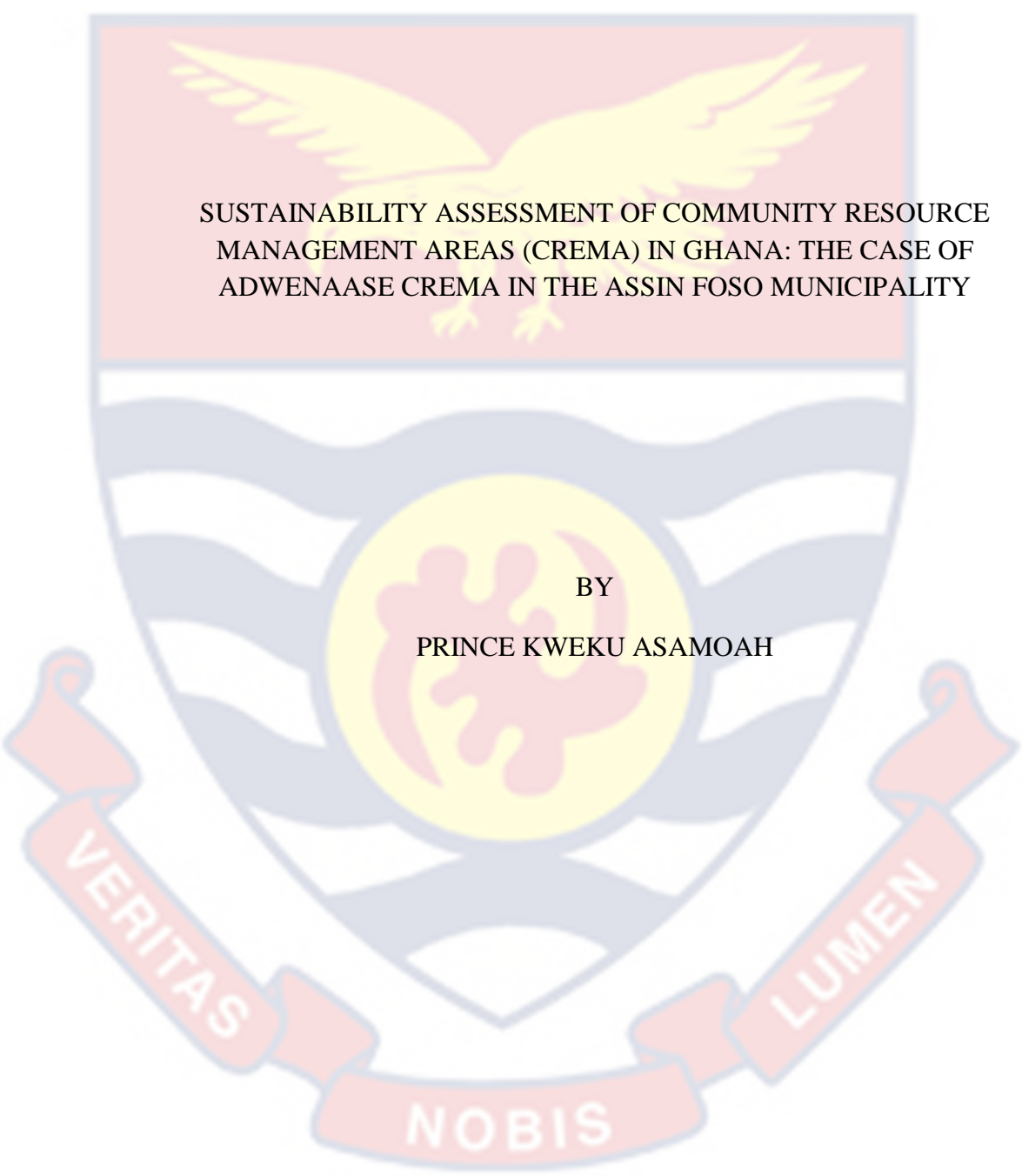


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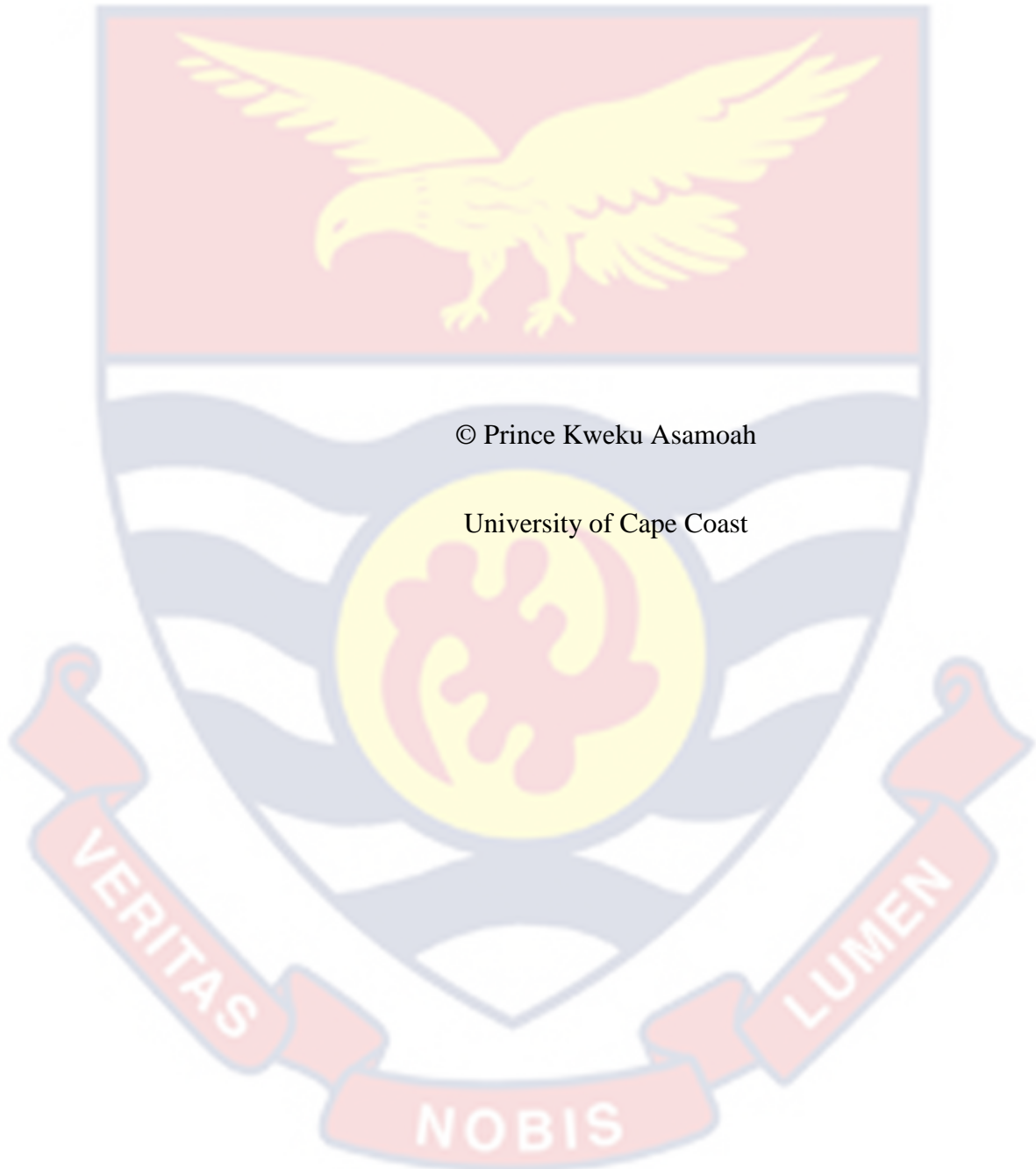


SUSTAINABILITY ASSESSMENT OF COMMUNITY RESOURCE
MANAGEMENT AREAS (CREMA) IN GHANA: THE CASE OF
ADWENAASE CREMA IN THE ASSIN FOSO MUNICIPALITY

BY

PRINCE KWEKU ASAMOAH

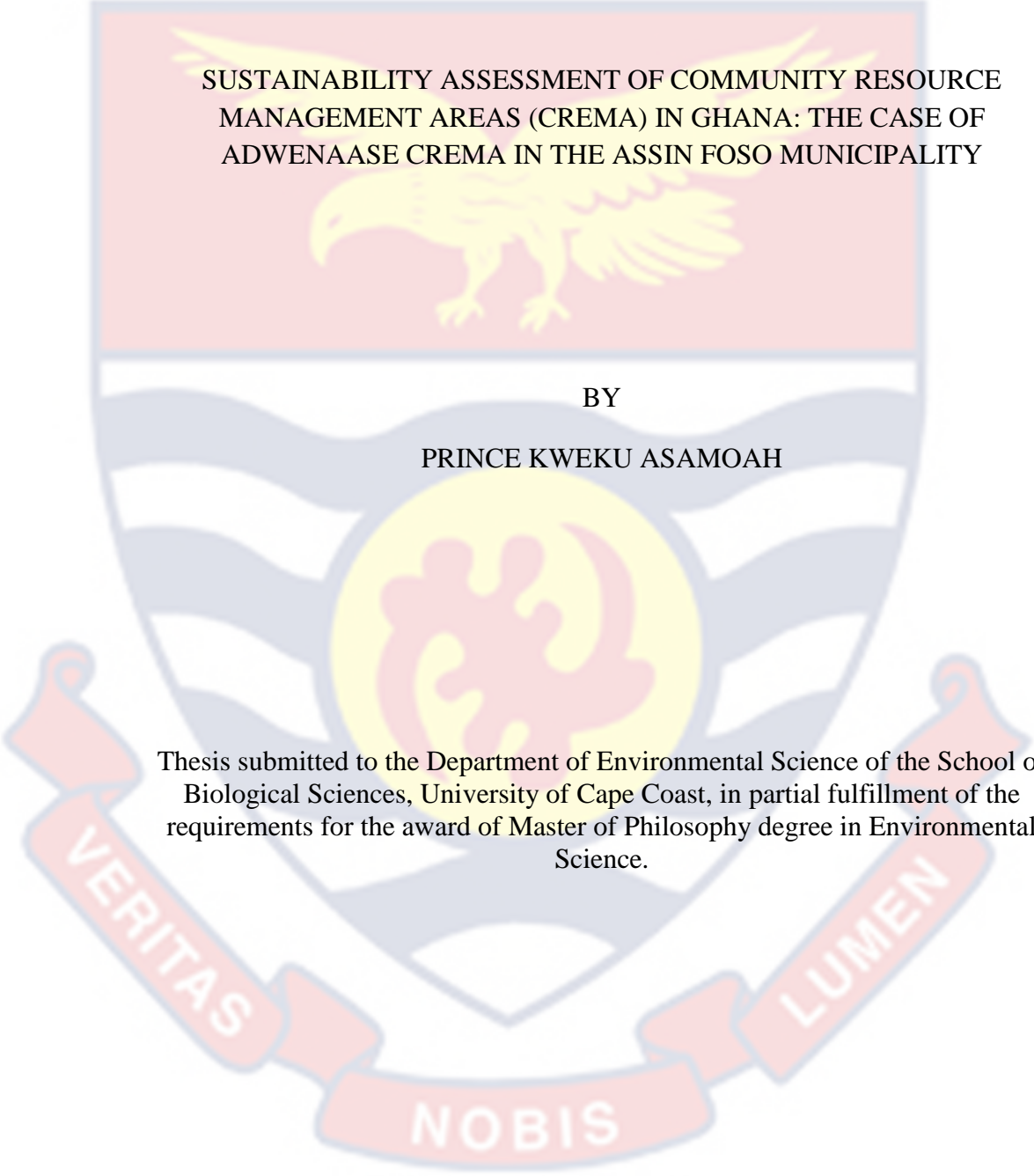
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MANAGEMENT AREAS (CREMA) IN GHANA: THE CASE OF
ADWENAASE CREMA IN THE ASSIN FOSO MUNICIPALITY

BY

PRINCE KWEKU ASAMOAH

Thesis submitted to the Department of Environmental Science of the School of
Biological Sciences, University of Cape Coast, in partial fulfillment of the
requirements for the award of Master of Philosophy degree in Environmental
Science.

APRIL, 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature Date

Name:

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the university of Cape Coast.

Supervisor's Signature Date

Name:

ABSTRACT

There are over 40 CREMAs at various developmental levels in Ghana based on existing records, which portray varying outcomes in terms of their intended purpose, yielding some uncertainties about sustainability of CREMAs in the country, with Adwenaase CREMA in focus. This thesis sought to assess the sustainability of Adwenaase CREMA based on ecological/environmental, economic, and the socio-cultural dimensions. The assessment seeks to inform actions towards making CREMAs resilient and sustainable. The study communities were Assin Akropong, Subinso No.1 and Agyalo, all in the Assin Foso Municipality in the Central region. Both structured and open-ended interview schedule were employed. A total of eight hundred and fourteen (814) were reached in the selected communities to persons 18 years of age and above. The 13 open-ended interview schedules targeted the reserve management team, the local opinion leaders and the management of the Forestry Commission, Assin Central Municipality. The hypotheses that “there exists significant positive economic impact of CREMAs on indigenous communities”, “there is a significant positive trend of resource condition in the Adwenaase Community Resource Area”, “there is a significant positive ecological/environmental impact of indigenous communities on CREMAs”, and “there is a significant economic impact of CREMAs on indigenous communities” are all rejected. Thorough media drives are required to create community alertness on forest resource conservation missions; CREMAs should be developed into tangible employment and income generating opportunities for indigenous communities.

KEY WORDS

Collaborative resource management (CRM)

Community resource

Forestry

Indigenous culture

Sustainability

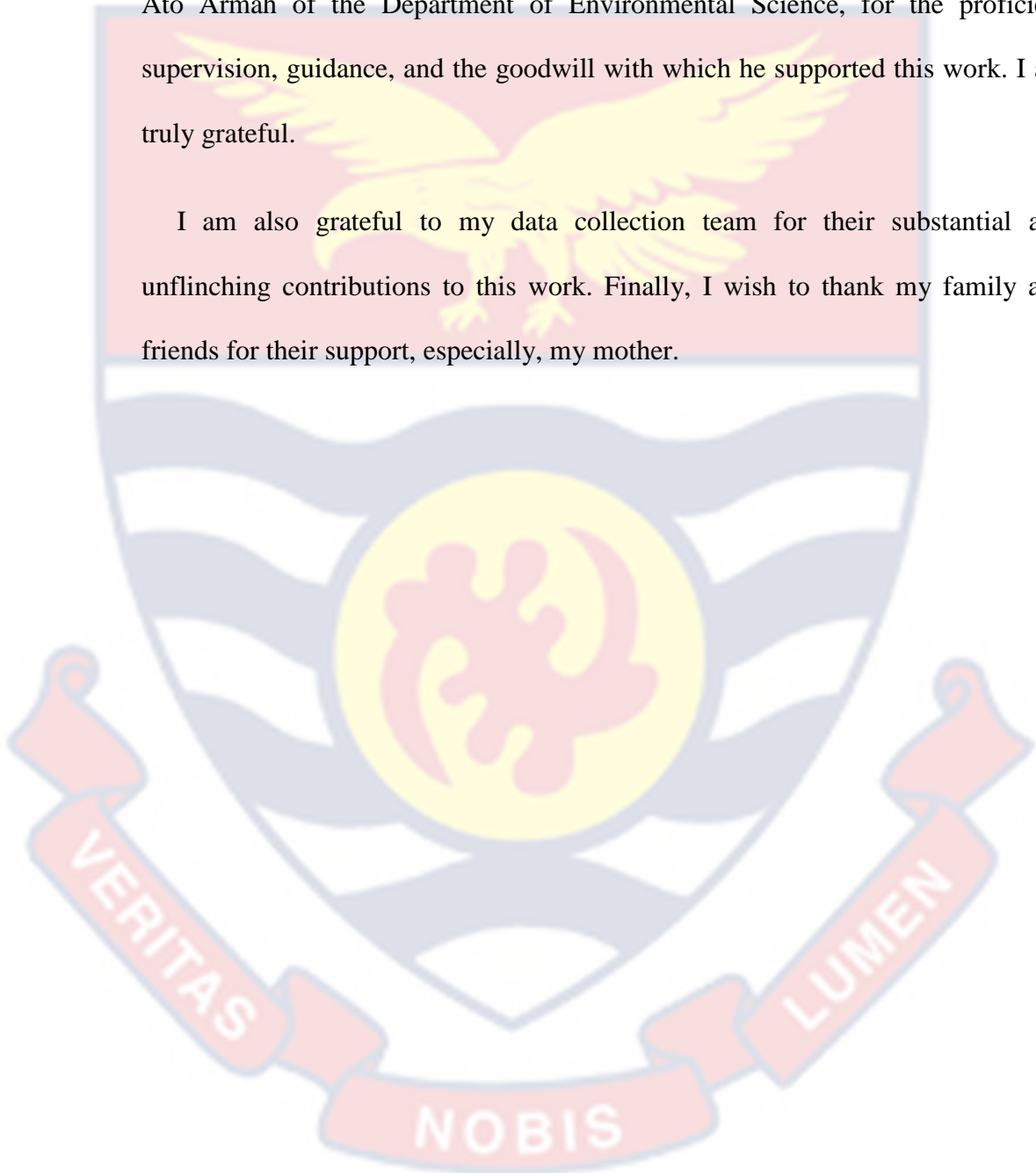
Sustainability assessment



ACKNOWLEDGEMENTS

I wish to express my sincerest appreciation to my supervisor, Prof. Frederick Ato Armah of the Department of Environmental Science, for the proficient supervision, guidance, and the goodwill with which he supported this work. I am truly grateful.

I am also grateful to my data collection team for their substantial and unflinching contributions to this work. Finally, I wish to thank my family and friends for their support, especially, my mother.



DEDICATION

To my late father, Mr. Benjamin Kobina Asamoah (Nana Kwaku Afrifah Kyerempeh XII), the former chief of Assin Andoe in the central region of Ghana, and my sister, Christiana Asamoah.



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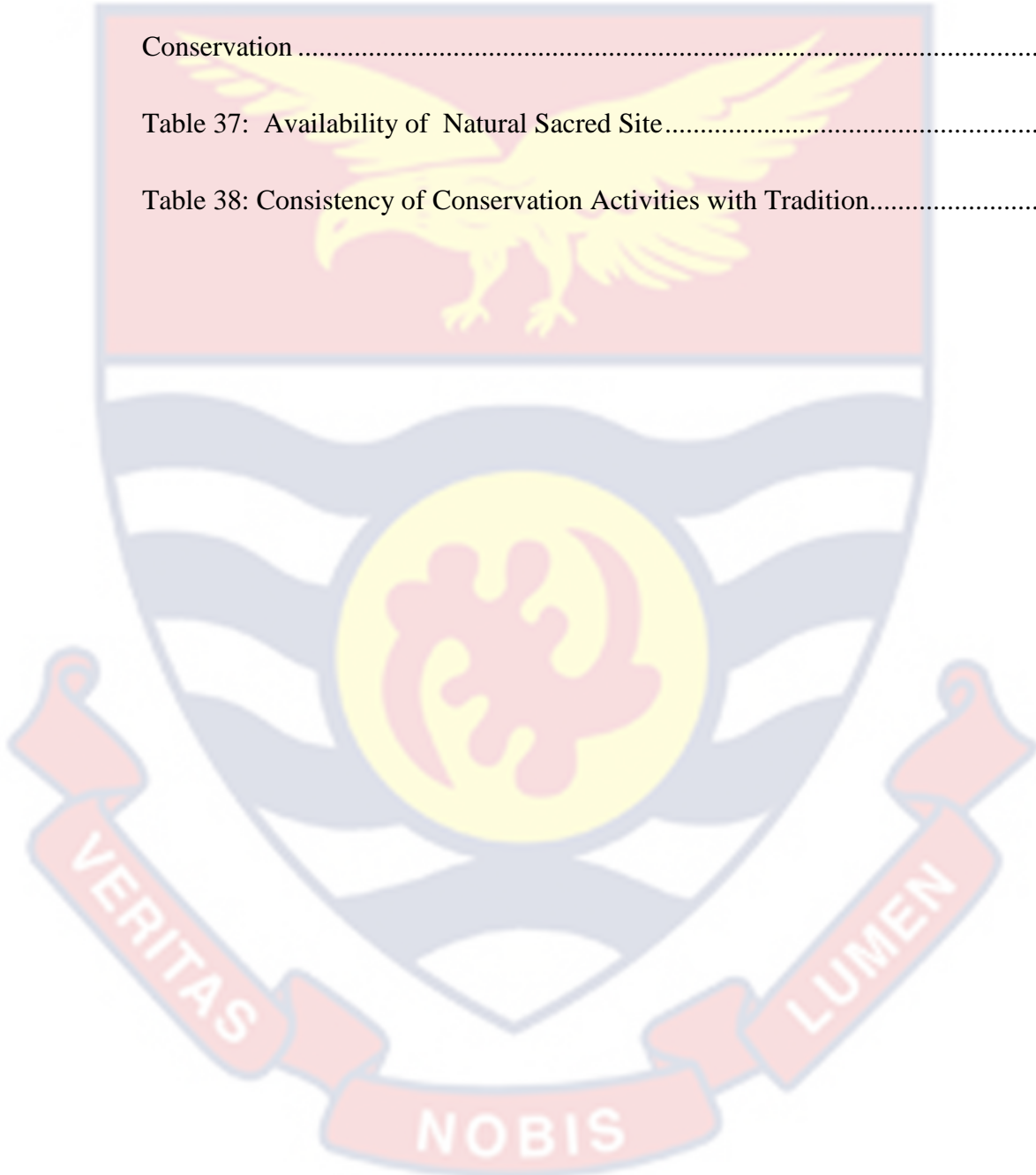
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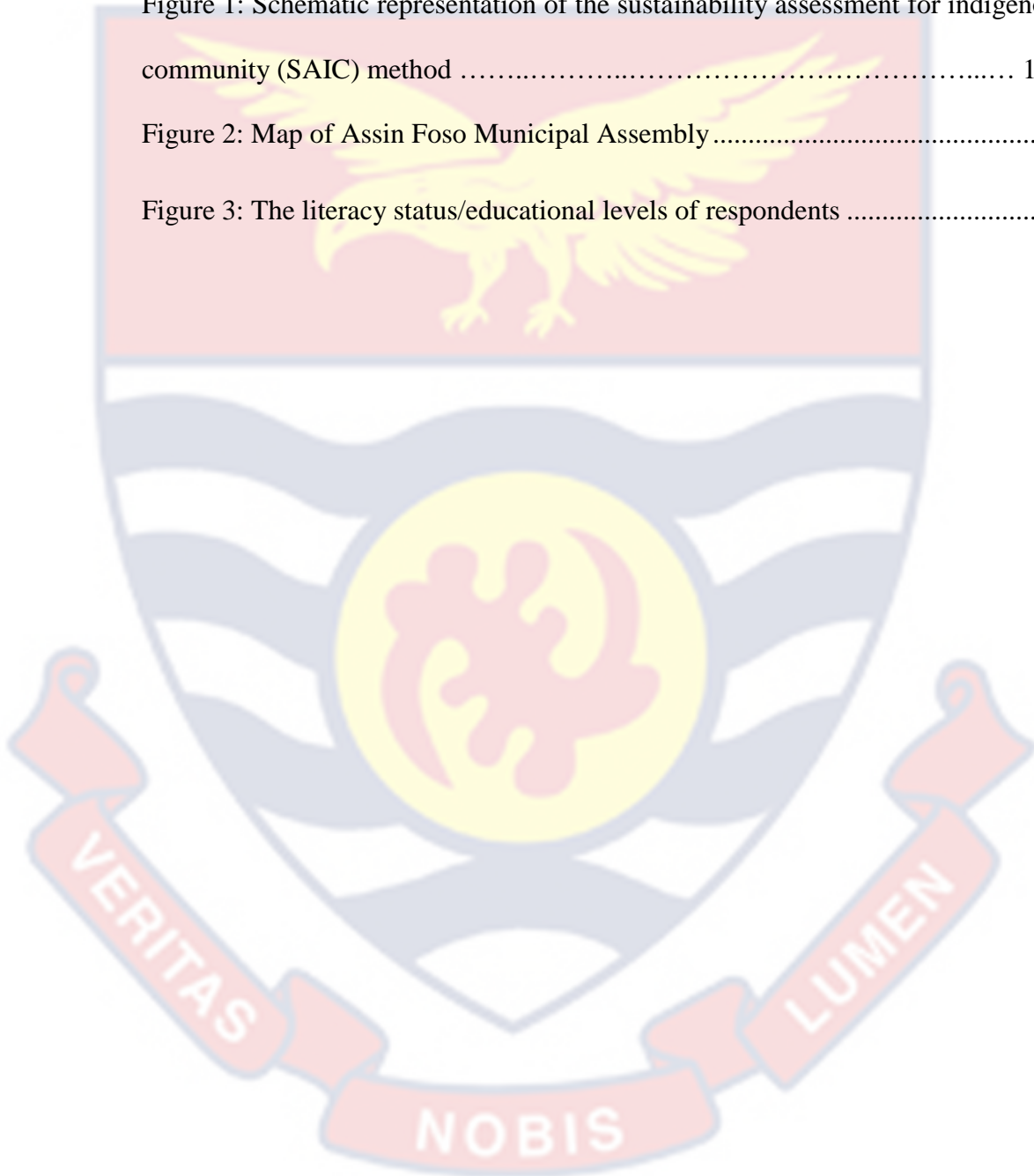
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LIST OF ACRONYMS

CREMA – Community Resource Management Area

CBNRM – Community Based Natural Resource Management

SAIC – Sustainability Assessment for Indigenous Communities

GFIP – Ghana Forest Investment Programme

ENFALP – Enhancing Natural Forest and Agroforestry Landscape

NRM – Natural Resource Management

CNRM – Community Natural Resource Management

CEC – CREMA Executive Committee

CRMC – Community Resource Management Committee

LSA – Livelihood Support Activities

IMI – Impact Mitigation Intervention

FPIC – Free Prior Informed Consent

CF – Community Forestry

UNCED - United Nations Conference on Environmental and Development

GHG – Green House Gas

GWP – Global Warming Potential

EU – European Union

GDP – Gross Domestic Product

UN – United Nations

TEK – Traditional Ecological Knowledge

ATR – African Traditional Religion

CHAPTER ONE

INTRODUCTION

This section introduces the study in ten sections namely; framework (background) to the problem, problem statement, study objectives, research questions and hypotheses, the significance, scope, and limitations of the study, as well as the definition of terms and the organization of the study.

1.1 Background to the Study

Globally, forest landscapes hold the utmost essential God made resources which offer indispensable benefits and products for anthropological sustenance (Gilli, Muriel, & Walters, 2020). Growing human population and poverty worldwide have fiercely accelerated the degradation of biodiversity and natural resources. Sustainability or sustainable forest resource management is the prudent use of natural resources in a mode, and at a pace that preserves their biodiversity, productivity, ability to regenerate, liveliness as well as the ability to meet the current and future, pertinent ecological, economic and social functions, in a way that does not affect other ecosystems (FAO, 2014). Native and Western societies are suffering growing glitches of unsustainability with least recognition to their natural resources and custom (Maturano, Serrano, García, Magos, & Herzberger, 2021). According to Koffi, Djoudi and Gautier (2016), approximately 600 million people in sub-Saharan Africa for example, depend on woodlands for their survival, most of which lack security for food. Sustainability assessments are impact assessments that focus on both the current and future advanced sustainability (Maturano et al., 2021). Sustainability assessment is therefore an

auspicious method for communal-level sustainability valuation (Sala, Ciufo, & Nijkamp, 2015). Sustainability valuations are indispensable in gathering evidences relevant to the key sustainability matters in view of their framework and complication (Bond & Morrison-Saunders, 2011) since it is a progression where tools, dimensions, indicators, methods and decision support methods link together (Karvonen, Halder, Kangas, & Leskinen, 2017).

More than seventy percent (70%) of the total populace of Ghana derive their source of living from forestry and biota resources (Amoah & Korle, 2020). However, these resources are suffering significant level of depletion owing to their unregulated exploitation (Amoah & Korle). A forest cover decline of near 1.6 million hectares was recorded in the country between the year 2000 and 2010 (Marfo, 2010; Osei-Mainoo, 2012). Consequently, sustainability valuation to warrant the Earth's ability to sustainably support its various life forms for the impending generation has turned out to be imperative (Karvonen et al., 2017). Both native and western groups have acknowledged the inordinate need for a communal level sustainability evaluation (Maturano et al., 2021).

Sustainability encompasses the environmental, economic and social settings (the three-dimensional approach). A multi-dimensional impact assessment for decision-making is central to sustainability assessment (Kangas, Kurttila, Hujala, Eyvindson, & Kangas, 2015). Unsustainability may occur when one dimension is recognized as more important than the others (Kopnina, 2016) and thus, employing the 3-dimensional approach is very crucial. It is however imperative to incorporate indigenous culture and beliefs in sustainability assessment as research

has confirmed that the triggers of unsustainability go beyond the popularly known three-dimensional approach (the environmental, economic and social dimensions). Sustainability issues have been tackled from diverse perspectives, ranging from recompence or compensation and thresholds to robust or weak sustainability (De Mare, Granata, & Nesticò, 2015; Janeiro & Patel 2015). The sustainability concept is also bashed for its human centered propensity (Kopnina, 2016). Though some impacts (such as global warming and trade) are universally felt, it's worth noting that the situations in all the three (3) dimensions differ with respect to locations (Karvonen et al., 2017).

Multi-dimensional sustainability is gradually becoming the conventional thought in policymaking against the earlier reserve-centered methods (Tuomasjukka, Berg, & Lindner, 2013a). Nevertheless, it is projected that the existing human influenced destructions have surpassed the bounds the earth could contain and more irrevocable harm is continually happening (Mancini et al. 2015).

The Community Resource Management Area (CREMA) concept was piloted by the government of Ghana as an approach to decentralize resource management to communities who unite to pursue the management regime of an area common to them. The CREMA concept was introduced by the Wildlife Division of the Forestry Commission of Ghana to enhance concerted and involved resource managing in the country (CREMA progress report, 2018). CREMA aims to promote communal resource management in un-gazetted lands and also grant

concerned communities the autonomy to run and benefit economically from their available resources (Asare, Kyei, & Mason, 2013).

According to existing records, more than 40 CREMAs at various stages of development have been created in Ghana (NRC, 2019). However, these CREMAs upon their good intentions have not lived up to the expectations according to several CREMA and expert practitioners. The sustainability of the CREMAs is unclear in terms of implementation. Hence the need to conduct “Sustainability Assessment of Community Resource Management Areas in Ghana”. This assessment will inform actions towards making CREMAs resilient and sustainable to achieve the purpose for which the model was designed.

1.2 Statement of the Problem

Community Forestry or Community Forest Resource Management has gained recognition as an auspicious method to achieving workable management of forest resources, whilst ensuring improved livelihood typically in rural settings of developing countries (Poudel, 2001). Ghana has integrated Community Forestry (Community Resource Management Area) as a complementary method to run the country’s forest resources since the year 2000. It is extensively thought that community forestry is a very competent resource management mechanism ecologically, economically and socially and thus, a reliable sustainability enhancement approach. As publicized in the year 2000, Ghana has for some time now been executing a collaborative resource management under the auspices of the Wildlife Division of the Forestry Commission to give local communities

governance and management responsibility for resource management to enable them benefit directly from their forest resources (NRC, 2019).

The strategy comes with appropriate governance structures and instruments that create the enabling environment for locals to manage sustainably the natural resources available to them in off-reserve areas (NRC, 2019).

According to existing records however, more than 40 CREMAs in various stages of development have been established in Ghana. These CREMAs notwithstanding their good intentions have not lived up to expectations according to several expert practitioners (NRC, 2019) and the observation made on grounds in the Assin Central municipality. The results vary nationwide yielding some uncertainties about sustainability of the existing Community Resource Management Area approach in some practicing areas. For instance whilst the results prove environmentally and socio-economically prudent at Zikpiri CREMA, according to research conducted by Baddianaa and Baaweh (2021) on the prospects of Community-based natural resource management in Ghana: A case study of Zukpiri CREMA, it is observed otherwise at the Ankasa CREMA via the study by Bempah et al. (2019) on the evaluation of the Community Resources Management Area (CREMA) programme around Ankasa conservation area, Ghana; and also through the study by Owusu-Ansah (2020) on Leading Sustainability: Understanding Leadership Emergence in Community Resources Management Areas in Northern Ghana.

Researches have been conducted on CREMAs from different perspectives of CREMAs. However, no work has been done on the sustainability assessment of

CREMAs in Ghana. Hence the need to conduct “Sustainability Assessment of Community Resource Management Areas in Ghana: The case of Adwenaase CREMA”. This assessment will inform actions towards making CREMAs resilient and sustainable to achieve their intended goal.

The research basically sought to assess and analyze the social, ecological, and economic sustainability as well as the cultural significance of the Community Forestry (Community Resource Management Area) in the Assin central municipality. It also sought to identify the connection between social and ecological conditions of community resources, by evaluating indicators and trends of respective conditions over a period of time. This will help in creating a robust self-monitoring scheme via the indicators developed with reference to indigenous management strategy that may be replicable in the future. Furthermore, the research outcomes are also aimed to help community resource planners, policy makers and researchers to understand and incorporate the dynamics of social, economic, ecological/environmental and cultural (belief systems) dimensions in the management and sustainability of Community Forestry (Community Resource Management Area).

1.3 Purpose of the Study

The research basically sought to assess and analyze the social, ecological, economic sustainability as well as the cultural significance of the Community Forestry (Community Resource Management Area) in Ghana, precisely, Adwenaase Community Resource Management Area in the Assin central municipality. It also sought to identify the connection between social and

ecological conditions of community resources, by evaluating indicators and trends of respective conditions over a period of time.

1.4 Research Aim and Objectives

Research aim

- To evaluate the sustainability of Adwenase Community Resource Management Area in the Assin South Municipality.

Research objectives

- To assess the socio-economic impacts of CREMAs on local communities;
- To assess the ecological/environmental impacts of local communities on CREMAs;
- To evaluate the impact of cultural/belief systems of indigenous communities on CREMAs.

1.5 Research Questions and Hypotheses

1.5.1 Research questions

The research sought to answer the following central questions:

- To what extent do economic variables of CREMAs impact indigenous communities?
- To what extent do indigenous communities impact the ecological/environmental variables of CREMAs?
- To what extent do belief systems of indigenous communities impact CREMAs?
- What is the trend of resource condition in the area?

1.5.2 Hypotheses

H_1 :

- There is an economic impact of CREMAs on indigenous communities.
- There is an ecological/environmental impact of indigenous communities on CREMAs.
- There is a socio-cultural impact of indigenous communities on CREMAs.

H_0 :

- There is no economic impact of CREMAs on indigenous communities.
- There is no ecological/environmental impact of indigenous communities on CREMAs.
- There is no socio-cultural impact of indigenous communities on CREMAs.

1.6 Significance of the Study

The study sought to contribute to the current literature on community-based resource management and sustainability in Ghana with particular focus on the Adwenase Community Resource Management Area in the Assin Central Municipality. Additionally, the study has a policy dimension as it could unravel novel information required to re-evaluate the sustainability spaces and approaches for enhanced sustainability of Community Resource Management Areas in Ghana. This could help:

- To provide baseline data for decision-making.

- To provide information on the sustainability of CREMAs in Ghana.
- For both references for academic and sustainability monitoring.
- To provide information on policy formulation, implementation and evaluation.
- To enhance attainment of the Sustainable Development Goal 15.2, which seeks to foster sustainable forest management.

