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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Thirtieth meeting of the Animals Committee
Geneva (Switzerland), 16-21 July 2018

Appendix-I species subject to export quotas Leopard

EXPORT QUOTAS REVIEW – UGANDA

This information document has been submitted by Uganda in relation to agenda item 15 on *Quotas for leopard hunting trophies*.*

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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

Interpretation and implementation of the Convention

Regular and special reports

Appendix-I species subject to export quotas Leopard

EXPORT QUOTA REVIEW – UGANDA

1.0 Background

Uganda Wildlife Authority (UWA), in accordance with Resolution Conf. 9.21 (Rev. CoP 13) on the interpretation and application of quota for species included on CITES Appendix I, applied for a leopard (*Panthera pardus*) quota at the 14th CITES Conference of Parties. The quota was to help Uganda harmonise Leopard conservation and livestock industry development, reduce human-leopard conflicts save the species in particular and other predator populations in general from persecution. Subsequently, Uganda was granted a quota of 28 Leopard skins arising out of killings in defence of human life and property. Uganda has since implemented a carefully monitored and highly regulated leopard sport hunting programme specifically targeting problem leopards. The revenue generated from leopard utilisation is used to offset costs incurred by livestock farmers and support species conservation as recognised in Resolution Conf.8.3 (Rev. CoP 13).

The specific objectives for the inclusion of leopard on hunting program are to:

a) Provide incentives to landowners to conserve leopards through realisation of economic value out of problem animals.

b) Demonstrate that wildlife conservation can contribute to government's poverty eradication action plan.

c) Attach an economic value to problem leopards that reside on private land and considered by local people as a threat to their lives, nuisance and useless.

d) Minimise human- leopard conflicts thus saving the population of animals of prey from illegal killing and poisoning.

e) Demonstrative that wildlife conservation is an economically competitive land use option

1.1. Justification

Problem leopard utilization is based on the following facts:

a) Leopards residing on private land had become highly problematic and dangerous. They would kill livestock and sometimes humans. Local people would in retaliation kill the leopards without any economic value being realised from them. Reports involving livestock attacks by Leopards were on an increase and wide spread. Worse still the capacity for Uganda Wildlife Authority (UWA) to directly address the challenge or hunt down the problematic individuals was limited. Compensation of affected farmers is not provided for under the current wildlife law. Therefore, it was envisaged that, sport hunting of problem leopard would make it more valuable and attractive to landowners who were poisoning or killing leopards without any tangible benefits. Sport hunting would therefore generate economic benefits that would motivate local people to protect the animal instead of regarding it as a nuisance.

b) Conservation of Leopard existing on private land was likely to improve because of economic value realised.

c) Government Policy on Wildlife Use Right is to encourage the general public and private sector to engage in game ranching and farming as one of the ways to sustainably utilise wildlife resources. Therefore maintenance of an annual quota for Leopard will continue to generate economic benefits that should positively influence the attitude of game ranchers and communities towards Leopard conservation.

2.0 Status of Implementation of CITES approve quota

2.1 Animals Hunted, Fees Structure and Revenue Management

So far, hunting of problem leopards has been conducted in ranches around Lake Mburo Conservation Area only. Table 1.1. below shows the details of the ten (10) leopards that have been hunted and fees generated as at the end of 2017.

Until January 2009, the animal fee for a leopard was at US $3,500. The current animal fee is at US $ 5,000. This fee applies to all companies that are licensed to conduct problem leopard hunting in Uganda. The sharing of such fees is in accordance with the agreements signed between UWA, the local governments of the concerned districts and the community associations.

The other fees charged under sport hunting such as professional hunters license, export fee and locally determined and charged fees such as guiding fee and entry fee remain the same whether there is a leopard hunt or not.

Table 1.1: Problem Leopards Hunted and Revenue Generated

SN	Hunter Name	Hunt Date	Parish	Total Fee (US $)	Animal Fee ($) Sharing			
					Community Ass. (US $)	UWA (US $)	Local Gov. (US $)	Land Owners (US $)
1	Boris Dreizen	09/09/2007	Rurambira	3,500	2,275	525	350	350
2	Christian Ilsoe	31/01/2008	Rurambira	3,500	1,575	525	350	1,050
3	Claus Buck Rasmussen	24/03/2008	Rurambira	3,500	1,575	525	350	1,050
4	Gerard Pommier	13/08/2008	Rurambira	3,500	1,575	525	350	1,050
5	Anders Holm	07/04/2009	Rurambira	5,000	2,250	750	500	1,500
6	Conrad Keifl	07/06/2010	Rurambira	5,000	2,000	500	-	2,500
7	Jens J. Glud	16/03/2012	Rurambira	5,000	2,000	500	-	2,500
8	Aage Dahl Sorensen	07/10/2013	Nshara	5,000	2,000	500	-	2,500
9	Shah Syed Ghuluan Mustafa	29/03/2015	Nshara	5,000	2,000	500	-	2,500

10	Niels Sorensen Dalgaard	24th/ 2/2017	Nshara	5,000	2,000	500	-	2,500
Total				**44,000**	**19,250**	**5,350**	**1900**	**1,750**

Since 2007, the programme has generated USD44,000 that has been distributed among various stakeholders including community association, Wildlife Authority, land owners and district local governments. This has not only contributed to income generation but also influenced support for the species.

Note: It is also observed that, despite being granted a quota of 28 problem leopards, on average, Uganda hunts only one (1) individual per year. Hence, the hunting remains sustainable with minimal impact on the species population. Nevertheless, the problem still persists and hence Uganda would like to maintain the quota of 28 animals to be able to address the challenge and generate incentives for farmers and land owners outside protected areas.

2.2 Skin Export Tags and Management

To be able to export the skins hunted, each skin is identified by a self-locking tag attached to it which indicates Uganda as a State of export, the number of the specimen in relation to the annual quota and the calendar year in which the animal was taken in the wild.

Uganda procured leopard skin tags from VIKELA ALUVIN (PTY) LTD of South Africa. The company is authorised by CITES Secretariat to manufacture tags for skins of leopards and crocodiles in international trade as per notification to CITES parties No. 2004/063 of 1 September 2004. Tags for years 2016-2019 were procured each with 10 tags corresponding with the maximum quota granted by CITES CoP 14. The tags are serial numbered from 1-10 for each year. The tags are safely kept in UWA strong room to ensure that there is no tampering of any nature. Careful handover is ensured in case there is absence from office by the responsible officer. All unused tags at the end of the year are declared in an official report and forwarded to CITES Management Authority. As of 30th June 2018, the clients that have utilized the tags are indicated in the Table 2.

Table 2: Export Licences for Leopards as of November 30th, 2008-2017.

No	Skin Tag Serial No.	Exporter / Hunter	Export License Serial No	Country of Import
1	CITES UG NIL 2008 0000001	Mr. Boris Dreizen	47878	Russia
2	CITES UG NIL 2008 0000002	Mr. Christian Ilsoe	47877	South Africa
3	CITES UG NIL 2008 0000003	Mr. Claus Buck Rasmussen	47874	South Africa
4	CITES UG NIL 2008	Mr. Gerad Pommier	47875	France

	0000004			
5	CITES UG NIL 2009 0000001	Mr. Anders Holm	47876	Denmark
6	CITES UG PAR 2010 0000001	Conrad Keifl	48308	Germany
7	-	Jens J. Glud	48209	Denmark
8	CITES UG PAR 2013 0000001	Aage Dahl Sorensen	29406	Denmark
9	CITES UG PAR 2016 0000001	Shah Syed Ghuluan Mustafa	36060	South Africa
10	CITES UG PAR 2017 0000001	Sorensen Niels Dalgaard	42431	Denmark

So far compliance to the set quota is excellent due to UWA's emphasis on targeting only problem leopard and strong internal control mechanism; one being that before any hunting of problem leopard is permitted, a detailed assessment is undertaken, and the professional hunter has to obtain permission from UWA Executive Director.

2.3 Issuance of Export Permits

Issuance of export permits for leopard skins is carried out within the established legal framework. However, additional safeguards and conditions have been put in place to deal with leopard trophy exports to enhance compliance. These extra requirements are:

a) The professional hunter must submit a separate hunting report on every animal hunted and the skin/trophy;
b) The leopard skin tag, uniquely identified, is inserted on the skin
c) The details of the tag are indicated on all export documents;
d) Applications for export license for skulls without their skins are not permitted; and
e) CITES import permit must be presented by the applicant prior to granting an export license and permit.

3.0 Assessment Study

A study was conducted in 2012 on the conservation status leopard of in Uganda. It was found that the species was widely distributed. The actual population status was however not established due to the elusive nature of the leopards. The local community attitude towards leopards was found to be negative due to the destructive nature of the species. This was attributed to the fact that people in most areas had not yet derived any tangible benefits from the leopards. Nevertheless, communities from leopard affected areas were willing to participate in sport hunting to harness the benefits. The study was stimulated by the fact that a significant number of leopards were being exposed to retaliatory killings through poisoning, shooting and trapping. The full report is **attached** to this document as Annex I. Land use changes as a

result of agricultural conversion was also identified as a key threat to leopard conservation.

4.0 Management of the problem Leopard (Quota)

The maximum quota for leopards in Uganda is 28 as established by CITES CoP14. The hunting quota is determination and allocated to registered hunting companies as and when problem leopards emerge or manifest. Hunting of leopards is also subjected to other conditions including a detailed assessment and obtaining special permission from the Wildlife Authority following reports of the problem leopard(s) in the area.

Hunting of problem leopard is mainly done in areas where leopards are reported to be in close contact and interaction with local communities especially in key livestock range districts. Hunting tends to mainly target mature male problem leopards. Where feasible and possible, young male and female problem leopards are captured and translocated to the rescue centre at the Entebbe Zoo. A leopard is considered to be a problem animal, if it has caused damage with clearly identifiable marks and must be resident outside the protected area as determined by a Wildlife Officer. A leopard may also be a problem, if it displays some behavior that threatens life and property as may be assessed by the officer.

Hunting of problem leopards is in accordance with PART VIII Section 61 of the Uganda Wildlife Act Cap 200. Professional hunters, together with their hunting clients, are accompanied by UWA official, who is responsible for collecting data on utilization/ hunting of leopard. The data sheets are designed in such a way that the most critical details on the conduct of hunters and adherence to ethics are captured, upon which subsequent evaluation of companies is based.

Step 1:
Reporting of the presence of a problem leopard

The affected community member(s) or relevant local governments report the presence of problem leopard in their locality to UWA as per Section 62 of the Wildlife Act: *"Any person having reason to believe that any protected animal is causing or may cause material damage to any land, crop, domestic animal, building, equipment or other property may report the facts to an officer";*

Step 2:
Verification of the problem: As provided in the Act, *"An officer who receives a report under subsection (1) shall, as soon as practicable, assess the extent of the threat posed by the said animal and take any necessary action he considers fit in the circumstances".* Wildlife officer makes an assessment of the situation. After the assessment, the concerned staff member makes a report to the line supervisor who in turn presents the report to Head of Department for consideration.

Step 3:
Decision making by UWA Head of Department: Depending on the results of the assessment, the management makes a decision either to trans-locate the animal or to hunt it. If the recommendation is to hunt which is usually the last resort, Executive Director communicates this decision to the licensed professional hunter to utilize the

problem animal(s) as per his official annual allocated quota. Note that, the decision making may be delegated to the Chief Warden of the nearest Conservation Area.

