

Research Article

The Role of Tribal Leaders/Traditional Leaders in Regulating Land Use and Biodiversity Among the Gurune-Speaking People of the Upper East Region in Ghana

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Abstract

Regulating land use and the biodiversity of a region requires lasting accords between those who make the decisions and those who are affected by the rules and regulations. In Africa, these accords depend on the effectiveness of the collective efforts of the representatives of the legal authorities and the civil society (the traditional leaders in the tribal system). In this study, we investigated the role of tribal leaders in conserving biodiversity (which is a base for obtaining accords with statutory regulations), the value of biodiversity for the tribal communities, and the role of the interaction between tribal leaders and legal authorities in successfully implementing the objectives of biodiversity. Successful collaboration requires indigenous regulatory systems to be merged with existing modern or statutory laws to ensure sustainable land use, the conservation of natural resources, and the promotion of biodiversity. To examine this relationship, we conducted in-depth interviews with key stakeholders of the Gurune-speaking people in the Upper East Region of Ghana. We found that the indigenous



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people still preserve and apply the norms for conserving nature that they inherited. These findings highlighted the importance of including indigenous tribal authorities in planning strategies and developing policies and regulations. This collaboration ultimately creates a harmonious balance between nature and the social well-being of the community.

Keywords

Ghana; biodiversity; indigenous culture; traditional leaders; land use

1. Introduction

Although there are practical, legislative, and policy-related issues in conserving biodiversity, the foremost concern is the need to balance biodiversity with all the other challenges of sustainable development, as stated by the United Nations General Assembly in their 17 Sustainable Development Goals (SDGs) in the 2030 Agenda (see example in <https://sdgs.un.org/goals>). The successful implementation of these goals requires the consent of all relevant authorities, developing agencies, and civil society. Biodiversity is specified in several SDGs. Goal 15 of the SDGs involves “protecting, restoring, and promoting sustainable use of terrestrial ecosystems, sustainable management of forests, combating desertification, halting, and reversing land degradation and stopping biodiversity loss”. Some aspects of biodiversity are also mentioned in Goal 12 (on sustainable consumption and production patterns), Goal 13 (on combatting climate change and its impacts), and SDG 14 (on the sustainable use of the oceans and marine resources). Biodiversity is further discussed in Goals 1 and 2, as the preservation of a decent livelihood and the removal of poverty and hunger depend on the health of the biosphere. Similarly, maintaining good health and providing quality education (Goals 3 and 4) requires harmony among humans and between humans and their environment.

The SDGs are an international agreement and encourage initiatives and changes on a global scale. Recognizing that “all business starts local” is as important as the agreement among international bodies (public and private). Thus, sustainable development and biodiversity must be implemented as a bottom-up approach. Like the aforementioned interrelations between the SDGs, while implementing measures at any level (local, regional, or global), the interconnections among the different parties must be considered. However, civil societies need to accept different types of intertwinements. For example, in Africa, indigenous wisdom has maintained a balance between measures and policies for development throughout the ages [1]. Our research, which is focused on the rural communities in Ghana, has shown that in such communities, traditional rules and regulations have always guided the use of land and the preservation of the environment [2]. These regulations are generally administered by the leaders of these communities. If state authorities respect and collaborate with these leaders, the conservation of biodiversity and improvement of the well-being of the people can be achieved harmoniously.

In the past, tribal leaders were obeyed by their village or community members and instituted by the people (living and dead) and the gods. Thus, they were revered, and their instructions were promptly obeyed to avoid punishment from the gods and the ancestors. However, in the modern age and with the incorporation of new technologies in daily lives, along with the presence of other

religious practices and the commodification of land, these ‘traditional conservation laws’ are threatened, they are no longer adhered to, and the reverence of the implementers (the chiefs and earth priests) has decreased. This divergence has important implications for sustainable land use and the conservation of biodiversity.

However, new initiatives have been taken to reduce and/or revert this threat. One such initiative proposed the preservation and application of traditional wisdom for sustainable development by creating regional centers that can maintain this body of knowledge and make its many applications available. To implement this, the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS; <https://ias.unu.edu/en/>) created the Education for Sustainable Development (ESD) Program and built a global network of more than 100 Regional Centers of Expertise (RCEs) on ESD. This scheme helped to form partnerships between educators, researchers, policymakers, tribal leaders, and youth leaders within local communities who could provide indigenous sources of knowledge [3]. Another approach involved the development of communities of practice between tribal leaders and the government. This approach aimed to establish groups that would co-create new compounds of shared knowledge and form standing committees to build strong bonds within stakeholder groups and establish commonly accepted solutions to problems related to conflicts (such as land-use and biodiversity-related issues [4]). In Africa, this approach helped to resolve issues effectively in some cases. For example, the South Africa-based sugar company Illovo established a “land champion” for each of its harvesting sites. Reports on the U.S. agro-industrialist Cargill showed how the firm involved all stakeholders when diversifying from cocoa to sugar in Ghana [5]. Ensuring that the interests of all stakeholders are heard is similar to having a common understanding of the principles. In our study, one ruling principle is that all outcomes are based on the “African worldview”.

2. Cosmovision, the African Worldview, and Its Effect on Conservation

Cosmovision is the perspective of society and is deeply rooted in the way society is organized and evolves. It is the approach of society to explain and better understand its surroundings, including its place within the cosmos or the universe [6, 7], and it is rooted in religious beliefs, traditional beliefs, and cultural mores and practices. These strongly influence the effectiveness of the conservation of the environment and specific organisms, especially in developing countries [2]. Thus, the conservation of the environment and biodiversity is connected to the worldview of the people. According to Haverkort and Hiemstra [8], cited in Millar [9], the cosmovision of people dictates how land, water, plants, and animals are used, decisions are made, problems are solved, experiments are conducted, and people organize in rural communities.

African cultures liken the earth to the mother or womb. Earth is considered to be a deity, a property of the gods, and of the first settlers on the land. To Africans, land, water, animals, and plants are more than resources with an economic value. Some plants and animals have spiritual significance and are considered to be sacred. For example, snakes, lizards, chameleons, and certain birds are thought to be messengers of the spiritual world. Trees like the baobab and fig are considered to be sacred [5]. This view strongly influences how these species are treated. They are not killed or cut down intentionally. Even when destroyed accidentally, rituals are performed to avert consequential mishaps.

Cosmovision presents a hierarchy among the divine, spiritual beings, men, women, and natural forces such as climate, disease, floods, soil, vegetation, and animals. The elders of clans, families, priests, soothsayers and spiritual leaders are put in charge of the rites and rituals [4, 6]. This is common throughout Africa. An example is the cosmovision of the people in Northern Ghana (the Gurune-speaking people are a part of this community), as shown in Figure 1.

