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Applying socio-ecological perspectives semantic networks in managing community conservation areas in Ghana

Nana Owusu-Ansah*

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Abstract: This study purpose was to identify key nature conservation themes and their semantic interrelationships that could be considered in the establishment and management of Community Resource Management Areas (CREMAs) in Ghana. A qualitative descriptive phenomenological approach was used to interview nine CREMA leaders from three different locations in northern Ghana. Seventeen major socio-ecological themes were identified under three nature conservation domains of: 1) conservation objectives, 2) risk management and 3) sustainable economic opportunities. Three semantic networks were developed under the central domains where the 17 themes served as labelled nodes interlinked with seven labelled links of: 1) *is part of*, 2) *is associated with*, 3) *promotes*, 4) *produces*, 5) *is cause of*, 6) *is property of*, and 7) *contradicts*. The study findings indicate that there are intricate interrelated socio-ecological issues that CREMA managers should understand and appreciate to attain sustainable benefits. The application of livelihood incentives, creating awareness and law enforcement are key activities managers must implement together with others to achieve sustainable benefits in the CREMAs.

Keywords: CREMA, phenomenological studies, semantic networks, sustainability

Introduction

Collaborative nature conservation principles are implemented in an attempt to perfect human-nature interrelationships (Vining et al., 2008) especially in the utilization of natural resources to promote viable nature based enterprises that produce sustainable benefits (Drexhage & Murphy, 2010). Proponents of collaborative nature conservation principles suggest the involvement of local people helps in achieving both conservation and socio-economic development goals among multiple actors with their complex interrelationships on the communal landscape. Conley & Moote (2001) for example stated the involvement of local people in nature conservation is required because: 1) they depend on the resources for livelihoods, 2) they have in-depth knowledge in the management of the resources, and 3) central government management alone is insufficient due to corruption and inadequate funding. Again, local people demonstrate their participation with responsibility and stewardship towards nature to improve their conservation goals and socio-economic development (Lockwood et al., 2010).

Collaborative nature conservation principles implementation is also important to avoid nature utilization rights exclusion; where the most powerful concessionaires enjoy the better share to the neglect of the weak who may reside in the affected areas. Again, Conley & Moote (2001) asserted four issues ought to be considered during nature conservation planning and development if the problem of exclusion is to be eliminated. They are: 1) all actors should be allowed to state their interests, values, needs and

* Forestry Commission Training Centre, naduono74@yahoo.co.uk, ORCID:0000-0001-9951-9926

concerns, 2) all identified issues should be included, 3) all actors should be engaged at all stages, and 4) all actors should be involved in the decision-making process.

However, contention always exists between different stakeholders' demands and expectations on biodiversity under conservation. Stakeholders' contentions range from local community members who feel they have been deprived of their rights to utilize biodiversity resources to merchants who think economic resources are being held without any utilitarian benefits. Also, these demands and expectations from community members and merchants are in opposition to the conservation practitioners' perspectives that promote non-consumptive values of biodiversity. Thus, implementing such multi-stakeholder engagements in collaborative nature conservation requires all the actors also to trade off entrenched stances to achieve compromised desirable goals (Kopnina, 2012).

Consequently, collaborative nature conservation programming which is seen as one of the panaceas to achieving sustainable biodiversity conservation and socio-economic development goals have been executed with participatory management approaches in many countries (Jones & Erdmann, 2013; Roe et al., 2009). Notwithstanding, the nature conservationists and socio-economic development policy makers are still confronted with a challenge to achieve a proper balance between the two opposing values on the communal landscape. This study applied qualitative semantic networks to explore an understanding and appreciation to the complex socio-ecological interactions (Rodrigues & Pietrocola, 2020) that occur in collaborative nature conservation ranges called Community Resource Management Areas (CREMAs) in Ghana.

Socio-ecological perspectives of participatory nature conservation

Agrawal & Gibson (1999) stated collaborative nature conservation programmes are founded on an image of a pristine ecosystem with an isolated local people who live in harmony on the landscape. The notion is that the local peoples' knowledge and the values they placed on the resources prevent them from abusing their control and utilization rights. The premise is that such an ecosystem with its human inhabitants is separated from the state and the negative effect of capitalism propelled by a free market system (Kopnina, 2012). Thus, promoting a pristine ecosystem that is free from human interferences from the conservationists' perspective which pits against the profit making industrialists' views of human socio-economic wellbeing contingent on commercial exploitation of natural resources.

Also, an ecosystem at its climax functions well with the capacity to provide services that benefit both human socio-economic demands and other biological species' functions. Striving to achieve such an ecosystem has framed the basis for setting up governance frameworks for both central government protected areas and off reserved management regimes even under community collaborative conservation. Biodiversity governance laws formulated to regulate natural resources utilization in protected and off reserved areas differ in many countries; with stringent application of laws in protected areas than off reserved areas (Shafer, 2015).

The above notwithstanding, the argument is that human interactions within ecosystems are historic which have changed the landscape many times, therefore, what is considered a productive ecosystem is as a result of human influences. Agrawal & Gibson (1999) pointed out that historical research suggests there is no truth in the assertion that community people are friendly to ecosystems because they live closer to the resources. That is, on the community collaborative conservation landscape, human interferences in the ecosystem still exist (Agyare, 2013; Brooks et al., 2013) and therefore community people's interaction with nature is a function of their utility interest (McDougal, 2010). Thus, it is the perspectives of actors involve in community collaborative resource management that determine whether outcomes generated from the consumptive and non-consumptive values of biodiversity are positive or negative.

Bixler et al. (2015) stated *participation* as used in collaborative conservation programmes lacks clarity because it is used to represent all sorts of nature conservation arrangements. The authors reiterated that in most cases the degree and the sort of participation is not clearly mentioned leading to all manner of challenges in the implementation of the resources governance arrangements. The myriad of actors, the

complexities and uncertainties associated with their interests, values, needs and concerns make participatory nature conservation implementation challenging (Brooks et al., 2013). Therefore participatory nature conservation governance should be built on citizenship engagement; considering its power relation, personal interests and benefits sharing arrangements (Agrawal & Gibson, 1999; Lockwood et al., 2010).

Again the definition of *community* in collaborative nature conservation programmes has been criticized; according to Agrawal & Gibson (1999), community in the conservation context has been defined as a small spatial area with homogenous people who share similar norms. The argument against this description is that it fails to identify the differences that exist in communities in regard to the processes, politics and alliances in nature conservation and its utilization arrangements. Defining a community as a small spatial area is a territorial concept that fails to acknowledge the movements of the people in and out of that space. Movements of people and their interactions with outsiders have impacts on their shared norms and the homogeneity that exist among them (Vining et al., 2008). Consequently, focus should rather be on the established communal norms that determine the outcomes of peoples' interactions and the political processes within communities.