1.7 Delimitations

The study focused on the Adwenaase forest, a Communal Resource Management Area at Assin Akropong and environs in the Assin Foso Municipality. The study captures in cooperation the management's and individual member's perspectives of the sustainable management of the resource area.

1.8 Limitations

These encompass factors that posed significant hindrance or held back the study, and include: delay in obtaining ethical clearance from the Institutional Review Board (IRB), UCC to start the work. The delay significantly reduced the time span of the study, and limited resources would not permit a census of all members of the study communities. Though the locals' participation was encouraging, the initial assumption that respondents would voluntarily partake in the study was not realised as assumed, as some locals expressed unwillingness to participate in the study, whilst others too demanded for some incentives to compensate their participation.

1.9 Definition of Terms

Indigenous People: According to the United Nations (UN) indigenous people are people who are heirs and who practice inimitable way of life and ways of connecting to society and the environment.

Community Based Natural Resource Management: According to Armitage (2005) is an approach that fulfills both environmental or ecological and socio-economic goals and thus, balances the utilization and management of vital ecosystem operations by way of entrusting local people and community-based organizations with decision-making powers and management authority over natural resources.

Community Resource Management Area: Is an area entrusted in the care of local people and community-based organizations to manage through approaches that fulfill both the environmental and socio-economic goals of the people.

Sustainability: Sustainability or sustainable forest resource management is the prudent use of natural resources in a mode, and at a pace that preserves their biodiversity, productivity, ability to regenerate, liveliness and their ability to meet present and the future, pertinent ecological, economic and social needs, in a way that does not affect other ecosystems (FAO, 2014).

Sustainability Assessment: Is a type of impact assessments that focus on both the current and future advanced sustainability (Maturano et al., 2021)

Economic sustainability is the means of ensuring prudent use of natural and economic resources to achieve persistent economic growth whilst recognizing the social, environmental and cultural aspect of a community.

Environmental sustainability is the ability to conserve natural resources and ecosystems for the present and future generations.

Social sustainability occurs when the formal and informal processes, systems, structures, and relationships actively support the capacity of current and future generations to create healthy and livable communities.

1.10 Organization of the Study

The write up has been structured into six chapters. Chapter one constitutes the introductory part and throws light on the background of the study, statement of the problem and the objectives of the study among other preliminary topics. Chapter two constitutes the literature review which discusses the thoughts and the theoretical contexts relevant to the work. Chapter three presents the methods and techniques employed for the data collection and analysis, as well as providing a transitory portrayal (description) of the case study area. Chapter four presents the results of the study; chapter 5 discusses the study outcomes as gathered from the field and also compares theory and the practice of sustainability issues in the study area. Chapter six presents the conclusions and policy recommendations.

CHAPTER TWO

LITERATURE REVIEW

This chapter evaluates literature associated with community resource management in general, particularly forests. The review considers the conceptual framework of the study, the contemporary global view of sustainable community resource management, community participation in forestry conservation projects, influencing and deterring factors of local participation in community resource management, sustainability and sustainability assessment of community resource management areas, and the importance of communal based resource management areas to local communities.

2.1 Conceptual Framework

The conceptual framework adopted for this research is based on the adaptation of the systematic guidelines for sustainability assessment (the Sustainability Assessment for Indigenous Community (SAIC) method) by Sala et al. (2015), particularly for native groups or communities. Frameworks have emerged imperative tools for assessing sustainability by way of framing ethics, standards and context of research (Bond & Morrison-Saunders, 2011; Sala et al., 2015) and as well enable the portrayal of standards and scalability (Sala et al.). A theoretic structure like this is typically employed in sufficiently dealing with the characteristics of aboriginal groups or people, including their portrayal of sustainability. The framework specifically addresses sustainability in two folds, that is, “values and considerations” and “procedure”. Figure 2.1 below expounds

how the Sustainability Assessment for Indigenous Community (SAIC) method addresses sustainability.

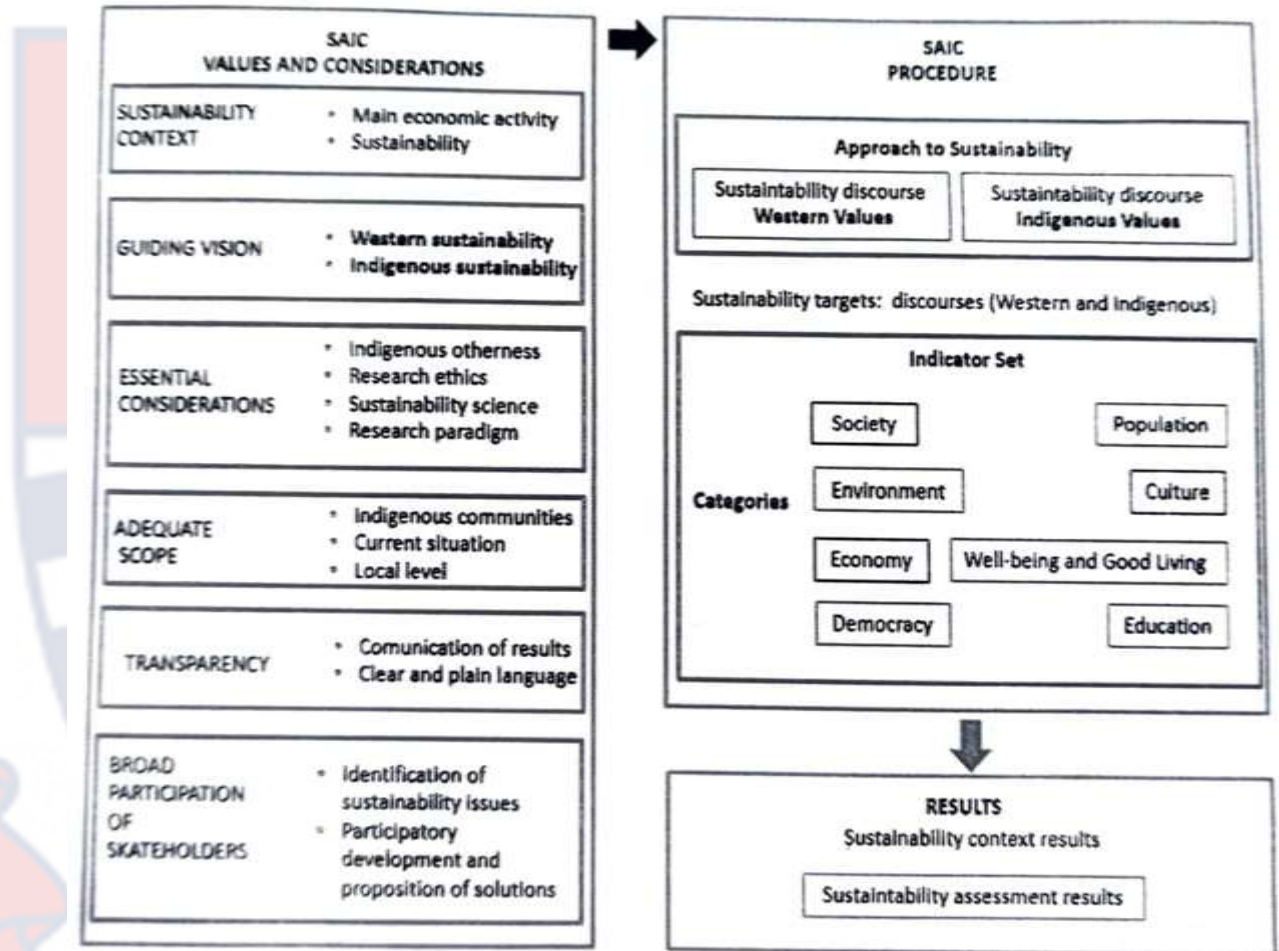


Figure 1: Schematic representation of the sustainability assessment for indigenous community (SAIC) method (Sala et al., 2015)

2.1.1 SAIC Basis: values and considerations

“Values and considerations” employ concepts and viewpoints to form grounds for enhanced community-researcher(s) interaction and collaboration (Maturano et al., 2021). The key elements considered are “sustainability context”, “guiding vision”, “essential considerations”, “appropriate scope”, “transparency” and “broad engagement with stakeholders” (from the left side of Figure 1).

The various elements of values and considerations work collectively towards enhancing balanced and clear linkages between local groups and their knowledge systems. It also includes essentials engrossed on enabling collaboration and knowledge synergies between native communities (participants) (Maturano et al., 2021). The “sustainability framework” dwells on diverse information interaction commendations (Calleros-Islas, 2019; Santana-Medina, Franco-Maass, Sánchez-Vera, Imbernon, & Nava-Bernal, 2013). This opening phase ought to grant the scientist or investigator understanding of the study community’s key economic activities, detect local stakeholders and gain insight of the over-all contextual overview of the community. The phase encompasses surveys and focus groups, and the obtained information forms the basis for the SAIC results interpretation (Maturano et al.).

Aspects of Western and native sustainability ought to be considered when formulating a “guiding vision”, in relation to the definition of Western sustainability (Brundtland, 1987) and that of indigenous sustainability (Galván-Martínez, Almada, & Espejel, 2016), to fit in both approaches to enhance sustainability (Maturano et al., 2021). The “essential considerations” element caters for the incorporation of social, economic, environmental, as well as the cultural and indigenous features of a community. “Indigenous otherness,” “research ethics,” “sustainability science,” and the “research paradigm,” form the fundamentals for an all-involving and inspiring intercultural discourse (Maturano et al.). “Indigenous otherness” acknowledges indigenous knowledge systems on sustainability and thus, frames research standards meant to establish the

appropriate ethical procedures for studies that involves indigenous groups (AIATSIS, 2019).

The ethics of sustainability science (Clark & Dickson, 2003; Sala et al., 2013) permit knowledge exchange amongst discourses within environmental studies and the study paradigm (Hart, 2010), by way of a philosophical guide to store knowledge through collaboration between researchers and native groups, in line with participatory procedures (Mistry & Berardi, 2016) to form an all-involving research. The component “adequate scope” denotes the existing sustainability situation pertinent to an aboriginal community adapted to a community’s topographical space (Maturano et al., 2021). To this extent, it is worth considering to incorporate both Western and native sustainability indicators within an inclusive set of indicators. Steps to certify “transparency” ought to confirm the consents to all-inclusive study (Mistry & Berardi, 2016), and ensure communal empowerment by using the element of ethical research, for instance by communicating survey outcomes in understandable and or plain language. The comprehensive involvement of stakeholders must be all through the full evaluation procedure.

2.1.2 SAIC Procedure: means of sustainability measurement

Having accomplished the components of “Values and considerations”, the procedure (from the left side of Figure 1) follows. The procedure encompasses (a) evaluating the sustainability approach employed, (b) evaluating sustainability goals, (c) employing Western and indigenous integrated sustainability indicator

set, (d) interpreting the study outcome (Fig. 1). The “method to sustainability” step relies on sustainability science (Maturano et al., 2021). The approach embraces both Western and aboriginal depictions and understanding of sustainability, and thus, integrates ethics of both the native and Western sustainability discourses (Maturano et al.). “Sustainability goals” entails objectives, features and values of Western and native sustainability.

The Western features of sustainability consist of Sustainable Development Goals (SDGs), the features of sustainable communities (Lu, Geng, Liu, Cote, & Yu, 2017) and Agenda 21 objectives (Quarrie, 1992). Native features of sustainability comprise of the “good living objectives” developed from the outskirts of sustainability and regards for nature, indorsed by native societies (Vivir, 2013) and features relevant to the description of indigenous sustainability (Galván-Martínez et al., 2016).

2.2 Brief Background of Community Resource Management Areas in Ghana

Community or communal based Natural Resource Management, according to Armitage (2005) is an approach that fulfills both environmental or ecological and socio-economic goals and thus, balances the utilization and management of vital ecosystem operations by way of entrusting local people and community-based organizations with decision-making powers and management authority over natural resources. Similar among many countries globally, possession, access, utilization and managing the naturally occurring resources are done on the basis of a defined set of policies and regulations in Ghana. In Ghana, possession or

ownership and management of natural resources are consigned in the president as stipulated in the nation's constitution, in trust of Ghanaians (Oduro, Duah-Gyamfi, Acquah, & Agyeman, 2012). The main aim is to attain the protection and sustainable utilization of the state's naturally occurring resources. Quite lots of collaborative management and communal-based NRM programmes since the 1930s and 1970s have been experimented by Ghana and Burkina Faso respectively in their quests to addressing the degradation of their forests (Asare, et al., 2013; Sawadogo & Tiveau, 2011). Such programmes and or interventions are targeted at forest areas where population pressure is appreciably high and the survival of small-holders hinge on the available forests. Upon realizing the pressures of climatic change and the increasing rate of natural resource dilapidation, the Government of Ghana, has assumed a combined approach to attaining sustainable management of its available natural resources. This combined technique of resource management is linked to the Forest and Wildlife Policy of the country as well as the Ghana Forest Investment Program (GFIP), and is intended to address the fundamental drivers of deforestation and forest degradation (CREMA progress report, 2018). Nevertheless, the initiative rests on external players and adequate funding, pointing to what required and/or appropriate conditions, locally ingrained resource conservation and management systems could warrant epitome of forest conservation on sustainable terms.

The absence of the sense of ownership and inclusiveness in resource management in Ghana counts among these underlying factors (CREMA progress report, 2018). According to the CREMA report, usually, the top-down decision-

making approach was adopted for decisions concerning natural resource management and use which portrayed a sense of imposition on potential forest users and the locals. The Lands and Natural Resource Ministry of Ghana in its quest to correct this phenomenon employed collaborative resource management strategy as advocated for in the strategic activities of the Forest and Wildlife Policy of Ghana. This is attained via a Ghana Forest Investment Program under the theme; “Enhancing Natural Forests and Agroforestry Landscapes (ENFALP)”, according to the report.

The environmental discourse of recent times expounds on the need for cohesive resource management and a guaranteed local economic growth and improved resilience to climatic fluctuations through the integration of conservation efforts with opportunities (Minang et al., 2014; Sunderland et al., 2015). This project saw the piloting of the Community Resource Management Area (CREMA) concept as an approach to include the locals in natural resource management by delegating resource management powers to groups of communities who form coalitions with a common sense of purpose (same goal and objectives) (CREMA progress report, 2018).

Though diverse tools and philosophies have been developed by quite lot of authors to serve as guide to research and policy formulation on multi-purpose ecological settings (Chia & Sufo, 2016; Reed, Deakin, & Sunderland, 2015), the operationalization of these philosophies in a precise context remains ambiguous (Reed, Van Vianen, Barlow, & Sunderland, 2017). Additionally, there is often a challenge with funding for a long time (Hart et al., 2014), complexity, time- and

cost-intensiveness in employing a natural resource management method which considers multiple and contending land use forms and manages the complexities between them (Reed, et al., 2015; Reed, Van Vianen., Deakin, Barlow, & Sunderland, 2016). Some of these implementation setbacks could be addressed upon diagnosing and implementing the appropriate locally ingrained Natural Resource Management (NRM) techniques that could serve as the start way to effective integrated landscape methods. The idea of Community Resource Management primarily encompasses a coalition of individuals or communities approving of the management strategy of a shared area. It is required that the involved communities formulate a decision-making structure, a constitution and appropriate regulations to ensure sustainable natural resource governance and management (CREMA progress report, 2018). With CREMAs, usually, local groups generate an ecological corridor for both vegetation and wildlife, by linking various Protected Areas and Forest Reserves of a given area, according to report.

The role of these resources in bettering the wellbeing of indigenous groups is typically susceptible when specific framework or context for integrating indigenous groups in natural resource management is lacking (Islam, Nath, Jashimuddin, & Rahman, 2019; Kamwi, Endjala, & Siyambango, 2020). For example, Jiao, Walelign, Nielsen, and Smith-Hal (2019) observed in Tanzania and Kenya that the economic gains from the ecological resources of the Greater Serengeti-Mara ecological landscape were not meaningfully integrated together with conservation methods, resulting in various degrees of destruction to the natural resources. With the CREMA approach, much more rights are given to

local land owners and communities to access and manage on sustainable basis, the available natural resources. Enhanced living and human wellbeing, security of habitat and protection to endangered species are among the benefits of the CREMA system and additionally contributes to strengthened answerability and egalitarianism at the communal or local level, and helps diversification of revenue and improved local economies (CREMA progress report, 2018).

2.2.1 CREMA establishment procedures in Ghana

Several policies and regulations relevant to natural resource conservation have been articulated by the state in its quest toward ensuring sustainable consumption and management of these resources to avert their overutilization and illegitimate collection from their natural ecological setting. However, these policies and regulations have failed to fulfill their purposes, thus, do not cater for the local people's needs whilst ensuring the sustainability of forest and wildlife resources because they are state-centered (Baker, Murray, & Agyare, 2018; Baruah, 2015). Also, the execution of these policies and regulations have met several encounters repetitively (O'Connor, Djoudi, & Zida, 2021).

Consequently, innumerable substitutes to the government-centered and top-down methods toward deforestation and forest degradation mitigation which endorses decentralized forest management systems have been suggested (Baker et al., 2018; Baruah, Bobtoya, Mbile, & Walters, 2016). The Communal Natural Resource Management (CNRM) system is among the devolved natural resource conservation and or maintenance approaches that permit indigenous groups to

manage the forest resources available to them (Gilli et al., 2020; Owusu-Ansah, 2020). Minimal extent of destruction of forest and wildlife resources is largely known as an attribute of forest resource zones that are conserved by or in partnership with local communities (Addison et al., 2019; Hussein, Kendie, & Agbesinyale, 2016). In this vein, the forest and wildlife policy documents of 1994 and 2012 place emphasis on the community involved forest resource management approach (Oduro et al., 2012).

A negative association seems to occur among natural resource dependence and the wellbeing of indigenous groups. Nevertheless, protected areas co-management has emerged as an effective alternative means to lessen forest resource reliance by local communities (Islam et al., 2019). This protected areas co-management system is what has currently metamorphosed into Community Resource Management Areas in Ghana.

Consultations and consensus building

Consultations and consensus building preceded all the other steps and formed the foundation of the entire process. This level of the implementation stages was very critical since the buy-in to the project by the targeted stakeholders, particularly the local people depended on this (CREMA progress report, 2018). This stage ensured preservation of people's rights and all-inclusiveness, according to the report. As the social exchange theory advocates to study the societal department of the local people to CREMA management, mutuality, fairness, levelheadedness, standards, rules, regulations and volunteer association are keen to forest resource management by local communities (Baddianaah & Baaweh,

2021). Imperatively, communities and or members of some communities who express unreadiness to participate in the project are not forced to join the common agenda (CREMA progress report, 2018). The social exchange theory shares the opinion that the application of independent cost-benefit analysis and the evaluation of alternatives establish the basis for human relationships (Baddianaah & Baaweh, 2021). Supported by the Forestry Commission and Ghana Cocoa Board, the Community Based Organizations assumed an essential role to make the process all-inclusive in devoid of conflict (CREMA progress report, 2018). It is worth noting that a system was in place for channeling all grievances throughout the process (CREMA progress report, 2018).

In line with the CREMA system, community members who defy the laid down guidelines and protocols which ensure prudent use and sustainable management of the resources could be sanctioned in accordance with laid down standards (Baddianaah & Baaweh, 2021). Indisputably, failure to apply the relevant sanctions to flouters of conservation policies and regulations will inspire uncontrolled deviance among local members which will adversely affect the authority and yield unsustainability of the CREMA (Owusu-Ansah, 2020). Hence the need for proper consultations and consensus building with local communities.

Considering resource management programmes and resource use, CREMA communities are granted the autonomy to negotiate and take decisions on their own, once power is entrusted in the local people by issuing the Certificate of Devolution. In this regard, communications and dialogs are held primarily among

community level functionaries, thus, small holders, land owners, the CREMA cooperatives and district managements (Agyare et al., 2015).

Demarcation of the CREMA boundaries

Next to the discussions and consensus building stage was the delineation and demarcation of the CREMA borders (CREMA progress report, 2018). To avert issues of land losses and restriction to access, an all-involving approach was employed in demarcating the areas (CREMA progress report). Five CREMAs which names were unanimously agreed upon by all stakeholders were earlier delineated within the ecological corridor (CREMA progress report). The earliest five CREMAs are;

- i. Aowin CREMA,
- ii. Boin CREMA
- iii. Akontombraman CREMA
- iv. AsuoBiaNkyirima CREMA
- v. Juaboso District CREMA

Selection of executives

The selection process begins with the endorsement of the CREMA Executive Committee (CEC), which operates as the managerial body of the CREMA. The CREMA Executive Committee consists of selected members from the various Community Resource Management Committees (CRMCs) and their functions are in accordance with the CREMA constitution. The CREMA system is community owned, and thus should motivate community acceptance and

participation. The Community Resource Management Committees (CRMCs), which constitutes the community chapter of the CREMA in each CREMA community comes next to the CREMA Executive Committee (Baker et al., 2018).

The establishment of the CRMCs is based on the existing community managerial procedures, spelling out and describing their roles and tasks in line with the CREMA constitution (Agyare, 2013). The participating communities are represented by these executives at the CREMA executive level and the CREMA officials in charge of the general operation of the group were also voted into office (CREMA progress report, 2018).

Additionally, the basis of the CREMA is constituted by the farmers' union and or landholders. They liaise closely with the CRMCs to implement the CREMA goals and also ensure that CREMA Executive Committee plays its roles as determined by the administrative systems. They ensure the proper running of the CREMA by formulating and adjusting the constitution of CREMA when appropriate (Baker et al., 2018). Considering how many and the dispersal of its concerned communities in space, a CREMA may ensue within or beyond a single unit committee level (Baddianaah & Baaweh, 2021). Based on the CREMA structure, the CREMA Executive Committee (CEC) plays oversight role over the Community Resource Management Committee (CRMC), whereas the Community Resource Management Committee manages CREMAs within each community.

The CRMC is assigned to operate toward attaining set targets and aims of the CREMA, to execute programs, as well as function as a liaison between the CREMA Executive Committee (CEC) and the participating communities (Baker

et al., 2018). Governance is abetted by indigenous policies and principles including the CREMA constitution established by concerned groups (local communities), championed by CECs and in conformity with the District Assembly bye-laws (Asare et al., 2013; Baker et al., 2018). In Ghana, The Wildlife Division of the Forestry Commission is the principal institution in charge of establishing CREMA (Baddianaah & Baaweh, 2021).

Inauguration of the CREMAs

Usually taking approximately 3–5 years to inauguration, CREMA development could be described as an unrapid process. The Ministry of Lands and Natural Resources through the Ghana Forest Investment Program organized the inauguration and swearing in ceremony for the Five (5) CREMAs after the establishment of the executive structure, the development of constitution and code of conduct (CREMA progress report, 2018). The report indicates that, a certificate signifying devolution of power was handed to each CREMA by the Ministry of Lands and Natural Resources to authorize each group to manage their area based on their gazetted regulations and management strategies to seal the CREMA formation process.

2.2.2 Sustainability of the CREMAs

Building of the resource centers for each group

CREMA offices were established in all the five CREMA blocks to serve as a resource center, offices for CREMA executives and community engagement to enhance effective CREMA activities within the five CREMA blocks were established (CREMA progress report, 2018). Having built the offices, the

Ministry of Lands and Natural Resources officially organized handing over ceremony to officially hand over, to enable the communities to assume ownership of the offices, according to the report.

The participating community members were supplied with protective clothing, wellington boots, cutlasses, bicycles, motorbikes and mobile phones to enhance their work (CREMA progress report, 2018).

Provision of alternative livelihoods

To ensure sustainable natural resource management, support to local fringe communities is keen to minimize stress on the natural forest by providing them with alternative livelihood sources (CREMA progress report, 2018). In ensuring effective and sustainable natural resource and biodiversity conservation and or management, Livelihood Support Activities (LSAs) are employed to serve as complementary scheme to the usual indigenous economic activities but not as a replacement for existing conservation strategies such as standing guiding principles, conservation education, and safety (Ekpe, Hinkle, Quigley, & Owusu, 2014).

Besides, over the years of implementation of CREMAs, it has been identified that without alternative livelihoods or Impact Mitigation Interventions (IMI), the CREMAs become inactive when the projects end due to lack of resources for the locals to organize themselves (CREMA progress report, 2018). This backdrop prompted the provision of community preferred alternative livelihoods to the established CREMAs so that proportion of the accrued revenue will contribute to continual operation of the CREMAs, according to the report.

In most instances LSAs include a more sustainable use of available natural resources to produce extra income. In other cases, however, the use of natural resource is excluded (Acheampong et al., 2014). Considering the stand point of the beneficiary communities, LSAs constitutes a compensation scheme for restraining and/or limiting accessibility and the right to use available resources (Ekpe et al., 2014). Livelihood Support Activities used for conservation reasons are mostly either government funded or funded by non-governmental organizations, and sometimes also under financial aids obtained via multi-lateral arrangements with some international organizations. In the developing parts of the world, such funds constitute minor grants and payments designed and targeted at providing economic relief to groups participating in or embarking on sustainable livelihoods and conservational programmes (Bauer, 2014). The aim of these funds is to serve as a booster to the local economic activities with trifling ecological effects, usually in fringe communities on the borders of conservation areas. Bauer asserts that, these support systems as well persuade actors to conserve biodiversity and or use its products in a sustainable way as it aims to balance the profitability difference between unsustainable activities and sustainable alternatives. The Livelihood Support System mechanism to augment sustainable management of forest resources have indeed proved to be an important conservation tool over the years.

The following alternative livelihoods were considered for the CREMA initiative;

- i. Bee keeping
- ii. Soap making (perfumed soaps and local soaps from cocoa pods)

- iii. Snail rearing
- iv. Fish farming
- v. Tree nurseries.

Appreciating the history of using LSAs as a mechanism for biodiversity conservation in Ghana could be traced from the past outlook of formal natural resource management, especially in Ghana's forests (Ekpe et al., 2014). The use of investments through livelihood support activities to provide economic incentives for natural resource and biodiversity conservation in Ghana is a strategic move to curb and/or curtail the threat posed to biodiversity due to increasing human population and poverty. Examples of such activities include woodlots, beekeeping, snail breeding, and mushroom farming (Ekpe et al.).

Capacity building

Building local capacity is central to attaining a long-term natural resource management outcome on sustainable basis (CREMA progress report, 2018). The report also asserts that, achieving operative and competent implementation of CREMA is dependent on the participating individuals and local communities possessing the essential capacity to undertake the various activities under the Ghana Forest Investment Project. Capacity building in this regard incorporates knowledge transfer in seedling production and afforestation programmes, as well as recognizing 'alternative livelihoods' (e.g., small-scale livestock rearing), according to the report. This training type places emphasis on skill transfer than augmenting farmers' cooperation ability and enablement (Ros-Tonen, Derkyi, & Insaideo, 2014). Community members, field facilitators and field safeguard

officers were engaged in capacity building training to equip them with the requisite knowledge and skill for the course (CREMA progress report). Capacity building may require the backing of external organizations such as the Tourism Board and NGOs and also via internal objectives of the CREMA itself (Eshun, 2010).

Community members are trained to appreciate the value of the environment and why to conserve it, whilst not compromising on their roles and anticipated benefits from conservation activities (CREMA progress report, 2018). Engagement with community members at the various community centers within the blocks provides opportunity to engage in a face-to-face interaction with project beneficiaries (CREMA progress report). The CREMA system is established on the principle of adaptive management, where monitoring and evaluation form critical components of its development and operation (WD, 2000, p. 10). Asare et al. (2013) suggest that the CREMA governance structure which is mainly tapped from traditional beliefs and values improves communal harmony, policy-formulation and problem solving and thus, affirms adaptive management.

2.2.3 The rationale of community resource management in Ghana

Community-based natural resource management (CBNRM) involves the communal use and conservation of the naturally occurring resources in the rural settings by indigenous groups with a defined, unique identity, using mutually possessed facilities (Asare et al., 2013). The aims of CBNRM according to Asare et al. (2013) are to:

- i. secure the involvement of communities on their own accord in an unrestricted programme that provides lasting remedy to natural resources use related problems.
- ii. present a novel system of communal ownership and provincial or territorial rights to the naturally occurring wildlife resources for residents in the target areas, whilst the management of these resources becomes the responsibility of the resident people.
- iii. present suitable organizations under whose custody resources can be legally and justifiably conserved and be utilised by residents or indigenous groups for their own direct gains in the form of income, employment, and production of venison.
- iv. provide technical and financial assistance to participating communities in the programme in aid of achieving their aims.

The emphasis of CBNRM goes beyond prudently managing natural resources, as it similarly reflects the necessity for communal development, aboriginal self-governance as well as the creation of native organizations for the conservation and or management of common resources. Governments, donors, non-governmental organizations (NGO), conservation agencies, and, rural communities have endorsed these and similar principles in their quest to ensuring sustainability of natural resources. CBNRM emerged the foremost resource management and development model of the 1990s of which international aid agencies and lending organizations have confidently adopted its principles (Asare et al., 2013).

2.3 Community Participation in Forestry Conservation Projects

The idea of community involvement initially developed as a result of the condemnation of the typical development programmes of the 1960s and 1970s, which critics demanded answers to the usual failure of development programmes and was concluded it was due to the non-involvement of local people (Macharia, 2015). Quite number of projects was debated to have been planned and executed without deliberation with and participation of the target people to be directly affected (Macharia). Participation per the World Bank is “a process through which stakeholder’s influence and share control over development initiatives and the decision and resources which affect them”.

According to Lise (2000) and In Phiri (2009), participation has three features, that is, contribution to, benefiting from, and participation in decision making and appraisal. Involvement connotes that the outcome of a plan or scheme is the direct initiative of the local people concerned (Macharia, 2015). Real participation entails people’s involvement in the planning, organization and decision making of a project from the start in a manner that the project reconciles with their desires and abilities. Macharia asserts that partaking does not assure definite accomplishment. However, additional influences like the formal and lawful support by the government and their respective institutions and agencies effectively aid the participatory processes by creating a conducive atmosphere for the processes to thrive.

The local communities’ vigorous participation in resource conservation and usage, commonly acknowledged as Community Forestry (CF), has assumed a

prominent method for workable forest conservation (Macharia, 2015). After the former forest policy to stop logging in Nepal failed, coupled with the relevance to employ a forest conservation system appropriate to integrate local needs and aboriginal schemes, the CF policy emerged in 1970 (Shrestha & Mcmanus, 2018). Participatory procedures result in stakeholders appreciating each other's goals and viewpoints, and that, smoothening communication flow even in situations where concerned parties miss the mark to fix a specific challenge (Watts, 2008).

This development yields indigenous capacity building for natural resources management and the skill to negotiate locally related conservational programmes and as well enable appreciable benefits targets to the vulnerable in society by identifying the key stakeholders (Macharia, 2015). Improved public involvement could enhance harmony, which is obligatory at all stages of decision-making and setting priority. According to Macharia, People's involvement in planning and executing plans and techniques or practices pertinent to ecological management is critical on both grounds of ethics and sustainability. Macharia emphasizes further that, on ethical grounds, people ought to be allowed to determine the direction of their development and also influence their means of subsistence because they bear the costs of their own choices and decisions. Environmental management programmes that ignore target parties in policy decisions have always suffered unsustainability.

It is very essential to encourage interactive communal involvement in natural resource management to instill and deepen the sense of ownership among native groups or communities that live within and around the borders of forested

landscapes (Watts, 2008). The involvement of local people in forest conservation emanates from the recognition that sustainable development entails building the potentials of local folks to inspire and control on long-term basis, the means by which they earn their livelihoods (Macharia, 2015). The unfortunate conservation outcomes that resulted from times of aggressive resource management approaches have provoked program or policy developers and academics to reassess community's role in resource conservation and use (Macharia). Understanding the perspectives of the different stakeholders enhances community involvement in forest resource management. Historically, suspicion, punitive measures and limited dialogue have shown to be the main characteristics of the connection between dwellers of native communities and the agencies assigned to resource conservation, according to Macharia. It is very relevant to have sessions where state officers and community folks can meet to deliberate on issues bordering the expectations or hopes of the local people in an attempt to improve community participation in resource management.

The move to optimize better indigenous involvement in resource conservation emanating partly from the conviction that native participation could minimize aggression to conservation programmes and also limit local groups' access to resources without any substitute measure is unethical (Stem et al., 2002). From conservationists' view-points, various wildlife and forest management methods have deprived local communities of their entitlement to what they own and thus, have adversely influenced their attitude towards conservation programmes (Macharia, 2015). Globally, protected area

management and local economic development conflict is on the rise. This requires conservation methods that additionally preserve the rights of the locals who live within and around the borders of conservation area. It is hence vital for the frontiers of a conservation area to lead to achieve the expectations of the fringe communities (Njogu, 2004), whilst not compromising on sustainability.

Wildlife and forest management methods that dwell on the protectionism approach, which is protection centered have deprived native groups or communities of their prerogative to resources available to them (Macharia, 2015). The global creation and extension of wildlife and forest conservation landscapes have the accidental effect of displacing indigenes and denying them of their principal source of social and economic means of support (Macharia). Macharia emphasizes that, the centralized state of management and the absolute neglect of aboriginal groups from resource conservation do not only alter their socio-economic schemes but as well the earlier confirmed practices that are acknowledged to be beneficial to the natural environment. Subsequently, conservation methods that acknowledge local involvement have become very common predominantly in emergent nations. These methods are aimed at providing community-level remedies to resource complications in a varying locally recognized structure (Macharia). This is attained by granting some specific rights as inducements to arouse local involvement in the conservation efforts. Until the UNCED (United Nations Conference on Environment and Development) consent which certifies execution of sustainable development to dwell on aboriginal resolutions resulting from local initiatives, the community-

based conservation method to biodiversity management was entrenched (Macharia).

Agenda 21 promotes a resource conservation strategy that guarantees indigenous involvement, and is attainable via decentralization of resource management powers to indigenous groups or communities to control and manage the use of the natural resources available to them (Njogu, 2004).

2.4 Factors that Influence Local Participation in Community Resource Management

According to Gebregziabher and Soltani (2019), the key influencing factor to local people's participation in the co-management of ecological resources chiefly hinges on the physical returns they obtain from the conservation area. Therefore, making the most of the physical returns from conservation areas, for instance CREMAs via the participation of indigenous communities in conserving their forest resources requires immense attention (Baddianaah & Baaweh, 2021).

2.5 Factors that Deter Local Participation in Community Resource Management

2.5.1 Top-down project initiation

Community-Based Natural Resource Management (CBNRM) programmes have diverse origins. Local residents may be demotivated or decline to participate in projects when they are initiated superficially and forced on them, because the project may be alien to them (Measham & Lumbasi, 2013). For instance, in

Madagascar, either NGOs or government introduced CBNRM programmes of which the locals had a very negligible role both in their start and management and eventually led to its failure (Duffy, 2006). However, with the foundation of the CAMPFIRE programme as a case in point, externally imposed projects do not assure failure (Measham & Lumbasi). The programme as introduced by public servants in Zimbabwe in the late 1970s has chalked varied successes but has sustained till the 21st century (Child & Barnes, 2010). According to Measham and Lumbasi, the survival of the initiative resulted from the emphasis placed on partnering local groups or communities and endeavoring to decentralize revenue to local level management.

2.5.2 Lack of economic incentives

Sometimes, CBNRM does not offer satisfactory economic motivation to enhance sustainable conservation of a resource compared to other possibilities like money-making illicit poaching of highly valued resources (Measham & Lumbasi, 2013). This eventually occurs when taxation revenues are withdrawn from indigenous institutions and local groups or communities have restricted income support possibilities to dwell on whilst engaged in CBNRM (Francis & James, 2003). A typical instance happened in the Luangwa Valley of Zambia (Measham & Lumbasi). The valley defines a key conservation zone which stretches into two national parks and six Game Management Areas (Measham & Lumbasi). Nevertheless, excessive plundering of wildlife especially elephants and rhinos pertained owing to a dearth of inducements for resource management

and or conservation practices coupled with the profitable returns from illicit hunting (Measham & Lumbasi).

