COMMUNITY ECO-GUARD PATROL PROGRAM

REPORT OF THE ACTIVITIES UNDERTAKEN IN AND AROUND THE PROPOSED GREBO NATIONAL PARK, LIBERIA (February-July 2014)

Report prepared by Wild Chimpanzee Foundation

In collaboration with Forestry Development Authority

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LIST OF ACRONYMS

CEP: Community Ecoguard Patrols
FDA: Forestry Development Authority
FMC F: Forestry Management Contract "F"
GNF: Grebo National Forest
HPM: Human Path Mapping
IUCN: International Union for the Conservation of Nature
MLME: Ministry of Lands, Mines and Energy
NTFP: Non-timber Forest Products
PGNP: Proposed Grebo National Park
TGSFC: Taï-Grebo-Sapo Forest Complex
TNP: Taï National Park
UTM: Universal Transverse Mercator
WCF: Wild Chimpanzee Foundation

EXECUTIVE SUMMARY

The current report presents results from community eco-guard patrols (**CEP**) undertaken in the Proposed Grebo National Park (**PGNP**), southeast Liberia. These patrols constitute the **first phase of the Eco-guard Law Enforcement Program inside the PGNP**. It was conducted by two teams composed of Forestry Development Authority (FDA) rangers, local community members and supervised by staff of the Wild Chimpanzee Foundation (WCF). The Ebola outbreak in Liberia and the state of emergency protocols prevented continued data collection within PGNP, though the teams managed to cover 78% of the targeted patrols. The remaining area of forest will be patrolled and surveyed in the early months of 2015 and the results presented upon its completion.

10-14 day patrol missions were performed by two teams: one in the north of the park in Grand Gedeh County and one in the south of the Park in River Gee County. During patrols, eco-guards collected data on key wildlife species and anthropogenic activities in order to identify main areas of the park under threat from hunting and habitat disturbance.

In total, **375.2 km were patrolled** over 9 missions, representing **an effort of 484 man-days (76 team-days) totalling more than 400 hours of patrol and more than 3217 man-hours.** A total of **74 traps** were found and destroyed by the ecoguards**. 48 farms, 12 mining sites, 24 hunting tents** and **4 chewing stick camps** were found and **60 persons** met by the teams, and all of these encounters were registered. Mapping of farms and mines showed that **38.4 hectares** of forest patrolled have been degraded, though the majority (27.8 ha) were found in community land (Native Reserve) and only 10.6 ha were found in the original Grebo National Forest. .

Immediate intensive law enforcement actions are needed to reduce and ultimately stop hunting and, most importantly, to stop the trade of chewing sticks imminently to prevent any further degradation of the proposed park. In the longer term, alternative measures to enhance the conservation of fauna and flora must also be implemented, such as protein micro-projects and community forestry for sustainable access to other non-timber products (e.g. food plant species, medicinal plants, firewood, building materials, etc), in local communities.

Ideally, the CEP program should continue on a monthly basis, with the aim of having a minimum of 26 days of presence each month of eco-guards in the forest, to efficiently fight poaching and habitat degradation within PGNP. Efforts are needed to monitor the effectiveness of patrol methods to keep the patrols at a high level. Monthly data must be made available to FDA for decisions on further implementation of patrols and the according appropriate conservation measures. A list of areas in need of additional patrolling is presented in the report. To be more effective, human resources should be increased (at least one more team) for the next phases and a database should be managed to aid conservation managers in strategic planning of enforcement activities. Additionally, FDA rangers qualified to legally enforce the law should also patrol the PGNP to ensure the conservation of the park.

A. INTRODUCTION

The Community Eco-guard Patrols (CEP) program follows on from the first step of the participatory meetings and community consultations held in December 2013 and January 2014 in 56 villages and towns around the Proposed Grebo National Park (PGNP), located in Grand Gedeh and River Gee Counties, Liberia (WCF, 2014). Law enforcement, patrols and permanent presence, have been shown to be some of the most effective means of protecting national parks and wildlife and are thus a priority for the conservation of the PGNP. To support FDA in protecting and creating the park, a CEP program was devised in which community members work alongside FDA rangers to patrol and raise awareness in local communities. Patrol efforts sensitize and deter poachers and illegal settlers, whilst collecting data on key wildlife and anthropogenic threats to identify and estimate the extent of the impact of human pressure on the local wildlife. Following patrols, time spent in local towns and villages permits the Eco-guards to educate their local communities on the impact illegal hunting and farming can have on their natural heritage, and to increase their engagement in the process of creating the Grebo National Park.

This document presents and discusses the major results of the first phase of the CEP program, led from February to July 2014 in and around the PGNP. Various recommendations are proposed to ensure the conservation and sustainable management of the PGNP as well as the maintenance of this program in the long term.

B. METHODS

B.1. PATROL AREA

B.1.1. History of Proposed Grebo National Park

The Proposed Grebo National Park (PGNP) is located in a forest previously known as Grebo National Forest (GNF). GNF was created in the 1950's as part of FDA's mandate to protect the forest estate of Liberia. **As a national forest, natural resource extraction was permitted (through logging activities, for example) but hunting was not allowed**.

Figure **1 Error! Reference source not found.**shows areas of overlap between PGNP and GNF, as well as PGNP and previously non-protected land (known as *native reserve*). The diagram clearly shows that the Grebo National Forest (black diagonal lined area) was split into two distinct fragments: a small isolated patch in the south that juts out towards Côte d'Ivoire (circled in red in
Figure **1**) and the main bulk of the forest extending from River Gee County up into Grand Gedeh County. This leaves an area between the two tracts of forest which represents the native reserve of the people of Glaro district, River Gee (on
Figure **1** it corresponds to the area between both fragments of GNF, without diagonal lines crossing it). This area of native reserve was previously unprotected when GNF existed, but is now included within the boundaries of PGNP. Another smaller native reserve is found in the northwest in Grand Gedeh (circled in orange in
Figure **1**) which belongs to the Bilibo community but is currently also found within the proposed boundaries of the PGNP.

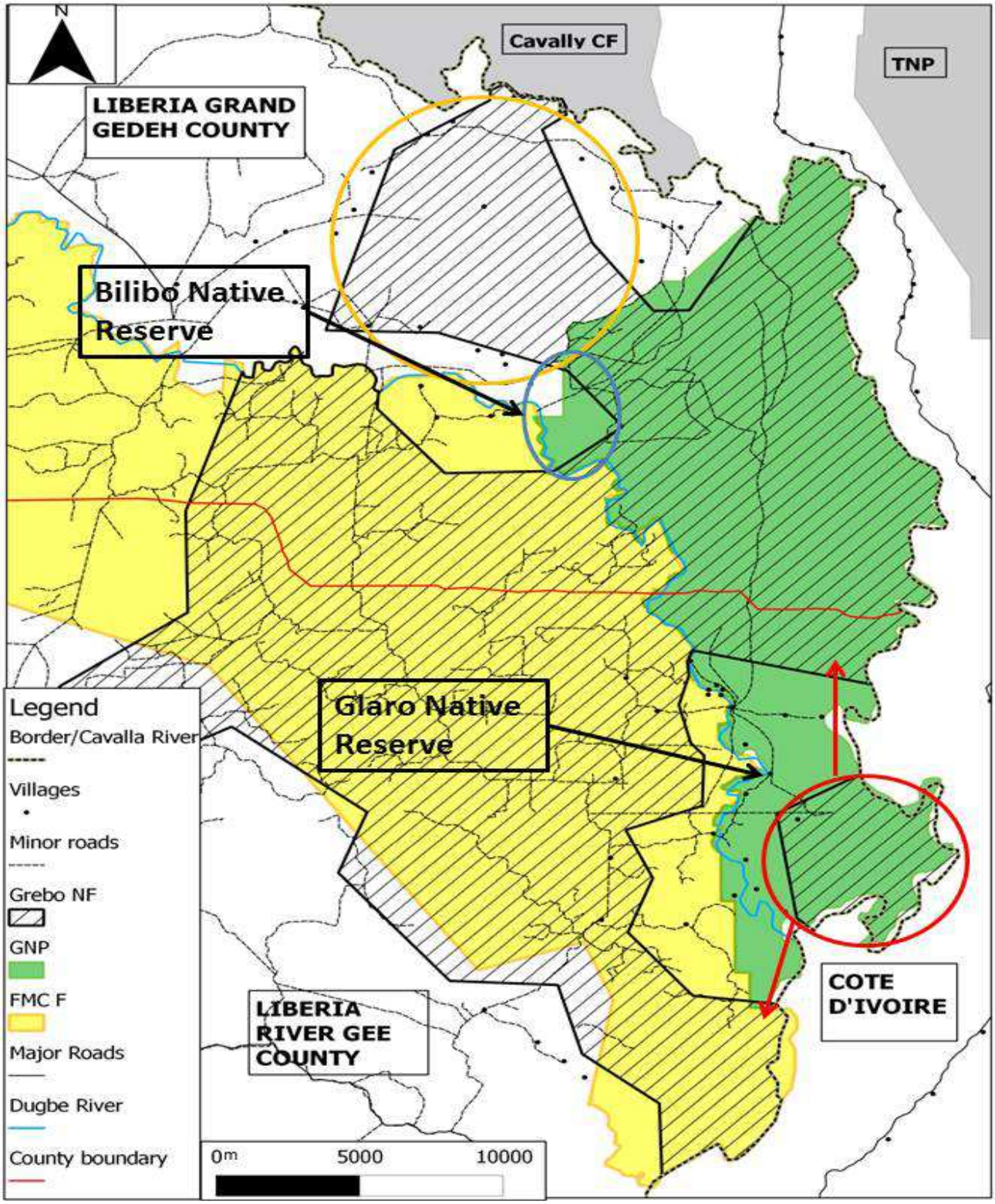

Figure 1: Diagram showing the location of the PGNP (green) in relation to the GNF. The area of black diagonal lines represents the original Grebo National Forest (GNF), demarcated in the 1950s. The yellow area represents the logging concession FMC F created in 2003.

In 2003, a new law was created to establish a protected area network in Liberia, based on FDA's pledge to protect 30% of their forest cover for conservation purposes. As part of this pledge, it was proposed to create "Grebo National Park" (depicted in green in
Figure **1Error! Reference source not found.**) that runs along the border with Côte d'Ivoire, with the Cavalla River acting as the boundary of PGNP to the east, and the Dugbeh river acting as the boundary to the west. The remaining western parts of the GNF were then attributed to form part of a major logging concession, known as FMC F, where heavy logging had occurred in the past. As shown in
Figure **1**, the boundary of both FMC F and PGNP do not align exactly with the GNF. For example, the original proposed GNP area overlaps with the native reserve of the Glaro people, as does FMC F. Additionally; the "horn" of the GNF (circled in blue in
Figure **1Error! Reference source not found.**) was omitted from both. The size of the PGNP was 97,140 hectares, compared to 260,326 hectares for the GNF.

In light of the above and results of previous surveys led by WCF and FDA in GNF in 2012 (discussed further in the report), WCF and FDA agreed that the borders of the PGNP should be revised. Due to the known importance of the "horn" in terms of wildlife (WCF, 2014) and also in terms of acting as a natural corridor of the GNF between Liberia and the Cavally Classified Forest in Côte d'Ivoire, it was agreed that it should now be allocated to PNGP. **Patrols were therefore led in the 126,900 hectares of the new PGNP.**

B.1.2. Issues with community land

The main issue is where PGNP overlaps with the native reserves of the Glaro people in River Gee, and the Bilibo community in the north (circled in orange in
Figure **1Error! Reference source not found.**). Previous discussions with FDA and local communities led to the agreement that the isolated patch of the GNF, surrounded by the Cavalla river and the Glaro native reserve, could remain part of PGNP by creating protected corridor areas leading north and south (red arrows in
Figure **1Error! Reference source not found.**), thereby ensuring connectivity and protection. Such corridors would then be considered as part of PGNP. Results from the eco-guard program would ultimately help in identifying where the final limits of PGNP should be, as they help identify land used by communities for farming, and thus the main problem areas.

B.1.3. Description of the PGNP as it stands in 2014

The PGNP (
Figure 1), which actually includes part of the GNF and some community lands, is a wet evergreen forest located in Grand Gedeh and River Gee Counties, east Liberia. It lies in the heart of the Taï-Grebo-Sapo Forest Complex and is contiguous to the Ivorian Cavally Classified Forest (CCF) on its northern edge and in close proximity to the Ivorian Taï National Park on its eastern edge. The PGNP consists of mature and open secondary forest with an open understory and isolated huge trees. Annual rainfall varies from 1700 to 2300 mm and is bimodal with two main peaks in June-July and September-October. The annual mean temperature is 25.7^{o}C.

Several endangered large mammal species inhabit the area, including the West African Chimpanzee (*Pan troglodytes verus*), the forest elephant subspecies (*Loxodonta Africana cyclotis*), the endemic pygmy hippopotamus (*Hexaprotodon liberiensis*), the Jentink's duiker (*Cephalophus jentinki*), the red colobus monkey (*Procolobus [Piliocolobus] badius*) and the Diana monkey (*Cercopithecus diana diana*) (see IUCN Red list 2014.2 website - www.iucnredlist.org).

