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ENVIRONMENTAL MANAGEMENT & CONSERVATION | RESEARCH ARTICLE

Evaluation of the community resources management area (CREMA) programme around Ankasa conservation area, Ghana

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Abstract: The Community Resources Management Area (CREMA) programme was evaluated in 2016 around the Ankasa Conservation Area of Ghana by comparing the outcome of this study with that of a baseline study in 2008. Data were collected by applying specific techniques to survey mammals, reptiles, habitats and focus groups. The results indicated a reduced average species encounter rate from 10.2/km in 2008 to 3.7/km in 2016; a decreased mammals' species richness from 25 to 18; a decreased Primates and Artiodactyles encounter but increased mammalian carnivores and reptiles encounters. Mammalian species richness declined through forest conversion and wildlife poaching in the CREMAs. The programme has yet to meet expectations but communities' interests have already waned through mistrust in the implementation messages, which beguiled their interests. The benefits of CREMA are a long way to go, which should have been declared at the onset because understanding the programme should be the first step towards its successful implementation.

Subjects: Environment & Agriculture; Bioscience; Environmental Studies & Management



Bempah, Dakwa and Monney

ABOUT THE AUTHORS

Kwaku Brako Dakwa We have multidisciplinary research interests across conservation, ecology, breeding and human dimension in wildlife management. Dr K. B. Dakwa and Mr G. Bempah are currently conducting research on the behaviour and population ecology of the common hippopotamus (*Hippopotamus amphibious*) for the enhancement of effective planning and action for a long-term conservation of the vulnerable hippopotamus, which originally lost its habitat through inundation by the construction of a dam over the Black Volta River to generate electricity. Dr Dakwa is also continuing his long-term ecological studies at the Mole National Park, Ghana on the large herbivorous mammals. Professor K. A. Monney is also busy with snail breeding to help local people source alternative livelihood. Our research reported in this paper relates to our projects as it provides information on how to collaborate with the local people to foster effective conservation in our reserves, in particular tourism promotion and livelihood provision.

PUBLIC INTEREST STATEMENT

Ghana has been no exception to the global response of combating biodiversity loss by setting aside wilderness areas. From their inception, these Protected Areas (PAs) were managed under the protectionist style in which human settlements, having access to the resources in the PAs, were prohibited. This has usually bred hostility among communities and PA managers.

A new type of institutional arrangement which integrates biodiversity protection and security of livelihoods has been applied at Ankasa Conservation Area in Ghana since 2003 through the Community Resource Management Area (CREMA) concept.

The study investigated the presence and distribution of mammals and reptiles and compared it to a baseline study done in 2008. It was found out that there is a decreased presence of primates and antelopes but an increased presence of reptiles and mammalian carnivores.

Acceptance of the CREMA concept has not been grasped by the inhabitants.

| **Keywords:** Conservation; local people; protected area; collaboration

1. Introduction

Biodiversity loss, as a global concern, has led to various responses including establishment of national parks modelled under the protectionist lifestyle where the system of governance falls under category II of IUCN classification (McKinnon & Thorsell, 1986). This is usually management of natural resources with complete exclusion of people who live next to the protected areas (PAs) (Baresford et al., 2011). In this stance, the needs and rights of the local people are ignored (Hackel, 1999; Stevens, 1997), generating hostility among communities and PA managers (Dakwa, Monney, & Attuquayefio, 2016; Ghimire & Pimbert, 1997; Monney, Dakwa, & Wiafe, 2010; Stoner et al., 2006; Western, Russell, & Cuthill, 2009). However, it has been realized that there is the need to gain support and co-operation from the local communities around PAs (Dakwa, 2016a) for more people-centred conservation methods, which incorporate integrated conservation and development projects through sustainable flow of benefits to local people to replace strictly PAs that are distanced from local people (Brown, 2003; McShane & Wells, 2004; Pearce, 2005). This reflects a situation where all stakeholders involved in wildlife management achieve gains (McShane & Wells, 2004; Pearce, 2005) and thus communities that depend on natural resources as source of subsistence livelihoods receive benefits while nature is conserved (Chopra, Leemans, Kumar, & Simons, 2005; Li, 2002). It has been suggested by Getz et al. (1990) and Shackleton (2009) that the enactment of clear policies and legislations are needed to clarify how natural resources should be managed and how benefits generated should be redistributed to all stakeholders. Therefore, local communities should be recognized to play essential roles in natural resources stewardship; this makes their involvement in conservation strategies necessary (Kreuter & Simmons, 1994; Ostrom, 2000; Dudley, 2008).

