JANA ROBEYST TRUST FUND

PROJECT COMPLETION REPORT FOR;

Population Status, Feeding Pattern and Anthropogenic Disturbances of Forest Elephants (*Loxodonta cyclotis*) in the Nki National Park and its Environs, East Region, Cameroon.

Forest elephants, Source: WWF-Cameroon

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Immense thanks go to my supervisor Prof. TONJOCK Rosemary KINGE for introducing me to the Jana Robeyst Trust Fund and Dr. FONKWO Sylvie NGUEDEM for their assistance and guidance all through the study.

Figure 1: Research team at Ikwa-Nki National Park

Thanks go to the Conservator of Nki National Park, Mr. Bidima Antoine who granted me the permission to carry out the study in the Park and also provided eco-guards who guarded me in the field. Not forgetting the Project Manager and the Junior Wildlife Biologist of WWF Jengi-Tridom in Ngoyla, Mr. Fondja Calvin and Mr. Bana Jean Belinga for organizing my research team and for their expertise advice prior to every field mission.

I am also very grateful to the chiefs and notables of the various villages; Ndimako, Lelene, Lamson, Ngoyla, Mabam-Baka, Mabam-Ndjem, Nkondong II, Djadom and Bareko II for their hospitality and for allowing me work with their subjects and to the porters who accompanied me to the field, I say thank you.

1. Executive summary

Elephant populations in Africa are increasingly being threatened by poaching for ivory, human-elephant conflict, habitat loss and fragmentation, and isolation of populations (Maisels *et al.,* 2013). However, there is limited data and understanding of forest elephant ecology, the worsening conservation status of the sub-species, and its management issues. This study was aimed at determining the population status, feeding pattern and anthropogenic threats of forest elephants in the Nki National Park.

- A total of 132 dung piles were detected along 22 Km transects. From this, elephant density was estimated at 0.14 (95% c.l 0.07-0.29; CV 32.8%) elephant/km^2, which was translated to 428 (95% c.l 217-897) individual elephants in the Nki National Park.

- Based on food species selection, 25 wild plants and 18 cultivated plants were identified to be fed upon by elephants in the Nki National Park. These plants were grouped into 24 families with different plant parts consumed (leaves, stems, bark, fruits, nuts, and pulp). Poaceae was the family that had the most abundant plants consumed by elephants, followed by Sapotaceae and the least being Pandaceae among other families. Many families had the same number of plants that were consumed by elephants.
- According to plant life form, elephants fed more on trees that accounted for 56% of their food plant species, followed by monocotyledons with 23% of species and the least is fern with 2% but according to plant parts, elephants fed more on fruits and seeds (62%) and least on stems (6%).
- A total of 107 open-ended questionnaires were administered to 107 participants (88 males and 19 females) from nine villages surrounding the Nki National Park; Ndimako, Lelene, Lamson, Ngoyla village, Mabam-Baka, Mabam-Ndjem, Nkondong II, Djadom and Bareko II and threats on elephants assessed.
- From the list of threats to elephants, respondents agreed that 6 of these threats reduced elephant population in the Nki National Park. These threats were: non-respect of law enforcement was the most accepted threat 101 (94.4%), followed by hunting for bushmeat 99 (92.5%), hunting for ivory 98 (91.6%), lack of management plan 79 (73.8%), logging 73 (68.2%) and the least was road construction 46 (43.0%).

The results of this study will help Researchers, Park management, NGOs on conservation, policy makers and the Government of Cameroon to be able to make good policy and take good conservation measures to conserve the Critically Endangered Forest Elephants in Cameroon.

