Strategic Action Plan for Large Carnivore Conservation in Uganda

2024 - 2034

2nd Edition

UGANDA WILDLIFE AUTHORITY
UWA
Conserving for Generations

Tree climbing lions in Queen Elizabeth National Park, Uganda.

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Funders

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Park rangers and vet, Dr Ludwig Siefert, change the collar on a Kasenyi lioness.

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Approval

The Uganda Wildlife Authority Board of Trustees approved the Strategic Action Plan for Large Carnivore Conservation in Uganda (2024-2034) for implementation on the 10 January 2025.

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Professor James Kalema
CHAIRMAN, BOARD OF TRUSTEES

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Mr Sam Mwandha
EXECUTIVE DIRECTOR

Preface

Wildlife is a cornerstone of Uganda's tourism industry and contributes significantly to the country's economic development. However, in the 21st century we are increasingly seeing the challenges and pressures facing the management of wildlife in the country. One such challenge is the absence of regular science-based species Strategic Action Plans for the conservation of key wildlife species in Uganda with consistent and coherent implementation. This situation could not be more pressing than for large carnivores in Uganda. Large carnivores represent some of Earth's most critical wildlife species intersecting hundreds of religions, cultures, and tourism economies. In Uganda along with great apes, African lions, leopards, and spotted hyenas are the mainstay of the wildlife economy, especially in places like Queen Elizabeth where every tree climbing lion is estimated to be worth US$ 14,000.

The Strategic Action Plan for Large Carnivore Conservation in Uganda aligns with the country's third National Development Plan (2020-2025) and Vision 2040, which recognize wildlife-based tourism as key to Uganda's industrialization and middle-income status. This plan is a valuable resource for stakeholders in conservation, community, and tourism development, supporting the objectives of the National Development Plan and Vision 2040 documents. Amidst challenges like habitat loss, deforestation, and rapid population growth affecting large carnivores in Uganda, the plan addresses the urgent need to protect these species and their habitats. It provides updated information on African lions, leopards, and spotted hyenas in six protected areas, aiding the government and stakeholders in making informed conservation decisions.

The plan identifies key policies, gaps, and opportunities for large carnivore species conservation in Uganda, aiming to garner support from local, regional, and international stakeholders, as well as partners and donors. This collaborative effort seeks to implement actions outlined in the plan, fostering the long-term conservation and management of large carnivore species in Uganda, with a specific focus on lions, leopards, hyenas, cheetahs, and wild hunting dogs.

I therefore encourage all stakeholders, policy makers and the general public to use this plan to enhance conservation of large carnivore species in Uganda, for the benefit of our tourism industry and proper functioning of their habitats and ecosystems for the benefit and survival of humankind.

Hon Col. (Rtd.) Tom R. Butime
MINISTER FOR TOURISM, WILDLIFE, AND ANTIQUITIES

Foreword

Today, Uganda finds itself at a juncture where some carnivore populations are under immense pressure, especially in the country's southwest and far north, where lions are threatened with local extinction. In Murchison Falls National Park, carnivore species appear to be doing well regionally with some of the highest densities in Africa recorded in the Nile Delta. This Strategic Action Plan for Large Carnivore Species Conservation in Uganda contains strategies to increase viable carnivore species populations, especially lion (Panthera leo) populations, by 30% in Uganda's national parks and wildlife reserves over the next decade. If communities, conservation organisations, non-governmental organisations (NGO) and scientific community can strategically partner with the Uganda Wildlife Authority, pool and effectively target their limited resources, significant progress will be made in attaining this goal. The African lion in particular is one of the critically threatened carnivore species in the country. Uganda's lion population decreased drastically from the 1970s and 1980s populations, due to political instability and the breakdown in the rule of law, which resulted in the illegal hunting of wildlife in places like Queen Elizabeth and Murchison Falls National Parks. Lions, which previously occurred across most of the savannah parks in Uganda, now only exist in the larger national parks of Murchison Falls National Park (MFNP), Kidepo Valley National Park (KVNP), and Queen Elizabeth National Parks (QENP). Even the recent lion population studies and survey results (2018-2023), indicate declining population trends with an estimated 39 and 12 lions remaining in Queen and Kidepo National Parks respectively. On a positive note, the lion population in MFNP appears to be faring far better with an estimated 240 individual lions in the park, presenting the park as one of the highest lion population density conservation areas in Africa.

This second edition of the ten-year Strategic Action Plan for Large Carnivore Species Conservation in Uganda presents objectives, strategies and actions, first for mitigating threats to large carnivores so as to maintain viable populations in their habitats in Uganda and second, strategies designed to base on scientific data and long-term monitoring to boost large carnivore populations and their conservation. The plan highlights park-specific threats and population status assessments factoring in local contexts, park size, land use, and conservation and stakeholder partner conservation organizations ready and willing to collaborate with the management of UWA. The plan also highlights the estimated budget allocation of resources required for large carnivore species conservation and management for the next ten years. The Strategic Plan was prepared through a rigorous consultative process involving active participation of local, regional and international stakeholders. The development process followed IUCN best practices and guidelines for the development of a species national strategy and action plan for large carnivore conservation.

Now that this Strategic Action Plan for Large Carnivore Species has been endorsed and launched, I call upon every stakeholder, policy maker, and managers with an interest in large carnivore species conservation in Uganda to support and promote its implementation.

Conserving for Generations

Professor James Kalema
CHAIRMAN, BOARD OF TRUSTEES

Four cheetahs photographed in Pian Upe in 2022.

Acronyms

1.	AWF	African Wildlife Foundation
2.	B4R	Biodiversity for Resilience
3.	KVNP	Kidepo Valley National Park
4.	KWS	Kenya Wildlife Services
5.	LMNP	Lake Mburo National Park
6.	MFNP	Murchison Falls National Park
7.	MTWA	Ministry of Tourism Wildlife and Antiquities
8.	MoU	Memorandum of Understanding
9.	NGO	Non-Governmental Organisations
10.	PUWR	Pian Upe Wildlife Reserve
11.	QENP	Queen Elizabeth National Park
12.	SECR	Spatial capture-recapture
13.	TSWR	Toro Semliki Wildlife Reserve
14.	UCF	Uganda Conservation Foundation
15.	UTB	Uganda Tourism Board
16.	UWA	Uganda Wildlife Authority
17.	UWEC	Uganda Wildlife Education Centre
18.	UWRTI	Uganda Wildlife Research and Training Institute
19.	WCS	Wildlife Conservation Society
20.	WWF	World Wide Fund for Nature

Glossary

Abundance:	Total number of individuals in a given area at a specific time.
Accuracy:	Measure of how close a population estimate is to true population size.
Bias:	Difference between the estimated and true population size.
Capture-recapture:	This refers to the capturing and recapturing of an individual animal (usually photographic). In this case it can also be synonymous with sighting and re-sighting an individual lion.
Density:	Number of animals per given unit area (e.g. lions/100 km2).
Detection:	Defined as the positive identification of an individual on a given day.
Extinct:	A taxon that is considered extinct when it no longer has living members in any area of its historical occurrence.
Extirpated:	A species that has been completely eradicated from an area where it previously existed.
IUCN Red List:	A list of globally threatened species that represents the categories; Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened, or Least Concern (the IUCN Red List has become an important tool for defining conservation status and subsequent action at international, national, and thematic levels; the existing definitions are based on a series of criteria).
Population Closure:	Assumption that population does not change during an estimation exercise. No death, birth, immigration or emigration of animals into the study area occurs.
Population Estimate:	An approximation of the true population size based upon a given method and sampling procedure.
Spatial Capture Recapture:	A framework for the estimation of animal populations using unique identity features and capture recapture statistics.

Executive Summary

Large carnivores in Uganda's context refer to; African Lions (Panthera leo), Leopards (Panthera pardus), Spotted hyenas (Crocuta crocuta), Cheetahs (Acinonyx jubatus), and African wild dogs (Lycaon pictus). These carnivores are not only a critical component of Uganda's tourism industry but they also play a key ecological role in ensuring a healthy ecosystem where they occur. Some of these species are globally recognised and have significantly contributed to Uganda's economy, such as the iconic tree climbing lions of the Ishasha sector in the Queen Elizabeth National Park, which are highly sought out for tourism purposes and are valued at roughly US$ 14,000 per individual. Worryingly, the populations of these carnivores have been in a state of decline throughout their natural habitat across Uganda for over a decade. Indeed, results of the censuses for these carnivores undertaken in 2018, 2022, and 2023 show that this is particularly the case in the Kidepo Valley and Queen Elizabeth National Parks. Concerned about this state of carnivore conservation in Uganda, the Uganda Government, through its wildlife statutory institutions, partners and stakeholders, embarked on a strategic planning process to address threats to these carnivores and ensure their survival into the future. The planning process adopted a participatory approach of key stakeholders and between May 8th and 10th 2023; a consultative workshop was held to formulate a revised second edition of the Strategic Action Plan for Large Carnivore Species Conservation in Uganda for the next ten years (2024-2034). This workshop brought together experts from the country's relevant protected areas, Uganda Wildlife Authority Technical Staff, international NGOs, donors, independent scientists, and research institutions to ensure credible data on carnivore population status and threats faced by these species was used. It is upon this data that feasible and relevant strategies were formulated, with the hope that if successfully implemented, this will halt the decline and ensure positive population growth trends for these large carnivores. The identified prioritised key threats upon which this 10-year strategic plan is woven are:

1 - Poaching or illegal killing of large carnivores mainly through snare and wheel trap poaching. This activity targets the prey of lions, leopards, and hyenas e.g. Uganda kob, Cape buffalo, impala, and topi. This loss of preferred prey threatens carnivores because they expand their range size due to a lack of resources. They are also often caught as bycatch even though they are not the targeted animals for poachers. Killing of lions for their body parts as contrabands on international markets or ritualistic cultural practices and beliefs among communities neighboring protected areas is another threat and has been directly observed in Queen Elizabeth's Ishasha sector, and Kidepo Valley National Park.

2 - The conflict between large carnivores and human populations from communities neighbouring Ugandan protected areas. This is characterized by retaliatory killing usually through poisoning leftover carcasses following carnivores preying on domestic animals both inside and outside protected areas.

3 - Habitat degradation and destruction. This is characterised by invasive plant species that make the habitat unsuitable for preferred large carnivore prey. This may also be driven by disturbances through activities such as cattle grazing. Infrastructure developments such as construction of roads through carnivore habitats or undertaking oil exploration activities as well as uncontrolled tourist visits to carnivore sightings also represent threats. The driving forces for these threats is increasing human population, unsustainable development programs such as agriculture and climate change with global warming related issues.

4 - Lack of awareness and an appreciation for carnivores. This cuts across different levels; at the policy level, policy makers may not appreciate the contribution of carnivores to the development of the national economy, mainly through the tourism industry or the role that large carnivores have as keystone species for a healthy ecosystem. At a local level, the perception that carnivores are destructive agents and an enemy to humans also serves as a threat to any co-existence.

5 - Lack of credible, timely and long-term research data upon which to make sound decisions for successful intervention in conservation of carnivores. This is exemplified by uncoordinated carnivore conservation interventions, which are not evaluated in time to provide documented lessons for decision makers.

After careful assessment of the threats faced by carnivores, participants to the formulation of this Strategic Action Plan for Large Carnivore Species Conservation in Uganda (2024 -2034) devised the following vision, mission, and five key objectives for the plan.

<u>Vision: Sustainable and viable populations of large carnivores in a healthy ecosystem in Uganda.</u>

<u>Goal: An increase of at least 30% of viable populations of large carnivore species in Uganda by 2034.</u>

The objectives are:

To reduce the poaching rates of large carnivores and carnivore prey base inside Protected Areas by at least 50%.

To maintain and improve the quality and extent of possible suitable habitats of large carnivore species inside and outside Protected Areas.

To enhance human–large carnivore coexistence inside and outside Protected Areas.

To enhance evidence based decision-making processes for large carnivore conservation.

To establish and operationalise coordination and collaboration mechanisms for large carnivore conservation in Uganda.

It is important to note that this national Strategic Plan for Large Carnivore Conservation (2024 – 2034), provides a national framework or guide for planning site-specific actions and specific species. Through site-specific annual operational work plans, respective protected area management teams, and their respective stakeholders will be responsible for making tailor-made activities to address management needs for specific species each year. This is for implementation at the conservation area level, both inside and outside the protected areas. Annual reviews and planning processes at specific sites will ensure effective collaboration and coordination among all stakeholders working at particular sites. This strategic plan also provides an estimate of budgeting framework for coordinated fundraising and guiding site specific managers to produce annual budgets. This will also assist in coordinating financial and human resources for realising the strategic interventions stipulated in this strategic plan 2024 – 2034.

An African leopard captured on a remote camera trap in the Kasenyi Plains of Uganda in 2018.

Chapter 1

1.1. Introduction

Five large carnivore species still exist in Uganda; African Lion (Panthera leo), African Leopard (Panthera pardus), Spotted Hyena (Crocuta Crocuta), Cheetah (Acinonyx jubatus), and Wild Dog (Lycaon pictus). The first three species form the mainstay of this national strategy and action plan for large carnivore conservation. Conservation of Uganda's large carnivores and their habitats, and maintaining their ecological integrity and function requires scientific evidence and a concerted strategy and actions. Uganda as a country is experiencing rapid human population growth and economic development (Wakabi 2006). The impact of these changes on the natural resources base is reinforced by the impacts of habitat degradation and climate change. These negative impacts underpin the importance and need of ensuring that protected areas in the country receive management support and responsible tourism that contributes to sustainable economic development. This document presents an opportunity to use the latest gold standard data on large carnivores in Uganda (based on methods in Elliot & Gopalaswamy 2017), highlighting the positives of where these species are doing well and also underscore the places and situations where their populations are under pressure, to ensure bettered management.