The coalescing of development and conservation gave rise to community-based natural resource management; a participatory model which provides the opportunity for conservation to produce tangible benefits for rural development (Brechin, Wilshusen, Fortwangler, & West, 2002; Munasinghe & McNeely, 1994; Steiner & Rihoy, 1995; Wells, Brandon, & Hannah, 1992; Western & Wright, 1994). The Communal Areas Management Programme for indigenous Resources was introduced in Zimbabwe and has documented the progress of this approach in promoting nature conservation in Africa (Murphree, 2004). Ghana has also introduced community-based conservation programmes such as the Community Resource Management Areas (CREMAs) and Community Based Tourism ventures to gain local support for conservation through participatory management and benefit-sharing. The CREMA was conceived in 2000 and since its inception in 2003, as a pilot programme around Ankasa Conservation Area (ACA), no evaluation has been undertaken. Therefore, it is unknown whether the CREMAs are successful in creating the conducive environment for wildlife to thrive outside PAs and whether they have addressed the needs of the local people to allow for sustained development and conservation. Thus, the rationale of this study. We investigated the abundance, species richness, distribution and poaching records of mammals and reptiles in two CREMAs around ACA over 6 months covering both wet and dry seasons in 2016 and compared the findings with existing baseline report of 2008 as the basis for the evaluation of the CREMAs around ACA. We also organized focus group interviews, which sought for the benefits the local people have obtained so far, as well as their attitudes and support for this new trend of conservation method.

1.1. Study area

The ACA (Figure 1) is located in the Western Region of Ghana ($5^{\circ} 09' - 5^{\circ} 25'N$; $2^{\circ} 29' - 2^{\circ} 45'W$) within the administrative rule of the Jomoro District and is contiguous with the Draw River Forest Reserve. About 60% of the district's labour force is involved in agriculture (Ghana Statistical Service, 2010) and most inhabitants settle within 5–7 km to the boundary of the ACA for farming. The ACA and surroundings experience a bimodal rainfall pattern from April to July and then from September to November. Monthly temperatures are typical of tropical lowland forest and range from 24 to 28°C. Relative humidity is high throughout the year ranging from about 90% in the night to about 75% early afternoon (WD, 2010).

Figure 1. Map showing CREMAs around Ankasa conservation area.



The ACA is largely a pristine forest with about 38 species of medium to large-sized mammals such as the forest elephant (*Loxodonta africana cyclotis*), bongo (*Tragelaphus eurycerus*) and leopard (*Panthera pardus*).

This study is based on a case study of two of the nine CREMAs around the ACA; namely: Ghana Nungua Cocotown (GNCT) CREMA and Navrongo Tweakor (NVT) CREMA (Figure 1). ACA has about nine CREMAs within 5–7 km radius from its boundaries. Governance of the CREMA is mediated by local communities led by CREMA Executive Committees (CECs) and shaped by the bye-laws of the District Assembly.

1.2. Data collection

Primary data were collected from the field by applying wildlife specific techniques on the field for mammal, reptile and habitat surveys and employing social tools in focus group survey. Secondary baseline information about the CREMA was obtained from previous research reports. For consistency and comparison, the protocols and methods used for data collection in the 2008 study were adopted in this study.

1.2.1. Mammal and reptile survey

Four 9-km transects were laid in each of the two CREMAs making altogether a 36-km transect, which was surveyed in each CREMA. The transects were spaced at least 500 m apart. Each transect traversed most vegetation and farm types typical of the CREMAs and it was assumed that transects were long enough to cover animals with large territories and home ranges. The research relied on Visual Encounter

Survey to collect data on the abundance and distribution of mammals and reptiles (Dakwa, 2016b; Heyer, Donnelly, McDiarmid, Hayek, & Foster, 1994) making use of a Bushnell H₂O Proof Prism Binocular 10 × 42-mm (Bushnell Corp, Overland, KA, USA) to view the animals when it was necessary. By walking the transects during both wet and dry seasons, in the morning (6:30–10:30 GMT) and evening and night (16:00–20:00GMT) when the animals were feeding, mammals and reptiles encountered were counted, identified and recorded. The perpendicular distance of an animal's location from the transect at both sides of it were also recorded. Extra effort was employed by scanning through the vegetation for 15–20 min at every 200 m point, and in all the habitat types traversed by a transect, to encounter and count mammals and reptiles. Headlamps and long-range flashlights were used to illuminate the transects and adjacent vegetation to encounter nocturnal animals. The use of a field guide (Kingdon, 2004) and the presence of two local experts helped in the identification of the animals sighted. A hand-held Garmin GPS map 60 (All Garmin Ltd., Olathe, KA, USA) was used to record the locations of the animals sighted.