2. Introduction

Forest elephants (*Loxodonta cyclotis*) population are under serious decline with about 62% between 2002-2011 across the central African forests as a result of poaching for illegal ivory trade (Maisels *et al.,*2013). South-east of Cameroon, represent a stronghold of forest elephant population that is recognized as a priority for conservation efforts (Brittain, 2013). A study of the population trends of forest elephants across the region is necessary to alert protected area (PA) management, Government body and Conservation strategies aimed at preserving this megafauna species from going extinct. For the Government and protected area mangers to make reliable decisions, a consistent estimates of population size, density, distribution and trends in these estimates, at regional and local level are necessary. In addition, proper knowledge on the anthropogenic and ecological factors that influence the distribution and population density of this species within its environment is vital for adaptive management strategies (Stokes, 2010). In 1998, an estimated population in Nki National Park was 2,178 (Ekobo, 1998), and there was a dramatic drop in 2015 with an estimated population of 565 (WWF Cameroon, 2016). According to Nzooh *et al.,* (2016a) Human activities are focused on elephant poaching for ivory where 3- 4 elephants were killed averagely per day in the Cameroon Tridom (Boumba-Bek National Park, Nki National Park and Ngoyla-Mintom Forests) in 2011, 2012, and 2015. Considering the mean

estimate, there was a 93% drop in elephant population in Boumba-Bek National Park from 2011 to 2015, 78% in the Nki National Park from 2005 to 2015 and 72% in the Ngoyla-Mintom Forests from 2011 to 2015 (Nzooh *et al.,* 2016a).

Information on the status of forest elephants in the Nki National Park is known as far back as 2016 but little is known on their anthropogenic disturbances. It was in this respect that this study seeks to fill these gaps as this will help in the development of conservation and management strategies of this Critically Endangered Species.

The primary objective of this study was to ascertain the population status, feeding pattern and anthropogenic factors affecting elephants in the Nki National Park. Specifically, this study seeks to

- estimate the density of elephants in Nki National Parked
- identify the different wild and cultivated plants fed upon by elephants in Nki National Park and along its peripheries
- identify the different human threats reducing elephant population in the Nki National Park and propose conservation strategies.

3. Study site

The Nki National Park (NNP) is located between latitudes 2°05‟N to 2°50‟N and longitudes 14°05‟E to 14°50‟E. It covers a surface area of about 309,362 hectares (3,093.62 Km^2). It is situated in the East region of Cameroon between Ngoyla Sub-Division in the Upper-Nyong Division, Moloundou Sub-Division in the Boumba-and-Ngoko Division and Salapoumbé Division (Figure 1). The Nki National Park has been described as “the last true wilderness” (Ngea and Peter, 2012).

