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First Sightings of the Roloway Monkey (*Cercopithecus diana roloway*) in Ghana in Ten Years and the Status of Other Endangered Primates in Southwestern Ghana

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Abstract: Primate surveys were conducted in community controlled peat swamp forest along Ghana's Tano River by West African Primate Conservation Action (WAPCA), the Wildlife Division of the Ghana Forestry Commission, and members of local communities in 2011 and 2012. The 2011 survey revealed the first sightings in Ghana of the Critically Endangered roloway monkey (*Cercopithecus diana roloway*) in ten years. A follow-up survey in 2012 indicated that despite a great deal of illegal logging and some hunting, this forest, informally known as the Kwabre Peat Swamp Forest, hosted all of Ghana's forest primate species with the exception of the Miss Waldron's red colobus (*Procolobus waldroni*), considered extinct by some scientists since 2000. These species included the Endangered white-naped mangabey (*Cercocebus lunulatus*), the Vulnerable white-thighed black-and-white colobus (*Colobus vellerosus*), the Near Threatened olive colobus (*Procolobus verus*), the Least Concern eastern spot-nosed guenon (*Cercopithecus petaurista petaurista*) and Lowe's guenon (*Cercopithecus campbelli lowei*). The results of the surveys are compared to encounter rates of earlier primate surveys in the region. With the continuous decline and extirpation of the roloway and other primates in Ghana and Ivory Coast, the last forests where these rarer primate species still exist center on the extreme corners of southwestern Ghana and southeastern Ivory Coast, composed of a complex of two community-owned peat swamp forests in Ghana and Ivory Coast, a few government protected areas and an un-explored wetland. Future recommendations for the protection of these species and their habitat are provided here.

Key words: Ghana, roloway monkey, white-naped mangabey, white-thighed black-and-white colobus, olive colobus, Miss Waldron's red colobus, community forest

INTRODUCTION

Although deforestation is occurring worldwide at an escalating rate, it has been especially rapid and extreme in Ghana and Ivory Coast in the last decade due to the clear cutting of mature rainforest for the cultivation of cocoa, rubber, and palm oil (Boafo 2013; Mongabay.com/20ghana.htm 2014). In 2011, WAPCA (West African Primate Conservation Action), in collaboration with Coastal Resources Center, initiated a community conservation project to protect the last remaining forests in southwestern Ghana, the Cape Three Points Reserve Forest, and the forests along the Tano River, informally known as the Kwabre Peat Swamp Forest. These forests, along with similar areas in southeastern Ivory Coast, are some of the few remaining forests in an area of secondary primate endemism that is isolated probably by geological history (Oates 1988). Oates noted Booth's argument that dry periods in

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Figure 1. Survey team members in Kwabre Peat Swamp Forest.

the Pleistocene in West African forests resulted in a refuge in eastern Ivory Coast and western Ghana which was enforced by the Baoule-V savanna and the Dahomey gap isolating Miss Waldron's red colobus (*Procolobus waldroni*), the roloway monkey (*Cercopithecus diana roloway*), and the white-naped mangabey (*Cercocebus lunulatus*).

These forests once hosted viable populations of seven nonhuman primates including Miss Waldron's red colobus, roloway monkey, the white-naped mangabey, the olive colobus (*Procolobos verus*), the white-thighed black-and-white colobus (*Colobus vellerosus*), Lowe's guenon (*Cercopithecus campbelli lowei*), and eastern spot-nosed guenon (*Cercopithecus petaurista petaurista*). Within the past two decades both the forest and nearly all the primate species in it have decreased to a precarious level. Despite cautionary warnings (Roberts & Kitchener 2006), primate numbers continue to decline and recent surveys have not given any indications that differ from an assessment declaring that Miss Waldron's red colobus is probably locally extinct (Oates *et al.* 2000) and the remaining primate species appear to be following in its footsteps. Both the roloway monkey and white-naped mangabey are IUCN listed as Endangered, although the roloway should be considered Critically Endangered (Magnuson 2002-3; Oates 2011), while the black-and-white colobus is Vulnerable and the olive colobus is Near Threatened. Only the Lowe's guenon and the spot-nosed guenon are still Red Data listed as Least Concern.

The goal of this survey was to verify the presence of roloway monkeys, white-naped mangabeys and potentially even Miss Waldron's red colobus in the Kwabre Peat Swamp Forest, a forest, previously unknown to primatologists, which had not yet been surveyed for primates.

METHODS

Study Site

The southwestern corner of Ghana is considered wet evergreen forest (Sayer *et al.* 1992), while the Kwabre Peat Swamp Forest, which runs north to south and follows the Ghana-Ivory Coast border on the eastern side of the Tano River, is a peat swamp ecosystem that floods seasonally and annually (Figure 1). It is composed of approximately 4,000

hectares of forest fragments along the lower Tano River on the southwestern border of Ghana.

This area forms part of a complex of forests in eastern Ivory Coast and western Ghana that are probably the last forests inhabited by the endemic roloway monkey (McGraw & Oates 2014), some of the last remaining habitat of the white-naped mangabey and currently represents the last possible hope for the persistence of Miss Waldron's red colobus. Since the 1940s, over 90% of Ghana's closed canopy forest has been clear cut for rubber, palm oil and cocoa and this peat swamp forest ecosystem represents one of the last remaining coastal forests in Ghana and Ivory Coast. Figures 2 through 6 show this complex that includes the Tanoé Forest in Ivory Coast, the Kwabre Peat Swamp Forest previously unknown to primatologists, the Amanzule Wetlands (yet to be studied) and Ankasa Conservation Area and Nin-Suhien National Park, a government Protected Area.

A study of carbon sequestering of Kwabre Peat Swamp Forest and Amanzule Wetlands noted it as a unique ecosystem with a total of 52 tree species recorded in all sites, some of which are endemic to West Africa and some endemic only to eastern Ivory Coast and western Ghana (Asante & Jengre 2012). Forty-one tree species were found in the seasonally flooded sites, while 31 species were in the permanently flooded sites with 21 tree species occurring only in seasonally flooded areas, and 11 species occurring only in permanently flooded areas. A list taken from the study (Asante & Jengre 2012) of trees observed over 25 times in either site indicated *Raphia hookeri*, *Amanoa bracteosa,* and *Manikara sylvestris* were the dominant species in the seasonally flooded sample areas, while *Uapaca paludosa* was the dominant species in the permanently flooded area (see Table 1).