Step 4:

a) ***Hunting of problem animal: Once the office of Executive Director grants permission to hunt a specific problem leopard, professional hunter goes ahead to*** utilize the concerned animal. Revenue generated is shared equitably as per the concession agreement. In addition, the professional hunter is obliged to inform the affected community leaders or local governments about the pending hunting expedition. The hunter is also required to observe hunting ethics and hunting guidelines.

b) **Mode of hunting and hunting ethics**

As noted earlier, leopard sport hunting is strictly for problem leopards existing outside protected areas. Leopard hunting is based mainly targets male problem leopards. In a situation where a problem leopard turns out to be a juvenile or female, no hunting is authorised. Instead, conservation education and community sensitisation is applied. The animal is translocated as soon as possible and no killing of female and or juvenile leopards is allowed. Leopards being challenging animals, they form a separate package and therefore hunters are normally obliged to spend maximum 14 days on a single safari, as a deliberate measure to allow more spending and revenue generation in the hunting region

Section 53 of the Uganda Wildlife Act 2000 prohibits hunting after darkness. In utilising leopard quota, problem causing leopards are targeted which often can be available at night and obtainable sometimes-using spotlights. This requirement actually saves the leopard. Sport hunting is implemented based on strict code of conduct for professional hunters. For example no person is allowed to;

a) Use any firearm capable of firing more than one cartridge as a result of one pressure of the trigger.
b) Hunt any animal during the dark hours, that is, period between sunset and sunrise.
c) Hunt any female animal, which is pregnant or accompanied by its young, or hunt the young animal.
d) Hunt within National Park.
e) In case it is necessary to use baits, ED can only authorise the use of domestic animals instead of game.
f) Export of leopard trophy is regulated and done based on CITES framework and the national laws. No person shall be allowed to export more than 2 skins in any calendar year. The export should only be for non- commercial purpose, that is, for personal use.

5.0 Conclusion

The utilization of leopard in Uganda has been highly regulated to enhance compliance to CITES and the national law, while addressing the challenge of human-leopard conflicts. Hunting is done outside protected areas. The population inside protected areas remains safe and is not exposed to any form of hunting or utilization.

Even on private land, hunting is done as a last option after having evaluated all available alternatives of saving the species. The revenue so far generated has contributed to supporting the affected community. Although Uganda has not been exhausting the national /CITES quota, sport hunting of a few problematic individuals has played a key role in enhancing benefits and influencing local community and landowners' support for conservation of leopard in particular and big cats in general.

Uganda therefore recommends that its leopard quota of twenty eight (28) individuals is maintained as it is not detrimental to the survival of leopards in the wild, and an intervention that addresses human-wildlife conflicts by adding value to the problem leopards and creating incentives for their conservation.

ANNEX

STUDY ON ASSESSMENT OF STATUS AND DISTRIBUTION OF THE LEOPARD (*Panthera pardus*) IN UGANDA

1. Background of study

The leopard is listed in IUCN red list of endangered species in Appendix I of CITES (IUCN, 2002). This implies that trade on any parts of the species is highly regulated because the species is at high risk of global extinction. Amidst these conservation measures, the leopard populations in Uganda continue to dwindle especially outside protected areas. This is due to habitat loss and degradation, poaching, threats from diseases, scarcity of prey and deliberate killing by pastoralists and hunters.

Considering Uganda's current human settlement pattern and the leopard's stealth behaviour of attacking and killing local people and their livestock has resulted in local communities killing leopards by either prey-bait poisoning or by direct hunting. People who keep livestock consider a leopard as very destructive and dangerous predator with no economic value and therefore needs to be exterminated. Yet in other countries like Tanzania, Zimbabwe, Zambia, Mozambique (Packer *et al*., 2011), South Africa (African Sky Safaris, 1998, South African Tourism, 2005 and Carus, 2009) and Namibia (Stander *et al*., 1997), leopards are taken as big economic assets to the community. Tanzania is the most popular destination for leopard trophy hunting in the world (Packer *et al*., 2011). Much revenue could be generated by communities through tourism and trophy hunting. Revenues generated by leopards to the communities have been found to outweigh the losses they cause (Stander *et al*., 1997; African Sky Safaris, 1998 and Carus, 2009). For these programs to be successful and sustainable, the ecology and populations of leopards must be known, and in addition the attitudes of the local communities towards leopards must be positive. However, in Uganda, little research has been done on the ecology of the leopards and attitude of the local communities towards leopards. It was against the above background that this study was designed to address the following specific objectives:

i) Establish the threats to the survival of a viable leopard population in Uganda
ii) Determine the attitudes of communities towards conservation and sustainable utilization of leopards in Uganda.
iii) Estimate the population and abundance of leopards in Uganda
iv) Determine the spatial and temporal distribution of leopards in Uganda.

The outputs of the study could be used:-

i) as a basis of understanding the distribution patterns of leopards in various ecosystems in Uganda.
ii) for mapping leopard problem hot spots in Uganda.
iii) for developing strategies for innovative involvement of the local communities in the sustainable management of leopards.
iv) for development of monitoring mechanisms for leopard population viability and distribution pattern studies.

v) for developing a management plan for leopards in Uganda.
vi) as a basis of establishing the strategies for sustainable leopard tourism and trophy hunting in accordance with CITES provisions and Uganda national legislation.

2. Methodology

This was a cross sectional study. The study sites were systematically selected to be representative of the country based on: vegetation types (savannah, forested areas etc), protected areas, land use (crop farming, livestock keeping, mixed crop livestock keeping areas) relative abundance of leopards, hunting and non-hunting areas. Classification of land use was enhanced using Satellite Landsat images. Research was carried in and outside protected areas in Lake Mburo Conservation Area, Queen Elizabeth Conservation Area and Central Albert Area in western axis of Uganda. It was also carried out in central, eastern axis and north eastern axis of Uganda in districts of Luwero, Nakasongoola, Sironko, Bukedea, Kween, Amudat, Nakapiripirit and Kaabong. Studies were also done in the north around Murchison Falls Conservation Area in districts of west Nile, Amuru, Nwoya and Oyam; Kabwoya game reserve. The leopard population verification study sites were selected after carrying out the initial reconnaissance surveys.

After initial participatory discussion with district vermin control officers, UWA staff and local communities in selected districts; and studying relevant reports (UWA reports, local government district reports etc) the leopard hot spots were identified. The leopard hot spots selected for the study for Murchison Falls Conservation Area (Northern and Central axis), Eastern and North eastern axis, Lake Mburo Conservation Area (LMCA), Queen Elizabeth Conservation Area (QECA) and Kidepo Valley Conservation Area (KVCA) were as shown in Tables 1, 2, 3, 4 and 5 respectively.

Table 1. Study sites in Murchison Falls Conservation Area

District	Sub county	Parish	Village
Nakasongoola	Nakityoma	Bujubi	Bugamwe
	Wabinyonyi	Kiwongone	Rwenyama
	Nakitoma	Nakitooma	Kyaani
	Kafu		Kafu
	Namasa	Namas	
	Nabiswela	Kyangugulu	
		Kalengende	
		Kakonge	
Luwero	Kamira	Kitendere	
		Kabunyala	
	Batuntumula	Kalwanga	
Nakaseke	Wakyato	Kalagala	
Nwoya	Alero	PanoKrac	Lebugec
	Nwoya	Kock goma	Kalib B/ Lila
Oyam district	Kamdin	Joma	Akurudia

Table 2. Study sites in Eastern and North eastern axis

District	Sub-county	Parish	Village
1.Kween	Kongais	Sundet	Ngorina
2. Amudat	Karita	Losidok	Abongai & Kichom
		Karita	Taparak
3. Nakapiripirit	Nakapiripirit	Namalu	Giriki and Namalu
4. Sironko	Buwalasi S/c	Nagudi	Buwira
5. Bukedea	Kidongole	Kalupo	Kalupo

Table 3. Study sites in Lake Mburo Conservation Area

District	Sub-county	Parish	Village
Kiruhura		Rwabalata	Minekye
	Sanga	Nombe 1	Kasharara
	Sanga	Akayanja, Kanyaryeru,	Bunawanjara
	Nyakashashara	Rurambira	Rurambira
Isingiro	Mbaare	Rutete	Rutete

Table 4. Study sites in Queen Elizabeth Conservation Area

District	Sub-county	Parish	Village
Kasese		Mukhoya	Mukhoya
	Lake Katwe	Katunguru	Kitaka
	Nakiyumbusi		Kayanzi fishing village
		Nyankatonzi	Nyankatonzi
	Kazinga		Busunga
			Kasenyi

Table 5. Study sites in Kidepo Valley Conservation Area (KVCA)

District	Sub-county	Parish	Village
Kaabong	Kareenga	Kangole	Kangole
		Opotipoti	Opotipot
		Loyoro	Loyoro
			Loruk
		Lokori	Lokori
		Geremech	Geremech
		Nakatoit	Nakatoit
		Karenga	Kamkoi
			Mining quarters
			Wapaakiru
			Karenga

The maps of the hotspots were stratified according to blocks. The blocks were randomly sampled. The selected blocks were further stratified according to land use, terrain and vegetation types.

The survey involved: use of secondary data, participatory discussions, carrying out interviews using questionnaire, carrying out leopard verification studies and data analysis.

Secondary data collection involved reviewing: literature on leopard –human conflicts in Uganda and sub-Saharan-Africa, Uganda Wildlife Authority (UWA) reports, district local government vermin and problem animal reports, Uganda Large Predator Project reports, Wildlife Conservation Society reports, Ministry of Tourism, Trade and Industry archive reports and News Bulletin archives.

Participatory rapid appraisal methods such as focus group discussions were held with the local communities and their leaders, key informants, extension staff and UWA staff aided with a check list of questions as shown in Appendices (I, II and III). The community ability to differentiate leopards from other cats was enhanced by using photographs and illustrations. A structured formal questionnaire (see attached Appendix IV) was later administered to community households. FGDs were held in 36 villages involving 647 people as shown in Table 6.

Table 6. Distribution of villages and number of people who had discussions with according to zones visited

Zone	Villages	People
QENP CA	5	106
North western	3	57
Nakasongola	4	61
Luwero	3	80
North Eastern & Eastern	5	88
LMNP CA	5	101
KVCA	11	154

Leopard verification studies involved: transect trail walks / drives, remote photography survey methodology (camera trapping) and radio-tracking. Transect or road walks / drives were carried out in the areas of study with aid of local community communities and key informants especially vermin control extension and UWA staff. It involved searching for leopard signs like: tracks (foot marks / spoors), scats, hair, scratches and prey remains. This was done as described by Henshel and Ray (2003). Remote photography survey (camera trapping) was done only to prove presence and absence of leopards in QENP CA and LMNP CA. One leopard which was trapped in QENP was radio collared and monitored.

Spatial data of leopard distribution was analyzed into GIS spatial models using ESRI software. Statistical analysis of descriptive nature was performed. Population estimates were extrapolated to reflect the distribution and size most suitable leopard habitats (savannah bush thickets and mountainous hilly ruggy terrain). Area sizes of suitable habitats confirmed to be having leopards were determined using cartographic maps and area data bases. Area sizes of parishes and sub-counties having leopards were also determined using cartographic area data bases. According to Martin and De Menlenaer (1988) one leopard was estimated to have a home area equivalent to 20 Km^2.

Sensitivity analysis was performed using models developed using STELLA® Research Modelling software to assess the impact trophy hunting quota on leopard populations outside protected areas. For modelling the following parameters: initial population size estimates; sex ratio, age structure, age – sex specific mortality rates, hunting quota size and community kill rates were determined.