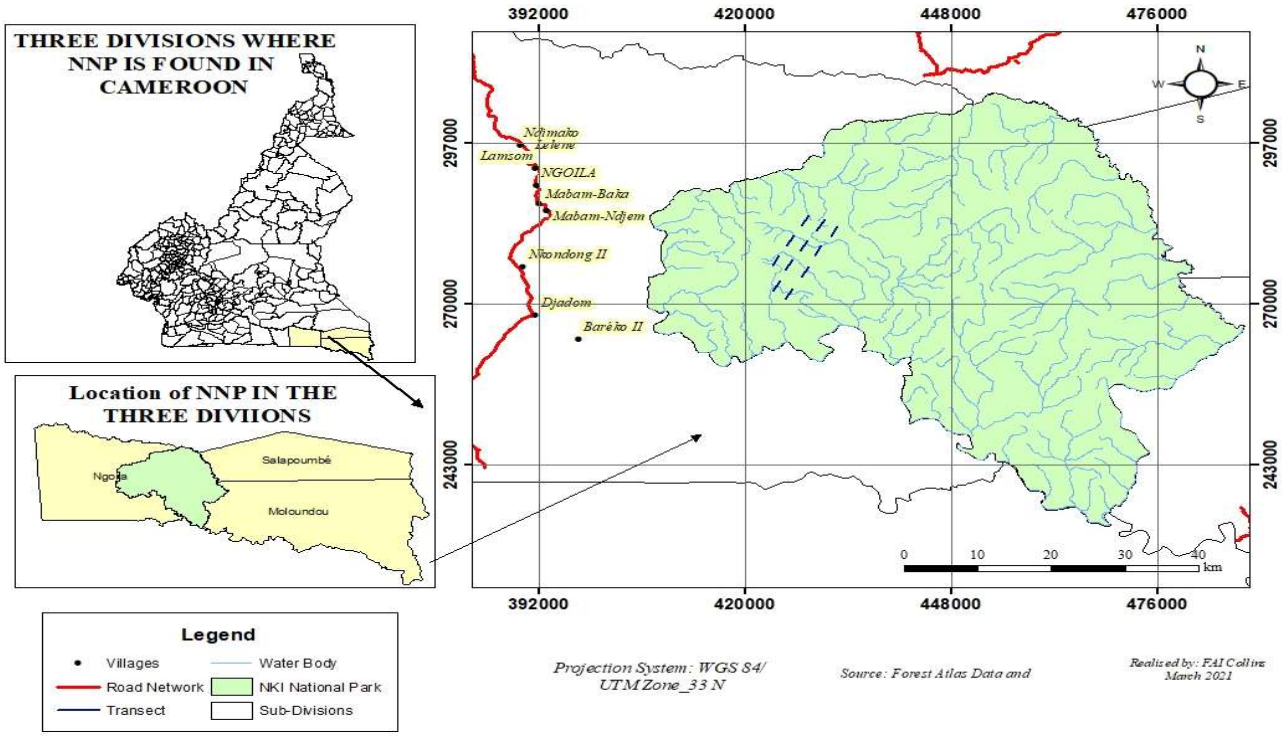


Figure 1: Nki National Park and some surrounding villages (Njoka, 2021)

4. Materials and Methods

4.1 Line Transect and Reconnaissance

Figure 2: Measuring perpendicular distance from transect center

The research team went to the field twice and cut a total of eleven 2 Km transects in IKwa, Nki National Park. Along these transects, all dung piles were recorded, categorized according to MIKE system of dung categorization and other parameters like distance and perpendicular distance also recorded (Figure 2). Feeding signs elephants were also recorded along the transects and along the approximately 40.16 Km reconnaissance (recce walks in between transects).

4.2 Questionnaire Administration and Informal Interview

Open ended questionnaires were administered to 107 individuals in 9 villages surrounding the Nki National Park and informal interviews held with these individuals (Figure 3. The nine villages were Ndimako, Lelene, Lamson, Ngoyla, Mabam-Baka, Mabam Ndjem, Nkondong II, Djadom and Bareko II. Questionnaires and interviews were to ascertain the different threats faced by elephants in the Nki National Park and its environs.

Figure 3: Questionnaire administration and informal interview based discussions in some villages; A: Lamson, B: Ndimako, C: Mabam-Baka, D: Mabam-Ndjem

5. Results and Discussion

The results from the study are presented below.

5.1. Elephant densities

A total of 132 dung piles were detected along 22 Km transects. Mean dung piles was 6.0 boli. Average perpendicular distance was 139cm. Dung density was estimated at 177 (85-372) dung/km^2 (Table 1).

Table 1: Statistic figures of dung survey in Ikwa-Nki National Park between March and May 2021 showing density and number of elephants after truncation and after DISTANCE had been run.

Parameter	Value
Number of dung piles	132
Distance surveyed (Km)	22
Dung density/Km^2 (95% c.l)	177 (95-372)
% CV dung density	34.4
Elephant density (95% c.l)	0.14 (0.07-0.29)
% CV animal density	32.8
Number of elephants (95% c.l)	428 (217-897)

Elephant estimated density was 0.14 (95% c.l 0.07-0.29; CV 32.8%) elephant/km^2, translated to 428 (95% c.l 217-897) individual elephants in the Nki National Park. From the results of this study, it shows that elephant population has reduced in the Nki National Park based on the result of 2015 survey by WWF Cameroon which was 565 elephants in the Park.

5.2. Feeding Pattern

5.2.1 Species of plants eaten by elephants in the Nki National Park and its peripheries

During the survey on transects, recces and interviews, several species of wild and cultivated plants were recorded. 25 wild plants and 18 cultivated plants were identified to be fed upon by elephants in the Nki National Park. These plants were grouped into 24 families with different plant parts consumed (leaves, stems, bark, fruits, seeds, and pulp). Poaceae was the family that had the most abundant plants consumed by elephants, followed by Sapotaceae. Many families had the same number of plants that were consumed by elephants (Table 2).