2011 Survey

In 2011, a team of six people conducted preliminary ad lib recce surveys of five areas from March to May to investigate the presence of the three focal primates, the roloway monkey, the white-naped mangabey and Miss Waldron's red colobus. The survey team spent nine days in the Kwabre area, three days in Nawule, two days in Takinta and one day in Agyeza (Figure 3). The team was composed of the lead author, a Ghana Wildlife Division wildlife guard, two members of the Ivorian team experienced in wildlife censusing and two members of the rural community (which varied depending on which forest area was surveyed). Five forest areas were surveyed (Anwiafutu, Kwabre,

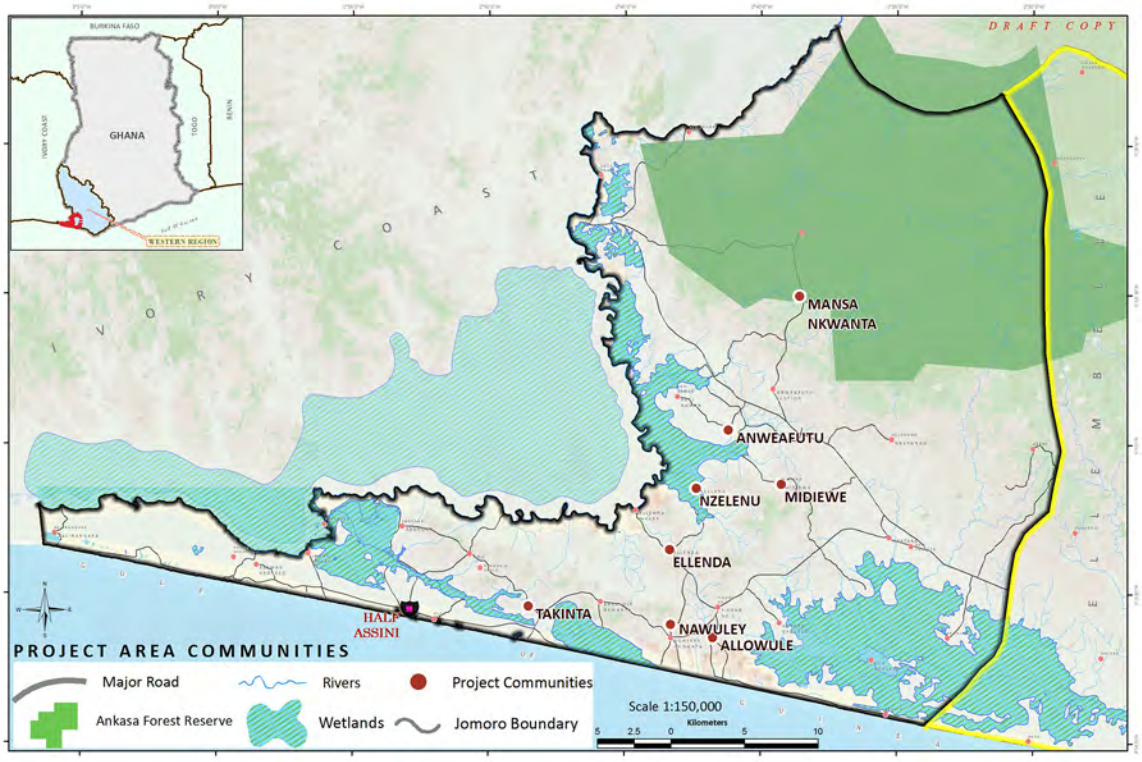

Figure 2. Map of area showing significant forests for the focal species.

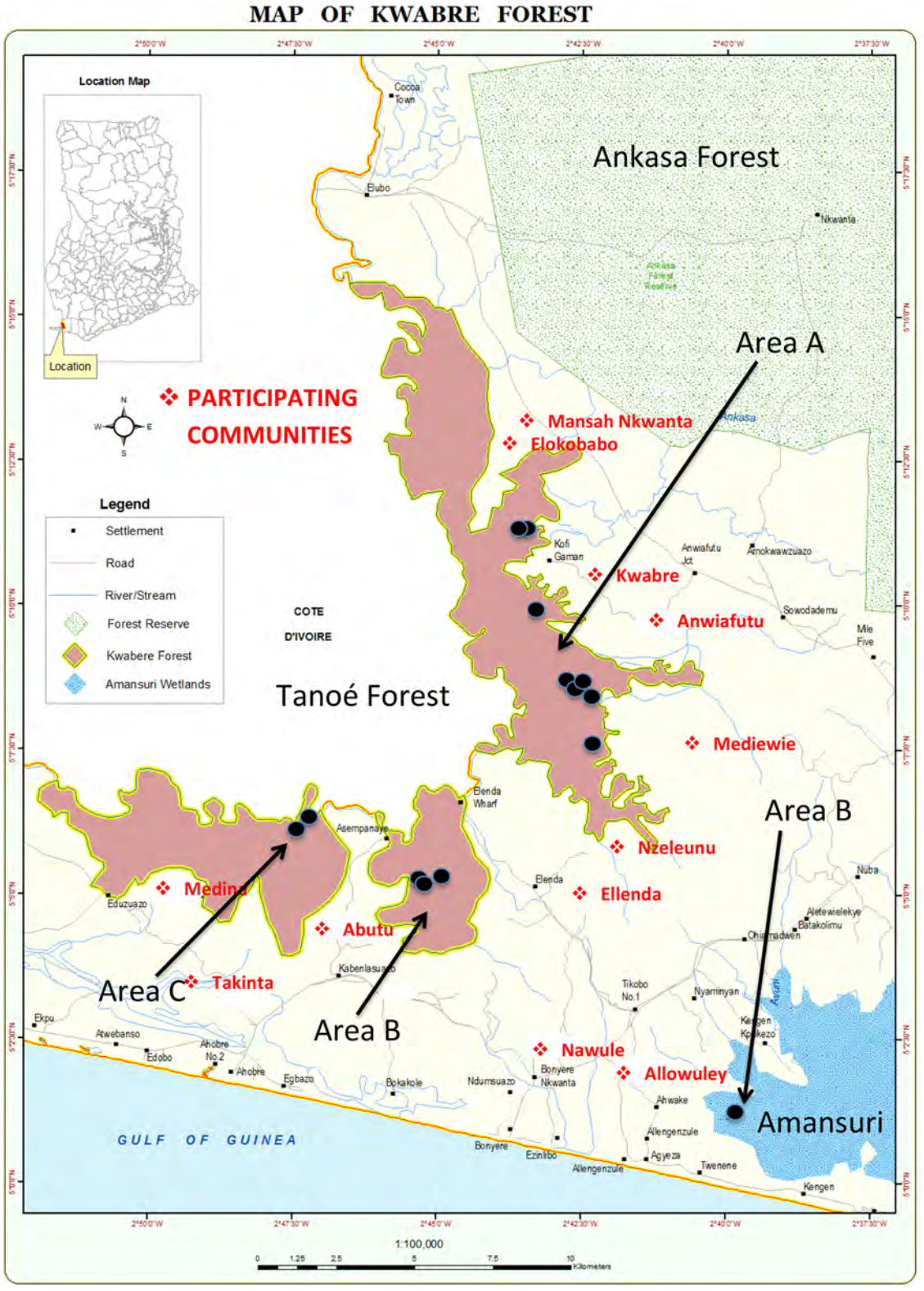

Figure 3. Map showing areas where 2011 recce surveys were conducted. The black dots indicate direct signs of primates, either audio or visual.

Table 1. List of most common tree species in the peat swamp forests (from Asante & Jengre 2012).