Uncertainties and complexities in nature conservation exist due to: 1) knowledge gaps in different species interactions, 2) difficulties in understanding the intricacies in the interrelationships between species and their living environment (Stevens & Tello, 2011), and 3) unpredictable impacts of certain external factors like climate change (Sarkar et al., 2004). These uncertainties and complexities make Lockwood et al.'s (2010) call for greater integration and coordination to accommodate multiple factors in the temporal and spatial scales of nature conservation noteworthy. Participatory nature conservation programme implementation in the CREMAs thus seeks to improve the interactions and coordination among natural resources managers, scientists, policy makers and the general public to attain sustainable benefits where biodiversity resources are utilized to promote viable socio-economic development.

Participatory nature conservation issues in CREMAs

The CREMA model in Ghana is a participatory nature conservation institution built on local community governance structures to receive and implement a devolved authority from the central government (Agyare, 2013; Bandoh, 2010). A CREMA is operationally defined to represent a geographically demarcated area that has adequate natural resources or has the potential to improve the condition of the resources, for the locally established institution and governance structures to sustainably manage for communal benefits. The CREMA establishment objective is to encourage local people to integrate nature conservation into their farming and other legitimate land use systems (Asare et al., 2013) and to leverage on the governance structures to promote socio-economic wellbeing (Owusu-Ansah, 2021). The CREMA model does not follow strict nature protection regimes on the communal landscapes, but it provides opportunities for sustainable utilization strategies to be adopted by the local people. The model is a participatory nature conservation approach that promotes democratic communication channels for proper natural resources governance and conservation (Conley & Moote, 2001); provides incentives to reduce poaching (Agyare, 2013); seeks paths for sustainable socio-economic development (Drexhage & Murphy, 2010) and explores to perfect the interrelationship that exists between humans and nature (Vining et al., 2008).

The law in Ghana prescribes that all natural resources in protected areas and off protected areas belong to the state (Kotey et al., 1998 cited in Ekpe et al., 2014). This provision in the law to some extent marginalizes and excludes local people in the governance and utilization of the resources. Incorporating inclusive principles in developing the CREMA model with its benefit sharing arrangements in Ghana is not only aimed at addressing the problem of exclusion and marginalization, but also to conserve the resources for the benefits of current and future generations by creating a sense of ownership for the local people. The CREMA model seeks to achieve citizenship participation in rule-making (Agyare, 2013), and establish local institutions and governance structures to administer procedural justice on the agreed rules in nature conservation on the communal landscape (Conley & Moote, 2001).

According to Joseph et al. (2008) budgetary constraints, evolutionary distinctiveness of ecosystems and values placed on species are some considerations that influence conservation objectives. Similarly, CREMA conservation objectives are generally founded on the participating stakeholders' considerations on the biological and economic values placed on the resources and also their vulnerability to utilization pressures. Mostly, society places more emphasis on the socio-economic contributions of the resources to influence values placed on them (Kopina, 2012; Vining et al., 2008). However, the premium given to socio-economic importance of biological resources presents risks that threaten conservation objectives. Unfortunately, the threat to conservation objectives also undermines the economic values of the resources in the long term due to unsustainable harvesting (Game et al., 2013).

The CREMA model principles are beautifully crafted, however there are challenges that hinder their implementation. For example, implementers sometimes find it difficult to persuade some communities to accept the principles of the CREMA because such communities view the approach as a means for the central government to cunningly annex their lands for a protected area establishment. Shafer (2015) similarly reported how certain communities in Africa and Latin America view the creation of buffer zones along protected areas as external actors' way of incorporating those lands into the protected areas. Another implementation challenge is where CREMA members sometimes feel some of the restrictive and prohibitory sanctions that govern the CREMAs limit their economic livelihood activities; notwithstanding that those very regulations were generated by themselves (Bandoh, 2010). These challenges create disenchantment among community members (Agrawal & Gibson, 1999) leading to poaching, illegal logging and other unsustainable nature degradative practices like overgrazing and illegal fishing being continuously reported in the CREMAs. The above arguments indicate an understanding and appreciation of the interrelationships that exist among conservation objectives, conservation risks and sustainable economic opportunities of the CREMAs would promote effective management.

Two research questions were asked for this study. 1) What socio-ecological issues are considered most relevant by CREMA leaders to establish functional community conservation areas? 2) How do the socio-ecological issues identified logically interrelate with each other in semantic networks around three domains of (I) Conservation Objectives, (II) Risk Management and (III) Sustainable Economic Opportunities?

Application of semantic networks to CREMA conservation objectives, risks management and sustainable socio-economic opportunities

Semantic networks graphically represent knowledge which is made up of nodes and their relations (Osorio-Forero et al., 2019). Majumder & Khanra (2015) showed semantic networks are mainly made up of two parts. First, there is the vocabulary part that denote labeled nodes and labeled links. The second is the structural part made up of the nodes and the links' interrelationships that give meanings associated between nodes and links. The semantic networks used for this study were designed around three central domains.

Osorio-Forero et al. (2019) stated semantic network methodologies permit speedy and simplified meaning in modelling qualitative content. Other advantages of representing knowledge in semantic networks is its flexibility, transparency and beauty (Majumder & Khanra, 2015; Steyvers & Tenenbaum, 2005). However, semantic networks application in knowledge development has some shortfalls. The disadvantages include possible loss of depth from the source information resulting in subjectivity in knowledge presentation (Osorio-Forero et al., 2019). Semantic networks also has the inability to expand on knowledge beyond certain bounds (Steyvers & Tenenbaum, 2005).

During interview sessions in this study, dialogue was applied to produce shared knowledge between the researcher and participants to reduce subjectivity (Rodrigues & Pietrocola, 2020). The approach helped in developing simple semantic networks around three central domains of: 1) Conservation Objectives,

2) Risk Management and 3) Sustainable Economic Opportunities. The researcher applied his socio-ecological perspectives to interview responses from nine CREMA leaders to develop the semantic networks. This exploratory research sought to develop shared knowledge (Rodrigues & Pietrocola, 2020) to understand and appreciate the interrelations among conservation factors that occur on the CREMA landscape.

The author of this study is an employee of the Wildlife Division of the Forestry Commission of Ghana where he has been involved in the establishment of CREMAs. This paper is generated from his doctoral dissertation where he applied qualitative phenomenological approach to study CREMA leaders' ecological worldviews and their impacts on nature conservation risk assessment. Dialogue was used during qualitative interviews to reduce possible biases from both the participants and the researcher and to bring out shared meaning. The researcher accepts community nature conservation programmes bring out positive outcomes by reducing the degradation of resources. He also believes local people can improve their livelihoods through effective resource management participation than the centralized government system that alienate them from benefits and control. Nonetheless, there are complexities in establishing and managing biodiversity resources in community conservation programmes like CREMAs. His experience shows CREMAs generally suffer from ineffective management which negatively affect sustainable conservation of the resources in the communal lands. It is noteworthy to state that this study does not constitute an official assessment of the studied sites by the researcher's employers.