Table 2: Plant species and parts fed upon by elephants

WILD PLANTS			
Family	**Scientific Name**	**English Name or Commercial Name**	**Plant Part Eaten**
Annonaceae	*Anonidium mannii*	Wild soursop /ebom	Fruit
	Xylopia athiopica	Okola	Fruit
	Gambeya lacourtiana	Abam vrai	Fruit/
	Omphalocarpum elatum	Navel fruit tree/mebememgono kosso	Fruit
Sapotaceae			
	Baillonella toxisperma	Moabi	Fruits
	Autranella congolensis	Mukulungu tree	Fruit and bark
Combretaceae	*Terminalia ferdinandiana*	Kakadu plum/bush Plum	Fruit
	Irvingia robur	African mango	Fruit
Invirgiaceae	*Irvingia gabonensis*	Bush mango	Fruit
	Klainedoxa gabonensis	Eveuss	Fruits
Arecaceae	*Raphia monbuttorum*	Raffia	Pulp, young bamboos and nuts
Moraceae	*Myrianthus arboreus*	Giant yellow mulberry/monkey fruit	Fruits
Clusiaceae	*Garcinia kola*	Bitter kola	Bark and fruits
Pandaceae	*Panda oleosa*	afan(e)	Bark and fruits
Anisophyllaceae	*Poga oleosa*	African Brazil nut/Afo/ ovoga	Bark and fruits
Malvaceae	*Duboscia macrocarpa*	-	Fruits
Mimosaceae	*Tetrapleura tetraptera*	Aridan fruit/four corners (akpa)	Fruits
	Setaria barbata	Corn grass	Whole plant
Poaceae	*Setaria palmifolia*	Palmgrass	Whole plant
	Pennisetum purpureum	Elephant grass	Stem and leaves
	Ataenidia conferta	Emviali	Whole plant
Marantaceae	*Haumania danckelmaniana*	Sel	Whole plant
	Megaphrynium macrostachyum	Okoe	Whole plant
Meliaceae	*Lovoa trichiliodes*	Dibetou	Fruit
Dennsreadtiaceae	*Pteridium aquilinum*	Bracken fern	Whole plant

Table 2 continued

CULTIVATED PLANTS			
Family	**Species**	**English name or commercial name**	**Plant part eaten**
Curcubitaceae	*Cucumeropsis edulis*	Egusi/Ngon	Fruit and seeds
	Cucurbita pepo	Pumpkin	Whole plant
Poaceae	*Zea mays*	Maize	Whole plant
Poaceae	*Saccharum officinarum*	Sugar cane	Whole plant
Musaceae	*Musa paradisiaca*	Banana	Pith, leaves and fruit
Musaceae	*Musa sapientum*	Plantain	Pith, leaves, and fruits
Anacardiaceae	*Mangifera indica*	Mango	Fruit
Burseraceae	*Dacroydes edulis*	Plum	Fruit
Lauraceae	*Persea americana*	Pear	Fruit
Myrtaceae	*Psidium guajava*	Guava	Fruit
Arecaceae	*Elaeis guinensis*	Palm tree	Pulp and nuts
	Cocos nucifera	Coconuts	Leaves and nuts
Annonaceae	*Annona muricata*	Cultivated Soursop	Fruit
	Citrus latifolia	Lime fruit	Fruit
Rutaceae	*Citrus aurantifolia*	Lime fruit	Fruit
	Citrus sinensis	Orange fruit	Fruit
Bromeliaceae	*Ananas comosus*	Pineapple	Fruit
Caricaceae	*Carica papaya*	Paw-paw	Fruit
Total = 24	**43**		

5.2.2 Percentage of plant parts consumed by elephants

The collected plants were grouped according to the different parts consumed by elephants; fruits and seeds, leaves, stems, bark, and whole plant (Table 3).

Table 3: Proportions of plant parts eaten by elephants

Plant part	Number (n)	Percentage (%)
Whole plant	8	16.0
Bark	4	8.0
Stem	3	6.0
Fruits and seeds	31	62.0
Leaves	4	8.0
Total	**50**	**100.0**

From the collected plants eaten by elephants, the highest proportion of the plant part eaten were fruits and seeds (62%) and the least was stem (6.0%).