B.2. DESIGN

B.2.1. Community eco-guard patrolling design

To effectively patrol the PGNP, a squared grid sampling design (with a random start), consisting of 104 cells of 16 km² (4 x 4 km) was created (Figure 2), to ensure systematic patrolling. This design will also facilitate intensifying patrols in identified key areas, such as zones under high hunting pressure. As such, the same grid design will be used each year, but areas of patrols may differ, depending on the management and conservation needs.

For each cell, two different patrol protocols were used: 1) 2 km Recces, followed by 2) 2 km of Human Path Mapping (**HPM**). During Recces, the eco-guard teams followed one direction from one of the four sides of the cells to the centre point of the cell (known as centroid). Once 2km of Recce were completed, an additional 2km patrol along human paths encountered in the target cell was done, if time permitted and if enough human paths were present. As such, a total of 4km was targeted per grid.

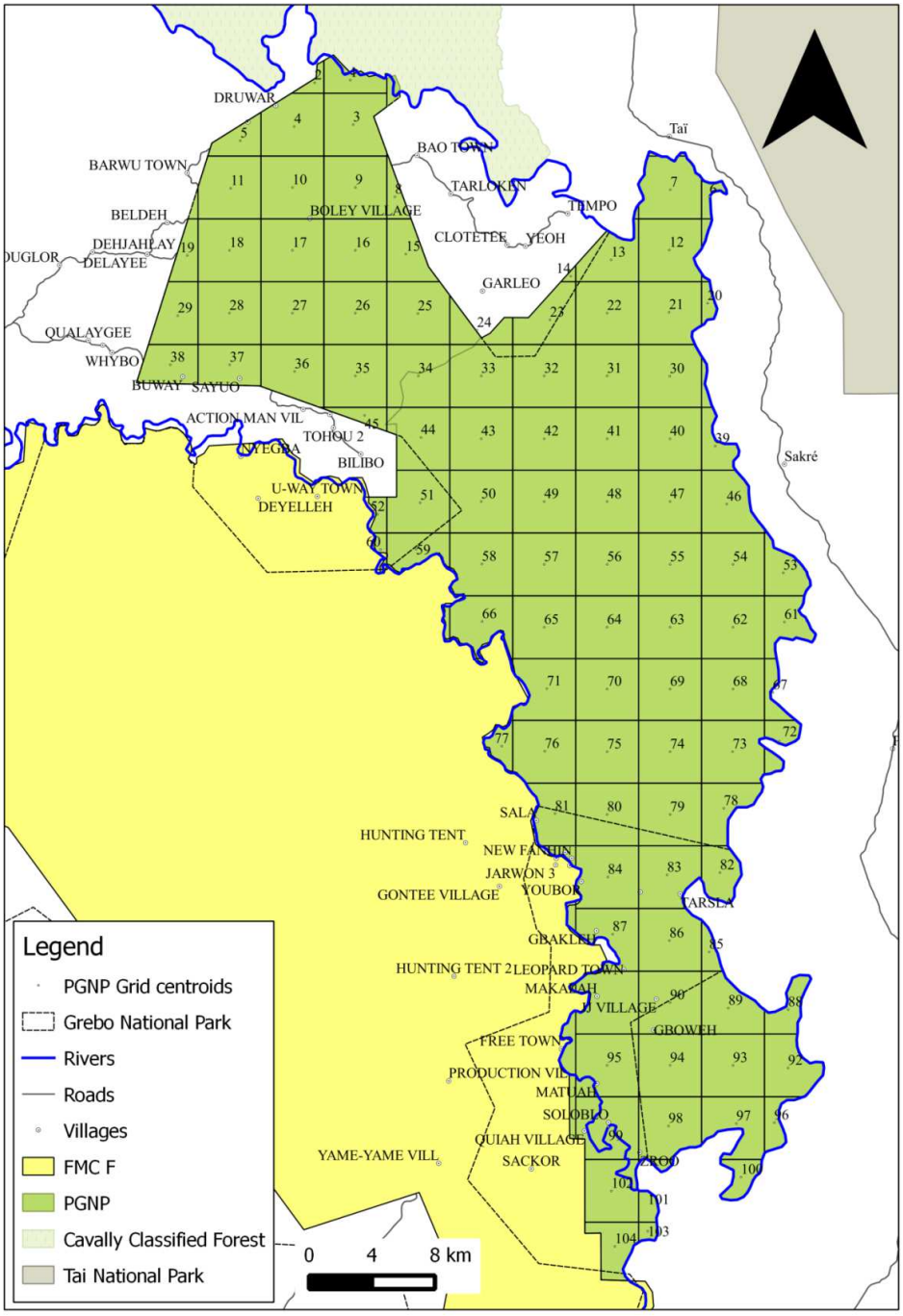

Figure 2: Ecoguard patrol grid in the Proposed Grebo National Park

B.2.2. Data collection and local capacity building

All CEP missions included at least 10 days of effective patrolling per mission with one grid surveyed per day (= 2 km recce + 2km human path patrolled) as a minimum rule. Other days were spent travelling to and from different camps and entering and exiting the forest, followed by 2-3 days of raising awareness in the local communities. This amounts to a minimum of 13 days to a maximum of 21 days of eco-guard work per team. In total, during the past year 2014, 9 missions were completed by two teams between February and July 2014. Each team consisted of 4 local community members and were supervised by 1 WCF staff member and led by 1 FDA ranger. In February and March 2014, team members were trained in patrol protocol and data collection during two workshops conducted by WCF.

During patrols on both recces and human paths, data was collected on all signs of human presence and activity. If people were met during patrols, they were interviewed regarding who they were, where they came from and their purpose in the PGNP. They were then informed about the creation of the park and that activities, such as farming, hunting, mining and extraction of non-timber forest products, would no longer be tolerated. The FDA ranger would issue a warning to the persons: if they were met again, they would be arrested, based on Liberian law. Mapping of habitat disturbance through farms and mines was done during recces and, if time permitted, during HPM. Data was also collected on the presence of chimpanzees (*i.e.*: nests, feeding sites or vocalizations), monkeys, elephants (*i.e.*: footprints, boli, etc…), pygmy hippopotamus and other large mammals (see APPENDIX 1: List of wildlife species of interest for CEP. For bovids, however, only direct observations were recorded. Direct observations of monkeys were also recorded. As such, data was recorded during the full 4km of patrols per grid.

B.2.3. Data analysis

As mentioned above, since this was the first time an eco-guard program has occurred within the park, different patrol protocols were tested (Recce and HPM). Encounter rates of species or anthropogenic activities were calculated by dividing the number of observations of a certain type, by the distance walked during the patrols in each grid, for both RECCE and HPM sessions. A global encounter rate was then calculated by compiling all observations made during the two patrol protocols, and by dividing the total by the total patrol distance. Encounter rates were then mapped using QGIS per Grid to identify grids under most threat or having a greater abundance of large mammals.

To evaluate the level of deforestation inside PGNP, plots of particular interest were mapped using QGIS. The total hectares degraded per grid, and the % of degraded land per grid, was calculated for each grid and in terms of type of habitat disturbance (farms, mines, etc).

C. RESULTS

C.1. PATROL EFFORT

A total of 82 grids was patrolled out of the 104 across PGNP, representing 78% of the targeted grid effort. The 22 remaining grids could not be completed, as fieldwork was stopped due to the Ebola crisis in Liberia in August 2014. A total of 202.5 km was patrolled along recces, representing 126.58 % of the theoretical patrol effort targeted (2 km per grid) and 172.7 km ($\acute{x}_{grid}$=2.303 [0.273-9.879]) were patrolled during HPM, representing 107.9% of the theoretical patrol effort targeted, giving a total of 375.2 km patrolled over 9 missions. **This represents an effort of 484 man-days (76 team-days) totalling more**

than 400 hours of patrol and more than 3217 man-hours. The 22 remaining grids will be surveyed upon the resumption of fieldwork in the first quarter of 2015. APPENDIX 1 provides data on patrol effort per day.

C.2. REVIEW OF OBSERVATIONS

C.2.1. Anthropogenic observations

In total, 2,626 observations of anthropogenic threats were made during patrols. Other observations made off patrols (when walking to and from the camp) were also noted, though not taken into account for the analyses. Table 1 shows the frequency of each type of observation, and the calculated encounter rate per protocol and overall. This table gives an idea of which threats are the most pertinent within PGNP, hunting being the most abundant (4.32 signs per km), with **74 traps observed and destroyed, and 48 farms, 12 mining sites, 24 hunting tents and 4 chewing stick camps found by the teams**. Persons met at these locations were told about the park and ultimately told to leave the park. Though not mentioned in the table, **a total of 60 people** (including nationals from Ghana, Côte d'Ivoire and Liberia) were encountered and interviewed by the FDA rangers leading the two teams. Ten Ghanaians were met in G073 as they were harvesting the *Garcinia*-chewing sticks and said they were for exporting to Para in Côte d'Ivoire. All of them had permits from FDA, though these permits did not specify where the harvesting can be done. These permits have since been annulled by the FDA Head Office. APPENDIX , APPENDIX and APPENDIX 5 provide calculated encounter rates per grid per observation for both protocols separately and conjoined.

Table 1. Number of observations and encounter rates (E-Rate) for each type of anthropogenic observation made during patrols (HPM and recce)

Category	General Observation	Detailed Observation	HPM	*HPM E-Rate*	RECCE	*Recce E-Rate*	TOTAL	TOTAL E-Rate
Hunting	Poaching	Cartridges	735	*3.63*	320	*1.85*	1055	2.81
		Fires made by poachers	7	*0.03*	1	*0.01*	8	0.02
		Gunshot	5	*0.02*	3	*0.02*	8	0.02
		Hunter (people met)	0	*0.00*	1	*0.01*	1	0.00
		Hunting tent	18	*0.09*	6	*0.03*	24	0.06
		Poacher's track	111	*0.55*	333	*1.93*	444	1.18
		Skull	1	*0.00*	0	*0.00*	1	0.00
		Traps	32	*0.16*	42	*0.24*	74	0.20
	Total Poaching observations						**1615**	**4.30**
	Fishing	Nets/canoes	0	*0.00*	3	*0.02*	3	0.01
		Fisherman (people met)	0	*0.00*	2	*0.01*	2	0.01
	Total Fishing observations						**5**	**0.01**
TOTAL HUNTING OBSERVATIONS			**909**	**4.48**	**711**	**4.12**	**1620**	**4.32**
Habitat Disturbance	**Farming**	Farm	27	*0.13*	21	*0.12*	48	0.13
		Farmers (people met)	6	*0.03*	5	*0.03*	11	0.03
	Total Farming observations						**59**	**0.16**
	Chewing sticks	Garcinia roots	42	*0.21*	34	*0.20*	76	0.20
		Cut Garcinia tree	24	*0.12*	18	*0.10*	42	0.11
		Chewing-stick camp	3	*0.01*	1	*0.01*	4	0.01
		Chewing-stick harvesters (people met)	13	*0.06*	0	*0.00*	13	0.03
		Chewing-stick loading site	1	*0.00*	0	*0.00*	1	0.00
	Total Chewing stick observations						**136**	**0.36**
	Logging	Old Logging roads	15	*0.07*	29	*0.17*	44	0.12
		Old logging loading sites	1	*0.00*	0	*0.00*	1	0.00
	Total Old commercial Logging observations						**45**	**0.12**
	Local logging	Pit-sawing	2	*0.01*	0	*0.00*	2	0.01
		Cut trees (new, local)	128	*0.63*	60	*0.35*	188	0.50
	Total Local Logging observations						**190**	**0.51**
	Mining	Active mining sites	0	*0.00*	5	*0.03*	5	0.01
		Prospection sites	3	*0.01*	4	*0.02*	7	0.02
	Total Mining observations						**12**	**0.03**
TOTAL HABITAT DISTURBANCE OBSERVATIONS			**265**	**1.31**	**117**	**1.02**	**442**	**1.18**
Other Human Activity		Objects	53	*0.26*	28	*0.16*	81	0.22
		Human paths	180	*0.89*	280	*1.62*	460	1.23
		School	0	*0.00*	1	*0.01*	1	0.00
		Zoe Bush	1	*0.00*	0	*0.00*	1	0.00
		Villages	4	*0.02*	2	*0.01*	6	0.02
		Car Roads	4	*0.02*	11	*0.06*	15	0.04
TOTAL OTHER HUMAN ACTIVITY OBSERVATIONS							**564**	**1.50**
GRAND TOTAL							**2,626**	**7.00**

C.2.2. Wildlife observations

In total, 287 observations regarding key wildlife species were made during patrols (Table 2). More observations of wildlife were made on recces in comparison to human paths. For bovids, only direct observations were recorded during patrols. Direct observations were also taken for monkeys. Signs of presence (dung, nests, tracks, etc) were taken for key species such as elephant, monkeys, pygmy hippopotamus, leopard and other felids and chimpanzees along patrols. For monkeys, direct observations and indirect observations were calculated together.