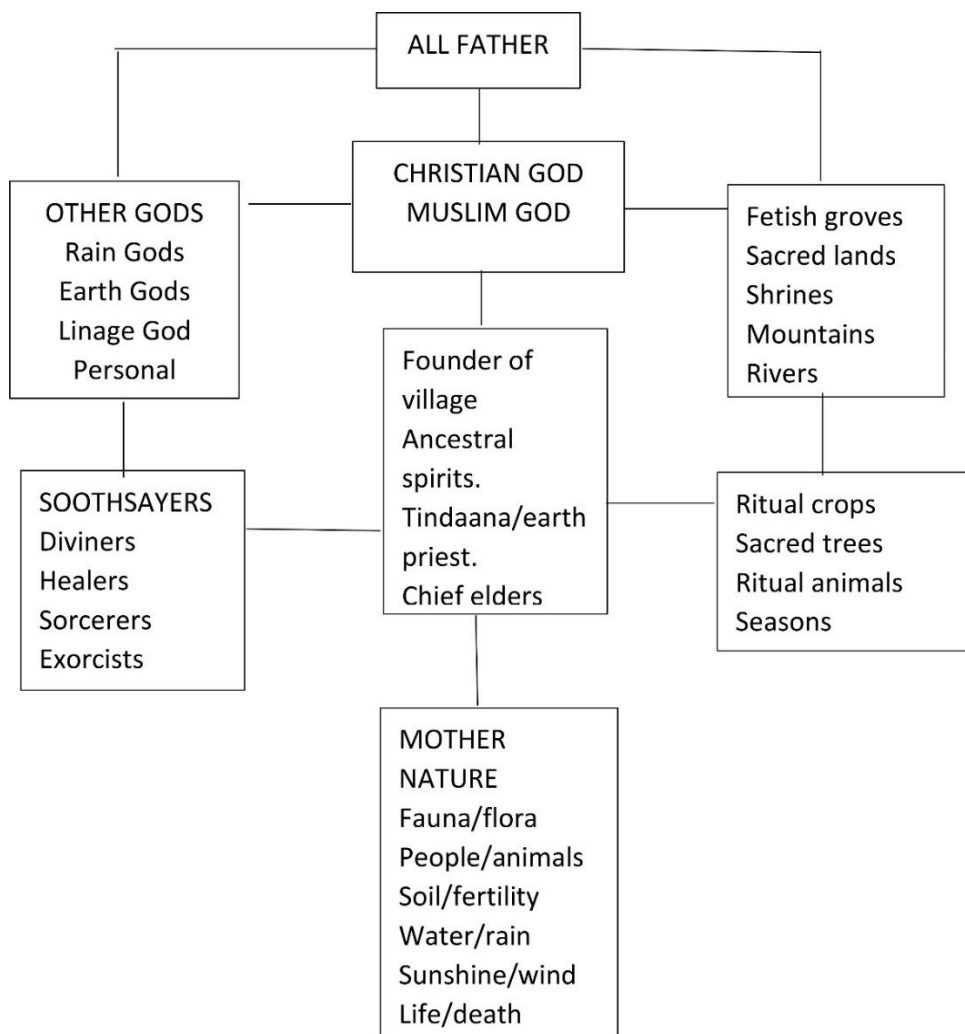


Figure 1 Cosmovision of the people in Northern Ghana. Source: Millar, 1999 [9].

As shown in Figure 1, “Mother Nature” and, specifically, (sacred) lands and trees, rivers, and mountains are cared for by the elders and priests. These are believed to have a vast knowledge of natural resources, and thus, the motivation to conserve the environment and biodiversity is linked to the cultures and belief systems of the people. In Ghana, the indigenous people have a reverential fear and respect for God (the supreme deity). Regarding the ancestors and the spirits of their land (see [10] for examples), Grim (2001) [11] reported that even with the advent of globalization and westernization, Africans still believe that nature and its resources are home to spirits, and this strongly influences their attitude toward nature. Thus, the belief that abusing nature will lead to the wrath and punishment of the spirits prevents harmful environmental practices [12]. Some of these punishments include untimely and disgraceful death, strange illness, and impotence among others. Owing to the belief of spirits inhabiting the things in nature, Adom et al. [10] noted that a typical member of the Asante kingdom in Ghana very rarely destroys natural resources.

Another aspect includes taboos and totems. They are fundamental for environmental conservation among Africans. The term 'totem' comes from a North American Indian language, which refers to vegetables or animals that are revered by individuals. Conversely, taboos refer to inhibition or a ban placed on something or an action. Taboos result from social customs, or emotional aversion declared as sacred and forbidden by people. Taboos are unwritten social rules that regulate human behavior [13], and among the Shona people of Zimbabwe, Chemhuru and Masaka [14] reported that taboos are more than a list of things to avoid or 'do not's' that are merely observed. Rather, taboos are a means of instilling the right conduct. Taboos associated with the environment entail prohibitions and restrictions on the unsustainable use of certain plant species, forests, mountains, rivers, pools, and some animals, among other species in the ecosystem. These practices are based on a long-standing tradition of the Shona people (ibid).

3. Tribal Leaders and the Conservation of Biodiversity

Similar to the example of Northern Ghana, a glimpse of how the tribal leaders of the Upper East promulgate their judgment is very telling. In this region, the main leaders are the chiefs and earth priests (tindaana). Both are custodians of the tribes or communities in different ways. The earth priest serves the land, while the chief serves the people [15]. Tribal leaders use traditional management practices to effectively preserve many tree species; however, these practices are not recognized by policies on conservation. These traditional institutions protect ecosystems and biodiversity without governmental or juridical restrictions [16]. Conservation is performed for various reasons, including the medicinal, spiritual, economic, and ecological values of plants.

The reasons that motivate traditional institutions to conserve biodiversity are not unique to African communities. A study on a tribal settlement in India showed how indigenous communities have developed solutions for symbiotic livelihood security and conserving biodiversity through decisions that are based on their age-old ethos of rural development and conservation [17]. A settlement is located at the edge of a protected area known as the Periyar Tiger Reserve. By cooperating with state authorities, the tribal leaders averted the threat of losing the genuine rural livelihood requirements through exaggerated measures to protect the tiger. The authorities respected the indigenous tradition of *jati panchayats*¹ and *gaon mokhi*², among others, and used these formats to cooperate with the tribal leaders. This also provided socio-economic benefits from tourism to the local people while they maintained and expanded their traditional source of income from cultivating and harvesting pepper (ibid)). This type of cooperation has become very common in Africa as well, not only in the context of preserving nature but also in mining (see, e.g., [18]). One way to deal with the issue of preservation is the concept of *Community Resource Management Area* (CREMA), which was developed by the Wildlife Division of the Forestry Commission of Ghana to promote collaborative and participatory wildlife management in the country. CREMA established local committees, which included all interested groups, including hunters, youth groups, farmers of baobab and shea or people who just pick these crops, and the tindaana, for exchanging ideas and making communal decisions [19].

¹ Jati Panchayat is the assembly of elders that controls the conduct of the members of a tribe ("jati") by traditional rules and regulations.

² The term gaon mokhi is used in Northern India for self-determination of village affairs by traditional leaders.

Another field where the intervention of African tribal leaders is indispensable and where benefit-sharing is an important feature is the REDD+ programs and policies (Reducing Emissions from Deforestation and forest Degradation and the enhancement of forest carbon stocks) under the United Nations Framework Convention on Climate Change. However, while this need is acknowledged, in principle, by the respective government authorities, for example, the Forestry Commission of Ghana [20] and the Ugandan Ministry of Water and Environment [21], the debate between the tribes and the authorities suggests that resource use inequalities might emerge and create new conflicts that can only be solved by changing policies and procedures. An important challenge is land tenure arrangements, which ignore tribal institutions and threaten to concentrate the benefits among a few powerful players [22].