1.2.2. *Habitat survey*

A 200 × 200 m plot was demarcated by a laser range finder (Yardage Pro Compact 800, Bushnell factory, Overland, KA, USA) and yellow ribbons marked each habitat type along each transect at every 500 m point. Habitat survey involved critical observation of vegetation and anthropogenic footprints in the habitat. Tree and shrub species present were recorded to determine the dominant plant species and its frequency of occurrence in order to classify the vegetation.

1.2.3. *Focus group interview*

This was used to collect data on community members' perceptions, opinion, knowledge and attitudes regarding the functioning and sustainability of the CREMAs. The basis for the focal group interview was to find out if community members strongly supported the establishment of the CREMA as a wildlife conservation programme and whether they perceived the CREMA agenda to be progressive. Primary data were sourced by developing an interview guide for focus group interviews in the CREMA communities. The focus group interview method was preferred to other options because it reduced fear, and therefore lies, from the interviewees, and also all members were expected to present their ideas for each question that possibly provided multiple answers to a single question. Open-ended questions and a conversational style interviews were conducted to minimize researcher bias. Data were collected in eight CREMA communities. Two focus group interviews were held in each of the eight communities, namely, Ghana Nungua, Cocotown, Domeabra, Fawoman (GNCT CREMA), Navrongo, Ebullekpole, Tweakor 1 and Tweakor 2 (NVT CREMA) and therefore a total of 16 focus groups were interviewed. The number of participants for the focus group in each community was 12, randomly selected from land users, opinion leaders and CREMA executives. In all 192 people, representing 24% were sampled from estimated population of 800 people in the eight CREMA communities. The focus group interviews were held in local languages (Akan, Aiyine and Nzema), with all community entry protocols being observed. A question was posed by one member of the research team and this was answered by each participant, while other members of the research team recorded answers. There were 20 questions, which were well designed to effectively evaluate the activities, progress and sustainability of the CREMA programme.

1.2.4. *Previous research*

The baseline study (Oduro, Danquah, & Ansah, 2008) to be compared with this current study was under the auspices of CARE International (CARE) with major cooperation from the Ghana Forestry Commission. It was a study that provided useful information about the area including species composition, abundance and richness, hunting signs and habitat types, which were also the focus of this study. However, the previous study concentrated on mammals and reptiles and missed the opportunity to provide baseline data for other faunal taxa, notably and birds, which play a significant role for indicating the health of the environment. Therefore, birds were left out of this study as there is no baseline data for comparing with data obtained from this study.

1.3. Data analysis

Data collected from the mammal and reptile survey, habitat survey and focus group interview were stored in Microsoft Excel 2010 and exported to the Paleontological statistics software package for education and data analysis, PAST version 3.0 (Hammer, Harper, & Ryan, 2001) for analysis. Relative abundance and densities of the animals in question were calculated by using the DISTANCE software.

1.4. Mammals and reptiles

The relative abundances (RA), frequencies of occurrence (FOO) and encounter rates (ER) of the mammals and reptiles on the transects were calculated by the following formulae:

$$RA = (\text{Number of individuals of a species} / \text{sum total of all species}) * 100 \quad (1)$$

$$FOO = (\text{Number of times a particular species occurs} / \text{total number of transects}) \quad (2)$$

$$ER = (\text{Number of individuals of a species encountered} / \text{sum total of distance covered}) \quad (3)$$

The Mann-Whitney U (Mann & Whitney, 1947; Zar, 1998) and Kruskal-Wallis H tests (Spurrier, 2003), which are free of assumptions of normality, were performed to compare groups' median scores. Mann-Whitney was performed to compare the mammal and reptile abundances between the two CREMAs studied, between seasons, between the encounter rates from the 2008 base line study and current data of 2016 and between hunting signs estimated for the 2008 study and current study. Kruskal-Wallis was performed to compare data of mammal and reptile abundances for the various habitat types. We evaluated species' diversities by calculating the Shannon-Wiener diversity index (Magurran, 1988), evenness (the variation in the abundance of individuals per species within a community) and dominance (proportional importance of the most abundant species (Magurran, 1988) for each habitat type.

1.5. Habitat type

Ground cover and frequency of dominant trees/shrubs were calculated for each habitat type, Ground cover was calculated as the percentage of ground surface covered by vegetation and frequency as the number of plots in which the species occurred.