Table 2. Number of observations and encounter rates (E-Rates) for each type of mammal observation made during patrols (HPM and Recce)

Category	General Observation	Detailed Observation	HPM	*HPM E-rate*	RECCE	*Recce E-rate*	TOTAL	TOTAL E-Rate
WILDLIFE	Bovids	*Cephalophus Dorsalis*	0	*0.00*	1	*0.01*	1	*0.00*
		Cephalophs Jentinki	0	*0.00*	1	*0.01*	1	*0.00*
		Cephalophus Niger	0	*0.00*	1	*0.01*	1	*0.00*
		Cephalophis Ogilby	2	*0.01*	3	*0.02*	5	*0.01*
	Total direct observations of Bovids		**2**	**0.01**	**6**	**0.03**	**8**	***0.02***
	Monkeys	*Cercecebus atys atys*	11	*0.05*	6	*0.03*	17	*0.05*
		Cercopithecus diana Diana	7	*0.03*	29	*0.17*	36	*0.10*
		Cercopithecus pettuarista	9	*0.04*	13	*0.08*	22	*0.06*
		Colobos polykomos	5	*0.02*	13	*0.08*	18	*0.05*
		Piliocolobus badius	7	*0.03*	14	*0.08*	21	*0.06*
		Procolobus verus	0	*0.00*	1	*0.01*	1	*0.00*
	Total observations of monkeys		**39**	**0.19**	**76**	**0.44**	**115**	***0.31***
	Elephants	***Loxodonta africana cyclotis***	7	*0.03*	47	*0.27*	**54**	***0.14***
	Felids	***Felis aurata***	1	*0.00*	1	*0.01*	**2**	***0.01***
	Pygmy hippopotamus	***Choeropsis Liberiensis***	1	*0.00*	10	*0.06*	**11**	***0.03***
	Chimpanzees	***Pan troglodytes verus***	14	*0.07*	83	*0.48*	**97**	***0.26***
	GRAND TOTAL		**64**	**0.32**	**223**	**1.29**	**287**	***0.76***

C.3.1. Areas under threat from hunting

Hunting appears to occur in all areas of the park (Figure 3), with high abundance in areas near villages and along the border with Côte d'Ivoire (Figure 3). **Boley village (G010 and G017), Sayuo (G037), Action man village (near G036), Gbakleh (G087) and Youbor (G084)** seem to be the main villages and towns concerned by those activities, though hunting signs around Youbor are concentrated in the native reserve. Boley village is located in the center of the horn of PGNP. The chief of the village, Mr. Boley, has been asked more than 3 times by the FDA to leave, though it appears he continues to make farms. No important wildlife observations were made in these grids, showing the destructive effect of high concentrations of anthropogenic behavior on biodiversity within the park. The aim of the maps below is to assist FDA in visualizing where future missions of FDA park rangers should be done. Moreover, APPENDIX gives the GPS coordinates of hunting tents found, which should be removed as a priority. Note that hunting is also high in **G030**, **G078** and **G096**, along the border with Côte d'Ivoire.

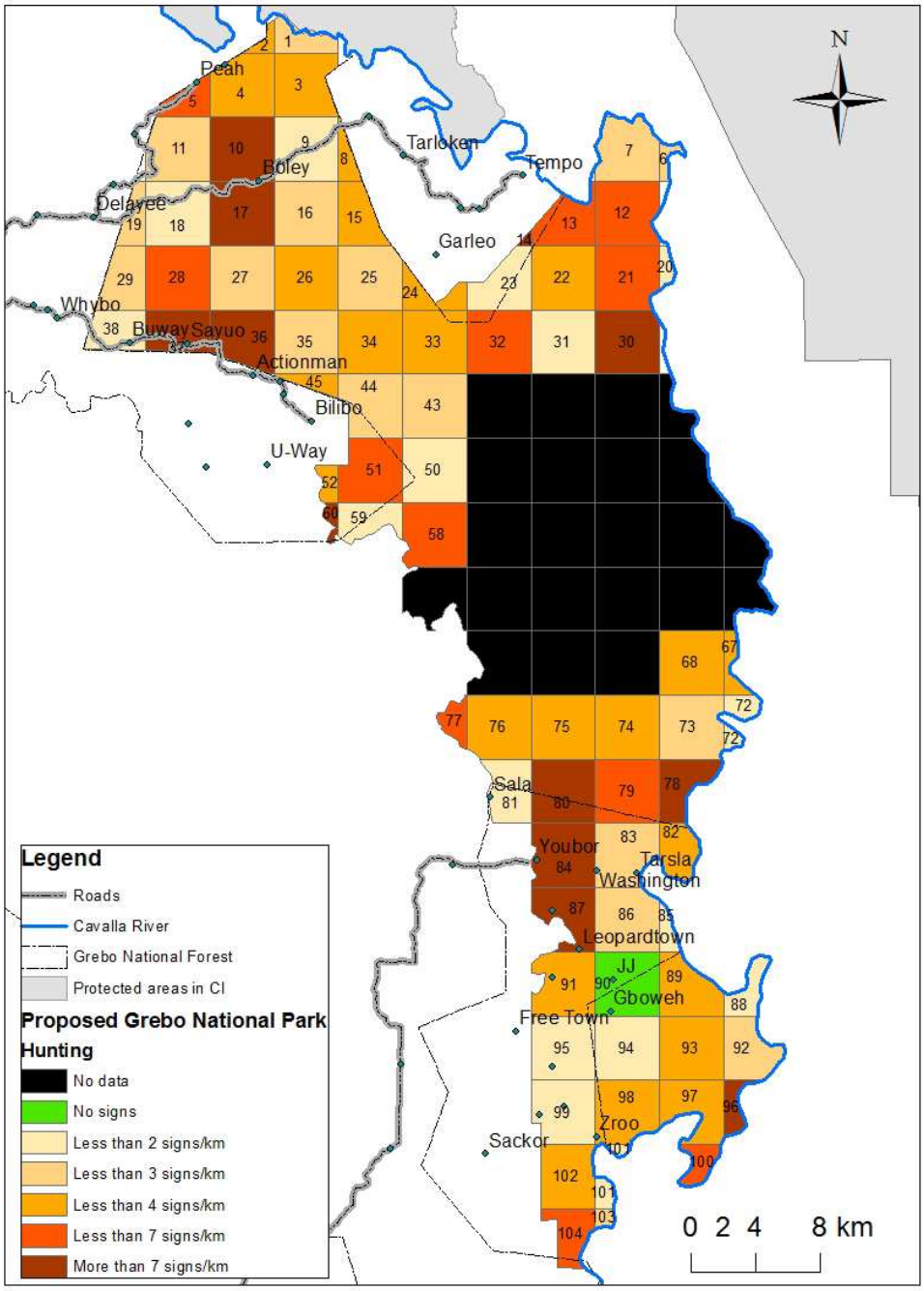

Figure 3: Spatial distribution of hunting signs in PGNP (the darker the colour, the higher the concentration of hunting signs)

C.3.2. Areas under threat from habitat disturbance

Signs of habitat disturbance are frequent across the entire PGNP (Figure 5). **G073** shows a zone of very high threat and this is largely due to chewing-stick harvesting activities that have developed into industrial scale operations. **G030 and G073** are also clearly under threat from the chewing-stick trade (Figure 4). All three grids should be visited immediately to evict the illegal settlers. The 4 camps located were used by Ghanaians who export the sticks to Côte d'Ivoire. Recent reports from WCF teams in Côte d'Ivoire show that the chewing-sticks continue to be exported, regardless of fact that the border is closed between Côte d'Ivoire and Liberia. In one of the areas, more than 300 sticks were piled up on the Cavalla River. Other heavily degraded areas correspond to areas of native reserves (previously not protected community-land, for which decisions must be made whether to include it in the park or not), where people have been farming, or other areas near villages where farming and mining are occurring. Figure 6Figure 5 shows the detailed locations of farms, mines, and chewing-stick sites. The diagram clearly shows that in the south, farms are for the majority inside the native reserve, whereas in the northwest of the horn, there is high encroachment by the communities of **Peah and Druwar (G004, G005)** in the horn of PGNP. Active mining sites are found outside the original GNF boundary line (**G051, G052**), but all prospection sites were found within the GNF and PGNP (**G059, G043**). APPENDIX shows the mapped land plots within PGNP and APPENDIX 7 shows the coordinates of the farms, mines and chewing-stick sites that FDA should use to guide further patrols. No. of hectares of each land plot are also presented.

Farms and mines were located in 22 of the 82 (26.8%) surveyed grids and were mapped and plotted accordingly. The total surface mapped represents **38.4 hectares of degraded forest** (*Table* 3). Many of these were found in native reserve land in both the north and south (see Figure 6). Farming represents 98.6% of degraded land and the majority (27.8 hectares) is located inside the native reserve. **10.6 hectares were located inside the GNF,** and are thus already illegal. Cocoa farms are the most abundant crop, particularly in the southern native reserve. The villages of Buway and Sayou were also mapped, as they appear to be inside the horn of the PGNP (including a missionary school). However, this could be simply due to the fact that the boundary line in the field does not correspond exactly the UTM coordinates on the shapefile. Further investigations may be required. Additionally, a sacred forest of the Leopard Town community was mapped. It is located in the native reserve in Glaro. **Error! Reference source not found.** provides an idea of the threat per grid in relation to habitat disturbance and in relation to the hectares of forest lost. In **G005, more than 5 hectares of habitat were degraded,** and this part is thus under the highest threat from encroachment.

Table 3 : Number and surfaces of land types recorded during the patrols per type of land status.

Location	**Native Reserve**		**GNF**		**TOTAL in new PGNP**	
Farm	**N°**	**Ha**	**N°**	**Ha**	**N°**	**Ha**
Rice	5	4.5	3	5.3	8	9.8
Clearing	5	1.6	2	0.4	7	2.0
Plantain	0	0	1	0.2	1	0.2
Cassava	0	0	1	0.5	1	0.5
Cocoa	20	19.9	4	4.0	24	23.9
Corn	1	1.4	0	0	1	1.4
Mining	3	0.4	2	0.1	5	0.5
TOTAL	**34**	**27.8**	**13**	**10.6**	**47**	**38.4**

Figure 4: Piles of chewing-sticks ready to be exported to Côte d'Ivoire

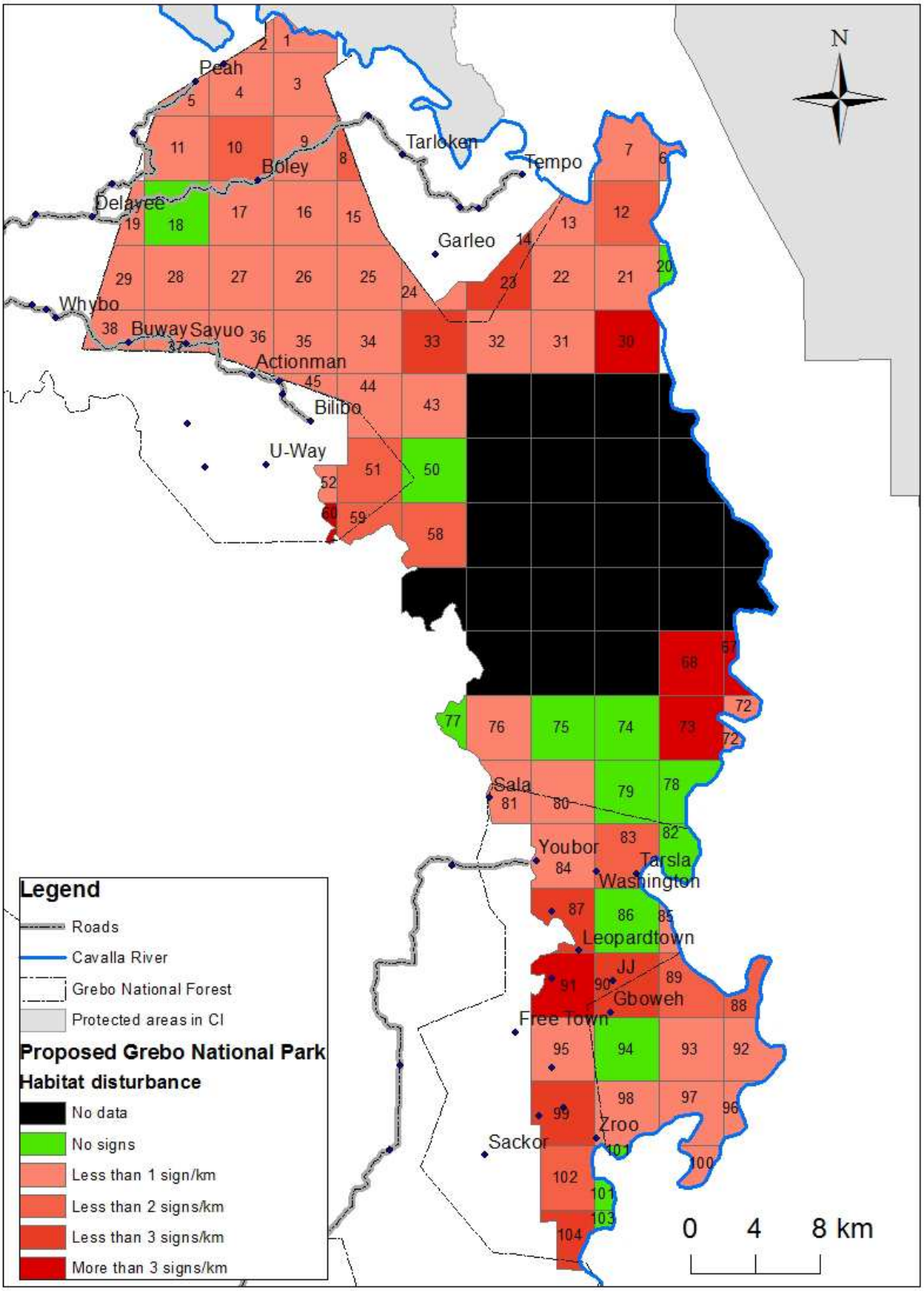

Figure 5: Spatial distribution of habitat disturbance sites in PGNP (the darker the colour, the higher the encounter rate of habitat disturbance)