The most immediate threats to large carnivores in Uganda include; direct killing caused by wire snare and wheel trap poaching, poaching of their preferred prey, habitat loss, conflict between carnivores and livestock rearing communities (and the associated poisoning and retaliatory killings), and a lack of resources to effectively tackle these problems at the managerial level. This plan has been designed in a way that it highlights the respective threats against the backdrop of each protected area that was assessed during the last national population survey so as to be specific in each area's unique context. As an example in KVNP, lions appear to be directly targeted by poachers in the Narus Valley, while in MFNP they are caught largely as by-catch in snares when poachers target their prey. Against these area-specific threats, and the status of their respective populations, strategic interventions and possible actions have been highlighted. Corresponding core conservation stakeholders at respective protected areas that could be involved in the implementation of these national strategic interventions have been identified. This second edition of the Strategic Action Plan for Large Carnivore Species Conservation in Uganda thus provides an opportunity and a framework to bring together key stakeholders involved in large carnivore species conservation and highlights nodes of potential joint and collaborative activities for effective conservation of these species in a coherent manner. The response to a questionnaire administered during the national stakeholders' consultative workshop, made it clearer that stakeholders' collaboration is a critical factor in Uganda's carnivore conservation program.

Currently efforts are not synchronized, activities overlap, and potential synergies are not harmonized. Collaboration between all actors in the carnivore species conservation landscapes in Uganda will be key for successful implementation of the strategies and activities identified in this Strategic Action Plan to achieve the overall goal of increasing carnivore populations (especially lions) by 30%.

It is envisaged that the development process of this Strategic Action Plan, will go a long way to consolidate stakeholder engagement and garner support for the implementation of the plan. The Strategic Action Plan is also unique in that it provides a framework in which specific actions for each carnivore species' conservation within each individual protected area is developed and implemented by the relevant management and stakeholders. Implementing conservation activities that will conserve large carnivore species in Uganda also supports the conservation of many other wildlife species, including many restricted range and other globally threatened species supported by the same habitats (particularly carnivore prey).

1.2. Rationale for the Strategic Action Plan

The implementation of the first strategic plan for conservation of large carnivores, which was formulated in 2010, expired in 2020 when it had not been effectively implemented. The poor performance was attributed to the lack of adequate financial resources, poor coordination and collaboration among key stakeholders, and interruption of Covid-19 with the resultant lock down. These carnivore species' populations continue to dwindle despite the fact that they are amongst the most iconic species in the country for both ecological and economic reasons. The cheetah and wild dog populations are rare and near extirpation in Uganda. African lions, leopards and hyenas are a key component of Uganda's tourism industry as they support a rich and vibrant tourism economy driving both national and local economic growth. In the Ishasha sector of Queen Elizabeth National Park, the tree-climbing lions (Figure 1) are internationally famous, for instance, they have been a focus of Disney and BBC documentaries. Lions in this region are estimated to generate approximately US$ 14,000 individually, contributing significant funds from experiential tourism to the local tourism economy. Similarly, night game drives for African leopards in LMNP generated US$ 40,000 for the park in 2018 alone (Braczkowski et al. 2020). Large carnivores are also key to wildlife management as they are components of trophic integrity and proper functioning of the protected areas network and healthy ecosystems functioning.

African lions feeding on a Uganda kob on the Kasenyi plains, Queen Elizabeth National Park.

Figure 1. Two African lions rest in a euphorbia Euphorbia candelabrum on the Kasenyi plains, QENP. This rare tree-climbing culture is only found in three populations in East Africa: Tanzania's Serengeti, Lake Manyara, and in western Uganda. This culture sees most if not all members of these populations engaging in the behaviour of climbing trees (typically between 07:00 and 18:00, and in Euphorbia, Fig, or Acacia species).

In light of the above, the Uganda Government through its line Ministry of Tourism Wildlife and Antiquities (MTWA) and the wildlife statutory institution, UWA, in partnership with other stakeholders, undertook a consultative process to develop the second edition of Strategic Action Plan that would see the reversal of the declining trends of large carnivore species populations in the country. The plan proposes timelines, financing, and coordination frameworks that would enable effective conservation measures against the existing threats to maintain viable carnivore populations in Uganda for their sustained conservation. Moreover it provides the latest cutting edge science surrounding carnivore numbers in Uganda.

1.3. Process for Developing the New Strategic Action Plan

The Strategic Action Plan for Large Carnivore Species Conservation in Uganda development process started with preparatory meetings and a three-day consultative workshop held at the Protea Hotel Marriot in Kampala from 8th to 10th May 2023 (Figure 2). The consultative workshop was attended by representatives from 23 different institutions. The workshop included relevant conservation actors and stakeholders. During plenary and group sessions participants listed and prioritised threats by park location to generate strategies to address these threats.

Figure 2. Participants from the Strategic National Action Plan Workshop held from 8th to 10th May 2023 at Protea Hotel Kampala.

Another objective of the stakeholders' consultative workshop was to present the results of a recent nationwide survey of large carnivores across six protected areas, assess the most recent information on the threats facing these species and update the expired carnivore conservation strategic plan (2010-2020). Therefore, this second edition has been developed using updated information on large carnivore species populations across six of Uganda's most critical protected area systems in the form of density and abundance information for lions, leopards, and hyenas. Considering that data for the first edition were based on opportunistic sightings (for leopards and spotted hyenas), it is believed that the data used in this second edition that were generated from systematic survey methods, presents the most robust and accurate picture of carnivore conservation status in the country for the 2022-2023 time period.

The vision and the goal of the strategic plan were formulated in light of the expired Strategic Action Plan (2010-2020) and based on recommendations put forward by stakeholders during the stakeholders' consultative workshop held in May 2023. The strategies, objectives, targets and priority activities in this revised strategic plan were developed following existing international and national frameworks, and stakeholder consultations which identified key threats to these species. The vision, goal, and objectives are big picture and holistic, while the targets and activities are specific, implementable, measurable and collaborative.

The stakeholders' consultative workshop was preceded by drafting the strategic actions for approval and launch by the Minister of MTWA. The drafting process considered all available data as an evidence for conservation status of large carnivores' species in Uganda to enable development of an informed Strategic Action Plan that will inform conservation of large carnivores' species at different levels of management and ecosystems.

Chapter 2

2.0. Conservation and Distribution Status of Large Carnivore Species in Uganda

Figure 3. UWA African lion monitoring ranger, Jimmy Kisembo, assisting with the 2017-2018 African lion survey on the Kasenyi Plains QENP.

Monitoring the population status of large carnivores is notoriously difficult since they are naturally cryptic nocturnal and wide ranging. In order to address this challenge, a variety of methods have been used, often within the same sites. The use of different methods, such as call-in surveys, track counts, and expert opinion, has also generated debates as to the actual numbers of large carnivore population trends, since these methods have variable and questionable reliability (Gopalaswamy et al. 2015; Belant et al. 2019; Dröge et al. 2020).

In light of these limitations, UWA adopted a robust and standardized framework to assess large carnivore populations in 2022. This was achieved through assembling a technical team to assist in conducting a national survey to provide robust estimates of large carnivores in six key wildlife areas: KVNP, PUWR, MFNP, TSWR, QENP and LMNP (Figure 4).

The team used methods that are the current gold standard in large carnivore monitoring and were also recently used in a national survey of lions and other large carnivores in Kenya, which was conducted by the Kenya Wildlife Service (KWS) and Wildlife Research and Training Institute (Elliot et al. 2021; Broekhuis et al. 2022).
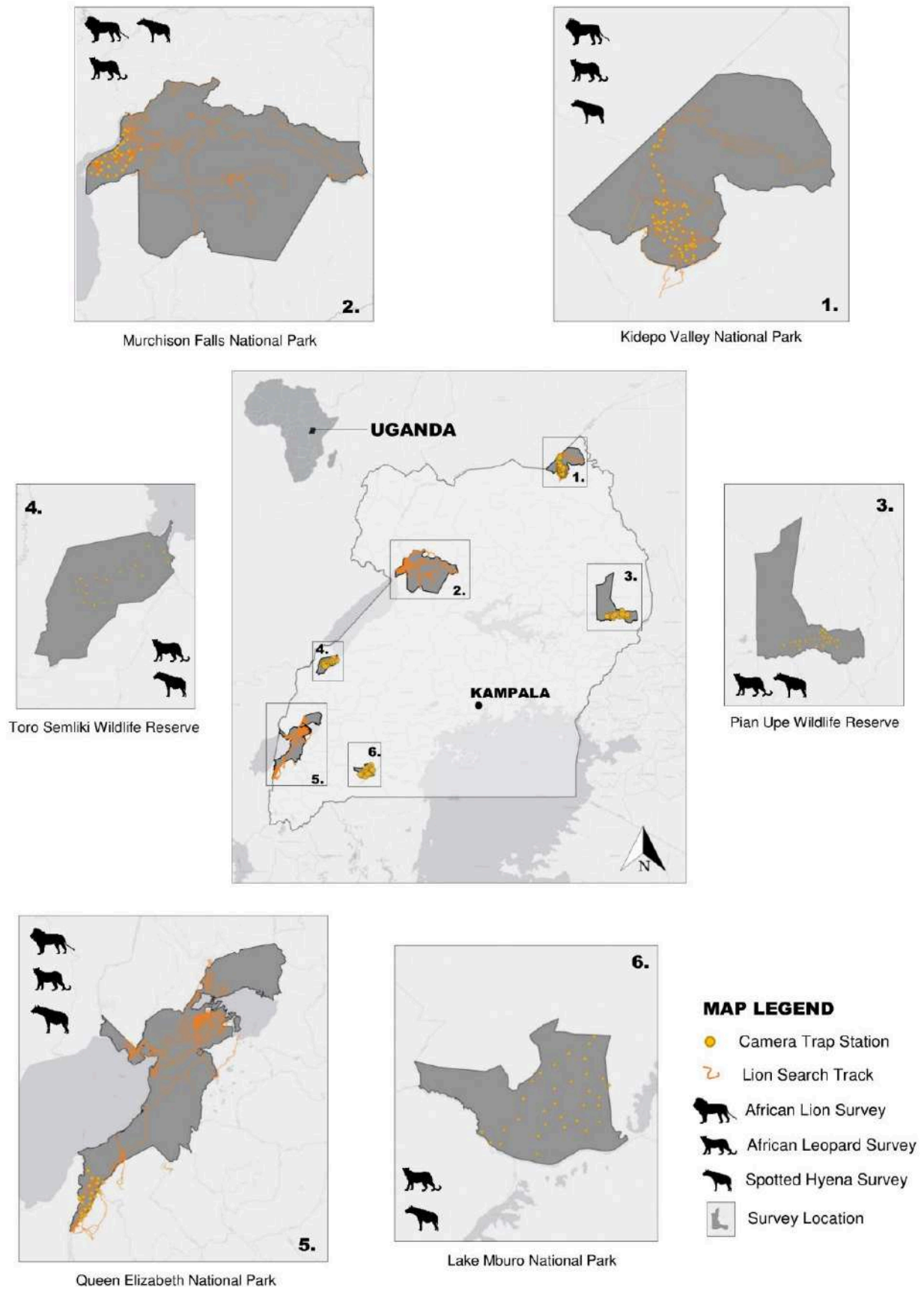
Figure 4. The sites surveyed during the 2022 African lion and large carnivore survey. Silhouettes denote species and search encounter tracks and camera trap locations denote the regions of each area surveyed.

2.1. Field Methods

2.1.1. African Lions

The fieldwork made use of unstructured spatial sampling (Elliot & Gopalaswamy 2017), and was deployed in all three sites in Uganda where lions still exist, i.e. QECA, MFNP and KVNP. While efforts were made to cover each of these national parks in their entirety, this was not always possible due to restricted road networks. Trained observation teams used vehicles to conduct fieldwork. They actively searched for lions while recording drive efforts and their location or sampling occasion for each lion sighting. In an effort to improve detection rates, playback protocols were utilised (Western et al. 2022). The playback protocol was conducted at night and consists of broadcasting sounds at 95DB to attract lions. Sites for playback were chosen either opportunistically or when fresh tracks had been found. Upon arrival at a site, the observation team waited in silence for 10 minutes, then broadcast for 5 min, repeating this cycle and rotating the speaker 90° until four broadcasts had been completed or lions had appeared. In this manner, each playback lasted a maximum of 70 min. Standard sounds that have been successfully used to attract lions in traditional playback surveys were used eg. buffalo (Syncerus caffer) calf in distress, squealing pig, squabbling hyenas (Crocuta crocuta); see Cozzi et al. (2013). The team recorded the spatial location and date of each playback. When lions were observed, wherever possible, a series of close-up photographs were taken of each individual. The photographs were later used to unambiguously differentiate individual lions based on their unique whisker vibrissae, spots and other distinguishing features (Pennycuick & Rudnai 1970). Each individual was assigned a unique identification and gender based on secondary sexual characteristics. Determination of age was based on phenotypic features (Miller et al. 2016). Individuals estimated to be less than one year were omitted from final analysis, since lion mortality in the first year is typically high (Packer et al. 1988) and including these individuals could violate assumptions of population closure (Otis et al. 1978).

Figure 5. An adult male African lion resting in a sycamore fig tree in the Ishasha sector of QENP.

2.1.2. African Leopards and Spotted Hyenas

To detect leopards and spotted hyenas, an array of remote camera traps were set in areas of interest in the following protected areas: Queen Elizabeth, Murchison Falls, Kidepo Valley, Lake Mburo national parks, and in Pian Upe and Toro Semliki wildlife reserves. It should be appreciated that these protected areas were too vast to exhaustively cover with camera traps. Instead, specific areas of interest were chosen within each site. As an example, in MFNP, the Nile delta was selected as an area of interest. While this does not provide protected area-wide estimates, it provides estimates that are comparable over time, if the surveys were to be repeated.

Figure 6. African leopard detected on remote camera trap in Lake Mburo.

