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Research Article

Illegal rattan extraction trends in the Ankasa Conservation Area in Ghana

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Abstract
Protected Areas (PAs) are created for the protection and maintenance of biological diversity, but many of Ghana's PAs are subject to severe pressures and threats, the main pressures being the illegal extraction of natural resources. Rattans are indisputably one of the most important Non-Timber Forest Products (NTFPs) in Ghana's Protected Areas that is without doubt one of the reasons for which it has drawn the attention of researchers. In this study the illegal rattan extraction patterns in the Ankasa Conservation Area (ACA) in Ghana was inspected. Simple random sampling and Snowball sampling techniques were used. Data collection employed the use of semi-structured questionnaires, interviews and field enumeration of rattans as well as an analysis of Effective Patrol Man-days (EPMDS) from 2004 to 2012. The results showed a significant positive correlation ($r = 0.75$, $p < 0.05$, $r2 = 0.557$) between patrol effort and rattan extraction encounters. In addition, there was a general reduction in illegal rattan extraction encounters from 2004 to 2012 at a rate of 4.3 per year. The highest illegal rattan extraction incidences were recorded in 2006 (76 encounters), 2005 (35 encounters), 2008 (22 encounters), 2004 (18 encounters) and the least incidence were recorded in both 2010 (3 encounters) and 2011 (3 encounters).The research also revealed that Eremospatha macrocarpa was the most extracted rattan species followed by Laccosperma secundiflorum. The major rattan extraction and trade routes originate in the northern parts and in the area east of the reserve and also south of Draw River Forest Reserve. Generally, rattan poaching in Ankasa Conservation Area has declined, but there are still human incursions in the northern part of the reserve. The study recommended an intensification of patrols in the north of the reserve. Also, enrichment planting and Agroforestry practices of inter-cropping rattans with seasonal crops should be pursued vigorously for the local communities.

Keywords
Rattan—Illegal extraction—Correlations—Non Timber Forest Products—Ankasa Conservation Area

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Contents

1. INTRODUCTION

Ghana has been able to conserve representative areas of her natural forest ecosystems in their pristine state in the form of national parks and reserves. These Protected Areas (PAs) are perceived as the absolute most vital strategy for conserving wildlife and preserving biodiversity [1]. In Ghana, the Wildlife Division (WD) of the Forestry Commission is in charge of the security and administration of eighteen (18) Wildlife Protected Areas (WPA) covering 5.6% of the nation's land area [2]. The establishment of PAs has been a key national strategy enshrined in Ghana's 1994 Forest and Wildlife policy which among others, is aimed at saving the rainforest and the intrinsic resources including the vast Non Timber Forest Products (NTFPs) such as rattan from excessive extraction and their subsequent extinction. The word rattan is gotten from the Malayan word "rotan", the local name for climbing palms [3]. Rattans are prickly palms local to tropical forest regions of South-east Asia, the Malayan Archipelago and Africa [4].

Rattans contribute largely to the subsistence economies of forest-based communities all through their extent. A

considerable lot of these individuals utilise the cane resource as a means of direct livelihood, especially during periods when other products are seasonally unavailable. They have a proven history of use at both the urban and village level in the production of furniture, fish traps, baskets, storage vessels and other essential products. Ghana's rattan sector currently contributes about 20 percent of total revenue from Non-Timber Forest Products [5]. There are over 650 rattan species worldwide belonging to 22 genera from the subfamily Calamoideae which belongs to the family Palmae [6]. The African rattans are represented by only 19 species from four genera (Calamus, Eremospatha, Laccosperma and Oncocalamus). In Ghana, majority of rattan collection areas are found in the Western Region of the country, located at the south-western corner of the country and within the Wet Evergreen Forest Zone. Natural resource exploitation is a major issue confronting protected area managers in sub-Saharan Africa and in spite of the 1992 Rio Convention on Biological Diversity; the world's natural resources keep on being lost at an alarming rate, mostly in developing countries where many biological resources are concentrated [7].