1.6. Focus group interview

Data on the interview were transferred to SPSS version 21 for analysis. A *t*-test was used to determine whether the differences in response between i) the two groups in each community and ii) GNCT CREMA and NVT CREMA communities for each of the 20 questions was significant or not.

2. Results

2.1. Species composition, abundance and diversity

In the Ghana Nungua-Cocotown (GNCT) CREMA, 253 individual animals comprising 19 species of mammals and four species of reptiles were recorded during the wet season, while 120 individuals comprising 13 species of mammals and five species of reptiles were recorded in the dry season (Table 1). In the Navrongo Tweakor (NVT) CREMA, 251 individuals of 17 species of mammals and four species of reptiles were recorded in the wet season (Table 2) and 139 individuals of 17 species of mammals and three species of reptiles recorded in the dry season (Table 2). Of all the mammals recorded in both CREMAs, rodents constituted the highest composition of 37.5%, followed by artiodactyles, 20.8%, primates 16.6% and carnivores, 12.5%. Chiropterans, pholidotes and hyracoides constituted just 4.2% each. Three reptilian species were lizards and two were snakes. *Gravithii* was the only species unique to the NVT CREMA.

Table 1. Abundance, encounter rate and frequency of occurrence during the wet season in the GNCT CREMA. (Where an animal is sighted in both seasons, dry season's results are in brackets.)

Species		Season		Relative abundance	Encounter rate per km)	Percentage frequency of occurrence
		Wet	Dry			
Mammal	<i>Anomalurus peli</i>	✓		0.4	0.1	25
	<i>Atherurus africanus</i>	✓	✓	2.8 (1.7)	0.2 (0.1)	100 (50)
	<i>Cephalophus maxwelli</i>	✓		0.8	0.1	25
	<i>Cephalophus niger</i>	✓	✓	2.8 (0.8)	0.2 (0.1)	50 (25)
	<i>Cercocebus torquatus</i>	✓		0.8	0.1	25
	<i>Cercopithecus lowei</i>	✓	✓	2.0 (0.8)	0.2 (0.1)	25 (25)
	<i>Civettictis civetta</i>	✓	✓	0.8 (1.7)	0.1 (0.1)	50 (25)
	<i>Cricetomys gambianus</i>	✓	✓	5.1 (6.7)	0.4 (0.3)	100 (75)
	<i>Dendrohyrax dorsalis</i>	✓		0.8	0.1	50
	<i>Eidolon helvum</i>	✓	✓	25.7(17.5)	2.0 (0.7)	50 (75)
	<i>Funisciurus pyrropus</i>	✓	✓	9.1 (11.7)	0.7 (0.4)	100 (100)
	<i>Galagoides demidovii</i>	✓	✓	0.4 (2.5)	0.1 (0.1)	25 (50)
	<i>Neotragus pygmaeus</i>	✓		0.4	0.1	25
	<i>Perodicticus potto</i>	✓		1.6	0.1	75
	<i>Phataginus tricuspis</i>	✓		1.6	0.1	25
	<i>Protoxerus stangeri</i>		✓	0.8	0.1	25
	<i>Tragelaphus scriptus</i>	✓	✓	19 (16.7)	1.5 (0.6)	100 (75)
	<i>Thryonomys swinderianus</i>	✓	✓	8.7 (15.8)	0.7 (0.6)	100 (100)
	<i>Paraxerus poensis</i>	✓	✓	2.4 (0.8)	0.2 (0.1)	100 (25)
	<i>Xerus erythropus</i>	✓	✓	6.7 (7.5)	0.5 (0.3)	100 (100)
Reptile	<i>Trachylepis polytropis</i>	✓	✓	2.0 (3.3)	0.2 (0.1)	50 (50)
	<i>Agama agama</i>	✓	✓	2.8 (7.5)	0.2 (0.3)	75 (75)
	<i>Dendroaspis viridis</i>	✓	✓	0.4 (2.5)	0.0 (0.1)	25 (50)
	<i>Naja melaleuca</i>		✓	0.8	0.1	25
	<i>Varanus niloticus</i>	✓	✓	3.2 (0.8)	0.3 (0.1)	100 (25)

Table 2. Abundance, encounter rate and frequency of occurrence during the wet season in the NVT CREMA. (Where an animal is sighted in both seasons, dry season's results are in bracket.)