Language barriers might be a key factor in hindering communication between tribal leaders and state authorities. This might also be the reason why heavy investments in development programs funded by international donors yielded insufficient outcomes [23, 24]. Thus, there are doubts regarding whether indigenous modes of communication can improve the interaction between the parties that are affected by sustainable rural development. For this, all who deploy information locally or nationwide must strive to improve the effectiveness of indigenous modes of communication while maintaining their originality, especially considering that modern systems are being introduced for the transmission of information. Such an approach can only succeed when the systems are connected to the culture of the people. Discussing the subject of biodiversity in cultural festivals and including the issue in the curricula of basic and second cycle institutions can better promulgate the topic when using indigenous modes of communication. When adopting an endogenous approach for development, radio programs that are broadcasted to the communities can help to bridge the gap [25].

The use of radio programs to connect to the younger generation is one feature that demonstrates a trend to alleviate the threat of dissociating from traditional institutions and disregarding the pronouncements of tribal leaders. Studies from the Kwame Nkrumah University in Kumasi, Ghana, have shown the prominent role of the Asante culture in biodiversity conservation in Ghana and how tribal leadership is prompted both locally and beyond the borders of regional communities through various means of communication (see [10] for examples). This is similar to the role of “climate ethics” in biodiversity conservation [26]. Ethics involves codes and norms that guide human behavior. It is similar to the pronouncements and belief systems of tribal leaders that their communities accept as their guiding systems. Ethical questions are fundamental to the main policies and decisions on biodiversity [27], and several environmental organizations uphold them. Based on their ethical principles, these organizations are the true protectors of biodiversity and practitioners of ecological sustainability. They communicate intensively and seek alliances with indigenous groups to ethically protect the ecosystem and biodiversity [28].

Non-governmental organizations (NGOs) also contribute positively by performing comprehensive work in education, health, agriculture, environment, and community development. For example, the volunteers of the U.S. Peace Corps facilitated communication among the bush burners, the leaders in their communities, and the state authorities in the savanna agroecological zone of Northern Ghana [29]. The findings were similar to those of other studies regarding the effectiveness of interventions in the domestic practices of rural farmers. Rather than forcing farmers to find alternatives to their traditional ways of increasing the availability of cultivable land and improving seed germination by bush burning, a more diverse set of interventions might be more

appropriate [30]. This should include input supply, support for value addition and processing, facilitating market access, and training or capacity building, thus, widening the development of water and irrigation, as well as storage facilities. Considering the ecological and socio-economic conditions of Northern Ghana, this type of intervention can have long-term benefits and help to conserve biodiversity [31].

Similar situations in South Africa have been solved without the participation of outside environmental activists through meticulous collaboration between the Zulu traditional leaders (“Amakhosi”) and the government. An example is the successful resolution of a problem between the local Amakoshi and the Department of Water Affairs and Forestry of South Africa concerning water management in the peri-urban area of Salem, Eastern Cape [32]. Although fewer Amakoshi were present in suburban environments than in rural areas, their intervention was diligently sought by state authorities. A survey was conducted where local leaders were interviewed. Their views helped to make a smooth decision [32] (pp. 85–92).

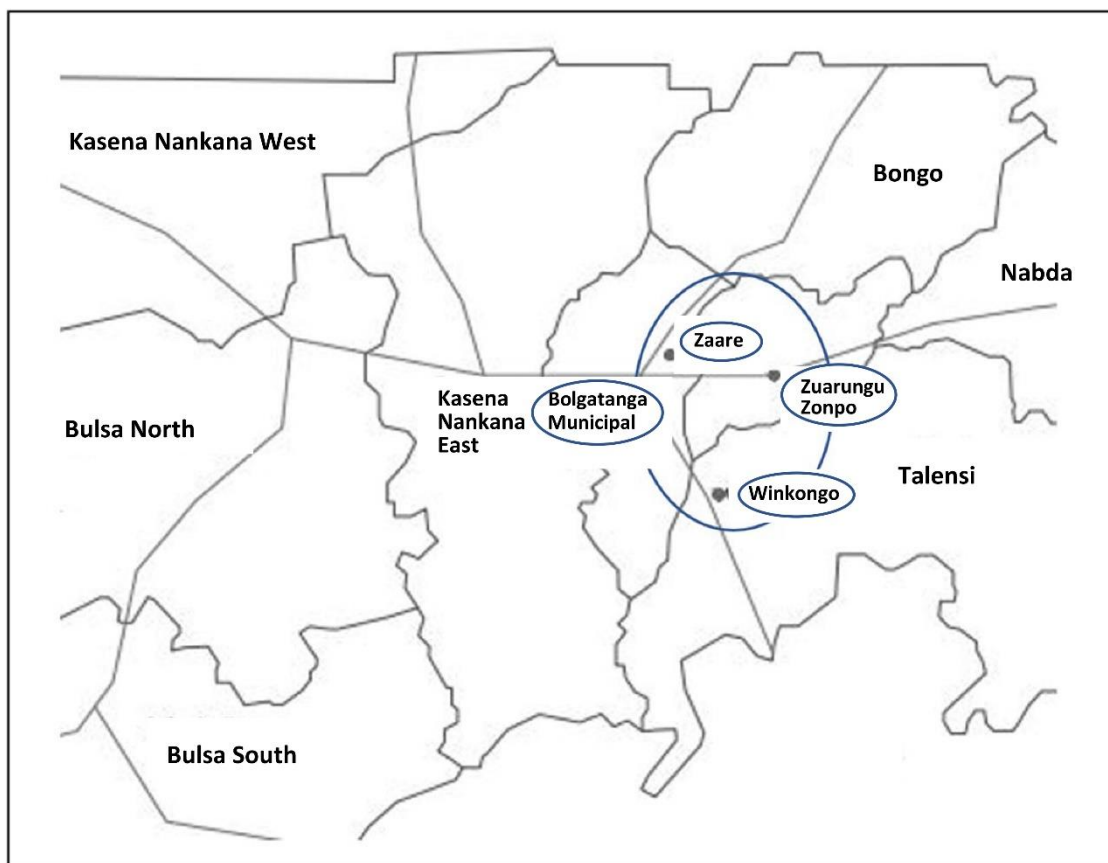
4. The Gurune-Speaking People

There are five administrative regions in Northern Ghana, including the Upper West Region, the Upper East Region, the Northeast Region, the Northern Region, and the Savanna Region. The Northeast Region and the Savanna Region were formed from the Northern Region in 2018. These regions are located approximately north of the Lower Black Volta River, whose tributaries are the White and Red Voltas and the Oti and Daka rivers. These rivers drain into the area that comprises Northern Ghana. In colonial times the people of this area were designated as the ‘Tribes of the Ashanti Hinterland’. Northern Ghana is home to several tribes and groups of people who have very similar cultures and speak a variety of related languages. Some of these people are autochthonous, while others are descendants of immigrant groups of warriors that invaded the area. Over the years, there were intermarriages among the different groups, which resulted in the co-existence of migrant groups and indigenes. However, in some communities, the difference between the invaders (“the royals”) and commoners still matters in local affairs.