Figure 7. Spotted Hyena photographed in Kyambura Gorge, QENP.

Camera traps were set roughly 2 km apart and were deployed along trails, game paths, roads, and drainage lines to increase the detection probability for these species. The effort invested in each protected area ranged widely (Tables 2 and 3) but generally averaged 55 days per site with 30-55 locations. At each camera trap station, a pair of camera traps were deployed in an effort to obtain photographs of left and right flanks. The photographs were later used to identify individual leopards and spotted hyenas based on their unique pelage patterns (Dheer et al. 2022). In addition, the GPS location of where they were photographed, the date, and functionality of the camera traps was recorded.

2.1.3. Cheetahs and African Wild Dogs

Large carnivore surveys for African lions (search-encounter), African leopards, and spotted hyenas (remote camera trapping) were designed in a way that if encountered, cheetahs and wild dogs could be incorporated into the analytical framework. Search-encounter using unstructured sampling has indeed been used with great success for cheetahs in Kenya (Broekhuis and Gopalaswamy 2016). This unstructured sampling approach also deals with the cheetah-specific behaviour of play trees, which traditional camera trapping along large roads and trails may miss (Marnewick et al. 2008). In Uganda's case there are only two landscapes with historic information about the presence of both species in the past decade. These are the Kidepo Valley National Park and Pian Upe Wildlife Reserve. Both sites have had a low frequency of sightings recorded in recent years, with a single male cheetah coalition regularly being photographed by tourists in the Narus Valley in Kidepo, Karamoja Overland Safaris staff regularly reporting cheetahs in the northern region of Pian Upe, and a single smart phone photograph being taken of an African wild dog in Kidepo on 27 June 2023. Because of the fact that our lion surveys were regularly implemented off track we anticipated encountering these species if they were present in the environment.

Uganda Wildlife Authority rangers setting a camera trap array on the granite inselbergs near KVNP rest camp. These camera arrays targeted African leopards, spotted hyenas, cheetahs, and wild dogs but also caught a wide diversity of non-target species including carnivore prey.

2.2. Analytical Methods

For all three species, the fieldwork was designed to be combined with spatially explicit capture-recapture models (Royle & Young 2008). To describe the manner in which individual animals were detected (the observation process), we compiled standard capture-recapture matrices consisting of individuals, trap locations (defined by discrete pixels), and sampling occasions. For each trap, on each sampling occasion we noted whether or not the trap was active, and included an additional covariate (logarithm of kilometers driven) to account for our search effort during the lion surveys (Elliot & Gopalaswamy 2017). We also included trap and sampling occasion-specific covariates for the playback protocol (Western et al. 2022).

For each species we defined a set of a-priori candidate models (defined in Appendix 4), which were implemented using Bayesian spatial capture-recapture analyses. More detailed descriptions of the analytical methods and model selection criteria are described in a scientific peer-reviewed publication that details all of these surveys (Braczkowski et al. in review), and also in other publications (Elliot & Gopalaswamy 2017; Braczkowski et al. 2020; Elliot et al. 2020; Elliot et al. 2021; Braczkowski et al. 2022; Western et al. 2022).

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Figure 8. Bosco Atukwatse, field team co-lead of the 2022 Kidepo Valley and Queen Elizabeth National Park carnivore surveys shows assistants how to segregate lion sighting data on their laptops.

2.3. Species-Specific Results

2.3.1. African Lions

The first national survey of lions was conducted in 2009 and 2010. A commonly used technique, playback surveys (e.g. Ogutu & Dublin 1998), was employed to estimate the number of lions (and spotted hyaenas) in Queen Elizabeth, Murchison Falls and Kidepo Valley NPs. The fieldwork consisted of driving to pre-defined points (spaced 5 km apart) and broadcasting a buffalo calf distress call for 30 minutes. The results of these surveys are written up by Omoya et al. (2014), and form the basis of the Strategic National Strategy and Action Plan for Large Carnivore Conservation in Uganda 2010 - 2020. This study estimated 416 lions in Uganda, with 144 in Queen Elizabeth, 132 in Murchison Falls, 132 in Kidepo Valley, 5 in Toro Semuliki, and 3 in Lake Mburo.

The second national survey of lions was conducted in 2022, using unstructured spatial sampling combined with spatial capture-recapture analyses as described above (Table 1). These methods have become the gold standard for monitoring not only lions, but large carnivores across the world. Spatial capture-recapture (SECR) models are appealing because they are statistically robust, and provide accurate and precise inferences of key population parameters, such as spatial density and abundance, sex ratios, and movements (Royle et al. 2013). In terms of data collection, this framework is attractive since it can accommodate a variety of field methods designed to obtain individual identities. This means that different field protocols can be used within and between sites, with the results being directly comparable. This is advantageous, since there is enormous heterogeneity across the lion range, meaning that there is no one field method that is appropriate everywhere.

Table 1. Lions - Summary table of results for sightings-based surveys conducted in 2022 within an SECR framework.

Location	Survey Date	Survey Duration	Area of inference (km2)	Lion Density (Posterior SD)	Lion Abundance (Posterior SD)
QENP	26 Aug – 29 Nov	96 days	2400	1.64 (0.33)	39.72 (7.96)
MFNP	5 Apr – 7 Jul	94 days	4059	7.43 (1.05)	240 (33.99)
KVNP	31 Aug – 9 Dec	101 days	1430	0.87 (0.46)	12.44 (6.53)

Note: The SECR results are presented with posterior standard deviations in brackets. The estimates provided are for lions over the age of 1 year.

2.3.1.1. African Lions in the Queen Elizabeth National Park

Historic Figures (Table 2)

1999: Total counts using individual identification were conducted (Driciru et al. 1999). In total, 116 individual lions were identified. Since this study did not cover the entire park, the authors reasoned that an "estimate in the range of 160 to 210 lions for the whole park seems reasonable" (Driciru et al. 1999).

2002: The Uganda Large Predator Program at Makerere University estimated 206 individuals.

2004: Citing personal communication with Siefert and Driciru, a figure of 200 lions (range: 140-260) was provided by Bauer and van der Merwe (2004).

2006: Aerial surveys of large mammals were conducted in 2006, and Treves et al. (2009) converted this to an estimated abundance of 140 lions in the NP.

2008: During November and December 2008, a playback survey was conducted to estimate the number of lions in Queen Elizabth NP (Omoya et al. 2014). The fieldwork consisted of driving to pre-defined points (spaced 5 km apart) and broadcasting a buffalo calf distress call for 30 minutes. A total of 35 playbacks were conducted and the authors estimated that this equated to a sampled area of 268 km2, which is 11% of the NP and 19% of the 1,386 km2 area defined by the study as the 'area suitable for lions'. Density was estimated within the 268 km2 area, and extrapolated to the 1,369 km2 area to provide an abundance estimate of 144 (SE: 22) lions.

2010: In 2010, a monitoring project conducted by the WCS and Wildlife and Animal Resource Management department (WARM) of Makerere University, recorded 82-87 individuals within the park.

2018: From 10 November 2017 to 10 February 2018, a survey using unstructured spatial sampling, combined with spatial capture-recapture models (consistent with the 2022 national survey) was conducted (Braczkowski et al. 2020). An estimate of 71 (PSD=11) lions over the age of one year was provided.

Current Status

Between 26th August and 29th November 2022, a repeat of the 2018 survey was conducted with the same level of vehicle-based drive effort (8232 km). This resulted in 171 detections of 19 individual lions over the age of one year. Abundance was estimated to be 39 (PSD=7.9) lions. Overall density was estimated to be 1.64 (PSD=0.33) individuals/100 km2. This was much lower than the 2018 estimate of (2.7 (PSD=0.47) individuals/100 km2, Braczkowski et al. 2020).

Table 2. Lion Population Trends in Uganda

PA	1977-1981a	1994-1996	1997-1999b	2000-2002c	2004d	2005	2010e	2013	2018f	2022g
QENP	400		185	206	200		144		71	39
MFNP				181-467	350	263	132	215		240
KVNP				35-60	25		132			12
LMNP		7		2				1		
TSWR				5-15				1		

Sources: a Din (1978) and Van Orsdol (1981); b (Driciru 1999, 2005; Driciru, Siefert & Mapesa, (2005); c Uganda Large Predator Program (2000–2002); d Bauer & Van Der Merwe (2004); e Omoya et al (2014); Tutilo Mudumba & Sophia Jingo (2013); f Braczkowski et al (2020b); g Braczkowski et al (in review and this action plan). Note there are 16 captive lions in UWEC as of 2025 excluded from these wild numbers.

Figure 9. In 2022, field data on lions was collected using unstructured spatial sampling protocols. Tile (a) details the field effort: In total, 8,232 km was driven while searching for lions. This led to 171 detections of 19 individual lions over the age of one year. Tile (b) depicts an output from the spatial capture recapture analysis and shows pixel-specific lion density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). In this area (2048 km2) we estimate a total of 33.59 lions. If we consider the entire 2400 km2 we estimate 39.34 individuals (PSD=7.96).

Discussion

It is not possible to directly compare the estimates from 1999-2010 to the current estimates, owing to unaccounted for variation in sampling techniques. However, the evidence points to a sharp decline of lions since 2008. Omoya et al. (2014) estimated lions of all ages, whereas the 2018 and 2022 surveys only estimated lions over the age of one year. Without accounting for that difference, these data suggest that a decline of 51% may have occurred between 2008 and 2018, with strong evidence of a 45% decline between 2018 and 2022. The 2018 and 2022 surveys are directly comparable. Numerous mortality events occurred in the time period between the last two surveys, including the poisoning of eleven lions in Hamkungu Fishing Village in April of 2018, the poisoning of six lions in the Ishasha sector in March of 2021, and the electrocution of three lions in April 2022.

2.3.1.2. African Lions in the Murchinson Falls National Park

Figure 10. Field photos from the 2022 African lion survey in the Murchison Falls National Park. Tile (a) shows field team members sweeping the Nyamsika river for lion presence. Tile (b) shows field team members Herbert Kigongo and Silvan Musobozi training to use photographic equipment used to collect lion ID data. Tile (c) shows one of the lionesses identified in the Nile Delta region of the park, and Tile (d) shows one of the field vehicles used in the survey exploring the grasslands near Tangi gate.

Historic Figures (Table 2)

2000-2002: A range of 181-467 lions is attributed to a report by Driciru et al. 2005.

2004: Citing personal communication with Siefert and Driciru, a figure of 350 lions (range: 280-420) was provided by Bauer and van der Merwe (2004).

2005: A figure of 263 lions is attributed to a report by Driciru 2005.

2009: Between September and November 2009, a playback experiment was conducted to estimate the number of lions across the 5,045 km2 Murchison Conservation Area (Omoya et al. 2014). The fieldwork consisted of driving to pre-defined points (spaced 5 km apart) and broadcasting a buffalo calf distress call for 30 minutes. A total of 72 playbacks were conducted and the authors estimated that this equated to a sampled area of 550 km2, which is 11% of the NP and 13.7% of the 4,004 km2 area defined by the study as the 'area suitable for lions'. Density was estimated within the 550 km2 area, and extrapolated to the 4,004 km2 area to provide an abundance estimate of 132 (SE: 24) lions.

2021: From 2016 to 2021, vehicle-based surveys were conducted to monitor the individuals within five prides in a 1,000 km2 study area. Based on these observations, Montgomery et al. (2023) calculated a "minimum number" of 139 lions for their 1,000 km2 study area.