Species	Season		Relative abundance	Encounter rate per km)	Percentage frequency of occurrence	
	Wet	Dry				
Mammal	<i>Atherurus africanus</i>	✓	✓	0.1 (2.2)	0.4 (0.1)	80 (40)
	<i>Atilax paludinosus</i>		✓	3.6	0.1	60
	<i>Cephalophus dorsalis</i>	✓		1.6	0.1	40
	<i>Cephalophus maxwelli</i>	✓		2.4	0.2	60
	<i>Cephalophus niger</i>	✓	✓	10.4 (3.6)	0.7 (0.1)	100 (80)
	<i>Civettictis civetta</i>	✓	✓	1.2 (4.3)	0.1 (0.2)	60 (60)
	<i>Cricetomys gambianus</i>	✓	✓	13.9 (5)	0.9 (0.2)	100 (60)
	<i>Crossarchus obscurus</i>	✓	✓	3.2 (2.9)	0.2 (0.1)	60 (60)
	<i>Dendrohyrax dorsalis</i>	✓	✓	1.2 (0.7)	0.1 (0.1)	40 (20)
	<i>Eidolon helvum</i>		✓	10.8	0.4	20
	<i>Funisciurus pyrropus</i>	✓	✓	10 (15.8)	0.6 (0.6)	100 (100)
	<i>Galagoides demidovii</i>	✓	✓	0.4 (1.4)	0.1 (0.1)	20 (40)
	<i>Gravia smithii</i>		✓	0.7	0.1	20
	<i>Heliosciurus rufobrachium</i>		✓	2.2	0.1	40
	<i>Neotragus pygmaeus</i>		✓	0.7	0.1	20
	<i>Perodicticus potto</i>	✓		2.4	0.2	80
	<i>Phataginus tricuspis</i>	✓		3.2	0.2	80
	<i>Thryonomys swinderianus</i>	✓	✓	10 (16.5)	0.6 (0.6)	100 (100)
	<i>Tragelaphus scriptus</i>	✓	✓	18.3 (5.8)	1.2 (0.2)	100 (60)
	<i>Protoxerus stangeri</i>	✓	✓	1.2 (0.7)	0.1 (0.1)	20 (20)
<i>Paraxerus poensis</i>	✓	✓	1.6 (2.9)	0.1 (0.1)	40 (80)	
<i>Xerus erythropus</i>	✓	✓	10 (14.4)	0.6 (0.5)	100 (100)	
Reptile	<i>Trachylepis polytropis</i>	✓	✓	0.8 (1.4)	0.1 (0.1)	20 (20)
	<i>Naja melaleuca</i>	✓		0.4	0.1	20
	<i>Varanus niloticus</i>	✓		1.6	0.1	60
	<i>Dendroaspis viridis</i>	✓	✓	0.4 (0.7)	0.1 (0.1)	20 (20)
	<i>Agama agama</i>	✓	✓	0.4 (3.6)	0.1 (0.1)	20 (60)

In the GNCT CREMA, Cocotown community had the highest species abundance (40) and highest species richness (12), with Domeabra community having the least species richness (8) and abundance (18). In the NVT CREMA, Azambule community had the highest abundance of species (42) as well as richness (15), with Navrongo community recording the least number of species (8). Tweakor I community recorded the least species abundance (18).

Among the species of mammals and reptiles recorded in the GNCT CREMA, the relative abundance ranged from 0.4 to 25.7 with *Eidolon helvum* with the highest of 25.7 and 17.5 in the wet and dry seasons, respectively (Table 1). *Tragelaphus scriptus* followed with 19.0 in the wet season and 16.7 in the dry season (Table 1). In the NVT CREMA, the relative abundance ranged from 0.8 to 18.3 with *T. scriptus* reaching the highest in the wet season followed by *Cricetomys eminis* with 13.9. In the dry season, *Thryonomys swinderianus* reached the highest of 16.5 followed by *Funisciurus pyrropus* with 15.8 (Table 2). Seven species of mammals, namely, *Phataginus tricuspis*, *Cephalophus dorsalis*, *C. maxwelli*, *Cercocebus torquatus*, *Dendrohyrax dorsalis*, *Anomalurus peli*, *Perodicticus potto* and *Neotragus pygmaeus*, which were recorded in the wet season, were not observed in the dry season. Similarly, five species of mammals, namely, *Atilax paludinosus*, *E. helvum*, *G. smithii*, *Heliosciurus rufobrachium* and *Protoxerus stangerii*, which were recorded in the dry season were not observed in the wet season. Mann-Whitney test indicated that the difference in seasonal abundance of mammals and reptiles in the CREMAs were not significant ($U = 307$, $p > 0.05$). This supports the hypothesis that seasonal differences do not affect the abundance of mammals and reptiles in the CREMAs. Mann-Whitney test also indicated that the differences in mammal and reptiles abundance between the two CREMAs were not significant ($U = 316$, $p > 0.05$). This supports the hypothesis that the abundances of mammals and reptiles are not different in the two CREMAs. Seasonal differences in mammals and reptiles abundance were significant for the various habitat types (Kruskal-Wallis Test: $H = 43.04$, $p < 0.01$). This rejects the hypothesis that the abundances of mammals and reptiles in the various habitat types are not different. The mean (\pm SE) abundance of mammals was highest in the forest, reaching 41.2 ± 9.6 , followed by cocoa farm with 34.8 ± 4.9 , and the least of 0.8 ± 1.0 in the rubber plantation. No species was recorded in the oil palm, coconut and rubber plantations.

