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Article

Assessing the Management Effectiveness of Three Protected Areas in Ghana

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Abstract

Assessments of management effectiveness of protected areas offer vital information about threats and management issues at the protected area. However, these assessments are frequently conducted mainly at the internal management level, without input from the local communities that implicitly influence the resources of the protected areas. The aim of this study was to assess the effectiveness of three protected areas in Ghana—Kogyae Strict Nature Reserve, Gbele Resource Reserve, and Kalakpa Resource Reserve—using the Rapid Assessment and Prioritisation of Protected Areas Management assessment tool. The study included workshops with park managers and representatives from local communities, district assemblies, and the Environmental Protection Agency. Poaching, settlements, agricultural encroachment, poverty in nearby communities, and bush fires were identified as common pressures to all the assessed protected areas. The degree of these pressures was influenced by little or no funding, poor community relations, lack of staff and research, and natural resource inventories in the protected areas. Our study highlights the priority of remedial actions that are urgently needed to preserve the protected area resources.

Keywords: biodiversity conservation, bushfire, logging, poaching, settlement, stakeholders, wildlife management

INTRODUCTION

Protected areas (PAs) are key sites where conscious efforts are made for the preservation of wildlife and the sustainability of ecosystems (Craigie et al. 2010; Stolton et al. 2015; Lindsey et al. 2017). However, the state of biodiversity is deteriorating globally, compromised by anthropogenic threats that have increased in recent decades (Pereira et al. 2012). The effectiveness of wildlife protection varies greatly across PAs, ranging from effective to almost entirely ineffective with poor or a complete lack of any protective measures (Craigie et al. 2010; Leverington et al. 2010).

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Currently, many West African countries are affected by the same kinds of land-use development, i.e., urbanisation and agricultural production, that in the past destroyed the original forest cover of many parts of Europe, the United States of America, and large areas of East Asia (International Cooperation and Development 2016). However, societal dynamics in the twenty-first century are connected with the numerous conservation issues facing PAs. Protected area managers are confronted with relentless increasing pressure to cope with these changes.

Assessments of PA management effectiveness offer valuable information about the threats and other management issues that PAs face (Schulze et al. 2017). These assessments create opportunities for all stakeholders, especially policymakers, to improve their conservation strategies, reallocate budget expenditures, and develop strategic responses to the most prevalent threats and management weaknesses (Leverington

et al. 2010; Watson et al. 2014). There is, therefore, a call for the periodic assessment of PAs in terms of their management effectiveness, as reported by many authors (e.g., Ervin 2003a; Goodman 2003; Kurdoğlu and Çokçaliskan 2011; Kolahi et al. 2013). In Ghana, the International Union for Conservation of Nature (IUCN/PACO 2010) assessed the management effectiveness of many PAs from the perspective of government authorities, with little or no inclusion of the views and knowledge of local communities, non-governmental organisations, district assemblies, the Environmental Protection Agency (EPA), and other relevant local stakeholders.

However, the local communities are directly dependent upon the natural resources and land-use decisions of these areas for their basic needs and livelihoods. Planning and implementing systems for managing PAs that exclude local communities and other stakeholders have resulted in various conflicts and frustrations, including dislocation, violence, poaching, and poverty among indigenous communities (Amaja et al. 2016; Frank 2016). Involving local communities and other stakeholders in the process can contribute to the effectiveness of PA management since people's perceptions and attitudes towards PAs are influenced by their involvement in the PA management activities and decision-making (Ramakrishnan 2007). It is therefore vital that local communities and other stakeholders be included in PA management effectiveness assessments to bring together a range of vantage points and knowledge for both, aligning interests and innovative problem-solving.

The study, therefore, aims to adopt a more open approach to the assessment of the effectiveness of PA management and seeks to link this assessment not only with PA staff but also with district assemblies, the EPA, and representatives from the local communities in three PAs in different ecoregions in Ghana; the Kalakpa Resource Reserve (Kalakpa), Gbele Resource Reserve (Gbele), and Kogyae Strict Nature Reserve (Kogyae). According to our knowledge, no comprehensive assessments have been done in these PAs as of conducting/publishing the study.

The study was designed to provide an opportunity for local communities and other stakeholders to be involved in policy-making, PA management decisions, and also as a guidance to decision-makers on the management problems and priorities of the three PAs. We, therefore, present a detailed assessment of the management effectiveness of these PAs and ask the following questions:

a How do the park authorities, local communities, and other stakeholders perceive pressures and threats in these Pas?
b How have pressures and threats affected these Pas?
c What are the strengths and weaknesses of the current PA management?

MATERIALS AND METHODS

Study areas

Kalakpa, Gbele, and Kogyae are three of the 13 PAs under the management of the Wildlife Division of Ghana. Table 1 gives a summary of the size, elevation, annual rainfall, geographic coordinates, and operational budget for 2018 in the three study areas.

Kalakpa is approximately 100 km northeast of Accra and 20 km south of Ho, the capital of the Volta Region (Figure 1). The natural attributes of the reserves—a lush terrain, good opportunities for wildlife viewing, and proximity to Ghana's capital city—provide an excellent potential for ecotourism. The vegetation of Kalakpa is dry forest, and short grassland savannah, and some commonly found plants include *Cussonia arborea*, *Daniellia oliveri*, *Entada abyssinica*, *Ficus platyphylla*, *Pterocarpus erinaceus*, *Vitellaria paradoxa*, and *Afzelia africana*. Mammals regularly encountered in the reserves include African buffalo *Syncerus caffer*, Kob *Kobus kob*, Waterbuck *Kobus ellipsiprymnus*, Oribi *Ourebia ourebi*, and Patas monkey Erythrocebus patas.