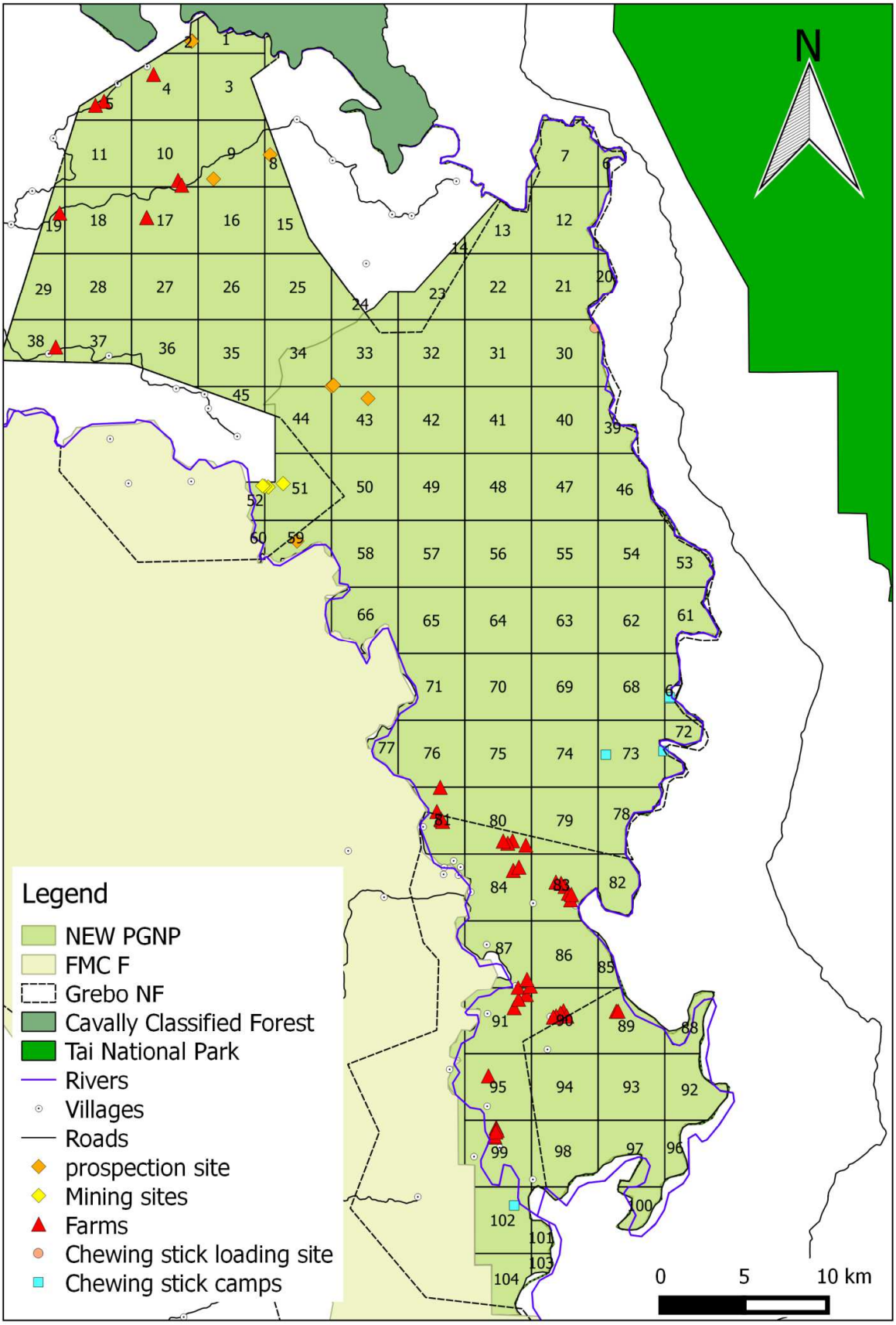

Figure 6: Locations of farms, mines and chewing-stick camps in PGNP

C.3.3. Spatial distribution of wildlife

The map compiling all signs of wildlife considered during this survey (large mammal) is presented in **Error! Reference source not found.**. As expected, indices of presence globally encompass PGNP. Nevertheless, for **4 main areas,** there are no observations, – a bad sign for biodiversity. One is located along the road between Delayee and Tempo villages (**G009, near Boley village**). The second one is at the north eastern part of the PGNP, along the Ivorian **border (G007, G012, G021, and G030**). The third area is inside the native reserve along Gbakleh and Makalah villages (**G087 and G091**). The last area encompasses all the southern part of the PGNP, south of Soloblo and Zroo villages (**G097, G099, G101, G103 and G104**). The highest encounter rates of wildlife indices are concentrated inside the community forest of Leopard Town (**G086**), at the northern border of the community forest (**G075**) and in **G043**.

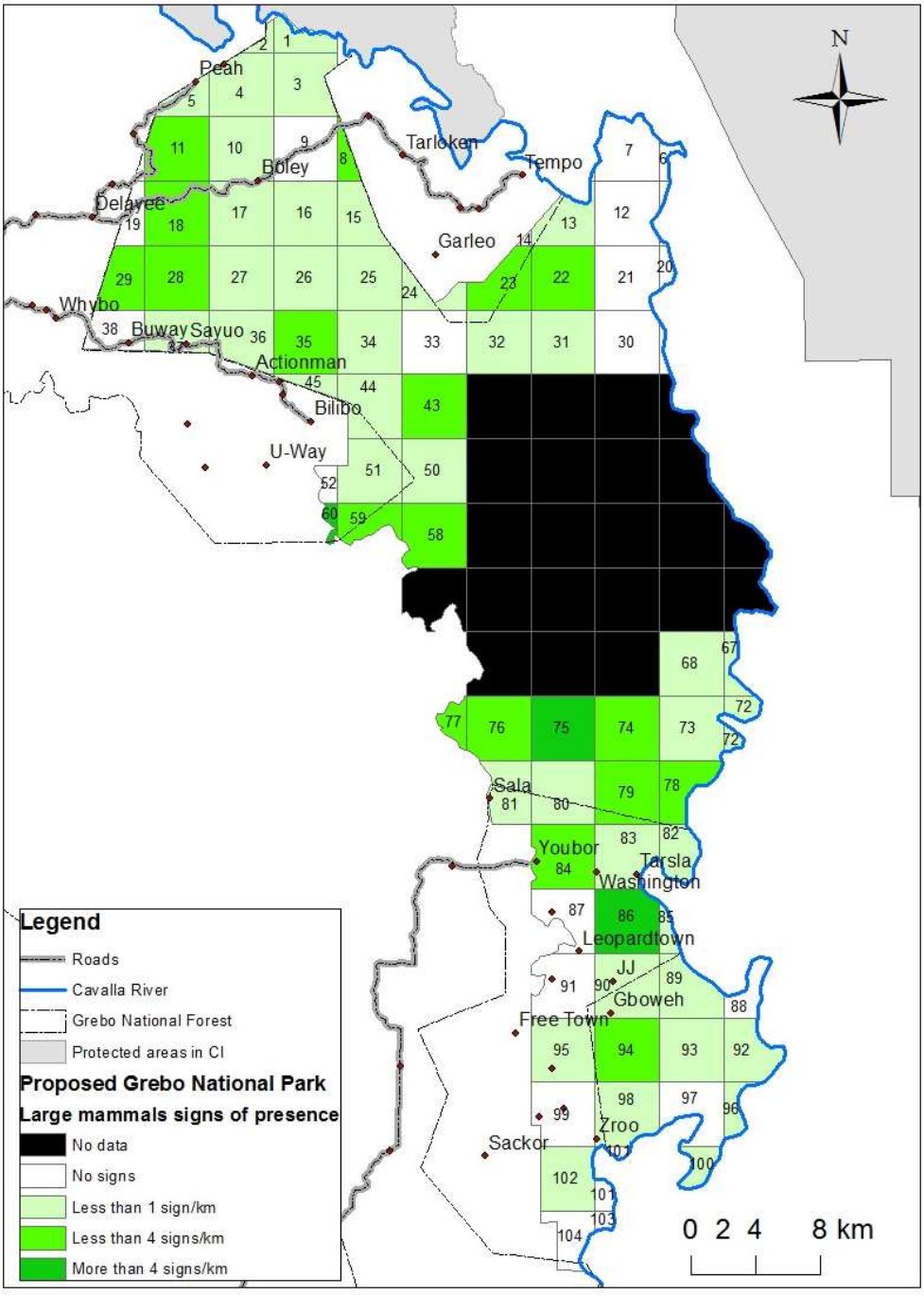

Figure 7: Spatial distribution and encounter rates per km of signs of all wildlife observations inside the PGNP

D. DISCUSSION

The very first phase of eco-guards in the Proposed Grebo National Park has so far proven a success. 8 community members under the supervision of FDA and WCF have been trained to undertake patrolling missions to support the FDA in detailed reporting on the threats such as hunting, mining and farming with the aim to react to those threats. As eco-guards are not official law enforcers, and since the creation of the PGNP is a relatively new idea for the local communities, the patrols in 2014 primarily **helped to locate major threats within the forest and raise awareness in the communities about the creation of the park**. The eco-guards also sensitized **60 persons** met during the patrols in the PGNP about the creation of the park. Using two different protocols (Human Path Mapping and Recces), the eco-guard teams were able to patrol over 320 km in the PGNP. Only 22 out of the 104 (4x4km²) cells were not patrolled, as work was cut short at the end of July due to the Ebola crisis. These remaining grids will be patrolled when work starts again at the beginning of 2015.

D.1. Illegal hunting

Though hunting is found all across the park, certain areas are clearly under higher threat – the border with Côte d'Ivoire, areas near villages (periphery of the proposed park) and in the centre of the horn. Inside **Grid G017** is the village of Mr. Boley, who has settled there for nearly 5 years illegally inside the original GNF. Mr Boley has been visited on numerous occasions by FDA to be told to leave the forest and to stop any activities inside the park, though these warnings have not been respected. The high abundance of hunting signs around his village clearly indicates that his community is hunting inside the park. Additionally, **Grids G036** and **G037** in the horn also show high abundance of hunting and are situated right next to the Twaabo communities of Buway and Sayuo (including the small settlement of Action Man village). **Grid G087** in the Youbor region (Gbakleh village), and **G060** just south of the Bilibo community, also shows high hunting signs encounter rate. However, these latter grids correspond to areas that were previously not inside the GNF. For such areas and the involved communities, FDA needs to decide on their status, whether to include them in the park or not, considering also the resulting potential increase of tensions. If it is decided to exclude them from the park limit, hunting inside these areas cannot be considered illegal (except if they are hunting protected species of Liberia), but awareness should be raised in the communities regarding the new wildlife act. Overall, an intensification of CEP patrols and FDA ranger patrols along the periphery of the park and the Côte d'Ivoire border is needed, as most hunting tents are found in both these areas. FDA rangers should also be placed permanently at the border crossing points to ensure that the ban on bushmeat trade is being respected. The absence of key wildlife species in many of the grids along the border with Côte d'Ivoire indicates that poachers from Côte d'Ivoire are also hunting in the PGNP. Thus, awareness activities are also essential in the bordering villages of Côte d'Ivoire. To summarize, key grids to target for hunting are: **G017, G036, and G037 in addition to G012, G022, G030, G032, G033, G050, G058, G028, G076, G088,** and **G096.**

D.2. Habitat disturbances

Habitat disturbance is caused by various activities such as farming, mining, pit-sawing and the chewing-stick harvesting. The latter is clearly the greatest threat at the moment to the PGNP. The *Garcinia spp.* is cut down to be used as chewing-sticks, and/or the roots extracted to be used for traditional medicinal purposes. To feed the unsustainable demand of chewing-sticks, economic migrants from Ghana have infiltrated the PGNP to harvest this valuable commodity (Osei-Tutu et *al.* 2012). Through investigations led by the ecoguards both during patrols and when in the communities, the towns of **Garleo, Bilibo, Gbakleh, Leopard town, Makalah and Zroo** have been identified as the Liberian communities allowing the Ghanaian harvesters to settle in the forest in return for a "rental" payment to use the land. Though FDA has already annulled all chewing-stick harvesting permits, awareness on this issue in the local communities is needed. Moreover, since the chewing–sticks are exported via Côte d'Ivoire, communication and collaboration with Ivorian authorities would help prevent the trade. The village of Para in Côte d'Ivoire appears to be one of the main areas through which the chewing-sticks are exported. Awareness-raising with these communities is thus crucial as well. Lastly and most importantly, FDA-patrols to evict the illegal settlers in the camps identified (**G067, G068, G073**) (a separate report with the exact GPS coordinates of the

camps has been provided to FDA) is vital to stop the trade. Such patrols could be supported by other law enforcement officials such as Immigration officers, Police and Emergency Response Unit officers.