In the absence of a better criterion for classifying the people of Northern Ghana, a language-based scheme is often adopted. The most common way of categorizing Northern Ghanaians involves putting speakers of a group of languages, commonly identified as Moore-Gurma or Oti-Volta, together [33]. Oti-Volta comprises a group of closely related languages, including Frafra-Nankani, Talni, Nabit, and Kusaal, which are spoken in the Upper East. These languages are largely mutually intelligible. The term “Frafra” derives from a greeting by the locals and is a denomination by which the people of the Bolgatanga District and the neighboring districts are known to the rest of Ghana. For example, some of them might call themselves “Gorse”, which comes close to the ethnonym Gurunshi, outside their villages (ibid.). In this study, the authors chose to call these groups the Gurune-speaking people³. There are about 526,300 Gurune-speaking (or FraFra) people in Ghana,

³Gurune is spoken in regions beyond the Upper East of Ghana, for example, in some areas of Burundi. Thus, in a strict sense, the Gurune-speakers might not be covered by the modern understanding of the term “indigenous people” as defined by the United Nations. This definition requires a strong link to territories and their surrounding natural resources, as well as, distinct social, economic, or political systems. However, they conform to other aspects of indigenous people as they have a historical continuity with pre-colonial and/or pre-settler societies, have a distinct language, culture, and beliefs, and they try to maintain and reproduce their ancestral environments and systems (https://www.un.org/esa/socdev/unpfii/documents/5session_factsheet1.pdf).

including 400,000 in the Upper East Region and 100,000 who live in various communities, towns, and cities in other regions (<https://www.ghanaweb.com/GhanaHomePage/tribes/frafra.php>). The map reproduced below shows the main Gurune-districts of the Upper East and highlights the communities from which the respondents of our study were selected.



The Gurune communities are led by their *Naduuma* (Chiefs) and *Tindaanas* or *Tindaama* (Earth priests); the roles of one support that of the other. The chief serves the people. He is the political leader of the community. The earth priest, on the other hand, serves the earth god, links the people to the ancestors, and is the spiritual head of the community. The *Tindaana* (translated loosely as landowner), in many cases, is the descendant of the original settler family in the community. Both the chief and the earth priest are selected from specific eligible families, and thus, not every member of the community can ascend to that position if they are not from those families.

Tindaanas seek answers to the spiritual problems of the people, while the chief sits in court to administer justice. A gurune proverb clearly distinguishes their roles “*Tindaana suo tinga ti naba suo neriba*”. Meaning “The *tindaana* is for the land and the chief is for the people” [15] (p. 27).

Also, Gurune communities consist of *Yizutos* (singular *Yizuo*), clans (people who trace their roots to one ancestor) that are led by the *Yizu kima* (clan head), and each family is headed by the *Yidaana* (house/family head). These leaders serve the people at each level (the family, clan, and community/village levels). The Gurune are mainly farmers who cultivate grains and legumes like millet and sorghum and maintain poultry and livestock, including cattle, goats, and sheep. The farms surround the compounds and land is scarce. The same plot is cultivated perennially; the use of livestock droppings and household refuse makes the farms relatively fertile. Thus, continuous agriculture is supported. However, the area is rocky, and fertile land is limited. The people are also

known for their artistic craft products, which include straw articles like hats and baskets and feather products, which can be found in the major towns of Ghana that tourists visit (*ibid.*, p. 7).

Due to their dependence on agriculture, the Gurune-speaking people are very vulnerable to any change that occurs in the biodiversity of the environment where they live and work; however, they have learned to cope with changes. In a study conducted by the University for Development Studies in Tamale and the Millar Institute for Transdisciplinary and Development Studies in Bolgatanga, the findings suggested that the traditional strategies used by smallholder farmers to alleviate the negative impacts of climate and ecological changes on their livelihood were very effective. But there are no written records of these strategies, and therefore, an intensive exchange of knowledge between and among smallholder farmers and formal institutions is very important. This can also publicize and empower residents [34].

Our study builds on the results of the above-mentioned study and aims to understand the insights and perceptions the local communities have on the effects of the changes in biodiversity, determine the kind of data and information they have inherited from the elders on the topic, and find out the information they have newly acquired and how they intend to deal with the changes.

The Gurune-speaking people are feeling the effects of the changes in biodiversity within the various undertakings they pursue. One case involves the traditional jute industry, where new challenges are arising from demographic changes [35]. Another challenge is the increase in the use of agrochemicals, which limits the practice of a traditional mixed cropping system as it promotes monoculture [36]. This has endangered the cultivation of neglected and underutilized species (NUS), which are minor or orphan crops that have been a part of the local food systems for centuries [37]. Another factor that affects the cultivation of NUS is the provision of subsidized and mechanized plowing services to farmers by the Ghanaese government to modernize farming. However, researchers (see [38] for examples) have reported that while the modern farming method has improved output, it has led to a shift in the cropping patterns from traditional staple crops (like pearl millet and sorghum) to market-oriented crops (e.g., maize, rice, and groundnut). Thus, there is widespread concern that new farming methods might adversely affect the cultural dimension of food security, as well as the organization of social life and climate change adaptation. Besides protecting NUS (which are not considered to be endangered at present), the conservation of tamarind and palm trees must be focused on by ethnobotany (see [39, 40] for examples).

Environmental changes that are not compensated by appropriate environmental policies might motivate people to move away from the affected area. Since the Frafra communities are predominantly rural, ecological deterioration and socio-cultural factors, like scarcity of employment, might force them to migrate to the South. While remittances in the workplace might minimize food insecurity in the area [41], some returnees might imbibe certain behaviors and tastes that are alien to the customs and beliefs of the community. Although this might reduce solidarity, some studies have shown that communal spirit is still pervasive in society and is an important mobilizing tool for development [42].

5. The Empirical Study

5.1 Scope and Methodology

As mentioned in the previous section, the Gurune-speaking people face many challenges concerning the conservation of biodiversity and the influence their tribal authorities can have on the issue. Since the communities are aware of the significance of conservation in their lives, the authors consider that a qualitative survey of the opinions and attitudes of key informants might help to understand certain critical questions.

- What are the roles of tribal authorities in conservation management?
- What is the significance of biodiversity in the lives of the people in the communities at present and in the future?
- What are the strengths and weaknesses of tribal authorities concerning the implementation of the objectives of biodiversity?
- What kind of outside help can strengthen the role of tribal authorities in resource management?

To address these questions, we conducted a qualitative study and determined the connection between the beliefs of the tribal leaders, the impact they have on their communities, and also the status and future of biodiversity in their region.

Selecting the methodology is a critical step in a research project [43]. Rather than analyzing the relationships by establishing and testing multiple hypotheses, we selected a framework that can help an investigator obtain answers to questions regarding a contemporary set of events over which the investigator has little or no control [43] (p. 913). Initially, we conducted a pilot assessment of our study questionnaire by conducting a semi-structured interview with the students of one of the authors. According to Qu and Dumay [44] (p. 246), “the semi-structured interview involves prepared questioning guided by identified themes consistently and systematically interposed with probes designed to elicit more elaborate responses”.