Gbele is approximately 700 km north of Accra, the capital of Ghana, and located in the Sissala East, Sissala West, and Daffiama-Bussie-Issa political districts of the Upper West region (Figure 1). The vegetation is a woody savannah dominated by *Burkea africana*, *V. paradoxa*, *Parkia biglobosa*, *Terminalia spp*., *P. erinaceus*, and grasses such as *Hyparrhenia spp*. and *Pennisetum spp*. The most common mammals are Olive baboon *Papio anubis*, Patas monkey, King colobus *Colobus polykomos*, Roan antelope *Hippotragus equinus*, Bushbuck *Tragelaphus scriptus*, Waterbuck, Oribi, and Common warthog *Phacochoerus africanus*.

Kogyae is in the transitional semi-deciduous forest zone of the Ashanti region of Ghana and underlain by the Voltaian geological system (Figure 1). Mammal species of conservation importance in Kogyae include buffalo, Kob, Waterbuck, Bushbuck, Oribi, Maxwell's duiker *Cephalophus maxwelli*, and Bay duiker *Cephalophus dorsalis*. The reserve also supports many primate species, including the Putty-nosed monkey *Cercopithecus nictitans*, King colobus, baboon, and Patas monkey (Wildlife Department 1994). The management of Kogyae is into four zones, namely, the Protected Zone, the Special-Use Zone, the Restoration Zone, and the Development Zone. The Protected Zone is the largest in Kogyae, constituting 220 sq. km and representing 57% of Kogyae. This area of the reserve represents the most important and least disturbed habitat. The Special-Use Zone constitutes 79 sq. km and represents 20% of Kogyae. The Development and Restoration Zones are 1 sq. km and 86 sq. km, representing 1% and 22% of the PA, respectively.

Data collection

We organised separate workshops of 12 to 15 participants to elicit detailed information on the conservation issues and management effectiveness in the three PAs involving park managers, local community representatives, and representatives from the district assemblies and EPA of Ghana.

In Kogyae, 15 participants were involved in the assessment process, which included the park manager, one representative each from the communities located inside the

Table 1
Description of studied protected areas

Protected area	Size (km²)	GPS Coordinates	Elevation (m above sea level)	Annual rainfall (mm)	Vegetation type	Operational budget (US$/km²/year 2018)
Gbele Resource Reserve	565	10° 22' N to 10° 44' N 2° 03' W to 2° 12' W	260-300	950-1050	Guinea savannah	43.34
Kogyae Strict Nature Reserve	386	7° 08'N to 7° 21'N 0° 59'W to 1° 14'W	120-230	1200-1300	Transitional woodland	7.41
Kalakpa Resource Reserve	320	06º 19′ N, 06º 28′ N 00º 18′ E, 00º 30′ E	60-400	1200-1300	Dry forest and short grassland savannah	10.7

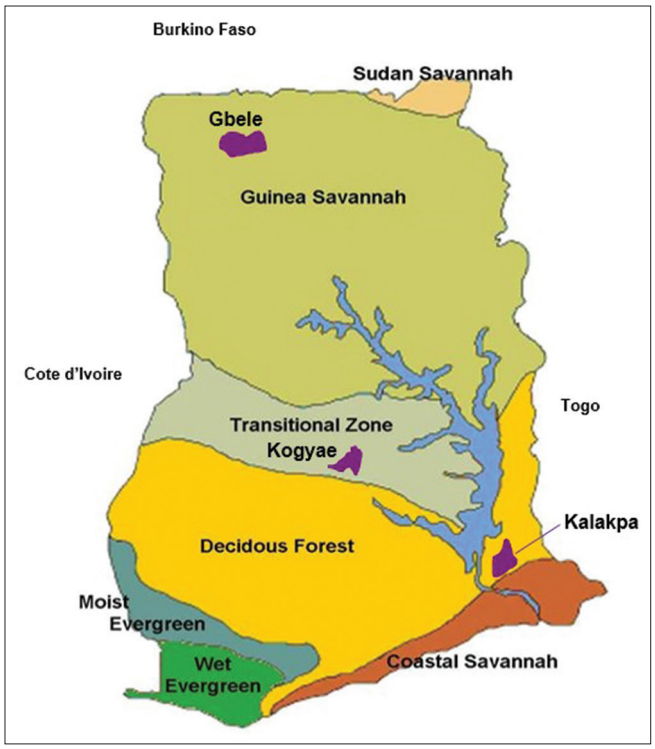

Figure 1
Map showing the location of the three protected areas and the vegetation zones of Ghana (according to Mensah Owusu 2017)

reserve (Asasebonso, Atakpame, Nyamekyere Dagomba, Birem, Yahayakura, Aberewanko, and Konkomba) and a representative from the political district of Kogyae (Sekyere Central District Assembly). The management effectiveness assessment in Gbele involved the park manager, one representative each from Gbele, Dasima, Duvie, Timie, Sentie, Jijen, Samambaw, and Jolinyiri communities. Additionally, representatives from Sissala East Municipality, Daffiama-Bussie-Issa, and Sissala West political districts, and the EPA, were also actively involved in the assessment process. All local community representatives in the three PAs assessed were selected by local chiefs/leaders of the respective communities. We conducted separate interviews with all park managers in all the PAs. These interviews were followed up by field visits to each PA to verify and further probe the opinions of the stakeholders on conservation issues. We carried out all consultations and interviews from August to October 2018.