Methodology

Study areas

Three CREMAs situated in the northern savanna zone of Ghana were selected for this study. The three study sites are Sayinga-Kasena-Gavara-Kara (SKGK), Wechiau Community Hippopotamus Sanctuary (WCHS) and Zukpiri Integrated Wildlife Sanctuary (ZIWS). Although the sites have differences in their establishment origins and the number of years they have existed as autonomous CREMAs, they also have similar nature conservation issues. The three sites are located in a comparable ecological landscape in the northern savanna zone of Ghana. Their similarities and differences provided opportunities to identify major issues that affect CREMA establishment and management. For example, issues of annual bushfires, poaching and illegal logging are reported within the selected sites. Also, the people of the study sites heavily rely on subsistence agriculture and collection of Non-Timber Forest Products (NTFPs) like Shea nuts, African Locust Bean and hunting of game to make a living.

Research Paradigm

The study was exploratory; aimed to understand and appreciate the socio-ecological issues of the CREMAs based on the lived experiences of interview participants. Descriptive qualitative phenomenological approach was used to allow the researcher and the participants to cross beyond themselves and into universal views (Groenewald, 2004) to create new insights. The application of phenomenological approach was to bring out lived experiences, consciousness and essences of the CREMA leaders' socio-ecological ideas (Sloan & Bowe, 2014). According to Finlay (2009) and Kafla (2011) phenomenological studies allow researchers and participants to stretch their understanding beyond the phenomenon under study to bring new perspectives on a subject. Nine CREMA leaders were interviewed to bring out their appreciation of the interrelation that exist among socio-ecological issues of the CREMAs.

A separate one on one interviews were conducted in the evenings after field visits to the CREMAs. The researcher visited the fields of the three conservation areas in the mornings to observe some conservation activities undertaken in the CREMAs. The field visits were used to shape up the approach to interviews. Dialogue was applied during interview sessions to produce shared knowledge between the researcher and participants to reduce subjectivity (Rodrigues & Pietrocola, 2020). This allowed for constructing

simple semantic networks around the three central domains of: 1) Conservation Objectives, 2) Risk Management and 3) Sustainable Economic Opportunities. The researcher allied his socio-ecological perspectives to interview responses from the nine CREMA leaders to develop the semantic networks.

Selecting participants for interviews

Three participants were selected from each of the three CREMAs for face-to-face interviews. The top management executives were purposively selected to fulfil the study's purpose to understand and appreciate the socio-ecological factors that influence CREMA management effectiveness as has been experienced by the leaders. The selected participants were well informed with CREMA leadership experiences having served as key implementers of nature conservation and socio-economic livelihood strategies for a number of years. Their leadership experiences ranged from five to 18 years. CREMA leadership is largely voluntary, the participants have had other engagements in their communities which made them suitable candidates to expatiate on nature conservation and socio-economic development. For example, five of the participants were members of their local District Assemblies whereas another was a chief of his community.

Boyd (2001) and also Creswell (1998) stated for phenomenological studies, selecting between two to 10 participants is enough to reach saturation point where no new significant data is generated from adding more participants. Thus, selecting nine participants from three different CREMAs expanded the study's scope which was important to ensure rigor and credibility.

Ethical issues of the study

The study design was approved by the Dissertation Review Board (SMC University Prospectus Review, 3/10/2017) of Swiss Management Center University. There was also no known legal barriers to undertaking this study. The researcher applied proper ethics (Laverty, 2003) in selecting and interviewing participants. Letters were written to the management executives of the SKGK, WCHS and ZIWS about the study. The executives were contacted via telephone and emails to determine their preparedness to take part in the interviews on the agreed date after the letters were sent. All the nine targeted participants agreed to participate and each was given a copy of a signed consent form on the day of interview. One of the respondent was not literate in the English Language, thus the consent form was read to him in the Twi Language (the language understand by both the researcher and this participant). Participants were told the study was for academic and practical purposes only and they had the choice to decline to be part at any point they feel to do so.

Data Collection

Separate face-to-face interviews were framed with a dialogue approach around the three central domains of conservation objectives, risk management and sustainable economic opportunities (Brooks et al., 2013; Game et al., 2013). Participants were asked about their lived experiences relating to major natural resources that existed in their CREMAs which has informed their conservation objectives, conservation threats and management activities. They were then asked to mention how their experiences have informed some socio-economic opportunities they have created to promote conservation objectives and reduce threats. Probing questions were asked to clarify issues. The researcher stated his understanding of the issues and their possible interrelatedness on socio-ecological landscape of the CREMAs to the participants at stages of the conversation. This approach enabled him to create a shared knowledge between himself and the participants. This follows Rodrigues & Pietrocola's (2020) assertion that shared knowledge could be developed through combine experiences between professionals and related key actors in an organization. Nature conservation and socio-economic issues identified and agreed on during interviews were used to develop semantic networks around the three central domains.

Interviews were video recorded after the researcher sought permission from participants (Downing, 2008). The essences from the non-verbal communication captured on video and the transcripts from the

interviews helped in the data analysis especially in helping to logically piecing together the semantic interrelationships. An assistant took the video recordings which allowed the researcher to concentrate on the interviews and also to take notes on salient points. The application of dialogue enabled the researcher and participants to move attention from the camera to concentrate on the interviews.

Semantic linkages applied in the study

Themes were developed from the nature conservation and socio-economic issues identified from interviews. The themes served as labeled nodes and they were linked to each other or to the central domains by seven labeled links. The labeled links were generated from shared meanings agreed between participants and the researcher. Table 1 provides the labeled links and their shared meanings.

Table 1.

Semantic linkages derived from interviews and their explanations

Labeled links	Interrelationship explanation
1. *Is cause of*	Theme that triggers actions to be taken on a central domain.
2. *Is part of*	Theme that shares in a central domain or in another theme.
3. *Is associated with*	Central domains/themes that directly or remotely influence the attainment of each other.
4. *Is property of*	Theme of belongingness to a central domain.
5. *Produces*	Consequential outcomes derived from a central domain.
6. *Promotes*	Central domain/theme that boosts the attainment of a central domain or another theme.
7. *Contradicts*	Themes that oppose each other.

Data Analysis

Each of the nine video recorded interviews was played in a free-to-use software called *easytranscript*. The researcher transcribed verbatim the audio contents of the videos. He also translated and transcribed directly into English Language the responses of the participant who spoke in a local dialect. The nine transcripts were edited for accuracy and also for the researcher to familiarize himself with the data in a Microsoft Word document. The edited transcripts were analyzed with the assistance of Atlas.ti software (version 7.0).