Farming is also a threat to the PGNP. In the north-eastern horn, there appears to be a clear encroachment on the park by farmers, coming from the communities of **Peah** and **Druwar**, **Buway** and **Boley village**. All communities have been met and told to stop extending their farming activities in the PGNP. During patrols, data on land plots and locations were noted, but no farms were destroyed. However, to ensure that farms are abandoned in the near future, new plantations should be removed during the next phase of ecoguard patrols. It would be important to start from the periphery of the park, where the threats are highest of infiltrating community members. Communities should be given a definitive date by FDA by which all farms should be abandoned. These farms are located in the GNF, a government forest, which will become part of the park. A clear message needs to be made to the communities to show that FDA is gaining authority of the forest. If farming activities continue in this area on the current scale, the north-east of the horn (a critical corridor for the TGSFC) will be completely destroyed. **Grids G004, G005, G010, G017, G019** and **G038** should be priority regions for these actions.

In the south of the park, the majority of farms were found inside the native reserves. Since these farms are located in community-owned land, no action needs to be taken. The mapping of these farms will help the FDA and WCF delimit a new boundary line that omits this area from the PGNP. However, **G089** also has farms within it, and is located in the original isolated patch of GNF and, thus, should also be patrolled by FDA in the near future. **G083** is in the native reserve and has many cocoa farms. Investigations by the teams showed that this area is used by the communities of Youbor who host/employ people from Burkinabe to farm cocoa for them in exchange for their own farm. If a corridor linking the isolated patch of GNF to the rest of the park is to be placed here, complete mapping of this area is a priority, as are discussions with the community members on the creation of a corridor there. Only once this is done can a final new park boundary line be created and demarcated.

Another land transformation of importance is **artisanal and/or illegal mining**. Five sites were detected and mapped during the patrols. All active mining sites are located in the region of Bilibo in Grand Gedeh. This area corresponds to original community-land and was not part of the original GNF. However, all prospection sites were located further in the forest, in the GNF and future PGNP. The mining sites in **G051** and **G052** are more than likely sites for which permits have been given by the Ministry of Lands, Mines and Energy (MLME). FDA should contact the MLME to decipher between legal mines and illegal mines. MLME should also be made aware of the PGNP boundaries to ensure they do not provide new permits for prospection inside the park. Awareness-raising in these communities should be done by FDA and the MLME.

To summarize, key grids to target are **G004, G005, G010, G017, G030, G033, G067, G068, G072, G073,** and **G089.**

D.3. Improvements to the patrolling protocol

As mentioned above, the new eco-guard program has been a success and helped locate areas in need of conservation measures to protect the PGNP as well as raise awareness. In addition to the suggestions below, it is advised that in 2015, the law enforcement aspects for the PGNP are led by the FDA, so as to be able to send clear messages to those threatening the forest. For example, FDA should lead patrols to take down old fields and hunting tents, to regain authority in the PGNP. To improve the program, a few suggestions are provided below. These should be validated at a meeting with FDA at the beginning of 2015.

I) To target anthropogenic threats more efficiently, patrols should be concentrated on human paths, not on recces. As such, for each grid, 4km of human paths should be mapped and patrolled. If human paths are absent from the grid, or not of 4km in total length, recces should be done to reach the 4km patrol target. Patrolling on human paths should make it clear that there is a serious legal presence in the region and thus decrease the presence of hunters, miners and farmers, etc…

II) All farms and mines should be plotted. Plotting should be set as a priority during patrols so as to monitor the extent of habitat disturbance and regeneration.

III) To ensure correct data is taken on *Garcinia spp.*, this data must have its own observation code to avoid confusion with other types of cut trees. For each observation, the quantity of cut trees should be noted (either stumps, or piled logs). A distinction between *Garcinia* roots and logs should also be made. For all other cut trees, the same protocol should be followed. If the trees are clearly cut by the local communities, the observation "Pit-sawing: and not "Logging" should be noted.

IV) For camp observations, the details on size must be noted (i.e. how many beds, number of drying racks, and the use, i.e. chewing stick, mining, hunting camp etc…).

V) For each observation of traps, the type of trap must be noted (*i.e.*: Pit trap, Wire trap, Jaw Trap, etc…)

VI) Observations on wildlife should be placed a least priority to ensure the eco-guards patrol at least 4 km inside a grid, i.e. covering the most ground to find the areas with the most threats to wildlife.

VII) Mission reports must be completed as soon as the mission is over. A simple, quick and easy means to this is by using the free SMART software (Spatial monitoring and reporting tool). FDA and ecoguards should be trained to use the software. By simply entering the data correctly, mission reports can be produced automatically, providing data on patrol effort, number of key observations, and areas of highest threat. Such a report can then help FDA plan further law enforcement patrols more efficiently. An example of this report is available in APPENDIX 3.

VIII) If funding permits, a 3rd ecoguard team should be formed. This team could be primarily composed of FDA rangers to revisit the sites noted as important during the first phase (i.e. hunting tents, illegal farms, mines and chewing stick camps) to enforce the law officially by destroying the camps etc…

IX) Grids overlapping with community-land, once agreed upon by WCF and FDA to definitely NOT form part of the PGNP (for example, **G084, G087, G091, G095,** and **G099**), should then no longer be patrolled to reassure the communities their land will not be taken away from them. It will also reduce the time spent patrolling the whole area.

X) A clear role and responsibility of the community eco-guards must be agreed on by the WCF and the FDA, e.g. can they be hired as FDA auxiliaries, or, what mandate does the FDA give them? A clarification with FDA must also be set for the community eco-guards' actions for when they come across new and old farms, mines, hunting tents etc…

XI) FDA rangers must patrol as well, in addition to the community eco-guards, to enforce the law, destroy traps, hunting tents, farms and other illegal activities. Eco-guards can continue to support these efforts by locating the threats and raising awareness in the communities.

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E. CONCLUSION

Though the PGNP is known to harbour important biodiversity, regular patrolling has shown it to be under a high threat from anthropogenic activities. In addition to a continued community eco-guard program, it is vital the FDA leads large scale ranger patrols in key areas to target the threats and reduce their imminent pressure on the wildlife and the forest. CEPs can be used to support FDA in the future to locate threatened areas and relay the information back to FDA quickly, so that FDA can subsequently react efficiently and enforce the law. In light of the high threats, a prioritization of measures must be decided on. Some recommendations are provided below. A meeting at the beginning of 2015 should be set up to validate the next steps to be undertaken by FDA, WCF and other partners.

1) **Increase human resources available for the park:** Currently FDA only has 9 rangers assigned to the park. In order for FDA to lead regular law enforcement patrols, a minimum of 20 rangers should be assigned to the park for this task alone.

2) **Delimit the horn of the PGPN in the field:** the towns of Buway and Sayuo, for example, appear to be inside the horn of the GNF when looking at the maps, though it appears that, on the ground, the old boundary line does not correspond to the shapefile of the GNF. To avoid confusion, mistrust and conflict with the local communities, the original GNF boundary line should be mapped and demarcated in the field by FDA, WCF and local community members. Only once this is done, FDA can be sure, for example, which farms are/are not illegal. In the meantime, these communities, and those of Peah and Druwar, should be told to stop extending their farms until the boundary line issue has been clarified.
3) **Lead eviction missions with the support of other law enforcement offices (Police, Emergency Response unit, etc...):** Priorities should be placed to remove illegal settlers within the Grebo National Forest boundaries, including the chewing-stick harvesters set up along the border with Côte d'Ivoire.
4) **Lead FDA ranger patrols in the periphery of the park and along the Cavalla River:** Both areas are subject to intense hunting and other anthropogenic activities. FDA ranger patrols should initially be led in these grids. This will make their presence known, showing the communities that FDA is re-gaining authority of their forest. Additionally, the trade along the border by Ivorians, Ghanaians and Liberians of for example chewing-sticks, needs to be stopped. Grids identified as priorities to revisit could be used as a guideline. The purchase of a boat to patrol the Cavalla River could facilitate monitoring infiltration on the eastern side of the park. In the near future, ranger-posts should be built along the border to prevent infiltration and the trade of both bushmeat and chewing-sticks.
5) **Lead extensive land-use surveys in the corridor areas within Glaro District (see Figure 1):** by better understanding which land is used by the local communities, corridors can be designed so as to limit their impact on the local communities, whilst connecting the isolated patch of Grebo to the rest of the forest. Once this is done, the corridors and FINAL boundary lines of the PGNP can be validated and demarcated.
6) **Use the GNF boundary as a basis for the final PGNP boundary lines:** Overall, it appears that for the majority of the inhabitants, the original lines of the Grebo National Forest have been respected by the local communities, at least in terms of mining and farming. By using the GNF boundary lines as a basis for the park boundary, this will reduce conflicts with local communities, as there is already an understanding that this forest belongs to the government.
7) **Inform Ministry of Lands, Mines and Energy (MLME) on the creation of the PGNP:** Communication should be improved between the FDA and MLME to ensure they do not provide more mining permits inside the PGNP. Awareness-raising missions to Bilibo community should be done in conjunction with the MLME.
8) **Develop alternative livelihood projects in key villages:** To reduce the local communities to depend on hunting as a livelihood and protein source, micro-projects such as fish and chicken farms should be developed with the communities.

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APPENDIX 1: List of wildlife species of interest for CEP

Common name / Observations	Family / Precisions	Species/ Precisions	Codes
DIRECT OBSERVATION : Animals			
Mammals			
Primates			
Campbell's monkey (Mona)	*Mammal / Cercopithecidae*	*Cercopithecus mona campbelli*	**Mona**
Sooty Mangabey	*Mammal / Cercopithecidae*	*Cercocebus atys atys*	**Sooty**
Diana monkey	*Mammal / Cercopithecidae*	*Cercopithecus diana diana*	**Diana**
Lesser spot-nosed monkey	*Mammal / Cercopithecidae*	*Cercopithecus petaurista buettikoferi*	**Petau**
Greater spot nosed monkey	*Mammal / Cercopithecidae*	*Cercopithecus nictitans nictitans*	**Nictitans**
Olive Colobus	*Mammal / Colobinae*	*Procolobus verus*	**Olive**
Western black and white colobus	*Mammal / Colobinae*	*Colobus polykomos polykomos*	**Polyko**
Western red colobus	*Mammal / Colobinae*	*Piliocolobus badius*	**Badius**
Chimpanzee	*Mammal / Hominidae*	*Pan troglodytes verus*	**Chimp**
Demidoff's galago	*Mammal / Galagonidae*	*Galagoides demidoff*	**Galag**
Thomas's galago	*Mammal / Galagonidae*	*Galagoides thomasi*	**Th Galag**
Potto	*Mammal / Lorisidae*	*Perodicticus potto*	**Potto**
Bovids			
Bay duiker	*Mammal / Bovidae*	*Cephalophus dorsalis*	**Black-B**
Black duiker	*Mammal / Bovidae*	*Cephalophus niger*	**Black-Dr**
Bongo	*Mammal / Bovidae*	*Tragelaphus euryceros*	**Bongo**
Buffalo	*Mammal / Bovidae*	*Syncerus caffer nanus*	**Buff**
Bushbuck	*Mammal / Bovidae*	*Tragelaphus scriptus*	**Bushbuck**
Jentink's duiker	*Mammal / Bovidae*	*Cephalophus jentinki*	**Jentink**
Maxwell's duiker	*Mammal / Bovidae*	*Cephalophus monticola maxvelli*	**Max**
Ogilby's duiker	*Mammal / Bovidae*	*Cephalophus ogilbyi*	**Ogilby**
Royal antelope	*Mammal / Bovidae*	*Neotragus pygmaeus*	**Ry Ant**
Yellow-backed duiker	*Mammal / Bovidae*	*Cephalophus sylvicultor*	**Yellow-B**

Zebra duiker	*Mammal / Bovidae*	*Cephalophus zebra*	**Zebra**
Elephant (forest)	*Mammal / Elephantidae*	*Loxodonta africana (cyclotis)*	**Eleph**
Pygmy hippo	*Mammal / Hippopotamidae*	*Choeropsis liberiensis*	**Pg hippo**
Tree hyrax	*Mammal / Procavidae*	*Dendrohyrax dorsalis*	**Tr hyr**
Giant hog	*Mammal / Suidae*	*Hylochoerus meinertzhageni*	**Gt hog**
Red river hog	*Mammal / Suidae*	*Potamochoerus porcus porcus*	**Rd hog**
Water chevrotain	*Mammal / Tragulidae*	*Hyemoschus aquaticus*	**Chevr**
Carnivores			
Golden Cat	*Mammal / Felidae*	*Felis aurata*	**Gold cat**
Leopard	*Mammal / Felidae*	*Panthera pardus leopardus*	**Leop**
Scaly ant-eaters			
Giant pangolin	*Mammal / Manidae*	*Smutsia gigantea*	**Gt pang**
Long-tailed pangolin	*Mammal / Manidae*	*Uromanis tetradactyla*	**Lg pang**
Tree pangolin	*Mammal / Manidae*	*Phataginus tricuspis*	**Tr pang**

APPENDIX 2: Patrol Effort of CEP teams

Patrol Effort (hh : mm : ss)