According to Measham and Lumbasi (2013), a step was initiated during the 1990s to permit trophy hunting by the locals within the area to compensate their livelihoods. The project was highly effective for the intended purpose; on estimation, roughly 45,000 dwellers in the Lupande Game Management Area gained from the project until its failure in 2000 (Measham & Lumbasi). The failure resulted from the absence of incentives for conserving wildlife in the area after all international trophy hunting activities were put off by the government (Measham & Lumbasi). The development of a robust CBNRM programme in the Luangwa Valley was partly affected by centralized management approach by the government and political struggles (Lubilo & Child, 2010). This case suggests clearly that, the replying effects of sidelining indigenous groups in conservation programmes could be numerous.

2.5.3 Lack of autonomy

The objective of local communal enablement is frequently affected by the exclusion of local folks in advanced levels of authority to spearhead projects and withholding resources from native stakeholders (Measham & Lumbasi, 2013). In India, the formerly “Community Forest Agreements (CFA)” has been officially substituted with the “Joint Forest Management (JFM)” mechanism to seal the role of government actors (Nayak & Berkes, 2008). In Nepal, for instance, “community forestry” related programmes have yielded enrichments to forest condition, though lacking returns to indigenous groups and communities owing to

the aim to curb the rate of use of forest resources in pursuit of sustainable forest management (Shrestha & McManus, 2018). Undeniably, the existence of top controls is too common in executing community-focused programmes, making reference to the foundation CAMPFIRE project in Zimbabwe which required endorsement from a body under the Parks and Wildlife Act (1975) of Zimbabwe, in the form of a District Council (Measham & Lumbasi).

Consequently, local natural resources conservation does not become the absolute responsibility of local community level, but rather that of the district-level authority (Measham & Lumbasi). Therefore, the communities feel sidelined from management in this instance and hence resulting in lack of motivation (Alexander & McGregor, 2000).

2.5.4 Incompatible livelihoods and opportunity costs

The failure of some CBNRM programmes could be attributed to opportunity costs being too high or the failure of the programmes to add value to a former resource use. Eco-tourism, for instance, frequently flops to offer fiscal gains to native populaces, except they themselves had developed the capacity and skill to obtain some returns from income generating techniques linking to tourism (Blackstock, 2005). In some instances, a stricter effort is put in to halt livelihoods observed as damaging from the standpoint of conservation (Measham & Lumbasi, 2013). CBNRM in Palawan Island in the Philippines, which was intended to conserve forest resources was abortive since it showed an uncertain switch from

swidden farming to rice farming, which disregarded indigenous source of living (Dressler, 2010).

Some of the problems concerned with opportunity costs is expectant or untried expectations concerning the productivity of adopted skills which have interrupted local conservation methods and compatible techniques, which do not yield production goals (Measham & Lumbasi). An example is the failure of alley cropping in Thailand, which upset local methods and could not upsurge production, and exposed fields to infestation by plant and animal pests (Li, 2002).

2.6 Sustainability

Sustainability or sustainable forest resource management is the prudent use of natural resources in a mode, and at a pace that preserves their biodiversity, productivity, ability to regenerate, liveliness and the ability to meet the current and the future pertinent environmental, economic and social functions, in a way that does not affect other ecosystems (FAO, 2014).

2.6.1 The concept and origin of sustainability

The idea of sustainability, which means not to harvest in excess of what the forest produces in new growth was established first in forestry (Wiersum, 1995). The term “Nachhaltigkeit” (thus, sustainability in German) was earlier used in 1713 (Wilderer, 2007) to depict its meaning.

Sustainability is an important matter of study for economic experts. A renowned instance is the discovery of Thomas Malthus’ “looming mass starvation” theory (owing to the unavailability of farming land to cater for the

agricultural needs of growing population) in 1798. Harold Hotelling, an American economic expert articulated a model on the optimum exploitation of non-renewable resource in 1931 and is still of great importance. In the report of the Club of Rome, attention was directed to global public policy (Meadows, Meadows, Randers, & Behrens, 1972), and projected that many life-dependent natural resources would run-out within one or two generations. These pessimistic predictions have been quite too numerous and have not yielded any solution to the pending doom of unsustainability.

Therefore, the popularly known Brundtland report of the UN World Commission on Environment and Development was hailed for directing the path out of this challenge (Kuhlman & Farrington, 2010). Thus, the concept of Sustainability originates from the Brundtland report of 1987. That report sought to address the strain between the ambitions of humans towards an improved life on one end and the naturally imposed restrictions on the other end. With time the concept has been re-constructed as entailing social, economic and environmental dimensions. It was through this report the concept of sustainability emerged and gave it the widespread recognition it has today. The question which Brundtland and her colleagues posed themselves was: “how can the aspirations of the world’s nations for a better life be reconciled with limited natural resources and the dangers of environmental degradation?” (Kuhlman & Farrington). Their answer was sustainable development: thus, development that caters for the needs of both the present and future generations without compromise (Kuhlman & Farrington).

2.6.2 Sustainability assessment

Sustainability assessments are impact assessments that focus on both the current and future advanced sustainability (Maturano et al., 2021). Sustainability assessment is therefore an auspicious method for communal-level sustainability valuation (Sala et al., 2015). Sustainability valuations are indispensable in gathering evidences relevant to the key sustainability matters in view of their framework and complication (Bond & Morrison-Saunders, 2011) since it is a progression where tools, dimensions, indicators, methods and decision support methods link together (Karvonen et al., 2017).

Sustainability assessment is a crucial step to provide stakeholders with the required information in aid of designing and executing sustainable alternatives (López Ridaura, 2005). Factually, sustainability evaluation is an essential phase in the course of designing workable alternatives, in terms of strategic actions or scientific innovations (López Ridaura). Once the focus of a study or a development programme is to plan substitutes targeting at better conservation options, the necessity for a means or a tool to appraise such instantly comes up. The outcome of the assessment procedure then establishes the rationale for design of better replacements or substitutes (López Ridaura). López Ridaura further asserts that three main methods presently exist for sustainability valuation; that is, through indicators, indices and methodological frameworks.

Indicators of Sustainability Assessment of Community Resource Management Areas

Ecological indicators

Ecological sustainability in forestry is influenced by various factors either directly or indirectly linked to others (Cambero & Sowlati, 2014).

- Greenhouse gases

Conceivably, greenhouse gases (GHGs) or the accumulation of diverse GHGs under the term of global warming potential (GWP) are among the critical ecological indicators of bioeconomy (Change, 2014). Advanced nations have devoted to the Kyoto Protocol to minimize their GHG production since 1998 (Karvonen et al., 2017). Then onward, the European Union (EU) established its peculiar aims to decrease GHG emissions in its quest to mitigate climate change (EU regulation No 525/2013; Decision No 406/2009/EC 2009). GHG is a comparatively easy to measure indicator even accurately to some extent (Karvonen et al.).

In forestry, the usage of fossil fuels when extracting, conveying and processing of raw resources, produce distribution, usage and dumping generates a significant non-renewable GHG emissions (Cambero & Sowlati, 2014). The overall GHG calculation becomes a fairly easy arithmetical work once the (fossil) inputs are known (Karvonen et al., 2017). Estimating incidental GHG emissions, such as emissions from soils would be more difficult owing to variations in soil activity (Levasseur, Lesage, Margni, Brandão, & Samson, 2012). The argument lingers around whether or not carbon discharges from renewable sources should be taken for carbon neutral' and in which time frame (Czeskleba-dupont, 2012;

McKechnie et al. 2011) or whether some other methods be considered (Pawelzik et al. 2013). With the carbon-neutral method the GHG (or carbon) discharges from burning of biomass are ignored in GHG estimations since they are considered to be guaranteed by (re) increasing flora which form a carbon neutral circle where the overall GHG in the atmospheric cycle is not rising (Karvonen et al.). Yet, attainment of biomass comprises fossil contributions (e.g., fuels) as well as the effect of the GHG releases from burning of biomass and fossil fuels in principle, correlates with the consequential climatic impacts (Karvonen et al.).

Consequently, the over-all direct GHG emissions could be more for biomass than for fossil fuels unit per energy produced (Karvonen et al., 2017). In view of the fundamental climate change mitigation goals, this may pose problems in no time. Nonetheless, the entire carbon amount in the atmospheric cycle does not increase by biomass and therefore mitigates global warming as the fossil fuels replaced by biomass leads to a reduced amount of carbon in the atmosphere in the long run (Karvonen et al.). Universal strives to mitigate GHG have been confirmed already, with the Paris 2015 Treaty recording the most recent of all (Karvonen et al.).

The general aim of climate neutrality is attainable through the GHG-indicator. Furthermore, GHG is a universal sustainability indicator and interlaced with several influences, for instance use of fossil fuel (Karvonen et al., 2017). Most of the data desirable to compute the releases of GHGs is obtainable from state data (Karvonen). The GHG rate may be assumed in complete terms, or in a further descriptive way, for instance the carbon footprint (Mancini et al. 2015). However,

more study is required since evaluating the effects of the GHGs with certainty is not precise. Meanwhile, people are a bit skeptic about climate change, its causes and effects.

- *Fossil fuel use*

The use of Fossil fuel is a fine-matched indicator relevant to policy development from diverse viewpoints, considering that it is clear to understand, answerable and connected to various scopes of sustainability (Pawelzik et al., 2013). For instance, replacement of fossil fuels with bio-fuel options could give appreciable detail concerning GHGs and the economy (Den Herder et al. 2012) and show in both complete terms (thus, in capacity or volume and economic or monetary worth) and in comparative figures, for example portions in nationwide consumption or trade (Karvonen et al., 2017). Reducing the use of fossil fuel is an active means to mitigate climate change. Additionally, the use and extraction of fossil resources upsurges environmental risks, such as oil spills, more than generating renewable fuels do (Ernst, 2012). As a result of the critical role of fossil fuels in sustainability, it is greatly useful if measured distinctly since fossil fuel use serves as an indicator incorporated in GHG (Karvonen).

- *Water contamination*

Contamination of water sources is an issue of international interest and ought to be paid attention to (Pawelzik et al., 2013). Pollution of water could adversely impact well-being, recreation and biological diversity (Karvonen et al., 2017). However, measures to protect water (water treatment) may ignite economic pressures (Karvonen et al.). Eutrophication is the principal threat to surface

waters, whereas the primary triggering contaminants are phosphorus and nitrogen (Karvonen et al.). Water pollution from Finnish forests predominantly results from overflows after excessive logging, dumping and fertilizer application (Tattari et al. 2015). A number of doubts entails in their measurements, which queries their precision, even though quite lot of researchers have come up with some correct data and their real effects could be estimated in various means (Pawelzik et al. 2013; Tattari et al., 2015).

- *Industrial Processes*

Industrial processes that encompass the use of chemicals and their resultant effects on the pH and ecotoxicology in water need to be known and evaluated (Karvonen et al., 2017). In Finland, law outlines certain ethics on water usage and purity monitoring (Finnish law 1040/2006) (Karvonen et al.). On the whole, industrial operatives in Finland are demanded to undertake environmental impact assessment in order to be granted approval by the appropriate state agencies to operate their businesses (Finnish law 468/1994) (Karvonen et al.). Regulations (e.g., Finnish law, 1022/2006) as well outline ethics and limits on the quality of disposable water. The accessibility of Environmental permits and various applications are made readily available to the Finland public and that, accounting for the critical contaminants from industrial waste is possible (Karvonen et al.). Such records facilitate valuation of water safety requirements, a mechanism enhanced by appropriate laws in Finland; though, the case of other parts of the world may differ (Karvonen et al.).

- *Land use and Land use Change*

Land Use and Land Use Change (LULUC) as well as Indirect Land Use Change (ILUC) are major problems pertinent to the tropics where ecological landscapes are transformed into agronomic or other use forms, which eventually alters the ecological setting eternally and or severely in extreme situations (Henders et al. 2015). Because altered woodland areas in for instance, Finland are almost constantly restored, permanent land Use Change (LUC) as an effect do not occur in such areas (Karvonen et al., 2017). Consequently, in terms of forest resource management, concerns with LUC requires to be addressed by employing suitable standards and do not require dedicated Indicators (Karvonen et al.).

Intensive land management involving the removal of vegetation (e.g., final cuttings) barely exposes landscapes to water and wind driven erosion (Karvonen et al., 2017). Predominantly erosion is a serious environmental challenge in steep zones. Erosion dangers mostly rely on place specific influences, though, existing approaches aimed at evaluating such peril are to some extent restricted (Pawelzik et al. 2013). According to Thiffault et al. (2014), one issue frequently debated in forestry is soil productivity, particularly due to the severe forest or woodland biomass use, which upsurges nutrient depletion. Nevertheless, these effects stand quite uneasy to measure and also not simple to take a broad view owing to the dissimilar site-specific settings (Thiffault et al.). The least standards for forest remain allowable at a site in Finland are clearly spelt out in the Finnish Forest Act (Metsäläki, 1996) in order to avert any significant consequential effect (Karvonen

et al., 2017). This implies that, soil efficiency or fertility is mostly a criterion rather than an indicator.

- *Biodiversity*

Biodiversity conservation is a concern of global interest and has been evaluated by diverse means, for instance from the perspective of threatened species, species richness, habitat indices, population diversities, gene pools, deadwood and habitat quality (Filyushkina Strange, Löf, Ezebilo, & Boman, 2016). Nevertheless, a handful of biodiversity indicators have been analytically tried in contrast to the standards which formed the basis for their supposed selection (Heink & Kowarik, 2010). Biodiversity is connected to Environmental Sustainability (ES) and thus, variations in biodiversity results in variations in sustainability of the environment (Karvonen et al., 2017). Strategic systems are frequently geared toward ensuring maintainable utilization of resources and preservation of biodiversity (Geijzendorffer & Roche, 2013), which consequently ensures environmental sustainability. Finnish legislation on forest management particularly emphasizes on the protection of key habitats, and requires to manage the rejuvenation of deforested areas to reserve biodiversity (Karvonen et al.).

Furthermore, stakeholders may hold diverse perceptions and interests concerning the relevance of vegetation, wildlife and non-living factors of biodiversity, rendering a biodiversity indicator tough to evaluate in a managerial course (Karvonen et al., 2017). This challenge could be addressed by maintaining the conservation area as a proxy to avert the risk of depleting biodiversity owing to not understanding ecosystem functions (Cao, Margni, Faviss, & Deschênes,

2015a). The existing information about ecosystem functions and biological diversity have wide gaps which encompass defective information (Karvonen et al.).

Economic Indicators

Economic productivity is a crucial consideration to proceed with investments. The significance of diverse economic pointers could differ amongst private, co-operate and government level decision-makers (Cao et al., 2015a). For instance, in Finland, the Finnish forest industry values production cost at nearly 20 billion euros (Metsätalastollinen vuosikirja, 2014) which subsidized roughly 20% of the overall trade sales in 2015 (Karvonen et al., 2017). It is clear therefore that forestry contributes significantly to the global economy. The following presents few common indicators and diverse pertinent features of economic sustainability generally, and as well details their applicability for measuring the forest-centered bioeconomy.

- *Gross domestic product*

Gross domestic product (GDP) is normally portrayed as an economic indicator in various studies (Hall, 2015). It is a critical economic indicator which aide to predict the welfare of people; though, as an indicator, GDP has its own limits (Solow, 1993). Besides, the connection between GDP and human welfare has not been well established (Karvonen et al., 2017). In this regard, it is also imperative to consider that economic evolution emanating from resource consumption upsurge will ultimately crash with planetary limitations (Mancini et al. 2015).

Feschet et al. (2013) asserts that a robust association occurs between GDP and state welfare, particularly when the previous level of GDP is low. Records suggest that the forestry sector in Finland added more than 4% to their GDP in 2011 (Metsätalastollinen vuosikirja, 2014). Nevertheless, in some parts of the world, this portion is above 12% inferring that the virtual significance of the forest must be evaluated locally (Karvonen et al., 2017). GDP is a universal yardstick, against which the economic welfare of a country is measured and has a direct connection with Gross National Value Added (GVA) (Karvonen et al.) as discussed below.

- *Trade*

The per annum summative cost of Finland's forest business production was estimated around 20 billion euros since 2010 (Karvonen et al., 2017). Roughly 11.5 billion euros of the production worth is transferred to other countries, amounting to more than 20% of the total trade exports by Finland (Karvonen et al.). It is therefore obvious that the forestry industry contributes essentially to the Finnish economy.

Trade in energy impacts the economy significantly; the entire value of the overall imported energy was 7.8 billion euros, while the cost of exports in 2015 was 3.7 billion euros, yielding a loss net trade balance of 4.1 billion euros (Karvonen et al., 2017). Thus, in Finland augmented industrial consumption of timber could possibly stabilize trade by raising exports and concurrently replacing (energy) imports (Karvonen et al.). The difference in the import-export ratio would serve as a good basis for both policy makers and the general public in their consideration to support local production (Karvonen et al.).

Social Indicators

There are five main categories of stakeholders under the social dimension; these include; workforces, local groups, society, regulars and value chain actors, which could be further subcategorized, which is measurable by indicators (e.g., excessive hours of work) (Lehmann, Russi, Bala, Finkbeiner, & Fullana-i-Palmer, 2011). However, there exist some procedural and practical limits in combining social indicators to decision making (Lehmann et al., 2011). Finland has been rated among the global leading nations having respectable social conditions (SPII, 2016) minimal corruption level (Transparency International, 2015). However, there exist a couple of social issues in Finland, which need to be made better (Karvonen et al., 2017).

- Employment

Employment is mostly considered as a societal or a social indicator in various forestry related researches, of which forests present a robust employment impact (Tuomasjukka, Berg, & Lindner, 2013a). It is popularly shared that forest-oriented ecological preservation hinders the economy, while Bezdek, Wendling, and DiPerna (2008) argues that this perception is false. Creating jobs comprises intended, unintended, and induced forms (Harsdorff & Philips, 2013). Consequently, assessing the precise count of created jobs will be quite tough (Harsdorff & Philips). Employment plays diverse imperative roles for wellbeing as it generates revenue, and revenue allows accessibility to diverse welfare functions (Karvonen et al., 2017). Moreover, improved returns translate into high monetary funds by taxation (Karvonen et al.). There exist input output methods

for assessing indirect bearings of employment on the welfare of people and the economy nationally (Bezdek et al., 2008). The required count of workforces is considerably reliant on skills and practices involved (Karvonen et al.).

- *Human Health and Welfare*

Health and social welfare are the collective effects of different influences from several economic, ecological and social features (Karvonen et al., 2017). One technique employed in assessing economic impact on well-being is by studying the association between GDP and human life span (life expectancy) (Karvonen et al.). The environment is essential for health and wellbeing. On the whole, the public knows the associated risks to the exposure of environmental contamination, yet it does not guarantee accordance adjustment to people's behaviour (THL, 2014b). Also, not all the impacts of environmental contamination are known (THL 2014c). To realize Changes in health requires time of over 10-years period (Feschet et al. 2013). Health issues are also of economic dimensions since ill-health poses economic drain to humanity and thus portrays resultant economic effect (Karvonen et al.).

- *Equity*

One critical factor of social sustainability is equity among people (Acevedo Tirado, Ruiz Morales, & Lobato-Calleros, 2015), which also constitute a matter of key concern in tackling climate change (UN, 2015). Globally, equality amongst persons varies significantly (Karvonen et al., 2017). It is imperative then to consider situations in regional terms. In broad terms, equity refers to shared equal rights, rules and responsibilities amongst the entire people in a society or, in

narrow terms refers to “only” treasure and revenue (Stanton, 2012). Stanton further contends that, though revenue distribution may not be an adequate measure of equity, it is undoubtedly the finest measurable factor of fairness for being linked, for instance, with improved ecological, healthiness and education results and vigorous total social capital (Karvonen et al.).

It could be contended also that corruption poses universal risk to both fairness and sustainability (Karvonen et al., 2017). Also, labour conditions in various nations could be punitive and unfair. In respect of this, should increase wood usage in Finland relocate jobs from labour disparity nations to Finland, labour situations are expected to be better there (Karvonen et al.). Issues of equity in general may vary significantly among industrialized and emerging countries. For instance, in Finland, several central equality schemes such as health care and education access are either free or costs are absorbed by the state and also opened to all (Painter, 2016).

Finland emerged the 3rd in terms of equity amid a total of 145 nations recognized and reported on by the World Economic Forum in 2015 (World Economic Forum, 2015). However, there pertain trifles of inequality problems in Finland despite the ranking (Karvonen et al., 2017). For instance, top-ranked jobs in Finland are predominantly assigned to men (Eurostat, 2016), coupled with disparity in income distribution between genders and among people in general (Karvonen et al.).

Calculating the Gini coefficient requires salary data which seems to be prohibited in Finland (Karvonen et al., 2017). Income and the equitable sharing of

returns and proceeds along the entire line of players (e.g., the forest bioeconomy production chain from forest owners to pulp/paper mills) could function as an appropriate and pertinent indicator (Karvonen et al.). Incidentally, fairness can stand evaluated and identified and projected development must yield an appreciable level of reception of a decision (social sustainability), and this can be likely on condition that income data were readily accessible, which is hardly so. Flawed data on incomes renders salary-based equality development indeterminate (Karvonen et al.). In Finland, however, labour unions set out commendations on salary levels for diverse jobs which could serve as reference point to evaluate the income levels following any project (Karvonen et al.)

- *Capacity and Freedom*

Fisher and Fukuda-Parr (2019) deliberated on several fundamental inalienable rights and ability matters (e.g., freedom of association, free choice of occupation and political liberty). A lot of rights may have eluded citizens of countries where one's ability to attain a particular dream is largely reliant on disposable income and time available rather than with gender or ethnicity as common in some locations (Karvonen et al., 2017). The indigenous people (e.g., Sami people in northern Finland) are a distinct instance of capacity and liberty to factor in policymaking to preserve their ethos and societal norms (Karvonen et al.). Some revenue limits may be set to measure liberty and capacity, though salary or revenue is only contributorily necessary for freedom (Hall, 2015). Most of the issues of capacity and freedom are generally influenced by employment and

salary, hence, the influence of jobs and payment could be a limiting condition for least standards jobs creation for Sustainability Impact Assessment (SIA).

- *Participation*

Opportunities in participation and information delivery could be sources of improvement for sustainability and overall tolerability of a policy (Karvonen et al., 2017). Assumptions that jobs are lost because of conservation programmes (Bezdek et al. 2008) may discourage local participation in environmental protection and sustainability. To avert these incidences, concerns ought to be addressed in a very comprehensive manner as possible and decisions also be stemmed from substantiated information (Karvonen et al.). To avert public disbelief to decision makers, transparency and participation are very critical components that ought to be upheld in decision-making (Fenster, 2006), in battling dishonesty and or corruption and in protecting democracy (Karvonen et al.).

Stakeholder involvement is very crucial to sustainable forest management, as forest management planning often entails several criteria and standards endorsed by diverse stakeholders and/or decision makers (Kangas et al. 2015). Communal involvement could be achieved through conferences, workshops, expeditions, circulars, collaborative information systems, and the social media (Karvonen et al., 2017). Development involving several stakeholders is prone to difficulties owing to differing viewpoints and interests. According to Kangas and others, the purposes for participatory forestry include:

- i. Raising cognisance of matters that concerns forestry and shared acknowledgement of interests.
- ii. Collate data and improve upon the existing information or knowledge on forestry and forest resource utilization.
- iii. Bettering the ability of forest to ensure sustained provision of various human needs (goods) and services.
- iv. Arouse participation in policy-formulation and execution.
- v. Increase reception of forest management strategies, and processes.
- vi. Raise openness and liability to decision-making.
- vii. Diagnose and resolve skirmishes and hitches collaboratively, in a just and unbiased manner.

Considering the above listed aims of participation, it could be suggested that a vibrant multi-lateral involvement process be considered a standard for sustainability issues.

- *Rural-urban Development*

Rural-urban drift is a continuing phenomenon ensuing from a switch in shared structures and communal interest, which serve as an ultimate driving force for people to pursue better job options, education and advanced standard of life from urban sources of revenue (Rye, 2006). The ability of rural enclaves to offer services and satisfy the wants of the enduring rural populace weakens, owing to the loss of rural jobs and the associated population reduction of rural enclaves (Stockdale, 2004).

Nevertheless, reduction in rural population is not always due to the desire for better life, and emigration from the rural enclaves is normally objectionable (Rye, 2006). This is for the reason that a lot of the rural dwellers who move to the cities wished to have lived in their local communities but situations have proved difficult due to lack of jobs and some basic services (Stockdale, 2004). Thus, rural-urban growth echoes in a way, the capacity and liberty indicator. Rural-urban drift could be employed as indicator for the effects of policies on societal conditions and health state of rural enclaves (Karvonen et al., 2017). For instance, job creation stands a crucial influence on rural growth and that more intensive utilization of forests could have contributed to creating new jobs in rural enclaves, since the rural enclaves serve as the pool of this raw material (Karvonen et al.). Moreover, processing facilities are mostly situated adjacent the source of resource for prudence sake, hereafter, policies to strengthen the forestry industry in economic terms could contribute to uplifting and sustaining inhabited rural areas (Karvonen et al.). It is possible to assess job sites and thus, evaluating rural growth in SIA with job availability in the rural setting is keen.

2.7 The Importance of Community Resource Management Areas to Local Communities

2.7.1 Socio-economic importance of CREMAs

Wildlife preservation and management remains among the main CBNRM goals for most African settings. Wildlife has regularly been perceived as pests and been hunted either for food (meat) or traded cheaply and on unsustainable basis,

either for sport hunting or basically to ensure human and crop protection (Brown & Bird, 2011). Through the enforcement of CBNRM which amasses the joint efforts of governments, NGOs, and communities progressively across the African continent, communities' attitude towards wildlife have changed from the former to now placing at the forefront, protection to wildlife and their habitat (Hefferman, 2016). Eco-tourism has significantly developed in many countries by protecting wildlife and their habitat, which consequently helps the tourism industries across for instance Africa to grow at appreciable percentage of GDPs (Snively, 2012).

In Africa, human activities pose diverse threat or dangers to wildlife species. CBNRM wildlife management schemes endeavour to change this phenomenon by securing their habitat and these populations through sustainable management (Hefferman, 2016). The wildlife resources ideally are not only preserved but also managed in an economically beneficial way by creating jobs, as wildlife populations grow and tourists visit to view and pay for the services, this results in injecting new capital into the communities as part of a sustainable industry (Hefferman). The capital raised from tourism can contribute to several local jobs, ranging from resorts, to gateways, guided hikes, safari tours, camping, and also add improvement to the local economy as tourists may eat, shop, explore etc. These jobs according to economic experts and development institutions are qualified as “development oriented” jobs, that contribute immensely to sustainability and efficiency than other sectors with low productivity (Todarro & Smith, 2012).

2.7.2 Cultural and spiritual importance of CREMAs on local communities

Grounded on the historic, societal and cultural linking to a certain area or region, aborigines in some regions globally are eligible to certain civil liberties to communally conserve and benefit from the natural resources available to them (Chunhabunyatip, Sasaki, Grünbühel, Kuwornu, & Tsusaka., 2018). According to the United Nations (UN), aborigines or indigenous people are individuals who are heirs and practice inimitable way of life and ways of connecting to people and the environment. Aborigines have preserved unique social, cultural, economic and political features from those of the central societies in which they dwell. Most Ashanti indigenous groups in Ghana, for instance, have successfully conserved their forests for generations through their culture or tradition (beliefs, prohibitions or taboos, myths, and songs) (Lebbie, 2008). The performance of rituals and sacrifices for one to be granted permit to access certain resources such as some tree species are some of the strict customs that govern access to sacred forests in Ashanti communities (Chunhabunyatip et al., 2018). This yields better conservation outcomes of their forests, as these practices offer protection to the ecological setting and watershed, and thus, averts overexploitation of resources on Ashanti land.

Totemism as a tool for safeguarding natural resources (vegetation and wildlife) by the Ba'Aka pygmies of Central Africa has been a practical indigenous strategy for conserving forest resources (Chunhabunyatip et al., 2018). They accept as true that hunting totems for food is forbidden and that would impact negatively on their well-being (Chunhabunyatip et al.). Additionally, they have it

that killing totemic animals would invoke commiserations on a community at large. It is thought also that if pregnant women consume some kinds of reptiles, birds and some animal types, there could be stoppage in producing breast milk or could lead to deadly miscarriages; hence pregnant women are prohibited from eating such types of animals (Tanyanyiwa & Chikwanha, 2011). Collectively all these beliefs contribute to sustainable conservation of wildlife.

Also, some parts of rivers or streams and forests are professed consecrated, and that fishing and hunting activities are banned except certain rites are performed to pave way for such activities to take place (Ayong, 2007). The cultural systems in Ba'Aka prove that the existence of the various traditional approaches employed by aboriginal people to preserve natural resources in some African local settings contribute immensely to sustainability (Chunhabunyatip et al., 2018). The cultural principles of the Lua people in Chiang Mai (Thailand), linked with procedures of the swidden agricultural practices are stemmed from animist beliefs in every farming practice (Chunhabunyatip et al.). Practicing their traditional beliefs has confirmed their capability to maintain agro-diversity and essential wildlife resources, safeguarding ecosystem functions, sustaining livelihoods and ensuring food security (Verschuuren & Furuta, 2016).

In another instance, the Black Tai Tribe in northern Vietnam managed and conserved their natural forests through their beliefs that there existed spirits (unseen creatures) in the forest (Anh & Pham, 2005). They (the Black Tai Tribe) dwelling in the "holy" forest performed primeval rites and rituals where their ancestral spirits were worshipped (Chunhabunyatip et al., 2018). It was their

belief that their god lived in the “sacred” areas. Accordingly, the forest resources were recognized and preserved by the inhabitants (Chunhabunyatip et al.). Additionally, the Bosis and Grusi ethnic groups in northeast Ghana practiced spiritual beliefs by offering sacrifices and reverences to the ancestral spirits (Aniah, Aasoglenang, & Bonye, 2004). Clearly, the parts of aboriginal belief systems that rely on the ascription of mystic powers to sections of the natural environment as the dwelling place of the gods appear to have led substantially to the sustainability of crucial resources such as groves, ponds, soil fertility and averted overexploitation of wildlife, and their use overtly promotes protection of environmental resources (Aniah et al., 2004).

According to Ktheettate (2000), a study carried out in north-east Thailand on the spiritual beliefs and a dwelling place of the god called Don Pu Ta came up with findings that Don Pu Ta is a holy area for the community, of which the natives appreciated the spirit and preserved the sacred area reverentially (Chunhabunyatip et al., 2018). The Don Pu Ta area was kept unaltered bounded by giant trees with a thick forest and established and maintained an intimate connection between the natural landscape and the natives in the region (Chunhabunyatip et al.). Research conducted on the connection between the ethnic groups in the northern regions of Thailand, such as the Hmong, Akha, Mien, Lue, and Lua people within the forests in the mountain regions yielded the outcome that aboriginal people who profoundly valued the spirit would value nature (Chunhabunyatip et al.). They portrayed their beliefs by performing sacraments and reverences. For, instance, the Akha people that resided in the

forest base on rites to worship portray their reverence to their guardian spirit by carrying out “tree ordination” and disallowing indigenes to cut down trees in consecrated areas, comparable to the spiritual belief in Don Pu Ta, portrayed by the indigenes of north-east Thailand, and particularly the natives of the Lower Songkhram River (Sretthachua et al., 2005).

Several consecrated areas around the LSRB (Lower Songkhram River Basin) are called Don Pu Ta, however, one utmost outstanding area is the wetland named Nhongchaiwan which spans approximately 0.96 km² (Mikhama & Sirisant, 2016). The wetland forms essential fragment of an inimitable ecosystem and also portray as the principal *Cephalanthus tetrandra* wetland forest in north-east Thailand (Mikhama & Sirisant). The wetland additionally serves as central point for the way of life and uniqueness of the indigenes owing to its ascription of communal or social relevance, and generating income for the entire community (Boonyaratpalin et al., 2002). The wetland serves as a reliable source of biological diversity and thus offer food and herbs to the indigenous community (Chunhabunyatip et al., 2018). There is an Island within a floating forest in the wetland which shows to be a conducive arena for fish breeding, and shelters fish to lay eggs upon migrating from the Mekong River in the flood season, which is beneficial to the indigenes and other communities not only in the LSRB, but also in the Lower Mekhong Greater Sub-Region (McCaskill & Lipricha, 2008).

2.7.3 The ecological and environmental importance of CREMAs

The challenges of poverty and environmental or ecological dilapidation are concurrently solved by communal natural resource conservation (Rim-Rukeh et

al., 2013). Provided that the local communities actively participate in resource management, the customary conservation beliefs are proficient of preserving biodiversity species specifically and the ecological setting at large (Rim-Rukeh et al., 2013). Actually, Traditional Ecological Knowledge (TEK) systems are imbued with practices and ideas, and approaches of knowledge transfer that can directly and indirectly be linked to resource stewardship and management at various scales (Rim-Rukeh et al.). There exists inadequate understanding about the development, evolution, and transmission of traditional ecological knowledge over time and space, notwithstanding the substantial attention paid to documenting these systems and the methods to conservation (Rim-Rukeh et al.).

Chacon (2012) asserts that the presence of customary beliefs/taboo does not assure sustainable harvest of forest resources. Along with the International Institute for Environment and Development (1992), African Traditional Religion (ATR) and cultural ethics as practiced in several parts of African local settings have proven to be environmentally/ecologically compatible and sustainable, therefore yielding natural resources sustainability and management (Rim-Rukeh et al., 2013). The functions of traditional beliefs in natural resources management are realized in diverse practices such as sacred groves and sacred landscapes. In India for instance, certain covers of forests are apportioned as sacred groves and managed under customary regulation and are conserved against extraction of any resource by the community (Rim-Rukeh et al.). Such ecological settings are endowed with biodiversity and stores several rare plant species such as rare herbs and curative plants.

Studies conducted on Oorani and Olagapuram sacred groves in the north-western Pondicherry discovered 169 angiosperms in all from both sites. Seventy-four (74) flowering plant species spread in 71 genera and 41 families were encountered in the Oorani grove (3.2 ha), which were further classified into 30 woody species, 8 lianas and 4 parasites (Rim-Rukeh et al., 2013). The Olagapuram grove (2.8 ha) recorded a total of 136 species in 121 genera of 58 families; 21 woody species, 9 lianas and 3 parasites occurred (Ramanujam & Kadamban, 2001). In Delta Central, Nigeria, the tribal groups of Urhobos practice environmental conservation traditions grounded on their various religious beliefs (Rim-Rukeh et al.).

Totemism (thus, the belief in a mystical relationship among a group of people and a group of objects such as certain animal species, some plants, or other objects) is the central feature of Urhobos' conservation of natural resources (Rim-Rukeh et al., 2013). Mostly, it is considered a taboo to kill or use totemic animal for food (Tonukari, 2007). Social taboos are inevitable aspects of cultural practices globally, which defines human behaviour through established informal institutions such as traditional or religiously governed norms or taboo systems (Rim-Rukeh et al.). These taboos form the principal guiding principles that monitor the exploitation of natural resources to ensure sustainability. Nevertheless, the significant role of these informal schemes in the management of natural environment has received less recognition.

Evidently, it could be traced from the literature reviewed that, work or findings on Sustainability Assessment of CREMAs in Ghana is missing. Hence, the need to

research into the Sustainability Assessment of CREMAs in Ghana precisely the Adwenase CREMA.



CHAPTER THREE

RESEARCH METHODS

This chapter details the data collection procedure of the research. Precisely, the section details the study plan (Research Design), description of the research zone (study area), the population in focus and the sample technique. Also, the data gathering tools, the data gathering method as well as the method for data processing and analysis in relation to the research questions are discussed.