A checklist of questions for the workshop and interviews was adopted and modified from the Rapid Assessment and Prioritisation of Protected Areas Management (RAPPAM) assessment tool (Ervin 2003b; see supplementary material for the RAPPAM questionnaires used in this study). We started each workshop with an overview of the purpose of the assessment, an introduction to the RAPPAM methodology, and an outline of the procedures that to be followed in completing the questionnaire. We projected each question onto an overhead projector screen and explained each question to all participants in each PA (Goodman 2003).

Additionally, we read each question out in English and translated into local languages in each of the PAs, i.e., Twi for participants in Kogyae, Ewe for those in Kalakpa, and Sissali, Dagaare and Twi for the participants in Gbele. Local translators were hired and trained in facilitation to ensure that participants who spoke Ewe, Sissali, and Dagaare were able to understand and freely express their views. The first two authors translated questions from English to Twi. Once there is a complete understanding of all participants, we scored the question, and the attempted next question. Each workshop lasted for a day and took five to six hours to complete. We used tape-recorder to capture all of the details of the discussion with the full consent of the participants.

Data analysis

We assessed the identified pressures and threats using three indicators (extent, impact, and permanence) as specified in the RAPPAM questionnaire. The 'extent' is the range of the activity's impact on the PA. For instance, the extent of poaching would be measured relative to the possible occurrence of the species population. The 'extent' could be localised, scattered, wide-spread, or throughout. The 'impact' is the degree, either directly or indirectly, to which the pressure affects overall PA resources. The 'impact' could be mild, moderate, high, or severe. The 'permanence' (persistence) is the length of time needed for the affected PA resource to recover with or without human intervention and could be short-term, medium-term, long-term, or permanent. Each identified pressure took a score on each of the indicators (extent, impact, and permanence) on a scale of 1 to 4, where 1 represents the lowest score, and 4 represents the highest score. We obtained the degree of each pressure by multiplying the scores of that pressure on the extent, impact, and permanence. In applying the scale values

from 1 to 4 on the three indicators, the lowest possible degree is 1, and the highest possible degree is 64. The degree serves as the overall impact of a given pressure/threat on the PA. By way of classification, a degree from 1 to 3 is considered mild, 4 to 9 is moderate, 12 to 24 is high, and 27 to 64 is severe (Ervin 2003b).

To determine the strength and weaknesses (management effectiveness) of the PAs, i.e., planning, inputs, processes, and outputs, we used a numerical index using statements with four options: *yes* = 5, *mostly yes* = 3, *mostly no* = 1, or *no* = 0. A score of 5 does not necessarily mean that there is no problem, and a score of 0 does not indicate a total failure (Ervin 2003b). The average scores were calculated as a percentage of the maximum possible score and compared with global average values (Leverington et al. 2010; Kolahi et al. 2013).

RESULTS

Pressures and threats and their effects on the PAs

Based on our results from the workshops, settlements, bush fires, agricultural encroachment, poaching, and poverty in nearby communities were pressures and threats common to all the three PAs; they were perceived, however, to have a varying degree of severity, the score ranging from 9 to 96 (Figure 2). In Kalakpa, participants perceived settlements as the extreme pressure and threat (63), followed by logging (54) and charcoal production (45). However, human settlements in Kalakpa are considered illegal by the Wildlife Authorities and the government. Other pressures and threats mentioned by participants during the workshop in Kalakpa were agricultural encroachment (35), grazing (35), and bush fires (30). Meanwhile, in Kogyae, participants perceived bush fires as the most extreme pressure and threat (scored 96), agriculture encroachment, and population increase (both at 54). Settlements (34) and poverty in nearby communities (30) were also perceived as pressures and threats in Kogyae. Participants revealed that bushfire is an annual activity that threatens the ecological stability of Kogyae. The most extreme pressures and threats in Gbele were logging (42), climate change (27), and poaching, and grazing (both at 21). Others mentioned by participants were poverty in nearby communities (20), bush fires (16), and agriculture encroachment (15). Although participants considered settlements as pressure and threat in Gbele and Kogyae, these settlements were legally established, and in Kogyae, they are designated as the Special-use Zone. Participants in all the workshops agreed that settlements increased the direct pressures and threats facing the PAs, including bush fires, poaching, agriculture encroachment, grazing, and charcoal production. All the PAs were faced with habitat loss/fragmentation, wildlife population decline, the spread of invasive species, and increased drought. Table 2 gives a summary of the pressures and threats in all the PAs, their implications for management, and solutions based on responses from participants and field visits.

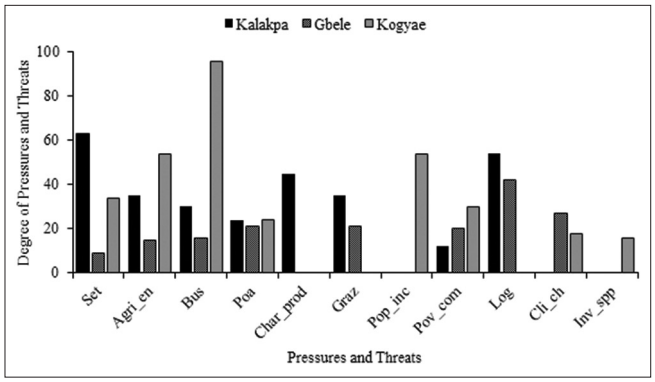

Figure 2

Assessment of the degree of severity of pressures and threats by participants in Kalakpa Resource Reserve, Gbele Resource Reserve, and Kogyae Strict Nature Reserve severity of the pressures and threats. Abbreviations: Set, Settlements; Agri_en, Agricultural encroachment; Bus, bush fires; Poa, Poaching; Char_prod, Charcoal production; Graz, Grazing; Pop_inc, Population increase; Pov_com, Poverty in nearby communities; Log, Logging; Cli_ch, Climate change; Inv_spp, Invasive species

Management effectiveness (strength and weaknesses) of PAs

The management effectiveness assessment, including planning, inputs, processes, and outputs of the three PAs, had the overall average scores (in %) as follows: Kalakpa (46), Gbele (55), and Kogyae (50). The scores for Kalakpa and Kogyae were lower than the overall global average of management effectiveness score for PAs of 54%, indicating deficiencies in their management. However, the overall average for Gbele (55%) was higher than the global average score (54%), indicating effective management practices (Figure 3).