Current Status

As part of the national survey, fieldwork was undertaken between 5th April and 7th July 2022, using the methods described above. During this survey the field teams recorded 13,442 km of vehicle-based search effort and conducted 40 playbacks (see the Field Methods section above for details on these protocols). This resulted in 181 detections of 57 individual lions over the age of one year. Abundance was estimated to be 240 (PSD=33.9) lions over the age of one year (Figure 11). This estimate is for an area totaling 4,059 km2, which is the area that was effectively sampled, and excludes the south-eastern region and Budongo areas of the park. Density was estimated to be 7.43 (PSD=1.05) individuals/100 km2 but ranged widely and in the Nile Delta area, density was estimated to be 15.21 (PSD=2.37) lions/100 km2.
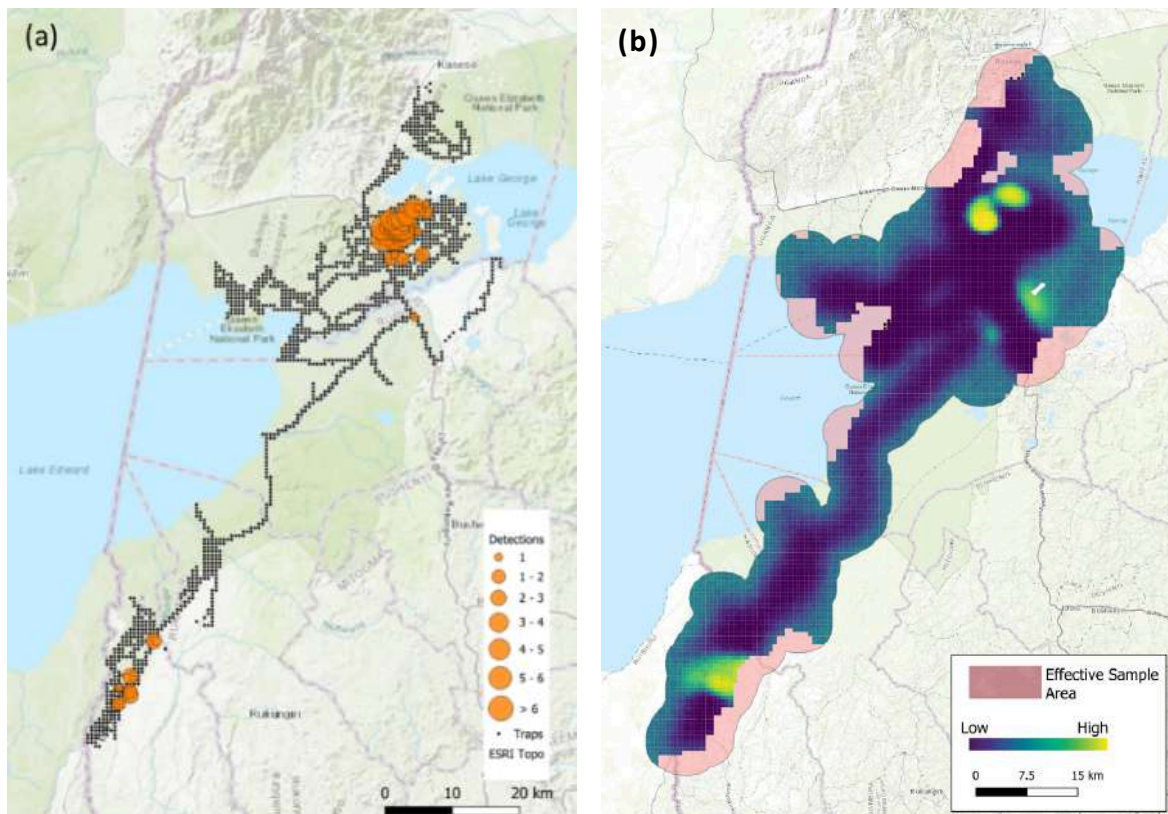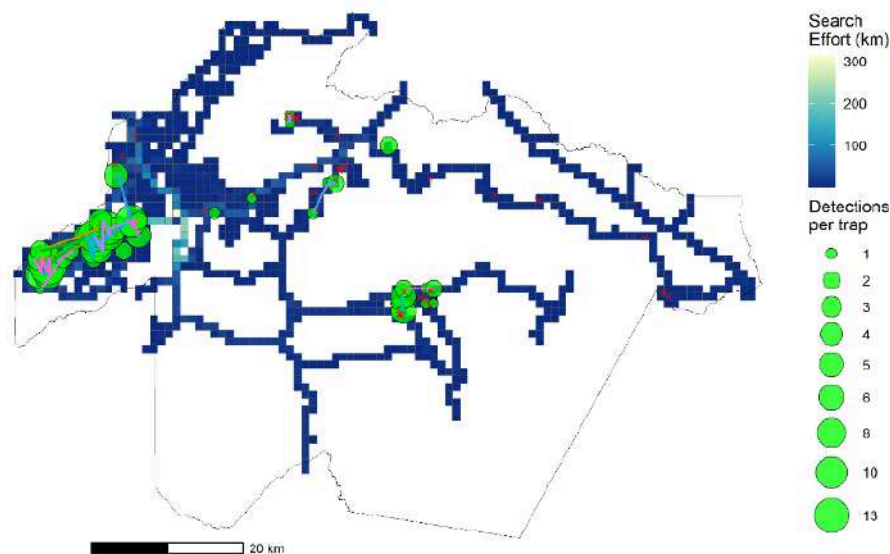

Figure 11. In 2022, field data on lions was collected using unstructured spatial sampling protocols. The figure details the field effort: In total, 13,442 km was driven while searching for lions, and 40 playbacks were conducted. This led to 181 detections of 57 individual lions over the age of one year.
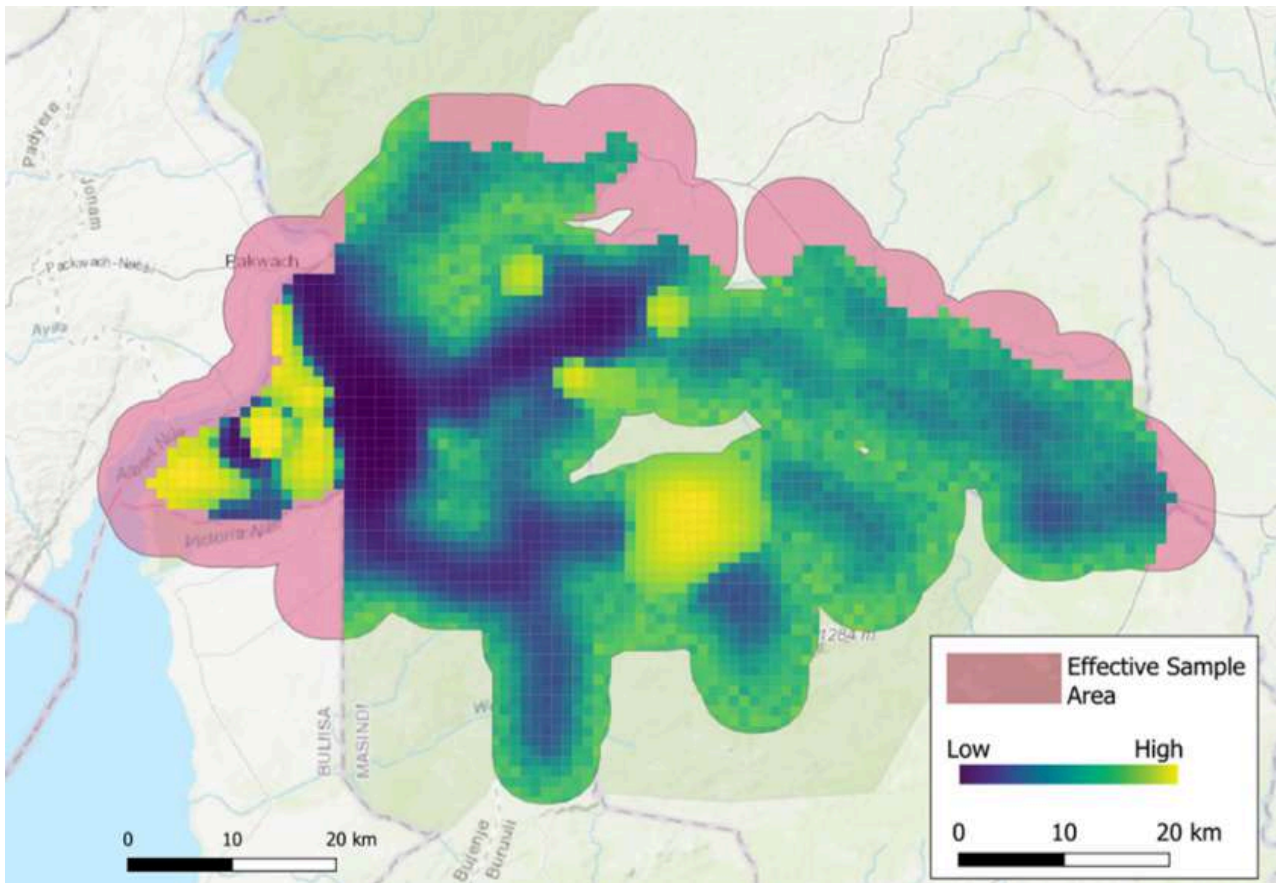
Figure 12. Output from the spatial capture recapture analysis, showing pixel-specific lion density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). This area was equivalent to 4059.3 km2 and in this area we estimate an abundance of 240.08 lions (PSD=34).

Discussion

The 2009 survey estimated 132 lions (SE=24) across an area of 4,004 km2, while the current estimates point to at least 240 lions (within 4,059 km2), excluding the Budongo Forest and the park's southeastern region which we could not access by vehicle. It is difficult to know if lions in Murchison Falls have increased from the 2010 call up surveys or if the abundance differences between our 2022 survey and those noted in Omoya et al. (2013) are methodological. It is noted that the 2009 survey results were based on a large-scale extrapolation (13.7% of the area was estimated to be sampled) and there was a lack of sampling effort across virtually the entire south-eastern region.

It is unknown to what degree Kony's rebel (lord's resistance army – LRA) activities and historic poaching impacted the Murchison lion population during the 2009 survey. However, we suggest that our 2022 survey results for both the Nile Delta and more broadly across the Park provide a robust baseline estimate of both density and abundance. These data (especially in the Nile Delta) are comparatively higher than many lion populations across Africa and are suggestive of a strong breeding population of lions.

2.3.1.3. African Lions in the Kidepo Valley National Park

Historic Figures (Table 2)

2000-2002: A range of 35-60 lions is attributed to a report by Driciru et al. 2005.

2004: Citing personal communication with Siefert and Driciru, a figure of 25 lions (range: 20-30) was provided by Bauer and van der Merwe (2004).

2009: Between March and April 2009, a playback experiment was conducted to estimate the number of lions across the 1,442 km2 Kidepo Valley National Park (Omoya et al. 2014). The fieldwork consisted of driving to pre-defined points (spaced 5 km apart) and broadcasting a buffalo calf distress call for 30 minutes. A total of 24 playbacks were conducted and the authors estimated that this equated to a sampled area of 183 km2, which is 13% of the NP and 14% of the 1,284 km2 area defined by the study as the 'area suitable for lions'. Density was estimated within the 183 km2 area, and extrapolated to the 1,284 km2 area to provide an abundance estimate of 132 (SE: 77) lions.
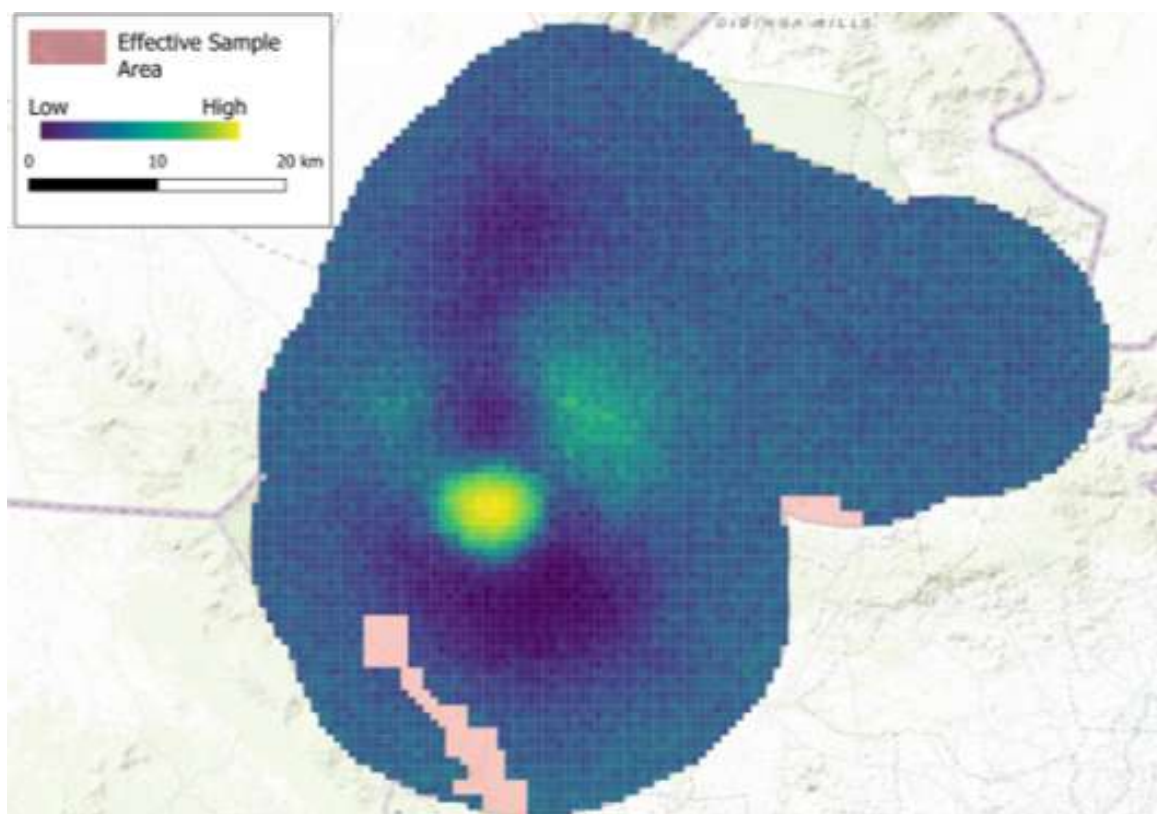
Figure 13. Output from the spatial capture recapture analysis and shows pixel-specific lion density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). This area was equal to 2555 km2 and in this we estimate 22.32 individual lions (PSD=11.67). If we consider the 1430 km2 national park alone we estimate 12.44 individual lions.

Current Status

As part of the national survey, fieldwork was undertaken between 31st August to 9th December 2022, in the Narus and Kidepo sections of the Kidepo Valley NP. During this survey the field teams recorded 4,519 km of vehicle-based search effort and conducted 41 playbacks (see the Field Methods section above for details on these protocols). This resulted in 16 detections of five individual lions over the age of one year (Figure 13).

Discussion

The 2009 call-in survey estimated 132 lions within Kidepo NP, whereas the latest estimate is 12.44 lions in the 1430 km2 national park. While direct comparisons between these figures are problematic, the evidence does suggest a severe decline in the national park. For instance, the 24 playbacks conducted in 2009 resulted in 19 responses, whereas in 2022, almost double the number of playbacks were conducted (41), plus 4,519 km of intensive search effort was invested, and this resulted in only 16 detections. Large sections of Kidepo Valley NP are thought to contain decent prey densities, and it is plausible that there is tremendous recovery potential for lions in this park. As with the 2009 survey, in 2022 large sections of the park were not surveyed due to insecurity and poor accessibility. While these continued challenges hamper a more comprehensive understanding of the lions in Kidepo Valley NP, it is thought to be unlikely that wildlife occurs in these unsampled areas at any notable density, since most of it is thought to have been exterminated.

2.3.1.4. African Lions in the Lake Mburo National Park

Omoya et al. (2014) reported that lions had been absent from the NP for several years, but around 2014 there had been sightings of up to five lions (Omoya et al. 2014). The last known lion in LMNP (a mature ~10-12 year-old male) was photographed on camera traps during a leopard survey in 2018 (Braczkowski et al. 2022) and was last sighted by lodge owners in 2020 (Ralph Schenk pers. comm). As a result, LMNP was not specifically surveyed for lions. However, during the 2022 national survey, 32 camera trap stations were deployed over 50 days (1,377 camera trap nights). No lions were detected during this survey and it is most likely that lions are now extinct from LMNP.