After the interview, the results were discussed with the students. The outcome was tested by applying the criteria provided by Alvesson and Deetz [45] regarding diagnostic empirical research – insight, critique, and transformative redefinition. According to Alvesson and Deetz, “Insight is closely related to [...] interpretation. An interpretation aims to read something into what is ambiguous; gaining insight represents the ‘what’ of knowledge production, critique questions the dominant messages, structures, and power relationships, and transformative redefinition is the natural extension to insight and critique” [45] (p. 141). The authors consider that ‘analyzing the analysis’ using this method might help to effectively answer the questions presented in this study.

The pilot study resulted in very little modification of the questionnaire; the questions were clear and not ambiguous. Following this, the research team identified suitable participants for the interviews who could provide meaningful information across all spectra of the community and the subject. The representatives from the Gurune-speaking people were selected because although they are very open to changes and innovations, they still value their traditions and practices. They also regard their traditional leaders in high esteem. Additionally, one of the authors of this study is a gurunga, and she is familiar with the three communities that were selected.

The three selected communities were located in different districts, including Zaare in the Bolga municipality, Winkongo in the Talensi district, and Zuarungu-Zonno in the Bolga East district (the

three districts were historically together as the greater Bolga district). Although the communities were peri-urban, the identified communities observed and maintained the tradition. Additionally, due to their geographical closeness to the educational institutions in Bolga, we expected them to easily understand the subject of the study.

Specifically, the key participants were the traditional leaders (chiefs and tindaanas), environmental protection agency personnel, individuals from the forestry commission, focal discussants (community members), and other key individuals deemed to be influential and knowledgeable in the larger community.

For the study, we developed a structured interview form with a series of open-ended questions, including basic demographic questions about the interviewee. The interviewee could provide elaborate responses to these questions (a copy of this form is provided in the Appendix). The interviewers consisted of two research assistants who were indigenous members of the community. Before the interview, all research assistants were oriented toward the study questionnaire and the method to conduct a structured interview by the indigenous author. Additionally, the questionnaire was reviewed by several individuals for wording and understanding before its administration.

Ten key stakeholders were selected for the interview, not only because of their knowledge of the community but also due to the direct and/or indirect roles that each play in the governance of the village and the community. The selection process was randomized, and no determinate sampling method was applied. The objective was to conduct interviews with knowledgeable and influential members of the community, but the process was also influenced by the availability of interviewees. The key stakeholders who participated in the study included:

- One Elder, representing a Chief,
- One District Assembly Member,
- Three Earth Priests, i.e., tindaana (among them was also a Chief Undertaker),
- Two women leaders (“Magazia”),
- One Opinion Leader, i.e., a person whose verbal and written comments often influence the community,
- One Youth Leader,
- One Elder (a member of the tindana’s court).

Besides the village and community leaders, two government officials (one from the Forestry Commission and one from the Environmental Protection Agency) were also selected for the study due to the key role they play in decision-making concerning the larger environment. The age of the respondents ranged from the mid-30s to over 50; most participants were 40–60 years old. Most of the respondents were farmers; similarly, most of the participants were males.

All interviewees were contacted before the study to ensure their participation. In this initial contact, the participants were briefed on the purpose of the study and informed that their responses would be confidential. The interviews were conducted at the participant’s home or workplace over two weeks in early 2022. The responses to the interviews were recorded in a Microsoft Excel file. The responses were then aggregated, and the key themes and topics were identified. All key data were then converted to a tabular form.

The tables of the participants’ statements are shown below. Each table shows the responses of the interviewees (condensed for brevity). To ensure anonymity, the specific respondent and their positions are not shown, although examples of the types of responses with specific groups are presented. Each table is preceded by a brief statement that states the rationale for that set of

questions. Some answers, although not (directly) related to biodiversity, were not removed to show the correct process of recording interviews.

5.2 Ethical Protocols

The respondents, especially the chiefs and Earth priests, being traditional leaders of the communities, had traditional protocols when receiving visitors. Although these protocols have been relaxed in modern times, we decided to follow some of them. For example, after stating the purpose of the visit, permission to visit the chief was requested through the linguist/elder; we had to wait for approval of the date and time. The request could be complied with immediately or later, depending on the issue. Since it involved an interview, specific timeframes were given, which the research assistants honored. In some cases, the dates were postponed several times as some of the respondents had other engagements that suddenly came up. But the research assistants were diligent (and persistent) and were able to conduct the interviews within the given time frame. The ritual of giving kola and tobacco was observed with the chief's representative (in one community) and the Earth priests (Tindaana) upon arrival. These are the traditional gifts that are expected to be given by visitors to the priest's palace. Nowadays, however, a visitor may give a small amount of money instead of traditional gifts. In the study, the researchers went for the latter.

Following tradition, the elders of the earth priests were present during the interview (tradition dictates that the elders of the chiefs and earth priests are always present and interact with visitors in the palace).

Permission was also sought from the other categories of respondents. They chose the date, time, and venue suitable for the interview. Each time a respondent was visited, the purpose of the study was explained in detail, and their consent was received before the interview. They were also informed that they could end the interview at any stage if they did not want to continue. Moreover, anonymity would be observed, and their answers would not be shortened or modified in the publication.

5.2.1 Results (1): What Indigenous Attitudes and Actions Exist Toward Biodiversity?⁴

Studies have shown that actions regarding biodiversity are governed by norms and values in the communities of the Gurune-speaking area (more than by official agencies). These norms and values are reinforced and upheld by traditional authorities and other institutions, such as the earth priests and women leaders (see [46] for examples). The resources that the tribal representatives deem to be valuable for the life and subsistence of the community are shown in Table 1. The listing and the subsequent clarifications present the view of the respondents toward the loss of biodiversity.

⁴ The brief statements preceding the tables deliver the rationale for that set of questions.

Table 1 Natural resources in the community.

What are the primary products (natural and man-made) that are essential for sustaining the Gurune People way of life? How might these products and materials interact?

- Land for growing crops, rearing animals, and the construction of homes, businesses, and roads.
- Herbs and trees as food and medicine for humans: Baobab, Neem, Mango, Kapok, Shea trees for fruit, nuts, and butter, cosmetics, and ingredients for the performance of rituals such as funerals.
- Crops that are required for food and their stocks as animal feed and manure.
- Straw for weaving baskets, which is an economic activity for both men and women.
- Trees and shrubs producing food for both humans and animals, serving as wind breaks and stabilizing the environment.
- Sacred grooves, which are believed to take care of humans spiritually.
- Fowls and domestic animals for food, sacrifice, and to be sold on markets outside the region. for money.
- Termites, besides being used to feed their existence in the soil, help in keeping it fertile for farming.
- Worms and caterpillars help in keeping the soil; they live in fertile.
- Some animals, e.g., pythons, leopards serve as totems and are believed to protect humans, who in turn protect them.
- Clay, straw, and metals for making clay utensils, baskets, and tools.
- Water from dams, rivers, streams, wells, pipes, etc. that, are needed by humans and animals for survival.
- Dugouts produce water for humans and animals as well as irrigation.

Which of those mentioned above no longer exist in this community?