The differences in Shannon-Wiener diversity indices between wet and dry seasons and between the two CREMAs studied were not significant ($p > 0.05$). The diversity index was highest in the forest ($H' = 2.457$), followed by cocoa farm ($H' = 2.253$), farmland ($H' = 1.503$), bush ($H' = 1.352$), rubber plantation ($H' = 0.693$), bamboo plantation ($H' = 0.363$), oil palm plantation ($H' = 0$) and coconut plantation ($H' = 0$) but the differences were not significant ($p > 0.05$). Shannon's evenness ranged from 0 to 0.97, with farmland reaching the highest and bamboo and rubber plantations, the lowest, but the differences were also not significant between seasons, between CREMAs and among the habitat types.

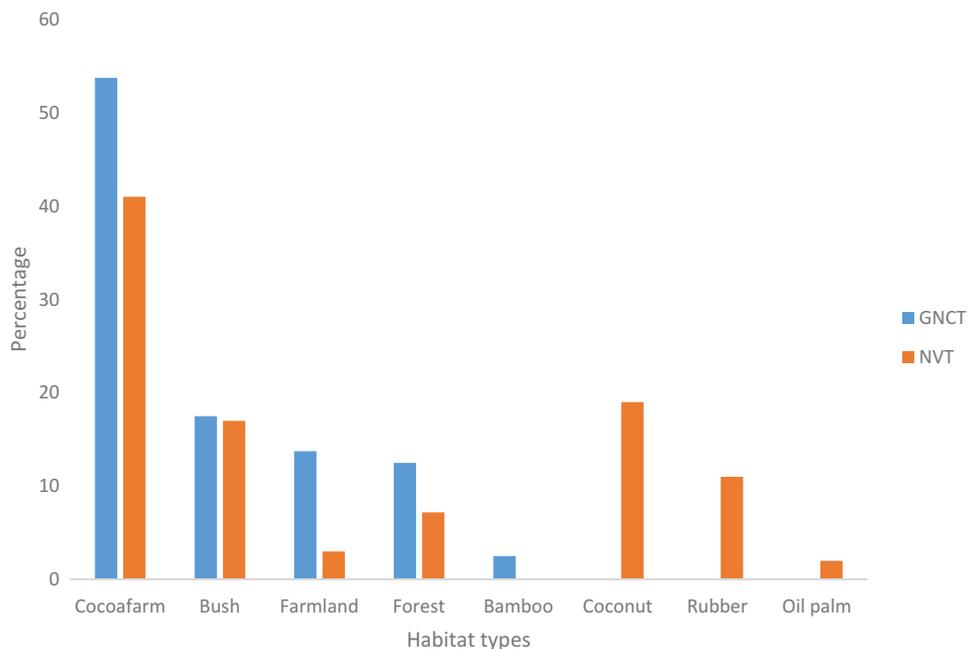
2.2. Availability of habitat types in the cremas

In the GNCT CREMA, cocoa farm reached the highest availability of 53.75% followed by bush with 17.5%, farmland and forest patches with 13.75 and 12.5%, respectively (Figure 2). The bamboo stands recorded the lowest availability of 2.5% (Figure 2). In the NVT CREMA, cocoa farm reached the highest availability of 41% followed by coconut with 19% and bush, rubber plantation and forest patches with 17, 11 and 7.2%, respectively (Figure 2). The farmland and oil palm recorded the lowest with 3 and 2%, respectively (Figure 2).

2.3. Hunting signs in the cremas

Seasonal variations in hunting signs were not significant at both GNCT CREMA ($U = 7$, $p > 0.05$) and NVT CREMA ($U = 5.5$, $p > 0.05$). In the GNCT CREMA, wire snares had the highest encounter rate (0.47/km); followed by empty cartridges, 0.09/km; and hunters observed, 0.06/km as the least. In the NVT CREMA, wire snares had the highest encounter rate of 0.83/km during the wet season; followed by empty cartridge, 0.30/km; hunters observed, 0.15/km; and jack trap the least encounter of 0.03/km.