Seasonally Flooded Forest Trees	# in Seasonal Flooded Forest	# in Annual Flooded Forest	Annually Flooded Forest Trees	# in Seasonal Flooded Forest	# in Annual Flooded Forest
Amanoa bracteosa	1549	35	*Uapaca paludosa*	65	260
Raphia hookeri	1101	0	*Syzygium rowlandii*	140	136
Manilkara sylvestris	401	0	*Xylopia rubescens*	47	95
Lonchocarpus santalinoides	81	0	*Anthostema aubryanum*	27	91
Spondianthus preussi	78	8	*Hallea ledermannii*	54	90
Gardenia imperialis	72	0	*Symphonia globulifera*	81	79
Millettia spp.	57	0	*Coffea humilis*	1	62
Sarcocephalus pobeguinii	35	1			
Garcinia smeathmannii	32	0			
Lijndenia barteri	27	0			
Cuviera subuliflora	25	0			
Diospyros chevalieri	25	9			

Mediewie, Nawule and Takintka) by conducting a total of 15 line transects of four kilometers length using the path of least resistance. The transects were traversed for two kilometers in one direction, with the team then moving perpendicular 500 meters and returning for two kilometers in the opposite direction. Additionally, during that same period, WAPCA and the Wildlife Division of the Ghana Forestry Commission distributed questionnaires to selected community members to obtain traditional and historic knowledge about the local primates.

2012 Survey

Surveys were conducted over a forty-one day period between March and May 2012, with 28 effective days of survey and a total survey time of about 300 hours covering a total of 167.9 kilometers.

Prior to the surveys, training sessions were held in the communities surrounding the Kwabre Peat Swamp Forest to teach community members to assist with the surveying. The survey team also met with the village chiefs of each area prior to surveying to gain permission to access the forest and then again after the surveys to report results to the chief and community members.

The surveys, conducted on foot, began in the Takinta area close to the town of Half Assini and ended in Mansah Nkwanta close to Elubo near the Ivorian border (Figure 3). The survey team consisting of six people was divided into two groups of three members, a team leader (either David Osei from WAPCA or Victor Agyeman Duah of the Wildlife Division), an experienced Ivorian team member and a newly trained Ghanaian community member.

Surveys were conducted using existing wildlife pathways combined with paths of least resistance. Due to high water levels and dense vegetation in the Kwabre Peat Swamp Forest survey, sufficient distances and time were covered despite the difficulties in walking through the wetland mud.

The two teams walked in parallel at a distance of approximately 500 meters apart until they reached the forest boundary where the teams then moved two hundred meters to the right and reversed direction back to the other boundary. The teams remained in contact with each other with walkie-talkies throughout the survey and notified each other with the direction and coordinates regarding primate sightings to reduce the possibility of counting any monkey group twice. Surveys began early in the morning, and lasted on average of 5 – 6 hours. Due to the dense forest cover, high canopy trees and shy nature of the endemic primates, positive identification can be challenging. The teams addressed these challenges by walking at a slow speed (1–2 km/hr) and stopping approximately every 200 meters to listen for sounds of primates or other animals. When a primate call was heard,

the team spread out in an attempt to circumscribe the group, using silent hand signals to coordinate their movements and positions. When the primate group eventually dispersed at the sight of the researchers, each team member counted the number of animals that passed their direction. The team also used additional methods to get closer to the primate groups for greater identification, including mimicking the calls and branch shaking behavior of the primate species sighted to draw the animals closer.

The data recorded included all primate sightings, primate calls, feeding and other signs as well as illegal activities (traps, gun cartridges, etc.). Opportunistic data on other mammalian and reptilian species were also recorded. For direct sightings, as far as possible, the numbers of individuals were counted.

RESULTS

2011 Surveys

The presence of roloway monkeys in the Kwabre Peat Swamp Forest was confirmed. In Kwabre (Area A in Figure 3) groups of Lowe's guenon numbering 10-15 were recorded and on one occasion a mixed species group of more than 30 individuals was seen which included white-thighed black-and-white colobus, Lowe's guenon, and the spot-nosed guenon. In this area there were high levels of disturbance from hunters and chainsaw operators. In Nawule (Area B), on two consecutive mornings in different parts of the forest, the field team encountered large mixed-species groups of primates feeding on Parkia bicolar, Uapaka guineansis and a species called locally "subaha", including roloway monkeys, the first sighting of the species in Ghana in over ten years. On the first day, the mixed group consisted of approximately five roloway monkeys, 14 spot-nosed guenons, 15 Lowes' guenons, five white-thighed colobus and 10 olive colobus. On the second day the mixed group consisted of 20 spot-nosed guenons, 15 Lowe's guenons, five white-thighed colobus and 10 olive colobus. No roloway monkeys were seen in that mixed group. In Agyeza (Area D), only one survey was conducted. Primates were heard moving through the tree canopy by their multiple loud crashing sounds, but species could not be identified visually or audibly.

2011 Questionnaires

A total of 142 questionnaires were administered to 12 communities: Agyeza (12), Anawhiafutu (20), Atsyimenu (7), Elokobabo (2), Kwabre (20), Kwabre Nsuoano (8), Mediewie (17), Medina (6), Nawule (4), Nyameadom (3), Nzalenu (23), Takinta (20). Of the respondents, 72.5% were male, 27.5% were female. Ninety-two percent of the respondents stated that they were not native to the area and had emigrated from other areas of Ghana and West Africa for farming (87%) mainly for cocoa, coconut, oil palm, rubber, cassava and other food crops. The remaining 13% were fishermen, gin distillers, and soap and coconut oil producers. Over a third (34%) of the respondents hunted bush meat, however some had abandoned the work due to old age or lack of animals to hunt.

Most respondents reported sightings of monkeys, giant rats (*Cricetomys gambianus*), grasscutters or cane rats (*Thryonomys swinderianus*), bushbuck (*Tragelaphus scriptus*), monitor lizards (*Varanus niloticus*), mongoose (sp.?) and striped ground squirrels (*Xerus erythropus*) in the area. Sightings of large yellow backed duikers (*Cephalophus silvicultor*), bongos (*Tragelaphus eurycerus*), red river hogs (*Potamochoreus porcus*), brush tailed porcupines (*Artherurus africanus*) and endangered primate species were less common or rare. Species with totem or other significance included rock pythons (*Python sebae*), dwarf crocodiles (*Osteolaemus tetraspis*) and monitor lizards. Species that caused crop damage problems included cane rats, bushbuck, giant rats and occasionally monkeys.

One section of the questionnaire used primate photographs, drawings and recordings to assess the respondent's knowledge of primates. Most respondents (81%) had hunted primates but showed great variability in terms of when they had last sighted a primate. Most said they thought there were still monkeys in the area but admitted not seeing them personally for a long time, and reported that there were fewer than in the past due to deforestation, farming and hunting. Ad lib comments from respondents included questions with regard to prevention of crop raiding and the support of wildlife and forest protection for the future and ecotourism.

2012 Survey

Figure 4 indicates all general primate activity noted during the 2012 survey. Figure 5 indicates the six primate species sightings by individual symbols during the 2012 survey and the sightings of mixed species groups indicated by symbols.