- Shea, Kapok, and Qawadawa trees are on the decline.
- Straw for weaving baskets is on the decline, and so are grasses for thatch and weaving. Same with clay.
- Silk cotton, “Nonnogba”, Kalanka no longer grows along riverbanks.
- Lions and leopards are not seen anymore.
- The fishes in the sacred groove are gone.

What do you have to say have led to their extinction?

- Urbanization with population growth and increased buildings have blocked the water ways and affected the climate. This has led to reduced rainfall and the drying up of these water bodies.
 - Wild trees are eliminated by human activities and windstorms. As they grow in the open and people do not plant them, replacing the trees that are gone is very difficult or impossible for the community.
 - Only some trees (“Yaaba tia”) and animals (“Pote”) that are associated with the ancestors or spiritual are valued and thus protected.
 - Sale of the trees as wood for fuel and construction, clearing of the land for farming, use of chemicals in farming.
 - Burning of the forests and the felling of trees.
 - The disregard for cultural and values by community members who have embraced other religions.
 - Christianity has contributed to this in some way as the young ones who should go to the bush to look for the herbs will not because they are Christians and do not want to be associated with “pagan activities”.
-

5.2.2 Results (2): The Role of Tribal Leaders in the Conservation of Biodiversity in Modern Times

The historical role that tribal authorities have played in the management of resources, including the monitoring of ethical matters, is exercised in the Gurune-speaking area. They are the custodians of indigenous culture, and inhabitants agree that their influence controls the ways and means to utilize the land and natural resources. The judgments of the authorities are accepted in other areas as well, and the respondents mentioned that judgments are related to biodiversity only indirectly, e.g., when they mentioned rulings on family life. We found that the tindaana encounters difficulties, especially in communicating with the young. But they hope that with the support of the Chief and the government agencies, their role can persist, and their words might be heard by all.

Specifically, as mentioned in Table 2, it is common knowledge that adhering to the values imparted by the tindaana, and also by the women leaders, can compensate for some negative effects of government policies, which lack precise rules for implementation.

Table 2 The instruments and policies of the traditional leaders vs. governmental regulations.

When considering traditional culture, taboos, etc., which ones do you feel are the most important to maintain your identity and way of life?

- The language spoken is a very important aspect of our culture and identity.
- Our marriage rites especially giving of the symbolic fowl that confirms the marriage.
- Giving names, be it naming of our children or places. This is important because it gives us our identity.
- Final funeral rites which is a means of saying goodbye deceased community members.
- The music or local entertainment that make us stand unique as a people.
- The funeral and marriage rites of our people that give us our identity as gururensis.
- Traditional boundaries and water ways are to be respected as this has protected our land and helped to prevent conflicts. It's a taboo to steal the land of another by farming into boundaries.
- Confiscating another person's farm is an abomination punishable by the gods.
- The "dabo zuo" (land on which the ancestors /family first built their house) must never be sold.
- Digging haphazardly is a taboo which protects both land and biodiversity.
- The taboo of not fishing from the pond in the sacred groove as this preserves the wet land and groove.
- Taboos against sexual immorality, e.g., incest and adultery.
- Polyandry and female infidelity in marriage are taboos as this keeps marital homes peaceful.
- It is a taboo to eat and sing at the same time. This is very important as it protects human nature.
- The taboo of not eating some animals which are totems that protect such animals, like goats (The Goat is said to have licked the eyes of an ancestor and made him see again).

What government policies or regulations do you feel have benefitted your village and community (i.e., contributed to the growth and preservation of the biodiversity in the village and the way of life, including economic growth)?

- The creation of access roads.
- The rural electrification.
- The "One Village - One Dam" policy, as it provides water for people, animals and for irrigation.
- The afforestation project as it educates people on the importance of trees and encouraged tree planting.

- The policy against the indiscriminate felling of trees.
- The agro-extension agents who teach good farming methods, and the introduction of credit support for women.
- By-laws against bush fires, tree growing by the Forestry Commission. Fire volunteer programs.
- The educational policy of increasing literacy rate has been very beneficial.
- Common timelines for the performance of funerals to allow for rains and for the onset of the farming season.
- Policies banning female genital mutilation.

What government policies or regulations do you feel have been most disruptive and impactful (to biodiversity/the way of life)?

- Dam-constructions which do not sustain the environment.
- Increase in fuel prices has led to the demand for charcoal and fuelwood.
- Policies promoting the use of chemical fertilizers and pesticides in farming. Policies that promote non-indigenous seeds.
- Tractor ploughing services compact the land and brings about erosion.
- Policies restricting the use of farmyard manure, on minimal tillage and bunding.
- Policies that change traditional, political and administrative boundaries as they fuel conflicts.
- Development policies when they are partisan in nature (e.g., on property owning procedures).
- Promoting products of western education that despise our culture. Policies on family planning.
- Luring unqualified persons into the educational system which produces unemployment.

What strategies or policies in your village and region are currently in place to address these issues?

- There is no particular policy to mitigate people's response to increase in fuel prices.
- Timelines given by tribal leaders for funerals as a measure to help check poverty and to enable people to farm.
- Supporting people who are taking to diversifying, e.g., farming and trading.
- Supervise government policies to ensure that they are applied as they are designed to be.
- Sensitization of people to return to manure and compost application instead of chemicals. Sensitization on non-burning.
- Teaching traditional trades to less qualified people, e.g., weaving of baskets and sewing of smocks.

What policies/strategies do you feel might be most helpful to not only sustaining your way of life and preserving your biodiversity but also contributing to maintaining your local culture and economic growth and sustainability?

(a) Government or Region

- Government revamping defunct factories for job creation and economic growth.
- The programs of "One Village- One Dam", "Planting Food and Jobs, "One District - One Factory", "Greening Ghana".
- Government support for communities to grow indigenous crops.
- Policies that will compel communities to perform final funeral rites within a stipulated time and also regulate expensive funerals.
- Policies to tackle boundary issues.
- Strict enforcement of policy on cutting down of trees. Protection of rivers and sacred grooves.
- Focused income generating avenues for community members especially women to prevent the exploitation of the environment.
- The drilling of boreholes in place of dams for water and irrigation where this is more beneficial.

(b) Internal by Local Community

- Policies that create new livelihood sources which will enable people to not concentrate on farming and thus clear lands and destroy biodiversity.
 - Strict policies against the cutting down of trees and bush-burning.
 - Enforcement of times of funerals. Policies or regulations that protect the sacred grooves.
 - Decreasing the rate at which farmlands are being sold and converted to other uses.
 - Educating children on the value of trees and herbs and of indigenous food crops.
 - Cultivating grass for animals instead of reliance on stalks and waste from crops.
 - Doing away with the use of chemicals for farming.
 - Enforcing community taboos, e.g., policies on the use of local cultural entertainment during funerals in place of foreign ones which produce noise and ramble damaging human health and the environment.
-

5.2.3 Results (3): How Can a Synergy of Traditional and Statutory Regulations Be Best Achieved for Sustainable Land Use and Biodiversity Conservation?

In the Gurune-speaking area, ecosystem-based adaptation is practiced, which uses traditional and statutory regulations to help people regain control of their lands and adapt to the adverse effects of climate change. This also contributes to socio-economic development because it is embedded in local culture and tradition. For regaining the control, the factors that present the greatest challenges to sustaining the community's way of life and biodiversity must be identified, and ways to address them must be decided collectively. The views of the respondents regarding these issues are presented in Table 3.