In Ghana there is no inventory record of rattan resource. However, it is known that rattans occur mainly in the forest reserves of the wet evergreen vegetation zone covering an area of 6,570km^2 [5]. In the Ankasa Conservation Area the major threats to the reserve are outsiders, for the commercial collection of rattan, as well as the chainsaw operators [8]. The increased demand for raw rattan has caused commercial rattan dealers to turn their attention to the wildlife reserve for their supplies. [8] reported that local rattan scarcity near many urban centers now forces many harvesters deep into PAs where they shelter in temporary camps to carry out their activities. The most acceptable measure of patrol effort in Ghana's WPAs is the Effective Patrol Man-days (EPMDs), which does not include time spent on patrol placement and preparations [10]. EPMD, which is the measure of staff performance is the amount of energy invested in terms of manpower (number of field staff in the patrol) and in terms of area covered (number of days actively patrolled or distance covered) in patrols. [8] stated that in order to undertake any meaningful rattan management, physical inventories must be conducted. [11] further recommended that in other to increase the protection of threatened NTFPs including rattan, areas with rich NTFP stocks should be located and mapped using the Management Information System (MISTGIS) software. Managing rattans is a serious challenge in Ghana and the situation is likely to exacerbate if measures are not adopted to secure the remaining stock in Ankasa. This project therefore aimed at studying illegal rattan extraction trends in the Ankasa Conservation Area and to provide suggestions to stakeholders for the effective management of the remaining rattan stock in the reserve.

The specific objectives of this study include: (a) to determine the correlation between illegal rattan extraction encounters and patrol effort in Ankasa Conservation Area between 2004 and 2012 (b) to identify key rattan locations in Ankasa Conservation Area (c) to identify the major rattan extraction areas and trade routes around Ankasa Conservation Area.

2. MATERIAL AND METHODS

2.1 Study area

The Ankasa Conservation Area (Ankasa Resource Reserve and Nini-Suhien National Park) covers 509km2 and lies in South West Ghana on the fringe with Ivory Coast. The park lies between 5° 09' and 5° 25' north and between 2° 29' and 2° 45' west (Figure 1). The climate of the Conservation Area is characterized by a bi-modal rainfall pattern occurring from April to July and September to November. The average annual rainfall is 1,700 to 2,000mm. Mean monthly temperatures are typical of tropical lowlandforest and extend from 24oC to 28oC. Relative humidity is high throughout the year, being around 90% amid the night falling to 75% in early afternoon. Ankasa lies within the Wet Evergreen zone of Ghana. According to Wildlife [12], there are 31 "Black Star" species in Ankasa; these include Afrostyrax lepidophyllus and Cola umbratilis. Ankasa is home to over 800 vascular plants including several endemics such as Psychotria ankasensis. The forest still holds viable populations of large and charismatic mammals, such as the forest elephant, bongo and leopard. Also a number of species occur which have not yet been named, which have been awarded "gold stars" pending the confirmation of their taxonomic status [13]. The soils are deeply weathered, highly acidic (pH 3.5 to 4.0) and prone to leaching.

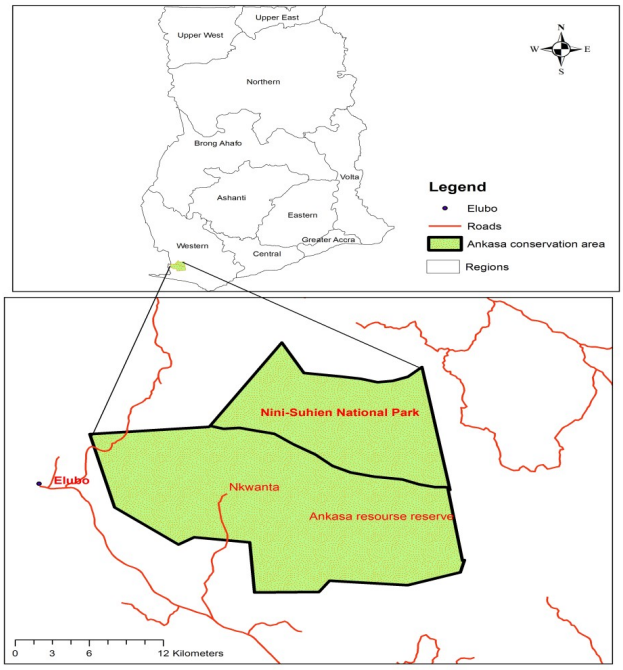

Figure 1. Map of Ghana showing Ankasa Conservation Area (source: Author, 2014)