Discussion

Lake Mburo National Park is increasingly being isolated from its original environment as land use around it is increasingly becoming intensified through agriculture (mainly in the form of modern cattle and small stock farms). This disadvantages any future efforts to consider the Park as a lion conservation area, considering the original lion-human conflicts that led to the extirpation of this population.

However, there is one management scenario where the park is completely fenced off. The population of ungulates such as impalas and zebras could likely support a couple of lion prides. This would boost the tourism potential of the Park and attract more tourists, and generate increased revenue.

2.3.1.5. African Lions in the Pian Upe Wildlife Reserve

Lions are thought to have become locally extinct in Pian Upe several decades ago. As a result, Pian Upe was not specifically surveyed for lions.

Indeed, during the 2022 national survey, 28 camera trap stations were deployed over 61 days (858 camera trap nights). No lions were detected during this survey, providing further evidence that lions have not recolonized PUWR.

Discussion

Pian Upe Wildlife Reserve was nearly degazzeted as a conservation area in the late 1990s due to encroachment and uncontrolled access to its resources among other threats. Its conservation status is now applauded as a success because of UWA's management intervention including translocations of some species such as impalas, and Uganda Kobs. It is also thought that animal populations are on the increase in the region. There is a serious partner – Space for Giants and a sport hunting program, Karamoja Overland Safaris who are co-managing this area with the Uganda Wildlife Authority, and revamping much of its infrastructure. Its geographical location in eastern Uganda neighbouring Kenya and at the foothills of Mt. Elgon National Park makes it ideal as a core component of the tourism circuit in Uganda and Kenya. Its potential as an large carnivore and potential African lion area needs to be explored further.

2.3.1.6. African Lions in the Toro Semliki Wildlife Reserve

Omoya et al. (2014) reported that there were few lions; two to eight in number, in the TSWR. However, recent anecdotal information suggested that lions were no longer present in this reserve. As a result, Toro Semliki was not specifically surveyed for lions. Nevertheless, during the 2022 national carnivore survey, 25 camera trap stations were deployed over 39 days (407 camera trap nights). No lions were detected during this survey, and it is most likely that lions are now extinct from Toro Semliki Wildlife Reserve.

2.3.2. African Leopards

The Research and Monitoring wing of UWA has never conducted a national survey of leopards. There is therefore no empirically derived national estimate of leopards in the country. As such, the first edition of this Action Plan only featured sighting data from UWA rangers. This is partly due to the complications of surveying leopards across their range, for they are known to occur quite widely outside protected areas and are elusive animals by nature. No effort has been made to assess the densities or abundance of this species outside of the formally designated protected areas of Uganda to date.

Figure 14. Tiles (a and b) Students from Makerere University setting up cameras in collaboration with Dr Tutilo Mudumba and Mihingo Lodge staff in the Lake Mburo National Park. Tiles (c and d) show staff from Karamoja Overland Safaris erecting camera traps with UWA rangers and Dr Alex Braczkowski and Miss Anna Crysell in the Pian Upe Wildlife Reserve

At a protected area level, in 2018 systematic surveys were conducted in LMNP and QENP to estimate leopard population numbers (Braczkowski et al. 2022). In 2022 and 2023, surveys were conducted in specific regions of interest in; QENP, MFNP, KVNP, LMNP, PUWR and TSWR (Figure 14). Table 3 summarises the results of this survey.

Table 3. Leopards - Summary table of results for camera trap surveys conducted in 2022 and 2023 within an SECR framework.

Location	Survey Date	Survey Duration	Area of inference (km2)	Leopard Density (Posterior SD)	Leopard Abundance (Posterior SD)
QENP (Ishasha)	20 Dec 2022 – 28 Feb 2023	36 days Ishasha	805	1.48 (0.6)	11.91 (3.83)
MFNP	23 April - 20 June 2022	59 days	262	14.06 (2.7)	36.83 (6.95)
KVNP	14 Sept - 8 Dec	60 days	432	6.26 (2.3)	27.04 (9.96)
LMNP	2 March - 20 April 2022	50 days	370	11.58 (2.46)	42.85 (9.12)
PUWR	23 Feb - 23 April 2022	61 days	1357	1.6 (0.5)	21.65 (6.6)
TSWR	24 April – 1 June 2023	39 days	-	None detected	None detected

Note: The preliminary SECR results are presented with posterior standard deviations in brackets.

2.3.2.1. African Leopards in the Queen Elizabeth National Park

Historic Figures

2018: Two leopard surveys were conducted in Queen Elizabeth in 2018. The first covered the northern extent of Kasenyi, Mweya, and the craters area. This took place from 8th March to 25th April 2018 and encompassed 44 camera-trap sites. The second survey was conducted approximately 70 km south, across 30 locations in the Ishasha sector from 27th April 2018 to 24th June 2018. Each respective survey estimated leopard densities of 5.03 (95% Highest Posterior Density, HPD = 2.80–7.63) and 4.31 (95% HPD = 1.95–6.88) individuals/100 km2.

Current Status

In 2022 only the Ishasha survey yielded enough detections of leopards for a credible estimate of leopard density. In this survey we obtained 21 detections of 7 individuals (2 males, 4 females, 1 unsexed) from 36 sampling days (732 trap nights) and 23 sites. From these data we estimated a density of 1.48 leopards/100 km2 (PSD=0.57). This represents a near 70% reduction in the density recorded.
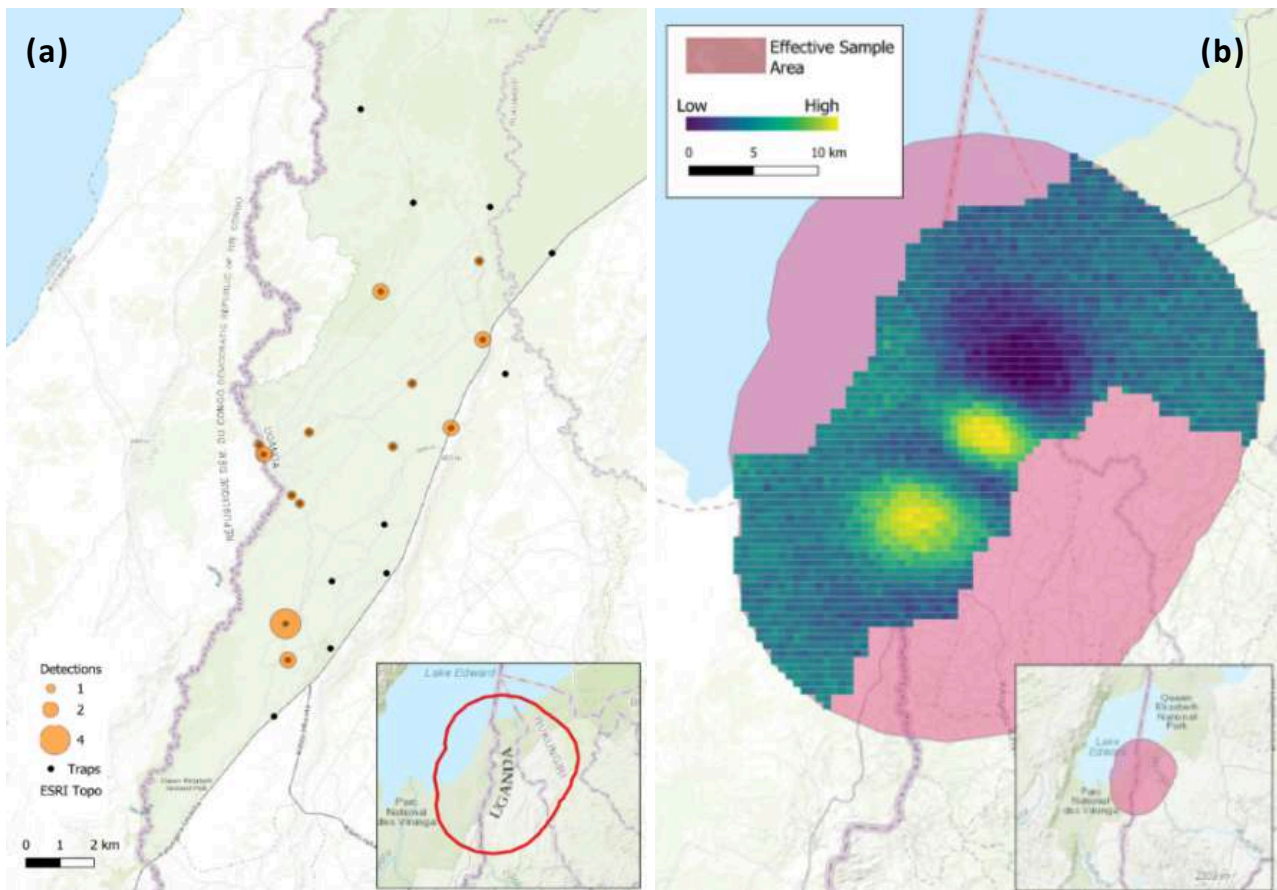
Figure 15. Tile (a) Locations of camera traps in the 2022 Ishasha leopard survey along with their corresponding leopard detections. Tile (b) depicts the 2.44 sigma area (805 km2) around our camera traps in the Ishasha leopard survey. This area contained an estimated 11.91 individual leopards (PSD=3.83).

Discussion

It is plausible that the estimate we present here was strongly affected by a low sample size, however the 95% confidence intervals still show a decline in the density of leopards in the southern Ishasha region of the park (0.55-2.54 individuals/100 km2). It is critical to repeat this survey in 2024 and extend the sampling frame to 45 days, and intensify the camera maintenance schedule. This being said, the same sampling regime obtained 227 detections of 42 individual hyenas, so sampling intensity in of itself cannot be blamed.

2.3.2.2. African Leopards in the Murchinson Falls National Park

Historic Figures

The 2010-2020 Action Plan for large carnivores did not include any data on leopard densities or abundance, and data on leopards in Murchison are virtually non-existent.
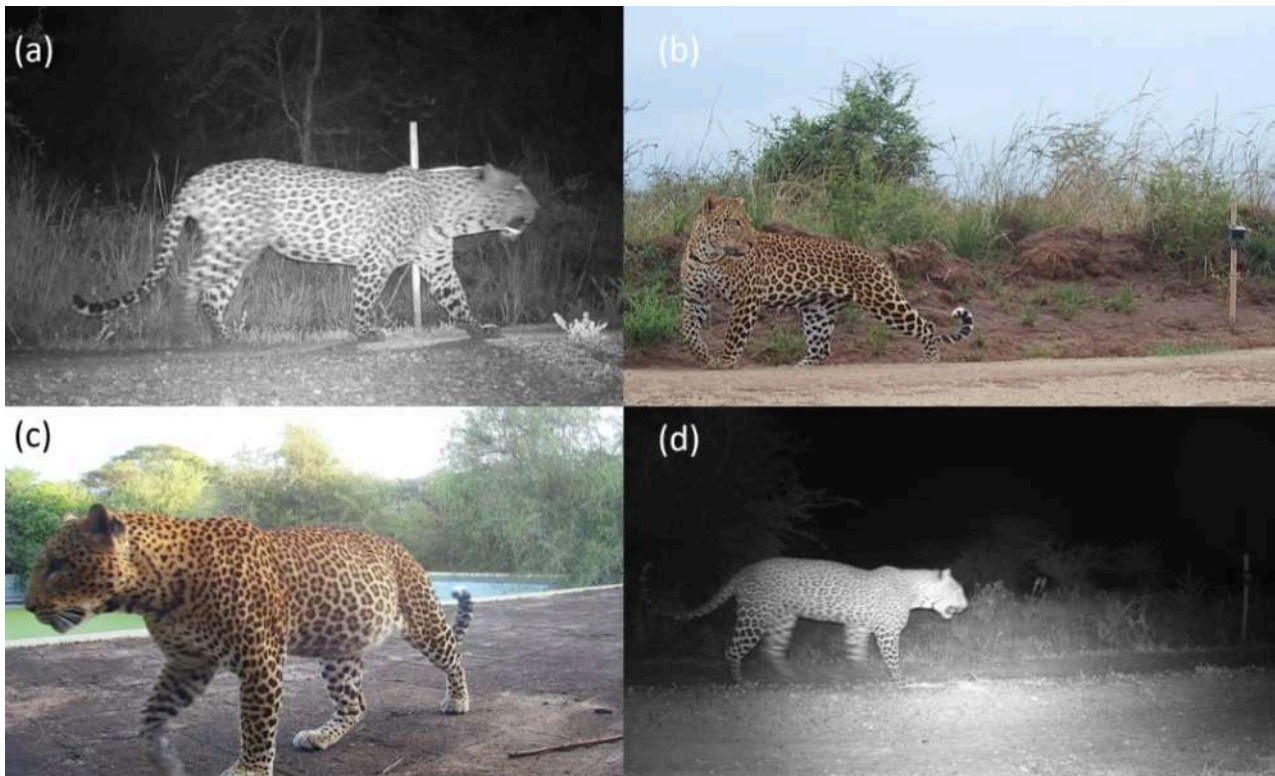
Figure 16. Leopards photographed in the MFNP. Tile (a) shows a large male photographed in the Buligi circuit. Tile (b) shows an individual photographed in the Commowealth Albert track of the Delta region. Tile (c) shows a female at the old Pakuba lodge pool, while tile (d) shows a female photographed on the access road to the new Pakuba lodge. The estimates generated from this leopard density estimate represent one of the highest in all of Africa.