A code list was deductively pre-prepared in Microsoft Word and was uploaded into Atlas.ti for analysis. The researcher applied his experiences in community conservation management and from literature Agyare, 2013, Brooks et al., 2013 and Ekpe et al., 2014) to prepare the codes. Deductive coding approach has been justified by researchers' like King (2004) because it forces researchers to include or eliminate some codes in data analysis. Both semantic and latent interpretations informed codes development in this study (Braun & Clarke, 2006). Latent codes are theorized to inform interpretive content of participants' responses whereas semantic codes portray just what was said in interviews. The researcher's intent was to develop the latent interrelationships of conservation issues of the CREMAs in semantic networks.

Themes were also deductively developed (King, 2004). To reduce arbitrariness and subjectivity, standards were set in developing themes which were in line with Osorio-Forero et al.'s (2019) assertion on mathematical graph applications which is akin to techniques used in qualitative semantic networks. Computer supported applications for qualitative semantic networks has been developed on the basis of

mathematical applications in graph theory models (Conte et al., 2012 cited in Osorio-Forero et al.'s (2019). For example, graphs have two parts represented by sets of integers which are knitted together by edges. The integers and the edges respectively are similar to labeled nodes and labeled links found in semantic networks. Osorio-Forero et al. (2019) acknowledged expert subjectivity exist in developing morphological features of semantic networks in the context of language and cognitive research, yet, the use of graph theory could reduce arbitrariness. Again for example, Ferrer i Cancho & Solé, (2001) developed semantic networks from mathematical graphs based on word frequency in a qualitative interview. Similar principles were used to develop themes from codes based on percentages a code was attached to similar quotations from the nine transcripts. This process was facilitated by the codes-primary-documents-table facility found in Atlas.ti software.

In this study, a code was given thematic status if it was tagged to at least similar quotations from six transcripts (66.7%) out of the nine. However, other themes were formed from related codes which were tagged with different quotations but did not meet the threshold set above. For example, related codes that were attached to similar quotations from four (44.4%) or five (55.6%) transcripts out of the nine were merged to form a theme. Again, related codes that were tagged to similar quotations from three (33.3%) and another three (33.3%) or three (33.3%) and four (44.4%) or three (33.3%) and five (55.6%) transcripts out of the nine were combined to form a theme. There were no codes that were attached to two similar quotations or to only one quotation for consideration. For example, 'economic activities' was merged with 'green economy' to form a new theme called 'alternative livelihood' whereas waterbody conservation emerged from river conservation and water provision. The application of percentages brought consistency and clarity to the process of holding and merging codes into themes (Braun & Clarke, 2006).

Trail of activities and participants' confidentiality

The researcher took note of his trail of activities in data collection, analysis and results presentation to ensure transparency, rigor and credibility to the study. Separate face to face interviews were conducted in the offices of each CREMA after morning field visits to CREMA sites. Interview sessions with an individual lasted between 45 minutes and one and half hours. Probing questions were asked for participants to clarify issues. The researcher stated his understanding of the issues and their possible semantic linkages at stages of the conversation to create a shared knowledge between himself and participants.

Participants' privacy has been protected by labeling their statements at the results section. The labels used were A1, A2 and A3 for participants from WCHS, B1, B2 and B3 were from ZIWS and C1, C2 and C3 were from SKGK. Labeling was done not in any particular order or through any attributions that relate to participants' positions in the CREMAs.

Results

Nature Conservation and Socio-Economic Development Issues in CREMAs

Presentation of findings begins with theme development. The next section is on themes and their description derived from shared understanding from interviews. The central domains and their semantic linkages follow. The interrelatedness of identified themes with their central domains are then discussed. Participants' statements have been presented to support how themes were developed and such quotations have been *italicized*. Also, semantic linkages have been presented in *italicized* format in the write up.

Theme development and their semantic linkages

CREMAs are established through consultations with key stakeholders where conservation baseline data is collected to provide information on unique resources found on the landscape and how unsustainable exploitation threatens the resources. Thus, conservation baseline data and unsustainable nature

exploitation are two major *causal* themes for CREMA establishment. The two *causal* themes also form *parts* of activities applied to manage conservation risks leading to the development of sensitization and law enforcement strategies.

Participant's statement below depicts how *causal* themes lead to CREMA establishment. Themes like nature conservation, unsustainable nature exploitation, conservation baseline data and conservation motivation were developed from this and similar quotations.

> C1: *…the natural resources like plants and animals or the environment was fast depleting and it seemed not to be under anybody's cares… The involvement of the communities has helped…Surveys were conducted…we realized the resources were common for everybody and we were using them without taking into considerations any sustainability plan. That is what brought us to the establishment of the SKGK CREMA.*

CREMA establishment purpose is to manage unsustainable exploitation of resources. The above statement shows CREMAs are established after surveys have been conducted to collect credible data on available resources and threats that militate against its sustainability. Good data enables effective conservation objectives to be set up to manage pressures that threaten the resources sustainability.

Sustainable socio-economic opportunities initiated in the CREMAs provided the basis for developing themes like agency facilitation, alternative livelihood, sustainable NTFPs collection, tourism development and gender considerations meant to empower women. These programmes are purposively initiated to win community members' support.

> *B1: There was a meeting with a new NGO (Non-Governmental Organization) today and they are intending to assist us in agriculture and also help our women to process Shea nuts into butter. They are also bringing buyers to buy Dawadawa* (African Locust Bean). *They have just come and we are yet to start.*

> B3: *'Environmental Protection Agency of Ghana rushed in and introduced us to UNDP (United Nations Development Programme)/GEF (Global Environmental Facility) small grant project for support when we started. Ghana Tourism Authority also came in to support us on our tourism development plan'.*

Nature conservation projects in the CREMAs require external agencies facilitation to *promote* conservation ideals and socio-economic development goals to achieve sustainable benefits. B1 and B3 statements above and similar ones from the transcripts show how external agencies (both governmental and non-governmental) provide socio-economic opportunities for the CREMAs. Sustainable utilization programmes are designed for non-timber-forest-products to economically empower the people. Women economic empowerment is the main gender consideration particularly promoted in alternative livelihood programmes.

Themes like conservation motivation, sustainable benefits and change in attitude were developed from participants' responses to questions related to conservation objectives. Conservation motivation comprises the incentives that *cause* the CREMA leaders to lead their people with conservation objectives which are aimed to achieve sustainable benefits. The sustainable benefits consists of the dual outcomes of viable nature conservation and sustainable socio-economic development.

> A1:*…besides the plants and animal conservation, we also think about the cultural and economic motivation linkages…You know in the project we look for sustainability. If this generation is not there, other people have to take over and they have to get some knowledge. So the WCHS has built schools. We have two schools so far at vantage points so that children from two or three communities can attend. We have provided scholarships to about 40 students at the tertiary level (*i.e. after high school*).*

CREMAs establishment motivation are generally placed on conservation objectives that seek to protect plant and animal resources. Successes achieved in nature conservation in the CREMAs becomes pivotal

to attract socio-economic development projects. A1's statement above shows how by focusing on plants and animals conservation, other benefits like education infrastructure has been built for some communities.