Based on the performance of the various management elements, Gbele and Kogyae scored the highest in terms of the "planning" element and Kalakpa scoring the lowest (Figure 3). The score for Kogyae in the 'planning' was the highest among its scores in all the other elements. Meanwhile, the management effectiveness score for Kalakpa was lowest in all the assessed elements, except for the 'output' element where Kogyae scored the least. The scoring for Gbele was also highest in the input, processes,

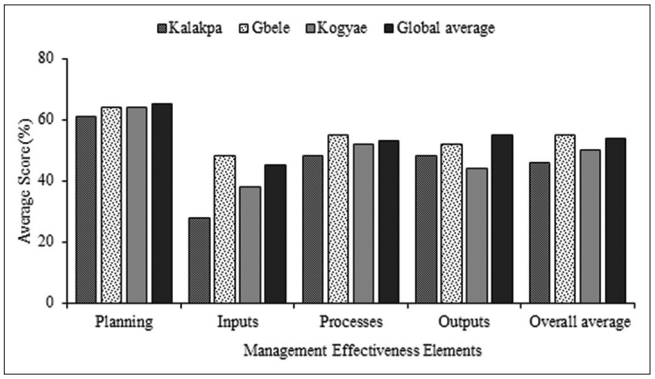

Figure 3

Assessment of the management effectiveness of Kalakpa Resource Reserve, Gbele Resource Reserve, and Kogyae Strict Nature Reserve by participants based on RAPPAM and compared with global averages

Table 2
Stakeholders perception of pressures and threats, their causes, implications and possible solutions in Kalakpa Resource Reserve, Kogyae Strict Nature Reserve, and Gbele Resource Reserve

Pressures and Threats	Kalakpa	Kogyae	Gbele	Causes	Implications	Possible solutions
Settlements	✓	✓	✓	Land tenure issues	Increase in direct pressures	Relocation outside the PAs with compensation; Coexistence strategies including alternative livelihood programmes, participatory PA management, and benefit-sharing
Agricultural encroachment	✓	✓	✓	Settlements in the PAs; Population Increase; Poverty	Habitat loss/ degradation/ fragmentation; Wildlife population decline	Strict law enforcement; education and awareness creation; collaborative PA management; poverty alleviation strategies
Bushfires	✓	✓	✓	Settlement activities (slash and burn agriculture, hunting, smoking)	Habitat loss/ degradation/ fragmentation; Wildlife population decline; invasive species	Strict and effective law enforcement; education and awareness creation; arrest and prosecution; establishment of an integrated fire prevention programme
Poaching	✓	✓	✓	High demand for protein; Subsistence needs; Economic gains; Ineffective law enforcement	A decline in Wildlife population	Strict and effective law enforcement; arrest and prosecution of poachers; alternative sources of livelihoods; alternative sources of meat
Charcoal production	✓	-	-	Settlements in the reserves; Lack of employment	Habitat loss/ degradation/ fragmentation	Creation of alternative livelihood sources of income; woodlot establishment; strict and effective law enforcement
Grazing	✓	-	✓	Settlements	Habitat loss/ degradation/ fragmentation	Improving pasture management through prescribed burning and livestock control; promoting stall feeding and the use of fodder spp.
Poverty in nearby communities	✓	✓	✓	Poor national economic policies and governance	Increase direct pressures on protected area resources	Promotion of off-farm activities such as food processing and packaging; Regular access to inputs and output markets; Better economic policies by the government
Population increase	-	✓	-	Migration; No proper population control measures	Increase in direct pressures on protected area resources	Effective population control measures; Investing in rural economies and diversify sources of income
Logging	✓	-	✓	Settlements; High economic gains; Corruption between perpetrators and wildlife officials	Habitat loss/ degradation	Strict law enforcement; Engaging local communities as 'watchdogs'; Effective punitive measures
Climate change	-	✓	✓	Human activities through emission	Increased drought; Desertification	Reforestation
Invasive species	-	✓	-	Continuous bush-fires	The spread of *Chromolaena odorata* which prevents natural tree regeneration	Reforestation; education and awareness creation; vegetation succession and species management programme

and output elements. However, within the various elements, the participants perceived some weaknesses in the management of these protected areas (Table 3). Under the planning element, the lack of local support, disputes of land tenure, and lack of funds for critical law enforcement were common weaknesses in the three PAs assessed. These were perceived to have led to the increased pressures and threats and the lack of support for conservation from the local communities. Similarly, all the three PAs had lower scores in inadequate staff, poor employment conditions, and poor infrastructure under the 'input' element.

Under the 'process' element, Kalakpa and Kogyae scored the lowest in terms of a "recent and comprehensive management plan." The implication is that the management of the PAs had no mechanism to apply the PA policies. Another area of poor performance was in research, monitoring, and evaluation. Except for Kogyae, the other two PAs had low scores in all the items under "research, monitoring, and evaluation."