3.1 Research Design

A research design (study plan), is the conceptual framework which borders the conduct of a study, and also establishes the plan for collecting, measuring and analyzing data (Kothari, 2004). Research design entails the general strategy employed to fit in the various aspects of the study in an intelligible and logical manner that ensures that the research problem is effectively addressed by ensuring that responses to study questions and to control variance are attained. It provides control for the experimental, peripheral and error variance of a specific study case under study. Research design is conceived to provide valid, objective, accurate and economically prudent answers to research questions. It could be considered as the research structure which portrays the way all the principal aspects of the study project work collectively in the quest to addressing the fundamental study problem. It is thought of as the 'glue' that binds together all the essentials of a study mission (Kombo & Tromp, 2009).

The design for this study incorporates the quantitative design method and procedure that yields discrete numerical data. The quantitative research approach is a method for carrying out studies that entails the use of operational descriptions that interpret abstract views (e.g., mood) into observable and quantifiable measures. It is the process of collecting and analyzing numerical data. It basically employed in finding patterns and averages, make predictions, test causal relationships, systematize data collection and generalize findings to wider populations. Data collection lasted for two months. That is, from September to October, 2022. Ethical clearance with identification number (UCCIRB/CANS/2022/28) was obtained from the Institutional Review Board, University of Cape Coast as official permit to conduct the study (See Appendix E).

Data saturation was determined through the application of International Labour Organization (ILO) App for determining sample size at 95 confidence level and 0.05 degree precision level. In all, eight hundred and fourteen (814) respondents were reached in the three selected communities (Assin Akropong, Subinso No.1 and Agyalo) for the study, instead of the estimated sample size of five hundred and two (502) targeted respondents out of a combined population of six thousand, one hundred and fourteen (6, 114). Thirteen key functionaries of the conservation area were engaged by using open-ended interview schedule, giving a grand total of eight hundred and twenty-seven respondents for the entire study. Data coding was done by two persons with appreciable knowledge in data management. Some themes were developed in advance; however, some were also derived from the data.

3.2 Study Area

3.2.1 Location and size

The survey was carried out in surrounding communities of the Adwenaase CREMA site in the Assin Foso Municipality in the central region. The Assin Foso Municipality falls within Longitudes $1^{\circ} 05'$ East and $1^{\circ} 25'$ West and Latitudes $6^{\circ} 05'$ North and $6^{\circ} 40'$ South and has a land mass of approximately 370.2sqkm and contains near 58 communities which consist of Assin Foso (the Municipal Capital), Assin Nyankomasi, Assin Akropong, Assin Dompim, Wurakase, Assin Awisem and others. The municipality is bordered by Twifo Atti Morkwa District on the west, Assin South District on the South, Asikuma, Odobeng-Brakwa District, and Ajumako Enyan-Essiam District on the East, Upper Denkyira East Municipality on the North-West and Assin North District on the North. The Borough is rich in resources such as gold deposits, rocks, sand and stone deposits, clay deposits, and forest resources (especially timber).

Adwenaase Community Reserve (CREMA) is located at the north-east side of the Assin Brofoyedur to Akyem Oda trunk route. The forest is about 2.5 kilometers east of Assin Brofoyedur. The forest is situated in the Assin Foso Municipality in the Central region of Ghana. The forest area is Assin Akropong stool land which is aligned with Assin Wurakese and Assin Akenkansu stool lands but owes allegiance to the paramount stool of Assin Apimanim Traditional Area.

The total area of Adwenaase CREMA is approximately 171 hectares. The reserve is bounded by the river Fum in the east, river Kanta Kuma in the south

and river Subin to the north-west. The south-western and the northern sections of the forest are land bounded. The total length of the forest boundary is 8, 035m. The length of the boundary along the river Fum is 1,897m and along river Kanta Kuma is 1,678m. The boundary with the river Subinso is 1, 230m. The south-western land boundary is 1, 794m and on the northern side is 1, 436m. There are two settlements inside the forest. These are Agyalo which is wholly inside, and Subinso No. 1 which is partially inside.

The Adwenaase CREMA is owned by the Aduana No. 1 royal clan of Assin Akropong.

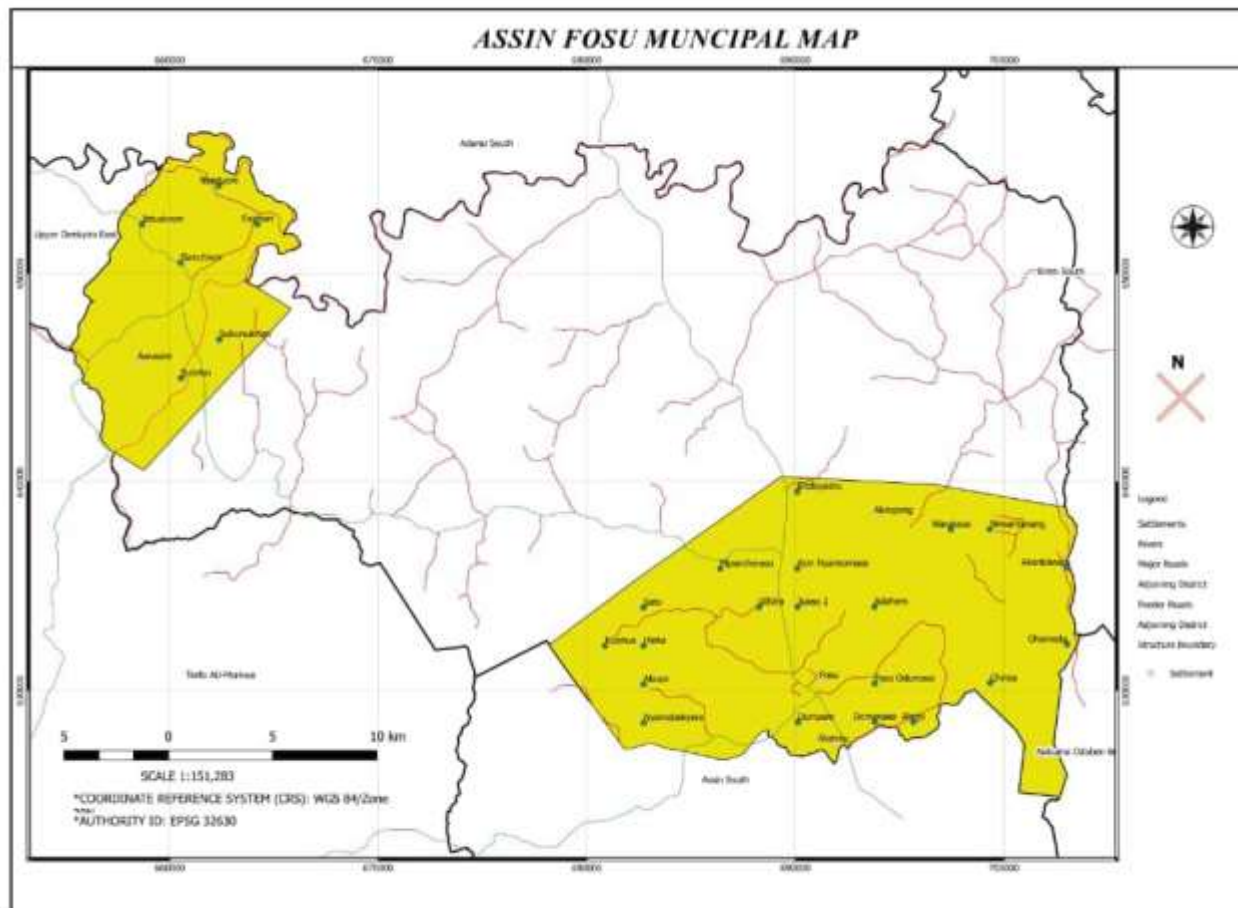


Figure 2: Map of Assin Foso Municipal Assembly [Source: Assin Foso Municipal Assembly].

3.2.2 Geology

The geological layers of the Cape Coast Granite Complex of the pre-Cambrian Platform lie beneath the land expanse of the municipality. This encompasses granites, grandiosities, and adamellites. In some communities it appears schistose whilst very massive in some others. Several components ranging in structure from grandiosities to granites and their magmatic variability are also involved.

Muscovite and biotite form the principal mica reserves in the municipality. Findings through studies depict that the lower Birrimian Phyllites, lie beneath about 60% of the communities in the municipality. These are indicated within the jurisdiction of the Awisem Zonal Council [Source: Assin Foso Municipal Assembly].

3.2.3 Water security

Bore-hole or pump tube well (47.2%), protected well (13.3%), rivers and streams (9.7%), sachet water (9.3%), public standpipe (6.9%), pipe-born water (6.7%) make up the six main sources of household drinking water in the municipality. The borough has water coverage of 85% of which all the vast towns and communities are able to access water all year round. In terms of refuse management, approximately 85.3% of the populace patronize public dumps (Communal Container), with about 11.1% throwing away refuse uncontrollably, and about 3.6% of households patronize house to house waste collection.

The settlement arrangement in the municipality is very poor and unplanned which is displayed by random layout of buildings in various locations. The reliance on rivers and streams in some communities has a bearing on the incidence of water-related diseases (e.g., bilharzias, onchocerciasis) in the Municipality. Sustainable provision of portable drinking water is an urgent need in some areas of the municipality [Source: Assin Foso Municipal Assembly].

3.2.4 Economic characteristics

The key livelihood source of the area includes Agriculture (farming), Commerce (mainly Wholesale/Retail Trade), Manufacturing (Agro - Processing) and Service. Farming and its associated ventures constitute the principal commercial undertakings and employs near 63.2% of the active populace in the Municipality.

Agriculture

Although skilled agricultural, forestry and fishery workers form about 59.4% of the occupational distribution, it also pertains that many people in the Municipality do involve in one form of agronomic venture or another to supplement their incomes apart from the occupations they are fully engaged in.

Agriculture which makes up the foremost economic venture of the populace engages near 80% of the labour force. Crop farming is done on a subsistence basis, especially by the populace who are mainly engaged in various professions other than agriculture.

The popularity of agriculture in the municipality is mainly due to the presence of appropriate vegetation and the accompanying auspicious climatic settings

occurring there. The major crops cultivated include plantation crops (oil palm, cocoa, rubber, and citrus) and food crops (maize, plantain, cassava, and rice) and animal rearing/husbandry and agro-processing [Source: Assin Foso Municipal Assembly].

Commercial sector

Women lead this sector, constituting near fifty-four (54) per cent of the providers of most of the things traded, most of which are industrial products transported or carried from Kumasi, Takoradi and Accra and traded in the interior and or outside the Municipality. Important Markets in the Municipality are found in Assin Foso which has two markets, Assin Akropong and Awisem. Market infrastructure comprising the physical space, stores, stalls or sheds, storage facilities and access roads constitute an essential component of the development of the Municipal's economy.

In the Assin Foso Municipal, markets are organized on a daily and weekly basis. Daily markets occur at Assin Foso, and a few other places. There are three periodic markets which include the following: Assin Foso, Awisem, and Akropong [Source: Assin Foso Municipal Assembly].

Industrial sector

Industrial activities are held both on small and medium levels. The challenge associated with the industrial sector stems from its frail context and the onward connections with the agriculture sector; only near 31 per cent of productions are agro-based. The industries are divided into three (3) broad types depending on the

size of the labour force. They are small, medium, and large scale. Among them are kente weaving, carpentry, soap making and corn milling.

The average number of persons in small-scale industries is engaged in woodcarving, sawmilling and brass made ornaments. An average of about fifty (50) people are employed in each medium scale industry. The average number of persons in small-scale industries is four (4). Among the medium scale industries is woodcarving, sawmilling and brass made ornaments.

The large-scale industries include the wood processing industries which employ more than a thousand people. The Wood Processing Company situated at Assin Atonsu is a typical example of a medium scale industry in the Assin Foso Municipal and employs about 55 people. Agro-based and wood-based industries employ about 12 per cent of the labour force. These industries include palm oil extraction at Dompim, Juaso, and Assin Nyankumasi. Food processing such as kenkey making is scattered in most towns of the Municipal. [Source: Assin Foso Municipal Assembly]

3.2.5 Environment

Natural resources

The Municipality is naturally gifted with several resources which warrant the potentials for driving both economic and social growth and development. Some of these important resources are exploited whilst others are unexploited. The available resource deposits include gold, rocks, sand and stone deposits, clay deposits, and the natural forest (particularly timber). The mineral resources such as gold deposits are sited at Awisem, and environs. The Municipality is also rich

in diverse forestry resources, particularly in timber species. Some species of timber commonly found include Odum, Mahogany and Wawa, which are being patronised by timber firms through concessions in the forest [Source: Assin Foso Municipal Assembly].

Climate and vegetation

The Assin Foso Municipality lies within the moist tropical forest, primarily deciduous forest. The area records a yearly rainfall ranging from 1500mm to 2000mm. The area experiences an annual high temperature ranging between 30⁰C from March to April and approximately 26⁰C in August, coupled with a relatively high humidity ranging between 60% and 70%. The ecological steadiness supports the cultivation of a variety of food, cash, and non-traditional export crops. The Municipality experiences a relatively cool and humid South-West Monsoon winds that originate from the Atlantic for most part of the year, particularly between December and February. Nevertheless, the dry harmattan or North-East Trade Winds originate from the North. Its dispelling consequence, nevertheless, is critically minimized by long passage over the forest zone. The area experiences the bimodal rainfall pattern. April to July is the main rainfall season and marks correspondingly the main farming period whilst the minor rainy season spans between September and November.

There are about five (5) Forest Reserves which include the Bimpong Forest Reserve, the Supong Forest Reserve, the Akropong Forest Reserve, Wawahi Forest Reserve and Krochua Forest Reserve, Braku Forest Reserve in the Assin Foso Municipality. These reserves contribute to protecting the major rivers that

drain the Municipality. The forest reserves are yet to be developed into a tourist site which would generate revenue for the local economy. [Source: Assin Foso Municipal Assembly]

Biodiversity, Climate Change, Green Economy and Environment in general

Most of the citizens in the municipality depend on the natural resources for their survival. Unfortunately, very little is done to ensure sustainability of the natural environment. This calls for proactive measures at Green Economy to ensure sustainable development. In other words, it is worth advocating for all-encompassing economic growth, human development, and enhanced welfare by means of effectual and maintainable use of natural resources while not compromising on the availability of the resources for the future generation.

The slash and burn method of clearing land is the primary agricultural practice in the municipality, which resultantly renders the farmland plain or bare and thus, exposed to erosion and also alters the ecology of the Municipality [Source: Assin Foso Municipal Assembly].

Depletion of the forest

Approximately 49.5 per cent of the households in the Municipality rely on fuel wood and charcoal for source of energy for cooking, which are obtainable from the forest. This circumstance leads to the exhaustion of important tree species, and hence the need for reforestation programmes to restore the depleted tree species in the Municipality in general. The Municipality harbours near 169.04 km² of forest reserves consisting of trees as Teak, Odum, mahogany and Wawa.

Various timber firms and illegal chainsaw operators within and outside the Municipality do exploit the timber, which resultantly leaves various degrees of effect on the natural environment. Some of these effects include;

- i. Fast deterioration of trees of economic value as no substantial afforestation and reforestation programme is done by the timber firms and other beneficiary individuals. This development leads to the convert of primary forest vegetation to secondary vegetation.
- ii. Causing damages to crops by way of uncontrolled chopping and transporting of removed timber from agricultural and forest lands.

The degree of the dilapidation caused to the natural ecology and its resultant effects on the natural environment cannot be underestimated [Source: Assin Foso Municipal Assembly].

3.3 Population

The human Population of the Assin Foso Municipality in line with the 2021 population and housing census showed to be **88,753** with **43,549 male** and **45,204 female** (Ghana Statistical Service 2021) and accounts for approximately 3.1 per cent of the summary population of the Central region. There are more females (50.9%) than males (49.1%) in the borough. The sex ratio of the Municipality depicts a number of males per 103 females of 100.

The population of the municipality is largely the active type, constituting approximately an active work force of 54% of the entire population. The youth in the municipality occupy over 40 per cent of the entire human population and thus, portraying a wide bottom (broad base) population pyramid which is crowned with

a relatively less aged population (persons of 60 years and older) [Source: Assin Foso Municipal Assembly]. However, for the purpose of this study, in line with the selected communities (Assin Akropong, Subinso No. 1, and Agyalo) a combined population size of 6114 was recorded, out of which a sample size of 502 upon applying the Internal Labour Organization (ILO) App at 95 confidence level and 0.05 degree precision level. However, a total of 814 respondents were covered in view of increasing precision of the study outcome.

3.4 Sampling Procedure

The study was conducted at Assin Akropong and surrounding villages/communities in the Assin Foso Municipality in the central region of Ghana. The community selection was based on the purposive sampling technique, which considered the communities that have a link with the resource conservation area. Two set of instruments (that is a structured interview schedule and an open ended interview schedule) were employed for the data collection.

Again, the purposive sampling method was applied in selecting the categories of respondents for the interview schedules. Generally, the study considered persons 18 years of age and above with the reason that most persons within this age bracket are likely to engage in activities that may impact or be impacted upon by the resource conservation area and could also have information about the Adwenase CREMA.

The structured interview schedule targeted the ordinary community dwellers, of which a total of eight hundred and fourteen (814) respondents were reached. The open-ended interview schedule targeted the frontiers of the local management

team of the conservation area, the chief, other local opinion leaders, and the management of the Forestry Commission, Assin Central Municipality, of which a sum of thirteen (13) persons were reached. In all a grand total of eight hundred and twenty-seven (827) respondents were reached for the entire study.

3.5 Data Collection Instruments

Structured interview schedules (both closed and open-ended) were employed for the data collection. They are efficient ways of collecting data from population samples that give a true representation of a population. These constitute very useful and versatile approaches in primary data collection, since the possibility to obtain all forms of logical information in a quantitative research is assured.

3.6 Data Collection Procedures

Data was gathered from both primary and secondary sources of CREMA activities in the study area. Primary data, which included data about CREMAs at the community level, was gathered through structured interview schedule during field visits to the practicing communities for the study, in line with the set objectives.

The structured interview schedules were designed in two folds. The first fold catered for the variables of the study, whilst the second fold catered for the general information about the respondents. Data was collected through focus group discussions with the management team, local opinion leaders, CREMA frontier groups and their leadership. Secondary data on CREMA and associated challenges on biodiversity and natural resource conservation schemes in the study area was collected. Other sources of information or data collection comprised of

literature and certified websites of local, national, and international development agencies working in Ghana on CREMA.

3.6.1 The study dimensions

Assessing the economic impacts of CREMAs on local communities;

- Adequate funding for resource management
- Adequate staffing of resource management
- Anti-corruption provision in place
- Indigenous perception on profit sharing mechanism
- Employment opportunities
- Compensation for damages
- Sources of income for the local people

Assessing the ecological/environmental impacts local communities have on CREMAs

- The existence of functioning buffer zone
- Maintenance of ecosystem function
- Maintenance of land scape patterns
- Variation/state of water quantity and quality
- Balance of human activities and environmental conditions

Assessing the social impacts of CREMAs on indigenous communities;

- The state of local management and access to resources
- Ownership and use right of resources

- Rules and norms of resource use
- Means of conflict resolution
- Security of indigenes on access to resources
- Mechanisms for sharing benefits
- Employment opportunities for forest dependent people
- Training workshops for local people
- Language and communication

Assessing the influences of indigenous communities' cultural/belief systems on CREMAs;

- Conservation and indigenous culture compatibility
- Influence of local culture on conservation activities
- Existence and maintenance of spiritual links to resources

3.7 Data Processing and Analysis

Quantitative data was coded and entered into Statistical Package for Social Sciences (SPSS version 21.0) database and simple percentages, frequencies, and means were determined for pertinent variables using descriptive statistics. Regression analysis (Negative log-log regression) and Pearson chi-square analysis were done to determine the significant relations that pertains among some relevant variables. The results have been shown in tables and figures in chapter four. Rejoinders from the focus groups and key informers were noted and transliterated in accordance with the principal themes. The transcriptions were furthermore scrutinized and well-organized according to the relevant themes for

presentation. This helped to pursue the research aim by specifically eliminating all extraneous discussions during the interactions with respondents. Finally, the results from the analysis have been portrayed in texts, some of which are either direct or indirect quotes.

Summary

The chapter three provides details of the research design, which incorporates both the quantitative and qualitative designs, and employs design methods and procedures that yield both the discrete numerical data and non-numerical data.

The survey method was employed in gathering the data through structured and open-ended interview schedules. The purposive sampling method was applied in selecting the categories of respondents, of which a total of eight hundred and fourteen (814) respondents were counted from the three communities considered for the study, as well as engaging with thirteen key functionaries of the conservation area, by using open-ended interview schedule, giving a grand total of eight hundred and twenty-seven respondents for the entire study. Generally, the study considered respondents who are 18 years of age and above.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic Characteristics of Respondents

This section provides details of respondents in respect of gender, age, religion, literacy or educational status, and marital status.

4.1.1 Gender of respondents

This section gives information about the number of males and females reached in the data gathering process.

A total of eight hundred and fourteen (814) respondents were reached in all three study communities. Out of this total number, 58% were males, 42% were females. Thus, more males were reached than females.

4.1.2 Age of respondents

This section presents the age ranges of respondents. The ranges assumed a uniform ten-year interval. Table 1 below gives vivid account of the age categories of respondents.

Table 1: The Age Categories of Respondents

Age Range	Frequency	Percent
20 – 29 years	85	10
30 - 39 years	224	28
40 - 49 years	239	29
50 - 59 years	154	19
60 years and above	112	14
Total	814	100

Source: Field Survey (2022)

From Table 1, 10%, 28%, 29%, 19%, and 14% of the respondents fall within the age ranges, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and 60 years and above respectively. It could be inferred that most of the respondents fall between 20 to 49 years age bracket.

4.1.3 Religion of respondents

This section presents the religious affiliation of respondents. Basically, four main categories were recorded. Table 2 presents findings on the religions practiced by respondents.

Table 2: The Religion Respondents Practice

Religion	Frequency	Percent
No Religion	71	9
Christianity	643	79
Islamic	92	11
Traditional	7	1
Total	814	100

Source: Field Survey (2022)

From Table 2, the religions practiced among the surveyed communities are Christianity, Islamic, and Traditional religions, of which Christianity is the main religion practiced among the surveyed communities..

4.1.4 Educational Status of Respondents

This section presents the literacy level of the locals of the study communities.

Figure 3 presents findings on the educational status of respondents.

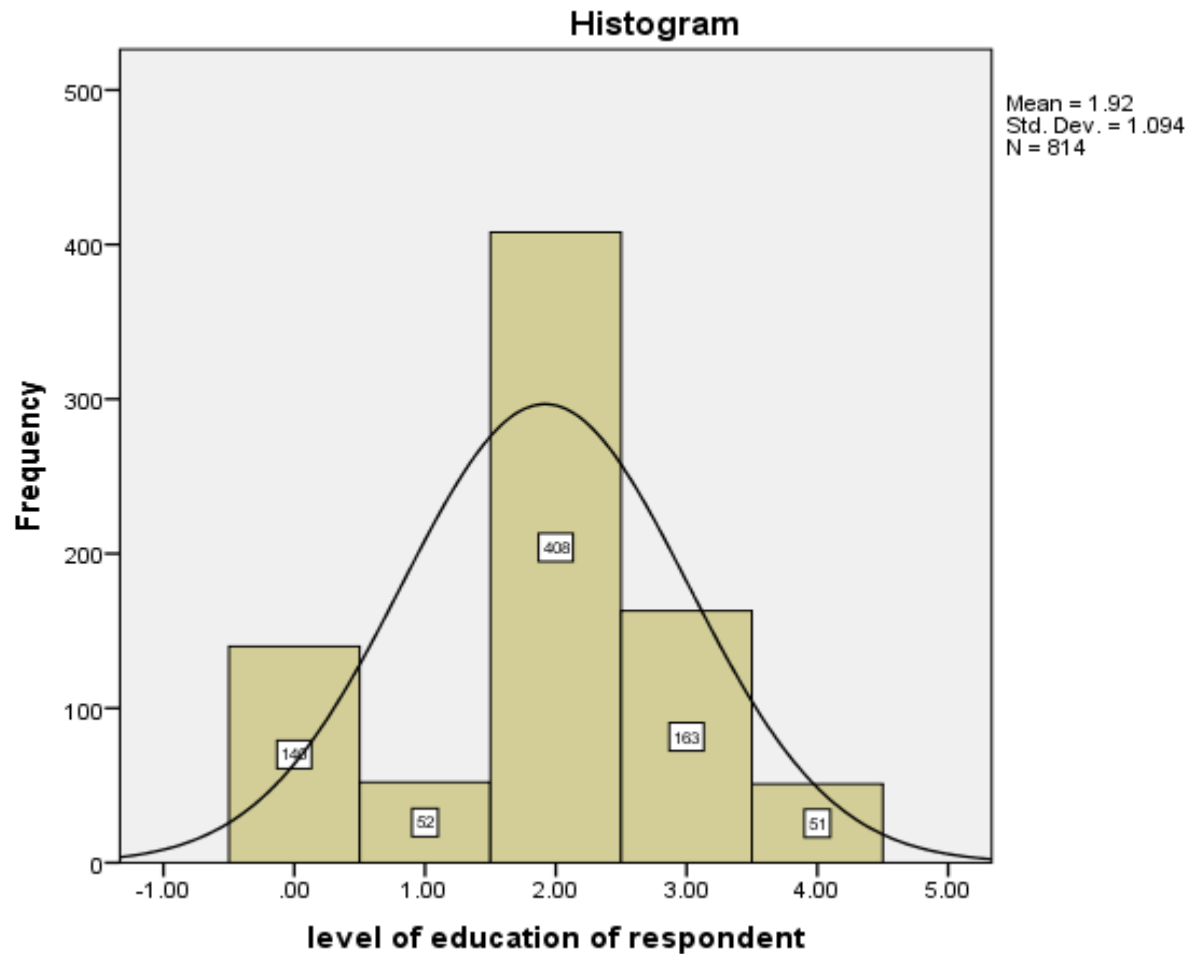


Figure 3: The literacy status/educational levels of respondents

From the figure 3, the horizontal axis bears the levels of education of respondents, which are represented as follows, 0.00 = No formal education, 1.00 = Primary Education, 2.00 = Junior High School/Middle School, 3.00 = Secondary Education and 4.00 = Tertiary Education. Whilst the vertical axis bears the number of respondents that have attained the various educational levels.

Therefore, it could be deduced from figure 3 that, out of the total respondents of eight hundred and fourteen, one hundred and forty (representing 17%), fifty-two (representing 6%), four hundred and eight (representing 50%), one hundred and sixty-three (representing 20%) and fifty-one (representing 6%) have attained No formal, Primary, Junior High/ Middle School, Secondary and Tertiary education respectively. Most of the local people have at least attained basic education.

Table 3 shows the results of crosstabulation of gender and the educational attainment of respondents.

Table 3: Crosstabulation of Gender and Level of Education of Respondents

Gender of Respondent	level of Education of Respondent					Total
	No formal Education	Primary	Junior High School/ Middle	Secondary	Tertiary	
Male	57	27	243	110	33	470
Female	83	25	165	53	18	344
Total	140	52	408	163	51	814

Source: Field Survey (2022)

From Table 3, clearly, there exists gender disparity among the respondents in terms of education. Thus, the higher the level of education, the fewer the females recorded and vise-versa.

Table 4 shows the results of crosstabulation of age and the educational attainment of respondents.

Table 4: Crosstabulation of Age and Level of Education of Respondents

Age of Respondent	Level of Education of Respondent					Total
	No formal Education	Primary	Junior High School/ Middle School	Secondary School	Tertiary	
20 – 29 years	0	1	36	45	3	85
30 - 39 years	13	15	107	68	21	224
40 - 49 years	30	14	142	35	18	239
50 – 59 years	52	17	72	11	2	154
60 +	45	5	51	4	7	112
Total	140	52	408	163	51	814

Source: Field Survey (2022)

From Table 4, one hundred and thirteen (113) respondents (constituting 37%) and twenty-four (24) respondents (constituting 8%) of the total respondents of three hundred and nine (309) within 20 - 39 years age bracket have duly attained their secondary, and tertiary levels of education respectively, compared with those respondents within the age bracket, 40 and above 60 years, where fifty (50) respondents (constituting 10%) and twenty-seven (27) respondents (constituting 5%) of the total respondents of five hundred and five (505) have duly attained their secondary and tertiary levels of education respectively.

4.1.5 Marital status of respondents

This section focuses on establishing the marital situation of the study communities. Table 5 shows the result of crosstabulation of marital status and gender of respondents.

Table 5: Crosstabulation of Marital Status of Respondents and Gender

Gender of Respondent	Marital Status of Respondents				Total
	Single	Married	Widow/Widower	Divorced	
Male	42	398	14	16	470
Female	37	218	41	48	344
Total	79	616	55	64	814

From Table 5, approximately 76% of the respondents are married, whilst the remaining nearly 24% are not married. The table further portrays that on the average, a higher percentage of males (85%) are married compared with the females (63%).

4.2. Land Acquisition Procedure for the Conservation Area

4.2.1 Land occupancy before CREMA creation

This section presents information on the use of the land area before creation of the reserve area in 1995. Table 6 shows the response of respondents on whether or not the land area was in use before the creation of the reserve.

Table 4.6: Crosstabulation of Land use Before Conservation and Level of Education of Respondents

Land use Before Conservation	Level of Education of Respondent					Total
	No formal Education	Primary Education	Junior High School/ Middle School	Secondary Education	Tertiary Education	
No	31	13	112	39	15	210
Yes	106	36	292	122	36	592
Not Aware	3	3	4	2	0	12
Total	140	52	408	163	51	814

Source: Field Survey (2022)

From Table 6, two hundred and ten (210) persons (representing 26% of the respondents) responded “No”, the land area was not in use, five hundred and ninety-two persons (representing 73% of the respondents) responded “Yes”, the land area was in use before the CREMA creation and twelve people (representing 1% of the respondents) responded they were not aware of what the land was used for. The response of the majority in this regard aligns with the history of Assin Akropong, which portrays that the reserved area was initially occupied by their ancestors. As at the time of the reserve creation, according to the reserve frontiers, all the dwellers had relocated to Assin Akropong and environs. Therefore, the area was a high forest, which due to cultural reasons was not cultivated or touched for any purpose except for hunting.

4.2.2 Major sources of livelihood before and after the CREMA

This section presents the results of responses obtained from respondents to the kind of livelihood options the locals engaged in before and after the creation of

the Adwenaase reserve. Table 7 presents respondents' responses to the major livelihood source of the local people before and after the CREMA creation.

Table 7: The Major Livelihood Source of the Local People Before and After the CREMA

Livelihood Source	Livelihood before		Livelihood after	
	Frequency	Percent	Frequency	Percent
Farming	562	69	796	97.8
Hunting	23	3	12	1.5
Herbal medicine	229	28	4	0.5
Trading	0	0	2	0.2
Total	814	100	814	100

Source: Field Survey (2022)

From Table 7, farming was and is still the major source of livelihood among the study communities before and after the creation of the CREMA respectively. Trading was not common before the creation of the CREMA and still not common owing to the extreme low response rate in favour of it. The use of herbal medicine as a livelihood source was appreciably high before the CREMA creation but declined drastically afterwards. Hunting as a main livelihood source has remained insignificant both before and after the creation of the community reserve.

4.2.4 Local dependence on resource area for survival

This section presents respondents' views on the locals' dependence on the conservation area. Find below the results as displayed by Table 8.

Table 8: Local Dependence on the Resource Area for Survival

Response	Frequency	Percent
No	650	80
Yes	164	20
Total	814	100

Source: Field Survey (2022)

From Table 8, 80% of the respondents responded “No”, whilst 20% of them responded “Yes”, which asserts that the locales’ dependence on the resource area for survival is minimal and suggests to have no significant influence on their living standards.

4.2.5 Means of land acquisition

This section presents respondents’ views on the means of land acquisition for the creation of the reserve. In all six diverse means of acquisition methods were gathered from the respondents. Table 9 shows the results of the means of land acquisition for the creation of the reserve.

Table 9: Means of Land Acquisition for the Conservation Programme

Means of land acquisition	Frequency	Percent
Purchased	2	0.2
On lease or rent	4	0.5
Released/Devoted by Community	730	90
Compensation and Agreement	76	9
Snatched	2	0.2
Total	814	100

Source: Field Survey (2022)

From Table 9, it is obvious that the land for the community resource area was devoted/released by the Assin Akropong community, precisely by the Aduana number one (1) royal family of the Assin Akropong community, the original owners of the land.

4.3 The Socio-economic Impact of Adwenase CREMA on the Local Communities (*Objective 1*)

4.3.1 Employment and job issues

This section seeks to report on the employment and job situation of the surveyed communities. Table 10 shows the result of the employment situation of the CREMA communities.

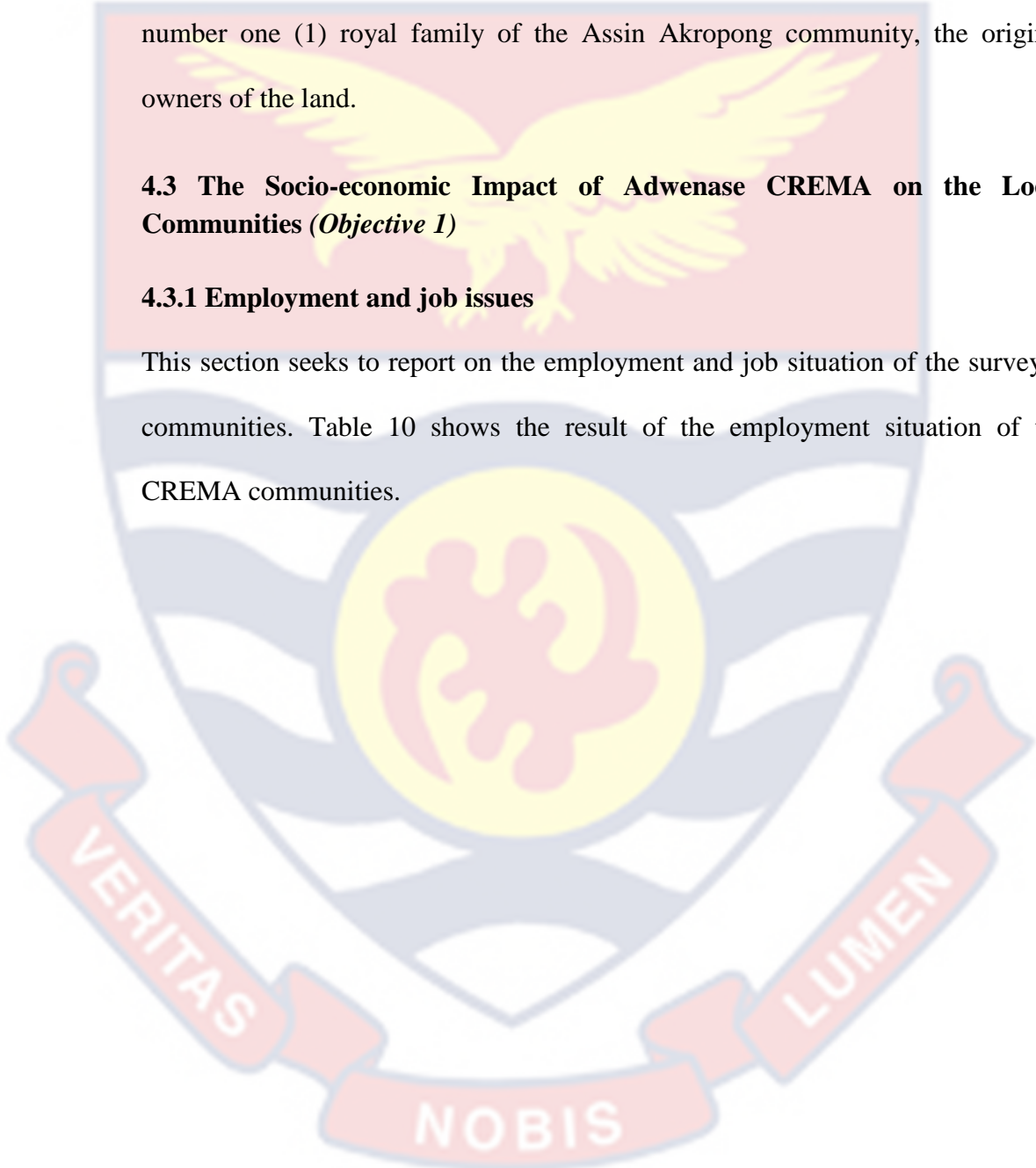


Table 10: The Employment Situation of CREMA Communities

Occupation	Frequency	Percent
Unemployed	21	3
Farmer	514	63
Laborer	32	4
Trader	85	10
Public servant/ Civil servant	44	5
Private Company worker	57	7
Hunter	7	1
Herbalist	20	3
Pensioner	9	1
Artisan	25	3
Total	814	100

Source: Field Survey (2022)

From Table 10, the predominant occupation of the CREMA communities is Agriculture or farming. This could be inferred from the outcomes that five hundred and fourteen (514) respondents (constituting 63% of the total respondents) are farmers. However, the occupational situation looks diverse considering the table above.