3. Results

3.1. Attitudes of people towards leopards

The attitude of the people in all areas was negative towards leopards. They were getting no benefits and leopards were considered as problem animals to them. Even communities in Nwoya, Oyam, Sironko and Bukedea were leopards were no longer seen did not want leopards.

3.2. Characterisation of communities with leopard problems

3.2.1. Economic activities

Kayanzi, Katunguru and Kasenyi were fishing village enclaves within QENP. The major activities were fishing and in addition they kept goats (9.8±1.6 per household (H/h), ducks (5.4±1.8 per H/h) chicken (3.1±1.2 per H/h) and sheep (0.3 per H/h). While Muhokya and Nyakatonzi were villages just adjacent to QENP. Adjacent to QENP were pastoral households who in addition kept cattle.

Luwero and Nakasongola, areas were sparsely populated and were inhabited mainly by pastoralists and ranchers keeping cattle and goats. Meanwhile in the north, in Nwoya and Oyam districts, the major economic activities were crop production, rearing of pigs, goats and chicken.

Kween, Amudat and Nakapipirit were pastoral areas where cattle, camels, goats and sheep were reared. Meanwhile in Sironko, most of the economic activities were crop growing and keeping of a few goats and chicken. People of Bukedea were agro-pastoral communities who kept cattle, goats, sheep and goats.

Around Kidepo Valley National Park Conservation Area (KVNP CA), in Karenga sub-county Kaabong district the people were agro-pastoralists growing crops and keeping livestock cattle, goats, sheep and chicken. Average land holding was 16.7±2.4 acres per H/h, of which 54±5.7% was for growing crops.

Lake Mburo area was ranching and pastoral area where cattle, goats and chicken were kept. They also had plantations of bananas. Average acreage of land per pastoral household was 98.3±10 acres with only 3.2% under crops. Average ranch was 3.14±0.2 square miles with only 2.5±0.5 under crops.

Total livestock holdings per district visited were as shown in Table 7.

Table 7. Populations of livestock per district visited

District	Cattle	Goats	Sheep	Chicken	Ducks
Kasese	97,243	227,518	24,490	752,800	45,036
Oyam	118,603	172,052	19,347	650,758	21,918
Amuru	33.063	67,692	9,773	142,121	44,754
Nakasongola	222,185	87,823	6,839	287,834	6,316
Luwero	79,787	68,527	13,275	464,943	7,032

Nakapiripirit	674,746	547,365	389,676	314,308	15,653
Moroto	352,867	380,172	307,028	260,997	18,834
Kotido	694,247	535,135	555,688	219,598	12,737
Kaabong	518,465	424,729	424,729	506,585	16,844
Bukedea	86,111	54,810	10,013	215,251	4,400
Katakwi	136,966	104,932	25,551	286,229	4,902
Kiruhura	342,315	188,686	28,017	142,459	4,719

Source: UBOS (2007)

3.2.2. Ability of the communities to identify leopards

Percentage ability of the communities to identify leopards and the signs they use for identifying them were as shown in Table 8.

Table 8. Percentage ability of communities to identify leopards and the signs they use

Identification sign	QENP	NW (Oyam & Nwoya)	Nakasongola	Luwero	East & NE	LMNP	KVCA	Overall
Sighting	100	100	100	100	66.7	100	100	92
Characteristic leopard kill	40	66.7	100	100	66.7	100	100	76
Number killed	0	33.3	100	100	66.7	100	100	64
Foot prints	40	33.3	100	100	66.7	100	100	72

Almost all communities could readily identify leopards and differentiate them from other cats by using their markings. Communities in Bukedea and Sironko could not readily identify leopards.

The communities could readily identify leopard kills through characteristic strangulation marks. Also, significant proportion reported that leopard could kill so many preferred livestock especially goats and sheep and only take one for a meal. A good proportion of the communities could identify leopard foot marks.

3.2.3. Community utilisation of leopards

Only communities around QENP Conservation Area (QENP CA), Kidepo Valley Conservation Area (KVCA) and Amudat in Karita parish and sub-county made use of leopard parts. In all these areas they made use of leopard skins. Leopard skins were used as decorations and traditional dances. In QENP each pelt was sold at Ug Shs 15,000. In QENP some communities used leopard skins (14.7%), claws (3.9%), meat (3.9%), viscera (2.9%) and fur (2.9%) for medicinal purposes. Around KVCA in Karenga sub-county, skins of killed leopards were given to UWA who used them for making trophies. However, some skin pelts were sold by the communities at an average price of Ug Shs 370,000±60,000. Also in KVCA, meat of leopards was eaten and was sold at average price of Ug Shs 5000 per Kg.

3.3. Problems caused by leopards

Of the villages visited and being identified by UWA staff, vermin control staff and extension staff as leopard hot spots, 84% had leopard problems. Two villages of Lengubec in Mwoya district and Akuridia in Oyam had no leopards. Lengubec communities last saw a leopard in 2006 and for Akuridia in 2004. In Eastern Uganda, in the villages of Kalupo in Bukedea and Buwira in Sironko, leopards were last seen in 2006. Even in Karenga sub-county in Kaabong district in the parishes of Karenga, Loyoro and Nakatoit leopards were last seen in 2007.

However, in some areas, the problems caused by leopards were not more in magnitude than those caused by other wild animals. In Kafu in Nakasongola hippopotamus and crocodiles were major problems which needed immediate attention. While in Lebungec in Nwoya district and Akuridia in Oyam district the major problem was hippopotamus; in Nakapiripirit were buffaloes, baboons and wild pigs; and in Karashara and Bunawanjarra around LMNP warthogs, bush pigs and buffalo were major problems. In Karenga sub-county adjacent to Kidepo National Park buffaloes, elephants, hyenas, baboons and bush pigs were a nuisance.

The problem caused by leopards were mainly livestock predation and human attacks. Human attacks were only reported in QENP CA and KVCA, with 14.7% of households reporting human attacks in QENP CA. In KVCA, 3 people had been killed by leopards in Lokori, Kangole and Opotipot. Two people were killed while hunting and one while grazing in leopard habitats. UWA staff member in KVCA had also been attacked very severely in the evening when on usual patrols in June 2010. Seventy percent of communities who had leopard problems were cattle keepers who reported that leopards preferred to prey on calves, goats, sheep and poultry. Meanwhile the other communities (12%) who did not keep cattle in enclaves of QENP and Lila in Nwoya district reported that leopards preyed on goats, chicken and ducks. Most attacks of leopards occurred at night.

Leopards had scared people from collecting firewood from the thickets in two villages around LMNP. In Kangole and Opotipot parishes in Karenga around KVCA leopards also had scared people from collecting firewood from the nearby forests and 2 people had been killed in these parishes.

The number of households affected by leopard attacks, livestock lost and frequency of leopard attacks per village over two year period in Kasese, Kiruhura, Amudat, Kaabong and Hoima were as shown in Table 9. No estimates were got for other districts.

It was reported that 137 households were reported to have had leopard attacks involving kills of 18 calves, 152 goats, 80 sheep, 7 pigs and 3 dogs amounting to Ug Shs 22,897,000 in the last one year in Kasese, Kiruhura, Amudat, Kaabong and Hoima districts. These reports were under reported because there was no active record keeping system about leopard attacks. Average value of a calf was estimated to be Ug. Shs 150,000 for a calf, 91,000±3000 for a goat, 75,000±2,000 for a sheep, 13,500±1,300 for chicken and 11,500±1,500 for a duck. On average, in Kasese 0.6±0.3 calves, 3.8±0.6 goats, 0.3 sheep, 2.7±1.02 ducks and 2.4±0.1 chicken amounting to Ug. Shs 523.000 were lost annually per household among the villages surveyed. In Kabwoya game reserve leopards were also preying on dogs.

Table 9: The number of households affected by leopard attacks, livestock lost and frequency of leopard attacks per village over last year in Kasese, Kiruhura, Amudat, Kaabong and Hoima districts.

District	Village	Households affected	Livestock lost				Frequency of attacks / other remarks
			Calves	Goats	Sheep	Pigs	
Kasese	Kayanzi			2			Attacked 4 months back
	Katunguru	60		70	8		Daily basis
	Kasenyi	60		+++			
	Muhokya	6	+	17			Every 2 months
	Nyakantonzi	3	+				3 attacks per year
Kiruhura	Minekye	+					
	Kasharara	3		3			
	Bunawanjara	4	13				
	Rurambira	1		16			

Amudat	Abongai	+		15			
	Taparak	+	1	2			
	Kichom	+			53		
Kaabong	Lokori	+	0	2	6	3	One person killed. Leopards attack any time of night and day.
	Mining quarters	+	0	7			
	Kangole	+	0	17	10	2	One man killed hunting in the forest 10 years ago
	Opotipot		2				One man killed hunting in the forest
Hoima	Kaiso-Tonya community (Kabwoya game reserve)	+	2	1	3	2	3 dogs were frequently attacked and preyed on

+ Unknown because of poor reporting

Around LMNP the number and value (Ug. Shs) of goats, sheep and calves killed by leopards according to their records from 2003-2009 were as shown in Table 10.

Table 10: The number and value (Ug. Shs) of goats, sheep and calves killed by leopards according to their records from 2003-2009

Year	Goats	Sheep	Calves
2003	15	3	10
2004	12	2	9
2005	17	0	3
2006	12	4	3
2007	16	0	2
2008	15	0	5
2009	14	0	3
Total	101	9	35
Value (Ug Shs)	9,241,500	675,000	5,250,000

I USD = Ug. Shs 2,000

The total amount lost due to leopard livestock kill between 2003 to 2009 was Ug. Shs 15,166,500.

3.4. Coping strategies towards problem leopards

The coping strategies adopted by different communities were as shown in Table 11.

Table: 11. Percentage of communities adopting a certain coping strategy for leopard problems