Months and days of patrols	North			South			Total		
	Number of patrollers	Time Team	Time People	Number of patrollers	Time Team	Time People	Number of patrollers	Time Team	Time People
February									
18	7	7:23	51:41:00				**7**	**7:23:00**	**51:41:00**
19	7	5:03	35:21:00				**7**	**5:03:00**	**35:21:00**
22	7	8:17	57:59:00				**7**	**8:17:00**	**57:59:00**
23	7	5:02	35:14:00				**7**	**5:02:00**	**35:14:00**
25	7	4:04	28:28:00				**7**	**4:04:00**	**28:28:00**
26	7	5:38	39:26:00				**7**	**5:38:00**	**39:26:00**
28	7	6:35	46:05:00				**7**	**6:35:00**	**46:05:00**
March									
1	7	5:23	37:41:00				**7**	**5:23:00**	**37:41:00**
23	6	4:23	26:18:00				**6**	**4:23:00**	**26:18:00**
24	6	4:29	26:54:00				**6**	**4:29:00**	**26:54:00**
25	6	5:21	32:06:00				**6**	**5:21:00**	**32:06:00**
26	6	4:19	25:54:00				**6**	**4:19:00**	**25:54:00**
27	6	3:27	20:42:00				**6**	**3:27:00**	**20:42:00**
April									
15				6	04:59	29:54:00	**6**	**4:59:00**	**29:54:00**
16				6	06:38	39:48:00	**6**	**6:38:00**	**39:48:00**
17				6	03:49	22:54:00	**6**	**3:49:00**	**22:54:00**
18				6	07:15	43:30:00	**6**	**7:15:00**	**43:30:00**
20				6	04:29	26:54:00	**6**	**4:29:00**	**26:54:00**
23				6	05:01	30:06:00	**6**	**5:01:00**	**30:06:00**
24				6	04:54	29:24:00	**6**	**4:54:00**	**29:24:00**
26				6	07:04	42:24:00	**6**	**7:04:00**	**42:24:00**
27				6	03:57	23:42:00	**6**	**3:57:00**	**23:42:00**
28				6	05:19	31:54:00	**6**	**5:19:00**	**31:54:00**
May									
9	6	4:09	24:54:00				**6**	**4:09:00**	**24:54:00**
10	6	5:03	30:18:00				**6**	**5:03:00**	**30:18:00**
11	6	3:25	20:30:00				**6**	**3:25:00**	**20:30:00**
12	6	5:12	31:12:00				**6**	**5:12:00**	**31:12:00**
13	6	1:16	7:36:00				**6**	**1:16:00**	**7:36:00**
14				6	04:58	29:48:00	**6**	**4:58:00**	**29:48:00**
15				6	03:09	18:54:00	**6**	**3:09:00**	**18:54:00**
16				6	03:43	22:18:00	**6**	**3:43:00**	**22:18:00**
18	6	3:21	20:06:00	6	03:54	23:24:00	**12**	**7:15:00**	**87:00:00**
19	6	4:24	26:24:00	6	04:17	25:42:00	**12**	**8:41:00**	**104:12:00**
20	6	4:45	28:30:00	6	02:01	12:06:00	**12**	**6:46:00**	**81:12:00**
21	6	4:11	25:06:00				**6**	**4:11:00**	**25:06:00**
22	6	4:34	27:24:00	6	03:24	20:24:00	**12**	**7:58:00**	**95:36:00**
23				6	04:23	26:18:00	**6**	**4:23:00**	**26:18:00**
24				6	03:52	23:12:00	**6**	**3:52:00**	**23:12:00**
25				6	03:48	22:48:00	**6**	**3:48:00**	**22:48:00**
June									

12	6	2:01	12:06:00				**6**	**2:01:00**	**12:06:00**
13	6	4:06	24:36:00				**6**	**4:06:00**	**24:36:00**
14	6	6:21	38:06:00				**6**	**6:21:00**	**38:06:00**
15	6	5:44	34:24:00				**6**	**5:44:00**	**34:24:00**
17	6	4:33	27:18:00				**6**	**4:33:00**	**27:18:00**
18	6	5:30	33:00:00				**6**	**5:30:00**	**33:00:00**
19	6	5:37	33:42:00				**6**	**5:37:00**	**33:42:00**
20	6	4:58	29:48:00				**6**	**4:58:00**	**29:48:00**
21	6	2:25	14:30:00	8	10:30	84:00:00	**14**	**12:55:00**	**180:50:00**
22	6	3:30	21:00:00	8	08:21	66:48:00	**14**	**11:51:00**	**165:54:00**
23				8	05:10	41:20:00	**8**	**5:10:00**	**41:20:00**
24				8	09:42	77:36:00	**8**	**9:42:00**	**77:36:00**
26				8	09:16	74:08:00	**8**	**9:16:00**	**74:08:00**
27				8	06:25	51:20:00	**8**	**6:25:00**	**51:20:00**
29				8	08:49	70:32:00	**8**	**8:49:00**	**70:32:00**
30				8	07:39	61:12:00	**8**	**7:39:00**	**61:12:00**
July									
1				8	05:55	47:20:00	**8**	**5:55:00**	**47:20:00**
2				8	05:13	41:44:00	**8**	**5:13:00**	**41:44:00**
10	6	4:59	29:54:00				**6**	**4:59:00**	**29:54:00**
11	6	7:50	47:00:00				**6**	**7:50:00**	**47:00:00**
12	6	5:48	34:48:00				**6**	**5:48:00**	**34:48:00**
14	6	2:53	17:18:00	6	07:22	44:12:00	**12**	**10:15:00**	**123:00:00**
15				6	11:45	70:30:00	**6**	**11:45:00**	**70:30:00**
16	6	4:44	28:24:00	6	07:56	47:36:00	**12**	**12:40:00**	**152:00:00**
17	6	3:56	23:36:00	6	07:44	46:24:00	**12**	**11:40:00**	**140:00:00**
18	6	3:34	21:24:00	6	06:24	38:24:00	**12**	**9:58:00**	**119:36:00**
19	6	3:27	20:42:00				**6**	**3:27:00**	**20:42:00**
Total	**254**	**191:40:00**	**1197:25:00**	**230**	**209:05:00**	**1408:30:00**	**484**	**400:45:00**	**3217:39:00**

APPENDIX 3: Encounter rates (ER) calculated for all protocols together

Grid number 20, 30, 39 to 42, 46 to 49, 53 to 57, 61 to 66 and 69 to 71 were not surveyed for RECCE protocol.

Grid number 5, 23, 27, 31, 39 to 42, 46 to 49, 53 to 57, 59 to 66, 69 to 71, and 82 were not surveyed for HPM protocol.

ID_CENT_F	Number of signs of Habitat Disturbance	Number of signs of Hunting	Number of signs of Wildlife	ER Habitat disturbance	ER hunting	ER Wildlife
G001	2	8	1	0.50	2.00	0.25
G002	2	12	1	0.53	3.18	0.27
G003	2	18	2	0.44	3.99	0.44
G004	1	20	1	0.23	4.61	0.23
G005	2	12	2	0.86	5.14	0.86
G006	1	4	0	0.64	2.56	0.00
G007	3	16	0	0.54	2.87	0.00
G008	4	17	5	1.18	5.00	1.47
G009	3	10	0	0.54	1.81	0.00
G010	6	40	1	1.17	7.81	0.20
G011	3	10	8	0.62	2.08	1.66
G012	11	32	0	1.76	5.13	0.00
G013	3	45	2	0.36	5.47	0.24
G014	3	15	0	2.28	11.42	0.00
G015	3	15	1	0.90	4.48	0.30
G016	1	15	4	0.20	2.94	0.78
G017	2	32	1	0.61	9.83	0.31
G018	0	8	5	0.00	1.93	1.20
G019	2	10	0	0.51	2.55	0.00
G020	0	1	0	0.00	0.87	0.00
G021	1	34	0	0.19	6.57	0.00
G022	1	23	6	0.20	4.61	1.20
G023	9	4	5	2.24	0.99	1.24
G024	2	13	1	0.76	4.91	0.38
G025	1	14	4	0.19	2.72	0.78
G026	2	14	3	0.56	3.90	0.84
G027	1	11	3	0.23	2.48	0.68
G028	1	40	16	0.14	5.72	2.29
G029	4	11	9	0.86	2.36	1.93
G030	34	45	0	6.56	8.68	0.00
G031	5	8	2	0.98	1.56	0.39
G032	3	32	3	0.58	6.15	0.58
G033	12	19	0	2.72	4.31	0.00
G034	4	17	5	0.73	3.12	0.92
G035	5	14	8	0.79	2.20	1.26
G036	1	97	1	0.21	20.39	0.21
G037	1	81	1	0.19	15.14	0.19
G038	1	11	0	0.18	1.99	0.00

G043	1	10	11	0.29	2.88	3.17
G044	1	12	4	0.22	2.65	0.88
G045	1	18	2	0.18	3.25	0.36
G050	0	10	1	0.00	1.36	0.14
G051	9	29	2	1.81	5.84	0.40
G052	1	6	0	0.50	3.01	0.00
G058	8	29	11	1.64	5.95	2.26
G059	5	2	14	1.09	0.44	3.05
G060	2	4	1	17.53	35.07	8.77
G067	14	11	1	5.03	3.95	0.36
G068	43	22	4	6.01	3.08	0.56
G072	3	6	1	0.48	0.96	0.16
G073	71	35	7	5.75	2.83	0.57
G074	0	15	14	0.00	3.64	3.39
G075	0	14	42	0.00	3.61	10.82
G076	1	33	10	0.14	4.71	1.43
G077	0	29	21	0.00	5.42	3.93
G078	0	30	10	0.00	8.11	2.70
G079	0	30	17	0.00	6.59	3.74
G080	6	52	3	0.98	8.50	0.49
G081	4	14	4	0.36	1.27	0.36
G082	0	9	1	0.00	3.94	0.44
G083	7	11	4	1.37	2.15	0.78
G084	4	34	6	0.94	7.97	1.41
G085	1	4	2	0.32	1.26	0.63
G086	0	8	13	0.00	2.75	4.47
G087	10	33	0	2.89	9.54	0.00
G088	5	4	0	1.47	1.18	0.00
G089	4	10	1	1.42	3.55	0.35
G090	9	0	2	2.65	0.00	0.59
G091	17	10	0	5.34	3.14	0.00
G092	2	9	3	0.55	2.50	0.83
G093	4	22	1	0.86	4.75	0.22
G094	0	8	7	0.00	1.72	1.51
G095	3	7	3	0.62	1.46	0.62
G096	1	68	2	0.22	15.29	0.45
G097	2	19	0	0.51	4.80	0.00
G098	2	27	2	0.36	4.92	0.36
G099	11	8	0	2.68	1.95	0.00
G100	1	16	2	0.32	5.12	0.64
G101	0	10	0	0.00	1.82	0.00
G102	7	29	1	1.11	4.59	0.16
G103	0	5	0	0.00	2.09	0.00
G104	17	30	0	2.88	5.09	0.00
TOTAL	**442**	**1620**	**331**	**1.18**	**4.32**	**0.88**

APPENDIX 4: Encounter rates calculated for Recce Protocol

Grid number 20, 30, 39 to 42, 46 to 49, 53 to 57, 61 to 66 and 69 to 71 were not surveyed for RECCE protocol.

GRID	Number of Habitat Disturbance sigsn on Recce	Number of Hunting Signs on Recce	Number of wildlife signs on Recce	ER Recce Habitat Disturbance	ER Recce Hunting	ER Recce Wildlife
G001	1	4	0	0.00	0.02	0.00
G002	1	7	0	0.00	0.03	0.00
G003	2	4	0	0.01	0.02	0.00
G004	0	6	1	0.00	0.03	0.00
G005	2	12	2	0.01	0.06	0.01
G006	1	4	0	0.00	0.02	0.00
G007	1	4	0	0.00	0.02	0.00
G008	1	8	5	0.00	0.04	0.02
G009	3	5	0	0.01	0.02	0.00
G010	0	3	1	0.00	0.01	0.00
G011	1	1	8	0.00	0.00	0.04
G012	0	2	0	0.00	0.01	0.00
G013	3	7	1	0.01	0.03	0.00
G014	1	0	0	0.00	0.00	0.00
G015	3	7	1	0.01	0.03	0.00
G016	1	4	3	0.00	0.02	0.01
G017	0	5	1	0.00	0.02	0.00
G018	0	4	5	0.00	0.02	0.02
G019	1	1	0	0.00	0.00	0.00
G020	0	0	0	0.00	0.00	0.00
G021	1	0	0	0.00	0.00	0.00
G022	0	14	5	0.00	0.07	0.02
G023	9	4	5	0.04	0.02	0.02
G024	0	9	1	0.00	0.04	0.00
G025	1	8	4	0.00	0.04	0.02
G026	2	12	3	0.01	0.06	0.01
G027	1	11	3	0.00	0.05	0.01
G028	0	36	12	0.00	0.18	0.06
G029	3	10	9	0.01	0.05	0.04
G030	0	0	0	0.00	0.00	0.00
G031	5	8	2	0.02	0.04	0.01
G032	2	7	3	0.01	0.03	0.01
G033	6	7	1	0.03	0.03	0.00
G034	0	15	5	0.00	0.07	0.02
G035	2	6	2	0.01	0.03	0.01
G036	0	70	0	0.00	0.35	0.00
G037	0	74	0	0.00	0.37	0.00
G038	0	5	0	0.00	0.02	0.00
G043	0	6	7	0.00	0.03	0.03
G044	1	6	2	0.00	0.03	0.01
G045	0	7	2	0.00	0.03	0.01
G050	0	2	1	0.00	0.01	0.00