2.2 Data Collection

2.2.1 Primary information

Primary data for this research was obtained from semi-structured questionnaires which were administered to Park law enforcement staff (anti-poaching team) and also to Community rattan collectors in nine Community Resource Management Areas (CREMAs). There are six anti-poaching teams in Ankasa comprising of five members each. Four members from each team were randomly selected and issued with questionnaires (20 respondents). Snowball sampling method was used to select and interview four primary rattan collectors from each of the nine CREMAs (36 respondents). In all 60 respondents (24 staff, 36 collectors) were interviewed for this research. Field enumeration of rattans was also done with the aid of GPS.

2.2.2 Secondary information

Data on rattan poaching between 2004 and 2012 was collated from patrol forms and also from the Management Information System (MISTGIS) database stationed at the park headquarters. MIST is a GIS based patrol monitoring software which provides rapid analyses of geo-referenced data for park management and administration.

2.2.3 Measuring law enforcement patrol effort

The Effective Patrol Man-days (EPMD)for each patrol between 2004 and 2012 were computed to give the yearly measure of staff performance during the period. According to [14], EPMD is calculated by the formula below well known among Wildlife Division staff as the Jachmann method; i.e.

$$EPMD = \frac{[DP] \times [PS]}{8}$$

Where; DP is the duration of active patrol hours and PS is the patrol size or the number of staff. The denominator eight (8) refers to the standardized number of hours guards are expected to spend while on patrol.

2.2.4 Enumeration and mapping of rattan sites

Two (50m x 50m) plots were demarcated in each of the four identified areas in the reserve. Within each plot, every rattan cluster was counted as a single stand and their corresponding GPS coordinates recorded. The results were analysed using SPSS and Excel.

3. RESULTS AND DISCUSSION

3.1 Respondents perception on rattan availability and main species extracted

Fifty-three respondents (88.33%) believed rattan resources have declined drastically, four (4) people (6.67%) said rattans are more available. Also two (2) people (3.33%) said there has been no change in rattan quantities and only one person (1.67%) said he had no idea on its availability. The detrimental impact of the decline of rattan resources was most clearly realized by local rattan collectors as well as communities already at the lower end of the economic scale. This observation by [9] has been confirmed by results of this study as most of the respondents (83.33%) decried the rapid declining of the nation's rattan resources and wished that urgent steps be taken by the government to curb this unfortunate trend. It can be expected that very soon the shortage of rattans would become a major problem and appropriate measures should be taken now to arrest the situation. According to [5], over-harvesting and poor management of rattans in their natural habitat have contributed to the acute shortage of raw rattan species in Ghana. This shortage can be addressed expeditiously through implementation of sustainable management practices including strengthened law enforcement, agroforestry and enrichment planting. Many examples exist of rattans being cultivated in agroforestry systems in forest lands controlled by local communities [15, 16] and these can be replicated in CREMAs around Ankasa. Although the concept of agroforestry has long been introduced in Africa, there is a need to know what crop types should be planted with what rattan species. For enrichment planting, a success story in Malaysia where more than 17,000 hectares of logged forest has been successfully planted with Calamus species can serve as a guide [17].