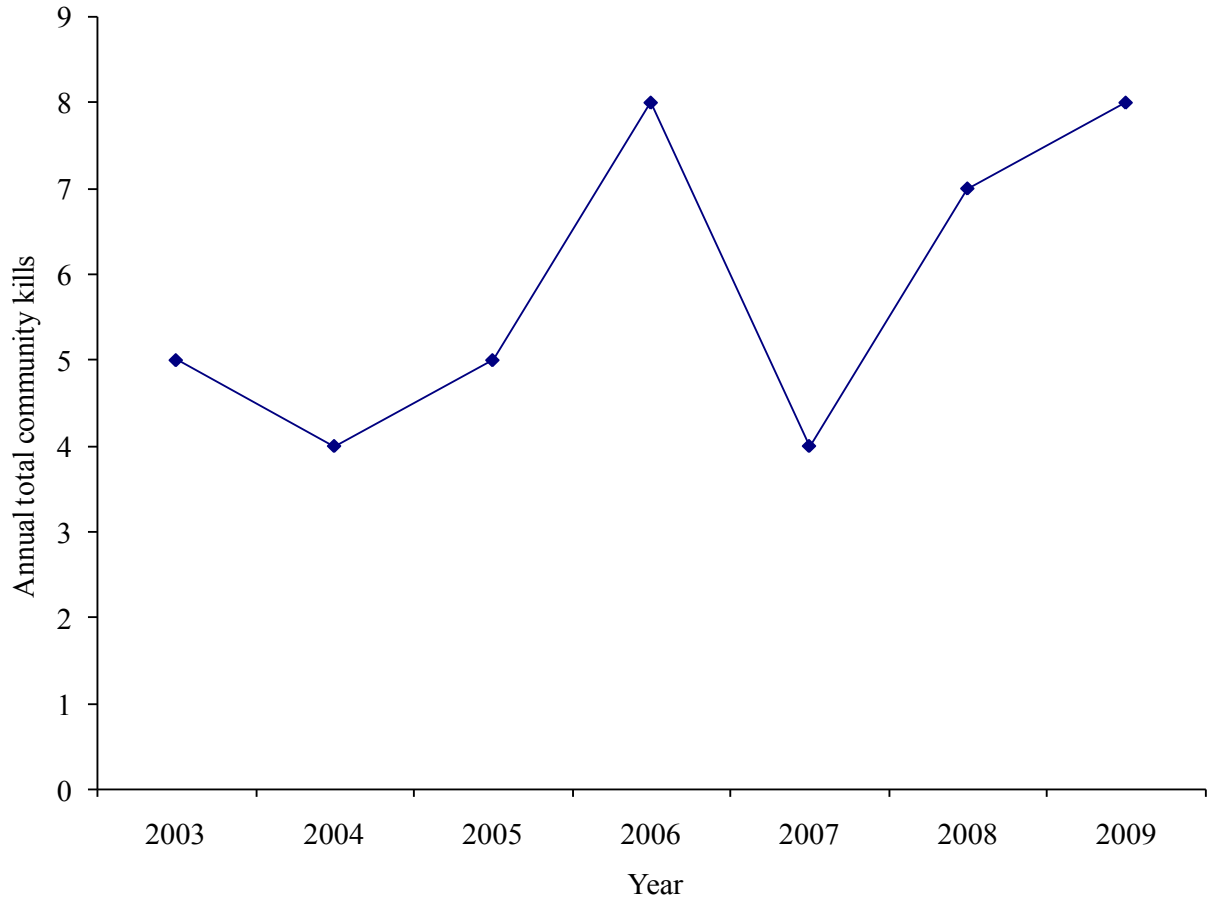
Coping strategy	QENP	NW (Amuru & Oyam)	Nakasongola	Luwero	East & North east	LMNP	KVCA	Overall
Inform UWA	100	0	50	66.7	50	100	100	64
Inform vermin control officers	0	0	100	100	0	0	0	24
Trapping	20	0	0	0	0	0	50	4
Killing	20	100	100	100	80	80	50	76
Scaring leopards	40	0	0	0	0	20	90	12
Compensation of injured people	10	0	0	0	0	0	0	4

There were no proper records kept for leopard kills in most of the regions except in LMNP. The number and value of leopards killed from ranches and private land around LMNP were as shown in Table 12. Trend of community kills of leopards from 2003 to 2009 were as shown in Figure 1

Table 12. The number and value of leopards killed from ranches and private land around LMNP from 2003 to 2009

Year	Number and method of leopard killing			Total killed	Estimated value (USD)
	Poisoning	Trapping	Shooting		
2003	4	0	1	5	17,500
2004	3	1	0	4	14,000
2005	2	3	0	5	17,500
2006	4	3	1	8	28,000
2007	3	1	0	4	14,000
2008	2	4	1	7	24,500
2009	1	5	2	8	28,000
Total	19	17	5	41	143,500

Figure 1. Trend of community leopard kills around Lake Mburo National Park



3.5. Community suggested mitigation strategies

Community suggested mitigation strategies for overcoming leopard problems were as shown in Table 13.

Table: 13. The percentage of communities suggesting certain mitigation measures for overcoming leopard problems

Community suggested coping strategies	QENP	NW (Nwoya & Oyam)	Nakasongola	Luwero	East & North east	LMNP	KVCA	Overall
Depopulation	20	0	100	100	0	20	0	32
Construction of park boundary fence	40	0	0	0	0	40	0	16
Translocating leopards to zoos	40	0	100	33.3	0	0	0	24
Confining leopards as in the zoo	40	0	0	0	0	0	0	8
Allowing more people to settle in a park	20	0	0	0	0	0	0	4
Compensation loss scheme	100	100	100	100	100	100	100	100
Construction of leopard proof housing for livestock	40	0	100	0	0	100	100	40
Eco-tourism	40	0	100	33.3	0	0	0	36
Spot hunting of leopards	0	66.7	100	100	66.7	100		68
UWA involvement in community leopard problem management	0	100	100	100	66.7	100	0	72
Sport hunting of other wild animals	0	0	100	100	0	100	0	48
Conservation education	0	0	50	66.7	20	0	0	20
Self help projects	0	0	50	100	20	100	0	44

3.6. Factors favouring leopard existence and attacks

The communities identified the factors favouring leopard existence and attacks as livestock keeping (cattle, goats, sheep, chicken and ducks), living in or close to protected areas, nocturnal grazing of livestock, movement of livestock in the park, living in thicket and bushy vegetation, hilly / mountainous terrain and having abundant leopard favoured prey. All respondents reported that leopards preferred thicket and bushy habitats. They also preferred hilly / mountainous terrain in north eastern and northern Uganda in Amudat, Kween, Nakapiripirit and Kaabong. All these areas were sparsely populated by humans.

The population livestock per district visited were as shown in shown in Table 7.

On abundance of wild prey, 75% of the respondents in QENP said that the population of Uganda kobs, warthogs and buffaloes were increasing. While 66.7% and 50% of the respondents were of the opinion that the population of bush pigs and waterbucks were also increasing in QENP. The population density of wild animals grazing in Katunguru, Kikorongo and Kasenyi between May-October, 2010 were as shown in Table 14. In Nakapiripirit and Pain-Upe areas there were medium sized antelopes which the leopards were feeding on. Similarly around LMNP there was variety wild animals found in pastoral and

ranch rangelands. In Karenga around KVCA there were rabbits, dikdik, warthogs, duikers, giant rats, bush pigs, rock hyraxes and oribi. The most abundant and increasing in number were rabbits, giant rats, water bucks and bush pigs.

Table: 14. The population density per Km^2 of wild animals grazing in Katunguru, Kikorongo and Kasenyi between May-October, 2010

Animal species	Density per Km^2
Uganda kob	348.3
Waterbucks	52.3
Warthogs	20.6
Buffaloes	272.4

Source: Abigaba (2011)

3.7. Spatial and temporal distribution of leopards

The spatial distribution of leopard hot spots was as shown in Figure 2. Distribution of leopards in relation to vegetation type and human activity were as shown in Figure 3. Red spots show where the leopards were found. Detailed location and inter-relation of sub-counties and parishes where leopards occur were as shown in Figure 4 for north eastern Uganda, Figure 5 for Luwero and Nakasongola and Figure 6 for Kaabong.

It was shown that leopards were common in areas in bushy thicket savannah areas where the prey was present. The favoured prey were calves, goats, sheep and poultry (ducks and chicken).

Figure 2. Location of leopard hot spots in Uganda

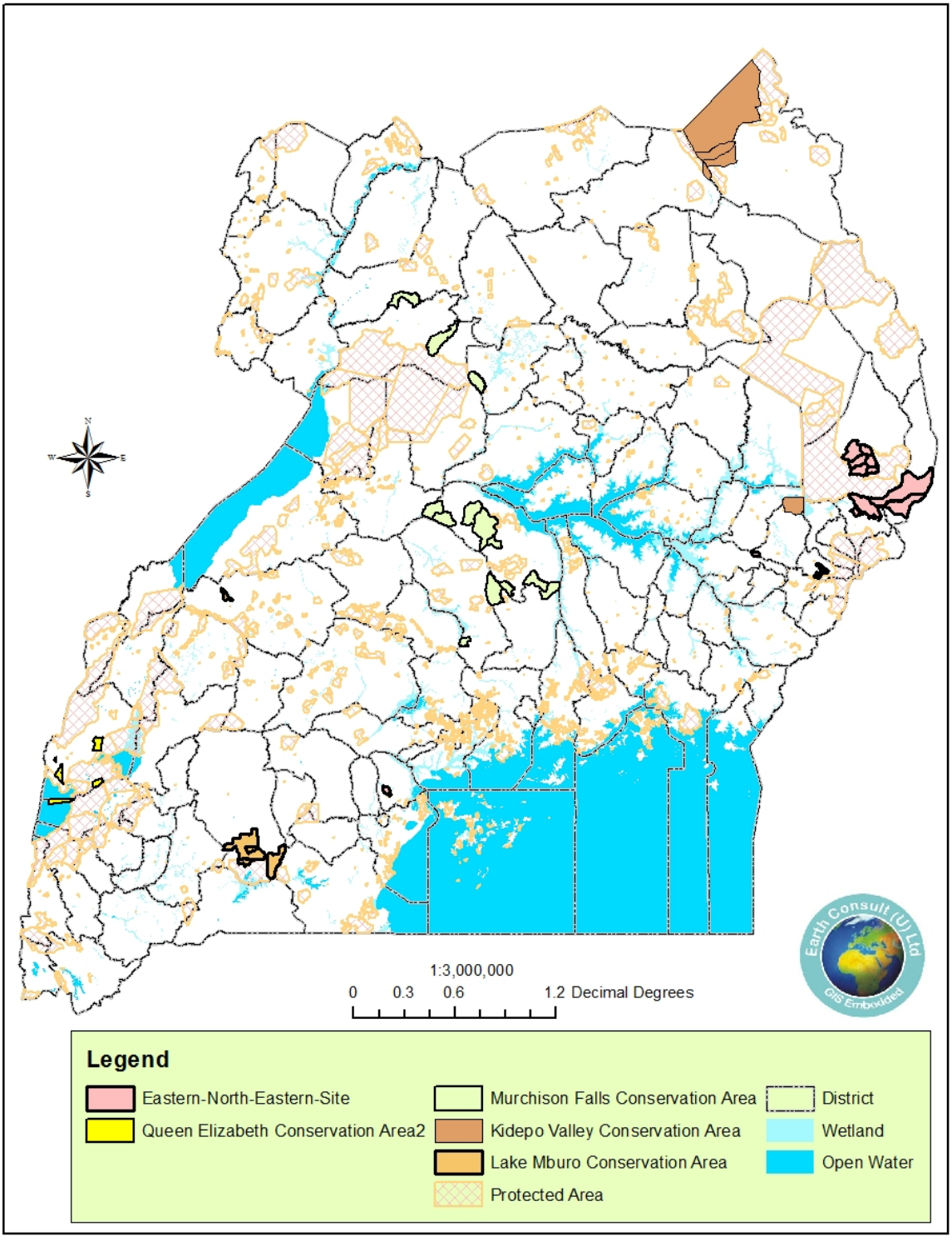


Figure 3. Location of hot spots for leopards in relation to vegetation type and land use