The presence of roloway monkeys was confirmed by two sightings in Takinta and Nawule (Figure 5). However, although the overall encounter rate for common species of primates such as Lowe's guenons

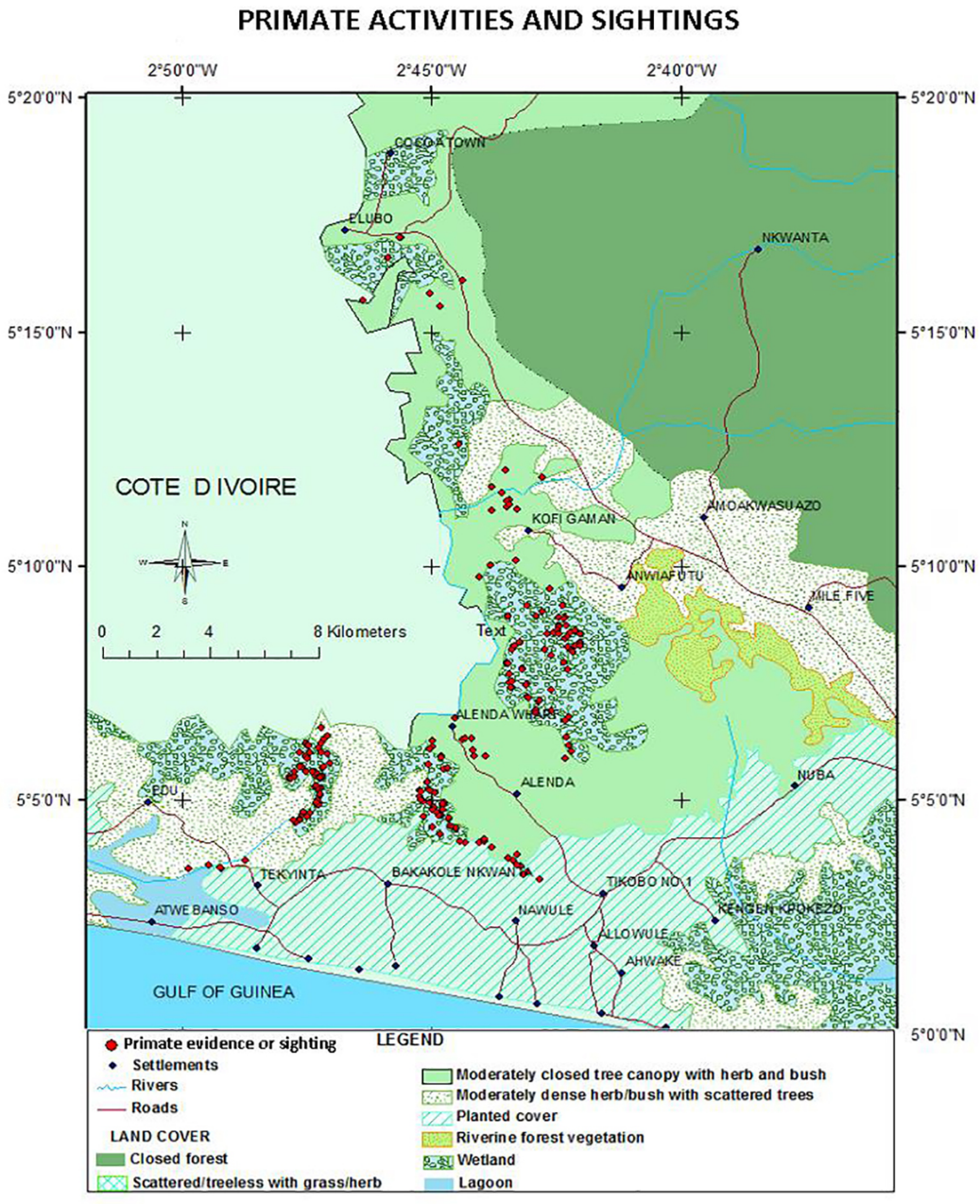

Figure 4. Map of all primate sightings and activities.

(18 sightings) and eastern spot-nosed guenons (19 sightings) was high, encounter rates for the rare species, roloway monkey (2 sightings) and white-naped mangabey (1 sighting), were relatively low and no Miss Waldron's red colobus were found (Table 2). There was additionally one sighting of the black-and-white colobus and three sightings of olive colobus groups (Table 2).

Data from the surveys indicate a high level of human (illegal) activity indicating hunting and deforestation; snares, traps, gunshot cartridges, felled trees and charcoal burning were observed (Table 3). Kwabre and Allowuley recorded the highest level of illegal logging. Nawule recorded the least. Eight chainsaws were confiscated in Allowuley, four in Kwabre and one each in Nawule and Ellenda. Illegal logging was so prevalent that it often disrupted the survey work. The noise from the chain saws drove the primates away making it very difficult to find their locations. The illegal logging was very indiscriminate with 10 to 15 trees being cut in one trip to Kwabre, Allowuley or Takinta.