The 'output' element of the assessment shows the effects of management actions, the achievement of goals, and management of the pressures and threats achieved by the authorities of the PAs over the past two years. To an extent, the score in this element reflects the evaluation results of the others previously mentioned.

Comments of participants

During the workshops, we collected comments from the stakeholders concerning the capacity and the positions by

Table 3
Stakeholders perception of management weaknesses, their implications and possible solutions

Management Effectiveness	Management weaknesses			Implications	Possible solutions
	Kalakpa	Kogyae	Gbele		
Planning	Lack of support from local communities	Lack of support from local communities	Lack of support from local communities	Increase PA pressures and threats; Lack of support for PA conservation	Engagement of local communities in PA management
	Disputes of land tenure	Disputes of land tenure	Disputes of land tenure	Increase encroachment; Lack of support for PA conservation; Increased conflicts between PA authorities and Local communities	Compensating and relocating residents into new communities outside the reserves; Creating sustainable livelihood options for residents
	Lack of funds for law enforcement	Lack of funds for law enforcement	Lack of funds for law enforcement	Increase in poaching and other human activities	Increase PA funding; Soliciting for external funds
	Adjacent land-use	Adjacent land-use; Poor PA zoning system	Poor PA layout	Increase encroachment	Creating sustainable livelihood options people living near the reserve's borders
	Unresolved conflicts with local communities	-	-	Lack of support for successful conservation	Involving the community and other stakeholders in a productive dialogue; education and awareness creation
Inputs	Inadequate PA staff	Inadequate PA staff	Inadequate PA staff	Ineffective law enforcement	Employ well-trained staff; Strengthen law enforcement capacity
	Poor employment conditions; Poor training of staff	Poor employment conditions	Poor employment conditions	The low motivation of PA staff	Increase staff salaries and allowances; provision of logistics for PA operations; strengthen staff capacity through regular training programmes
	Inadequate means of communication between field staff and office staff	Lack of ecological and socio-economic data	Inadequate means of communication between field staff and office staff	No knowledge of the changes in vegetation cover and wildlife population for proper management actions; No knowledge of socio-economic information of local communities; Lack of collaboration between field and office staff	Provision of mobile phones and other communication gadgets to field and office staff; incorporate individual research results into PA management decisions; Promote PA driven research
	Poor Infrastructure	Poor infrastructure; Inadequate systems for data analyses	Poor infrastructure	Low motivation of staff; Lack of scientific information and technology for effective PA	Construction of accommodation for PA staff and office complex especially in Kogyae; Provision of modern computers and software for data analyses e.g., MIST, SMART, ArcGIS, etc.
	Inadequate funding	Inadequate funding	Inadequate funding in the next 5 years	Poor PA management operations	Increased PA budgetary allocation; Soliciting for external funding from donor partners
Processes	Outdated Management plan	Outdated Management plan		No mechanism to apply PA legislation and policy; lack of continuity	Update Management plans
	Poor Research, Evaluation, and Monitoring	No comprehensive inventory of natural/ cultural resources	Poor Research, Evaluation, and Monitoring	No knowledge of the status of PA resources and factors affecting conservation efforts	Develop PA resource monitoring programme; Implement annual research and inventory programme
		Lack of participation of local communities in decision making		Lack of support for PA conservation	Formation of CREMA and PAMAB
		No regular access to scientific data to PA staff		Lack of knowledge on the current trends in PA management	Develop regular training and dissemination of current scientific information for PA staff
Outputs	Poor site restoration measures	No site restoration measures	Poor visitors and tourist management	Continued habitat loss; Loss of revenue from tourism	Develop habitat monitoring programme and reforestation of degraded areas; Construction of visitor/tourist centers

Contd...

Table 3 Contd...

Management Effectiveness	Management weaknesses			Implications	Possible solutions
	Kalakpa	Kogyae	Gbele		
	Poor visitors and tourist; Poor staff training and development management	Poor infrastructure development	Poor staff training and development	Loss of revenue through few visitors and tourists; Low staff motivation; Lack of skills for effective PA management	Develop a comprehensive tourism plan
		No management planning and inventorying		No knowledge of the status of PA resources	Update Management plans
	Lack of research and monitoring outputs	Lack of research and monitoring outputs	Lack of research and monitoring outputs	Poor knowledge of the status of the PA and factors affecting its conservation	Collaboration with research institutions e.g., Universities, Center for Scientific Research and other international research agencies

the management authorities, and the different perspectives of pressures and threats, and their implications and also management solutions in the three PAs (Tables 2 and 3).

The majority of the participants in all the three PAs supported and recognised the importance of the assessment. However, the local community representatives who formed the majority of participants in all the PAs were concerned about the lack of involvement of local communities in the PA decision-making process and management. Although the PA authorities acknowledged this concern, they also argued that local communities must support wildlife conservation by reducing activities that hamper conservation efforts. The PA authorities, especially in Gbele, assured the local communities of their involvement in the decision-making process since measures were in place to establish Community Resource Management Areas (CREMA) and Protected Area Management Advisory Board (PAMAB). The CREMA and PAMAB support participatory management of the PAs and are successful in other PAs in Ghana (IUCN/PACO 2010).