Though it is suspected that almost all the rattans brought to markets around Ankasa might have been illegally collected from Ankasa and neighboring reserved

forests, interviews amongst primary rattan collectors did not yield direct answers on their sources of supply for fear of prosecution. Forest Services Division (FSD) reserves were those mentioned as being the source of supplies for rattans collected from reserves. All collectors were fully aware that Ankasa was a protected area thus entering them meant taking an unnecessary risk. They claimed that at the time that the Ankasa wildlife reserve was being managed by the then Forestry Department (FD), they had freer access to the resources than now. In their words, 'the wildlife people are too harsh as compared with the forestry people.' This confirms the statement by [18] that the establishment of forested protected areas places restrictions on the use of resources which had been freely available to local and indigenous communities. What could also not be fathomed was their claim that they were being arrested even outside the confines of the forest or wildlife reserves whenever they were discovered to be in possession of rattans. To them, it was most unfair since some of the rattans are still found outside these protected areas. This could be due to the fact that in some cases, collectors claim they were either planting or protecting rattans for their use. The outcome of the research showed that Eremospatha macrocarpa (mfia) was the most extracted rattan species (61.67% respondents) followed by Laccosperma secundiflorum (eyie) with 33.33% respondents and Calamus deeratus (demere) also with 5% respondents (Figure 2).

Eremospatha macrocarpa (mfia) was the most collected of the species because it has the smallest diameter which makes it widely preferred for weaving baskets, fish traps, furniture production and house construction. [19] also attributed the high preference for "mfia" to its strength, flexibility and its ability to be easily split and woven. Laccosperma secundiflorum (eyie) was mentioned by 33.33% of respondents as the most preferred because of its largest diameter and is typically strong and inflexible. It is, therefore, generally preferred for making frames or structures during basket and furniture production as well as house construction. According to these respondents, "eyie" may be split for weaving where "mfia" is scarce or not available. Non-availability of 'mfia" and "eyie" in some areas, has compelled the collection of "demere", a rather medium-sized rattan species for making frames and weaving, which 5% of respondents believed are the most preferred by collectors. [20, 19] confirmed these three species as the main types that provide the raw materials for the commercial rattan sector in Ghana.

Table 1. Respondents views on the most rattan species collected

Species	Frequency	%
Eremospatha macrocarpa	37	61.67
Laccosperma secundiflorum	20	33.33
Calamus deeratus	3	5
Total	60	100

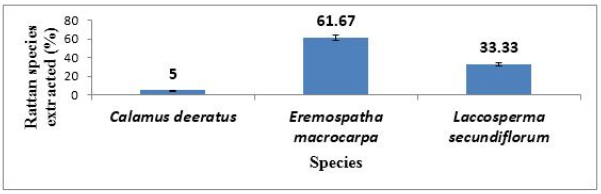

Figure 2. Main rattan species extracted

3.2 Rattan extraction peak periods in Ankasa Conservation Area

Forty-nine respondents representing 81.67% were of the view that rattan collection was highest in the dry season, eight respondents representing 13.33% mentioned the rainy season as the period when rattan collection was at its peak and three respondents representing 5% said rattan collection was high all year round (Figure 3).

Although most collectors denied collecting rattans from the Ankasa reserve, they claimed extraction is undertaken all year round because rattan collection has become an important source of income to the household economies of collectors. [21] partly attributed this to increased trade within and between countries across West and Central Africa. Although rattan is harvested all year round, 81.67% of the respondents believed that extraction is at its peak during the dry season due to easy access and extraction of the resource during this period. According to most respondents, the best time to harvest mature rattan is during the dry season because during the rainy season, heavy rains and floods prevent them from gaining access into rattan sites (Figure 3). It could also be due to the fact that the period fall in the off farming season, thus labour could be diverted into other economic ventures to supplement household incomes. Whiles 13.33% of respondents said collection was highest in the rainy season mainly for its sale and also for the rehabilitation of damaged houses caused by the onset of the rains and also for fish traps; 5% said rattan extraction was high throughout the year. It is therefore imperative that law enforcement be intensified especially during the dry season.