4.3.2 Monthly estimated income of respondents and dependency

The maximum monthly earning of the surveyed communities is above GHS 1,100.00, the average ranges between GHS 500 to GHS 700 and the least ranges

between GHS 100 to GHS 300. Table 11 gives results of gender and monthly income crosstabulation.

Table 11: Gender of Respondents and Income per Month Crosstabulation

Gender	Income per month						Total
	GHS 100 – GHS 300	GHS 301 – GHS 500	GHS 501 – GHS 700	GHS 701 – GHS 900	GHS 901 – GHS 1100	Above GHS 1100	
Male	14	133	191	82	20	20	460
Female	19	142	103	47	10	12	333
Total	33	275	294	129	30	32	793

Source: Field Survey (2022)

From Table 11, seven hundred and ninety-three (793) respondents (constituting approximately 97% of the total respondents) out of the total sample size of eight hundred and fourteen (814) are working and earn varying amounts of income depending on the nature of work they do. Out of the total of seven hundred and ninety-three respondents (793) in this regard, thirty-three (representing 4%), two hundred and seventy-five (representing 35%), two hundred and ninety-four (representing 37%), one hundred and twenty-nine (representing 16%), thirty (representing 4%), and thirty-two (representing 4%) earn within the income ranges, GHS 100-300, GHS 301-500, GHS 501-700, GHS 701-900, GHS 901-1,100, and above GHS 1,100 respectively. On the average, males earn higher than females in the fringe communities of Adwenase CREMA.

4.3.3 Community participation in CREMA management

This section gives account of locals' participation in the conservation programme.

Table 12 presents results of communities' involvement in the programme.

Table 12: Communities' Involvement in the Conservation Programme

Response	Frequency	Percent
No	711	87
Yes	103	13
Total	814	100

Source: Field Survey (2022)

From Table 12, it could be asserted that the locals' involvement and or participation in the Adwenaase CREMA which a potential sustainability threat to the conservation programme.

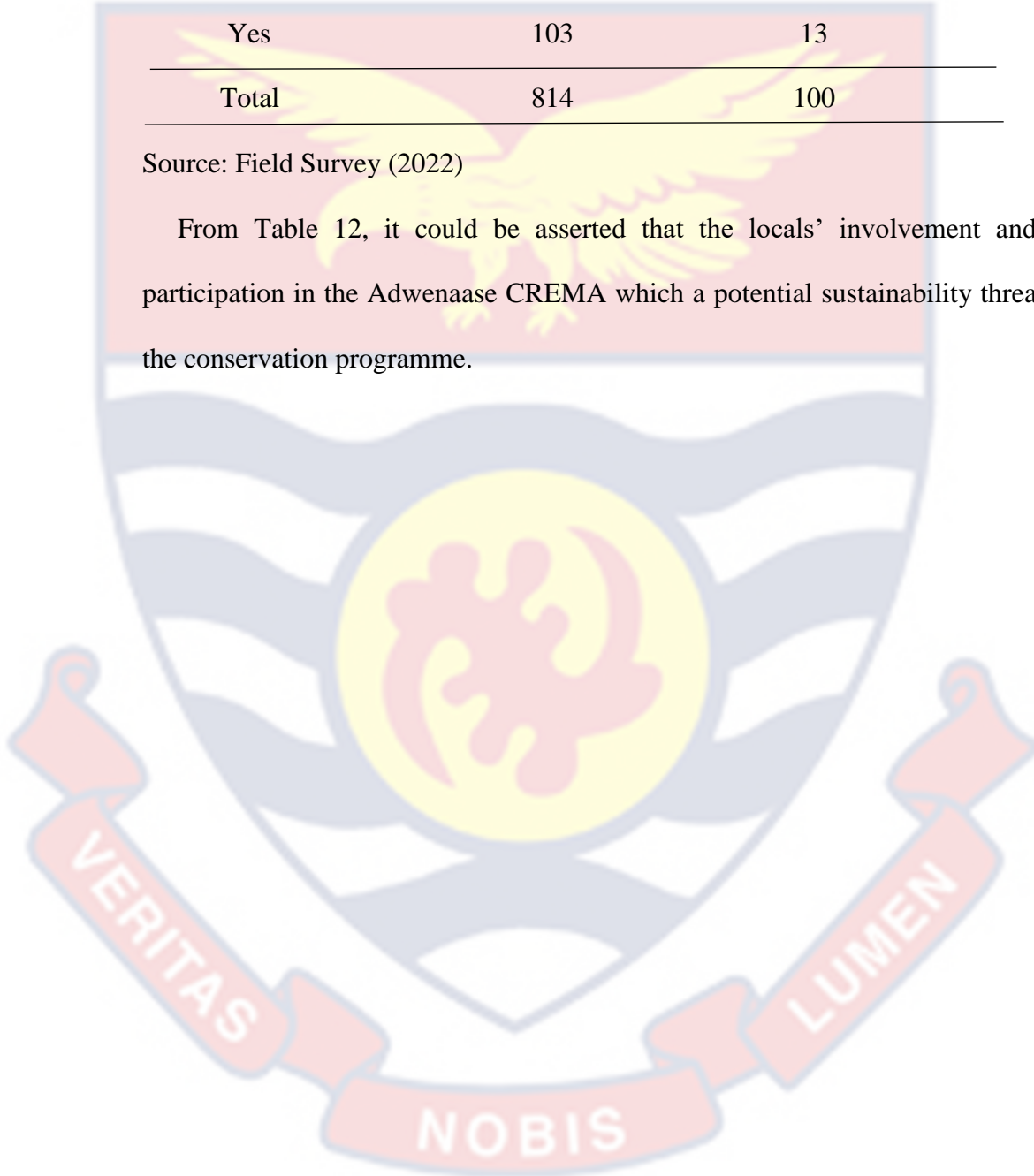


Table 13: Negative Log-Log Regression Model on Communities' Participation in Conservation Programme by Predictor Variables

Variable	Education Level + Biosocial Factors					Socio-cultural Factors					Contextual Factors				
	OR	SE	P-value	Conf. Interval		OR	SE	P-value	Conf. Interval		OR	SE	P-value	Conf. Interval	
	Model 1					Model 2					Model 3				
Education level (Ref: No formal education)															
Primary	1.993	1.094	0.209	0.68	5.845	2.035	1.056	0.171	0.736	5.626	2.437	1.224	0.076	0.911	6.521
J.H.S	3.191	1.302	0.004	1.434	7.1	3.192	1.354	0.006	1.390	7.330	3.071	1.284	0.007	1.353	6.967
S.H.S	2.701	1.179	0.023	1.148	6.356	2.808	1.269	0.022	1.158	6.808	2.727	1.218	0.025	1.137	6.543
Tertiary	2.053	1.112	0.184	0.71	5.937	1.322	0.830	0.657	0.386	4.526	1.143	0.724	0.833	0.330	3.958
Age of respondents (Ref: 20-29 years)															
30-39	1.206	0.348	0.518	0.684	2.123	0.928	0.268	0.796	0.527	1.634	0.942	0.267	0.834	0.541	1.641
40-49	1.063	0.312	0.835	0.598	1.89	0.803	0.244	0.472	0.442	1.458	0.805	0.244	0.474	0.445	1.457
50-59	1.135	0.368	0.697	0.601	2.142	0.928	0.297	0.816	0.496	1.737	0.907	0.287	0.758	0.487	1.687
60 and above	0.847	0.335	0.675	0.39	1.839	0.697	0.265	0.342	0.331	1.468	0.684	0.257	0.313	0.328	1.430
Sex of respondents (Ref: Male)															
Female	0.993	0.16	0.964	0.723	1.362	0.882	0.140	0.427	0.646	1.203	0.891	0.140	0.464	0.654	1.213
Income per month (Ref: Ghc 100-300)															
301-500						2.249	1.408	0.195	0.660	7.669	2.283	1.429	0.187	0.669	7.786
501-700						1.887	1.188	0.313	0.550	6.481	1.928	1.214	0.297	0.562	6.622
701-900						1.132	0.759	0.853	0.304	4.211	1.156	0.775	0.829	0.311	4.303
901-1100						2.571	2.021	0.230	0.551	12.005	3.104	2.437	0.149	0.666	14.465
1100 and above						2.647	1.911	0.178	0.643	10.900	2.867	2.054	0.142	0.704	11.676
Religion (Ref: No religion)															
Christianity						4.373	2.933	0.028	1.175	16.282	4.297	2.870	0.029	1.160	15.913
Islamic						2.390	1.751	0.234	0.569	10.046	2.341	1.718	0.246	0.556	9.860
Traditional						8.488	7.147	0.011	1.630	44.211	7.378	5.888	0.012	1.544	35.260
Others						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Number of dependants (Ref: None)															
1-2						3.222	2.980	0.206	0.526	19.737	3.217	2.974	0.206	0.526	19.690

Table 13, continued

3-4	2.472	2.260	0.322	0.412	14.834	2.460	2.248	0.325	0.410	14.752
5 and above	2.728	2.477	0.269	0.460	16.170	2.758	2.504	0.264	0.465	16.350
Wealth status (Ref: Poorest)										
Poor	0.893	0.216	0.642	0.556	1.436	0.887	0.214	0.620	0.553	1.424
Rich	1.168	0.249	0.465	0.770	1.773	1.172	0.246	0.448	0.777	1.768
Richest	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Community (Ref: Assin Akropong)										
Subinso No.1						0.383	0.358	0.305	0.061	2.400
Agyalo						0.000	0.000	0.000	0.000	0.000
Total	814				777					777

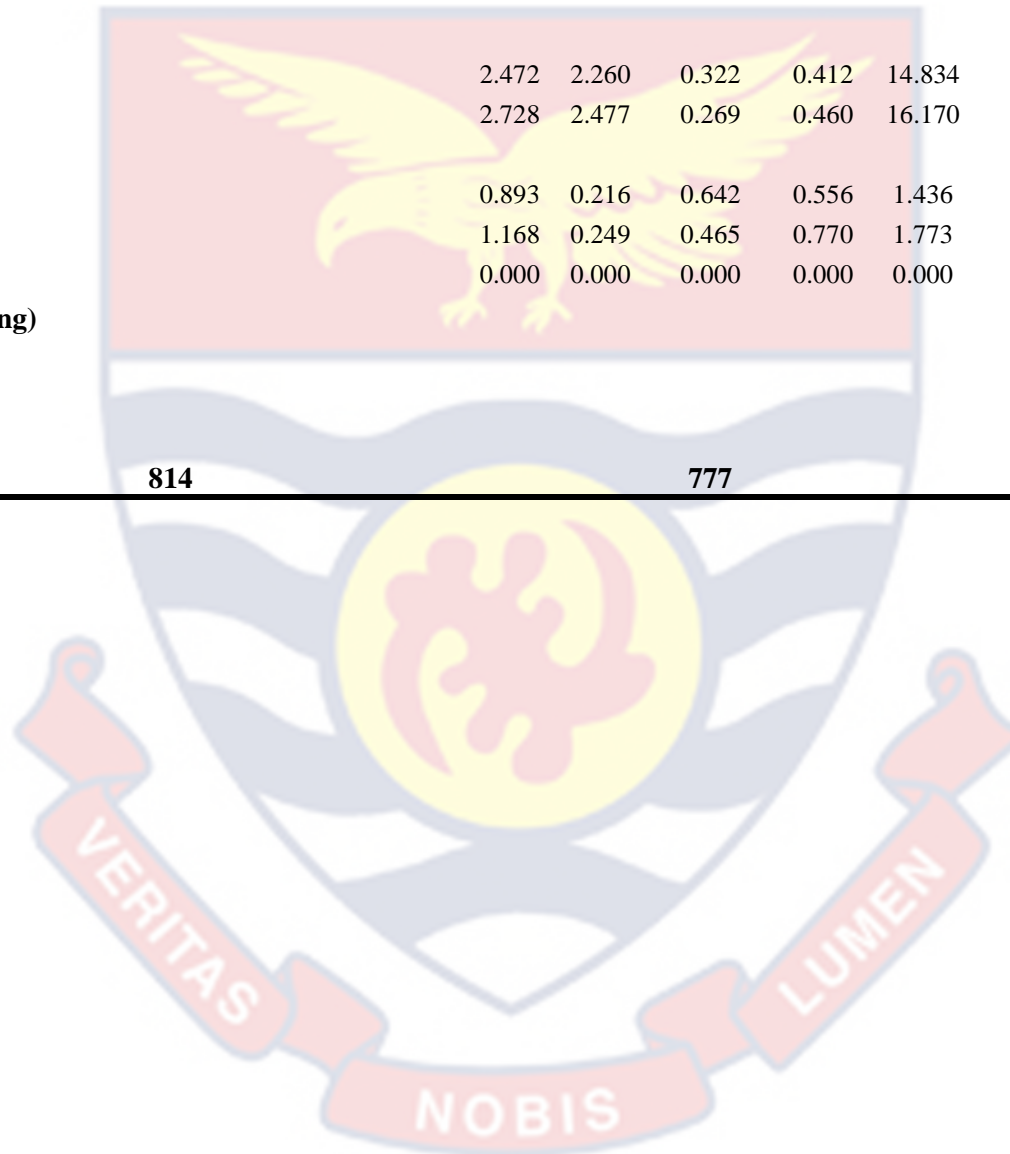


Table 13 shows the odds ratio (OR), Standard Error (SE), P-Values, and Confidence interval (95%) and the associated predictor variables. In model 1, persons with educational level of JHS (OR= 3.191, $P<0.05$), and SHS (OR= 2.701, $P<0.05$), were more probable to partake in conservation programme. It could be deduced that a person's participation in conservation programmes matters with educational level, whereas age and gender did not have any significant effect on local's participation in conservation programmes.

Considering model 2, persons with educational level of JHS (OR= 3.192, $P<0.05$), and SHS (OR= 2.808, $P<0.05$), as well as those who are Christians (OR= 4.373, $P<0.05$), and Traditionalists (OR= 8.488, $P<0.05$), appeared more likely to partake in conservation programmes. However, age, gender, monthly earnings, religion, number of dependents, wealth status, and community of origin did not significantly influence locals' participation in communal resource management.

Considering model 3, persons with educational level of JHS (OR= 3.071, $P<0.05$), and SHS (OR= 2.727, $P<0.05$), as well as those who are Christians (OR= 4.297, $P<0.05$), and Traditionalists (OR= 7.378, $P<0.05$), are more likely to partake in conservation programmes. However, age, gender, monthly earnings, religion, number of dependents, wealth status, and community of origin do not significantly influence locals' participation in communal resource management.

Table 14 shows results on employment opportunities for locals in the conservation.

Table 14: Native Employment in the Conservation Area

Response	Frequency	Percent
No	620	76
Yes	194	24
Total	814	100

Source: Field Survey (2022)

From the Table 14, about 76% of the total respondents confirmed their non-participation, whilst about 24% of them said they are involved in the conservation programme. This depicts locals' minimal participation which is an imminent sustainability threat to the conservation programme.

4.3.4 Alternative livelihood support systems

This section presents the results of responses on the Alternative Livelihood Support Systems communities engage in. Table 15 shows the association between Alternative Livelihood Support Systems available to the study CREMA communities and level of education.

Table 15: Association between Alternative Livelihood and Level of Education

Alternative Livelihood	Level of Education of Respondent					Inferential Statistics
	No Formal Education [%]	Primary Education [%]	Junior High/Middle School [%]	Secondary Education [%]	Tertiary Education [%]	
None	13	7	51	23	6	Pearson chi2 =71.9502 P-value = 0.000 Cramér's V = 0.1487
Bee keeping	37	0	33	30	0	
Livestock Farming	28	2	48	16	6	
Snail farming	15	10	49	13	12	
Others	6	9	65	17	3	
Trading	18	5	51	23	3	
Labourer	23	15	46	16	0	
Crop farming	27	13	33	13	14	

From Table 15, three hundred and ninety (390) respondents (constituting 48% of the total respondents) are not engaged in any alternative livelihood activity, whilst four hundred and forty-two respondents (constituting 52% of the total respondents) are engaged in various forms of alternative livelihood.

From Table 15, the p -value = 0.000 depicts that there exists an association between level of education of respondents and the alternative livelihood they are engaged in. However, the Cramer's $V = 0.1487$ depicts that the association is a weak one, meaning that, educational level is not strongly associated with respondents' engagement in alternative livelihood.

According to the respondents, all the alternative livelihood support forms shown above were developed by the individuals who are engaged in them without any form of support from any organization or the government. The results above portray that level of education in this instance is not strongly associated with respondents' engagement in alternative livelihood systems

4.3.5 Locals' accessibility to resources

This section presents the results of responses on local people's accessibility to resources in the resource reserve as shown by Tables 16, 17 and 18 respectively.

Table 16: Permission to Harvest Resources from Reserve Area

Response	Frequency	Percent
No	275	34
Yes	539	66
Total	814	100

Source: Field Survey (2022)

From Table 16, locals are granted access to the reserve to harvest relevant resources that are allowed to be harvested based on the conservation guidelines of the reserve.

Table 17: Restrictions to Resource Access

Response	Frequency	Percent
No	230	28
Yes	584	72
Total	814	100

Source: Field Survey (2022)

From Table 17, there are actually restrictions in place to monitor the various activities in the resource area, yet some community dwellers flout the restrictions or do not comply with them, which could in turn pose threat to the sustainability of the reserve.

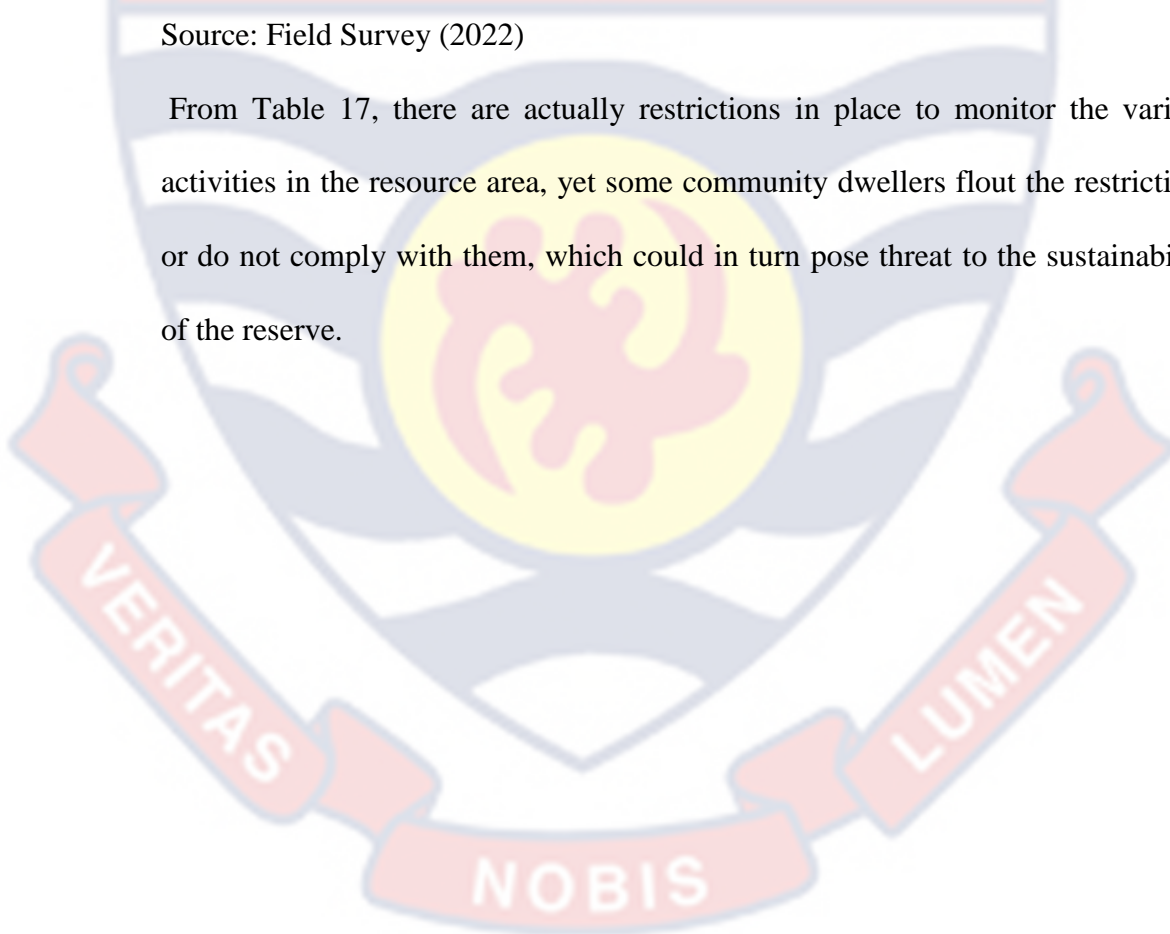


Table 18: Association Between Resources Permitted to Harvest, Level of Education and Duration of stay in Study Communities

Variable	Resources Permitted to Harvest								Inferential Statistics
	Herbal Medicine [%]	Timber [%]	Wildlife [%]	Food stuff [%]	Honey [%]	Firewood [%]	Herbal and Firewood [%]	Herbal and Timber [%]	
N = 539									
Level of education									
No formal education	51	4	1	6	2	18	16	2	Pearson chi2 = 48.760 P-value = 0.009 Cramér's V = 0.1504
Primary	38	5	0	8	5	38	3	3	
Junior High/Middle School	39	11	3	7	7	21	12	0	
Secondary education	32	20	0	2	5	28	12	1	
Tertiary education	46	0	0	11	4	25	14	0	
Duration of stay in community									
6-10 years	50	0	0	0	0	50	0	0	Pearson chi2 = 10.060 P-value = 0.758 Cramér's V = 0.0966
11-15 years	27	18	0	0	0	55	0	0	
Above 15 years	40	11	1	6	6	23	12	1	

From Table 18, the total respondents for the harvestable materials were five hundred and thirty-nine (539). From the table, herbal medicine and fire wood appears to be the commonest resources accessed by most people of the CREMA communities.

From table 18 above, $p\text{-value} = 0.009$ depicts that there exists an association between permitted resources to harvest and the level of education of respondent. However, the Cramer's $V = 0.1504$ depicts that the association is relatively weak, meaning that, educational level is not strongly associated with respondents' response on harvestable resources. Also, the $p\text{-value} = 0.758$ is statistically insignificant and depicts that there exists no association between permitted resources to harvest and the duration of stay in study communities, the Cramér's $V = 0.0966$ depicts that the association is relatively weak, meaning that, duration of stay in study communities is not strongly associated with respondents' response on harvestable resources.

4.3.6 Benefits obtained from the CREMA

This section presents the results of responses pertinent to the benefits derived by the CREMA communities from the reserve, from the local people's perspective. Table 19 shows the outcome of the benefit derived by communities from the reserve.

Table 19: Communities' Perception of Benefits Derived from the CREMA

Benefit	Frequency	Percent
No benefit	540	66.3
School Building	8	1.0
Palace	3	0.4
Others	6	0.7
Communal Development	100	12.3
Wood for community project	157	19.3
Total	814	100

From Table 19, approximately 66% of the respondents representing 540 persons responded that the communities derive no benefit from the reserve, which is a threat to sustainability of the reserve. Communal development and wood for community project also recorded some responses (that is, 12% and 19% of the total respondents in this regard respectively) but not relatively appreciable.

4.3.7 CREMA related challenges encountered by community locals

This section presents the results of responses on resource management related conflicts and resolution approaches employed. The section as well captures the conflict types, the frequency of conflict and Conflict resolution approaches as portrayed by Tables 20, 21, 22 and 23 respectively.

Table 20: Encounter of Conflict in the Reserve Conservation

Response	Frequency	Percent
No	217	27
Yes	597	73
Total	814	100

From Table 20, approximately 27% of the total respondents responded “No”, and about 73% of the total respondents) responded “Yes”, which suggests that there exists some significant extent of conflict in the area.

Table 21: Frequency of Conflict

Frequency of Conflict	Frequency	Percent
Always	57	10
Occasionally	540	90
Total	597	100

Source: Field Survey (2022)

From Table 21, It could be deduced that there pertain occasional occurrence of conflict in Adwenaase CREMA and yet could have a very significant adverse effect on the natural resources.

Table 22: Types/Nature of Conflicts Encountered

Conflict type	Frequency	Percent
Over-exploitation	125	21
Unfair sharing of resource benefit	111	19
Flout of rules and norms	15	2
Encroachment	329	55
Chieftaincy issues	17	3
Total	597	100

Source: Field Survey (2022)

From Table 22, in line with Tables 21 and 20, five hundred and ninety-seven (597) respondents representing 73% of the total respondents of the study responded to the “type of conflict encountered” in the study area. This implies that, total respondents of 597 were recorded for the conflict types. It could be traced from the table that “encroachment” forms the major conflict type as it recorded approximately 55% of the responses, whilst “over-exploitation” and “unfair sharing of resources” recorded 21% and 19% respectively are also quite significant.

Table 23: Conflict Resolution Approaches

Resolution Approach	Frequency	Percent
Amicable resolution	130	22
Legal resolution	208	35
Resolution by local tribunal	191	32
Nothing	68	11
Total	597	100

Source: Field Survey (2022)

From Table 23, three main conflict resolution approaches, thus, amicable resolution, legal resolution and resolution by local tribunal were gathered, with 22%, 35% and 32% respectively. However, some few people, representing approximately 11% of the respondents shared that nothing is done when conflicts arise, which could be provoking and inspire heightened resource exploitation.

4.3.9 Management performance in managing the CREMA from indigenes' perspective

This section presents the results of responses on management performance in managing the CREMA from indigenous perspective. Table 24 shows results of the management performance of CREMA from the Indigenes' Perspective.

Table 24: Performance Ratings of the Resource Management

Response	Frequency	Percent
Good	51	6
Fairly good	161	20
Poor	602	74
Total	814	100

Source: Field Survey (2022)

From Table 24, generally, the management performance of the reserve is poor from the perspective of the majority of the respondents (that is, 74% of the total respondents).

4.4 The Environmental/Ecological Impact Local Communities have on the Adwenase CREMA (Objective 2)

4.4.1 Resource accessibility, regulations, and compliance

This section presents the results of responses on resource accessibility, availability of laid down rules and norms for resource access and use and compliance with rules and norms by CREMA communities as portrayed by Tables 25, 26 and 27 respectively.

Table 25: Accessibility of Resources from the Indigenes' Perspective

Response	Frequency	Percent
No	275	34
Yes	539	66
Total	814	100

Source: Field Survey (2022)

From Table 25, the locals are allowed access to resource in the conservation area, which is positive and serves a fertile premise to enhance communal participation in sustainability thrive.

Table 26: Laid Down Rules and Norms for Resource Access and Use

Response	Frequency	Percent
No	95	11
Yes	714	88
Unknown	5	1
Total	814	100

Source: Field Survey (2022)

From Table 26, there are laid down regulations based on which the resource area is managed. However, they are often flouted.

Table 27: Compliance with Rules and Norms

Responses	Frequency	Percent
No	85	14
Yes	546	86
Total	631	100

Source: Field Survey (2022)

From Table 27, in all, a total of six hundred and thirty-one (631) responded in this regard. Out of this, approximately, 14% responded “No”, and approximately 86% responded “Yes”, which indicates that there is optimum compliance to the laid down regulations based on which the resource area is managed.

4.4.2 Water resource availability, quality and management

This section presents the results of responses on the availability, quality and management of water in the CREMA communities. Tables 28 and 29 below show water resource availability, Quality and Management status from the Indigenes' Perspective.

Table 28: Main Source of Water and Water Quality

Water Source	Water Quality			Total
	Clean and Fresh	Clean but has particles	Clean but salty	
Community stream, river	13	43	0	56
Well	29	6	0	35
Borehole	232	33	15	280
Tap	214	39	0	253
Borehole and well	110	16	18	144
Borehole and tap	24	0	0	24
Borehole and River/Stream	17	5	0	22
Total	639	142	33	814

Source: Field Survey (2022)

From Table 28, the major sources of water for the surveyed communities are borehole and tap with other alternative water sources such as well and community river/stream.

Table 29: Frequency of Water Access

Response	Frequency	Percent
Anytime	625	77
Daily	189	23
Total	814	100

With frequency of water access, Table 29 shows that availability and accessibility are not challenges in the CREMA communities. At least water is accessed on daily basis and there wasn't any concern of water shortages whatsoever during the survey.

4.4.3 Impacts of human activities on the CREMA

This section presents the results of responses on how local people's activities impact the resource reserve. The section in expounds captures respondents' perception on the current state of animal species in the reserve, and the reasons behind their perception.

Table 30 shows results of the respondents' perception on the current state of animal species in the reserve. The table portrays respondents' response to the question, "Compared to 10 years back are the animal population/species still intact?"

Table 30: Respondents' Perception on the Current State of Animal Species
Compared to ten Years ago

Response	Frequency	Percent
No	799	98.2
Yes	14	1.7
Can't tell	1	0.1
Total	814	100

Source: Field Survey (2022)

From Table 30, it could be deduced that there is a significant decline in the animals' population and species currently compared to ten (10) years back.

Table 31: Reasons for the Declined Animal Population

Reason	Frequency	Percent
Poached	465	58
Escaped to other places	290	36
Encroachment	7	1
Escaped and Poached	24	3
Don't know	13	2
Total	799	100

Source: Field Survey (2022)

From Table 31, in line with Table 30, seven hundred and ninety-nine (799) respondents, representing approximately, 98% of the total respondents answered to whether or not the animal species in the reserve are still intact compared to ten years back. It could be traced from Table 4.31 that "poaching" (representing 58%

of respondents) and “escape of animals” (representing a 36% of respondents) form the foremost reasons for the declined state of the animal species in the reserve, whilst the rest, thus, “Encroachment”, “Escape and poaching” and “Not known” form approximately 14% altogether.

4.4.4 Land ownership and utilization

This section presents the results of responses on land ownership and land use types among the CREMA communities. Tables 32 and 33 show results of land ownership and utilization respectively in the reserve.

Table 32: Land Ownership

Response	Frequency	Percent
No	96	12
Yes	718	88
Total	814	100

Source: Field Survey (2022)

From Table 32, it could be asserted that most of the locals own land for diverse purposes.

Table 33: Land use Type and Land Size Owned Crosstabulation

Land use Type	Land size Owned									Total
	1 acre	1.1 to 2 acres	2.1 to 3 acres	3.1 to 4 acres	Above 4 acres	1 plot	1.1 to 2 plots	2.1 to 3 plots	Above 4 plots	
Crop farming	11	19	53	99	437	1	2	2	1	625
Livestock farming	0	2	0	4	14	0	0	0	0	20
Housing	1	3	23	12	13	5	8	3	1	69
Tree planting	0	0	1	0	1	0	0	0	0	2
Others	2	0	0	0	0	0	0	0	0	2
Total	14	24	77	115	465	6	10	5	2	718

Source: Field Survey (2022)

It could be inferred from Table 33 that most of the land holders (625 of them representing about 87 percent) engage in crop farming, with a higher proportion (thus, 437 respondents out of the 625) engaged in quite extensive or large-scale farming. Few respondents have invested their lands in livestock farming, housing, and other land use forms. This confirms the results on employment of respondents as Table 10 captures, that the major work of the CREMA communities is agriculture, particularly crop farming.

4.4.5 Resource area encroachment and conflicts

This section presents the results of responses on resource area encroachment and conflict in the resource reserve. The section illustrates whether or not the reserve area is encroached and also the causes of encroachment as portrayed by Table 34.

Table 34: Encroachment of Conservation Land Area

Response	Frequency	Percent
No	90	11
Yes	724	89
Total	814	100

Source: Field Survey (2022)

Considering Table 34, it is clear to deduce that the reserve land area has been encroached, which portends for sustainability threat or resource unsustainability.

Table 35: Causes of Encroachment and Estimated Percentage of Land Area Encroached Crosstabulation

Causes of encroachment	Estimated percentage of land area encroached						Total
	1–10	11–20	21–30	31–40	41–50	Can't tell	
Greed	45	82	30	12	0	29	198
Land ownership	19	31	9	3	0	12	74
Land for farming	34	69	8	6	0	33	150
Greed and land	1	13	3	0	0	18	35
Greed and ownership	11	8	4	0	0	19	42
Poor management	18	46	8	1	6	39	118
Chieftaincy conflict	40	32	5	0	0	13	90
Not known	1	2	3	0	0	11	17
Total	169	283	70	22	6	174	724

Source: Field Survey (2022)

From Table 35, in line with Table 34 seven hundred and twenty-four respondents (representing 89% of the total respondents for the study) were recorded in this regard. It could be deduced from table 35 again that the foremost drivers of encroachment of the resource area are greed, land for farming, poor management of the reserve and chieftaincy conflict at Assin Akropong, which represent 27%, 21%, 16% and 12% respectively of the responses gathered, which sums up to 76% of the entire responses. However, land ownership, greed and land ownership struggles, greed and land for farming form the minor reasons for the encroachment of the reserve area.

4.4.6 Community engagement on resource management and sustainability

This section presents the results of responses on community engagement in resource management and sustainability. Specifically, the section portrays the outcomes of whether or not the locals undergo training on community resource conservation as shown by Table 36.

Table 36: Organisation and attendance of Training Workshops on Community Resource Conservation

Response	Frequency	Percent
No	721	89
Yes	93	11
Total	814	100

Source: Field Survey (2022)

Considering Table 36, seven hundred and twenty-one (721) respondents (representing approximately 89% of the total respondents) said that the CREMA communities do not undergo any training regarding community resource conservation, which is a critical threat to resource conservation and sustainability.

4.5 The Impact of Cultural/Belief Systems of Indigenous Communities on Adwenase CREMA (Objective 3)

4.5.1 Available natural sites and the related cultural or traditional significance to the indigenous people

This section presents the results of responses on the availability of natural sacred site. Table 37 shows the results of respondents' knowledge on the availability of a natural sacred site.

Table 37: Availability of Natural Sacred Site

Response	Frequency	Percent
No	91	11
Yes	578	71
Not aware	145	18
Total	814	100

Source: Field Survey (2022)

Considering Table 37, there exists a natural sacred site in the Adwenase reserve, which forms a basis for high community patronage for resource conservation.