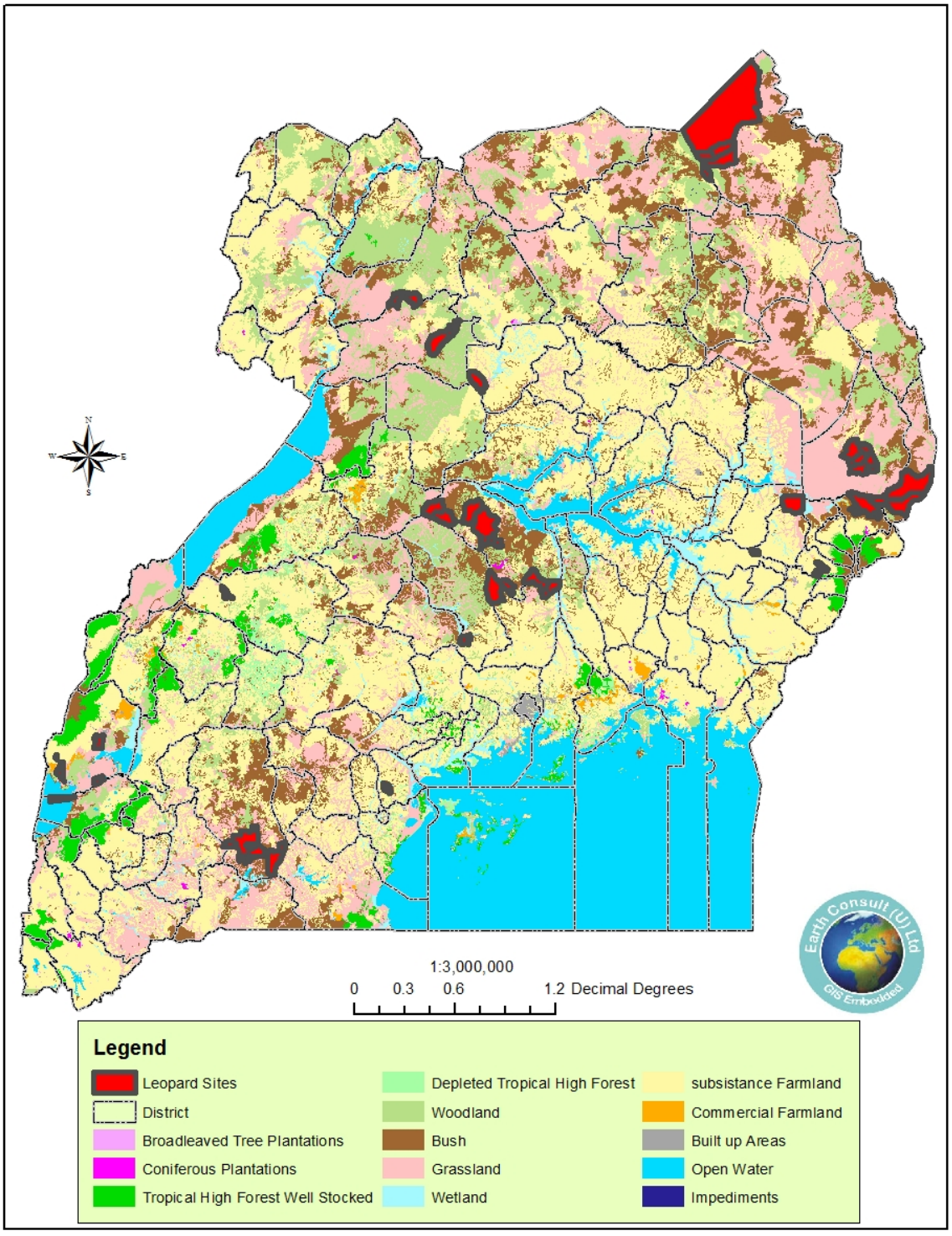


Figure 4. Detailed location and inter-relation of sub-counties and parishes where leopards occur in Amudat, Kween and Nakapiripirit

Figure 5. Location and inter-relation of sub-counties and parishes where leopards occur in Luwero and Nakasongola, areas

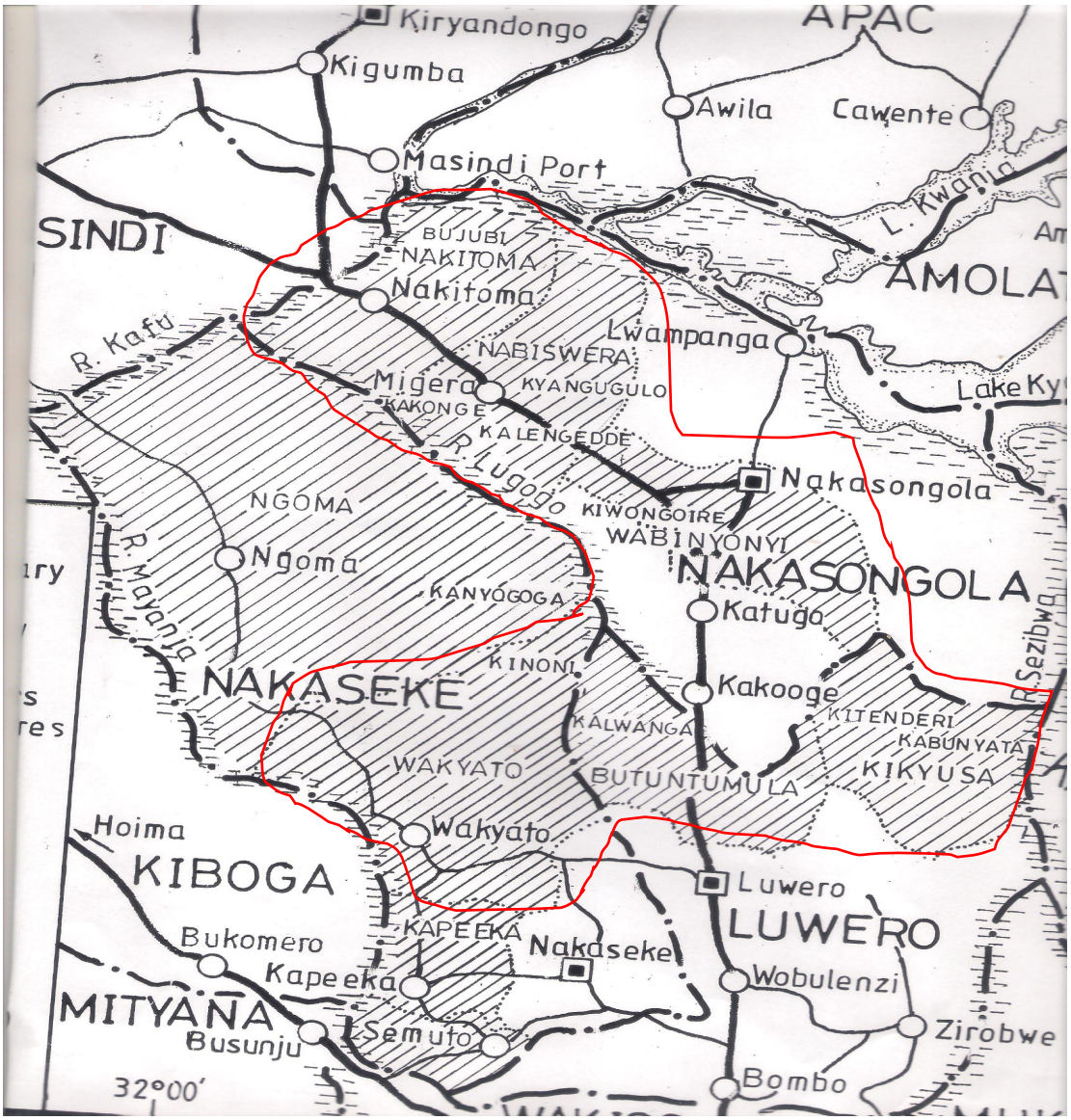
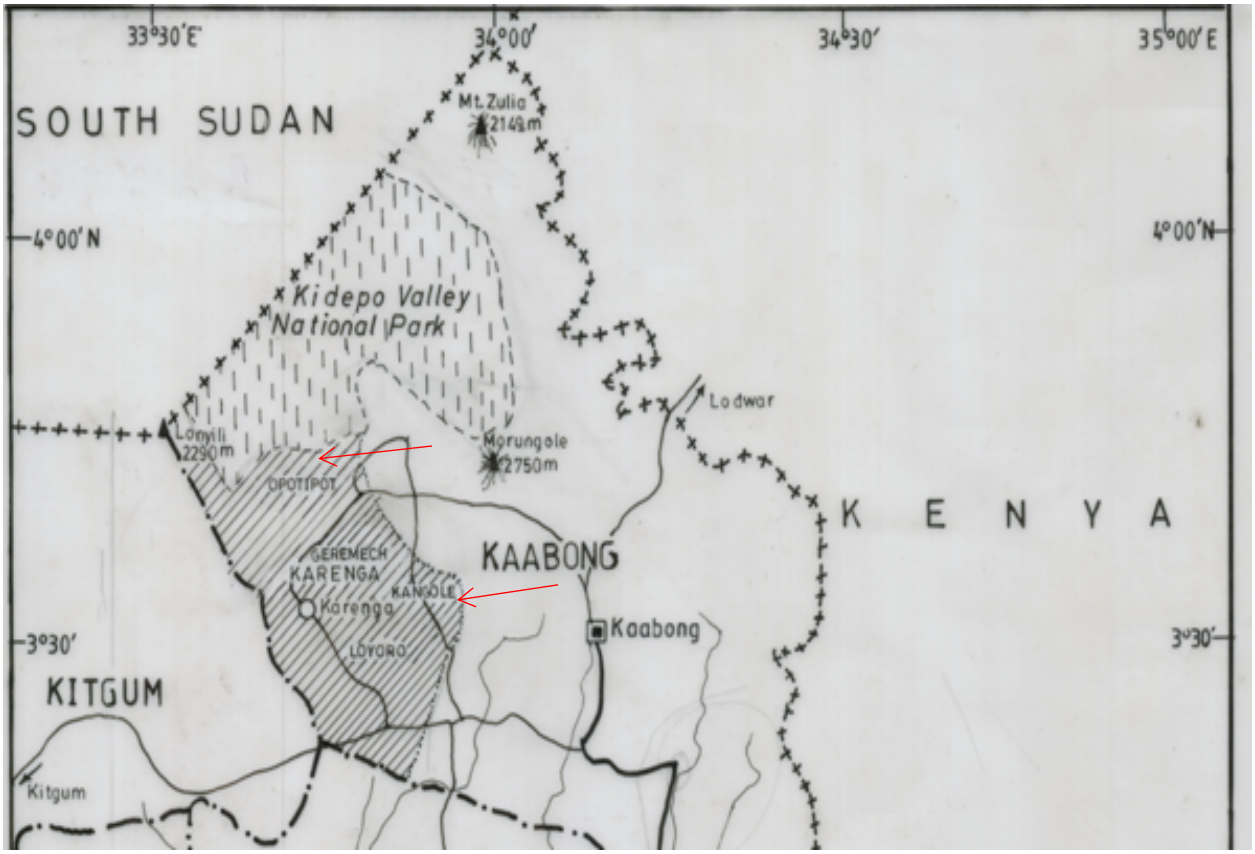


Figure 6. Detailed location and inter-relation of parishes where leopards occur in Karenga subcounty, in Kaabong distirct with Kidepo National Park



Details of leopards population estimates per community visited were as shown in Table 15. Leopard population estimates outside protected areas as perceived by communities and based on area size of favourable habitat areas in leopard hot spots outside protected areas were as shown in Table 16. Luwero and Nakasongola; and north eastern Uganda constituted the major proportion of the leopard habitat outside protected areas being 31.9% and 44.1% respectively. The total leopard population estimates based on the size of the suitable habitats (savannah; hilly /mountainous forested and bushy/thicket habitats) where they are found in Uganda were as shown in Table. 17.