Current Status

As part of the national survey of large carnivores, a survey of African leopards was conducted in the Nile Delta region of the Murchison Falls National Park from 23rd April to 20th June, spanning a total of 59 days and 1,603 trap nights. This is the most important tourism area of the Park and also has the highest observed densities of large carnivores, both lions and hyenas. A total of 99 detections of 27 individual leopards (10 males, 17 females) was recorded. We estimated leopard density at 14.06 individuals/100 km2 (PSD=2.65). Importantly this is not only the highest density of leopards in Uganda, but across most of the species' range in Africa. Other populations approaching this density include the Sabi Sands of South Africa with 11.8 individuals/100 km2 and Matusadona National Park in Zimbabwe with 12.2 individuals/100 km2.
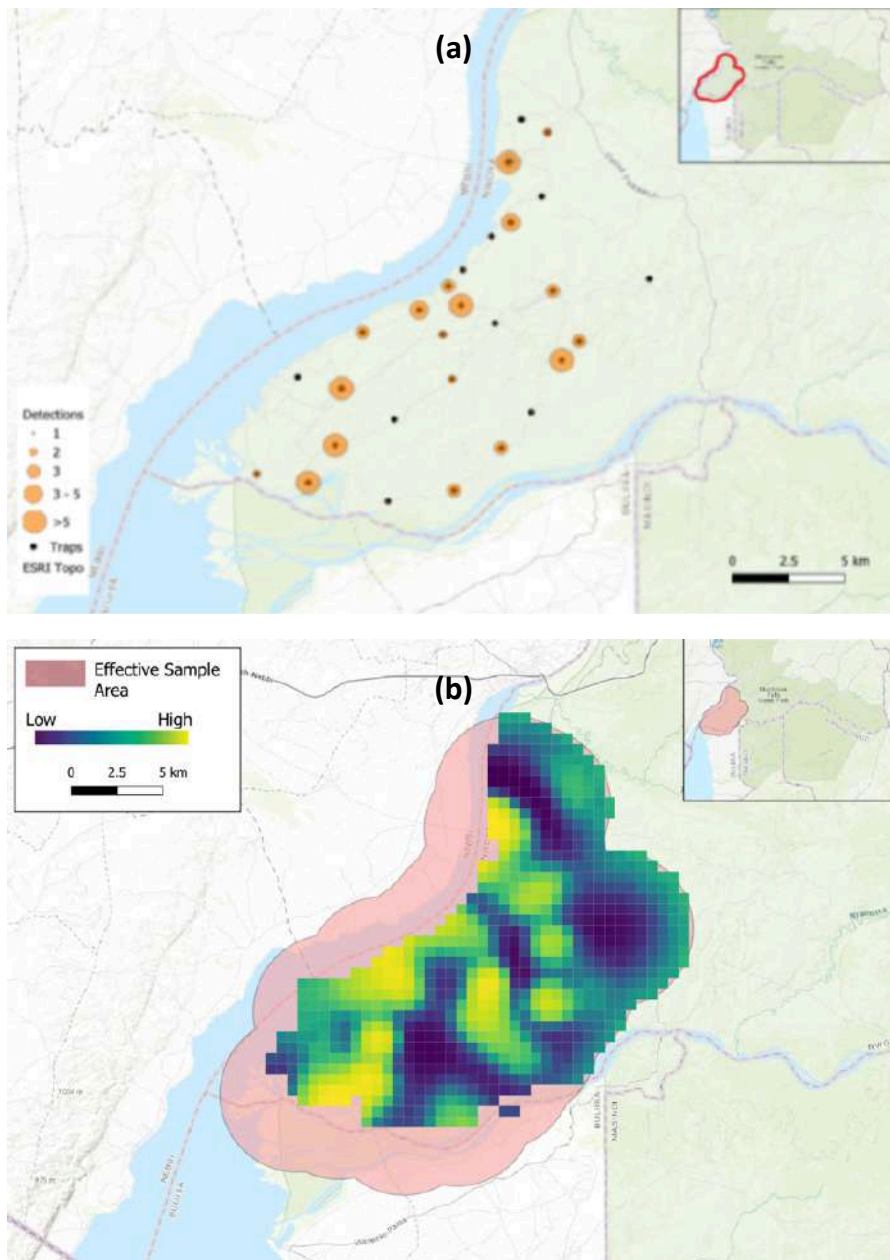
Figure 17. Tile (a) denotes the 32 camera trap locations in the Nile Delta region of Murchison Falls National Park along with their associated detections illustrated by sphere size. Tile (b) depicts an output from the spatial capture recapture analysis and shows pixel-specific leopard density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). This area was equal to 262 km2 and in this area we estimate 36.83 individual leopards (PSD=6.95).

Discussion

Our results show one of the highest recorded densities of leopards anywhere in continental Africa. These data help to confirm that the tourism zone of the Nile Delta has an intact, high density large carnivore guild and the de-snaring efforts of UWA and other NGOs appear to be working. It is recommended that this site is regularly monitored due to it being a key leopard source population in Uganda.

2.3.2.3. African Leopards in the Kidepo Valley National Park

Historic Figures

The 2010-2020 Action Plan for large carnivores did not include any data on leopard densities or abundance, and data on leopards in Kidepo Valley and the north of Uganda are extremely limited in scope.

Current Status

As part of the national survey of large carnivores we implemented a survey of African leopards in the tourism zone, and northern border road of the Kidepo Valley National Park from 14th September to 8th December (86 days, 1262 trap nights). Despite this intensive effort we recorded only 19 detections of nine individuals (4 males, 5 females). From these data we estimated a leopard density of 6.26 individuals/100 km2 (PSD=2.30).

Figure 18: The 60 camera trap locations set during our 2022 African leopard survey along with their associated detections illustrated by sphere size. Due to insecurity and a lack of access we had extremely limited access into the Kidepo Valley portion of the national park during the survey
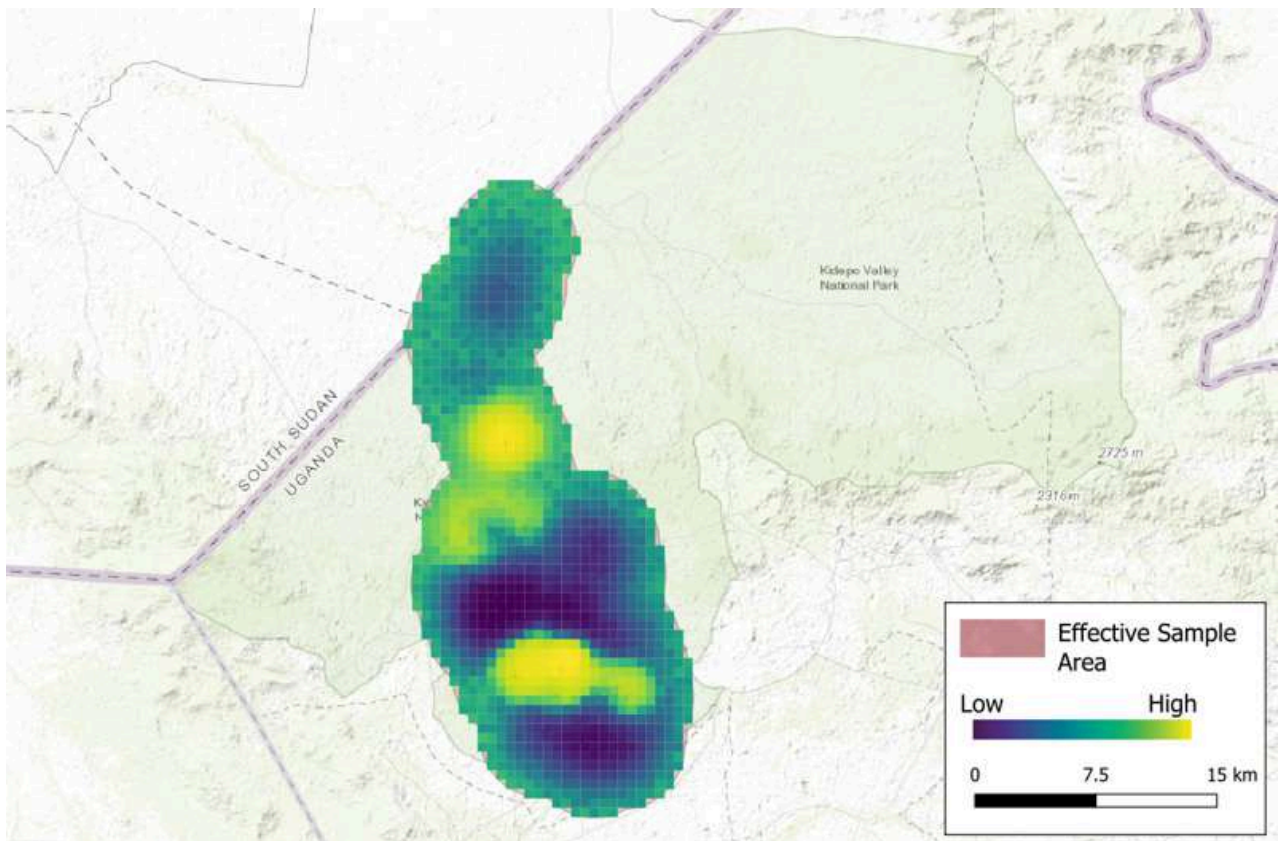
Figure 19. Map depicting an output from the spatial capture recapture analysis for leopard densities in KVNP. Shows pixel-specific leopard density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). Area totalled 432 km2 and 27.04 individual leopards (PSD=9.96) are estimated.

Discussion

Results show that the pressures observed on the lion population in Kidepo Valley are likely decoupled from African leopards and spotted hyenas. The mid-tier densities of leopards, and high densities of spotted hyenas (section to follow) suggest these species are not as exposed to the threats as those facing the lion population. It is suggested that a repeat survey be conducted into this leopard population in future.

2.3.2.4. African Leopards in the Lake Mburo National Park

Historic Figures

2018: In 2018 the leopard survey used 30 camera locations between 26th July 2018 and 16th September 2018 (53 days) and recorded a density of 6.31 individuals/100 km2 (posterior SD 1.47, 95% CI range [3.75–9.20]) and a posterior mean abundance for the Lake Mburo National Park was 24.87 (posterior SD 7.78).

Current Status

As part of the national survey of large carnivores we implemented a survey of African leopards across the entirety of the park from 2nd March to 20th April; a total of 50 days and 1377 trap nights using 32 camera trap locations. A total of 72 detections of 25 individuals (6 males, 16 females, 3 unsexed) were recorded. This put the estimate of leopard population density at 11.58 individuals/100 km2 (PSD=2.46) in this protected area.
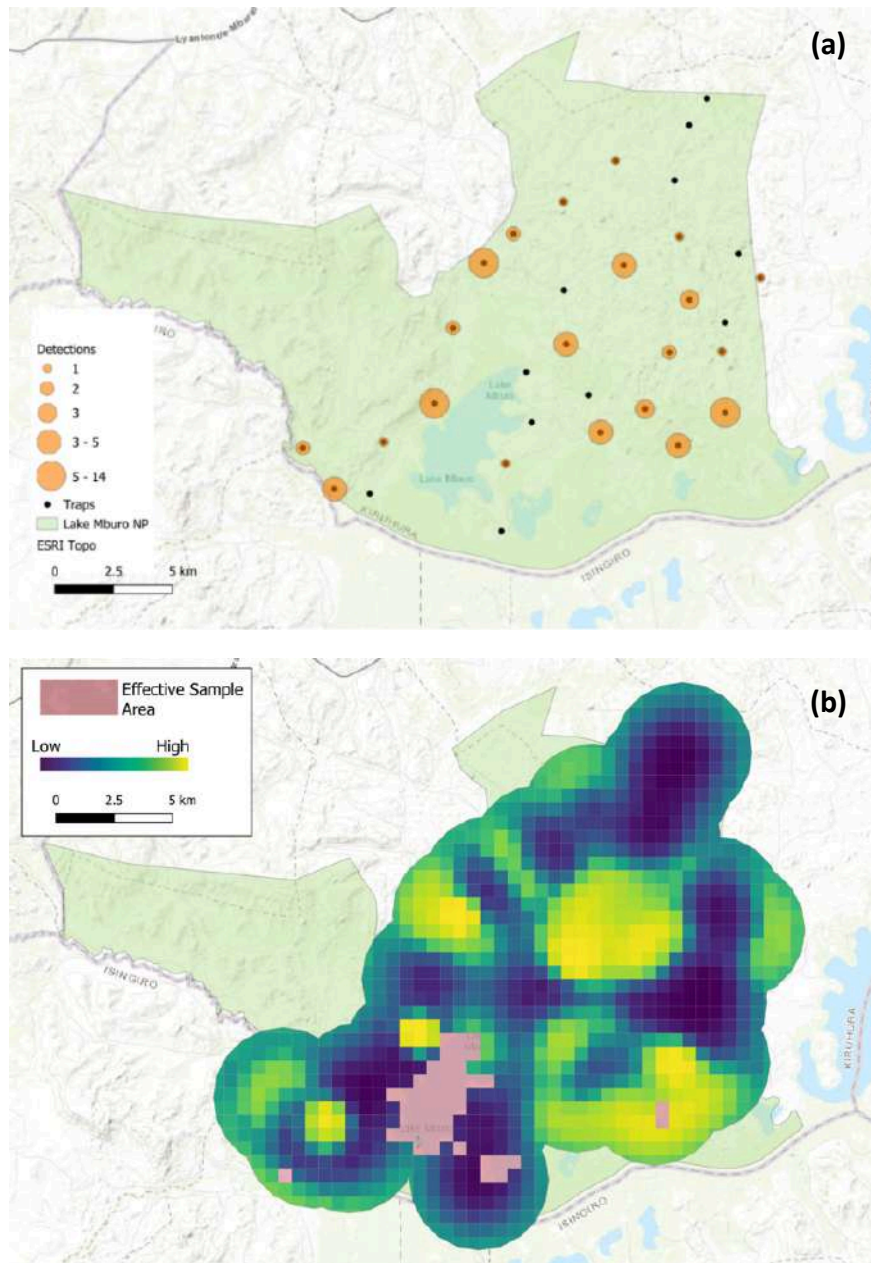
Figure 20. Tile (a) denotes the 32 camera trap locations in the LMNP along with their associated detections illustrated by sphere size. Tile (b) depicts an output from the spatial capture recapture analysis and shows pixel-specific leopard density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). Area equalled to 360 km2 and the leopard population density estimated at 42.85 individual (PSD=9.12).