The respondents were asked about the involvement of tribal leaders in environmental policies and regulations, as well as the instances where tribal leaders and government agencies, such as EPA or MoFA, conducted programs in their communities.

The respondents, including the elders, tribal leaders, earth priests, women leaders, opinion leaders, youth leaders, and assemblymen, cited numerous occasions of their involvement with government and other agencies. Below is a short list of some of these collaborative efforts.

Table 3 Examples of collaborative efforts between indigenous leaders and government/non-government agencies.

-
- Village chiefs have assisted the Ministry of Food and Agriculture (MoFA) in their training programs.
 - Chiefs meet with leaders and members of the community and with EPA groups in regard to good agronomic practices.
 - Chiefs and elders have supported Ghana Health Services in health promotion programs.
 - Chiefs consult with EPA officials and others in regard to tree planning.
 - Assembly men have worked with the Ministry of Food and Agriculture in animal vaccination.
 - Assembly men have supported farmers in varied educational programs.
 - Leaders have met with MoFA on block farming and fertilizer control.
 - Leaders have worked with UNDP/ICOUR on a tree planting project.
 - Women leaders have worked with government and non/government on agronomic practices, health programs, and sanitation.
-

The respondents were asked, “What do you feel is the role of the tribal leader in supporting and maintaining your local culture and way of life?” The responses were diverse. A brief overview of their responses is presented below.

-
- To maintain the traditions and culture of the people
 - To respond to concerns of the community
 - To investigate (earth priests) issues of spiritually and relay the information to the people
 - To engage sectional/clan leaders to maintain the culture and traditions
 - To organize the people (the chief) and educate the community to preserve natural resources
 - To educate others about the varied taboos of the tribe and community
 - To discipline members who go against taboos and community laws
 - To guard the culture and tradition of the community
 - To be a leader who encourages people to take responsibility for local culture/traditions
-

In a similar question, the respondents were asked, “What role does the tribal leader play to ensure that the natural and economic factors that support your village are maintained?” Similarly, the responses involved a balance between the economic and cultural aspects. Examples of some responses are provided below.

-
- Maintaining social control and order
 - Put in place laws that protect the environment (especially the trees)
 - Collaborate with stakeholders to develop laws that protect and address economic/environmental growth
 - Discipline violators
 - Govern the village to ensure that natural and economic factors support/benefit the village
 - Seek support from “spiritual leaders” during times of drought, hunger and other disasters
 - Encourage others to tend to their farms and animals
 - Ensure that burning is done in control way to not harm farm and bushes
 - Educate people against unnecessary expenses of funerals
 - Reward virtues and punish vices
-

The respondents were asked about the challenges that the leaders faced while performing their task of ensuring the sustenance of biodiversity. The respondents were asked to provide examples. Some of the examples provided are mentioned below.

-
- There is both cost and safety concern in carrying out their roles
 - There is occasion of ongoing conflicts with tribal leaders
 - Older more traditional leaders have misled or misdirected some younger members in regard to tribal tradition and culture
 - Challenge of youths embraces modern activities at the expense of tradition and culture
 - Leaders can be physically threatened by others
 - Select individuals undermining authority
 - Political rivalry between varied village-leaders; e.g., chiefs, earth priests, etc. which hinders good governance
 - New technologies undermine the role and authority of leaders
 - Conflict and land disputes
 - Family conflicts
 - Disrespect of elders and others in authority
-

In a similar question, respondents were asked about the factors that presented the greatest challenges to sustaining their way of life and biodiversity in their community and region. The responses were similar to those for other questions regarding the challenges associated with land issues, corruption, changing culture, etc. Examples of responses are provided below.

-
- Degradation of the land
 - Land use challenges
 - Conflicts between community leaders that obstruct ability to perform duties
 - Changes in the agricultural system: earth priests knowing which portion of land is suitable for use
 - Loss of land through sales and conflicts
 - Pollution that is harmful to crops and animals
 - Climate changes; e.g., rainfall pattern,
 - High rate of poverty
 - Lack of alternate sources for people
 - People not prepared to work to support themselves
 - Bad or incorrect farming practices
 - Urbanization
 - Greed and corruption
-

Like in any study, there were challenges and barriers. Only a few respondents knew about practical instruments that would produce synergies between the endeavors of tribal leaders to conserve biodiversity and statutory regulations, for example, communities of practice (see [4]). This was one of the gaps highlighted in our study. All regulations, governance and management, institutional arrangements and partnerships, knowledge, communication and engagement, and financial mechanisms need to be addressed simultaneously and by all parties involved. The involvement of the tribal authorities can help to find the best solutions and implement action plans. The ideas that the tribal representatives expressed on the issue are presented in Table 4.

5.2.4 Results (4): What Are the Factors That Present the “Greatest Challenges” to Sustaining Your Way of Life and the Existing Biodiversity of Your Community and Region?

The 10 respondents were initially asked to *rate* several biodiversity challenges based on their impact on indigenous norms and taboos. The ratings were based on a 1 to 10 scale, with 1 indicating *the least impact* and 10 indicating *the greatest impact* on indigenous norms and taboos and maintaining the existing biodiversity. A rating of the “challenges” that had the highest impact based on sustaining the way of life of the respondents and the existing biodiversity of their community and region is provided below.

Table 4 Rating of the “Greatest Challenges” to sustaining the way of life.

Agricultural Change	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total Mean
Soil erosion	5	6	10	7	7	8	5	7	6	9	7.00
Reduced availability of freshwater	5	8	5	5	7	9	5	10	5	5	6.40
Quality of Air	4	8	2	3	6	7	7	7	7	4	5.50
Insufficient Crops of staple food	8	5	6	6	9	10	8	10	8	7	7.70

Damage of forests	6	7	5	9	7	6	6	10	9	3	6.80
Increase of Invasive species	4	4	10		6	6	6	9	7	9	6.78
Policy Challenges	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total Mean
Land Tenure	8	9	6	5	9	8	10	9	9	7	8.00
Security	7	7	8	10	8	7	8	8	6	10	7.90
Woman Labor Issues	6	9	9	9	6	6	5	7	5	9	7.10
Government Corruption	9	6	10	9	9	9	9	10	9	10	9.00

The respondents were also asked to mention challenges other than those listed that presented problems to their way of life. In the category of “agricultural change”, two respondents noted the depletion of wetlands and the sale of lands. In the category of “policy changes”, one respondent mentioned the challenge of tribal leaders not being included in decision-making. Following this rating, the respondents were asked to *rank order* the top challenges to maintaining traditional norms and taboos and the biodiversity of their community and region. The respondents ranked the challenges, and those that were considered to be the highest in order of ranking were as follows:

-
- | | |
|---|--|
| <ul style="list-style-type: none"> • Soil erosion • Insufficient crops of staple food • Damage to forest | <ul style="list-style-type: none"> • Land tenure • Security • Woman labour issues |
|---|--|
-

The respondents were asked about the dual issue of living in a changing environment and the importance of maintaining tradition. They were specifically asked what current or future policies, regulations, and support they would like to have that would contribute to both natural and economic growth while preserving their way of life.