G051	2	10	1	0.01	0.05	0.00
G052	0	3	0	0.00	0.01	0.00
G058	5	12	0	0.02	0.06	0.00
G059	7	5	15	0.03	0.02	0.07
G060	0	1	0	0.00	0.00	0.00
G067	10	9	1	0.05	0.04	0.00
G068	22	13	0	0.11	0.06	0.00
G072	0	8	4	0.00	0.04	0.02
G073	10	9	3	0.05	0.04	0.01
G074	0	7	13	0.00	0.03	0.06
G075	0	9	38	0.00	0.04	0.19
G076	0	5	9	0.00	0.02	0.04
G077	0	11	8	0.00	0.05	0.04
G078	0	20	10	0.00	0.10	0.05
G079	0	11	11	0.00	0.05	0.05
G080	0	8	2	0.00	0.04	0.01
G081	4	11	4	0.02	0.05	0.02
G082	0	9	1	0.00	0.04	0.00
G083	2	6	4	0.01	0.03	0.02
G084	1	10	2	0.00	0.05	0.01
G085	1	2	2	0.00	0.01	0.01
G086	0	5	13	0.00	0.02	0.06
G087	4	18	0	0.02	0.09	0.00
G088	3	1	0	0.01	0.00	0.00
G089	2	6	1	0.01	0.03	0.00
G090	3	0	2	0.01	0.00	0.01
G091	15	10	0	0.07	0.05	0.00
G092	2	7	3	0.01	0.03	0.01
G093	2	4	0	0.01	0.02	0.00
G094	0	1	1	0.00	0.00	0.00
G095	1	2	1	0.00	0.01	0.00
G096	1	9	1	0.00	0.04	0.00
G097	0	7	0	0.00	0.03	0.00
G098	1	5	2	0.00	0.02	0.01
G099	8	8	0	0.04	0.04	0.00
G100	1	6	2	0.00	0.03	0.01
G101	0	7	0	0.00	0.03	0.00
G102	2	16	0	0.01	0.08	0.00
G103	0	3	0	0.00	0.01	0.00
G104	10	12	0	0.05	0.06	0.00
TOTAL	**174**	**711**	**249**	**0.86**	**3.51**	**1.23**

APPENDIX 5: Encounter rates calculated for HMP data

Grid number 5, 23, 27, 31, 39 to 42, 46 to 49, 53 to 57, 59 to 66, 69 to 71, and 82 were not surveyed for HPM protocol.

Grid	Number of habitat Disturbance signs along HPM	Number of hunting signs along HPM	Number of wildlife signs along HPM	ER HPM for Habitat Disturbance	ER HPM for hunting	ER HPM for Wildlife
G001	1	4	1	0.01	0.02	0.01
G002	1	5	1	0.01	0.03	0.01
G003	0	14	2	0.00	0.08	0.01
G004	1	14	0	0.01	0.08	0.00
G005	0	0	0	0.00	0.00	0.00
G006	0	0	0	0.00	0.00	0.00
G007	2	12	0	0.01	0.07	0.00
G008	3	9	0	0.02	0.05	0.00
G009	0	5	0	0.00	0.03	0.00
G010	6	37	0	0.03	0.21	0.00
G011	2	9	0	0.01	0.05	0.00
G012	11	30	0	0.06	0.17	0.00
G013	0	38	1	0.00	0.22	0.01
G014	2	15	0	0.01	0.09	0.00
G015	0	8	0	0.00	0.05	0.00
G016	0	11	1	0.00	0.06	0.01
G017	2	27	0	0.01	0.16	0.00
G018	0	4	0	0.00	0.02	0.00
G019	1	9	0	0.01	0.05	0.00
G020	0	1	0	0.00	0.01	0.00
G021	0	34	0	0.00	0.20	0.00
G022	1	9	1	0.01	0.05	0.01
G023	0	0	0	0.00	0.00	0.00
G024	2	4	0	0.01	0.02	0.00
G025	0	6	0	0.00	0.03	0.00
G026	0	2	0	0.00	0.01	0.00
G027	0	0	0	0.00	0.00	0.00
G028	1	4	4	0.01	0.02	0.02
G029	1	1	0	0.01	0.01	0.00
G030	34	45	0	0.20	0.26	0.00
G031	0	0	0	0.00	0.00	0.00
G032	1	25	0	0.01	0.14	0.00
G033	6	12	0	0.03	0.07	0.00
G034	4	2	0	0.02	0.01	0.00
G035	3	8	5	0.02	0.05	0.03
G036	1	25	1	0.01	0.14	0.01
G037	1	7	1	0.01	0.04	0.01
G038	1	6	0	0.01	0.03	0.00
G043	1	4	6	0.01	0.02	0.03
G044	0	6	0	0.00	0.03	0.00
G045	1	11	0	0.01	0.06	0.00

G050	22	8	0	0.13	0.05	0.00
G051	7	19	1	0.04	0.11	0.01
G052	2	3	0	0.01	0.02	0.00
G058	3	17	11	0.02	0.10	0.06
G059	0	0	0	0.00	0.00	0.00
G060	0	0	0	0.00	0.00	0.00
G067	2	2	0	0.01	0.01	0.00
G068	23	9	4	0.13	0.05	0.02
G072	3	6	1	0.02	0.03	0.01
G073	61	18	0	0.35	0.10	0.00
G074	0	8	1	0.00	0.05	0.01
G075	0	5	3	0.00	0.03	0.02
G076	0	27	0	0.00	0.16	0.00
G077	0	18	13	0.00	0.10	0.08
G078	0	10	0	0.00	0.06	0.00
G079	0	19	6	0.00	0.11	0.03
G080	6	44	2	0.03	0.25	0.01
G081	1	4	1	0.01	0.02	0.01
G082	0	0	0	0.00	0.00	0.00
G083	5	5	0	0.03	0.03	0.00
G084	3	24	4	0.02	0.14	0.02
G085	0	2	0	0.00	0.01	0.00
G086	0	3	0	0.00	0.02	0.00
G087	6	15	0	0.03	0.09	0.00
G088	2	3	0	0.01	0.02	0.00
G089	2	4	0	0.01	0.02	0.00
G090	6	0	0	0.03	0.00	0.00
G091	2	0	0	0.01	0.00	0.00
G092	0	2	0	0.00	0.01	0.00
G093	2	18	1	0.01	0.10	0.01
G094	0	7	6	0.00	0.04	0.03
G095	2	5	2	0.01	0.03	0.01
G096	0	59	1	0.00	0.34	0.01
G097	2	12	0	0.01	0.07	0.00
G098	1	22	0	0.01	0.13	0.00
G099	3	0	0	0.02	0.00	0.00
G100	0	10	0	0.00	0.06	0.00
G101	0	3	0	0.00	0.02	0.00
G102	5	13	1	0.03	0.08	0.01
G103	0	2	0	0.00	0.01	0.00
G104	7	18	0	0.04	0.10	0.00
TOTAL	**268**	**907**	**82**	**1.55**	**5.25**	**0.47**

APPENDIX 6: Locations of hunting tents

GPS Coordinates of Hunting tents located in the PGNP in need of revisits by FDA rangers

Location	Grid	Longitude	Latitude	Comments	Action to be taken
Grebo National Forest (Will become Grebo National Park)	13	668 058	642 267	Still used	Remove
	17	645 913	642 161	Still used	Remove
	18	642 309	643 199	Still used	Remove
	22	667 837	639 902	Still used	Remove
	28	641 792	636 904	Old	Remove
	32	664 270	635 658	Still used	Remove
	32	664 190	635 600	Old	Remove
	32	663 119	635 425	Old	Remove
	33	657 518	632 713	Still used	Remove
	50	658 072	626 002	Old	Remove
	50	658 092	626 584	Old	Remove
	50	659 069	627 530	Still used	Remove
	58	658 341	623 620	Old	Remove
	73	678 055	609 470	Abandoned	Remove
	73	676 662	610 459	Abandoned	Remove
	73	676 588	610 662	Abandoned	Remove
	76	663 098	609 379	Still used	Remove
	88	677 040	593 277	Still used	Remove
	96	678 275	585 047	Abandoned	Remove
	96	678 317	585 269	Still used	Remove
Bilibo Native Reserve (possibly not part of Grebo National Park)	51	653 618	626 000	Old	Visit and discuss with community members
	51	653 096	625 985	Still used	Visit and discuss with community members
Glaro Native Reserve (possibly not part of Grebo National Park)	84	668 414	603 826	Still used	Visit and discuss with community members
	104	668 248	577 810	Still used	Visit and discuss with community members