Discussion

Results show that the leopard population in this area has increased since the 2018 survey. The 11.58 population density estimate lies beyond the confidence interval from the 2018 survey (i.e. 3.75 to 9.20 individuals/100 km2). However, spotted hyenas during this same period declined. It is recommended that due to the small size of LMNP and high rates of conflict associated with farming neighbouring communities; (see Braczkowski et al. 2020) this population continues to receive intensive surveillance and monitoring.

2.3.2.5. African Leopards in the Pian Upe Wildlife Reserve

Historic Figures

Pian Upe, until recently, was a relatively unstable wildlife area, with very little information available on its predators and prey base.

Current Status

As part of the national survey we surveyed leopards across the tourism and hunting zone of PUWR from 23rd February to 23rd April 2022; a total of 61 days and 858 trap nights using 28 camera trap locations. A total of 56 detections of 14 individuals (5 males, 9 females) were recorded. From these data a density of 1.60 leopards/100 km2 (lower 95% Highest Posterior Density (HPD) = 0.62, upper 95% HPD = 2.50, PSD=0.49) was generated. This estimate is amongst the lowest using SECR methods and represents the second lowest leopard density recorded in Uganda. Mean density from 17 studies in 20 locations was 5.0 individuals/100 km2; range = 0.62; 11.8 individuals/100 km2; (see Braczkowski et al. 2022).
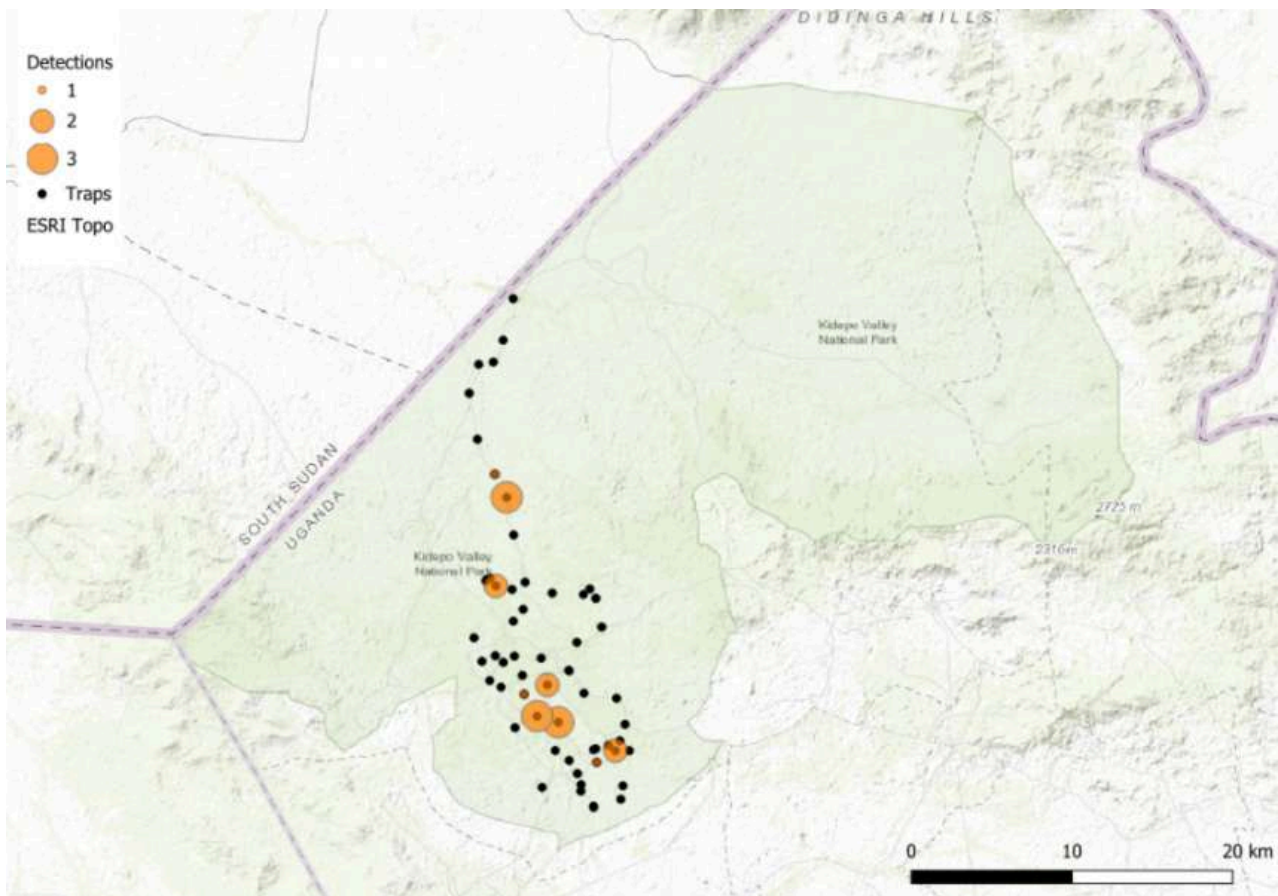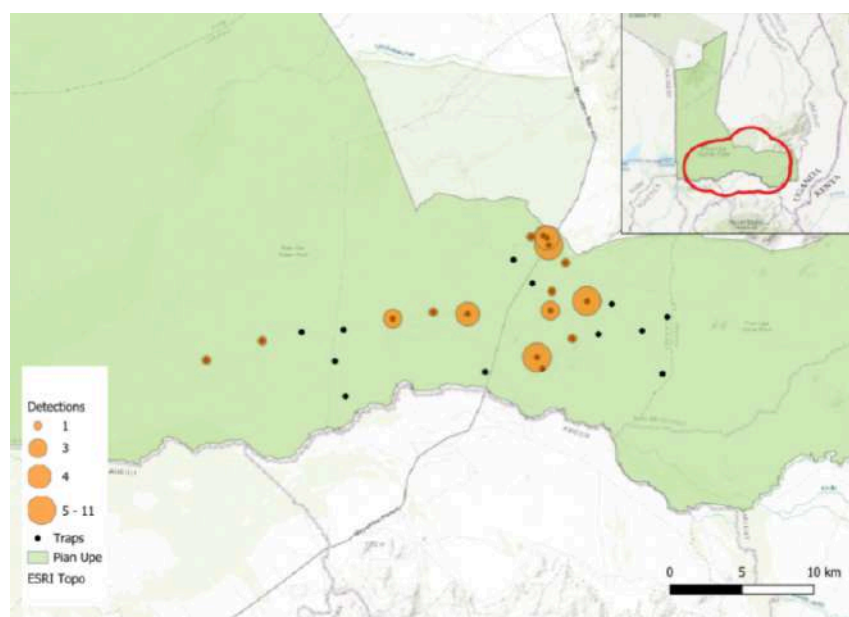

Figure 21. The 28 camera trap locations set during our 2022 African leopard survey in PUWR along with their associated detections illustrated by sphere size.
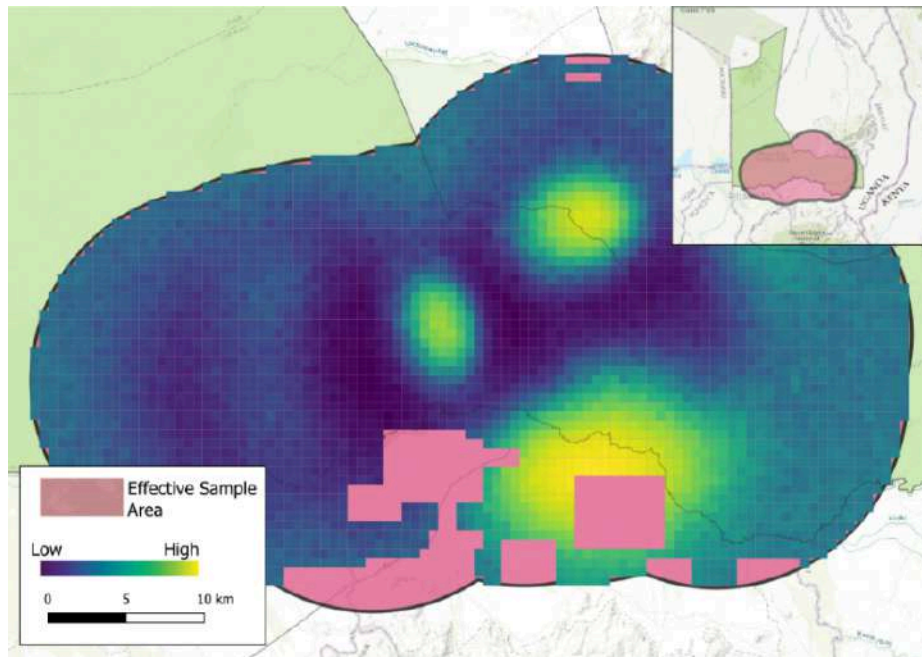
Figure 22. Map depicting an output from the spatial capture recapture analysis for leopard densities in Pian Upe Wildlife Reserve and shows pixel-specific leopard density within the effective sample area (created by calculating a buffer around the traps equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). Area equalled 1,357 km2 and 21.65 individual leopards estimated (PSD=6.60).

Discussion

It is hypothesized that a key reason leopard density in Pian Upe is low is due to lack of medium-sized prey which is typically preferred by leopards (especially that 15-40 kg in weight, Hayward et al. 2006). Based on field camera traps sessions, observations were regularly recorded of herds of hartebeest, buffalos, waterbucks, roans, and giraffes. However, no observations of smaller prey, other than the oribi (Ourebia ourebi) were recorded. This hypothesis needs further exploration through a series of distance sampling exercise to assess the integrity of the small-medium-sized ungulate component of this ecosystem. Indeed, this is the single biggest driving force leading to the hyper-abundant leopard populations of conservation areas like South Africa's Sabi-Sands (Balme et al. 2009) and Sri Lanka's Wilpattu National Park (Samarasinghe et al. 2022).

2.3.2.6. African Leopards in the Toro Semliki Wildlife Reserve

Historic Figures

There are no credible historic data available on the status of leopards or any large carnivore in the Toro Semliki Wildlife Reserve.

Current Status

This was the last survey site implemented as part of the nationwide survey in 2023. A total of 25 camera locations were deployed across the tourism network between January and March 2023. Despite the camera traps recording, 407 nights of survey effort, there were no detections of leopards during the course of this time period.

Discussion

There may be leopards in TSWR but it is likely, they occur in very low numbers. For comparison, in Pian Upe, despite occurring at a low density of 1.60 individuals/100 km2 we still managed to obtain 56 detections of 14 individual leopards in the 2-month-long survey. We also do not ascribe the lack of detections to some detection problem as cameras were set along main tourism tracks and animal trails – a pattern consistently followed across all of the study sites.
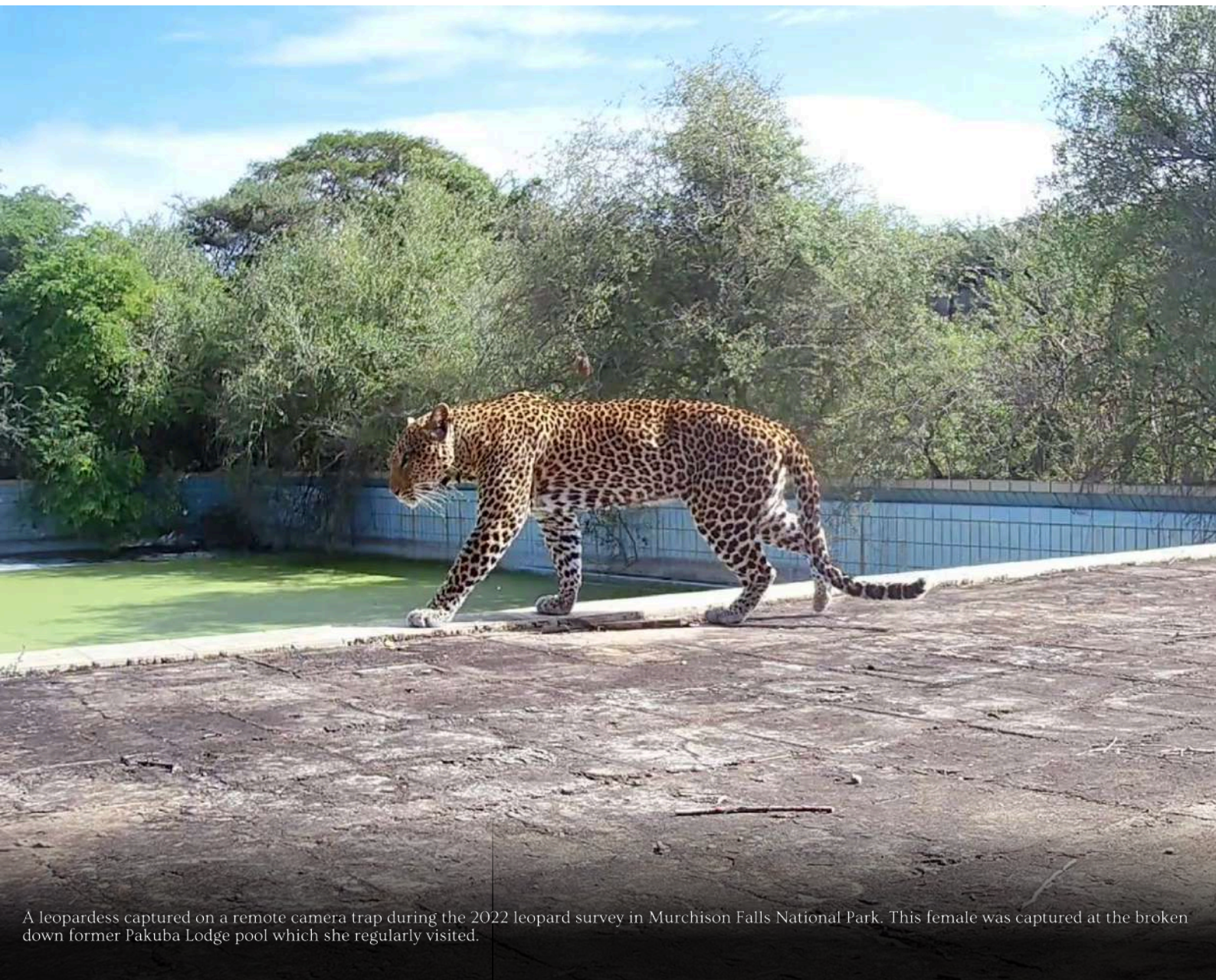
A leopardess captured on a remote camera trap during the 2022 leopard survey in Murchison Falls National Park. This female was captured at the broken down former Pakuba Lodge pool which she regularly visited.