The responses of the respondents were broad and covered several domains, including education, politics/decision-making, land use, and farming. Examples of some of these responses are provided below.

Subject Area	Examples of Responses
Employment/Economics	Need for policies to create jobs Need for greater empowerment of workforce Provision of basic amenities
Land	Policies are needed on land boundary protection Policies needed to compel government agencies to properly engage landowners and compensate them Need policies on land boundary protection to prevent potential litigation
Politics/Decision Making	Government needs to include tribal leaders in both policy formation and policy implementation Need for political parties to decrease partisan politics Need to ensure smooth running of government policies after elections Need to “decentralize” policies

Farming	<p>Need for central/local governments to increase education regarding planting of trees</p> <p>Need for stronger policies to protect natural environment and to enhance biodiversity</p> <p>Government should help communities with planting of trees</p> <p>Need for laws against burning of fields</p> <p>New policies should be implemented to encourage people to return to organic farming</p> <p>Tribal leaders should lead effort to demarcate wetlands/grazing areas</p>
Education	<p>Greater assistance to help people to read</p> <p>Need to educate people about culture</p> <p>Need greater education on environmental protection</p>

The two government officials who responded to the same set of questions as the tribal representatives agreed with most of the statements given by the local community. Additionally, they mentioned that poverty also prevented people from being concerned about the conservation of the environment. When people are hungry, their main concern is food, and since many people in the rural areas depend on the environment for survival, they harvest the trees for fuel and timber, or they sell them to make a living. The Forestry Commission (FC) expects communities to report perpetrators.

On specific government policies, the following were mentioned:

- a) *The Modified Tonugya System* for the rehabilitation of degraded areas. It involves a public-private partnership between the FC and farmers/individuals, where a portion of the degraded land is given to the farmer/individual to grow food crops and trees for three years and return the land to the FC for another land. The benefits from the trees are shared as 40%/40%/20% among the farmer, the FC (Government), and the stool land, respectively. The chiefs know that some farmers do not return the land to the FC, but the policy is partially successful in most of the cases.
- b) *Youth in Afforestation* is a government flagship program for the rehabilitation of degraded areas – both forest and non-forest – employing the youth to plant trees inside and outside reserves. Again, political interferences hinder the success of the program.
- c) *Private Plantation Developers* is a program where private organizations or individuals take land from the FC and plant trees. The benefits are shared 90%–10% between the individual and government, respectively. Again, various causes hinder its success.

An issue was raised that the interventions by the government and NGOs were ineffective due to the activities of nomadic people. Although the Forest Protection Act of 1974 prevents grazing (NRCD 243, Section 1 subsection I), the chiefs of the communities often are forced to accept these nomadic people. Although the agencies adopt a multi-stakeholder approach, this policy does not work as planned because some communities do not see their direct benefits to accept it. A better approach would be demand-driven projects that are tied to livelihoods, where the communities assess their needs and request projects and interventions that they can own.

5.3 Discussion

Although a qualitative study involving ten interviewees cannot substantively prove the specific strengths or weaknesses of the relationship between the leaders and their community and how this relationship can affect or change what is intended by governmental regulations, it provides some interesting information on the topic. In general, our study supported the presence of a genuine concern of the indigenous people, whether they feel represented by their tribal leaders or not, regarding biodiversity and the effect of changes in biodiversity on their lives. We found that both sides are willing to cooperate. The representatives of the government and the tribes understand the importance of collaboration, although they still have to develop the pertinent forms of collaborative decision-making. The distinct models of the *Tonugya System*, the *Youth in Afforestation*, and the *Private Plantation Developers* programs indicate that there are effective ways of integrating all parties affected by a measure. Based on the answers of the tribal representatives to the questions on the challenges that they are faced with, we concluded that they know the issues regarding which they need to confront their counterparts.

Another result that is of relevance for alleviating the status of the tribal leaders concerns their view of the problems in performing their role of ensuring the sustenance of the existing biodiversity. This must be considered along with the general acceptance of tribal interference in government affairs. Various examples indicate the types of effects such interference might have. One such example was provided by Zeka [12], who investigated the access to and use of river resources in Salem, a peri-urban area of Eastern Cape, South Africa, on which the Inkosi and Izinduna tribes exert their tenurial right of managing the riparian sites. Another study was conducted by Asante, Ababio, and Boadu [47]. They studied the level of incorporation of traditional methods in current scientific systems of forest management applied by the Ghanaian government. Both studies investigated a more specific topic, and their sampling was more precise than that of our study. Both studies found that the local governments accepted tribal intervention, although Asante, Ababio, and Boadu [47] found that the respondents felt that they were being neglected when applying cultural practices in public forest management. The advent of the United Nations' Agenda (2030) might have changed the perception of the people from the time the study on forest management was performed. This might also provide additional support to the demand of international political movements that governments should recognize the traditional ownership claims of indigenous people and legalize the rights to the land held by them [48].

6. Conclusion and Recommendations

Cook [49] stated that people are at the heart of the quest for sustainability and the attainment of sustainable development rests on building human capacity. The optimum conditions for this include exposure to empowering leadership, accepting the decision-making authority at the work level, and belonging to learning and affirming organization. Including tribal authorities in strategizing, planning, and executing facilitates the subjective empowerment of people affected by the loss of biodiversity and those who can contribute to its restoration. Due to the power bestowed upon them, traditional leaders are the custodians of values and norms that govern resource usage in their communities. As the leaders are mostly well-accepted by the Gurune-speaking people, their common goods and values shall be maintained for future generations. As the Gurune's capabilities generally include the development of skills, knowledge, and attitude in the area of biodiversity, they

might also reach a status of harmony with nature and social well-being. One factor that can validate this is that they have various traditional techniques that they use to resolve conflicts arising in their communities [50]. With the proper deployment of the SDGs, an amalgamation of traditional and modern systems of conflict resolution might be feasible.

Conflict resolution is the main factor that helped to produce the three systems of collaborative efforts in Ghana, including the *Tonugya System* for the rehabilitation of degraded areas, the *Youth in Afforestation* program, and the *Private Plantation Developers* initiative. In each case, the specific implementation actors from the communities and government agencies have bridged the gaps that existed between them previously. There is no other way to resolve issues affected by indigenous regulatory systems and statutory laws. Thus, any actors in analogous areas are recommended to promote cooperation between tribal communities and public authorities. The authors consider that the findings of this study provide learning opportunities for improving the state of affairs in African rural areas and also in other developing countries. Our questionnaire might serve as a model for other studies. The caveat, however, is that the questions were prepared for a very explicit group of respondents. This might limit the ability of this study to be generalized. However, researchers in the field of indigenous tradition might find the set of questions that is appropriate for their study.

Another limitation of our study was that we could not connect our findings to existing projects like the ones that are listed under (a), (b), and (c) above. For further research, establishing a link between ongoing biodiversity conservation projects might be helpful, specifically at the site of the interviews. This might reveal how cultural practices, including beliefs, taboos, and myths, have played a role in successful biodiversity conservation in the past and how they might be integrated with scientific agricultural methods used by state authorities.

Author Contributions

The authors share equally in the work which was based upon prior research published together.

Competing Interests

The authors have declared that no competing interests exist.

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