A change in attitude that *promotes* a sense of communal ownership of the resources is the level of cooperation the CREMA leaders expect from community members. A major change in attitude mentioned by all the nine participants is themed 'peer risk management'; where community members foil illegal and unsustainable activities of other community members. To the participants, it was a measure of nature conservation success as it *part* in risk management. A2 made the statement below to depict how positive change in attitude of community members form *parts* in law enforcement.

> *…there was a time that some people wanted to fell a tree, I got a call and we moved in to stop them. Also you can see the change when a community member can question others for example why are you carrying a gun into your farm? ...people in the community will stop you or they will call the Sanctuary authorities when they found you out… Even when I am going around and small children see me, they hide their catapults* (slingshots).

CREMA members are expected to shift their views on the resources from the commons to a sense of ownership that *promote* communal benefits. For community members to report others or confront them for inappropriate use of the resources result from constant conservation sensitization, awareness creation and enforcing laws. The indication that even children within the CREMAs to understand the implications of illegal hunting, thereby resorting to hide their slingshots from authorities is a testament to change in attitude.

Identified socio-ecological themes of the CREMAS and their explanations

Seventeen different themes were developed under the three central domains. Conservation objectives had nine themes, risk management had eight themes and sustainable economic opportunities, 11 themes. Ten of the themes were exclusive to a particular central domain. However, unsustainable nature exploitation, sustainable benefits, conservation motivation and alternative livelihood were crosscutting themes appearing under all the central domains. Law enforcement, conservation sensitization and agency facilitation fell under at least two domains. The 17 themes, their descriptions and their related semantic linkages are shown in Table 2. Empty cell shows that themes is not valid under that domain.

Table 2.

Themes description and their semantic linkages to the Central Domains

Themes	Themes Description	Conservation Objective	Risk Management	Sustainable Economic Opportunities
Agency facilitation	Governmental and non-governmental agencies that facilitate socio-ecological activities in the CREMAs.	*Promotes*		*Promotes*
Alternative livelihood	Supportive programmes initiated to promote nature conservation and to improve living standards of members.	*Promotes*	*Promotes*	*Is property of*
Change in attitude	Changes that occur in community members' perception and behaviour to accept nature conservation.		*Is part of*	
Conservation baseline data	Status of unique flora and fauna species including their socio-economic importance in the CREMAs.	*Is cause of*		

Conservation motivation	The incentive to conserve an ecosystem or flora or fauna species because of their utility and amenity values.	*Is cause of*	*Promotes*	*Promotes*
Conservation sensitization	Educational and nature conservation awareness programmes carried out to make people understand conservation issues.		*Is part of*	*Promotes*
Cultural conservation	The importance attached to the conservation of nature because they have inherent cultural values to the people.	*Is part of*		
Gender considerations	Socio-economic opportunities created on gender considerations with emphasis to support women.			*Is part of*
Law enforcement	All regulations and restrictions used to curb illegal and unsustainable nature conservation threats.		*Is part of*	*Promotes*
Nature conservation	Unique flora and fauna species conserved in the CREMAs.	*Is part of*		
Peer risk management	Community members foiling illegal activities of others to reduce or eliminate nature conservation threats.		*Is part of*	
Sustainable agriculture production	Agriculture programmes that integrate quality inputs supply and soil fertility interventions with livestock rearing to improve farmers' living conditions.			*Is part of*
Sustainable benefits	All socio-ecological benefits sustainably derived from the CREMAs; including their allocation to beneficiaries.	*Produces*	*Produces*	*Produces*
Sustainable NTFPs collection	Sustainable collection and processing of NTFPs to improve CREMA members' living conditions.			*Is part of*
Tourism development	Eco-tourism activities initiated to generate sustainable alternative income for CREMA members.			*Is part of*
Unsustainable nature exploitation	All socio-economic utilization activities of nature that unsustainably degrade the resources base.	*Is cause of*	*Is cause of*	*Is cause of*
Waterbody conservation	The importance attached to the conservation of waterbodies because of its utility and amenity values.	*Is part of*		

Definitions applied to the central domains in this study

The focus of all the three CREMAs was first to protect the natural resources and then leverage on that to promote the peoples' living conditions. The key focal resources are the plants, animals and water as

well as cultural resources of the landscape. There were no major differences in participants' responses on conservation objectives, risk management and socio-economic opportunities approaches.

The following are the shared meanings derived from interviews to define the three central domains. *Conservation objective*: The purposes of setting up CREMAs to promote nature conservation and to improve living standards of community members. *Risk management*: Mechanisms use to reduce or eliminate nature conservation threats in the CREMAs. *Sustainable economic opportunities*: The application of sustainable mechanisms to exploit natural resources to improve living standards of members.

Semantic interrelationships of labelled links to the central domains

Figure 1 is a semantic interrelationships developed from participants' responses for the three central domains. Statements below and similar ones show how the semantic linkages among conservation objectives, risk management and sustainable economic opportunities relatedness were derived.

> *A1: The objective of the project is to conserve plants and animals…we are also looking to lifting up the culture of the people. Again one of the objectives is to protect the water bodies by reducing threats against the resources and promote their linkages or influences on the tourism potentials and other sustainable development potentials of the area.*

> C1: *The objectives are to protect the CREMA resources and to raise the living standards of the citizens living in the various communities. For example through the CREMA we have alternative livelihood support for members in beekeeping and Shea nuts processing.*

The core objectives of the CREMAs were to protect natural resources by managing risks that threaten the resources. The leaders then leverage on their conservation success to promote alternative livelihoods to improve living standards of members. From figure 1, conservation objective *promotes* sustainable economic opportunities. However, the attainment of sustainable economic opportunities *is associated with* how the risks that threaten the resources are managed. Risk management importance in the CREMAs rests on its direct or remote *associations with* the other two central domains. A1 and C1 views indicated above show the CREMAs strive to manage threats by reducing illegal and unsustainable utilization practices to attain conservation objectives that *promote* sustainable economic opportunities.