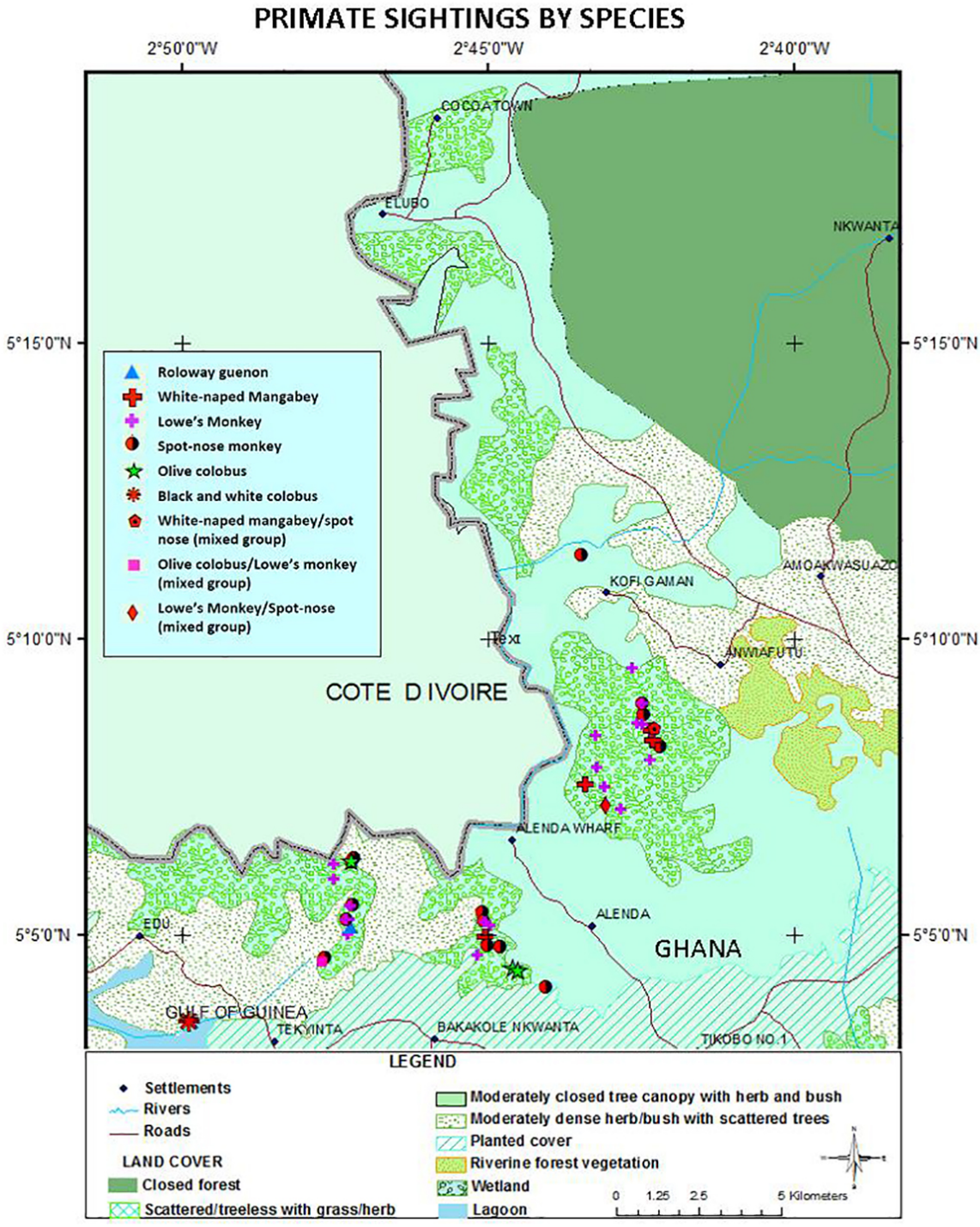

Figure 5. Map of area surveyed with primate species of concern.

Table 2. Encounter rates of groups per kilometer of primates in the Kwabre Peat Swamp Forest survey in 2012 (see Figure 3).

2012 Census	Roloway Monkey	White-naped Mangabey	Miss Waldron's Red Colobus	Black & White Colobus	Olive Colobus	Lowe's Guenon	Spotnose Guenon
Takinta	.18	.26	0	0	.13	1.26	1.00
Nawule	.22	0	0	.24	.14	.84	1.39
Allowuley	0	0	0	0	0	.62	.69
Ellendra	0	0	0	0	.24	3.86	1.79
Kwabre	0	0	0	0	0	.67	.78
Mansah Nkwanta	0	0	0	0	0	0	0
Total	.012	.006	0	.006	.018	.11	.12

Evidence of wildlife poaching on the other hand was minimal. Throughout the surveys, only three bush meat hunters were spotted. One hunter had two brush-tailed porcupines and the other had two giant wild rats and one gun was seized from a hunter who confessed to killing bushbuck, brush-tailed porcupine and even a Lowe's guenon. During the surveys, the forest was scanned for signs of illegal animal trapping. No traps set for mammals were seen but a number of fish traps were recorded. The entire forest area is flooded throughout most of the year, so the most common hunting activity is fishing. Illegal fishing in the forest can lead to illegal hunting of mammals if the fishing trip is unsuccessful. Occasionally, dugout canoes crafted from large forest trees were seen.

Table 3. Illegal activities encountered in 2012 survey of the Kwabre Peat Swamp Forest.

Community	Illegal Lumber Encounter	Poaching Activities Encounter	Arrests Made	Equipment Seized	Date of Arrest
Takinta	7	1	1 poacher	1 gun	31 March 2012
Nawule	4	1	3 chainsaw operators	1 chainsaw	11 April 2012
Allowuley	10	1	6 chainsaw operators	8 chainsaws 1 gun	24 April 2012
Ellendra	1	0	3 chainsaw operators	1 chainsaw	21 April 2012
Kwabre	8	0	3 chainsaw operators	4 chainsaws	28 April 2012
Mansah Nkwanta	0	0	No arrests	None	---

Table 4. Comparison of encounter rates/km in other studies.

Year Surveyed/ Surveyor	km	Roloway Monkey	White-naped Mangabey	Miss Waldron's Red Colobus	Black & White Colobus	Olive Colobus	Lowe's Guenon	Spotnose Guenon
1976 Martin *et al.*[1]	820	.17	.03	.02	.18	.04	.09	.03
1996 Oates *et al.*[2]	90	.008	0	0	0	.07	.21	.28
2001 Magnusen (2002-3)	216.9	.04	.02	0	.03	.003	.39	.11
2003 Dershner & Kpelle (2005)	175	0	0	0	0	+	+	+
2004-6 Bi *et al.* (2008)		+	+	0?	+	+	+	+
2006 Gatti[3] (2010)	5614	.0002	.0005	0	.0013	.0012	.0352	.0231
2006 Oates[4] (2006)	448	0	0		.018	.012	.053	.032
2009 Bi *et al.* (2013)	429.3	.38	.28	0?	.04	.11	.58	.44
2011 Wiafe (2013)	131.6	0	0	0	0	0	0	0
2011 Buzzard & Parker (2012)	125.6	0	0	0	0	0?	.075	.075
2012 WAPCA	167.9	.0119	.0059	0	.0059	.018	.107	.113

[1] from Oates *et al* 1996-7, averaged 3 sites by Martin *et al.*; averaged 5 sites surveyed by Oates and Struhsaker
[2] converted encounters/hour to encounters/km
[3] averaged 4 sites
[4] averaged 4 sites and converted from encounters/hour. ? = no data; 0? = not encountered but indirect evidence of presence

DISCUSSION

Of the 16 primates found in Ghana, 12 reside mainly in the high forest that covers a large area of southwestern Ghana composed of mainly four forest types (Booth 1979; Sayer *et al.* 1992) (Figure 6). However, Ghana's high forest primates have been disappearing at an alarming rate due to deforestation and hunting for bush meat. Even in the 1950s, the roloway monkey was considered Ghana's (then Gold Coast's) rarest primate (Booth 1979). There has been continuous surveying of the roloway and other arboreal primates in Ghana's southwestern protected areas since that time, which has documented a steady decline of rare primate species and the eventual report of extinction of the Miss Waldron's red colobus and potential local extinction of the roloway monkey in Ghana. Table 4 shows a compilation of the surveys that occurred from 1976 to 2012. Figure 6 shows a map of southwestern Ghana and its vegetation types and the areas that were surveyed in the past for the seven forest primate species.

In the late 1970s roloway monkeys and white-naped mangabeys were still common in Bia (Rucks

in Magnuson 2002-3). Struhsaker and Oates (1995) surveyed Bia, Ankasa and Kakum National Parks in 1993 and noted the isolated nature of the parks and degradation due to logging and hunting. They found no Miss Waldron's red colobus, roloway monkeys or white-naped mangabeys in Kakum but there were some black-and- white colobus. Struhsaker found none of the three species in Bia but according to park staff black-and-white colobus occurred but were extremely rare. Oates heard only one roloway call in Ankasa and saw no red colobus or white-naped mangabeys. In 1995 Whitesides and Abedi-Lartey saw roloways in Ankasa as did Oates and Abedi-Lartey later the same year (Oates 1999).