DISCUSSION

Pressures, threats, and their effects on the PAs

Settlements

Human settlements in the three PAs contributed to most of the pressures and threats. Due to the dangers from settlement activities, the Wildlife Division, in collaboration with its donor partners, started constructing a new resettlement site in Gbele, approximately 4 km outside the reserve boundary, for the relocation of the inhabitants of the Gbele community. However, in Kalakpa, there is currently no established process from the government to relocate the inhabitants. Since policy prohibits the Government of Ghana from providing services to these illegal residents, there are no facilities inside the reserve, i.e., no schools, electricity, health facilities, piped water, or boreholes. The lack of such basic amenities further deepens residents' poverty, resulting in their direct dependence on the park's resources. However, human settlements usually cause the degradation of park health and ecosystem services, as reported for instance in Khojir National Park in Iran (Kolahi et al. 2013) or in Côte d'Ivoire where the Marahoué National Park, Mont Péko National Park, and Monogaga Forest Reserve contain over 10,000 inhabitants each, resulting in increased poaching and forest degradation (Bitty et al. 2015). On the other hand, the absence of land tenure conflicts in PAs was positively associated with reduced deforestation (Nolte et al. 2013). Therefore, PAs cannot be managed effectively and fulfil their objectives without solving human settlement issues, either by resettling the inhabitants outside or finding a new strategy for co-existing.

Agricultural encroachment

Agricultural encroachment was the most prevalent either on the borders or inside the PAs. Some of Ghana's forest reserves were destroyed by agricultural encroachment following settlement

by immigrant farmers, namely, in the Bia-Tawya and Sukusuku Forest Reserves (Danquah 2015). These forests were intended to be buffers around the Bia Conservation Area, established to protect the rare primates and other wildlife. The conversion of PAs into crop-production lands, such as oil palm, rubber, and cocoa farms, were responsible for the decline in wildlife; see, for instance, the reduction of Côte d'Ivoire's primate population (Woods 2003; Gonédélé et al. 2012). To reduce the encroachment of agriculture in PAs, authorities must ensure the intensification of agriculture outside PAs through the provision of fertilisers, irrigation facilities, credit facilities, improve market access, develop high-yield crops, and adopt genetically modified crops.

Poaching

Poaching is one of the causes of wildlife population decline in the world (Newmark 2008). However, in Kogyae, there is stability in poaching since 2012 in comparison to high rates in previous years (Afriyie et al. 2020), whereas in Gbele, it has drastically reduced (Wildlife Division 2017). This is mainly because of the high interest in and market value in the trade of Kosso *Pterocarpus erinaceus*. Poaching in Kalakpa is relatively low because of the movement of most animals away from areas close to human settlements and towards the northern part of the reserve, where there is little or no human presence, and there is active law enforcement. More efficient ranger patrols will deter poaching-related threats and may lead to the arrest of poachers. Additionally, community-based conservation (Steinmetz et al. 2014), and or alternative livelihood projects (Wright et al. 2016) are also important in reducing poaching because they involve the local community in the conservation of PAs through various means. In areas with high levels of poverty, such as Ghana, these approaches could be instrumental because they provide local communities with an alternative source of livelihood (Milder et al. 2010).

Bush fires

In transitional and savanna ecosystems, fires are known to important stress factors and are more intense and frequent inside than outside the PAs (Caillault 2011). Officials in Kogyae blamed the origin of the bush fires on the activities of residents in the Special-use Zone, but the local community representatives alleged that the fires usually started from the Protected Zone, which is accessible exclusively to officials of the Wildlife Division. Though the lack of communication and collaboration between the Wildlife Division authorities and local communities caused the recrimination, it also reveals the differing opinions of various stakeholders and their openness during the assessment processes. It is, therefore, important to provide opportunities for the participants to comment on the role and position of the PA management authorities before classifying the pressures and the threats for PAs by reflecting on the area's situation and providing direct feedback to site management (Lu et al. 2012).

In Gbele, bush fires caused the degradation of parts of the reserve, revealed by a time series map between 1990, 2000, and 2010 (Wildlife Division 2017). Bush fires sweep through these reserves from inside and surrounding areas. However, human activities cause bush fires, e.g., from livestock herdsmen who intentionally burn dried grass in the dry season to induce the early sprouting of fresh grass for forage. Moreover, poachers also start fires to force animals out of their hideouts, and also by palm wine tappers, local gin distillers, farmers, and cigarette smokers (Ayivor and Ntiamoa-Baidu 2015). These activities are highly destructive but deeply ingrained in the local culture in all of the assessed PAs.

Logging

Although regulations and laws prohibit logging in all PAs and wildlife reserves in Ghana, the illegal logging of rosewood in Gbele and Kalakpa has recently emerged. The rapidly increasing demand for rosewood in China, the top market, and consumer of rosewood, has led to increased and illegal exploitation in these reserves (Treanor 2015). The United Nations Office of Drugs and Crime (UNODC) in 2016 reported that rosewoods seized accounted, at 35%, for the highest proportion of all wildlife confiscated from 2005 to 2014 (UNODC 2016).

Concerns about the exploitation of rosewood in the fragile savannah and transitional ecosystems led to the imposition of two export bans in Ghana (Dumenu and Bandoh 2016). The latest ban in 2014 is still in place. In Kalakpa, there was evidence of rosewood harvesting through the numerous rosewood stumps, among others, found during field visits. However, the local community representatives accused some field staff working with Kalakpa have granted individuals and wood companies' access to the reserve to fell rosewood. Elsewhere in Ghana, Saibu (2016) reported that the invasion of local people's farms and Mole National Park by loggers for the extraction of rosewood is also active despite the ban. Exploitation in the face of an active ban reflects the current situation in many range countries in West Africa. Benin, Burkina Faso, Cote d'Ivoire, Mali, Nigeria, and Sierra Leone have long-standing bans on harvesting and export of rosewood, yet China Customs reports significant imports of rosewood logs from these countries (Gueye 2015; EIA, 2017). Though there have been efforts to arrest and prosecute illegal loggers (Luri 2017), the current development raises concerns about the impact of the rate and level of exploitation on the conservation of these PAs, with the current management resources being inadequate to prevent this situation. Protected area managers must, therefore, ensure strict law enforcement, and engage local community members as 'watchdogs' in monitoring the exploitation of rosewood.