4.5.2 Consistency of conservation activities with local tradition

This section presents the results of responses on consistency of conservation activities and local tradition. Table 4.38 shows the results of respondents' knowledge on the availability of a natural sacred site

knowledge on the availability of a natural sacred site

Table 38: Consistency of Conservation Activities with Local Tradition

Response	Frequency	Percent
No	28	3
Yes	786	97
Total	814	100

Source: Field Survey (2022)

Considering table 38, seven hundred and eighty-six (786) respondents (representing approximately 97% of the total respondents) said that the CREMA conservation activities are compatible with their tradition and norms, which is a suitable condition enhancing resource conservation and sustainability.

CHAPTER FIVE

DISCUSSION

5.1 Socio-demographic Characteristics of Respondents

5.1.1 Gender of respondents

A total of eight hundred and fourteen (814) respondents were reached in all three study communities. Out of this total number, 58% were males, 42% were females. Thus, more males were reached than females. It is clear among all the communities surveyed that, the population of male respondents out-weighted the population of female respondents.

The common trend of gender difference among respondents in all the surveyed communities could be attributed to the fact that population of males in general dominates that of females in the communities surveyed. Perhaps more females especially the youth who are not yet married might have left their communities for towns and cities in search of jobs. Considerably, others might have been married to men outside the surveyed communities, of which custom demands them to live with their husbands. In line with (Baddianaah et al., 2020; Osumanu, 2020), the men or males dominate the household headship in the CREMA communities and echoes an overriding characteristic of household headship in indigenous communities in Ghana, where the family head becomes the principal decider in respect of ensuring the welfare of the whole household (Osumanu, 2020). Males in general have superior advantage to influence the decision-making process in respect of resource exploitation and CREMA management.

5.1.2 Age of respondents

The age ranges of respondents assumed a uniform ten-year interval as shown in Table 1 above. The results characterize the potential labour force of the surveyed communities as high, since most of the respondents fall within 20-49 years age bracket which portrays a promising work force in these communities. However, in pursuit of the objectives of the study, focus was placed on persons fifty years and above as well, purposely to get in touch with people who knew more and could tell much about the reserve.

5.1.3 Religion of respondents.

The religions practiced among the surveyed communities are Christianity, Islamic, and Traditional religions, represented by 79%, 11%, and 1% respectively of the total sample size. Whilst seventy-one individuals representing 9% of the total sample size did not practice any religion. Thus, among the three main religions in Ghana, Christianity is the commonest religion practiced among the local people of the surveyed communities. It could be inferred thereof that the CREMA communities are quite religious which should serve a fertile ground for the propagation of environmental sustainability issues through the various religious teachings as enshrined in the various religious dogmas such as the Holy Bible and the Holy Quran.

Surprisingly, the situation is different. The religious nature of the communities seems to have less or no influence on resource conservation and sustainability of the CREMA.

5.1.4 Educational status of respondents

Considering *Figure 3*, it could be deduced that most of the local people have at least attained basic education. On the average, 26% of the sample populations have attained secondary and tertiary education. This suggests that the literacy level of the CREMA communities is relatively low, which could be a contributory factor to the pertaining CREMA situation in the study area. In this vein, average to high literacy or educational level could translate into in-depth knowledge on natural resource conservation and sustainability and thus ignite and or complements communal and or indigenous patronage in resource conservation and sustainability programmes.

On the other hand, however, low levels of education of local people could translate into low knowledge in resource conservation and sustainability practices. Therefore, the relatively low levels of education of the CREMA communities could adversely impact resource sustainability programmes and interventions to a significant extent. This finding is in line with that of Baddianaah and Baaweh (2021) who found that the attainment of low-level formal education by indigenous communities could have consequences on their acceptance of supplementary benefits accrued from CREMA sidewise the collection of non-timber forest products. The locals' decision to preserve the CREMA resources may depend on the direct or apparent gains they stand to obtain from the CREMA. This affirms the finding of Abukari and Mwalyosi (2018) that indigenous knowledge on official procedures (rules and regulations) of reserve areas (Mole National Park, Ghana and the Tarangire National Park, Tanzania), including other gains like job

opportunities, non-timber forest products (NTFPs) accessibility and alternative livelihoods greatly inform local communities' decision on conservation.

Clearly, figure 3 portrays there exists gender disparity issues among the locals in terms of education. Thus, the higher the level of education, the fewer the females recorded and vice-versa. This is a critical trend which has the potential to adversely impact the CREMA programme, since females in general are assertive compared to males, and that are able to influence the learning process of children and the family at large, just as asserted by Dr. Kwagyir Aggrey that, "if you educate a man, you educate an individual but if you educate a woman, you educate a nation". Therefore, there is the need to bridge the gender gap to enhance conservation programmes.

From Table 4, it is quite obvious that the proportions of the youth attaining their secondary and tertiary levels of education respectively are on a steady rise in the study area. This could be inferred from the output 37% and 8% of the total respondents of three hundred and nine (309) within 20 - 39 years age bracket have duly attained their secondary and tertiary levels of education respectively, compared with those respondents within the age bracket, 40 and above 60 years, where 10% and 5% of the total respondents of five hundred and five (505) have duly attained their secondary and tertiary levels of education respectively. This is a good development which has the potential to positively impact the CREMA programme.

5.2 Land Acquisition Procedure for the Conservation Area

From Table 6, two hundred and ten (210) people (representing 26% of the respondents) responded “No, the land area was not in use before the creation of the CREMA”, five hundred and ninety-two people (representing 73% of the respondents) responded “Yes, the land area was in use before the CREMA creation” and twelve people (representing 1% of the respondents) responded they were not aware of what the land was used for. The response of the majority in this regard aligns with the history of Assin Akropong and that of the Adwenase Community Resource Area, which portrays that the reserved area was initially occupied by their ancestors. As at the time of the reserve creation, according to the reserve frontiers, all the dwellers had relocated to Assin Akropong and environs. Therefore, the area was a high forest, which due to the cultural and the belief systems of the indigenes was neither cultivated nor touched for any purpose except for hunting, which is consistent with the finding of Shastri et al. (2002), which asserts that the role of traditional beliefs in the conservation of local biodiversity, regardless of their use value, has pertained since time immemorial; and that of Diawuo and Issifu (2015), which asserts that norms play crucial role in local level resource management due to their ability to ensure compliance and or adherence to rules and regulations that oversee resource use by all.

The main occupation of the respondents before the creation of the CREMA as depicted by Table 7 was farming. Farming was and is still the major source of livelihood among the CREMA communities before and after the creation of the CREMA respectively. Trading was not common before the creation of the

CREMA and still not common owing to the extreme low response rate in favour of it. The use of herbal medicine as livelihood source was appreciably high before the CREMA creation but declined drastically afterwards. Hunting as a main livelihood source has remained insignificant especially after the creation of the community reserve. Farming has been the predominant occupation for most fringe communities along the borders of reserved areas as depicted by most studies.

With regards to locals' dependence on the conservation area for a living, it could be asserted that it occurs at a very minimal rate and could not even have any significant influence on their living standards, as portrayed by Table 8 above, where six hundred and fifty (650) respondents (representing 80% of the total respondents) responded "No", and one hundred and sixty-four people (representing 20% of the total respondents) responded "Yes" to whether or not the locals or indigenous people depended on the conservation for a living. This finding is contrary to that of Baddianaah and Baaweh (2021), where the locals of Zukpiri CREMA communities are able to obtain income from the CREMA and even use in many ways including payment of school fees, acquiring household culinary utensils and settling medical bills of households and more.

From the perspective of the reserve frontiers, a lot of illegal exploitations are encountered in the reserve area, which really threatens sustainability of the available resources. This corroborate the assertion of the Food and Agriculture Organisation (FAO) (2014) that forest and wildlife resources have suffered recurrent sequence of depletion notwithstanding the substantial service they offer to human welfare, and contrary to the finding that reduced levels of depletion of

natural resources pertains in areas where resources are managed by or co-managed with indigenous communities (Husseini et al., 2016; Addison et al., 2019).

From Table 9 above, it is obvious that the land for the community reserve was devoted/released by the Assin Akropong community, precisely by the Aduana number one (1) family of the Assin Akropong community, the original owners of the land.

A community devoting a land area of approximately 177km² for conservation programme depicts its level of enthusiasm for the programme. This sets a good start for a conservation programme and assures immense community participation and or involvement, and thus, attaining sustainability. However, a community devoting a land area for resource conservation does not beget sustainability. Sustainability sets in when all-relevant stakeholders prove functional and uphold to the laid down principles and plans for the conservation project. This confirms the assertion by Baker et al. (2018) that, a robust local management approaches and active input of the indigenous groups are required to incorporate their opinions for improved decision-making at the local level.

5.3 The Socio-economic Impact of Adwenase CREMA on the Local Communities (*Objective 1*)

From Table 10, the predominant occupation of the Adwenase CREMA communities is Agriculture or farming, just as pertained in most communities along the fringes of reserves. This could be inferred from the study outcomes that the majority (63%) of respondents are farmers, which supports the finding of

Baddianaah and Baaweh (2021) that most indigenes of the fringe communities of Zukpiri CREMA in the Upper West Region of Ghana are crofter farmers. The employment situation in the study communities looks quite diverse compared with study findings of Baddianaah and Baaweh where about 95% of the locals of fringe communities of Zukpiri CREMA are into agriculture as their major occupation. At Assin Akropong and environs, the occupation of the indigenes and other community dwellers spread across diverse professions, as portrayed by Table 10. The study recorded quite reasonable number of respondents who work as public servants, artisans, traders and others. The diverse nature of the occupation of respondents in the study communities especially Assin Akropong shows that the community is gradually developing.

From Table 11 above, approximately 97% of the total respondents are working and earn varying amounts of income depending on the nature of work they do. Out of the total estimated percentage in this regard, 4%, 35%, 37%, 16%, 4%, and 4% earn within the income ranges, GHS 100-300, GHS 301-500, GHS 501-700, GHS 701-900, GHS 901-1,100, and above GHS 1,100 respectively. It could be deduced thereof that about 76%, of the dwellers of the CREMA communities are low salary earners, whilst the remaining 24% are relatively average salary earners.

Contrary to the findings of Baddianaah and Baaweh (2021) which indicates that aside the direct gains the surrounding communities of Zukpiri CREMA obtained from the CREMA through communal access to non-timber forest products, they received various donations and recompenses in cash from NGOs and CSOs, value-addition entrepreneurial trainings on processing raw materials

obtained from the CREMA in accordance with sustainable exploitation and utilization of natural resources in reward of managing the resources prudently, such opportunities seem to have eluded the communities of Adwenase CREMA, and in fact, the economic standard of the communities is low, which could partly be a contributory factor to the communities' attitude towards the Adwenase reserve. This confirms the findings of Gebregziabher and Soltani, (2019) that the perceptible benefits indigenous communities obtain from these protected areas is one major enticing element that informs their participation in co-managing the natural resources available to them.

Though there is high labour force in the communities, generally low incomes are realized from their various occupations, which is an imminent contributor to rural poverty in the study area. It could be concluded that the standard of living in the CREMA communities is low, which could spark diverse forms of illicit resource exploitations, which corroborate the findings of Jiao et al. (2019) that in the Greater Serengeti-Mara Ecosystem landscape of Tanzania and Kenya, the economic aids obtainable from conservation programmes have not been strongly projected along with conservation methods, resulting in various gradations of depletion.

Meanwhile, Community Resource Management Areas (CREMAs) aim at environmental conservation and conform to curbing poverty among indigenous groups (Duguma et al., 2018).

From Tables 12 and 14, the local or indigenous involvement in the conservation programme is trifling which could literarily translate into their non-

acceptance or their non-involvement in the conservation programme owing to the poor economic state of the communities despite the presence of the reserve, which could adversely impact sustainability of the resources. On the other hand, one important step to seal sustainable communal management of natural resources is by endearing communal readiness to comply with the pertaining guiding principle and as well partake in safeguarding the resources (Asare et al., 2013; Owusu-Ansah, 2020). Nevertheless, the indigenes require a reasonable sharing of the accruing benefits from the CREMA.

From Table 13, considering model 1, persons who have attained educational level of JHS (OR= 3.191, $P<0.05$), and SHS (OR= 2.701, $P<0.05$), were more probable to partake in conservation programme compared with those who had attained the other levels of education. This implies that a person's participation in conservation programmes matters with educational level, whereas age and gender do not have any significant effect on local's participation in conservation programmes.

Considering model 2, persons with educational level of JHS (OR= 3.192, $P<0.05$), and SHS (OR= 2.808, $P<0.05$), as well as those who are Christians (OR= 4.373, $P<0.05$), and Traditionalists (OR= 8.488, $P<0.05$), appeared more likely to partake in conservation programmes. However, age, gender, monthly earnings, religion, number of dependents, wealth status, and community of origin do not significantly influence locals' participation in communal resource management.

Considering model 3, persons with educational level of JHS (OR= 3.071, $P < 0.05$), and SHS (OR= 2.727, $P < 0.05$), as well as those who are Christians (OR= 4.297, $P < 0.05$), and Traditionalists (OR= 7.378, $P < 0.05$), are more likely to partake in conservation programmes. However, age, gender, monthly earnings, religion, number of dependents, wealth status, and community of origin do not significantly influence locals' participation in communal resource management.

Alternative livelihood systems are interventions that are employed especially in conservation areas to mitigate the impact indigenous groups or local people could have on resources under conservation. The study outcome shows that about 48% of the respondents were not engaged in any alternative livelihood activity, whilst approximately 52% of the total respondents were engaged in various forms of alternative livelihood.

Nevertheless, the locals of Zukpiri CREMA communities are able to obtain income from the CREMA and even use in many ways including payment of school fees, acquiring household culinary utensils and settling medical bills of household (Baddianaah & Baaweh, 2021). Similarly, numerous herbal plants are collected from the CREMA, of which all collectively contribute to improving the revenue sources of the CREMA communities (Baddianaah & Baaweh).

From Table 15 above, the p-value = 0.000 depicts that there exists an association between level of education of respondents and the alternative livelihood they are engaged in. However, the Cramer's $V = 0.1487$ portrays that the association is a weak one, meaning that, educational level is not strongly associated with respondents' engagement in alternative livelihood.

According to the respondents, all the alternative livelihood support forms they engage in were developed by the individuals who are engaged in them without any form of support from any organization or the government. The results portray that level of education in this instance is not strongly associated with respondents' engagement in alternative livelihood systems. Positive enough, the locals are granted access to the reserve to harvest relevant resources that are allowed to be harvested based on the conservation guidelines of the reserve as confirmed by Table 16. This finding is in corroboration with that of Baddianaah and Baaweh (2021) that, in the fringe communities of Zukpiri CREMA, the locals (women) have access to harvestable forest resources from the CREMA to augment their domestic food consumption and the local economy. Some locals do engage in illicit harvesting of some important resources that are not granted to be exploited. Some of the illicit activities recorded include tree felling, poaching, encroachment of the land area and the like. Moreover, communal resource conservation models go together with numerous encounters which include, contending land uses, resource use conflicts, headship conflicts, time-intensive and expensive (Reed et al., 2016).

Most of these people when caught according to the reserve frontiers are either summoned to the local tribunal of Assin Akropong or the law court for the right decisions and sanctions to be applied.

As confirmed by Table 17, there are restrictions to monitor human activities and curb their impacts on the reserve, however, they are mostly flouted by the community folks, a worrying trend that has exposed the reserve to various degrees

of deterioration. The finding portrays the observation that both former and topical efforts towards ensuring sustainable management of environmental resources have failed in their quests ending in overutilization, excessive logging, and depletion of the environmental resources (Husseini et al., 2016; Jarvis et al., 2021), which is contrary to that of Baddianaah and Baaweh (2021), which portrays that using fines and other forms of punitive strategies to prevent illicit resource exploitation by the local people seems appropriate for CREMA programmes. The main harvestable resources in the reserve are herbal medicine, timber, wildlife resources, food stuff, honey, and fire wood. From Table 4.18, herbal medicine and firewood emerged the commonest resources accessed by most locals of the CREMA communities. From Table 18, p -value = 0.009 depicts that there exists an association between permitted resources to harvest and the level of education of respondent. However, the Cramer's $V = 0.1504$ depicts that the association is relatively weak, meaning that, educational level is not a strong determiner of respondents' response to harvestable resources. Also, the p -value = 0.758 depicts that there exists no association between permitted resources to harvest and the duration of stay in study communities, the Cramer's $V = 0.0966$ depicts that the association is relatively weak, meaning that, duration of stay in study communities is not strongly associated with respondents' response on harvestable resources.

In consonance with the finding of Abukari and Mwalyosi (2018) that the knowledge of the standards of conservational parks (Mole National Park, Ghana and the Tarangire National Park, Tanzania), and accompanying benefits like

employment opportunities, access to non-timber forest products (NTFPs) and alternative livelihood support systems significantly influence local communities' conservation decision, in community forestry or CREMA, one vital component that sustains locals' interest and enhances incessant participation is the benefit(s) they derive from it. From Table 19, it could be deduced that the communities derive no benefit from the reserve, which is a threat to sustainability of the reserve. This is in consonance with the findings of Persha et al. (2011) who asserts that when local people realize the benefits or the goods and services they obtain from conservation programmes, they get enthused to adjust their resource and land use patterns and demonstrate high sense of commitment. Not benefiting anything from the reserve as asserted by most respondents could be seen as disincentive to the local people and hence spark negative actions towards the conservation programme. Consequentially, this could be considered part of the reasons for the rampant illicit exploitation of resource in the Adwenase reserve area, as gathered through the study, which is contrary to the findings of Baruah (2015), Husseini et al. (2016), Baker et al. (2018), and Addison et al. (2019) that conservation areas that are co-managed by indigenous groups experience minor dilapidation of forest and wildlife resources.

From the responses obtained, there exists significant conflict within the reserve area which occurs occasionally. The conflict types recorded included encroachment, over-exploitation and unfair sharing of resources. Encroachment forms the major conflict type as it recorded the highest rate of occurrence, whilst over-exploitation and unfair sharing of resources followed respectively. The

reserve frontiers confirmed that some percentage of the reserve area has been encroached for crop farming activities. This again affirms the assertion that both former and topical efforts towards ensuring sustainable management of environmental resources have failed in their quests ending in overutilization, excessive logging, and depletion of the environmental resources (Husseini et al., 2016; Jarvis et al., 2021).

From Table 23, three main conflict resolution approaches, that is, amicable resolution, legal resolution and resolution by local tribunal were gathered, with 22%, 35% and 32% respectively. However, some few people, representing approximately 11% of the respondents shared that nothing is done when conflicts arise, which could be provoking and could trigger heightened resource exploitation and yield continual dissatisfaction among the indigenes, which is in line with the observation that failure to apply the relevant sanctions to flouters of conservation policies and regulations will inspire uncontrolled deviance among local members which will adversely affect the authority and yield unsustainability of the CREMA (Owusu-Ansah, 2020).

It was gathered through the study that, in general terms, the management performance of the reserve is poor from the perspective of the indigenes (that is, six hundred and two (602) persons, making 74% of the total respondents confirmed). Though integrating indigenous perspectives in managing the natural resources available to them underpins a system of co-ownership, which corroborate hands-on democratic views (Keats & Evans, 2020), a robust local management approaches and vigorous participation of local groups are required

for enhanced local level policy-making (Baker et al., 2018) and management of the naturally occurring resources.

The assumptions made by the local people owing to their assessment on the management of the resources are quite disturbing and requires attention. This could portray the ill-feelings, and disappointment the indigenes harbour in them concerning the running of the resources, and could serve a fertile basis for the locals to rebel against the resource management team and even flout the resource management regulations, which profess a contradictory phenomenon to the assertion by Baddianaah and Baaweh (2021) that, the CREMA mechanism has proved an indispensable participatory model proficient for establishing the appropriate conditions for sustainable management of forest and wildlife resources through authorizing aboriginal groups to manage the forest and wildlife resources available to them. In this vein, various retaliating attitudes against conservation practices such as illicit logging, poaching, encroachment and the like are imminent to serve as the locals' response to their dissatisfaction owing to their observations and assumptions. Comparing the economic livelihood of respondents before and after the CREMA, that is; [t(1624) = 0.931, p(2 tail) = 0.352] there is no significant impact of CREMAs on the local people (see appendix C). *Therefore, the hypothesis that “there exists an economic impact of CREMAs on indigenous communities” is rejected.*

5.4 The Environmental/Ecological Impact Local Communities have on the Adwenase CREMA (*Objective 2*)

5.4.1 Resource accessibility, regulations, and compliance

According to the respondents, in line with the results portrayed by Table 25, and according to the resource management frontiers, the locals are allowed access to some harvestable resources in the conservation area, which is positive and enticing to enhance communal participation in sustainability thrive. On the contrary however, most locals turn to abuse this opportunity regardless of the existing guiding principles to monitor sustainable utilization of resources and to curb or avoid undue exploitation of resources.

Though there are laid down regulations based on which the resource area is managed, in accordance with Table 26, these regulations have been flouted (there is no ideal compliance with the laid down regulations based on which the resource area is managed, which is contrary to the results portrayed by Table 27 above) based on feedback obtained from respondents, and also confirmation by the management of the resource area, rampant happenings of illicit activities such as, poaching, illicit logging, encroachment and the like do occur at very disturbing rates at Adwenase CREMA, which contradicts the observation made by Jarvis et al. (2021) on the operationalization of indigenous land and sea management programmes (ILMPs) that the participation of aboriginal communities in the co-management of the natural resources available to them (aboriginal communities) does not promote indigenous communal growth alone, but also enhance and set the premise for western and indigenous knowledge exchange with *environmental quality* and communal development being the targeted resulting positive effect.

The observed posture of the locals in regard of the resource management, utilization, and sustainability could be linked to their observations, perception, and assumptions made owing to their dissatisfaction of how the resources are managed by the local management frontiers. In situations where local communities seem not to realise any direct benefit from conservation programmes their participation dwindles, which in the end yields unsustainability.

5.4.2 Water resource availability, quality and management

The major water sources for the surveyed communities are borehole and tap with other alternative water sources such as well and community river/stream as portrayed by Table 28. With frequency of water access, Table 29 shows that availability and accessibility are not challenges in the CREMA communities. At least water is accessed on daily bases and there wasn't any concern of water shortages whatsoever during the study. This positive development has exposed the locals to quality water for diverse uses.

5.4.3 Impacts of human activities on the CREMA

Compared to 10 years back, there has been a significant decline in the animals' population and species currently, according to the locals and the resource management frontiers, as shown by Table 30. In line with Table 31, the current state of the wildlife species and population are largely attributed to "poaching" (representing 58% of the responses) and "escape of animals" (representing 36% of the responses). This trend of resource overexploitation is causing appreciable level of depletion (Amoah & Korle, 2020) of the available natural resources.

Rampant and uncontrolled exploitation of wildlife resources in a conservation area has the potency to limit or yield decline in their population, particularly when exploitation exceeds the reproductivity rate of the wildlife species, which is consistent with the findings of Amoah and Korle (2020) which suggests that overutilization of natural resources (both flora and fauna) highly depletes resource, and hence yields unsustainability. Thus, the current wildlife situation in the Adwenase reserve could be attributed to over-exploitation of the wildlife resources by the local people.

On the other hand, however, the situation could be partly blamed on wildlife being scared away to other places by the noise generated through both illicit and licit logging activities by some locals and the resource management frontiers respectively. Considering Table 34, seven hundred and twenty-four (724) respondents (representing 89% of the total respondents) responded that the reserve land area has been encroached. However, the margine of encroachment is unclear

From Table 35, in line with Table 34, seven hundred and twenty-four respondents (representing 89% of the total respondents for the study) were recorded in this regard. It could be deduced from Table 35 that the foremost drivers of encroachment of the resource area are greed, land for farming, poor management of the reserve and chieftaincy conflict at Assin Akropong, which represent 27%, 21%, 16% and 12% respectively of the responses gathered, which sum up to 76% of the entire responses. However, land ownership litigation, and land for farming form the minor reasons for encroachment of the reserve area,

which all together affirms the findings of Reed et al. (2016) that, communal-based natural resource conservation standards come with diverse encounters such as; competing land uses, conflicts over resource use, management conflicts, time and cost-intensiveness.

It could be deduced on the whole that, the Adwenase CREMA is adversely impacted by the activities of the local people of the fringe communities. The observed posture of the locals in regard of the resource management, utilization and sustainability could be linked to their observations, perception, and assumptions made owing to their dissatisfaction of how resources are mismanaged by the local management frontiers.

In situations where local communities seem not to derive any direct opportunities from conservation programmes, their participation and attitude towards the programme dwindles, and yield's unsustainability.

Comparing the state of resources from respondents' perspective before and after the CREMA, that is; $[t(1575) = 3.922, p(2 \text{ tail}) = 0.000]$ there is a significant impact of local people on CREMAs (see appendix D). *Therefore, the hypotheses that "there is a significant positive trend of resource condition in the Adwenase Community Resource Area"; "There is a significant positive ecological/environmental impact of indigenous communities on CREMAs" are both rejected.*

5.4.4 Land ownership and utilization

From Table 31 above, it could be asserted that most of the local people own land for diverse purposes. Most of the land holders engage in crop farming, with a

higher proportion engaging in quite extensive or large-scale farming. Few respondents had invested their lands in livestock farming, housing, and other land use forms. This confirms the results on employment of respondents as Table 10 captures, that the major work of the CREMA communities is agriculture, particularly crop farming.

Positive enough, the study revealed that most of the land holders who engage in crop farming do not have their lands close to the borders of the reserve area, hence there is relatively low level of human wildlife-conflicts in the area, since farmers do not really record crop raiding and other possible adverse impacts wild animals could have on their farms. In some few instances, some respondents who have their farms close to the borders of the reserve stated that their farm crops sometimes suffered damages from wildlife. This confirms that, Human-wildlife Conflict could be deemed inevitable in all communities where human and wildlife co-exist and share the same habitat (Le Bel et al., 2011). Also, as farmers extend into use of uninhabited lands, competition with wildlife for resources and conflict with animals are the resultant effects (Elsner, 2008). Though the declined wildlife population as a result of which there is a relatively less adverse impact on the bordering farms may be a relief to the local farmers, it also depicts the extent of the adverse impact the fringe communities have on wildlife in the reserve area.

The major means of land acquisition in the CREMA communities are through family line inheritance, lease and or purchase, of which family line inheritance dominates. Lands are owned predominantly by the indigenes who mostly acquired

the lands through inheritance from their relatives who happened to be earlier settlers of the area and so becomes the original owners of the lands.

5.4.5 Community engagement on resource management and sustainability

Considering Table 36, the locals of the CREMA communities do not undergo any form of training regarding community resource conservation, which is a critical threat to resource conservation and sustainability. This fails to fulfill the requirement revealed through several studies that effective management of natural resources must fit in and permit the indigenes to manage their natural resources (Baruah, 2015; Baruah et al., 2016). Local communities' active participation and patronage to conservation activities partly hinges on the requisite knowledge and understanding of the methods, procedures and principles applied, as well as the roles assigned to them.

In conservation programmes where indigenes are not assigned particular roles and or not given the requisite training by the appropriate authority in line with any particular role assigned to them, they are indirectly limited in their participation and certainly compromise on their patronage to the project. The less involvement or non-participation of indigenous groups in conservation projects could be very unfavorable and adversely impact sustainability, especially when the locals turn not to derive any direct benefit from the project. Thus, the role of environmental resources to bettering human welfare is mostly endangered without a distinct context for integrating indigenous groups in natural resource management, (Islam et al., 2019; Kamwi et al., 2020).

It could be inferred from the study outcomes that, the local folks of the bordering communities of Adwenase CREMA have been sidelined in managing the resource reserve, which serves a conducive atmosphere for communal retaliation to the various conservation programmes, especially in the instance of the bordering communities of Adwenase CREMA, where the locals portray not to benefit any direct gains from the programme. Meanwhile, the involvement of local people in forest conservation emanates from the recognition that sustainable development entails building the potentials of local folks to inspire and control on long-term basis, the means by which they earn their livelihoods (Macharia, 2015).

5.5 The Impact of Cultural/Belief Systems of Indigenous Communities on the Adwenase CREMA (*Objective 3*)

There is a natural sacred site in the Adwenase CREMA, of which the responses obtained suggests that the CREMA management activities are compatible with the local tradition, norms and belief systems of the bordering communities. This affirms the findings that CREMAs have a solid linkage with the socio-cultural and religious practices of the local communities (Murray & Agyare, 2018), a condition which ideally should set the owing to the locals' reverence to these systems, which is consistent with the findings by Baker et al. (2018) that the governance and managing of CREMAs have a robust linkage with the social and spiritual practices of aboriginals.

It is unfortunate however that regardless of the pertaining promising cultural conditions in the study area, sustainability of the resources has been a challenge,

which is contrary to the findings of Rim Rukeh et al. (2013) that, traditional conservation ethics are capable of protecting biodiversity species in particular and the environment in general as long as the local communities have a stake in resource conservation but rather in line with the findings of Chacon (2012) which indicates that the presence of traditional beliefs/taboo does not warrant sustainability of the naturally occurring resources available to an indigenous group. It could be asserted owing to the situation of Adwenase CREMA that, even if all conditions relevant to ensuring sustainability of conservation programmes are set, indigenous patronage, participation, and subsequently sustainability could be compromised if direct benefits from the programme are not felt by the locals of fringe communities.

It could be deduced that, culturally, the Adwenase CREMA has minimal or no impact on the local people of Assin Akropong and environs, which is contrary to the findings of Asare et al. (2013) that, dwelling on the traditional or local beliefs and value systems for resource conservation emerges a major strength upon which the CREMA mechanism thrives, while not compromising on independent decision-making and governance processes.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The study sought to tentatively and analytically augment current literature on community-based resources management and sustainability in Ghana with particular focus on the Adwenase Community Resource Management Area in the Assin Central Municipality. Additionally, the study has a policy dimension as it sought to unravel novel information required to re-evaluate the pertaining sustainability spaces and approaches for enhanced sustainability of Community Resource Management Areas in Ghana. This is to help; To provide baseline data for decision-making; To provide information on the sustainability of CREMAs in Ghana; For both references for academic and sustainability monitoring; To provide information on policy formulation, implementation and evaluation; To enhance attainment of the Sustainable Development Goals 1, 2, 3, 13, and 15, which seek to foster sustainable forest management.

The study was premised on the following central questions: To what extent do economic variables of CREMAs impact indigenous communities? To what extent do indigenous communities impact the ecological/environmental variables of CREMAs? To what extent do socio-cultural factors of indigenous communities impact CREMAs? What is the trend of resource condition in the area?

The study was conducted at Assin Akropong and surrounding villages/communities in the Assin Foso Municipality in the central region of

Ghana. The community selection was based on the purposive sampling technique, which considered the communities that have a close link with the resource conservation area. Two different sets of questionnaires were administered. A structured questionnaire and an open-ended interview guide. Generally, the study considered persons 18 years of age and above, with the reason that most persons within this age bracket are likely to engage in activities that may impact or be impacted upon by the resource conservation area and could also have adequate information about the Adwenase CREMA.

The questionnaire was designed in two folds. The first fold catered for the variables of the study whilst the second fold catered for the general information about the respondents. Data was collected through focus group discussions with the management team, local opinion leaders, CREMA frontier groups and their leadership. Secondary data on CREMA and associated challenges on biodiversity and natural resource conservation schemes in the study area was collected. Other sources of information or data collection comprised of literature and certified websites of local, national, and international development agencies working in Ghana on CREMA.

The structured questionnaires were administered to the community dwellers, of which a total of eight hundred and fourteen (814) were administered. The open-ended interview guide targeted the frontiers of the local management team of the conservation area, the chief, other local opinion leaders and the management of the Forestry Commission, Assin Central Municipality, of which a sum of thirteen (13) questionnaire were administered. In all a grand total of eight hundred and

twenty-seven (827) questionnaires were administered. The research outcomes indicated that; the locals derive inconsequential socio-economic benefit from the CREMA, the pertaining CREMA practices are ecologically unsustainable, and there is trivial cultural influence on the CREMA.

6.2 Conclusions

It could be concluded from the research that; the locals derive inconsequential socio-economic benefit from the CREMA. locals' dependence on the conservation area for living occurs at a very minimal rate and does not even have any significant influence on their living standards (*therefore, the hypothesis that "there exists significant positive economic impact of CREMAs on indigenous communities" is rejected*).

The pertaining CREMA practices are ecologically unsustainable. A lot of illegal exploitations as well as encroachment are encountered in the reserve area, which really threatens sustainability of the available resources (*therefore, the hypotheses that "there is a significant positive trend of resource condition in the Adwenase Community Resource Area"; "there is a significant positive ecological/environmental impact of indigenous communities on CREMAs" are both rejected*).

Even though there are restrictions to monitor human activities and curb their impact on the reserve, they are mostly flouted by the community folks, and thus have exposed the reserve to various degrees of depletion. The local or indigenous involvement in the conservation programme is trifling which the study findings suggest that most of the local people are not involved in decision making and

hence sidelined. The Adwenase CREMA is adversely impacted by the activities of the local people of the fringe communities. The observed posture of the locals in regard of the resource management, utilization and sustainability are linked to their observations, perception, and assumptions made owing to their dissatisfaction of how the resources are mismanaged by the local management frontiers.

There is trivial cultural influence on the Adwenase CREMA. There is a natural sacred site in the Adwenase CREMA, of which the CREMA management activities are compatible with the local tradition, norms and belief systems of the bordering communities, yet, sustainability of the resources has been a challenge (*therefore, the hypothesis that “there is a significant positive socio-cultural impact of indigenous communities on CREMAs” is rejected*). It could be asserted owing to the situation of Adwenase CREMA that, even if all conditions relevant to ensuring sustainability of conservation programmes are set, indigenous patronage, participation, and subsequently sustainability could be compromised if direct benefits from the programme are not felt by the locals of fringe communities.

The locals of the CREMA communities do not undergo any form of training regarding community resource conservation, which compromises on local capacity building to manage community-owned resources and also poses a critical threat to resource conservation and sustainability.