Table 2. Respondents views on seasonal rattan extraction

Species	Frequency	%
Dry	49	81.67
Wet	8	13.3
All year round	3	5
Total	60	100

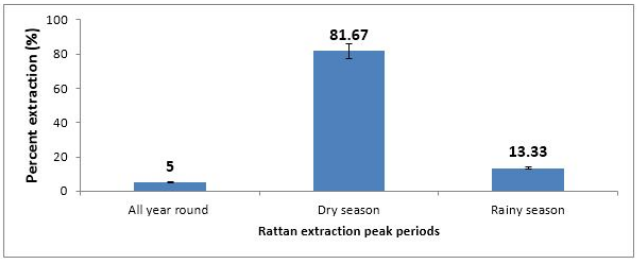

Figure 3. Rattan extraction peak periods

3.3 Illegal rattan extraction trends in relation to patrol effort in ACA (2004-2012)

There was a significant positive correlation (r = 0.75, p< 0.05, r2 = 0.557) between patrol effort and rattan extraction encounters. This indicates that when patrol efforts increases staff encounter per man day also tend to increase (EPMD) (Figure 4). Generally, the results showed a decrease trend in illegal rattan extraction encounters from 2004 to 2012 at a rate of 4.3 per year (Figure 5).The illegal rattan extraction encountered in 2004 was 18 and rose to 35 in 2005. There was a sharp increase in illegal rattan extraction from 35 to 76 in 2006. There was no incidence of illegal rattan extraction in 2007. However, twenty-two illegal extraction incidences were reported in 2008 and the extraction rate reduced to 9 in 2009. There were 3 encounters each in 2010 and 2011 and increased to 12 in 2012 (Figure 5).

Table 3. Patrol effort and illegal rattan extraction incidence encounters

EPMD	Encounter
4506	76
4491.4	40
4248.8	35
3810.8	22
2707.45	35
1411	12
1369.13	3
1633.74	3

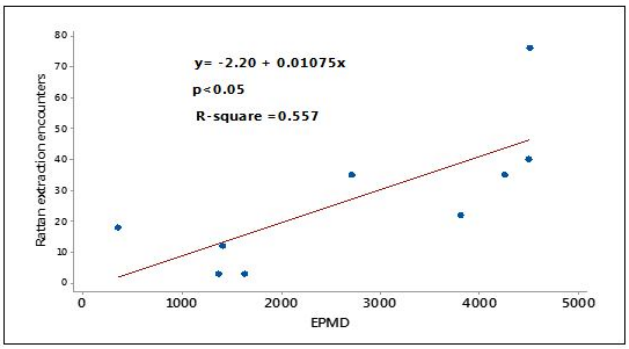

Figure 4. Relationship between patrol effort and illegal rattan extraction incidence encounters

Table 4. Trend of illegal rattan extraction incidence from 2004 to 2012

Year	Rattan extraction encounter
2004	18
2005	35
2006	76
2007	0
2008	22
2009	9
2010	3
2011	3

The sharp increase in illegal rattan extraction from 18 in 2004 to79 in 2006 could be due to inefficient law enforcement system, low staff productivity, inadequate supervision, staff indiscipline, insufficient manpower, inadequate funding and logistics such as weapons and vehicles. It was observed that until 2004, rattans were highly abundant in and around the Ankasa reserve, and not much effort was targeted at controlling its extraction. Working on rattans in Thailand, [6] observed that rattans are considered to be only minor forest products and not given much importance compared to wood. Moreover, Ankasa was running the camp patrol system where staff was permanently based in five different patrol camps in the reserve which were very far from the park office hence staff control was difficult. Anti-poaching patrols were poorly planned, executed and also insufficiently supervised. [14] confirmed that within the Wildlife Division, the importance of a properly planned and executed law-enforcement program in combination with monitoring of the effort and of illegal activity had been highly underrated in the past. However, to monitor patrol staff performance, the Wildlife Division in mid-2004 developed a simple patrol-based monitoring system [22] in Ankasa. The primary objective was to introduce performance and adaptive management to make law enforcement more