Magnuson (2002–3) surveyed nine areas in the high forest zone in 2001. She noted that roloway monkeys were found in only four forests at that time Krokosua Hills Forest Reserve (FR), Dadieso FR, Yoyo FR, and Ankasa noting that they had likely been extirpated from Bia National Park (NP), Cape Three Points FR, Draw River FR, and Nini-Suhien NP. Three years later in 2004, Deschner and Kpelle (2005) surveyed Draw River, Boi-Tano, Tano Nimiri and Krokosua Hills FRs. No roloways, white-naped mangabeys, red colobus or black-and-white colobus were found in any of the sites. The olive colobus was found in Draw River and spot-nosed guenons and Lowe's guenon were found in Draw River FR and Krokosua Hills FR. However, interviews with local poachers gave more hope claiming that white-naped mangabeys, roloways, and Miss Waldron's red colobus were present in Boi-Tano, Tano-Nimiri, and Kroskosua Hills FR and white-naped mangabeys were in Draw River FR.

But later surveys by Oates (2006) in 2005–6 in Mamiri FR, Boi-Tano FR, Krokosua Hills FR, Bia NP, Bia RR saw no roloways or white-naped mangabeys in any of the sites. Spot-nosed guenons and Lowe's guenons were found in three sites and olive and black-and-white colobus were found at Krokosua and Bia.

Gatti (2010) spent two years from 2006-2008 surveying Bia, Krokosua, Ankasa, and Cape Three Points RF. Miss Waldron's red colobus was absent in all four sites. At the time, Wildlife Division staff reported seeing roloway monkeys in Ankasa but there was no direct evidence. Ben Phalan reported hearing the call of roloway monkeys and a young captive roloway was found in a nearby village by WAPCA staff. White-naped mangabeys were seen in Ankasa and Phalan heard them in Cape Three Points. Black-and-white colobus were seen in Krokosua Hills and heard by Phalan in Cape Three Points with possible signs in Bia and Ankasa. Olive colobus were sighted in Ankasa, Bia and Krokosua Hills. Spot-nosed and Lowe's guenons were seen in all four sites. Later surveys by Buzzard and Parker (2012) in Subri River and by Wiafe (2013) in Dadieso RF in 2011 found none of the four most endangered primates. Horwich in 2011 (pers. obs.) saw olive colobus, Lowe's Guenon and spot-nosed guenons in the tiny Monkey Hill city park in Takoradi. Table 5 shows which species are thought to currently occur in the various areas surveyed in the past (Figure 6).

When we compare the encounter rates of this study with other surveys in Ghana (Table 4), it can be seen that roloway monkey and white-naped mangabey occurrence had already decreased by 1996 in all sites except in Tanoé forest and Kwabre. Tanoé as of 2009 had an extremely high population (Bi *et al*. 2013).

Although the encounter rate for primates was low in much of the Kwabre Peat Swamp Forest, it is encouraging that it was possible to confirm the presence of most forest primate species, most notably the Critically Endangered roloway monkey and the Endangered white-naped Mangabey. It was also encouraging to see that the primates were often moving in relatively large groups. Despite the low primate encounter rates compared to anticipated levels, there were significantly more primate sightings and more primate species diversity than noted during 2008 primate surveys in the nearby Cape Three Points Forest Reserve and Ankasa Conservation Area. Gatti (2010) indicated no sightings of roloway monkeys in either Cape Three Points or Ankasa.

However, from the hunter survey and observations by community patrols (Table 3), the extent of illegal human activities is very high in the Kwabre Peat Swamp Forest, particularly in Allowuley and Kwabre areas of the forest where there appears to be virtually open access. Illegal logging is indiscriminate and of greatest threat to the primates due to loss of habitat. Hunting with guns is a much greater threat to primates, but its incidence was very minimal in this location.

The bright spot for the more endangered species is with the Tanoé Forest in Ivory Coast in which the encounter rates in 2009 was 19 times higher for roloway monkeys than that of Kwabre and 47 times higher for the white-naped mangabey. This high population seems to be due to the inaccessible nature of the Tanoé Forest and the protection by the local communities. The Tanoé Forest is the last place in which the roloway monkeys are found in Ivory Coast (see Koné *et al*, this issue).

Table 5. Best current knowledge of species occurrence.

Areas	Km²	Roloway Monkey	White-naped Mangabey	Miss Waldron's Red Colobus	Black & White Colobus	Olive Colobus	Lowe's Guenon	Spotnose Guenon
Kwabre	50	+	+	0	+	+	+	+
Tanoe	120	+	+	0?	+	+	+	+
Ankasa/Nini Suhien	509	0	+	0	0	+2008	+	+
Amanzule	?	?	?	?	?	?	?	?
Draw River	235	0	0?	0	0	+2005	?	?
Cape 3 Points	51	0	0?	0	+	0	+	+
Subri	45	0	0?	0	0	+	+	+
Boi-Tano	129	0	0	0	0	0	+	+
TanoNimri	206	0	0	0	0	0?	?	?
Mamiri	206	0	0	0	0	?	+	+
Dadieso	171	0	0	0	0	0	0?	0?
Yoyo	236	?	?	0	?	?	?	?
Bia	306	0	0	0	+	+	+	+
Krokosua	481	0	0	0	+2008	+	+	+
Kakum	375	0	0	0	+	+	+	+
Monkey Hill	.12	0	0	0	0	+	+	+

? = no information;
0? = not encountered but indirect evidence of its presence; year indicates when last seen with no more recent surveys

CONCLUSION

The world's only remaining forests where roloway monkeys, one of the three endemic primate taxa in this region, can still be found are in community-owned peat swamp forests in southeastern Ivory Coast (Tanoé Forest) (Bi *et al.* 2008, 2013) and southwestern Ghana. These forests, also one of the last remaining habitats for the white-naped mangabey, currently represent the only possible hope for the continued persistence of Miss Waldron's red colobus. There is an additional large swamp forest, the Amanzule Wetland forest, east of the Kwabre Forest (Figures 2, 3, 6) that may