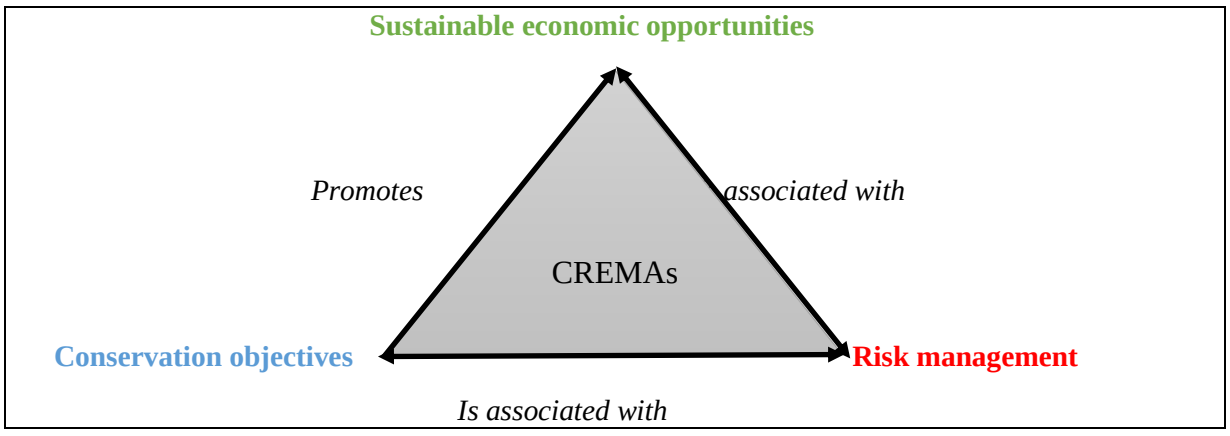

Figure 1. Semantic interrelationship among the three central domains

CREMA Conservation Objective and Its Themes Interrelationships

Conservation baseline data, nature conservation, waterbody conservation and cultural conservation were exclusive to conservation objective domain. CREMA objectives are promoted to achieve nature conservation principles that also improve living standards of community members. The conservation objectives of the WCHS, ZIWS and SKGK did not vary much as the major purpose was to conserve

unique flora and fauna species that occur on their communal lands and to leverage on them for socio-economic development.

Semantic interrelationships of conservation objective themes

The CREMA conservation objectives have both ecological and socio-economic themes. Unique flora and fauna resources found on the communal landscape are *associated with* abiotic resources like waterbodies and the cultural heritage of the people which together form *parts of* the objectives. See B3 and C3 statements.

> *C 3: The first objective is the conservation of the animals and plants… because where there are animals, the land is always fertile for farming activities… we do not only talk about animals; it is also about rivers or water, culture…The conservation of wildlife will bring the other economic benefits.*
>
> *B 3: The main objective is just to preserve the area. We want to protect both wild animals and plants. Also, we want to conserve the Black Volta which is an international River for Ghana and Burkina Faso…locally the fish and the River has cultural significance*.

The above statements and similar ones indicate the core objective of nature conservation is also *associated* with the culture of the people and waterbodies of the landscape.

The main *causal* themes that prompt the setting up of CREMAs are conservation baseline data, unsustainable nature exploitation and conservation motivation. The three *causal* themes give credence to the basis of establishing CREMAs. For example, C1 captured these essences. *'… the plants and animals or the environment was fast depleting…Surveys were conducted…. That is what brought us to the establishment of the SKGK …'.* Resources degradation is the main *cause* that prompt surveys to be conducted to get baseline data. The leaders use the established basis to formulate conservation objectives aim to *produce* sustainable benefits. Figure 2 shows conservation objectives and its themes placed logically to each other in a semantic interrelations.

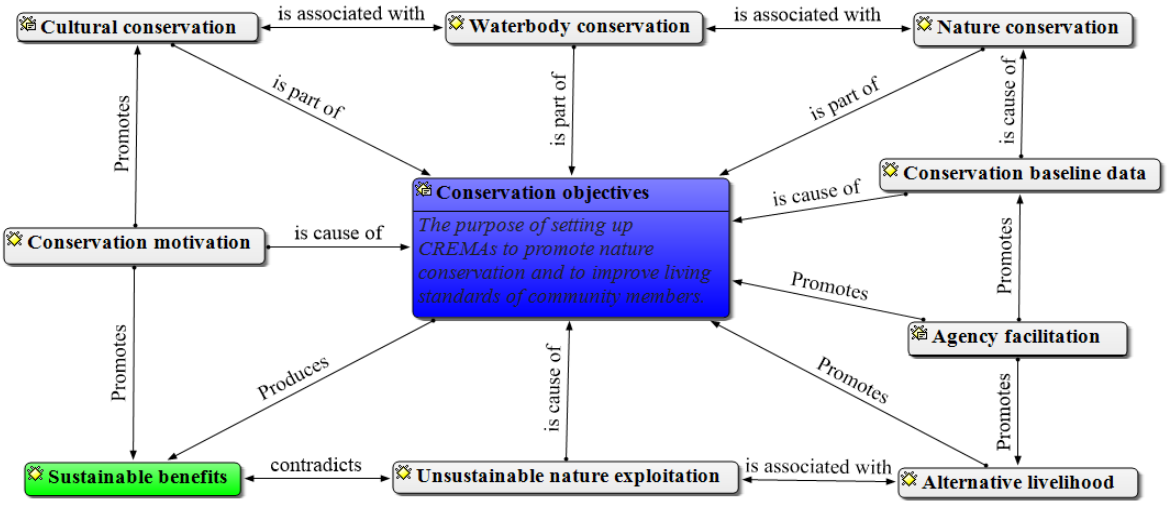

Figure 2. Conservation objective thematic interrelationships

There are themes like agency facilitation and alternative livelihood that *promote* the attainment of the CREMA objectives. External agencies mainly facilitate the initiation of socio-economic opportunities in the CREMAs. B 3's statement below shows the CREMAs tap into external agencies' support to promote socio-economic opportunities.

> *…we have realized we have tourism potential. We have the hippos,.. I have already written to the District Assembly to help tap our development potential. The Member of Parliament of the area has a copy and the UNDP/GEF programme also has a copy of our proposal*.

Risk Management and Its Themes' Interrelationships

Risk management are the mechanisms used to reduce or eliminate major conservation threats such as poaching, bushfires, illegal logging, and unsustainable agriculture in the CREMAs. Out of the eight themes that fell under this central domain, peer risk management and change in attitude were exclusive.

Semantic interrelationships of risk management themes

Figure 3 shows the semantic interrelationships of socio-ecological themes of the CREMAs.