5.2.3 Plant species eaten by elephants classified according to family

The different plant species eaten by elephants were classified according to families to identify which family had the highest number of species eaten by elephants (Figure 4).

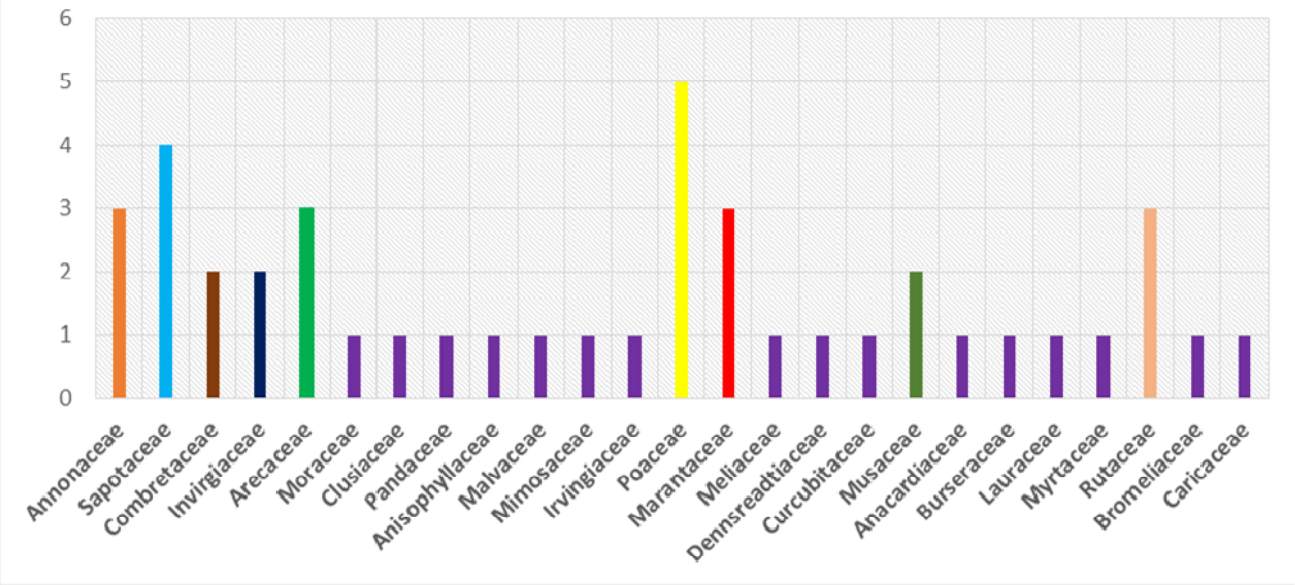


Figure 4: Proportions by family of plants consumed by elephants.

Amongst the plants classified by family, Poaceae was the family that had the most abundant plants consumed by elephants, followed by Sapotaceae. Many families had the same number of plants that were consumed by elephants.

5.2.4 Main threats according to percentage acceptance

The factors accepted to be threats on elephant population were ranked according to level of acceptance (Table 4).

Table 4: Percentage acceptance of main threats to elephants

Threats	Number of respondents	Level of acceptance n (%)
Non respect of law enforcement		101 (94.4)
Hunting for bush meat		99 (92.5)
Hunting for ivory	107	98 (91.6)
Lack of management planning		79 (73.8)
Logging		73 (68.2)
Road construction		46 (43.0)

From the factors agreed to reduce elephant population, non-respect of law enforcement was the most accepted threat n=101 (94.4%). This was followed by hunting for bushmeat n=99 (92.5%), then closely by hunting for ivory n=98 (91.6%). In that order, lack of management planning n=79 (73.8%), logging n=73 (68.2%) and the least affected threat on elephant was road construction n=46 (43.0%).

6. Conservation recommendations

The results from this study leads to the following recommendations for elephant conservation in the Nki National Park:

1. Improve anti-poaching missions should be carried out in the Park.

2. Eco-guards should carryout night patrols at forest clearings since most gunshots were heard at night and also due to the fact that elephants mostly visit forest clearings at night.