Grazing

Livestock grazing causes severe habitat degradation and has multiple effects on wild herbivore distributions (Maxwell et al. 2016). In Kalakpa, approximately 90% of households engage in several livelihood activities, such as farming and livestock rearing, that are the most destructive to Kalakpa's natural environment (pers. obs). The cattle population in the

reserve is estimated to be at least 7000 heads (Akunnor Samuel, pers. comm.) and resulted in overgrazing in many areas. In Gbele, grazing only occurs in the reserve when communities experience a shortage of pasture and water sources in village lands, especially during dry seasons. Kideghesho et al. (2012) and Mwakatobe et al. (2013) reported similar situations in Serengeti National Park in Tanzania. Moreover, livestock grazing is widespread in tropical regions (de Haan et al. 1997), including inside PAs (Naughton-Treves et al. 2006), where often, livestock are left to range freely to feed on the native vegetation (Stern et al. 2002). In some cases, livestock owners' clear natural areas favour the growth of native or introduced pastures that are beneficial for livestock which changes the forest structure and also affects the diversity of wildlife (Piana and Marsdenm 2014). The wildlife authorities must, therefore, provide measures such as pasture and livestock management to reduce the negative impact of grazing on the PAs.

Charcoal production

Following the comments from participants, charcoal production is a means of earning money when other preferred options are no longer viable or sufficiently productive. Local communities in Kalakpa produce charcoal to generate additional income because of large family size (Sunderlin et al. 2005). Charcoal production, together with wood harvesting, clearly results in a decrease of natural habitats, as reported, for instance, in the Mekrou Forest Reserve in Benin (Bouko et al. 2016) and the Fina Wildlife Reserve in Mali (Diallo et al. 2011). Given that charcoal production has severe impacts on biodiversity we suggest that protected area management planning should systematically include mechanisms to detect, understand, and mitigate or adapt to livelihood change to minimize its potential negative effects.

Poverty in nearby communities

Poverty in nearby communities in the assessed PAs reflects what pertains worldwide (Scherl et al. 2004). While the poverty rate in Ghana has decreased from 85.4% in 1998 to 56.9% by 2016, poverty persists in many rural areas (Ghana Statistical Service; GSS 2016). Contrary to earlier studies by the IUCN/PACO (2010) in nine PAs in Ghana, poverty in nearby communities were not considered to be a pressure or threat to the PAs. However, since the economic conditions of most communities in and around PAs in Ghana are similar, the exclusion of such pressure or threat is attributed to the lack of involvement of other stakeholders during the assessment process of these areas. It must be stated that reducing or eradicating poverty in the nearby communities is not within the jurisdiction of PA authorities and may only be effectively managed by national-level policy reforms and resources. It is possible that involving only PA managers during the assessment, as was the case in the IUCN/PACO assessment (IUCN/PACO 2010), may not give accurate results since they may consider only pressures and threats whose impacts can be prevented, mitigated or reversed through management intervention. It is therefore imperative that wider consultation including local communities and other stakeholders should be considered in management effectiveness assessments.

Population increase

The high influx of migrant populations over the past decades and an increase in the indigenous population caused the rise in the population of settlements in Kogyae and surrounding communities. Population data indicates that between 1960 and 2010, the population of fringe communities increased by 600% on average (GSS 1984, 2014). High populations in and around PAs result in increased demand for food and fuelwood, which is evident in the high degree of severity of agricultural encroachment in Kogyae and may lead to a significant decline in the wildlife population (Metzger et al. 2010). As the human population grows around PAs, collisions between these areas and people struggling to find land on which to survive will continue. Governments and policymakers must link the development of urban areas with rural areas by providing diversified sources of income, and also investing in rural economies. Moreover, connecting existing PAs through corridors (Anderson and Jenkins 2006) and creating future PAs in places where they can be most effective are much needed.

Invasive species

The spread of main invasive species in Kogyae, *Chromolaena odorata*, is attributed to forest gaps created by frequent bush fires. Ch. odorata has affected many PAs in Africa, such as Hluhluwe-Imfolozi National Park in Kwazulu-Natal, South Africa, where Ch. Odorata has covered almost half of the park (IUCN/PAPACO 2013). In Cameroon, *Ch. odorata* displaced native species in the *Zingiberaceae* family, the main food source for the endangered Western lowland gorilla *Gorilla gorilla gorilla* (Van der Hoeven and Prins 2007). Invasive species, in general, pose a significant threat to PAs worldwide (Foxcroft et al. 2013a) but are rarely recognised as a threat in Africa, except in South Africa (Foxcroft et al. 2013b). The lack of information on the severity of the invasions indicates the failure of the management of PAs to address the issue effectively.