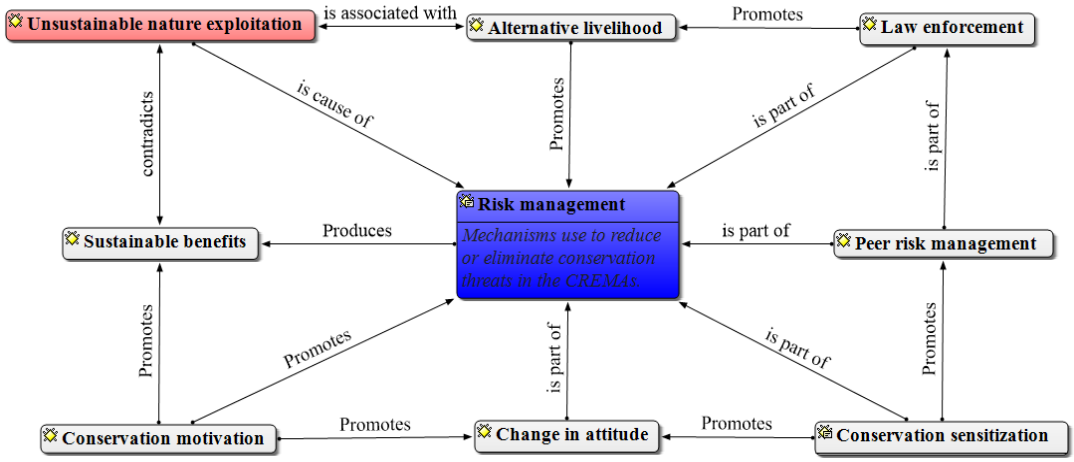

Figure 3: Risk management thematic interrelationships

The basis for risk management programmes in the CREMAs is to reduce illegal activities. The main *causal* theme under this domain is unsustainable nature exploitation. For example, A 2 mentioned; '*If it happens, I will stop my work and I believe most of the workers will stop too. That could be disastrous to our conservation objectives'*. The participant asserted to stop his work if the hippopotamus is poached; this is an indication to the conservation motivation for the species and also how its unsustainable utilization will *cause* the collapse of the conservation project.

Risk management is *promoted* by conservation motivation and alternative livelihood whereas change in attitude, law enforcement, conservation sensitization and peer risk management form *parts* of risk management activities in the semantic network.

A change to create a new sense of communal ownership and for community members to incorporate nature conservation as a legitimate land use in their farming activities *form* part of risk management. The main themes that *promote* change in attitude are conservation sensitization and conservation motivation. For example, C 2 stated: '*In the past you would see about five or six people will just come from somewhere on motorbikes and they joined those around to go hunting… It is not happening as it used to be since the CREMA was established'.* This statement infers the level of poaching has reduced from the previous levels.

Sustainable Economic Opportunities and Themes

Sustainable mechanisms are applied to exploit the natural and cultural resources of the CREMAs for socio-economic development. Sustainable economic opportunities had 11 themes and four were exclusive to the central domain. The exclusive themes were sustainable NTFPs collection, gender considerations, sustainable agriculture production and tourism development.

Semantic interrelationships of sustainable economic opportunities themes

Just as it is under risk management, unsustainable nature exploitation is the main *causal* theme under sustainable economic opportunities. That is, the aim to establishing viable nature based businesses is to *contradict* unsustainable nature exploitation practices. However, under sustainable economic

opportunities domain, alternative livelihood theme *is property of* the domain unlike under conservation objectives and risk management where it *promotes*. For example, B3 mentioned some alternative livelihood programmes that serve as sustainable economic opportunities created in ZIWS.

> *We also have small ruminants project with 48 people involved. We have beekeeping established for 40 people… We have a fast growing cassava plant supplied from Ministry of Food and Agriculture to selected farmers. The Gari-Tapioca women group process the cassava into gari (*local staple*). We also have batik-tie-dye group who make clothing for sale. We are again developing our tourism plan around the hippopotamus.*

Tourism development, sustainable agriculture production, gender considerations and sustainable NTFPs collection themes' strategies are initiated to form *parts of* sustainable economic opportunities. These programmes are pursued as major nature conservation and socio-economic development options. For example, gender considerations are enshrined in the constitutions with affirmative clauses to ensure women participation in CREMA activities with emphasis to promote their greater economic empowerment.

The rest of the themes under sustainable economic opportunities *promote* the attainment of the central domain and their connected themes. However, tourism development and sustainable agriculture *associates with* each other. That is, both sets of themes directly or remotely influence the successes of each other. For example, the number of tourists' visitations will have an impact on the kind and level of sales of food packages in the CREMA communities. In the same way, a successful implementation of eco-tourism activities would create new businesses and other job opportunities that could affect the number of people who would be engaged in agriculture. A 1's statement attest to this assertion.

> *… We have the tourism aspects which I will say is now fueling the conservation project. The money we get from tourism is used to protect the area. Through that we have employed staff such as rangers who are working for us to make sure human activities do not interfere….*

Noticeably, some community members are employed to be tour guards and rangers to respectively guide tourists and protect the conservation area against activities that are detrimental to the eco-tourism. The new employment and eco-tourism business opportunities limit the number of people who could have been farmers and also restrict areas that could have been put under cultivation; indicating the *associative* relationship between agriculture and eco-tourism. Figure 4 is the semantic networks for sustainable economic opportunities in the CREMAs.

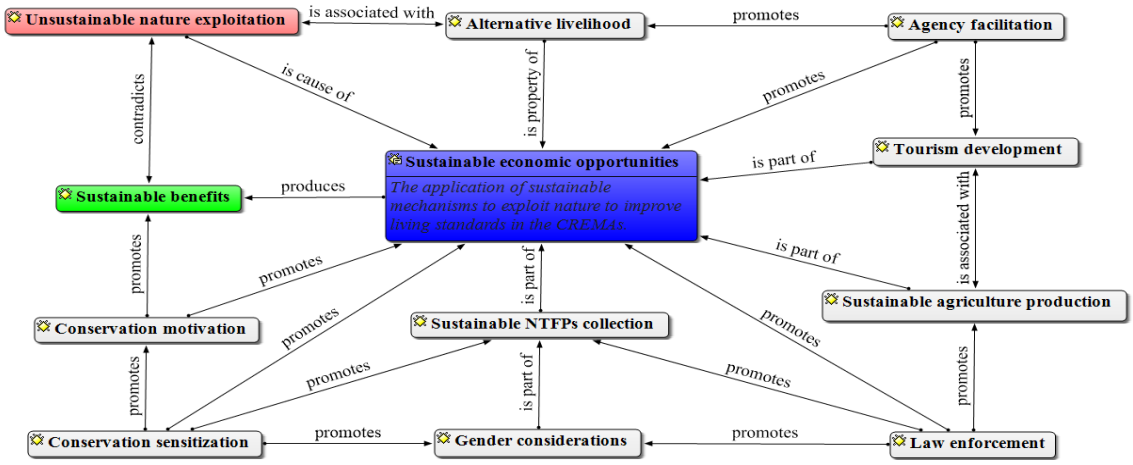

Figure 4. Sustainable economic opportunities thematic interrelationships

External agencies are really important in developing sustainable economic opportunities in the CREMAs. These agencies provide, for example, capital and machinery for processing NTFPs and they also support the communities to regenerate degraded lands or linked them to private sector investments to develop other businesses. Both governmental and non-governmental agencies *promote* sustainable

socio-economic opportunities by providing both technical and financial supports. See C 1 statement. '*With a help from the Wildlife Division, our communities have put up their Shea nut processing plants; it is left with Katiu and Kayoro although the machines have been brought'.*

Discussion and Conclusion

This study identified the CREMA landscape to have both ecological and social themes with intricate interrelationships that implementers have to understand. First, there are *causal* themes that prompt CREMA conservation activities. Nature conservation threats (Game et al., 2013) emanate from unsustainable exploitation which is the major *causal* theme, because it *contradicts* the determinations of sustainable benefits that are expected to be *produced* from implementing CREMA activities.