Table 15. Leopard population estimates outside protected areas as perceived by the communities

District	Village	Status	Estimate numbers	Remarks
Kasese	Kayanzi	High	3	Attacked human previous year
	Katunguru	Very high	10	Seen daily
	Kasenyi	Very high	10	Seen daily
	Nyakatonzi	High	6	Seen every 3 months
	Muhokya	High	5	Seen every 3 months
Nwoya	Lebungec	Low	0	Last seen in 2006
	Lila & Kalib B	Moderate	1	Last seen 3 months back
Oyam	Akurudia	Low	0	Last seen in 2006
Nakasongoola	Bugamwe	High	4	Sightings are common of 1 female and 2 cubs
	Rwenyaana	Very high	5	Stable population
	Kyaani	High	4	1 female, 3 cubs commonly sighted
	Nabisweera	High	5	Commonly tracked
	Kafu	Moderate	1	Female commonly seen
Luwero	Kamira S/c (Kitendere & Kabunyala)	High	6	Sparsely populated mainly pastoralists & ranching
	Batuntumula S/c (Kalwanga & Kaya ranch)	Very high	8	Kaya ranch (30 miles^2) very big stretching from Kafu to Ziwa ranch
Kween	Kongais, Nyenge S/c, Sundet parish, Ngorina	Very high	10	No leopards were killed despite being a nuisance
Amudat	Karita S/c, (Abongai, Kichom, Taparak)	High	7	Leopards are readily seen. It is forested mountainous area.
Nakapiripirit	Giriki and Namalu, Pian-Upe offices	Very high	9	8 leopards are seen moving from Mount Elgon towards Malera.1 leopard hiding in a rock near Pian-Upe offices
Bukedea	Kalupo S/c, Kalupo	Low	0	Last seen in 2006
Sironko	Budadiri	Low	0	Last seen in 2006
Kiruhura	Rwabalata, Minekye	High	4	Have been seen for the last 2 years
	Sanga S/c, Kasharara	High	2	Dominated by thickets & bushes
	Sanga S/c, Kanyaryeru, Akayanja, Bunawanjara	High	4	Foot prints very common. Dominated by thickets & bushes
	Nyakashashara, Rurambira	High	4	Dominated by thickets & bushes
Isingiro	Mbaare, Rutete	High	3	Witnessed leopard attack during the study
Kaabong	Lokori	High	8	Attack any time of the day or night. Area is neighbouring the park
	Kangole	High	5	Come from nearby forest on a hill.
	Opotipot	High	10	Near the park and leopard descend from nearby forest on a hill

Table 16. Leopard population estimates outside protected areas as perceived by communities and according to savannah favourable habitat area in leopard hot spots outside protected areas

Place	Community estimates	Area size Km^2) of leopard hot spot habitats	Predicted leopard population based on suitable habitat type
Luweero and Nakasongola	33	1298	65

Outside LMNP	18	360	18
Kween	10	364.3	18
Amudat	7	178	9
Nakapiripirit	9	977	49
Outside KVNP	23	619	31
Outside QENP	14	273	14
Total	114	4,069.3	204

Table: 17 The total leopard population estimates based on the size of the suitable habitats in areas where they are found in Uganda

Place	Favourable habitat area size (Km^2)	Predicted population based habitat area size
QENP CA	1512	76
Nakasongola and Luwero	1298	65
MFCA	3286	164
LMNP CA	585	29
Kween	364.3	18
Amudat	178	9
Nakapiripirit	977	49
KVCA	1350	68
Kabwoya game reserve	301	15
Total	9,493.4	493

The predicted leopard population dynamics of leopards outside protected areas subjected to trophy hunting with assumptions stated below would be as shown in Figure 7. The assumptions were that:-

i) There were 204 leopards outside protected areas which were distributed as 27.2 % (n=56) males, 36.4% (n=74) and 36.4% (n=74) sub-adults

ii) Annual trophy hunting of leopards would involve off-take of 20 male leopards which was 35.7% of the current male leopard population outside protected areas.

iii) Leopards gestation period was 3.5 months

iv) Litter size was of 2 cubs

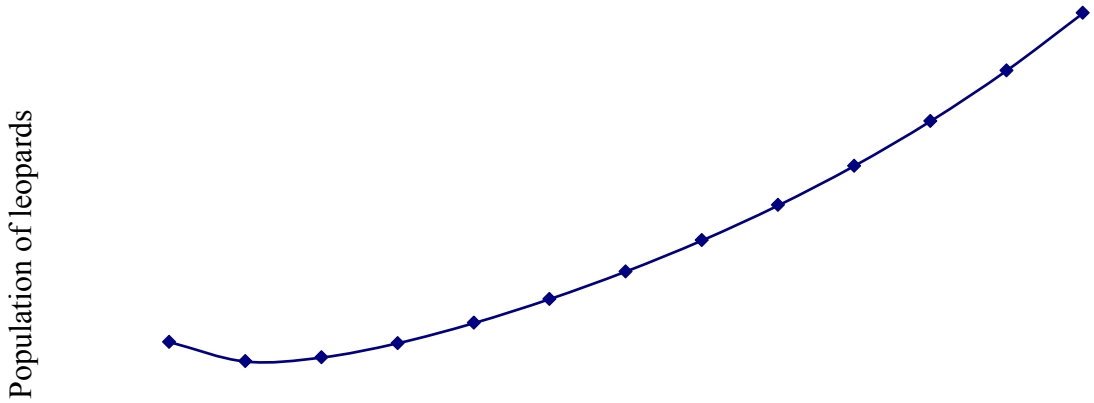
v) Leopard cub and sub-adult mortality rates were 50% and 40% respectively.

vi) Leopards would attain puberty by 4 years of age.

vii) Total population of leopards was taken to include adults and sub-adults only.

viii) Adult females had annual mortality rate of 20%.

Figure 7 . Predicted population dynamics of leopards outside protected areas when trophy hunting is introducted



Time in years post introduction of trophy hunting

4. Discussion

4.1. Perception of the communities towards leopards

The local communities' attitudes towards leopards were negative, even among communities in northern Uganda and in eastern Uganda (Sironko and Bukedea) where leopards were no longer seen This was because leopards were predating on their livestock and also attacking them. This finding agreed to what had earlier been reported elsewhere in South Africa (Minnie, 2099), among the Indians of Himalayas (Mishra, 1997), in mountainous region of northern Pakistan (Hussain, 2003) and in Iran (Sanei, 2007). Besides, the communities had never gained any tangible benefits from use of leopards from tourism activities. There has been no compensation that had been done on damage caused by leopards on the communities (Table 11). Amazingly, even in Botswana, where compensation of livestock was done, the negative attitude of the people towards leopards did not change (Gusset *et al.,* 2009).

Eighty four percent of the communities which were identified to be hot spots for leopards were proved to be having leopards in them. This showed how accurate the community leopard problem reporting system to UWA and vermin control officers was. Earlier on Gros *et al.* (1996) found that community reporting and discussion was very accurate method in estimating large predator populations in an area. Gros *et al.* (1996) used this method for estimating cheetahs in East Africa and found to give 70-100% accurate estimates. It had also been used by Husain (2003) for estimating leopards in Pakistan, Andean mountain cat in Chile (Walton, 1996) and tiger and leopard populations in Cambodia (Kimchhay, 1998).

Ability of the communities to identify leopards was very good. This was especially true where leopards were still a problem (see Table 8). The communities could readily identify leopards according to their characteristic coat colour patterns, characteristic kill through strangulation marks (canine marks on the neck) and foot prints. A good proportion also reported that a leopard could kill many of the preferred livestock prey (goats and sheep) and

only take one for a meal. The communities could readily differentiate leopards from civet, hyenas and jackals. Hussain (2003) also found this to be true among the communities in northern Pakistan. It had also been shown that leopards had characteristic way of feeding on the carcass. It starts to open the kill from the ventral or lateral portion of the abdomen and take off the stomach and intestinal contents first, then continues to feed on the abdomen portion and then goes for the chest and hind quarters last. This was in agreement to what was reported by Maheshwari (2006).

In this study, losses of stock was believed to be high, but no attempt had been taken to keep records of this losses. Similarly, Boshoff (2008) and Minnie (2009) found that stock losses attributed to leopards was believed to be high in areas surrounding Baviaanskloof Nature reserve in South Africa but no attempt had been done to quantify them. The same was found to be true in Northern Pakistan (Hussain, 2003).

Temporal leopard attacks occurred at night where the livestock housing was poor. This finding agreed with most beliefs elsewhere as reported by Norton and Henley (1987) in Cape Province in South Africa, Hamilton (1981) in Kenya and Bothma and Bothma (2006) in Kalahari.

The manner of reporting of the leopards attacks differed. Around LMCA, the communities reported to local councils, who then reported to police, the police then report to UWA and vermin control officers. In QECA and in North-eastern Uganda, the attack reports were made directly to UWA officials. While in Central Uganda (Nakosongola and Luwero) leopard attacks were reported to both vermin control officers and UWA. In most cases the response of UWA has been sluggish (not immediately). Vermin control officers in Nakosongola were too few to handle the leopard problems.

However despite having elucidated leopard attack reporting system, no records were available to estimate leopard attack losses and number of attacks. Elsewhere this has found to be true in South Africa at Baviaanskloof Nature reserve (den Hertog, 2008 and Minnie, 2009) and in North Pakistan (Hussain, 2003). This showed there was lack of trust between livestock keepers and conservation authorities. There was therefore a need to build trust between livestock keepers and conservation authorities so that conservation of leopards becomes successful. This could be achieved by establishing accurate record keeping system for losses caused by leopards. This recommendation had earlier been echoed by Marshall *et al. (*2007).

4.2. Problems caused by leopards and coping strategies adopted by communities

The major problems caused by leopards were livestock predation and human attacks. Active human leopard attacks were reported only in QENP CA and KVCA. QENP CA the attacks were occurring in village enclaves within the park hence leopard human conflicts were intensive. Among, communities around LMNP both in Kiruhura and Isingiro the leopards had scared women from collecting firewood. The same was seen in Kaabong district in Kangole and Opotipot parishes in Karenga sub-county where leopards had prevented communities from collecting firewood and mushrooms, and grazing livestock in the nearby mountainous / hilly forested areas. The leopards attacks on human being has always exacerbated negative attitude towards leopards. In Iran, attack of leopards worsened humans' tolerance towards leopards in communities which were formerly tolerant to them (Sanei, 2007).

About 137 households reported leopard attacks involving kills of 18 calves, 152 goats, 80 sheep, 7 pigs and 3 dogs amounting to Ug. Shs 22,897,000 in the last two years in Kasese, Kiruhura Amudat and Kaabong districts. These reports were under reported because there was no active record keeping system about leopard attacks. In QENP CA the most predated were goats, followed by ducks, chicken, calves and sheep with annual average predation per

household estimated to be 3.8±0.6, 2.7±1.02, 2.4±0.1, 0.6±0.3 and 0.3 respectively amounting to Ug. Shs 523.000. Inside QENP (village enclaves) 38.3% and 30% of the goats and ducks were lost to leopards. This could be explained by the intensity of the conflict and by straying nature of goats and naiveness of ducks' behaviour to predators.

Meanwhile losses in LMNP were not too high as compared to QENP CA. According to records (Table 9) available at LMNP 14 goats, 5 calves and 1 sheep was lost around LMNP amounting Ug. Shs 2,166,643. While according to records kept in LMNP, the losses of calves, goats and sheep between 2003-2009 amounted to Ug Shs 5,250,000 only (Table 10). These losses were low because the leopard–human interfaces here were not too intensive as compared to QENP. Partially this could also be attributed to poor reporting and recording systems in QENP CA.

In other areas, cases of leopard attacks were not being recorded. This was attributed to lack of vigilance because the communities knew that they were not going to get any benefit from it. Yet this could form a basis for fair sharing of revenue generated from leopard use.