Figure 2. Habitat availability in the study area for the post CREMA (2016) survey.



2.4. Comparison of results of pre-CREMA (2008) and post-CREMA (2016) studies

The average species encounter rate during the 2008 baseline study was 10.2/km but this had decreased to 3.7/km in 2016. There was a significant difference in the number of animals encountered between 2008 and 2016 ($U = 0$; $p < 0.05$) and therefore the hypothesis that the number of animals encountered in 2008 and that of 2016 is not different is rejected.

In both CREMAs, 25 different species of mammals were recorded during the 2008 study as compared to 18 species in this study (2016). In 2016, more species in the order Carnivora were encountered than in 2008 for both CREMAs but more species in the order Primates and Artiodactyla were encountered in 2008 than in 2016 (Table 3). However, the number of species of reptiles encountered was higher in 2016 than 2008 for both CREMAs. In 2008, many mammals including Maxwell’s duiker (*Cephalophus maxwelli*), Marsh mongoose (*Atilax paludinosus*), Black and white colobus (*Colobus vellerosus*), Bushbaby (*Galagoides demidovii*), Genet cat (*Genetta tigrina pardina*), Palm civet (*Nandinia binotata*), Tree pangolin (*Phataginus tricuspis*), Red river hog (*Potamochoerus porcus*), Cusimanse mongoose (*Crossarchus obscurus*), Tree hyrax (*Dendrohyrax dorsalis*), Bosman’s potto (*Perodicticus potto*), Royal antelope (*Neotragus pygmaeus*), Pel’s

Table 3. Mammalian species richness in the CREMAs for 2008 and 2016

Order	GNCT CREMA		NVT CREMA	
	2008	2016	2008	2016
Rodentia	7	7	6	8
Primates	4	2	0	1
Artiodactyla	6	2	2	3
Carnivora	5	1	6	3
Hyracoidea	1	0	0	1
Chiroptera	0	1	0	1
Pholidota	1	0	1	0
Squamata(reptile)	1	5	1	4

anomalure (*Anomalurus peli*) and White collared Mangabey (*Cercocebus torquatus*) were recorded, but these were not sighted in the 2016 study. On the other hand, Lowe's monkey (*Cercopithecus lowei*), Straw coloured fruit bat (*Eidolon helvum*) and Green bush squirrel (*Paraxerus poensis*) were recorded in 2016 but not in 2008 in both seasons. The encounter rate of hunting signs in 2008 was significantly higher than 2016 ($U = 0$; $p < 0.05$), implying that hunting was reduced in 2016. Over the period between 2008 and 2016, some parts of the forest in the CREMAs had been converted to agricultural lands. For instance, in the GNCT CREMA, forest availability reduced from 18% in 2008 to 12.5% in 2016, while cocoa farm increased from 50.5% in 2008 to 53.75% in 2016. Also in the NVT CREMA, forest availability reduced from 8.7% in 2008 to 7.0% in 2016, while cocoa farm increased from 34% in 2008 to 41% in 2016. There has been a strong emergence of rubber plantation in 2016, which received less consideration by farmers before the CREMA in 2009.

2.5. Focus group interview

For 11 out of the 20 questions, responses between either the two groups in a community or the two CREMA communities were significant ($p < 0.05$). For nine questions, responses were not significant both between the two groups in a community and the two CREMAs ($p > 0.05$). This implies that respondents' evaluations of the CREMA programme by nine questions were consistent and fair while they were divided in respect of their responses to the other 11 questions. A significant majority (75%; $p < 0.05$) of the community members fully supported the programme during the initial stages but later their interest waned and the participation of the majority in CREMA activities also waned. One member said, "I thought the CREMA is dysfunctional now. We don't see anything going on again", and another said, "one gets involved in a programme which is beneficial". The respondents reported poor attendance at CREMA related meetings (64%; $p < 0.05$), with some respondent saying "For some time now we have not done any work or organised any meeting because we don't have the resources to do so. So we are waiting on the Game and Wildlife to come and assist us" and "When we call for a meeting at the community level, the people do not come". The results identified nine factors as reasons for loss of interest in the CREMA programme in the area. These are: (1) expectations had not been met, (2) they did not understand the CREMA concept very well, (3) initial beneficial opportunities were not sustainable, (4) they were frustrated by the poaching and encroachment in the CREMA, (5) volunteers to the CREMA program thought they had sacrificed for nothing, (6) initial benefits favoured the elite in the community, (7) many promises remained unfulfilled, (8) poor supervision of the CREMA programme and (9) the programme was initially over-reliant on the CREMA proponents than the community members who are the main beneficiaries.