3. NGOs and Ministry of Forestry and Wildlife should continue to promote the development of other income generating activities on the communities adjacent to the park which will draw their attention away from hunting.

4. NGOs and Ministry of Forestry and Wildlife should sensitize the local populations around the Nki National Park on the benefits of conserving their wildlife resources especially the benefits from ecotourism.

7. Challenges

- The Nki National Park has a very rough terrain with many hills and dense vegetation making survey extremely difficult.
- The study was carried out during the rainy season which delayed the survey while in the forest as rivers were mostly full to cross to study areas and reducing number of transects cut a day as the team could not work under heavy rains.
- The Park is located very far from human settlement and from the WWF base at Ngoyla where the research team was organized making transportation and accessibility very difficult.
- No study on elephant dung decay rate has been done in the Park so estimating population density was difficult and I had to use the dung decay rate from neighboring Boumba-Bek National Park. So my next study in the Park will be on elephant dung decay rate.

8. PERSPECTIVES

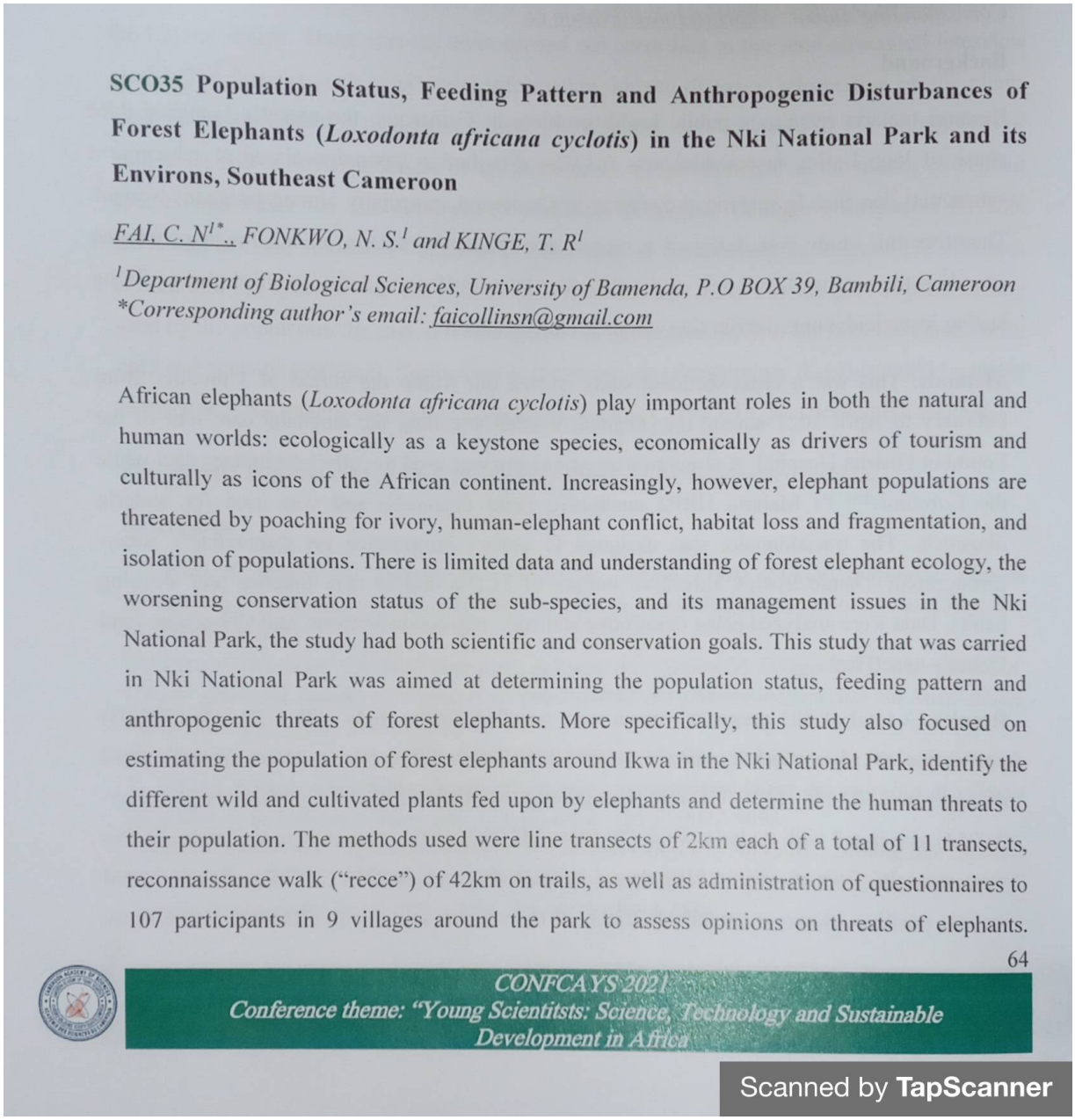
Further studies needs be carried out in the Nki National Park on:

1. Dung production rate and dung decay rate of elephants for both dry and rainy seasons.

2. Feeding ecology of forest elephants especially on the relative frequency of plant life forms eaten by forest elephants.

9. Upcoming outputs

After presenting this study in a conference organized by the Cameroon Academy of Young Scientists (CAYS) (Figure 5), the results and recommendations of the study will be submitted to the authorities of the Nki National Park, WWF team in Ngoyla, Ministry of Forestry and Wildlife, manuscripts in the process of publication and the study has also served as my Masters Thesis.



SCO35 Population Status, Feeding Pattern and Anthropogenic Disturbances of Forest Elephants (*Loxodonta africana cyclotis*) in the Nki National Park and its Environs, Southeast Cameroon

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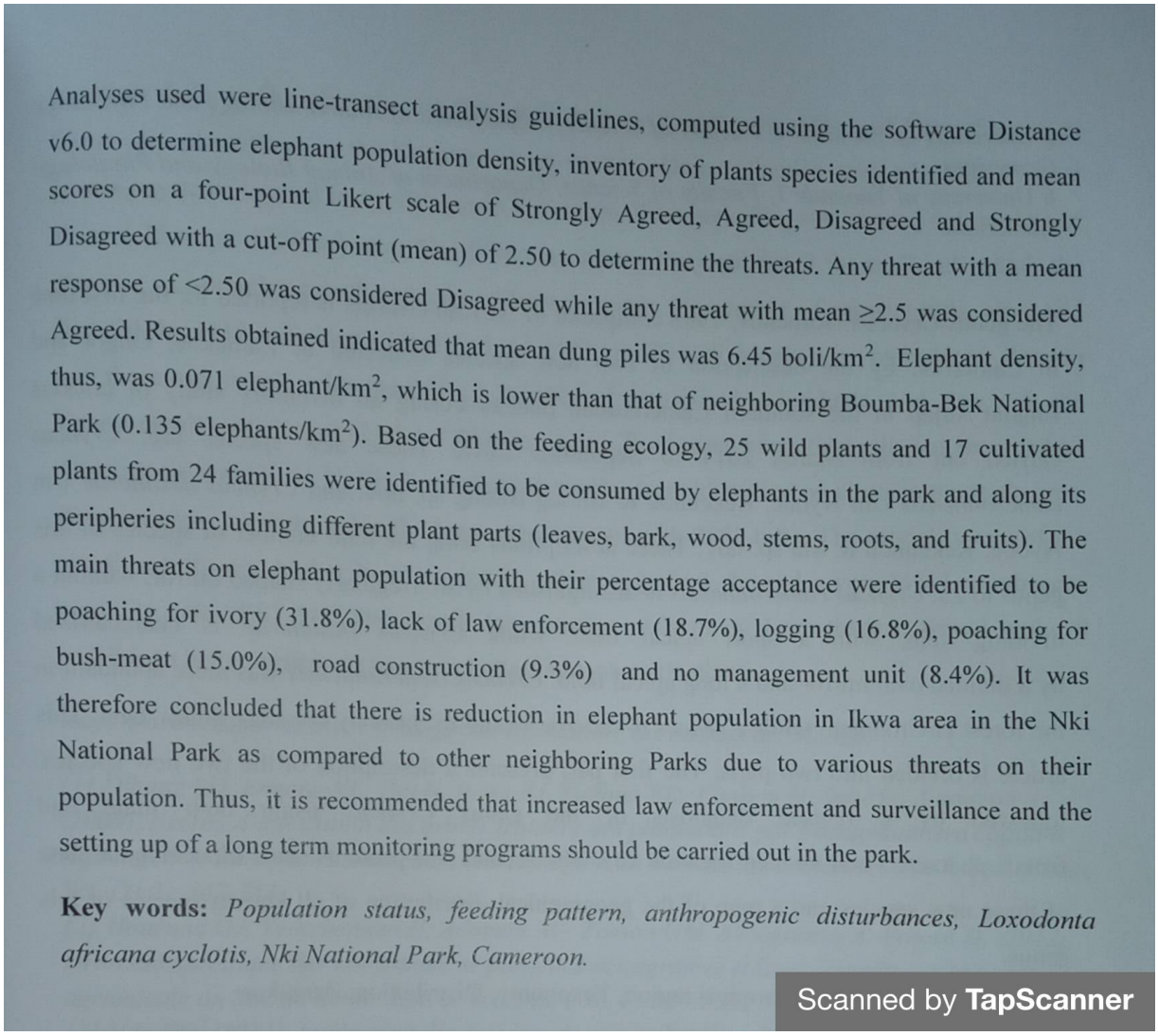
African elephants (*Loxodonta africana cyclotis*) play important roles in both the natural and human worlds: ecologically as a keystone species, economically as drivers of tourism and culturally as icons of the African continent. Increasingly, however, elephant populations are threatened by poaching for ivory, human-elephant conflict, habitat loss and fragmentation, and isolation of populations. There is limited data and understanding of forest elephant ecology, the worsening conservation status of the sub-species, and its management issues in the Nki National Park, the study had both scientific and conservation goals. This study that was carried in Nki National Park was aimed at determining the population status, feeding pattern and anthropogenic threats of forest elephants. More specifically, this study also focused on estimating the population of forest elephants around Ikwa in the Nki National Park, identify the different wild and cultivated plants fed upon by elephants and determine the human threats to their population. The methods used were line transects of 2km each of a total of 11 transects, reconnaissance walk ("recce") of 42km on trails, as well as administration of questionnaires to 107 participants in 9 villages around the park to assess opinions on threats of elephants.