There were no proper records kept for leopard kills in most of the regions except in LMNP. Around LMNP it was shown that 6 leopards were being killed annually (valued at USD 21,000 annually) of which 46.5 % was by poisoning, 41.4% by trapping and 12.1% was by shooting (Table 10). It was shown that trend of killing had two peaks. The first peak occurred in 2006 dropped in 2007 and started peaking up to now (Figure 1). This could be attributed to intolerance towards leopards which were being regarded as a nuisance which were killing their valuable wild animals and livestock. Wild animals were seen to have value since the communities were reaping benefits from trophy hunting use (Mwesigwa, 2010)

4.3.Spatial distribution and population estimates of leopards

The leopards were found existing in and around QENP in Kasese district, in Luwero and Nakasongoola in central Uganda, in Kween, Amudat and Nakapiripirit in North eastern Uganda around LMNP in western Uganda and Kaabong in northern Uganda (Figure 2 and 3). It was shown that leopards preferred thickets and bushy habitats (Figure 3). In Amudat, Kween, Nakapiripirit and Kaabong the leopards preferred hilly / mountainous forested or thicket covered terrain. The thicket and bush provided cover and shelter for leopards (Maheshwari *et al*., 2006). Elsewhere in South Africa leopards preferred bushy thickets (Palma *et al*., 1999) and mountainous terrain having steep slopes, river courses and deep gorges (Roogers, 2008 and Stahl *et al.*, 2002). This was confirmed to be true in Nakapiripirit, Amudat, Kween and Kaabong areas.

The leopards occurred in dry savannahs which were either protected areas or inhabited by livestock keepers (Table 7; Figures 2 and 3). These areas were sparsely populated by humans. In these areas they could get prey easily. Prey abundance had been shown to have direct bearing on abundance of leopards in an area. Leopards were found to predate on calves, goats, sheep, ducks and chicken. They have been shown to feed on animals weighing between 10 to 40 Kg (Hayward *et al*., 2007). Among the wild animals in sub-Saharan Africa they preferred to feed on were impala, bushbuck, common duikers and hares (Bailey, 1973 and Hayward *et al*., 2007). In Gir national park, in India chital, sambar, langur, civet, hare and rodents were the favoured prey (Maheshwari, 2006). However, leopard has been known to be opportunistic feeders, in areas were the size of these prey were not in abundance they fed on rodents and other small mammals (Woodroffe *et al*., 2007). Ott *et al*. (2008) found

20% of the diet of leopards consisting of rodents in Baviaanskloof regions in South Africa and 7.05% in Gir National Park and Sanctuary in Gurujat state in India (Maheshwari, 2006). Communities estimated 134 leopards occurred in the areas visited (Table 15) and 114 occurring outside protected areas (Table 16). The difference in leopards reported by communities in areas visited and those outside protected areas was because in QENP areas visited were village enclaves within the park. It was estimated that 34 leopards occurred in and around QENP, 18 around LMNP, 26 in north eastern Uganda; 33 in Luwero and Nakasongola, areas and 23 around KVP. However population estimates based on habitat area size with leopard population density advocated by Martin and De Menlenear (1988) of one leopard per 20 Km^2 found that there could be 204 leopards outside protected areas in Uganda (Table 16). Community leopard estimates were putting the leopard density to be of one leopard per 30 Km^2. This finding had been reported by Nowell and Jackson (1996) and Mizutain and Jewell (1998).

In Uganda, based on area size of the favourable habitat in areas where leopards were occurring, it was found that there were 493 leopards occurring at density of one leopard per 20 sq Km^2. It was shown that a big proportion (41.4%) of leopards occurred outside protected areas (Table 16 and 17)

In QENP, 34 leopards were estimated by communities to be near them. Most of the communities were village enclaves within or in-close proximity to the park. Both communities estimate and habitat area size based estimate at one per 20 Km^2 put 14 leopards to be present outside QENP (Table 16) in sub-counties of Nyankatonzi and Muhkoya. This leopard population density was supported by population of prey animals especially Uganda kob that had been reported to be increasing (Abigaba, 2011). Also there were many goats which were roaming in the park enclaves.

There were about 33 leopards in Luwero and Nakasongola, areas according to community estimates. These number was far much lower than the habitat area size leopard population estimates at one leopard per 20 Km2 of 65. Community estimates suggested that leopards were occurring at a density of one leopard per one leopard occurring per 50 Km^2. This agreed with what was reported by Odden and Wegge (2005) in Royal Bardia National Park in Nepal.

In Nakasongola, leopards were found in Rwenyana area along river Lugogo area (see Figure 5). This area was sparsely populated and was occupied by pastoralists and ranchers. Also leopards were found in Nabiswera sub-county (Kyangugulu and Kalengede parishes) and Kakooge sub-county along Luwero-Nakasongola, border. Leopard presence had also been reported in Namaasa sub-county. Exact number of leopards were unknown, but about five leopards had been tracked by their foot prints in Lugogo and Nabiswera areas. In other areas the leopards have been reported to be occurring in the villages of Bugamwe, Kyaani and Kafu. One female leopard and 2 cubs occurred in Kafu.

In Luwero 14 leopards were community estimated to be in Kamira sub-county (Kitendere and Kabunyata parishes) and Butuntumula sub-county in Kalwaga parish (see Figure 5). The most affected area, Kitendere parish had a low human population, with most land used for ranching. This area borders Nakasongola and the leopard problem was at the other side of the border as well. In May, 2012 leopards attacked 2 people in Kamira sub-county in Kirunda and Mawanika villages. A metal trap was recovered which had cut the foot of one leopard. This attack affected cultivation and grazing of cattle (Wandera, 2012)

In Butuntumula sub-county, at Kalwaga parish contains a very large ranch (Kaya ranch), measuring up to 30 square miles. Leopards live in Kaya ranch permanently. This area stretches between Kafu and Ziwa ranch. Leopards moved between Kafu and Masindi. Early this year, I young leopard was shot in this ranch and 1 female trapped.

In Wakyato sub-county, Nakaseke county, Nakaseke ranch Kalagala village, in 1 square mile ranch a male leopard had eaten 6 goats and 1 calf early 2012. This leopard was usually seen during day time. UWA had taken a metal trap to catch it.

According to community estimates, in North eastern Uganda, 26 leopards occurred distributed as 10 in Kween, 7 in Amudat and 9 in Nakapiripirit. However, according to estimates based on habitat area size (Table 16), 76 leopards occurred in north-eastern Uganda at density of one leopard per 20 Km^2. Fourty nine were estimated to be in Nakapririt area in Giriki-Namalu livestock grazing area. According to this study, community estimates give a leopard density of one per 30 Km^2 in Kween and one for 20 Km^2 for Amudat. In Kween leopards occurred in Kongais and Nyenge sub-counties (see Figure 4). In Amudat they occurred in Kasita sub-county in Losidok and Karita parishes. In Nakapiriprirt leopards were found in Nakapiririt county in Giriki-Namalu (see Figure 4). Eight leopards had been tracked moving from the eastern side of the Mt Elgon National park to the west towards Bukedea (Malera sub-County). A big leopard was known to hide under a rock, 7 Km from Pian Upe UWA offices. In Karenga, Geremech and Loyoro parishes in Karenga sub-county, the leopards had not been seen in the communities since 2006. However according to community estimates, there were about 23 leopards around KCVA occurring in Kangole, Opotipot and Lokori parishes (Table 15). They occurred at the hills and forests especially at the Imiling hill near Opotipot village, Kangole hill and Napore hill.

According to community estimates, around Lake Mburo National Park 18 leopards were found in Kiruhura district. This area was mostly livestock the ranching and pastoral area. This area was about 370 Km^2 (see Table 16). This findings agreed with what was advanced by Martin and De Menlenaer (1988), Hayward *et al.* (2007) and Minnie (2009) that one leopard required 20 km^2 of savannah territory to survive. Leopards were found in Sanga sub-county in Kasharara, Kanyaryeru and Rwabalata parishes, Nyakasharara sub-county, Biharwe sub-county, Ruhengyere government, Nshara government ranch and Ranch 33. This area had plenty of leopard preferred prey like impalas, warthogs, bush bucks, topi and goats (Ocaido *et al.* 2008). In this area goats were left to roam freely in the bush.

Leopard population estimates based on regression equations developed by Hayward *et al.* (2007) for estimating leopard populations based on prey biomass of those prey species that fall within the preferred prey weight range (Pw: 10-40 Kg) like goats, sheep and wild animals; and also based on biomass of preferred species (Ps: bushbuck, common duiker and impala) could not be done. This was because the biomass of prey especially wild animals could not be estimated. Another elucidated study needs to be done to estimate wild animals outside protected areas. However, the equations which could be used for estimating leopard population using the prey biomass were as stated below:
Pw: $y = -2.248 + 0.405x$; Ps: $y = -2.455 + 0.456x$, where y = potential leopard biomass and x = $\log_{10}$ prey biomass (Hayward *et al.*, 2007 and Minnie, 2009).

Camera trapping method of determining presence of leopards was done in QENP and LMNP. This method could be the best method for estimating the population of leopards because these animals were secretive and solitary. This method could not be used for determining the

leopard population estimates because the cost for this exercise which was too high in terms of equipment and time. It needed a deployment of 10 ordinary camera traps (at cost of USD 3,500) and one excellent camera (USD 7,000 per each) at each site at a time. The cameras would cost USD 10,500.

4.4.Threats to survival of leopards

The major threat to the survival of leopards in Uganda was that 42.8% of leopard habitat was outside protected areas and was harbouring 41.4% of the Ugandan leopards (see Tables 16 and 17). There was a rapid loss of this habitat due to clearing of thickets and bushes for charcoal burning and crop farming brought about by increasing human population. Human population was increasing annually by 3.3% annually and is expected to reach 50 million by year 2025 (UBOS, 2002). Due to increasing population the leopard habitats are being cleared for growing crops. This could explain the disappearance of leopards in northern Uganda in Oyam, Nwoya, Amuru and west Nile region; and in eastern Uganda in Sironko and Bukedea. This has been seen to be true around LMNP whereby the rangeland was being invaded by human settlements with more of crop growing and keeping of Friesian dairy cattle (Ocaido *et al*., 2009). The human settlement pressure was also being experienced in Luwero, Nakasongola Nakapiripirit, Amudat and Kween. During the study period there was lot charcoal burning been done in Luwero, Nakasongola, and around LMNP to meet urban demands for fuel.

Another threat to leopard survival was the declining prey base. Declining prey base leads to reduction of productive females, delayed age of first reproduction, reduction on litter size and increased cub mortality. Lack of prey leads increased home ranges in search of food leading to increased human –leopard conflicts (Khorozyan *et al*., 2008). Usually it has been found that when there was abundant wild prey, leopards rarely invaded human habitats (McNutt and Boggs, 1996, Woodroffe et al., 2007 and Gusset *et al*., 2009). It is therefore better to maintain high population of wild animals in the mixed game and livestock areas where trophy hunting is going to be undertaken in order to minimize predation (Woodroffe *et al*., 2007 and Gusset *et al.,* 2009). However, outside protected areas where leopards occur there was a lot of poaching of wild antelopes. This was especially true in Nakosongola, Luwero and Karamoja region where benefit of wild animals was not being appreciated. In Tanzania, increased poaching for bush meat led to decrease of prey for predators in Katavi National Park (Caro, 2008) and western edge of Serengeti ecosystem (Sinclair *et al.,* 2003). Conversion of land for agriculture in Masai rangeland blocked migratory route for wildebeest to Tarangire National park thereby forcing lions to rely on livestock (Kahurananga and Silkluwasha, 1997).

Fragmentation of leopard habitats leads to isolation of small islands of leopard populations (see Figure 1) which cannot interact with other populations. This leads to inbreeding due to low exchange of genetic materials hence increasing their vulnerability to disease outbreaks (Smith and McDougal, 1991; Davies and Du Toit, 2004 and Kissui and Packer, 2004). This means that this vulnerable population could easily be wiped out by diseases.