3. Discussion

According to Songorwa (1999), communities could be enticed by promises of socio-economic benefits to accept and join collaboration for wildlife conservation. As long as there is clear evidence of the fulfilment of these promises, community members could be seen to have embraced the conservation without doubt. On the other hand, if these promises would remain unfulfilled and expectations have not been met, then communities could hold strong mistrust for the conservation programme and lose interest in the entire programme (Dakwa, 2016a; Songorwa, 1999). Unfortunately, the latter seems to be rather true about the CREMA programme around the ACA. The CREMA communities admitted they received some benefits to their households including soap making, pepper powder production, fish farming and honey-production, which are all alternative livelihood activities that marginally improved their household nutrition and income. Yet, none of these activities is still functioning, as at the time of this study in 2016. Other promises, including poultry and sheep rearing, have never been fulfilled by the CREMA programme implementers. Moreso, the communities' project priorities, such as the construction of a footbridge, were never considered.

CREMAs were identified to be a sustainable land use option to secure community resources and judicious use in few communities near PAs (Newmark, Leonard, Sariko, & Gamasa, 1993). However, the whole CREMA programme around ACA was not properly understood from the onset. Indeed,

while majority of the members of the CREMA have no idea in what is enshrined in their constitution and bye-laws, some of them have distanced themselves from the CREMA and have labelled the CREMA executive members as the owners of the CREMA. Success indicators of the CREMAs include but importantly, the availability of sustainable populations of game that could benefit the communities directly for protein needs and indirectly through livelihood ventures such as tourism. The CREMAs have a long way towards this goal but the communities did not know this from the onset.

The decline in species encounter rate between 2008 and 2016 is even more frustrating. Many factors account for this. For example, while the results indicated that wildlife utilized the forest zones more than other habitat types of the CREMAs around ACA, the availability of forests in the CREMAs has reduced through conversion to plantations by farmers. The combined availability of forest and bush, which are good habitats for wildlife reduced from about 30% in 2008 to about 23% in 2016; and forest alone from about 12 to 6%, respectively. Cocoa farm, which is not a good habitat for large mammals, increased its availability by about 11% in 2016. Thus, a total habitat loss of about 7% accounted for the mammalian species decline observed in this survey. Other possible causes of species decline are predation and poaching as the results indicated that poaching of wildlife had been extended to the CREMAs. The survey findings indicated the diversity of the large mammals had reduced and this suggests that though the hunting pressure that occurred in 2016 was relatively low, large mammals were targeted. Therefore, considering the type of mammals that have disappeared in the 2016 survey compared to the 2008 baseline report, poaching and forest conversion are more likely the causes of mammalian species decline. The mammalian carnivores encountered, in particular, cannot hunt the large mammals encountered, being too small in size. We suggest that wildlife decline in the CREMAs studied could be attributed partly to a condition that has failed to create incentives to the local people as reported elsewhere by Musambachime (2012), and so they have started poaching wildlife and disturbing wildlife habitats.

Given the recurring nature of conflict between conservation and local communities, it is critical that conservationists better understand local views with respect to wildlife and PAs, particularly the cost of living next to a wildlife PA, the sacrifices of accepting the establishment of a PA and their readiness to tolerate raid emergencies (Dakwa, 2016a). Thus, conservation has placed a huge burden on local communities, which can be alleviated by incorporating development goals into conservation practices for them (Hulme & Murphree, 2001). These were the initial efforts at the CREMAs around ACA, but which folded up soon, according to the results of our study. For the CREMA programme to succeed around ACA, the beneficiary communities need a sustainable support from NGOs to acquire alternative sources of livelihood.

4. Conclusion

Thirteen years since its inception around ACA, the first-ever CREMA programme in Ghana has yet to meet expectations as communities' interests have waned through mistrust in the implementation messages, which beguiled their interests. It is clear that the benefits of CREMA to communities in terms of wildlife production has a long way to go. This should have been declared at the onset. The communities' understanding of the CREMA programme would be the first step towards a successful implementation of the programme. Without these, their expectations are likely to be either high or early as observed in this study. As most reserves in Ghana are expected to introduce community-based programmes to gain local support for conservation through participatory management, stewardship promotion and benefit-sharing, we hope that implementers of other CREMAs would learn a lesson from this. However, we express the need for interventions from NGOs to reinvigorate the ACA CREMA communities with support by providing sources of subsistence livelihoods while the ACA and the surrounding CREMAs are conserved. This will eventually make the CREMAs a success.

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