examined inclusive planning for micro-watershed management that takesinto account local socio-cultural, economic, and environmental considerations in Indonesia. They noted that because the land and water are communal resources and the main means of subsistence for locals, conservation is comparatively challenging. They believe that by considering the socioeconomic circumstances of surrounding communities and the ecological attributes of the watershed, upstream watershed management must safeguard soil and water. Therefore, their study suggests that micro-watershed management that makes use of nature and indigenous knowledge is essential to ensuring that the management of the watershed is sustainable from the upstream areas to the parts that are further downstream. According to Perry and Thompson (2019), the increasingly prevalent societal issue of water resource management is framed by the ambiguities and unreliability of change in the climate. With an emphasis on vulnerable people, Perry and Thompson (2019) adopted a pedagogical interactive and constructivist design to encourage a greater awareness of ecosystem-based watershed management under diverse climatic predictions. Their study advances that to support choices that promote access to water as a human right amid uncertainty, prospective watershed managers will need to be able to collaborate across social, cultural, and economic divides.

An increasingly vital component of watershed management is an adaptation to climate change as highlighted by Qiu *et al* (2019). Their study set out to measure the consequences of a changing climate on watershed hydrological processes and quality in assessing the effectiveness of what they term Best Management Practices (BMP) to lessen the effect that climate change has on the world's water supplies.

Indigenous Knowledge and watershed protection

Indigenous ecological knowledge can be put to use to detect and keep track of shifts in the local environment, such as variations in the amount and purity of available water. This knowledge can assist locals in adjusting to shifting conditions and developing efficient management strategies for their respective watersheds (Bannister *et al*., 2014). Indigenous people have cultivated religious and cultural attachments to water and watersheds, which can assist to build a sense of stewardship and respect for these natural resources. It is feasible that it will be possible to improve the health of watersheds while simultaneously sustaining significant cultural traditions if conservation policies are developed that considers indigenous customs and expertise.

Millions of people's means of livelihood are at risk due to watershed deterioration in many underdeveloped countries, which also limits their potential to build strong agricultural and natural resource foundations (Aglanu, 2014). Traditional knowledge has been with Africans since time immemorial and has informed their relationship with the environment. In fact, according to Mbah *et al* (2021), Africans have a long history of using Indigenous and Local Knowledge (ILK) to guide their adaptations to climate fluctuation and changes, which makes the continent particularly rich in ILK. Indigenous knowledge techniques according to Osei (2023) could be used to solve Ghana's water resource crisis.

It is feasible that it will be possible to improve the health of watersheds while simultaneously sustaining significant cultural traditions if conservation policies are developed to take into account indigenous customs and knowledge.

The Role of Sacred Groves in Watershed Protection in Ghana

For years people in Ghana have been discouraged from intruding into watersheds by the use of taboos and sacred groves (Opoku-Agyemang, 2008). There are between 2,000 and 3,200 sacred groves in Ghana, with roughly 80% of them situated in the south (Nganso *et al*, 2012). The conservation and restoration of watersheds is one major ecological activity of sacred groves in Ghana. Due to their cultural, religious, and traditional spirituality, sacred groves preserve virgin or secondary forest areas with abundant biodiversity that have been preserved for generations. Indigenous Ghanaians have faithfully protected swathes of forest and water sources for ages. Despite their significance, the history and motivation for the creation and preservation of sacred groves—a key element of traditional conservation practices—remained murky (Blicharska *et al,* 2013). Nyamekye (2014) posits that the folklore and mythology surrounding the origins of sacred groves suggest religious rather than environmentalist motivations, despite the assertions of community members to the contrary.

Referencing the Tanoboase Sacred Grove in the Bono East Region, Ghana, Imarhiagbe and Ogwu (2022) assert that sacred groves are believed by natives to be the abode of gods and therefore perform rituals to honour them. The Tanoboase Sacred Grove is the source of the Tano River. Other major rivers in Ghana, that take their sources from sacred groves are the Ankobra, Pra and Densu rivers which take their sources from the Ankasa, Bosomkese and Atiwa forest reserves respectively which serve as forest reserves for the local people. The River Tano is considered a sacred god according to traditional beliefs, hence fishing is forbidden there and, consequently, the river is protected. Due to the reverence attached to them, sacred groves contribute a significant ecological role in watershed preservation and protection. The presence of trees in sacred groves contributes to the prevention of erosion, the slowing of runoff, and the enhancement of infiltration, all of which help to keep groundwater recharged and control water flow. Also, the roots of trees in sacred groves assist in absorbing excess nutrients and contaminants, which stops these substances from entering water bodies and adding to the problem of water pollution.

As a whole, protecting sacred groves in Ghana can help keep watersheds healthy and productive, and it can serve as an excellent model for combining traditional and ecological values in pursuit of sustainable development.

The Challenges of Traditional Mechanisms in Watershed Protection

The protection of Ghana's watersheds, which are essential to the country's overall socioeconomic development, has been accomplished through the employment of traditional procedures for generations. Unfortunately, these conventional systems are up against several obstacles, which hinder their ability to ensure the conservation efforts of watersheds. Traditional authorities, also known as the keepers of indigenous knowledge systems, have instituted punitive measures, such as fines, expulsion, and other forms of punishment, to deter local communities from disregarding indigenous conservation practices. However, Kosoe *et al* (2020) have noted that formal schooling, the spread of Christianity and Islam, in addition to urbanization, has become a major issue that raises

serious questions about the viability of Ghana's current indigenous knowledge systems and the possibilities that exist for the preservation of these systems.

Conclusion and recommendations

Traditional knowledge is essential to the maintenance of the watersheds in Ghana so that they can continue to function properly. This study recommends that traditional indigenous knowledge be included in formal watershed management policies and practices. Traditional watershed conservation strategies in Ghana face a complicated and diversified set of issues. To effectively address these difficulties, there will be the need for a collaborative effort on the part of every relevant party, comprising non-governmental organizations and community groups as well as official entities. To have a complete understanding of the part that indigenous knowledge plays in the management of watersheds in Ghana, additional research is required.

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