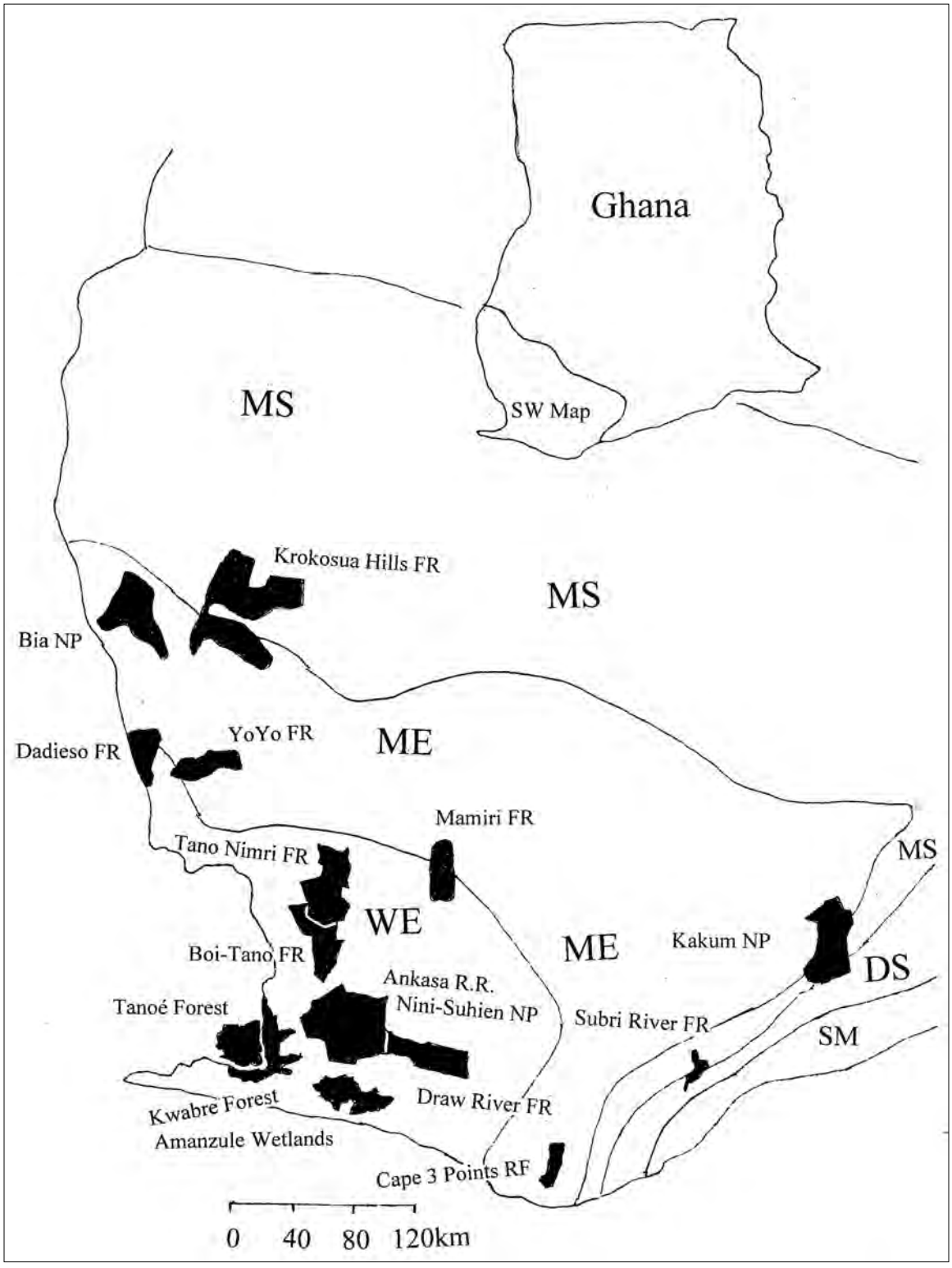

Figure 6. Map of Southwestern Ghana locating areas surveyed by all researchers (from authors cited and web search) and vegetation types. WE=wet evergreen, ME=moist evergreen, MS=moist semi-deciduous, DS=dry semi-deciduous, S M=southern marginal.

also host this endemic primate community but it has only been explored in a preliminary manner. The Draw River and Cape Three Point Forest Reserves still hold some possibility for the white-naped mangabey. These community-owned forests, along with the Ankasa/Nini-Suhien National Park, form a complex that is the last stronghold for the roloway monkey and the white-naped mangabey, which if strengthened and managed could provide protection to the endangered primates as well as the whole primate community. Work with local human communities in the Ivory Coast over the past nine years and our work with Ghanaian communities could help create a community protective complex for those primate species.

CREMAS and Community Protection

Governments throughout the world are beginning to understand the importance of incorporating communities into conservation strategies and within the past 20 years, some, perhaps many, have incorporated policies and laws that involve communities in conservation as partners. Some examples, include the conservancies of Namibia (Horwich *et al* 2012), the Gelose law (gestion local sécurisee) in Madagascar, CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) in Zimbabwe, laws for community management in Peru (Shanee *et al.* 2014), community co-management policy in Belize (Young & Horwich 2007; Horwich *et al.* 2012), community forests in Nepal (Ojha 2011), and the CREMA (Community Resource Management Area) law in Ghana (Forestry Commission 2004). This is an important trend because community members are proving to be stronger and more consistent conservationists than governments that change as different political parties come to power. For example, recently in Belize political change is threatening a 30 year old successful co-management system for oil exploration in protected areas. Only community co-manager and indigenous groups are actively resisting this illegal activity (Horwich pers. obs.).

Success of any of these policies or programs depends on the government or NGO individuals who introduce communities to the ideas. Success in motivating communities depends on simple human interactions based in trust and transparency. Explaining that the species are specific to their areas and that government and NGOs cannot protect the species without the community's help and asking for their help is the first step in empowering the communities and engendering pride in their natural areas; then, encouraging them to form conservation groups and larger federations for regional protection is at the base of success in most areas and countries. These simple steps engender sustainability as 96% of 26 projects carried out by Community Conservation in 30 years are on-going many for 23 to 30 years (Horwich pers. obs., and see www.communityconservation.org).

The CREMA (Community Resource Management Area) policy was developed in 2000 to devolve management authority to community-based organizations (Forestry Commission 2004). Physically, CREMA is defined as an area including one or more communities that agree to manage resources sustainably. It focuses on sustainable use of wildlife which is usually not a possible goal, especially in forested areas. However, in African savannas with large ungulates and high biomass such as in Namibia, it has been very successful (Horwich *et al.* 2012). So, with our work with communities in the Kwabre area, we have instead emphasized other more altruistic, conservation minded incentives and have helped the 12 communities around the Kwabre Peat Swamp Forest to create the Ankasa Tano CREMA, which in turn has organized community patrols.

The Tanoé forest has been protected by the local communities for over nine years and the Kwabre Peat Swamp Forest is now protected by 12 community forest protection teams under the Ankasa-Tano CREMA. The Ankasa complex has the Amokwaw CREMA that, while active, is not actively protecting the area. The Amanzule Working Group, formed under the Coastal Resource Center project (Adupong *et al.* 2013), has adopted a plan to create a protected area for the Amanzule Wetlands using a modified CREMA plan (Adupong & Gormey 2013). West African Primate Conservation Action and Community Conservation Inc. have been working together to help form the Ankasa-Tano CREMA and bring them together with the communities of Tanoé forest to create a trans-border protected area. Presently, the communities of Ivory Coast and Ghana have been conducting joint community patrols to reduce illegal activities on a limited basis.