However, the ability to initiate successful nature conservation programmes that yield sustainable benefits depend on quality conservation baseline data that connect to the socio-economic demands of the people on the resources. To avoid collaborative nature conservation pitfalls (Agrawal & Gibson, 1999; Shafer, 2015), surveys are thus conducted first to understand the status and nature of utilization dynamic potentials to improve livelihoods (Bixler et al., 2015; Brooks et al., 2013). Such surveys are expensive to undertake and usually external agency facilitation is needed to collect quality data for CREMA establishment and its effective management.

There are also themes that form *parts* of the central domains (conservation objectives, risk management and sustainable economic opportunities) and some other related themes. An understanding of the interrelationships that exist among the themes that form *parts* of the three central domains and their related themes can better explain the socio-ecological functions (Agrawal & Gibson, 1999) of the resources. For example, the flora, fauna, waterbody and cultural resources of the CREMAs form *parts* of the conservation objectives and it is on the basis of their socio-ecological status and functions that alternative livelihood programmes which are aimed to bring effectiveness and efficiency to their utilization are initiated (Brooks et al., 2013). Some programmes like sustainable NTFPs collection, sustainable agriculture production, gender considerations and tourism development are initiated to form *parts* of sustainable economic opportunities. Implementing such programmes is contingent on available natural resources of the CREMA. However, the sustainable benefits to be derived will not thrive only on effective risk management strategies, but also on measures that encourage their just and fair allocation to the people (Agyare, 2013).

Five themes *promote* the achievement of the central domains. These encouraging themes; agency facilitation, alternative livelihood, conservation motivation, conservation sensitization and law enforcement are also crosscutting, transcending beyond one central domain. Apart from their encouraging roles in the achievement of the central domains, these themes also, under some interrelationships, encourage the achievement of other themes or they themselves are *promoted* by related themes. For example, alternative livelihood under risk management domain *promotes*, but the same theme is *promoted* by agency facilitation under conservation objective and sustainable economic opportunities. These intricate interrelationships among conservation themes to their central domains bring to the fore Lockwood et al. (2010) warning to the nature conservationists to consider addressing conservation issues at both temporal and spatial scales.

Ideas on how to achieve conservation objectives differ on the communal landscape. Shafer (2015) for example advocated for sole application of strict law enforcement whereas Geldmann et al. (2019) advised livelihood improvement programmes be combined with law enforcement. The findings of this study confirm an application of placating themes like livelihood incentives and creating awareness together with sanctions are the effective mechanisms to achieve sustainable benefits in the CREMAs.

The *promoting* themes interrelationships to both nature conservation objectives and socio-economic opportunities bring further understanding to CREMA establishment and management. For example, the CREMA leaders actively seek external agencies support to establish and implement CREMA programmes (Owusu-Ansah, 2020). Again, to secure the resource base upon which the alternative livelihood strategies are built, conservation sensitization and law enforcement strategies (Shafer, 2015)

which *promote* change in the local peoples' attitudes are initiated. The effectiveness of conservation sensitization and law enforcement strategies thrive on an understanding and appreciation of the *contradictory* effects that unsustainable exploitation have on the expected sustainable benefits to be *produced* from the CREMAs.

Additionally, law enforcement and conservation sensitization strategies *promote* sustainable economic opportunities unlike under risk management where they form *parts* of the central domain. Therefore these strategies are not only initiated to reduce or eliminate threats that degrade the resources, but also to change attitudes to secure the resource base of rural enterprises. Peer risk management was noticeably mentioned by all participants as an important indicator to effective risk management. The communities in the study sites can be characterized as having cultures of collectivism and masculinity; with a great power distance between males and females (Hofstede, 2001). The reported changes in attitudes and behaviours in the CREMAs is worth mentioning. That is, implementing CREMA activities have allowed members to now challenge unsustainable practices of others based on the expected equal and equitable collective shared benefits to members.

Gender considerations are mostly reserved for women's economic empowerment in the sustainable economic opportunities programmes. They are initiated to reduce the economic power distance relation between males and females (Hofstede, 2001). The economic power distance between males and females in the study sites is manifested in the control and access rights to natural resources; where women are disadvantaged (Laube, 2015). Ironically, women form the majority who depend on NTFPs collection and processing for livelihoods (Moore, 2008). Thus, affirmative clauses are enacted into CREMA constitutions to deliberately promote programmes that encourage women active participation in CREMA activities.

Conclusively, there are important intricate socio-ecological issues in the CREMA landscape which must be managed effectively to achieve conservation strategies planned to protect the landscape resources and also to promote rural livelihoods. The challenge to the CREMA managers is how to balance the application of both incentives and restrictive programmes (Bandoh, 2010) to fairly share sustainable benefits to members to avoid the disenchantments that occur in collaborative nature conservation (Agrawal & Gibson, 1999).

Study limitations

The study was undertaken in only three CREMAs and therefore interpretation and application of the findings to broader community conservation projects should be done with caution. Again, the findings were influenced by the experiences of the researcher in collaborative nature conservation. His experiences and those of the participants' influenced the shared meanings used to develop the semantic networks in line with Osorio-Forero et al.'s (2019) which admit experts' subjectivity in semantic networks development.

Recommendations

This study considers conservation education, law enforcement and livelihood programmes should be combined to effectively manage CREMAs unlike in the government protected areas where little livelihood incentives are provided. CREMA leaders should carefully incorporate law enforcement, conservation education with livelihood incentives to achieve sustainable nature conservation objectives.

CREMA managers have to work assiduously to change the local people attitudes towards the resources from the commons to a sense of communal ownership to promote effective risk management. 'Peer risk management' where community members challenge the unsustainable activities of others is the revolutionized attitudinal change on natural resources that managers should target in the CREMAs.

CREMA programmes that seek to promote economic empowerment of women should be pursued with finesse even as they aim to reduce economic power distance between males and females. That is to remove some cultural barriers that control women access to natural resources.

The findings of this study should be explored further because the CREMA model has the potential to enhance socio-economic opportunities to improve livelihoods of rural people by managing risks that threaten natural resource sustainability.

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Ethical approval

In the writing process of the study titled "**Applying socio-ecological perspectives semantic networks in managing community conservation areas in Ghana**", the rules of scientific, ethical and citation were followed; it was undertaken by the authors of this study that no falsification was made on the collected data, "Journal Action Qualitative & Mixed Methods Research [JAQMER] and Editor" had no responsibility for all ethical violations to be faced, and all responsibility belongs to the authors and that the study was not submitted for evaluation to any other academic publishing environment.

Ethics committee approval

The study design was approved by the Dissertation Review Board (SMC University Prospectus Review, 3/10/2017) of Swiss Management Center University.