Besides leopards predating on their livestock and attacking them, the communities were receiving no tangible benefits from leopard use (Tables 11 and 13). This has increased hostility of humans towards leopards. With exception of Kween, leopards were being killed by poisoning, hunting and shooting (Table 11). Some leopards were being trapped and left to die of starvation. In Karamoja, where there were a lot of illegal fire arms and the leopards population has been depleted by shooting. This could explain the apparent disparity of population estimates by communities and those based on habitat area size in Nakapiripirit (Namalu-Giriki). The leopard was being depopulated as this area was for livestock grazing. There was therefore a need for communities to receive tangible benefits from leopard use

inorder for them to survive outside protected areas. This strategy has ensured survival of leopards outside protected areas in Tanzania (Packer *et al.*, 2011), Zimbabwe (Smith, 1993), South Africa (African Sky Safaris, 1998 and Carus, 2009) and Namibia (Stander *et al*., 1997)
There was poor collaboration between UWA staff and the communities on management of leopards. There was poor response of UWA staff to calls by the communities for intervention whenever there was a leopard attack. For example, in Kaya ranch in Luwero, UWA staff was notified about the problem of leopards but they did not come to rescue the situation. Later community poisoned the 3 leopards. UWA was not doing community leopard conservation education in Luwero, Nakasongola, and north eastern Uganda.

4.5.Sustainable conservation and utilisation of leopards

All the communities recommended that a compensation scheme be established to take care of losses caused by leopard attacks (Table 13). Currently there was no compensation being done although there was a policy in place to do so. Elsewhere this was found to be true in northern Pakistan (Hussain 2003) and South Africa (Minnie, 2009). The functional leopard attack compensation scheme has been reported to occur in Botswana (Gusset *et al.,* 2009).
Depopulation of leopards was suggested in Nakosongola, Luwero and QENP areas (see Table 13). Twenty percent of the communities were of the view that leopard population was increasing in their areas. Increase of the population of predators was usually associated with increase in the prey animals (Gros *et al.,* 2006 and Hayward *et al*., 2007). In these areas, there was high presence of prey animals. In QENP, there was a high abundance of Uganda kobs, warthogs and bush pigs which were said to be increasing in numbers. Inside QENP, Abigaba (2011) reported high densities of these animals in Katunguru, Kikorongo and Kasenyi areas (see Table 14).
Forty percent of the communities suggested that leopard proof housing be constructed for their livestock especially goats, sheep, calves and poultry to house them during night. This was found to be true with communities in QENP, Nakasongola and Lake Mburo Area (see Table 13). Gusset *et al.* (2009) and Minnie (2009) found that kraaling of cattle at night reduced predation by large predators. Communties in north eastern Uganda and Karamoja were practising construction leopard proof housing as a mitigation measure for their livestock.
Communities in QENP, Nakasongola and Luwero advocated that let the problem leopards be captured and translocated to regional zoo parks (see Table 13) where the communities and tourists could go and view them at a premium fee. This idea could be integrated with establishment of regional wildlife education centres, recreational and amusement parks. However translocation of leopards to far areas as 135 Km in Namibia have found not be effective as leopards returned to their home ranges within 2 days (Stander *et al*., 1997),
Communities around QENP and LMNP suggested that park boundary fences be constructed to keep away leopards (see Table 13). This was not possible with leopards, as they can climb over on the growing vegetation. Elsewhere electric fencing has been used to keep away wild animals in Kenya (Sommerlatte, 1993) and in Zimbabwe (Smith, 1993).
Except in QENP, all other communities wanted UWA active involvement with community in management of leopards (Table 13). The cordial understanding between communities and UWA in managing leopards was crucial in the success in survival of pockets of leopards outside protected areas (Minnie, 2009).
With exception of QENP CA, all other communities (see Table 13) were willing to participate in community sport hunting of leopards. They were willing to participate in this project provided they were involved in the process from planning to implementation phase. Problem male and old senile leopards could be identified and trophy hunted. About USD

70,000 could be generated annually from trophy hunting. This income generated could be used for improving communal amenities like schools, dispensaries and communal business enterprises as advocated by 44% of communities visited (see Table 13). Trophy hunting was feasible in Nakasongola and Luwero in central Uganda; Kween, Amudat and Nakapiripirit in North eastern Uganda, and around LMNP in western Uganda. Trophy hunting was not feasible in QENP because communities where leopards were causing problems were inside or in close proximity to the park.

Twenty leopards should initially be trophy hunted. These would be as follows: 7 in Luweero and Nakasongola 4 in around LMNP, 4 in north eastern, 3 around KVNP and 2 around Kabwoya game reserve. If communities were not allowed utilize leopards in this form, their attitude would increasingly become negative and more leopards would be killed. Around LMNP where other wild animals were being trophy hunted and people had seen benefit from this project, they would start seeing leopards as nuisance who were predating on their valuable wild animals and livestock. For this reason, they would be justified to kill leopards to protect their sources of income. This has been experienced in Northern Pakistan when IUCN Mountain Areas Conservancy Project in 1997 introduced hunting of mountain ungulates (Hussain, 2003). In Tanzania trophy of leopards has been practiced (Packer *et al.*, 2011). Tanzania is the most popular destination for trophy hunting of leopards in the world (Packer *et al*., 2011). Four hundred trophies were being hunted every year. Average off take in the Selous game reserve has been estimated to be 2.9 leopards per 1000 km^2 (Packer *et al*., 2011). The suggested off take for trophy hunting falls within the Selous recommendations. The suggested offtake for trophy hunting would be sustainable provided community kill was reduced (See Figure 7). Elsewhere in Zambia and Zimbabwe, 55 and 96 leopards respectively were being trophy hunted every year, no any other country exports more than 20 leopard trophies per year (Packer *et al*., 2011).

Trophy hunting of leopards would be more viable land use option. Trophy hunting would offset the losses caused by leopards. The value of leopards killed from 2003-2009 around LMNP (valued at 143,500 USD) was 22.7 times more than cost of livestock kills by leopards during the same period. Each leopard hunted a trophy fee of USD 3,500 would be paid.

In order to setup viable leopard communal trophy hunting schemes, the communities needed to be educated and sensitized about the value of safari trophy hunting of leopards. Local leaders, landlords, herdsmen, squatters, hunters and vermin guards should be made to appreciate the value of trophy hunting leopards. UWA should play a role of co-ordination of these activities.

Communities in Nakasongola, and Luwero wanted also other wild animals on their properties to be trophy hunted with leopards. There were many wild ungulates found in these areas but their actual populations were not known. Studies should therefore be done to determine their populations. Trophy hunting of these antelopes would then stimulate the local communities who were mainly ranchers and pastoralists to conserve the wild animals better. Keeping of large numbers of wild animals was advantageous in that the incidences of leopard predation on livestock could be reduced (Gusset *et al*., 2009). Mixed game and livestock ranches could be developed. Earlier studies done by Ocaido *et al.* (2008) found that mixed and livestock ranching around LMNP was feasible and trophy hunting would be one of the major activities.

Another form in which leopards could utilised was green hunting also called “dart safaris”. Here leopard could be darted using tranquilisers. Instead of shooting a leopard with a rifle, it could be darted using a dart gun and tourist can observe the leopard closely. The advantage of this form utilisation was that the leopard could be darted several times like 3 times a year bringing more income than trophy hunting. This activity could be combined with research activities on leopards and ecotourism. This form of non-consumptive utilisation is currently

winning favour among traditional hunters, conservationists and researchers (Stander, 1997, Fox News, 2001 and South African Tourism, 2005).

The use of leopards for eco-tourism was supported in QENP, Luwero and Nakasongola, (Table 13). Problem leopards could be radio collared and habituated for viewing. Leopard watching towers could be constructed in sites were radio-collared leopards were commonly seen like at the watering points and wild animal mineral licks. This has been practiced in South Africa and Namibia. Among Suan community in Ju/Hoan villages in north-eastern Namibia, the income earned from leopard ecotourism was 12 times more than losses caused by leopards (Stander *et al*., 1997). For example, in QENP one leopard was trapped in the nearby village of Nyakatonzi and intervention was made to radio-collar it and was released. The movement of this leopard was being tracked with ease and levy of USD 50 could be paid per tourist.

Twenty percent of communities visited wanted wildlife conservation education (Table 13). This would increase community awareness of values of conservation of leopards. School children could be educated on values of conservation of leopards. Communities in Nakasongola, Luwero and North eastern Uganda wanted communities to be educated on values of conserving these animals. Whereas in QENP and LMNP where UWA was actively educating the communities, they did not want conservation education (Table 13).

It was possible to combine sport hunting and eco-tourism activities of leopards with experiential tourism. This was a type of tourism which encourages tourist interactions with the local communities and the tourist learns through experience about communities cultures and heritage values (Pichaichannarong, 2004). This form of tourism promotes memorable tourist adventures. It would promote the local communities interacting with tourists. Thereby making local people own tourism activities in their localities.

5. Conclusions and recommendations

5.1. Conclusions

1. The attitude of towards the communities was negative due to nuisance caused by leopards and they were not deriving any tangible benefits from their use.

2. There was active system for reporting leopard problems but there was no active recording of leopard attacks and killed leopards.

3. Communities were leopards were problem animals, the people were willing to participate in sport hunting of leopards provided benefits were shared.

4. A significant number of leopards were being poisoned by the communities.

5. Leopard s occurred in areas were high density of livestock especially goats and sheep and wild animals especially small antelopes were present. Leopards preyed more on calves, goats, sheep and poultry (ducks and chicken)

6. There was a positive correlation between habitats where the above animals were found (savannah bushy thickets, hilly mountainous terrain) and leopard hot spots. These areas were either protected areas or were inhabited by livestock keepers. Thirty four point nine percent of favourable leopard population is outside protected areas,

7. There were 493 leopards in Uganda. There were 114 according to community based estimates and 204 leopards according to habitat size based area estimate outside protected areas in Uganda. Forty one point four of the leopards were outside protected areas.

8. The hot spots were leopards occurred and were good for sport hunting were in Luwero and Nakasongola in central Uganda; Kween, Amudat and Nakapiripirit (Pian-Upe) in north eastern Uganda, around Kidepo Valley National Park, around Lake Mburo National Park and around Kabwoya game reserve. It was possible to spot hunt 20 leopards annually.

9. It was possible to conduct regulated green hunting in all hot leopard hot spots.

10. Combined leopard trophy hunting with other wild animals was possible in Nakasongola, Luwero and LMNP.

11. Eco-tourism of leopards was possible in QENP, Luwero and Nakasongola.

12. In all areas, it was possible to combine leopard utilization with experiential tourism and green hunting.

6.2. Recommendations

1. Communal sport hunting of leopards (20 annually) should be done in Luwero and Nakasongola in central Uganda; Kween, Amudat and Nakapiripirit (Pian-Upe) in north eastern Uganda, around Kidepo Valley National Park and around Lake Mburo National Park.
2. Combined leopard trophy hunting with other wild animals should be done in Nakasongola, Luwero and LMNP. Studies should be done to determine the population of wild animals in Nakasongola, and Luwero so that hunting quotas can be established.
3. Green hunting could be combined with research activities.
4. Eco-tourism of leopards should be done in QENP, Luwero and Nakasongola. Problem leopards should be radio collared, habituated and tracked at a premium fee.
5. In all the areas, experiential tourism should be combined with leopard utilization activities.
6. All stakeholders should be sensitized and demonstrated the values of conservation and having sustainable leopard schemes.
7. Efficient leopard problem reporting and recording system should be established to monitor leopard attacks and community leopard kills.

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