RECOMMENDATIONS

- Survey the Amanzule Wetlands for primates
- If Amanzule contains roloway monkeys and white-naped mangabeys, work with the Amanzule Working Group to develop a CREMA or a modified CREMA and forest protection

forces as in Kwabre
- Work with the Amokwaw CREMA around Ankasa to further develop forest protection forces to prevent hunting of primates in the reserve
- Develop forest corridors between Ankasa and Kwabre and conduct reforestation in discontinuous areas within the Kwabre Peat Swamp Forest
- Stimulate primate surveys in Ankasa/Nini-Suhien, Draw River FR and Tanoé forest
- Bring Ankasa-Tano, Amokwaw, Amanzule and Tanoé community groups together to create a regional plan of protection for the forests and primates.

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LITERATURE CITED

Adupong, R. & B. Gormey. 2013. *Development of Conservation Scenarios: The Case of Amanzule Wetlands*. USAID. CRC, FoN, Accra

Adupong, R., D.D.N. Nortey & J. Asiedu. 2013. *Customary Laws and Practices in the Greater Amanzule Wetland Areas*. USAID, Accra

Asante, W. & N. Jengre. 2012. *Carbon Stocks and Soil Nutrient Dynamics in the Peat Swamp Forests of the Amanzule Wetlands and Ankobra River Basin*. USAID, CRC, NCRC, Accra.

Bi, S.G., I. Koné, J-C.K. Bené, A.E. Bitty, B.K. Akpatou, Z. Goné Bi, K. Ouattara & D.A. Koffi. 2008. Tanoé forest, south-eastern Côte-d'Ivoire identified as a high priority site for the conservation of critically endangered primates in West Africa. *Tropical Conservation Science* 1(3): 265-278.

Bi, S.G., J-C.K. Béné, E.A. Bitty, B.K. Kassé, A.N. Guessan, A.D. Koffi, B. Akpatou & I. Koné. 2013. Roloway guenon (*Cercopithecus diana roloway*) and white-naped mangabey (*Cercocebus atys lunulatus*) prefer mangrove habitats in Tanoé forest, south-eastern Ivory Coast. *Journal of Ecosystem and Ecography* 3: 126. doi:10.4172/2157-7625.1000126

Boafo, J. 2013. The impact of deforestation on forest livelihoods. *Africa Portal Backgrounder* 49: 1-6.

Booth, A.H. 1979. The distribution of primates in the Gold Coast. In *Primate Ecology: Problem-Oriented Field Studies*. R.W. Sussman, ed. John Wiley & Sons, New York. Pp. 139-153.

Buzzard. P.J & A.J.A. Parker. 2012. Surveys from the Subri River Forest Reserve, Ghana. *African Primates* 7(2): 175-183

Deschner, T. & D.G. Kpelle. 2005. Rapid assessment of the primates of Draw River, Boi-Tano and Krokosua Hills. In *A Biological Assessment of the Terrestrial Ecosystems of the Draw River, Boi-Tano, Tano Nimiri and Krokosua Hills Forest Reserves, Southwestern Ghana*. J. McCullough, J. Decher & D.G. Kpelle, eds., RAP Bulletin of Biological Assessment 36. Conservation International, Washington DC. Chapter 9, Pp. 73-78.

Forestry Commission. 2004. *A Brief Guide to Establishment of Community Resource Management Area (CREMA)*. Collaborative Resource Management Unit, Wildlife Division, Accra.

Gatti, S. 2010. Status of Primate Populations in Protected Areas Targeted by Community Forest Biodiversity Project. Unpublished Report for WAPCA and WD/FC, Accra

Horwich R.H., J. Lyon, A. Bose & C.B. Jones. 2012. Preserving biodiversity and ecosystems: catalyzing conservation contagion. In *Deforestation Around the World*. P. Moutinho, ed. InTech, Rijeky. Pp. 283-318.

Magnuson, L. 2002-3. Distribution and abundance of the roloway monkey *Cercopithecus diana roloway* and other primate species in Ghana. *African Primates* 6(1-2): 19-26.

McGraw, W.S. & J.F. Oates. 2014. Roloway monkey *Cercopithecus diana roloway* (Schreber, 1774). In *Primates in Peril The World's Most Endangered Primates 2012-2014*. C. Schwitzer, R.A. Mittermeier, A.B. Rylands, L.A. Taylor, F. Chiozzo, E.A. Williamson, J. Wallis & F.E. Clark, eds. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, VA. Pp. 14-16.

Mongabay.com/20ghana.htm. 2014. Forest data: Ghana Deforestation Rates and Related Forestry Figures. Accessed 8/24/14.

Oates, J.F. 1988. The distribution of *Cercopithecus*

monkeys in West African forests. In *A Primate Radiation: Evolutionary Biology of the African Guenons*. A. Gautier-Hion, F. Bouliere, J.P. Gautier & J. Kingdon, eds. Cambridge University Press, New York. Pp. 79-103.

Oates, J.F. 1999. *Myth and Reality in the Rain Forest*. University of California Press, Berkeley, CA.

Oates, J. F. 2006. *Primate Conservation in the Forests of Western Ghana: Field Survey Results, 2005-2006*. Unpublished Report to the Wildlife Division, Forestry Commission, Ghana.

Oates, J.F. 2011. *Primates of West Africa*. Conservation International, Arlington, VA.

Oates, J.F., T.T. Struhsaker, & G.H. Whitesides. 1996/1997. Extinction faces Ghana's red colobus monkey and other locally endemic subspecies. *Primate Conservation* 17: 138-144.

Oates, J.F., M. Abedi-Lartey, W. McGraw, T.T. Struhsaker & G.H. Whitesides. 2000. Extinction of a West African red colobus monkey. *Conservation Biology* 14(5): 1526-1532.

Ojha, H.R. 2011. The evolution of institutions for multi-level governance of forest commons: the case of community forest user groups federation in Nepal. In *Sustaining Commons: Sustaining Our Future.* 13th IASC International Conference. January 2011.

Roberts, D.L. & A.C. Kitchener. 2006. Inferring extinction from biological records: were we too quick to write off Miss Waldron's red colobus Monkey (*Piliocolobus badius waldronae*)? *Biological Conservation* 128: 285-287.

Sayer, J.A., C.S. Harcourt & N.M. Collins (eds.). 1992. *The Conservation Atlas of Tropical Forests Africa*. IUCN, Simon and Schuster, NY.

Shanee, N., S. Shanee & R.H. Horwich. 2014. Effectiveness of locally run conservation initiatives in north-east Peru. *Oryx* 49(2): 239-247.

Struhsaker, T.T. & J.F. Oates. 1995. The biodiversity crisis in south-western Ghana. *African Primates* 1(1): 5-6,

Wiafe, E.D. 2013. Status of the critically endangered roloway monkey (*Cercopithecus diana roloway*) in Dadieso Forest Reserve, Ghana. *African Primates* 8: 9-16.

Young, C. & R.H. Horwich. 2007. History of protected area designation, co-management and community participation in Belize. In *Taking Stock: Belize at 25 Years of Independence.* B.S. Balboni & J.O. Palacio, eds. Cubola Books, Benque Viejo del Carmen, Belize. Pp. 123-150.

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