6.3 Recommendations

Considering the research outcomes, the following are recommended;

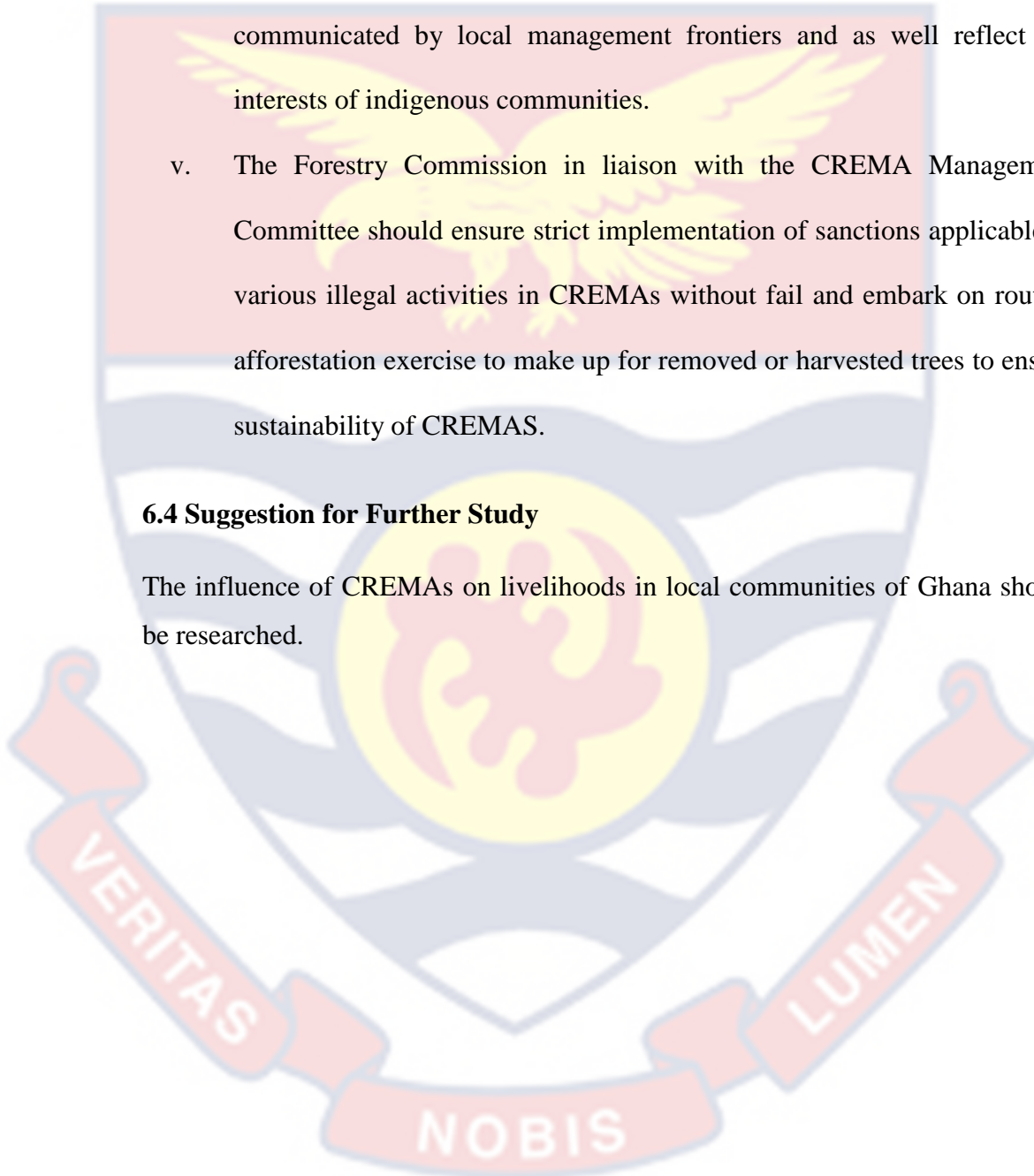
- i. The Government in partnership with the Forestry Commission should initiate thorough media drives to create community alertness on forest resource conservation missions. This is imperative to help build indigenous communities' capacity to enhance their effective involvement in natural resource conservation programmes, and also contribute to instilling the sense of ownership of CREMAs among indigenous communities and so protect them jealously without compromise.
- ii. The government and civil society groups should make use of conservation programmes such as CREMAs as real employment and income generating opportunities for the dwellers, especially the youth of indigenous communities. This will help raise to some extent the living standards of the locals, and also provide a means of direct benefit to the locals of fringe communities. This dimension will also contribute to curbing or eliminating the attacks indigenous communities stage against conservation programmes.
- iii. In liaison with the Forestry Commission and the local resource management committee, the government should encourage the formation of conservation based social groups in the indigenous communities. This will contribute to effective communal participation in conservation programmes since the members of these groups will have leadership who

will communicate their interest to the appropriate authorities, and thus yield their interests being represented.

- iv. Social benefits accruing from CREMA programmes should be well communicated by local management frontiers and as well reflect the interests of indigenous communities.
- v. The Forestry Commission in liaison with the CREMA Management Committee should ensure strict implementation of sanctions applicable to various illegal activities in CREMAs without fail and embark on routine afforestation exercise to make up for removed or harvested trees to ensure sustainability of CREMAS.

6.4 Suggestion for Further Study

The influence of CREMAs on livelihoods in local communities of Ghana should be researched.



References

- Abukari, H., & Mwalyosi, R. B. (2018). Comparing conservation attitudes of Park-adjacent communities: The case of Mole National Park in Ghana and Tarangire National Park in Tanzania. *Tropical Conservation Science*, *11*, 1940082918802757.
- Acevedo Tirado, A., Ruiz Morales, M., & Lobato-Calleros, O. (2015). Additional indicators to promote social sustainability within government programs: equity and efficiency. *Sustainability*, *7*(7), 9251-9267.
- Acheampong, E., Marfo, E., & Addo-Danso, S. (2014). Chainsaw operators, alternative livelihood options and climate change mitigation. *Kumasi: CSIR Forestry Research Institute of Ghana*.
- Addison, J., Stoeckl, N., Larson, S., Jarvis, D., RNTBC, B. D. A. C., RNTBC, E. A. C., ... & Esparon, M. (2019). The ability of community based natural resource management to contribute to development as freedom and the role of access. *World Development*, *120*, 91-104.
- Agidee, Y. (2011). *Forest carbon in Ghana: spotlight on community resource management areas*. Forest Trends.
- Agyare, A. K., Murray, G., Dearden, P., & Rollins, R. (2015). Understanding inter-community performance assessments in community-based

resource management at Avu Lagoon, Ghana. *Environment, Development and Sustainability*, 17(6), 1493-1508.

Agyare KA. 2013 Community resource management areas in Ghana: the history, challenge and success of an evolving conservation approach in Ghana. NCRC and Ecosystem Alliance Ghana Project. Accra, Ghana: Nature Conservation Research Centre.

Alatsis, G. (2019). El rol de los intermediarios culturales en la producción de la “creencia colectiva”.

Alexander, J., & McGregor, J. (2000). Wildlife and politics: CAMPFIRE in Zimbabwe. *Development and Change*, 31(3), 605-627.

Amoah, A., Korle, K., 2020. Forest depletion in Ghana: the empirical evidence and associated driver intensities. *Forest. Econ. Rev.* 2 (1), 61– 80.

Aniah, P., Aasoglenang, A. T., & Bonye, S. Z. (2014). Behind the myth: Indigenous knowledge and belief systems in natural resource conservation in North East Ghana. *International Journal of Environmental Protection and Policy*, 2(3), 104-112.

Anh, H. V., & Pham, T. V. (2005). Link between spiritual forest and forest conservation: A case study in Noong La village, Son La Province, Vietnam. *Asia-Pacific Forum for Environment and Development*.

Armitage, D. (2005). Adaptive Capacity and Community-Based Natural Resource Management. *Environmental Management* 35:703–715

Asare, R. A., Kyei, A., & Mason, J. J. (2013). The community resource management area mechanism: a strategy to manage African forest resources for REDD+. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 368(1625), 20120311.

Asare, R. (2010). Implications of the legal and policy framework for tree and forest carbon in Ghana: REDD opportunities scoping exercise. *Implications of the legal and policy framework for tree and forest carbon in Ghana: REDD opportunities scoping exercise.*

Ayong, L., Pagnotti, G., Tobon, A. B., & Chakrabarti, D. (2007). Identification of Plasmodium falciparum family of SNAREs. *Molecular and biochemical parasitology*, 152(2), 113-122.

Baddianaah, I., & Baaweh, L. (2021). The prospects of community-based natural resource management in Ghana: A case study of Zukpiri community resource management area. *Heliyon*, 7(10), e08187.

Baddianaah, I., Peprah, K., & Yembilah, N. N. (2020). Nexus between smallholder irrigation farming and farmers' livelihood outcomes in Ghana's Guinea Savannah. *International Journal of Irrigation and Agricultural Development (IJIRAD)*, 4(1), 221-233.

Baker, D. M., Murray, G., & Agyare, A. K. (2018). Governance and the making and breaking of social-ecological traps. *Ecology and Society*, 23(1).

Baruah, M. (2015). *Effect of institutional choices on representation in a community resource management area in Ghana*. CODESRIA.

Baruah, M., Bobtoya, S., Mbile, P., & Walters, G. (2016). Governance of restoration and institutions: working with Ghana's community resource management areas. *World Development Perspectives*, 3, 38-41.

Bauer, S. (2014). United Nations Environment Programme. In *Essential Concepts of Global Environmental Governance* (pp. 245-247). Routledge.

Bempah, G., Dakwa, K. B., & Monney, K. A. (2019). Evaluation of the community resources management area (CREMA) programme around Ankasa conservation area, Ghana. *Cogent Environmental Science*, 5(1), 1592064.

Bezdek, R. H., Wendling, R. M., & DiPerna, P. (2008). Environmental protection, the economy, and jobs: National and regional analyses. *Journal of Environmental Management*, 86(1), 63-79.

Blackstock, K. (2005). A critical look at community based tourism. *Community development journal*, 40(1), 39-49.

Bojang, F. (2016). Sustainable management of forests and wildlife in Africa: enhancing value, benefits and services. *Nature & Faune*, 30(2).

Bond, A. J., & Morrison-Saunders, A. (2011). Re-evaluating sustainability assessment: Aligning the vision and the practice. *Environmental Impact Assessment Review*, 31, 1–7.

Boonyaratpalin, M., Kohanantakul, K., Sricharoendham, B., Chittapalpong, T., Termvitchagorn, A., Thongpun, W., & Kakkaew, M. (2002). Ecology, fish biology and fisheries in the lower Songkhram River basin. *Warasan Kan Pramong*.

Brundtland, G. H. (1987). Global change and our common future. *Environment: Science and Policy for Sustainable Development*, 31(5), 16-43.

Calleros-Islas, A. (2019). Sustainability assessment. An adaptive low-input tool applied to the management of agroecosystems in México. *Ecological indicators*, 105, 386-397.

Cambero, C. & Sowlati T., (2014). Assessment and optimization of forest biomass supply chains from economic, social and environmental perspectives – a review of literature. *Renew Sustain Energy Rev* 36:62–73.

Cao, V., Margni, M., Favis, B. D., & Deschênes, L. (2015). Aggregated indicator to assess land use impacts in life cycle assessment (LCA) based on

the economic value of ecosystem services. *Journal of Cleaner Production*, 94, 56-66.

Chacon, R. J. (2012). Conservation or resource maximization? Analyzing subsistence hunting among the Achuar (Shiwiar) of Ecuador. In *The ethics of anthropology and Amerindian research* (pp. 311-360). Springer: New York, NY.

Change, I. C. (2014). Impacts, adaptation, and vulnerability. *Part A: global and sectoral aspects. Contribution of working group II to the fifth assessment report of the intergovernmental Panel on Climate Change*, 1132.

Chia, E. L., & Sufo, R. K. (2016). A situational analysis of Cameroon's Technical Operation Units (TOUs) in the context of the landscape approach: critical issues and perspectives. *Environment, development and sustainability*, 18(4), 951-964.

Child, B., & Barnes, G. (2010). The conceptual evolution and practice of community-based natural resource management in southern Africa: past, present and future. *Environmental Conservation*, 37(3), 283-295.

Cricelli, L., Greco, M., & Grimaldi, M. (2016). Assessing the open innovation trends by means of the Eurostat Community Innovation Survey. *International Journal of Innovation Management*, 20(03), 1650039.

Chunhabunyatip, P., Sasaki, N., Grünbühel, C., Kuwornu, J. K., & Tsusaka, T. W.

(2018). Influence of indigenous spiritual beliefs on natural resource management and ecological conservation in Thailand. *Sustainability*, 10(8), 2842.

Clark, W. C., & Dickson, N. M. (2003). Sustainability science: the emerging research program. *Proceedings of the national academy of sciences*, 100(14), 8059-8061.

Commission on Genetic Resources for Food. (2014). *The State of the World's Forest Genetic Resources*. Food & Agriculture Org..

CREMA progress report, 2018

Czeskleba-Dupont, R. (2012). A secular carbon debt from atmospheric high temperature combustion of stem wood. *The Journal of Transdisciplinary Environmental Studies*, 11(2), 37-47.

Dadebo, M. A., & Shinohara, T. (1999). Forest resources and timber production of Ghana: current instruments for sustainable development. *Journal of forest research*, 4(1), 1-12.

De Mare G, Granata M, Nesticò A (2015) Weak and strong compensation for the prioritization of public investments: multidimensional analysis for pools. *Sustainability* 7:16022–16038. doi:10.3390/su71215798

Den Herder, M., Kolström, M., Lindner, M., Suominen, T., Tuomasjukka, D., & Pekkanen, M. (2012). Sustainability impact assessment on the

production and use of different wood and fossil fuels employed for energy production in North Karelia, Finland. *Energies*, 5(11), 4870-4891.

Diawuo, F., Issifu, A. K., (2015). Exploring the African traditional belief systems in natural resource conservation and management in Ghana. *J. Pan Afr. Stud.* 8 (9), 115–131.

Duguma, L.A., Atela, J., Ayana, A.N., Alemagi, D., Mpanda, M., Nyago, M., Minang, P.A., Nzoka, J.M., Foundjem-Tita, D., Ntamag-Ndjebet, C.N., (2018). Community forestry frameworks in sub-Saharan Africa and the impact on sustainable development. *Ecol. Soc.* 23 (4),

Dressler, W., Büscher, B., Schoon, M., Brockington, D. A. N., Hayes, T., Kull, C. A., ... & Shrestha, K. (2010). From hope to crisis and back again? A critical history of the global CBNRM narrative. *Environmental conservation*, 37(1), 5-15.

Duffy, R. (2006). Non-governmental organisations and governance states: the impact of transnational environmental management networks in Madagascar. *Environmental Politics*, 15(5), 731-749.

Ekpe, E. K., C. Hinkle, M. F. Quigley & E. H. Owusu (2014) Natural resource and biodiversity conservation in Ghana: The use of livelihoods support activities to achieve conservation objectives, *International*

Journal of Biodiversity Science, Ecosystem Services & Management, 10:4, 253-261, DOI:10.1080/21513732.2014.971056

Elsner, R. M. (2008). Knowledge, attitudes, and opinions about human-wildlife conflicts held by community leaders in Virginia (Doctoral dissertation, Virginia Tech).

Ernst, W. G. (2012). Overview of naturally occurring Earth materials and human health concerns. *Journal of Asian Earth Sciences*, 59, 108-126.

Eshun, J. F., Potting, J., & Leemans, R. (2010). Inventory analysis of the timber industry in Ghana. *The International Journal of Life Cycle Assessment*, 15(7), 715-725.

FAO, 2014. The State of the World's Forest Genetic Resources and the Global Plan of Action for the Conservation, Sustainable Use, and Development of forest Genetic Resources. Committee on Forestry; Twenty-Second Session, pp. 23–27.

Fenster, M. (2006). The opacity of transparency. *Iowa L. Rev.*, 91, 885.

Feschet, P., Macombe, C., Garrabé, M., Loeillet, D., Saez, A. R., & Benhmad, F. (2013). Social impact assessment in LCA using the Preston pathway. *The International Journal of Life Cycle Assessment*, 18(2), 490-503.

Filyushkina, A., Strange, N., Löf, M., Ezebilo, E. E., & Boman, M. (2016). Non-market forest ecosystem services and decision support in Nordic countries. *Scandinavian journal of forest research*, 31(1), 99-110.

Firey, T. A. (1999). *Socrates' Conception of Knowledge and the Priority of Definition* (Doctoral dissertation, Virginia Tech).

Fisher, A., & Fukuda-Parr, S. (2019). Data, politics and knowledge in localizing the SDGs. *Journal of Human Development and Capabilities*, 20(4), 375-485.

Foli, S., Ros-Tonen, M. A., Reed, J., & Sunderland, T. (2018). Natural resource management schemes as entry points for integrated landscape approaches: evidence from Ghana and Burkina Faso. *Environmental management*, 62(1), 82-97.

Francis, P., & James, R. (2003). Balancing rural poverty reduction and citizen participation: The contradictions of Uganda's decentralization program. *World Development*, 31(2), 325-337.

Ghana Statistical Service, 2021.

Gebregziabher, D., & Soltani, A. (2019). Exclosures in people's minds: Perceptions and attitudes in the Tigray region, Ethiopia. *Forest Policy and Economics*, 101, 1-14.

Geijzendorffer, I. R., & Roche, P. K. (2013). Can biodiversity monitoring schemes provide indicators for ecosystem services?. *Ecological Indicators*, 33, 148-157.

Gilli, M., Muriel, C., Walters, G., 2020. Gatekeeping access: shea land formalization and the Distribution of market-based conservation benefits in Ghana's CREMA. *Land* 9 (359), 1–15. Homans, G.C., 1958. Social behavior as exchange. *Am. J. Social.* 63 (6), 597–606.

Hall, M. R. (2015). A transdisciplinary review of the role of economics in life cycle sustainability assessment. *The International Journal of Life Cycle Assessment*, 20(12), 1625-1639.

Harsdorff, M., & Phillips, D. (2013). *Methodologies for assessing green jobs*. ILO.

Hart, M. A. (2010). Indigenous worldviews, knowledge, and research: The development of an Indigenous research paradigm. *Journal of Indigenous Social Development*, 1(1A)

Hart, S. J., Veblen, T. T., Eisenhart, K. S., Jarvis, D., & Kulakowski, D. (2014). Drought induces spruce beetle (*Dendroctonus rufipennis*) outbreaks across northwestern Colorado. *Ecology*, 95(4), 930-939.

Heffernan, A. (2016). Community-based natural resource management: strengths and weaknesses for sustainable development and resource governance in sub-Saharan Africa.

Heink, U., & Kowarik, I. (2010). What criteria should be used to select biodiversity indicators?. *Biodiversity and Conservation*, 19(13), 3769-3797.

Henders, S., Persson, U. M., & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters*, 10(12), 125012.

Husseini, R., Kendie, S.B., Agbesinyale, P., 2016. Community participation in the management of forest reserves in the Northern Region of Ghana. *Int. J. Sustain. Dev. World Ecol.* 23 (3), 245–256.

Index, S. P. (2014). Social progress imperative. URL: <https://www.socialprogressindex.com/>(Last accessed: 20.12. 2017).

International Institute for Environment, & Great Britain. Overseas Development Administration. (1992). *Environmental Synopsis of Ghana*. International Institute for Environment and Development.

Islam, K., Nath, T.K., Jashimuddin, M., Rahman, F.M., 2019. Forest Dependency, Comanagement and Improvement of Peoples' Livelihood Capital: Evidence from Chunati Wildlife Sanctuary, Bangladesh. *Environmental Development*.

Janeiro L, Patel MK (2015) Choosing sustainable technologies. Implications of the underlying sustainability paradigm in the decision-making

process. J Cleaner Prod 105:438–446.
doi:10.1016/j.jclepro.2014.01.029

Jarvis, D., Stoeckl, N., Larson, S., Grainger, D., Addison, J., & Larson, A. (2021).

The learning generated through indigenous natural resources management programs increases quality of life for indigenous people—improving numerous contributors to wellbeing. *Ecological Economics*, 180, 106899.

Jiao, X., Walelign, S. Z., Nielsen, M. R., & Smith-Hall, C. (2019). Protected

areas, household environmental incomes and well-being in the Greater Serengeti-Mara Ecosystem. *Forest Policy and Economics*, 106, 101948.

Kamwi, M.J., Endjala, J., Siyambango, N., 2020. Dependency of rural communities on non-timber forest products in the drylands of southern Africa: a case of Mukwe Constituency, Kavango East. *Trees Forest. People* 2, 1–6 (100022).

Kangas, A., Kurttila, M., Hujala, T., Eyvindson, K., & Kangas, J. (2015). *Decision support for forest management* (Vol. 30). Springer.

Karvonen, J., Halder, P., Kangas, J., & Leskinen, P. (2017). Indicators and tools for assessing sustainability impacts of the forest bioeconomy. *Forest ecosystems*, 4(1), 1-20.

Keats, B., Evans, P., 2020. Traditional Knowledge and Resource Management in the Northwest Territories, Canada: Definitions, Disciplinary Divides, and Reasons for Decisions. *The Extractive Industries and Society*.

Kettate, B. (2000). The Ancestral Spirit Forest (Don Pu Ta) and the Role Behaviors of Elders (Thao Cham) in Northeastern Thailand. *Journal of the Siam Society*, 88(1&2), 96-110.

Koffi C.K, Djoudi H, Gautier D (2016). Landscape diversity and associated coping strategies during food shortage periods: evidence from the Sudano-Sahelian region of Burkina Faso. *Reg Environmental Change* 16:1–12

Kopnina H (2016) The victims of unsustainability: a challenge to sustainable development goals. *Int J Sustain Dev World Ecol* 23:113–121. doi:10.1080/13504509.2015.1111269

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Kuhlman, T., & Farrington, J. (2010). What is sustainability?. *Sustainability*, 2(11), 3436-3448.

Le Bel, S., Murwira, A., Mukamuri, B., Czudek, R., Taylor, R., & La Grange, M. (2011). Human wildlife conflicts in southern Africa: riding the whirl wind

in Mozambique and in Zimbabwe. The importance of biological interactions in the study of biodiversity, 283-322.

Lebbie, A., & Guries, R. P. (2008). The role of sacred groves in biodiversity conservation in Sierra Leone. *African sacred groves: Ecological dynamics and social change*, 42-61.

Lehmann, A., Russi, D., Bala, A., Finkbeiner, M., & Fullana-i-Palmer, P. (2011). Integration of social aspects in decision support, based on life cycle thinking. *Sustainability*, 3(4), 562-577.

Levasseur, A., Lesage, P., Margni, M., Brandão, M., & Samson, R. (2012). Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. *Climatic change*, 115(3), 759-776.

Li, T. M. (2002). Engaging simplifications: community-based resource management, market processes and state agendas in upland Southeast Asia. *World development*, 30(2), 265-283.

Lise, W. (2000). Factors influencing people's participation in forest management in India. *Ecological economics*, 34(3), 379-392.

López-Ridaura, S. (2005). *Multi-scale sustainability evaluation: a framework for the derivation and quantification of indicators for natural resource*

management systems (Vol. 68). Wageningen University and Research Centre.

Lu, Y., Geng, Y., Liu, Z., Cote, R., & Yu, X. (2017). Measuring sustainability at the community level: An overview of China's indicator system on National Demonstration Sustainable Communities. *Journal of Cleaner Production*, 143, 326-335.

Lubilo, R., & Child, B. (2010). The rise and fall of community-based natural resource management in Zambia's Luangwa Valley: an illustration of micro-and macro-governance issues. In *Community Rights, Conservation and Contested Land* (pp. 214-238). Routledge.

Macharia, B. W. (2015). *Factors influencing community participation in forestry conservation projects: a case of Kithoka-Twajai forest community-based organization, Meru county Kenya* (Doctoral dissertation, University of Nairobi).

Mancini, M. S., Galli, A., Niccolucci, V., Lin, D., Bastianoni, S., Wackernagel, M., & Marchettini, N. (2015). Ecological footprint: refining the carbon footprint calculation. *Ecological indicators*, 61, 390-403.

Marfo, E., 2010. Chainsaw Milling in Ghana: Context, Drivers and Impacts. Tropenbos International, Wageningen, the Netherlands, p. 64 xii p.

Martínez, D. G., Almada, J. L. F., & Espejel, I. (2016). ¿ Sustentabilidad comunitaria indígena? Un modelo integral. *Sociedad y Ambiente*, (11), 4-22.

Maturano J.M., Serrano L. A. G., García J.A.C., Magos M.A.G.A., Herzberger A.M (2021). An indicator-based sustainability assessment method for indigenous communities: a case study from Mexico. *Environment, Development and Sustainability* (2022) 24:3293–3333 <https://doi.org/10.1007/s10668-021-01567-x>

McCaskill, D. N., Līprīchā, P., Leepreecha, P., & He, S. (Eds.). (2008). *Living in a globalized world: Ethnic Minorities in the Greater Mekong Subregion*. Silkworm Books.

Meadows, D.H., Meadows, D.L., Randers, J., & Behrens, W.W., III (1972). *The Limits to Growth*; Potomac Associates, New American Library: Washington, DC, USA.

Measham, T. G., & Lumbasi, J. A. (2013). Success factors for community-based natural resource management (CBNRM): Lessons from Kenya and Australia. *Environmental management*, 52(3), 649-659.

Minang, P. A., van Noordwijk, M., Freeman, O. E., Mbow, C., de Leeuw, J., & Catacutan, D. (Eds.). (2014). *Climate-smart landscapes: multifunctionality in practice*. ASB Partnership for The Tropical Forest margins.

Mikhama, K., & Sirisant, P. (2016). The Last and Largest of Cephalanthus Tetrandra Freshwater Swamp Forest in Northeast Thailand: Natural Resource Appreciation and Management of Local Community. *International Journal of Agricultural Technology*, 12(3), 429-438.

Mistry, J., & Berardi, A. (2016). Bridging indigenous and scientific knowledge. *Science*, 352(6291), 1274-1275.

Murphree, M. (2008). Community Resource Management Areas (CREMA): a review of progress and implementation in the Western Region of Ghana. *Wildlife Division (Forestry Commission), Republic of Ghana*.

Murray, G., Agyare, A., 2018. Religion and perceptions of community-based conservation in Ghana, West Africa. *PLoS One* 13, 1–15 (4:e0195498)

National review of CREMAs in Ghana, 2019.

Nayak, P. K., & Berkes, F. (2008). Politics of co-optation: community forest management versus joint forest management in Orissa, India. *Environmental management*, 41(5), 707-718.

Njogu, K. (2004). *Reading Poetry as Dialogue: An East African Literary Tradition*. Jomo Kenyatta Foundation.

Nyame, S. K., Okai, M., Adeleke, A., & Fisher, R. (2012). *Small changes for big impacts: lessons for landscapes and livelihoods from the Wassa Amenfi West Landscape, Ghana*. IUCN.

O'Connor, A., Djoudi, H., & Zida, M. (2021). Potential for integrated landscape approaches: A review of Ghana's national environment and development policies. *CIFOR Infobrief*.

Oduro, K. A., Duah-Gyamfi, A., Acquah, S. B., & Agyeman, V. K. (2012). *Ghana forest and wildlife handbook: a compendium of information about forests and wildlife resources, forestry-related issues and wood processing in Ghana*.

Osei-Mainoo, D., 2012. *Assessing the Contribution of Collaborative Forest Management to the Livelihood of Households in the Ashanti Region*. MSc. thesis, Kwame Nkrumah University of Science and Technology, Kumasi.

Osumanu, I. K. (2020). Small-scale mining and livelihood dynamics in North-Eastern Ghana: Sustaining rural livelihoods in a changing environment. *Progress in Development Studies*, 20(3), 208-222.

Owusu-Ansah, N. (2020). Leading sustainability: understanding leadership emergence in community resources management areas in Ghana. *The Qualitative Report*, 25(7), 1766-1779.

Painter, A. (2016). A universal basic income: the answer to poverty, insecurity, and health inequality?. *BMJ*, 355.

Pawelzik, P., Carus, M., Hotchkiss, J., Narayan, R., Selke, S., Wellisch, M., ... & Patel, M. K. (2013). Critical aspects in the life cycle assessment (LCA) of bio-based materials—Reviewing methodologies and deriving recommendations. *Resources, Conservation and Recycling*, 73, 211-228.

Persha L, Rodgers W, Nabanyumya R, Mpunda E; (2010) Community Conservation of Closed Forest Biodiversity in East Africa: Can it work? http://www.undp.org/gef/documents/publicationscross_bordersites_east_africa

Phiri, M. (2009). *Evaluation of the performance of joint forest management (JFM) programme: case of Dambwa Forest Reserve in Livingstone District, Zambia* (Doctoral dissertation, Stellenbosch: University of Stellenbosch).

Poudel, D. D., Ferris, H., Klonsky, K., Horwath, W. R., Scow, K. M., van Bruggen, A. H., ... & Temple, S. R. (2001). The sustainable agriculture farming system project in California's Sacramento Valley. *Outlook on AGRICULTURE*, 30(2), 109-116.

Quarrie, J. (1992). United Nations Conference on Environment & Development Rio de Janerio, Brazil. Regency Press. Agenda 21.

Ramanujam, M. P., & Kadamban, D. (2001). Plant biodiversity of two tropical dry evergreen forests in the Pondicherry region of South India and the role of belief systems in their conservation. *Biodiversity & Conservation*, 10(7), 1203-1217.

Reed, J., Deakin, L., & Sunderland, T. (2015). What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol. *Environmental Evidence*, 4(1), 1-7.

Reed, J., Van Vianen, J., Deakin, E. L., Barlow, J., & Sunderland, T. (2016). Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. *Global change biology*, 22(7), 2540-2554.

Reed, J., van Vianen, J., Barlow, J., & Sunderland, T. (2017). Have integrated landscape approaches reconciled societal and environmental issues in the tropics? *Land Use Policy*, 63, 481-492.

Richards, M., & Asare, A. (1999). *Economic incentives for cocoa farmers to tend timber trees in Southern Ghana*. Overseas Development Inst.

Rim-Rukeh, A., Ierhievwie, G., & Agbozu, I. E. (2013). Traditional beliefs and conservation of natural resources: Evidences from selected communities in Delta State, Nigeria. *International journal of Biodiversity and Conservation*, 5(7), 426-432.

Ros-Tonen, M. A., Derkyi, M., & Insaadoo, T. F. (2014). From co-management to landscape governance: Whither Ghana's modified taungya system? *Forests*, 5(12), 2996-3021.

Rye, J. F. (2006). Leaving the countryside: An analysis of rural-to-urban migration and long-term capital accumulation. *Acta Sociologica*, 49(1), 47-65.

Sala, S., Farioli, F., & Zamagni, A. (2013). Progress in sustainability science: lessons learnt from current methodologies for sustainability assessment: Part 1. *The international journal of life Cycle Assessment*, 18, 1653-1672.

Sala, S., Ciuffo, B., & Nijkamp, P. (2015). A systemic framework for sustainability assessment. *Ecological Economics*, 119, 314-325.

Santana-Medina, N., Franco-Maass, S., Sánchez-Vera, E., Imbernon, J., & Nava-Bernal, G. (2013). Participatory generation of sustainability indicators in a natural protected area of Mexico. *Ecological Indicators*, 25, 1-9.

Shastri, C. M., Bhat, D. M., Nagaraja, B. C., Murali, K. S., & Ravindranath, N. H. (2002). Tree species diversity in a village ecosystem in Uttara Kannada district in Western Ghats, Karnataka. *Current Science*, 82(9), 1080-1084.

Sawadogo, L., & Tiveau, D. (2011). Twenty years of experience of joint dry forest management in Burkina Faso.

Sheppard, D. J., Moehrensclager, A., McPherson, J. M., & Mason, J. J. (2010). Ten years of adaptive community-governed conservation: evaluating biodiversity protection and poverty alleviation in a West African hippopotamus reserve. *Environmental Conservation*, 37(3), 270-282.

Shrestha, K., & McManus, P. (2018). The politics of community involvement in conservation and use of forest resources: Lessons from community forestry in Nepal. *Aust. For*, 71, 135-146.

Shrestha, K. K., & McManus, P. (2008). The politics of community participation in natural resource management: lessons from community forestry in Nepal. *Australian Forestry*, 71(2), 135-146.

Snively, S. W. (2012). Environmental laws of Namibia: Constitutions, conservation, and cheetahs. *Prob. & Prop.*, 26, 44.

Solow, R. M., Kneese, A., & Riker, R. (1993). Resources for the Future. *An Almost Practical Step Toward Sustainability. Res. Pol*, 19, 162-172.

Sretthachua, C., Pitakthesombut, R., & Niyomchat, W. (2005). Tai Baan Research Network of Lower Songkhram Basin. Tai Baan Research

on the Ecology and History of the Seasonally Flooded Forest of the Lower Songkhram River Basin MWBP, Vientiane, Lao PDR.

Stanton, E. A. (2012). The tragedy of maldistribution: climate, sustainability, and equity. *Sustainability*, 4(3), 394-411.

Stockdale, A. (2004). Rural out-migration: community consequences and individual migrant experiences. *Sociologia Ruralis*, 44(2), 167-194.

Sunderland, T. C., Baudron, F., Ickowitz, A., Padoch, C., Ros-Tonen, M. A. F., Sandbrook, C., ... & Serban, A. (2015). Response options across the landscape.

Tanyanyiwa, V. I., & Chikwanha, M. (2011). The role of indigenous knowledge systems in the management of forest resources in Mugabe area, Masvingo, Zimbabwe. *Journal of Sustainable Development in Africa*, 13(3), 132-149.

Tattari, S., Puustinen, M., Koskiahho, J., Röman, E., & Riihimäki, J. (2015). Vesistöjen ravinnekuormituksen lähteet ja vähentämismahdollisuudet.

Thiffault, E., Barrette, J., Paré, D., Titus, B. D., Keys, K., Morris, D. M., & Hope, G. (2014). Developing and validating indicators of site suitability

for forest harvesting residue removal. *Ecological indicators*, 43, 1-18.

Todaro, M. P., & Smith, S. C. (2012). *Economic development* 11th edition.

Tonukari, O. (2007). Sacred Groves and Tree Worship among the Urhobos, Sapele.

Transparency International (2015) Corruption perceptions index 2015.

Kombo, U., & Tromp, T. (2009). *Quantative Evaluation and Research Methods*.

Tuomasjukka, D., Berg, S., & Lindner, M. (2013). Managing sustainability of Fennoscandian forests and their use by Law and/or agreement: for whom and which purpose?. *Sustainability*, 6(1), 18-49.

UN (2015) United Nations, Adoption of the Paris Agreement 2015. Available via UNFCCC.

<http://unfccc.int/resource/docs/2015/cop21/eng/109r01.pdf>.

Verschuuren, B., & Furuta, N. (Eds.). (2016). *Asian sacred natural sites: Philosophy and practice in protected areas and conservation*. Routledge.

Vivir.B. Ecuador–Quito, E.S.T. del S. N. (2013). *Objetivos nacionales para el Buen Vivir*

Watts, S. (2008). Institutional constraints on interactive community participation in forest conservation in Mozambique. *Journal of Sustainable Forestry*, 26(4), 301-327.

Western, E. Social Progress Index 2016.

Wiersum, K. F. (1995). 200 years of sustainability in forestry: lessons from history. *Environmental management*, 19, 321-329.

Wilderer, P. A. (2007). Sustainable water resource management: the science behind the scene. *Sustainability science*, 2(1), 1-4.

World economic Forum (2015). World economic Forum Reports 2015. <http://reports.weforum.org/global-gender-gap-report-2015/>.



APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST



SCHOOL OF BIOLOGICAL SCIENCES
DEPARTMENT OF ENVIRONMENTAL SCIENCE

STRUCTURED SURVEY QUESTIONNAIRE ON THE SUSTAINABILITY
ASSESSMENT OF CREMAS IN GHANA

QUESTIONNAIRE NUMBER;

SECTION 1: The procedure of land acquisition for the conservation Area

1.	Was the land area occupied before turned into conservation area?	No	0
		Yes	1
2.	Is the conservation area a family land?	No	0
		Yes	1
3.	How was the land acquired for the conservation program?	Purchased	1
		On lease or rent	2
		Released/Devoted by Community	3
		Compensation and Agreement	4
		Snatched	5
4.	If you answer yes to question 1; a) were the occupants fully compensated?	No	0
		Yes	1
	b) Do they show regret for unsatisfactory compensation?	No	0
		Yes	1
5.	What was your [community's] major	Farming	1

	source of livelihood before the conservation area was established?	Hunting	2
		Herbal medicine	3
		Fishing	4
		Trading	5
		Others	6
6.	Were you relying on the conservation area for living?	No	0
		Yes	1
7.	What is your major source of livelihood after the conservation area was established?	Farming	1
		Hunting	2
		Herbal medicine	3
		Fishing	4
		Trading	5
		Others	6
8.	Do you depend on the conservation area for a living?	No	0
		Yes	1

SECTION 2: Assessing the economic impact of CREMAs on local communities

9.	What work do you do?	Unemployed	0
		Farmer	1
		Laborer	2
		Forest guard	3
		Trader	4
		Public servant/ Civil servant	5
		Private Company worker	6

10.	Where is the work place?	In the community	1
		Outside the community	2
11.	How much do you gain in a month?	Between GHS 100 and GHS 300.00	1
		Between GHS 301 and GHS 500.00	2
		Between GHS 501 and GHS 700.00	3
		Between GHS 701 and GHS 900.00	4
		Between GHS 901 and GHS 1,100.00	5
		Above GHS 1,100.00	6
12.	How many people depend on you?	None	0
		1 – 2	1
		3 – 4	2
		5 and above	3
13.	Do you sought for extra aid to sustain you in a month?	No	0
		Yes	1
14.	If you answer yes to question 13, what specific aid?	Loan from bank or others sources	1
		Assistance from family or friends	2
		Earnings from extra work	3
		Others specify;	4
15.	What alternative livelihood systems are available to you?	None	0
		Bee keeping	1

		Rabbit farming	2
		Grasscutter farming	3
		Livestock farming	4
		Snail farming	5
		Others specify	6
16.	Are there natives employed in the conservation area?	No	0
		Yes	1
17.	Are you permitted to harvest resources from the conservation area?	No	0
		Yes	1
18.	If you answer yes to question 17, what resources are you permitted to harvest?	Herbal medicine	1
		Timber	2
		Wildlife resources	3
		Food stuff	4
		Honey	5
		Fire wood	6
		Others, specify;	7
	How often do you assess the resources?	Daily	1
		Weekly	2
		Monthly	3
		Seasonally	4
		Annually	5
		Occasionally	6
	How do these resources benefit you?	No benefit	0
		Generates income	1
		Heals ailments	2

		Others, specify;	3
19.	Are there restrictions in accessing the resources?	No	0
		Yes	1
20.	If your answer yes to question 19 , have you ever been accused of flouting any accessibility restriction?	No	0
		Yes	1
21.	Is the profit or benefit derived from conservation activities in your community shared fairly?	No	0
		Yes	1
22.	Is the profit or benefit derived from conservation activities in your community of immense benefit to you?	No	0
		Yes	1
23.	Do you encounter any form of damages as a result of the conservation activities?	No	0
		Yes	1
24.	If you answered yes to question 23, what form of damages?	Crop raiding by wildlife	1
		Damages caused by bad resource harvesting methods	2
		Surface wash	3
25.	If you answered yes to question 23, are you compensated for the damages?	No	0
		Yes	1
26.	If you answered yes to question 25, how well are you compensated?	Not fair	0
		Moderate	1
		Fair	2

SECTION 3: Assessing the Environmental impact of CREMAs on local communities and vice-versa

27.	Does the area experience fire outbreaks?	No	0
		Yes	1

28.	If your response to question 27 is yes, how often does the area experience fire outbreaks?	Occasionally	1
		Regularly	2
		Seasonally [during the harmattan]	3
29.	Is there a buffer zone?	No	0
		Yes	1
30.	If you answer yes to question 29, do you know the demarcation of the buffer?	No	0
		Yes	1
31.	What important resources used to be available in the reserve?	Record as mentioned:	
32.	What 1?	Record as mentioned:	
33.	What resources are currently extinct?	Record as mentioned:	
34.	What is your main source of water?	Community stream, river	1
		Well	2
		Borehole	3
		Tap	4
		Others, specify:	5
35.	How often do you access water?	Anytime	1
		Daily	2
		Seasonally	3
36.	What is the quality of the water you access?	Clean and fresh	1
		Clean but has particles	2
		Clean but salty	3
		Dirty and has bad smell	4
		Dirty but odorless	5

37.	How is waste water discharged?	Poured on the ground or in gutters	1
		Directed through channels into water bodies	2
		Directed through channels to a designed sewage site	3
		Others, specify:	4
38.	Is there any treatment mechanism for waste water?	No	0
		Yes	1
39.	How is the water of your community managed locally?	No local management system in place	0
		Individuals	1
		Community water committee	2
40.	Do you encounter water shortage?	No	0
		Yes	1
41.	Do you encounter human-wildlife conflict/competition for water resources?	No	0
		Yes	1
42.	Do you own land?	No	0
		Yes	1
43.	If your response to question 42 is yes, what is the total size in plots you know?	1 plot	1
		1.1 to 2 plots	2
		2.1 to 3 plots	3
		3.1 to 4 plots	4
		Above 4 plots	5
44.	What is the nature of your land	Owned with title deed	1

	ownership?	Owned without title deed	2
		Rented	3
		Owned by parents	4
		Communal/government/cooperative	5
45.	How long in years have you owned the land?	Less than a year	1
		1 to 3 years	2
		4 to 6 years	3
		7 to 9 years	4
		10 years and above	5
46.	What type of land use do you engage in?	Crop farming	1
		Livestock farming	2
		Housing	3
		Tree planting	4
		Others specify	5
47.	Are you permitted to harvest resources from the reserve?	No	0
		Yes	1
48.	If yes is your answer to question 47, what type of resource[s]?	Herbal medicine	1
		Timber	2
		Wildlife resources	3
		Food stuff	4
		Honey	5
		Fire wood	6
		Others, specify;	7
49.	Do you replant harvested trees?	No	0

		Yes	1
50.	How long does it take for replanted trees to be re-harvested?	1 - 5years	1
		6 – 10	2
		11 – 15	3
		16 – 20	4
		20 -25	5
		Above 25 years	6
51.	How many times do you harvest trees in a year?	One time	1
		Two times	2
		Three times	3
		Four times	4
		Five times and more	5
52.	How many trees on average is harvests per annum?	20 – 50	1
		51 – 80	2
		81- 110	3
		111- 140	4
		Above 140	5
53.	Compared to 10 years back are the animal species still intact?	No	0
		Yes	1
54.	If no is your answer to question 53 what happened?	They've been poached	1
		Escaped to other places	2
		Others, specify;	3
55.	Has the land mass been encroached?	No	0
		Yes	1
56.	If yes is your answer to question 55, what	1 – 10	1

	estimated percentage has been encroached?	11 – 20	2
		21 – 30	3
		31 – 40	4
		41 – 50	5
		Above 50	6
		Not at all	7
57.	What caused the encroachment?	Record as mentioned:	
58.	Are you involved in the conservation program?	No	0
		Yes	1
59.	Is it necessary to conserve resources?	No	0
		Yes	1
60.	If yes is your answer to question 58 or 59, what is your reason?	Record as mentioned:	
61.	If no to question 58 or 59, what is your reason?	Record as mentioned:	

SECTION 4: Assessing the Social impact of CREMAs on local communities

62.	How do you rate the performance of the resource management?	Good	1
		fairly good	2
		Poor	3
63.	Are you allowed access to resources in the reserve?	No	0
		Yes	1
64.	Are there laid down rules and norms for resource access and use?	No	0
		Yes	1
65.	If you answer yes to question 64, do you	No	0

	know the rules and norms?	Yes	1
66.	If you answer yes to question 65, do you comply with them?	No	0
		Yes	1
67.	If you answer yes to question 64,65 or 66, are the rules and norms really relevant?	No	0
		Yes	1
68.	If you answer no to question 67, why?	Record as stated;	
69.	Does agreement exists on rights and responsibilities of relevant stakeholders	No	0
		Yes	1
70.	Do you feel secured and assured of access and use of resources whenever necessary as planned	No	0
		Yes	1
71.	If you answer no to question 70, why?	Record as stated;	
72.	Do you encounter conflict in the reserve conservation?	No	0
		Yes	1
73.	If you answer yes to question 72, how often does conflict occur?	Always	1
		Occasionally	2
74.	If you answer yes to question 72, what type of conflict?	On over-exploitation	1
		On accessibility of resources	2
		On unfair sharing of resource benefit	3
		On flout of rules and norms	4
		On encroachment	5
75.	How are conflicts resolved?	Amicable resolution among stakeholders	1
		Legal resolution	2

		Resolution by local tribunal	3
76.	Do you attend training workshops on Community resource conservation?	No	0
		Yes	1
77.	If yes to question 76, how often do you attend such meetings?	Weekly	1
		Monthly	2
		Quarterly	3
		Yearly	4
		As and when necessary	5
78.	If yes to question 76, under the auspices of which organization?	Record as mentioned:	
79.	If yes to question 76, have the meetings been useful?	No	0
		Yes	1
80.	What language is commonly spoken in your community?	Asante Twi	1
		Fante	2
		Others specify;	3
81.	In which language is communication done among stakeholders?	Asante Twi	1
		Fante	2
		Others specify;	3
82.	Are the local stakeholders seen as important entity of the resource conservation?	No	0
		Yes	1
83.	Do you have a basic school in your community?	No	0
		Yes	1
84.	If yes to question 83, how long has it been in existence in years?	1 – 5 years	1
		6 – 10 years	2
		11 - 15 years	3

		Above 15 years	4
85.	If no to question 83, how do children access basic education?	Attend nearby schools	1
		Live with relatives at places where they can access education	2
		Do not attend school	3
86.	Is basic education really important?	No	0
		Yes	1
87.	Are children educated on the need for resource conservation, on formal or informal basis?	No	0
		Yes	1
88.	What is the main source of food for your family?	Farming	1
		Purchase from earnings	2
		Supplied by relatives and others	3
		Other specify;	4
89.	Do you always have food?	No	0
		Yes	1
90.	Are you able to meet the 3-square meal per day?	No	0
		Yes	1
91.	Do you have social groups for conservation in your community?	No	0
		Yes	1
92.	How many of such groups are there?	None	0
		1	1
		2	2
		3	3
93.	What is their role?	Record as mentioned:	

94.	Do you receive incentives from the government or any private agency into conservation?	No	0
		Yes	1
95.	If yes to question 94, what form of incentive?	Cash	1
		Foodstuff	2
		Clothes	3
		Others, specify;	4
	If yes to question 94, how is the schedule?	Weekly	1
		Monthly	2
		Quarterly	3
		Yearly	4
		Others, specify;	5
	Does is come regularly?	No	0
Yes		1	
96.	Do you have electricity in your community?	No	0
		Yes	1
97.	Do you have electricity in your house?	No	0
		Yes	1
98.	If yes to question 97, are you able to afford?	No	0
		Yes	1
99.	Are both males and females given same level of recognition in your community?	No	0
		Yes	1
100.	Are females paid the same rate as males for the same work?	No	0
		Yes	1
101.	Which gender dominates in leadership roles in your community?	Male	1
		Female	2

		No Disparity	3
102.	Do both males and females work under the same labor conditions?	No	0
		Yes	1
103.	Do people frequently lose jobs?	No	0
		Yes	1
104.	What benefit does the community derive from the reserve?	Record as mentioned:	

SECTION 5: Assessing the Cultural impact of CREMAs on local communities

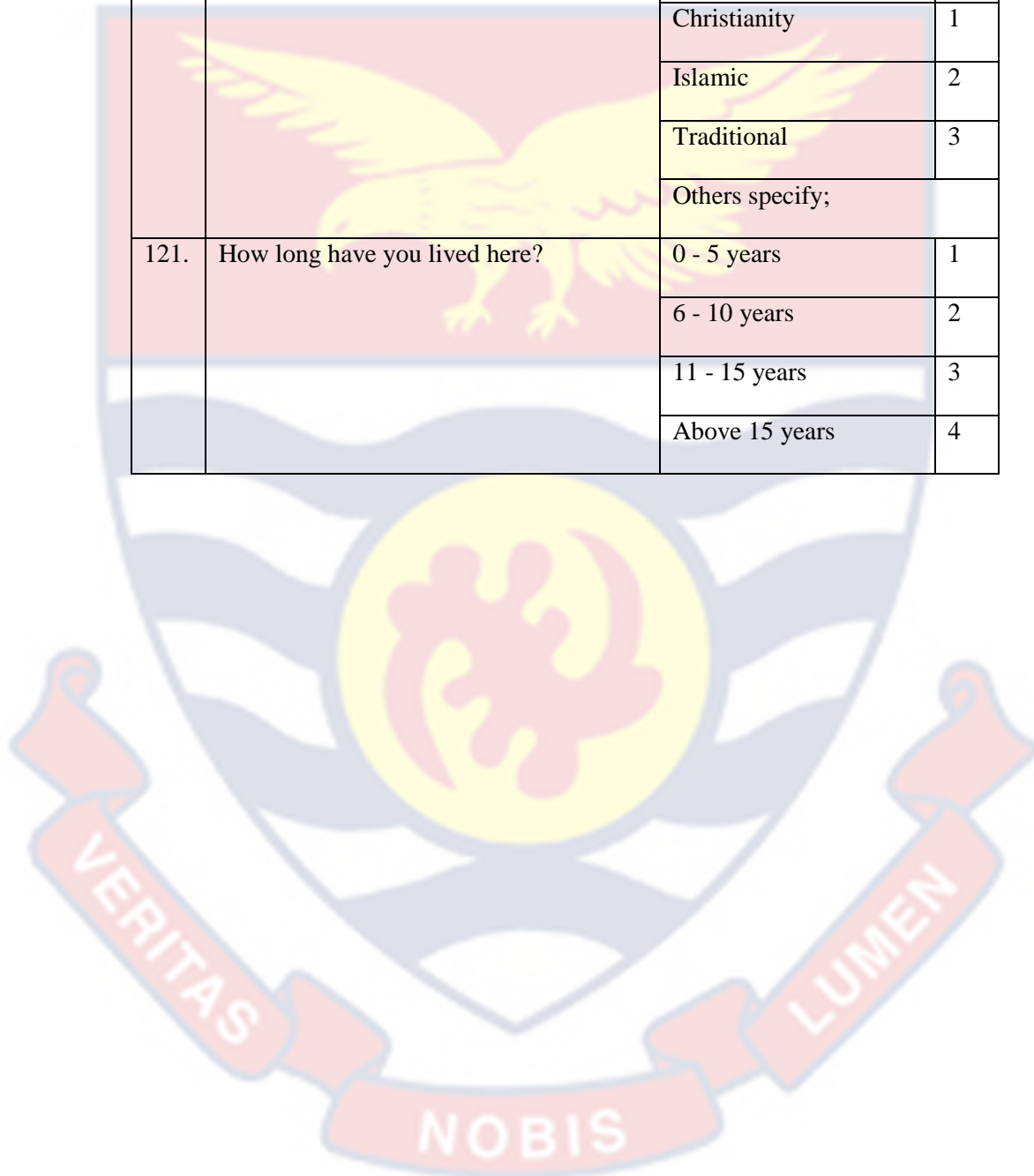
105.	Do you have a natural sacred site in the conservation area?	No	0
		Yes	1
		Not aware	2
106.	If yes to question 105, are you allowed access to the site?	No	0
		Yes	1
107.	If yes to question 106, when do you visit there?	Weekly	1
		Monthly	2
		Seasonally	3
		Annually	4
		Occasionally	5
108.	If no to question 106, why?	Record as mentioned:	
109.	Do the conservation activities affect your tradition?	No	0
		Yes	1
110.	Are the conservation activities entirely consistent with your tradition e.g taboos?	No	0
		Yes	1
111.	Are there signs of cultural disintegration	No	0

	resulting from the resource conservation?	Yes	1
112.	If yes to question 111, to what extent is the disintegration?	Record as mentioned;	
113.	In line with your culture will you urge for the sustainability of the reserve?	No	0
		Yes	1
114.	Are there resources in the reserve that are very vital for cultural purposes?	No	0
		Yes	1
115.	If yes to question 114, do you get access to them when needed?	No	0
		Yes	1

SECTION 6: Respondent's background information

116.	Gender	Male	1
		Female	2
117.	What is your age?	18 – 29 years	1
		30 - 39 years	2
		40 - 49 years	3
		50 – 59 years	4
		60 years and above	5
118.	What is your marital status?	Single	1
		Married	2
		Widow/Widower	3
		Divorced	4
119.	What is your highest level of education?	No formal education	0
		Primary Education	1
		Junior High School/ Middle School	2

		Secondary Education	3
		Tertiary Education	4
120.	What religion do you practice?	No Religion	0
		Christianity	1
		Islamic	2
		Traditional	3
		Others specify;	
121.	How long have you lived here?	0 - 5 years	1
		6 - 10 years	2
		11 - 15 years	3
		Above 15 years	4



APPENDIX B

UNIVERSITY OF CAPE COAST

SCHOOL OF BIOLOGICAL SCIENCES

DEPARTMENT OF ENVIRONMENTAL SCIENCE



OPEN-ENDED QUESTIONNAIRE ON THE SUSTAINABILITY ASSESSMENT OF CREMA_s IN GHANA FOR KEY STAKEHOLDERS

SECTION 1: The procedure of land acquisition for the conservation Area

1. How was the area acquired for the conservation program?

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2. What was the use of the area before the conservation began?

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3. What was the local's major livelihood source before establishing the resource area?

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4. What is/are the major of livelihood of the locals?

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5. Does any form of conflict pertain to the resource area?

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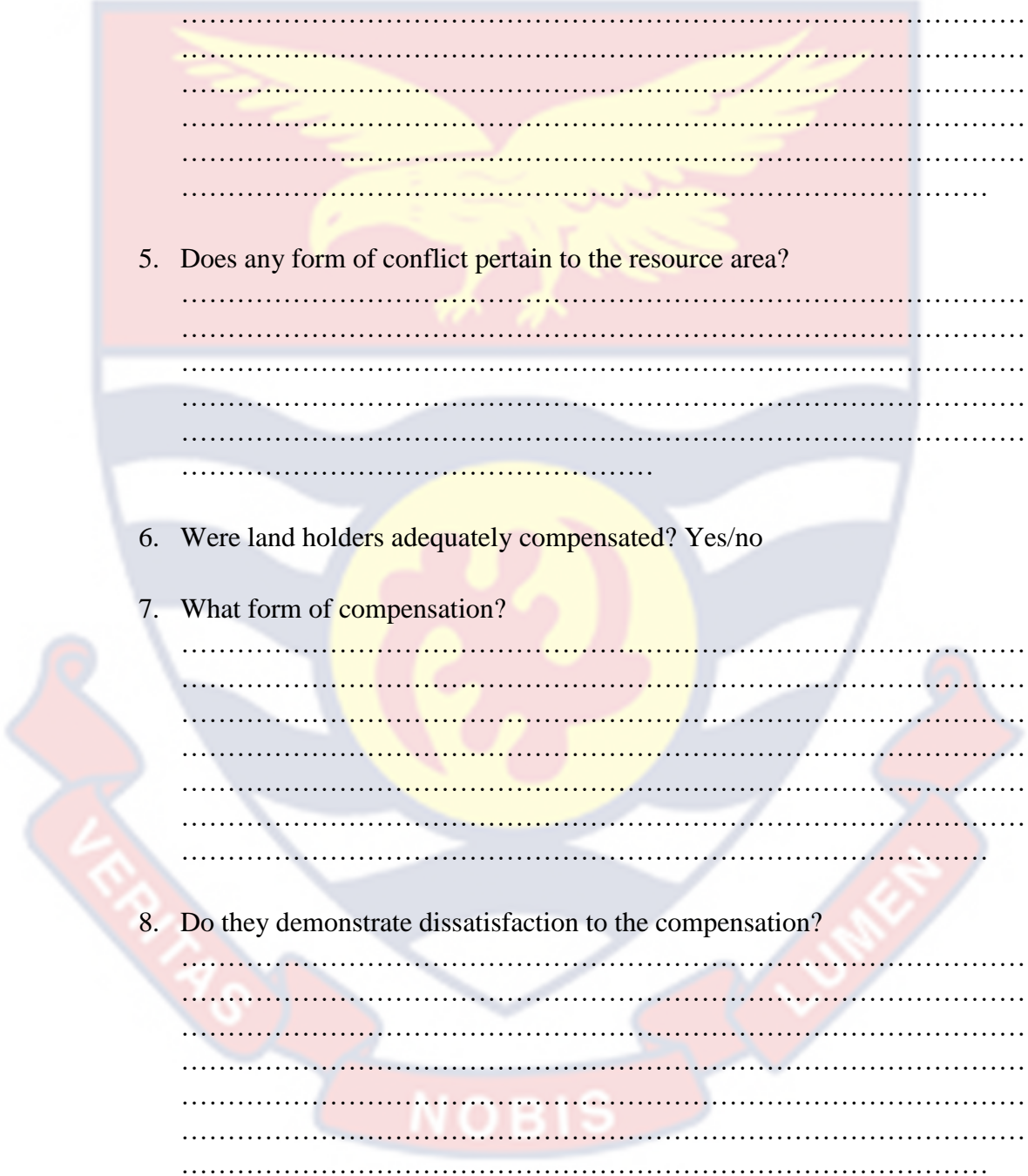
6. Were land holders adequately compensated? Yes/no

7. What form of compensation?

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8. Do they demonstrate dissatisfaction to the compensation?

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SECTION 2: Assessing the economic impact of CREMAs on local communities

9. What is the source of funding for the project?

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10. Is it sustainable? If no why?

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11. Would you need additional staff to the existing ones you have?

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12. What anti-corruption provision is in place?

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13. What mechanism is in place for profit sharing?

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14. What is the community's perception about how profit is shared?

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15. To what extent has the project helped in curb employment or scale up employment opportunities?

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16. How is concession allocation done?

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17. Is there any plan for sharing of benefits? Yes/No

18. How are resource benefits shared?

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19. What concerns do stakeholders have with the mode of sharing of the resources?

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20. How are differences settled with respect to such concerns?

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21. What re-investment in forest use options are available?

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22. What are some of the economic challenges linked with the resource conservation?

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23. How are damages compensated?

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SECTION 3: Assessing the Environmental impact of CREMAs on local communities and vice-versa

24. Is there a buffer zone around the resource area? Yes/no

25. What is the dimension of the buffer zone [if any]?

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26. Is the buffer zone serving its intended purpose?

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27. How has been the local's regard to the buffer?

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28. What are the conservation challenges pertaining to the management of the resource area?

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29. Do you do enrichment planting? Yes/No

30. Which times do you do enrichment planting?

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31. What common species are used for the enrichment planting and why?

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32. what species rare or endangered in the resource area?

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33. How are the rare or endangered species in the resource area restored?

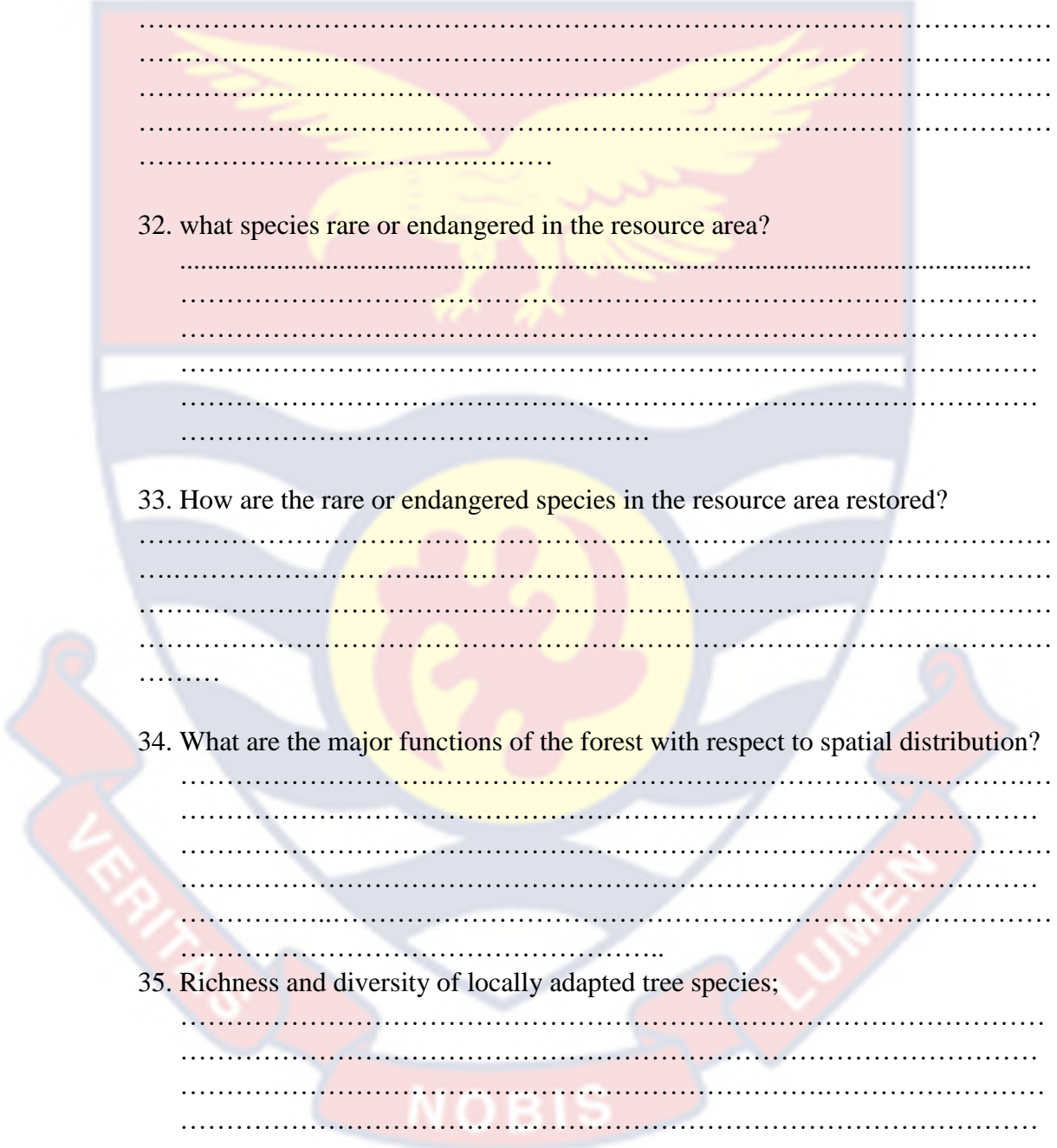
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34. What are the major functions of the forest with respect to spatial distribution?

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35. Richness and diversity of locally adapted tree species;

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36. Population size and demographic structure of adapted tree species;

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37. What human activities adversely impact the resource area?

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38. What resolution mechanism is place?

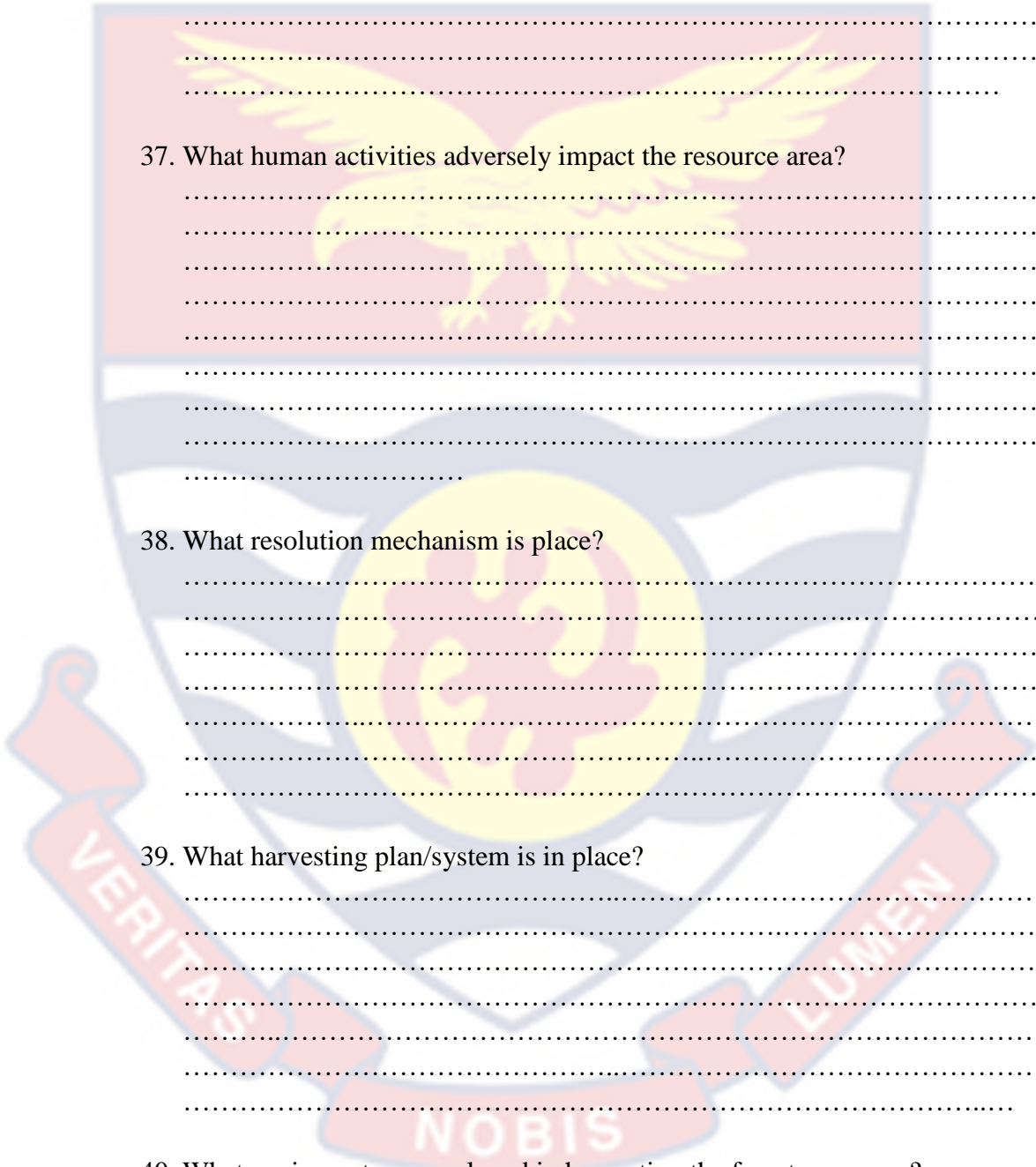
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39. What harvesting plan/system is in place?

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40. What equipment are employed in harvesting the forest resources?

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41. What observed effect[s] do the harvesting method and the equipment employed have on the forest resources including water?

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SECTION 4: Assessing the Social impact of CREMAs on local communities

42. What are the main objectives for the management of the resource area [is it clearly documented]?

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43. Which group/body is responsible for the management of the area?

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What regulations [legal framework] are available for the management of the resource area [request for copy of document if available]?

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44. How is your relationship with the forestry commission and vice-versa?

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45. Does the commission receive complaints from the communities or the local resource management frontiers? Yes/no

46. What have been the major complaints?

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47. To what extent has the local management demonstrated effectiveness in its managerial operations?

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48. What are the rules and norms governing resource use?

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49. How are conflicts yielding from the resource management and use managed [if any]?

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50. What is the indigenous perception about access to resources?

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51. In which language is communication done between resource managers, resource beneficiaries and the entire community?

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52. Through which means are decisions made?

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SECTION 5: Assessing the Cultural impact of CREMAs on local communities

53. How does the resource management plan reflect care in handling human cultural issues?

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54. To what extent does the project adversely affect the local culture?

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55. What positive influence does the resource area have on local culture and vice-versa?

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56. Are there signs of cultural disintegration? If yes, what are they?

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57. What spiritual links exist between the locals and their resources?

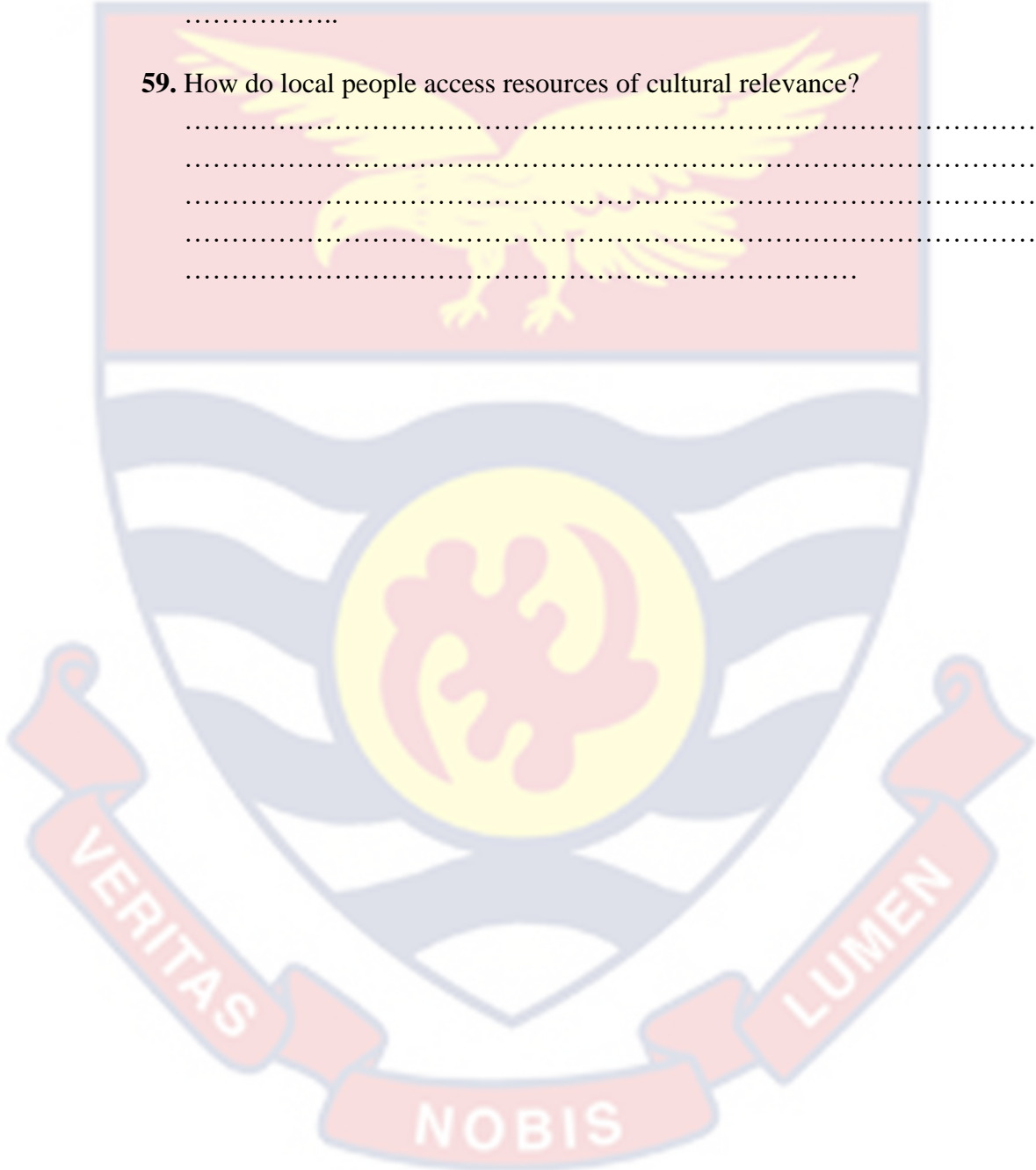
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58. What natural resources of cultural or spiritual influence are in the reserve?

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59. How do local people access resources of cultural relevance?

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APPENDIX C

t-Test: Two-Sample Assuming Unequal Variances (Comparison of economic livelihood of local people before and after CREMA)

	Livelihood before conservation	Livelihood after conservation
Mean	2.716216	2.589681
Variance	7.219491	7.806831
Observations	814	814
Hypothesized Mean Difference	0	
Df	1624	
t Stat	0.931319	
P(T<=t) one-tail	0.175913	
t Critical one-tail	1.645792	
P(T<=t) two-tail	0.351827	
t Critical two-tail	1.961426	

APPENDIX D

t-Test: Two-Sample Assuming Unequal Variances (Comparison of state of resources before and after CREMA)

	State of resources before CREMA	State of resources after CREMA
Mean	1.812039	2.019656
Variance	0.935107	1.345247
Observations	814	814
Hypothesized Mean Difference	0	
Df	1575	
t Stat	-3.92259	
P(T<=t) one-tail	4.57E-05	
t Critical one-tail	1.645822	
P(T<=t) two-tail	9.14E-05	
t Critical two-tail	1.961471	