APPENDIX 7: Location of land plots completed

Geographical distribution of land use plots within the PGNP

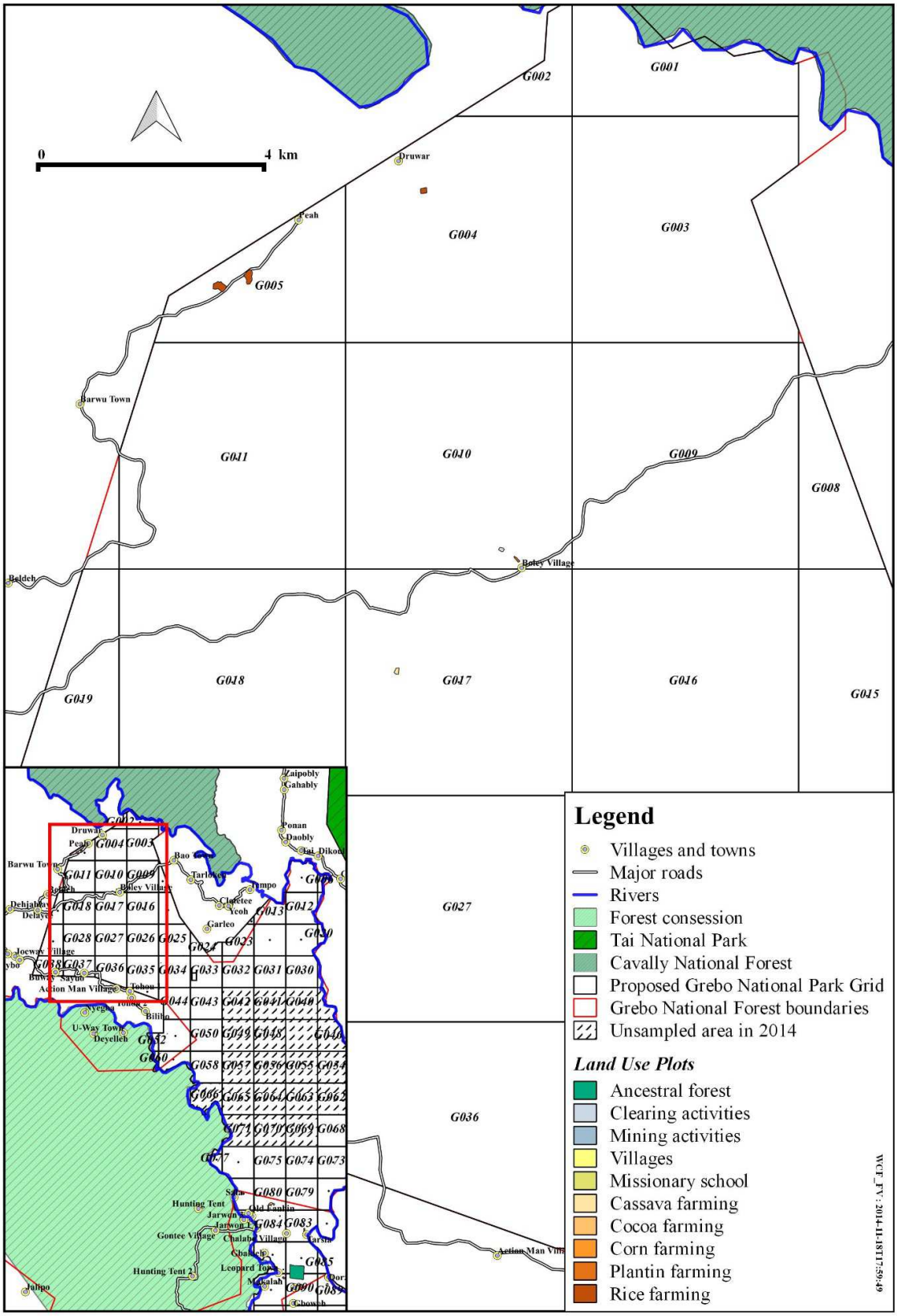

Figure 8: Land plots taken in PGNP Grebo Horn

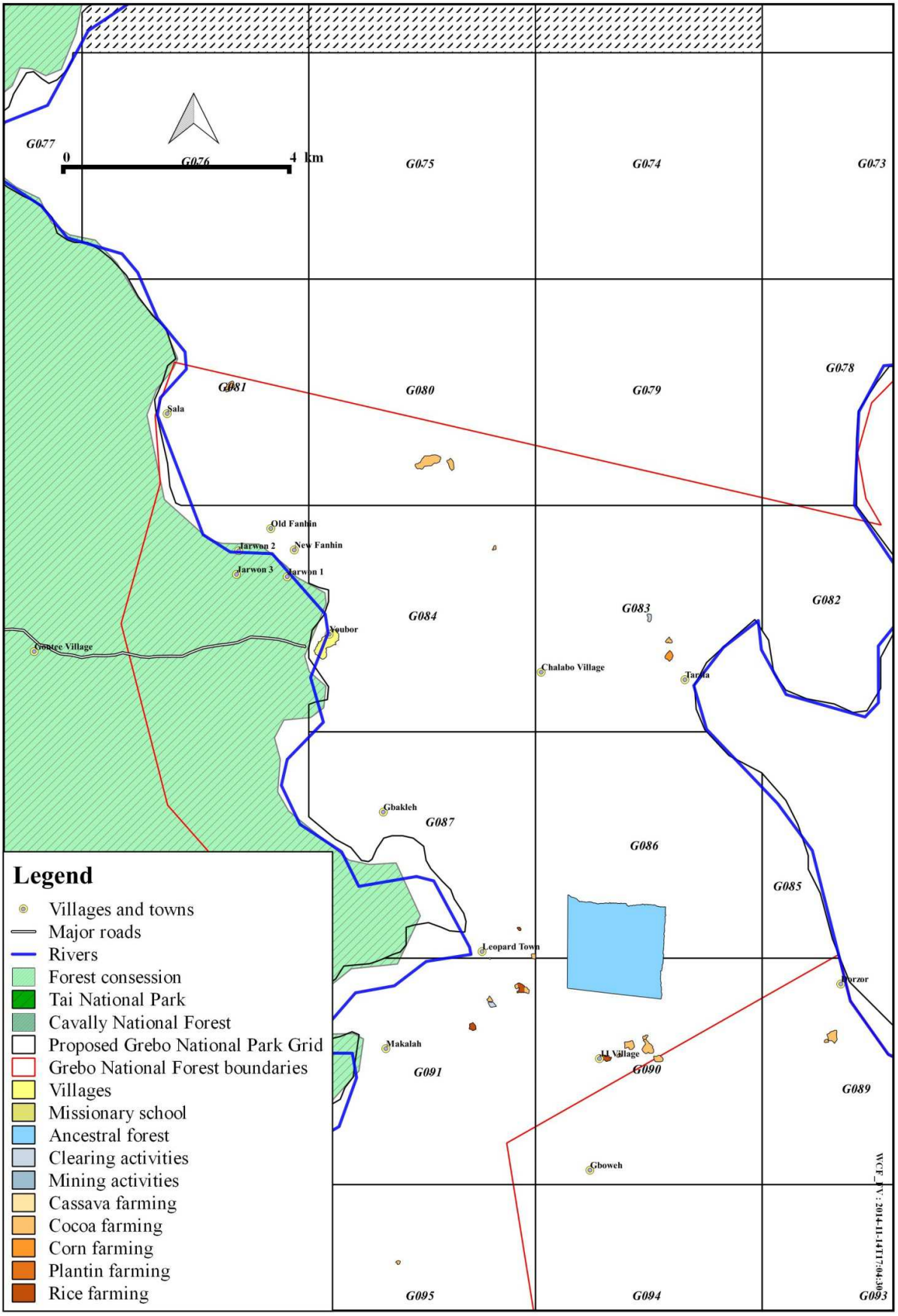

Figure 9: Land plots taken in southern part of PGNP and Glaro native reserve

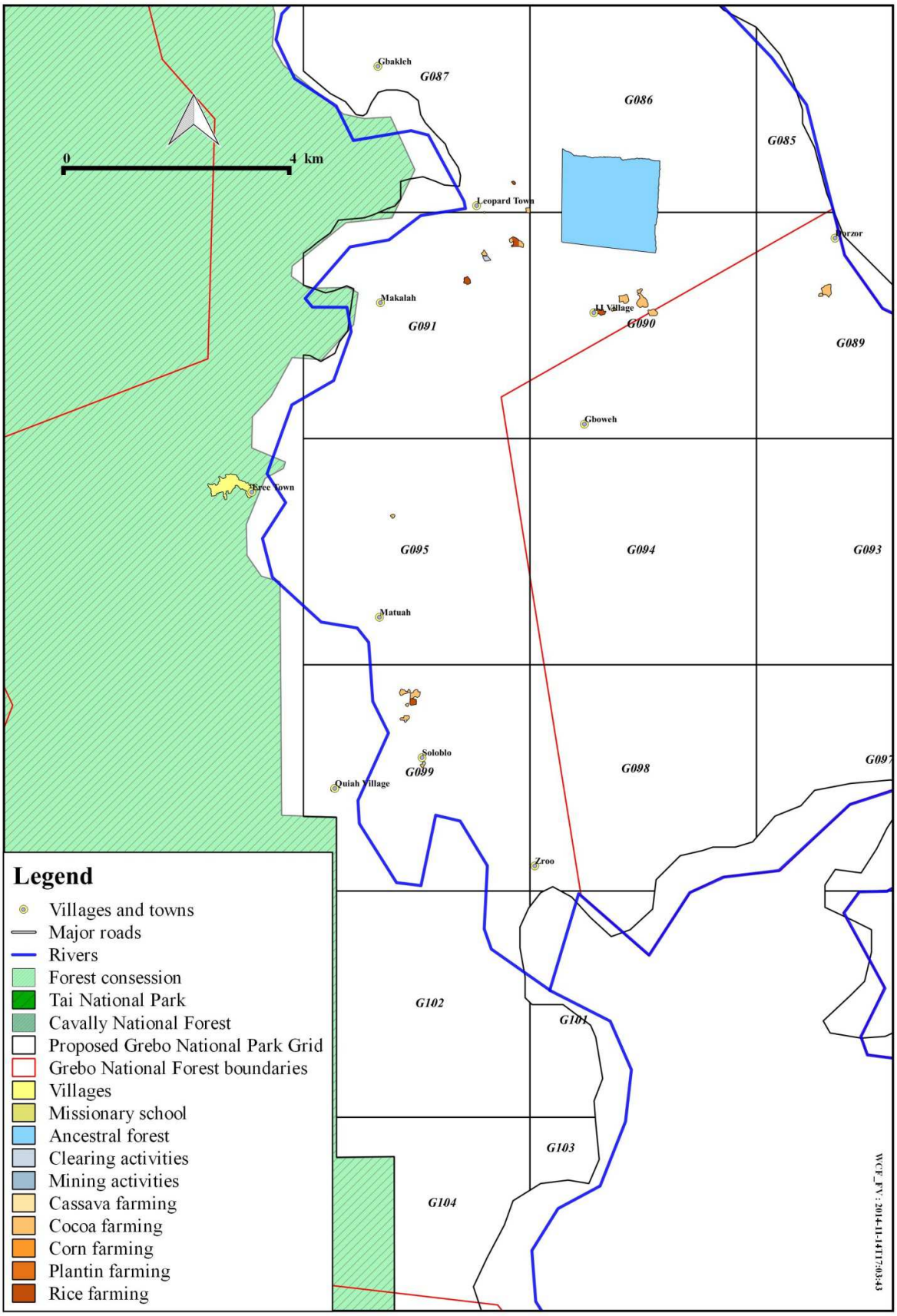

Figure 10: Land plots taken in southern PGNP and Glaro native reserve

APPENDIX 8: Distribution and extent of land-use per type per Grif

Location	GRID	Type	Longitude	Latitude	Number of plots	plot Surface (Ha)	Action to be taken
Grebo National Forest (Will become Grebo National Park)	**G004**	Rice	646325	650738	1	0.80	Check to see if inside GNF boundary line in the field
	G005	Rice	643349	649129	2	4.53	Check to see if inside GNF boundary line in the field
	G005	Rice	642838	648889			Check to see if inside GNF boundary line in the field
	G010	Clearing	647795	644396	1	0.38	Revisit to check has not been farmed
	G010	Plantain	648017	644101	1	0.22	Remove
	G017	Cassava	645913	642161	1	0.53	Remove
	G017	Clearing	645913	642161	1	0.02	Revisit to check has not been farmed
	G019	Clearing	640696	642428	1	NA	Check to see if inside GNF boundary line in the field
	G038	Cocoa	640457	634364	1	0.15	Check to see if inside GNF boundary line in the field
	G081	Clearing	663527	607988	1	NA	Revisit to check has not been farmed
	G089	Cocoa	674091	594547	2	2.61	Remove
Glaro Native Reserve (possibly not part of Grebo National Park)	**G080**	Cocoa	667578	604649	2	7.10	Raise awareness with communities to NOT extend farms over boundary lines
	G080	Cocoa	667307	604775			Raise awareness with communities to NOT extend farms over boundary lines
	G080	Clearing	667869	604795	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
	G080	Clearing	668666	604529	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
	G081	Cocoa	663323	606544	2	1.30	Raise awareness with communities to NOT extend farms over boundary lines
	G081	Cocoa	663565	606102			Raise awareness with communities to NOT extend farms over boundary lines
	G081	Cocoa	663593	606040	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
	G081	Clearing	663670	605953	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
	G083	Clearing	671013	602068	1	0.62	Raise awareness with communities to NOT extend farms over boundary lines

G083	Cocoa	671221	601664	1	0.56	Raise awareness with communities to NOT extend farms over boundary lines
G083	Corn	671354	601269	1	1.38	Raise awareness with communities to NOT extend farms over boundary lines
G083	Cocoa	671395	601589	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
G083	Cocoa	670777	602251	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
G083	Rice	670470	602322	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
G084	Cocoa	667909	603021	1	0.22	Raise awareness with communities to NOT extend farms over boundary lines
G084	Clearing	668249	603217	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
G087	Cocoa	668928	596063	1	0.44	Raise awareness with communities to NOT extend farms over boundary lines
G087	Rice	668735	596502	1	0.18	Raise awareness with communities to NOT extend farms over boundary lines
G090	Cocoa	670924	594575	4	5.10	Raise awareness with communities to NOT extend farms over boundary lines
G090	Cocoa	670924	594575			Raise awareness with communities to NOT extend farms over boundary lines
G090	Cocoa	671123	594255			Raise awareness with communities to NOT extend farms over boundary lines
G090	Cocoa	670742	594433			Raise awareness with communities to NOT extend farms over boundary lines
G090	Cocoa	670478	594266	1	1.24	Raise awareness with communities to NOT extend farms over boundary lines
G090	Rice	670315	594199	1	0.93	Raise awareness with communities to NOT extend farms over boundary lines
G091	Clearing	668299	595156	1	0.67	Raise awareness with communities to NOT extend farms over boundary lines
G091	Cocoa	668228	595269	3	1.37	Raise awareness with communities to NOT extend farms over boundary lines
G091	Rice	668696	595549	2	2.41	Raise awareness with communities to NOT extend farms over boundary lines
G091	Rice	667960	594765	1	NA	Raise awareness with communities to NOT extend farms over boundary lines
G091	Clearing	668203	595993	1	0.03	Raise awareness with communities to NOT extend farms over boundary lines
G095	Cocoa	666419	590665	1	0.26	Raise awareness with communities to NOT extend farms over boundary lines
G099	Clearing	666807	586996	2	0.30	Raise awareness with communities to NOT extend farms over boundary lines
G099	Cocoa	666885	587562	5	3.53	Raise awareness with communities to NOT extend farms over boundary lines
G099	Cocoa	666901	587477			Raise awareness with communities to NOT extend farms over boundary lines

	G099	Cocoa	666780	587055			Raise awareness with communities to NOT extend farms over boundary lines
	G099	Cocoa	666859	587299			Raise awareness with communities to NOT extend farms over boundary lines
	G099	Cocoa	666859	587299			Raise awareness with communities to NOT extend farms over boundary lines
	G099	Rice	666943	587397	1	0.99	Raise awareness with communities to NOT extend farms over boundary lines
TOTAL Farming/clearings					**53**	**37.88**	
Grebo National Forest (Will become Grebo National Park)	**G002**	Prospection site	648629	652748	**1**	**NA**	Check to see if inside GNF boundary line in the field
	G002	Prospection site	648613	652711	**1**	**NA**	Check to see if inside GNF boundary line in the field
	G008	Prospection site	653319	645921	1	**NA**	Check to see has been abandoned
	G009	Prospection site	649923	644470	1	**NA**	Check to see has been abandoned
	G025	Mining	NA	NA	1	0.11	Check to see has been abandoned
	G033	Prospection site	657017	632014	1	**NA**	Check to see has been abandoned
	G033	Prospection site	657121	632082	1	**NA**	Check to see has been abandoned
	G034	Mining	NA	NA	1	0.00	Check to see has been abandoned
	G043	Prospection site	659192	631285	1	NA	Check to see has been abandoned
Bilibo Native Reserve (possibly not part of Grebo National Park)	**G051**	Mining	654101	626194	2	0.03	in community land. Raise awareness with communities to not mine inside PGNP
	G051	Mining	653203	625990	1	NA	in community land. Raise awareness with communities to not mine inside PGNP
	G052	Mining	652993	626028	1	0.39	in community land. Raise awareness with communities to not mine inside PGNP
	G052	Mining	652869	626062	1	NA	in community land. Raise awareness with communities to not mine inside PGNP
	G059	Prospection site	654934	622755	1	NA	Check to see if inside GNF boundary line in the field
TOTAL Mines/Prospection sites					**15**	**0.53**	
TOTAL LAND Plots					**68.00**	**38.41**	