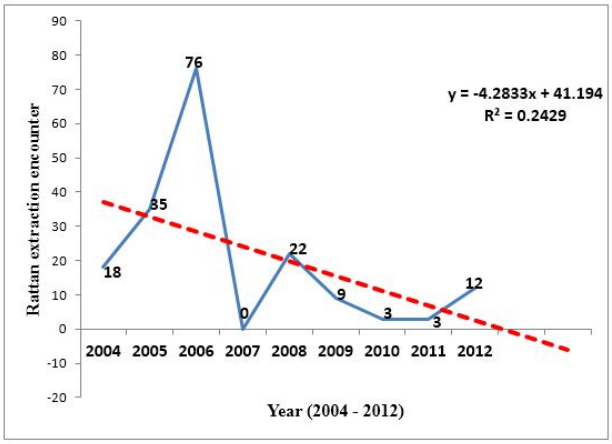

Figure 5. Trend of illegal rattan extraction incidence from 2004 to 2012

effective and cost-efficient [23]. A study by [24] on poaching trends in Ankasa for the period 2007-2011 reported a significant reduction in total illegal activities from 787 in 2007 to 234 in 2011. Consequently, there was a sharp decline in illegal rattan extraction observations between 2006 and 2011 when EPMDs began to rise. Rattan extraction encounters reduced during this period due to a better patrol operation system, increased staff productivity and improved discipline and supervision. Instead of the Camp system, the park currently operates the Range system of law enforcement which was scheduled in such a way that at any point in time, at least two teams are on extended patrols (5 day-patrol on-reserve) whiles the rest carry out local patrols, secrecy of patrols is strictly adhered to. There was also evidence that the greatly strengthened and extensive CREMA programme on the periphery of the Conservation Area had also contributed to the reduction of illegal rattan extraction in the Park. According to the ranger of the park there is inadequate human resource capacity to patrol the entire reserve area. However, with information from some of the CREMA members park rangers are able to arrest illegal rattan extractors. [25] observed that for the majority of protected areas in Ghana, budgetary allocations were too low to provide adequate protection for their gradually declining resources. However, one significant intervention that contributed to the decline in rattan extraction between 2006 and 2011 was the implementation of the European Union-sponsored Protected Areas Development Programme Phase II (PADP II) in the park. According to [26], the capacity to oversee protected areas adequately depends on a blend of good administration, sufficient capacity, well-trained staff and enough cash to pay for fundamental administration exercises. The PADP II provided operational funds, vehicles, motorbikes, tractors, generators, tents, uniforms, boots, raincoats, haversacks, staff training and other incentives which boosted staff morale and confidence.

3.4 Rattan enumeration in four key identified locations in Ankasa Conservation Area

The mean number of rattan enumerated from the four sampling locations were significantly different, $F(3)= 6.30$, $p<0.05$. Nkwanta recorded the highest mean number of rattan, 9.5±2.12 followed by Radio Hill with the mean of 6.5±0.71, the mean number of rattan recorded from Suhien was 6±1.41. The least number of rattan was recorded from Elubo 3±1.41. Hence the increasing order of rattan enumerated were Nkwanta>Radio Hill>Suhien>Elubo (Figure 6). The highest number of rattan enumerated from Nkwanta could be due to the fact that Nkwanta was observed to be relatively close to the heart of the park where rattan poachers are scared and also because they cannot carry bundle loads for long distances. It could also be due to the presence of patrol staffs that were permanently stationed at the Nkwanta patrol base camp 8km inside the reserve. Rattan inventories carried out in some rattan-producing countries for example in Indonesia [27] and the Philippine [28] have revealed that higher rattan stocks are concentrated in remote areas where accessibility is restricted for various reasons. The Radio Hill and Suhien also recorded next abundant rattan locations. These two areas were also relatively located in the middle of the reserve. The presence of patrol staff has afforded better protection of the biodiversity in such areas compared to areas close to the boundary where collectors pose serious threat. The Elubo area recorded the least mean number of rattan because commercial rattan collectors took advantage of the proximity of this area to the main Elubo-Takoradi highway to extract and transport rattans unnoticed. This suggests that there are still human incursions around the periphery of the Ankasa Conservation Area and hence law enforcement must be intensified in these areas.