Analyses used were line-transect analysis guidelines, computed using the software Distance v6.0 to determine elephant population density, inventory of plants species identified and mean scores on a four-point Likert scale of Strongly Agreed, Agreed, Disagreed and Strongly Disagreed with a cut-off point (mean) of 2.50 to determine the threats. Any threat with a mean response of <2.50 was considered Disagreed while any threat with mean ≥2.5 was considered Agreed. Results obtained indicated that mean dung piles was 6.45 boli/km^2. Elephant density, thus, was 0.071 elephant/km^2, which is lower than that of neighboring Boumba-Bek National Park (0.135 elephants/km^2). Based on the feeding ecology, 25 wild plants and 17 cultivated plants from 24 families were identified to be consumed by elephants in the park and along its peripheries including different plant parts (leaves, bark, wood, stems, roots, and fruits). The main threats on elephant population with their percentage acceptance were identified to be poaching for ivory (31.8%), lack of law enforcement (18.7%), logging (16.8%), poaching for bush-meat (15.0%), road construction (9.3%) and no management unit (8.4%). It was therefore concluded that there is reduction in elephant population in Ikwa area in the Nki National Park as compared to other neighboring Parks due to various threats on their population. Thus, it is recommended that increased law enforcement and surveillance and the setting up of a long term monitoring programs should be carried out in the park.

Key words: *Population status, feeding pattern, anthropogenic disturbances, Loxodonta africana cyclotis, Nki National Park, Cameroon.*

Figure 5: Abstract presented in the conference of Cameroon Academy of Young Scientists

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