Climate change

The changing climate has had adverse effects on Kogyae and Gbele and in many parts of Ghana (Environmental Protection Agency, EPA 2011). Severe droughts caused by the change in climate in Kogyae led to animals foraging outside the reserve and making them susceptible to poaching (Jachmann 2008). However, the park management has taken steps to build many artificial watering points in the reserve to curb the problem. The savannah zone of Ghana—where Gbele is located—is considered more vulnerable to the effects of climate change, as this area has only one rainy season compared to the two rainy seasons in the transitional and the forest zones (Asante and Amuakuah-Mensah 2015). Over the years, the temperatures in all the ecological zones of Ghana are rising, while rainfall levels have generally reduced and patterns increasingly becoming erratic (EPA 2011). Ghana has

therefore developed a National Climate Change Adaptation Strategy, which aims to enhance Ghana's current and future development to climate change impacts by strengthening the country's adaptive capacity and building the resilience of the society and ecosystems.

Management effectiveness

The assessment of management effectiveness reveals the system-wide strengths and weaknesses of PAs. Compared to other assessment elements, planning ranked as a qualified strength across all three PAs. The protection and conservation of biodiversity were the primary objectives of management in all PAs. Management plans and policies were consistent with those objectives, and PA employees were generally familiar with these objectives. Moreover, the PAs were legally secure, and their settings were consistent with their objectives. However, the lower score of 'planning' under the theme 'site design and planning' for Kalakpa relates to the 35+ years of illegal settlements in the park, increasing the pressures and threats in the park.

Additionally, the lack of local community support in conservation and disputes of land tenure was deficient in all the three PAs. Developing and improving the relationship between the PA authorities and local communities is vital to achieving the PA's conservation goals. Participatory management is, therefore, paramount in the management of the PAs (Kolahi et al. 2013). Collaborative management will protect local communities' rights and interests and focus on a management body that represents all stakeholders equitably. Generally, the planning element in the RAPPAM methodology has received the highest score in most PAs assessed around the world, including for instance those in Russia (Tyrlyshkin et al. 2003), China (Diqiang et al. 2003), and Turkey (Kurdoğlu and Çokçaliskan 2011).

In terms of inputs, the highest scores for Gbele was as a result of external funding from the Sustainable Land and Water Management Project (SLWMP) sponsored by the World Bank and Global Environmental Facility, which began in 2011 and ends in 2020. Kalakpa, which had the lowest management input scores, has insufficient funds, and consequently, extremely inadequate staff facilities and equipment and poor visitor facilities. The primary sources of funds for PAs in Ghana are the Government funds, the internally generated funds from the Forestry Commission of Ghana, and the contributions by the donor agencies/governments. Insufficient funding often creates a shortfall that is extremely difficult to overcome, even when PAs have well-trained and highly motivated staff. According to officials of the Wildlife Division, PAs have approximately 55-60% of the staff needed for effective management. Lack of staff, funding, inadequate facilities, and equipment are some of the causes of poor management in PAs at a global level (Leverington et al. 2010; Lu et al. 2012; Kolahi et al. 2013; López-Rodríguezа and Rosado 2017).

The lack of a management plan for Kogyae and Kalakpa suggests that these two PAs lack the support of a specific and workable plan. Without management plans in PAs, it will be difficult for the management of PAs to know the progress of management actions leading to difficulties in the allocation of resources by governments and other funding agencies (Kolahi et al. 2013). In all three PAs, there is inadequate research, long-term and regular evaluation, and monitoring of biodiversity. Consequently, there is a lack of knowledge of the proper ecosystem, the state of the biodiversity, key species, and ecological relationships that when applied in management decision-making, would make conservation more effective (Niesenbaum, 2019). Unfortunately, few PAs in the world have comprehensive research, monitoring, and evaluation programmes (Lockwood et al. 2012; Kolahi et al. 2013; López-Rodríguez and Rosado 2017). Hence, research and monitoring are frequently reported as the weakest output of PAs' management effectiveness assessments (e.g., Li et al. 2003).

Inputs of local communities and other stakeholders

We emphasise the participation of local communities in the assessment process. Our approach is mostly different from numerous RAPPAM assessments, in which, primarily the people from management authorities and sometimes from non-governmental organisations are involved. In this study, we allowed local communities and other stakeholders to voice their opinions and to be involved more in the discussions. Open discussions helped the gathering of comments of different stakeholders and to clarify and communicate the present condition of the PAs with the stakeholders, who usually lacked means to receive relevant, comprehensive, and accurate information. Moreover, the open discussion generated diverse opinions among stakeholders to avoid restrictions in the assessment process or depend only on experts' opinions (Stoll-Kleemann 2010; Cook and Hockings 2011).

CONCLUSION

Applying the RAPPAM methodology, this study conducted the first extensive and explicit management effectiveness assessment in PAs in Ghana. Although this wide-ranging consultation process of the RAPPAM methodology has not always been a feature of the implementation, this study involved representatives of local communities, district assemblies, and the Environmental Protection Agency, which reflected the different perspectives, especially in terms of the pressures and threats. The extensive consultations increased the participation of stakeholders, helped to collect and share comprehensive information, and increased data quality, which created more responses to the inquiries concerning PA assessments. The studied PAs face intense external pressures and threats from human activities deeply influenced by the macro-economic and social environments of Ghana. Well-resourced management can effectively deal with threats by setting priorities, developing situation analyses, and designing and executing strategic and monitoring plans. However, the effects of pressures and threats deepen with the lack of support from local communities, inadequate funding, and management resources in these PAs.

Our findings lead us to suggest the following priorities for government and management decisions: a) create or speed up measures for collaborative PA management; b) increase funding and also plan for long-term financial sustainability for PAs by extending the time frame of interventions; c) improve research and monitoring systems that facilitate adaptive management

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The authors declare no conflict of interest.

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