Table 5. Rattan enumeration in four locations in Ankasa Conservation Area

Sampling Location	Plots (50m x 50m)	Number of ramets counted
Nkwanta	Plt1	8
	Plt2	11
Radio Hill	Plt1	7
	Plt2	6
Suhien	Plt1	7
	Plt2	5
Elubo	Plt1	2
	Plt2	4
Total	**8**	**50**

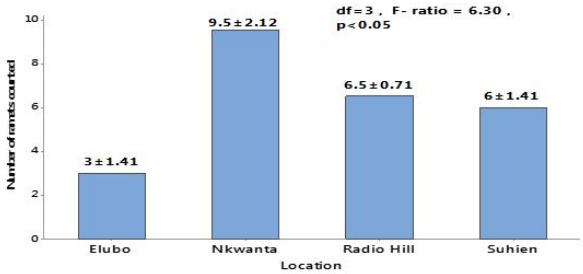

Figure 6. Rattan enumeration in four locations in Ankasa Conservation Area

3.5 Rattan extraction and trade routes around the Ankasa Conservation Area

An overview of rattan extraction and trade routes around ACA is shown on the map presented in figure 7 below. The major rattan extraction and trade routes originate in the Northern parts and in the area east of the ACA and also South of Draw river Forest Reserve. In the western part of Ankasa, around Mempeasem, rattans are passed on in canoes on the Tano River to Fawoman, where the Asemkrom-Elubo road crosses the stream. From here the road is used to convey rattan to Elubo and further towards Takoradi or Jewi-Wharf. In the north-western area around Abenie and Mmofrafadwene, rattans are transported through Apatase or Ayensukrom to Tolongpang and Mumuni. There are many primary rattan collectors in these areas that mostly migrated from Asamankese in the eastern region of Ghana. From there the rattans are conveyed to Prestea, where they are patronised by retailers from Kumasi, Takoradi and Accra. In the south-eastern area the main trade routes start in the Atababo area, where rattans are transported to Aiyinasi, Asasetre and Esiama. In the south-western area the routes start at Ohiamadwen or Tweakor II areas and go to Tikobo I and II. The survey also showed that within the Jomoro district the main Trans-African Highway from Elubo to AgonaNkwanta serves as the major rattan carriageway, and rattans are sent as far as Takoradi and Accra [29].

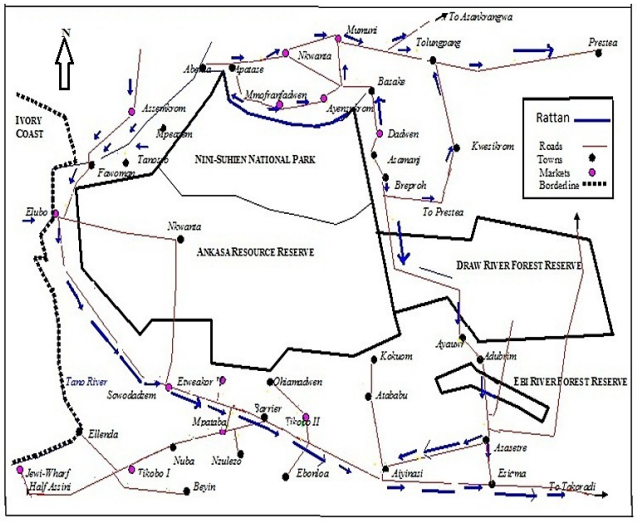

Figure 7. Rattan extraction and trade routes around Ankasa Conservation Area (source: Author, 2014)

4. CONCLUSION

The study generally showed that illegal extraction of rattan had been decreasing form 2004 to 2012 in Ankasa Conservation Area due to improved patrol system, increased productivity per guard and improved supervision. The study also showed a significant positive correlation ($p<0.05$) between EPMD and rattan extraction encounter. Most rattans in Ankasa are concentrated in areas close to the middle of the reserve and also close to patrol base camps because of the permanent presence of patrol staff. The research also revealed that Eremospatha macrocarpa (mfia) was the most extracted rattan species. The major rattan extraction and trade routes originate in the northern parts and in the area east of the reserve and also south of Draw River Forest Reserve. Anti-poaching patrols in the reserve should be strengthened and directed towards areas of high rattan stocks as well as the park peripheries and in the northern sections especially in the dry season to ensure sustainable management.

5. ACKNOWLEDGEMENT

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