2.3.3. Spotted Hyenas

Similarly to the African leopard, no national survey of spotted hyenas has ever been conducted in Uganda and no empirically derived national estimate for the species exists. As such, the 2010 to 2020 Large Carnivore Action Plan only featured sightings data from UWA rangers. There has also not been a formal attempt to assess the densities or abundance of the species outside of the formally designated protected areas to date.

The only population work performed on spotted hyenas in Uganda was in 2018 when Braczkowski et al. (2022a and b) initiated systematic surveys in LMNP and QENP to estimate spotted hyena population numbers. In 2022 and 2023, surveys were conducted in specific regions of interest in the following protected areas: QENP, MFNP, KVNP, LMNP, PUWR and TSWR.

Figure 23. A spotted hyena photographed in the Kyambura gorge in 2018 with a high resolution DSLR camera trap. The gorge is comprised of tropical rainforest and is home to hyenas, chimpanzees, lions, and a community of forest ungulates.

Table 4. Spotted hyena population summary table noting key results for camera trap surveys conducted in 2022 and 2023 within an SECR framework.

Location	Survey Date	Survey Duration	Area of inference (km2)	Spotted Hyena Density (Posterior SD)	Spotted Hyena Abundance (Posterior SD)
QENP (Kasenyi - Craters)	20 Dec 2022 – 20 Jan 2023	32 days	219	34.28 (9.09)	75.06 (19.91)
QENP (Ishasha)	24 Jan 2023 - 28 Feb 2023	36 days	386	22.07 (3.73)	86.18 (14.40)
MFNP	23 April - 20 June 2022	59 days	355	45.31 (5.42)	160.86 (19.23)
KVNP	14 Sept - 8 Dec	60 days	423	29.71 (6.11)	125.68 (25.83)
LMNP	2 March - 20 April 2022	50 days	370	6.15 (1.42)	22.76 (5.26)
PUWR	23 Feb - 23 April 2022	61 days	939	16.13 (4.5)	151.47 (42.29)
TSWR	24 April – 1 June 2023	39 days	Camera traps set in the tourism zone	None detected	None detected

2.3.3.1. Spotted Hyenas in the Queen Elizabeth National Park

Historic Figures

2018: Two hyena surveys were conducted in Queen Elizabeth in 2018 and two core sites were assessed, the northern Kasenyi, Crater, Mweya region (north of Kazinga Channel), and the southern Ishasha area. The first region was surveyed from 8th March to 25th April 2018 and encompassed 44 camera-trap sites while the second area was assessed across 30 locations from 27th April 2018 to 24th June 2018. Hyena densities were estimated to be 13.44 (95% Highest Posterior Density, HPD = 9.01-18.81) and 14.07 (95% HPD = 8.52–18.54) individuals/100 km2 for the north and south of the conservation area, respectively.

Current Status

In 2022 the northern Kasenyi survey yielded 15 individual hyenas detected 18 times. This data generated a density of 34.15 individuals/100 km2 (PSD=9.03). The Ishasha survey yielded 227 detections of hyenas (42 individuals) and from this we generated a density of 22.07 hyenas/100 km2 (PSD=3.73). Based on their respective 2.44 sigma values we estimated abundances of 75.06 (PSD=19.91) and 75.06 (PSD=14.40) in the northern and southern regions of the park.

Figure 24. Tile (a) Locations of camera traps in the 2022 Kasenyi-Craters spotted hyena survey along with their corresponding hyena detections. Tile (b) depicts the 2.44 sigma area (386 km2) around our camera traps in the Kasenyi-Craters region which denotes the hyena density in this area. This area contained an estimated 75.06 individual hyenas (PSD=19.91).

Figure 25. Tile (a) Locations of camera traps in the 2022 Ishasha spotted hyena survey along with their corresponding hyena detections. Tile (b) depicts the 2.44 sigma area (219 km2) around our camera traps in the Ishasha region which denotes the hyena density in this area. This area contained an estimated 86.18 individual hyenas (PSD=14.40).

Discussion

This hyena density estimate represents a slight increase from the 2018 survey in Ishasha and shows the Ishasha hyenas to be largely stable. This also illustrates more resilience in hyena populations compared to lions. However, the northern population of hyenas was more than double the density - we suspect this could be due to low sample sizes creating a faulty estimate.

2.3.3.2. Spotted Hyenas in the Murchinson Falls National Park

Historic Figures

The 2010-2020 Action Plan for large carnivores did not include any data on hyena densities or abundance, and data on hyenas in Murchison are virtually non-existent other than some sightings data provided in the last edition of the National Action Plan (2010-2020).

Current Status

In the 2022 survey field teams focused on the Nile Delta tourism zone of the national park. Due to the extensive size of Murchison, it was impractical to provide a park-wide picture of the density and abundance of hyenas, however a comprehensive assessment of the ~300 km2 delta region could be given. Camera traps were deployed at 32 unique locations between 23rd April to 20th June; a total of 59 days and recorded a density of 45.31 individuals/100 km2 (posterior SD=5.42). Importantly this is not only the highest density of hyenas in Uganda, but comparable to some Tanzanian sites.
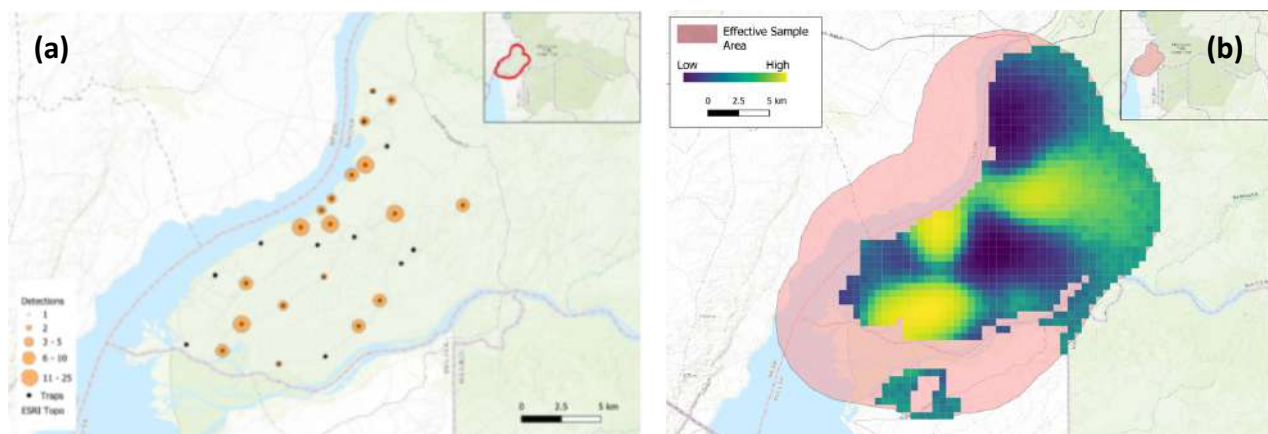
Figure 26. Tile (a) Locations of camera traps in the 2022 Murchison Falls National Park spotted hyena survey along with their corresponding hyena detections. Tile (b) depicts output from the spatial capture-recapture analysis in Murchison Falls National Park showing pixel-specific spotted hyena density within the effective sample area created by calculating a buffer equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). In this area (355 km2) we estimate a total of 160.86 hyenas (PSD=19.23).

Discussion

This spotted hyena density estimate is not only the highest in Uganda, it is the highest recorded using SECR in Africa – again these data confirm the presence and functionality of an intact guild and source population of large carnivores in MFNP.

2.3.3.3. Spotted Hyenas in the Kidepo Valley National Park

Historic Figures

The 2010-2020 Action Plan for large carnivores did not include any data on hyena densities or abundance in the Kidepo Valley National Park and the north of Uganda generally.

Current Status

The results from a spotted hyena survey implemented from 14th September to 8th December 2022 are presented; this ran for a total of 86 days in the Narus and Kidepo valleys of KVNP. During this survey a density of 29.71 individual hyenas/100 km2 (posterior SD = 6.11) was recorded and an abundance of 125.68 (PSD=25.83) individuals were estimated in the 423 km2 effectively sampled area our camera traps covered.
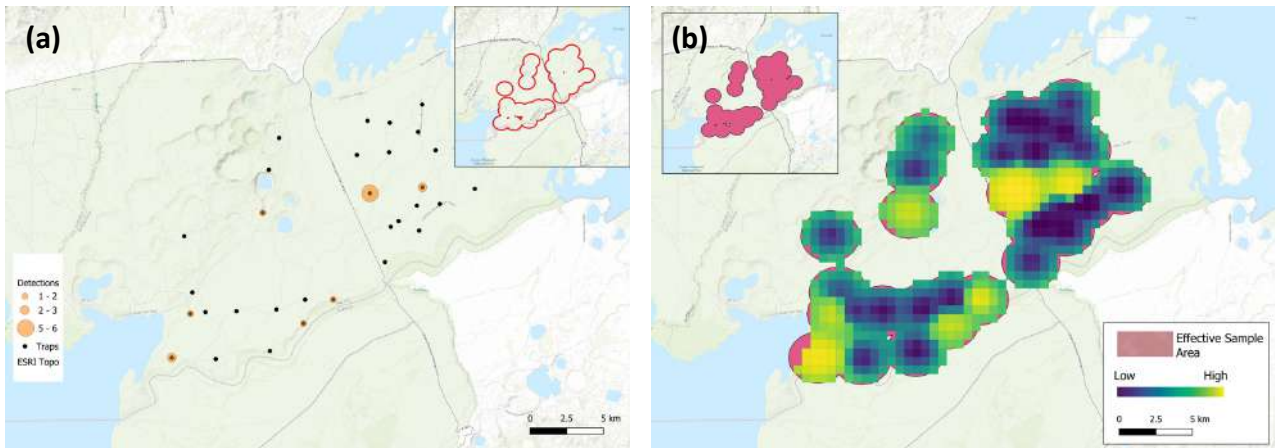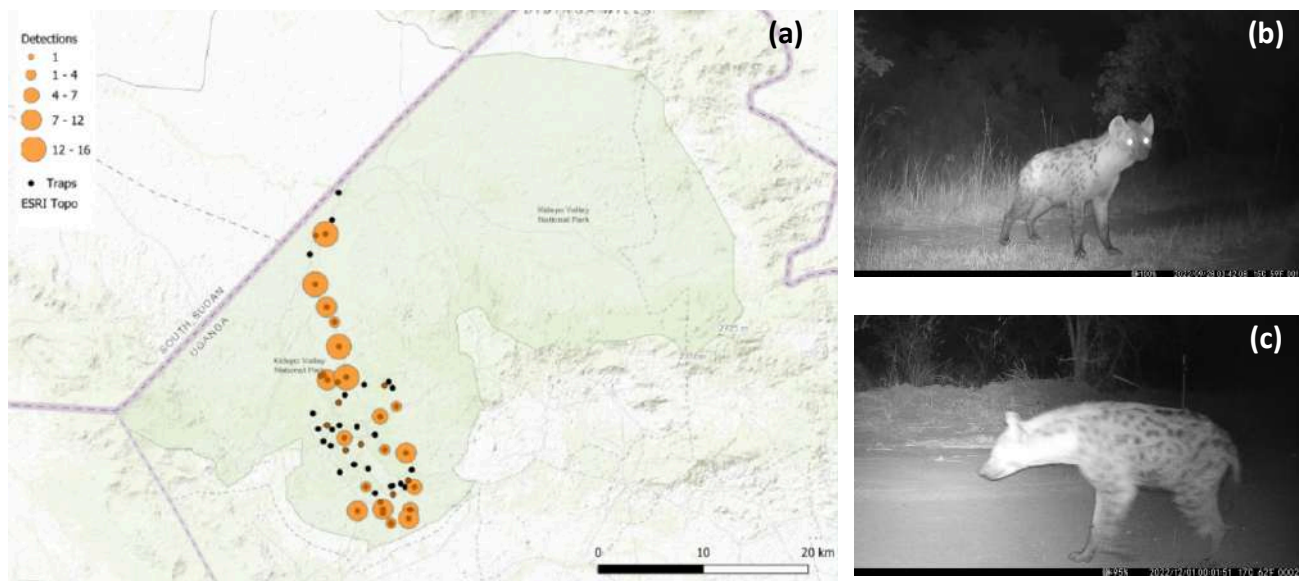

Figure 27. Tile (a) Locations of camera traps in the 2022 Kidepo Valley National Park spotted hyena survey along with their corresponding hyena detections. Tile (b) shows a spotted hyena caught on a camera trap near the Katurum Lodge on September 28th 2022, while Tile (c) shows an individual caught on Tongobore junction on December 1st 2022.
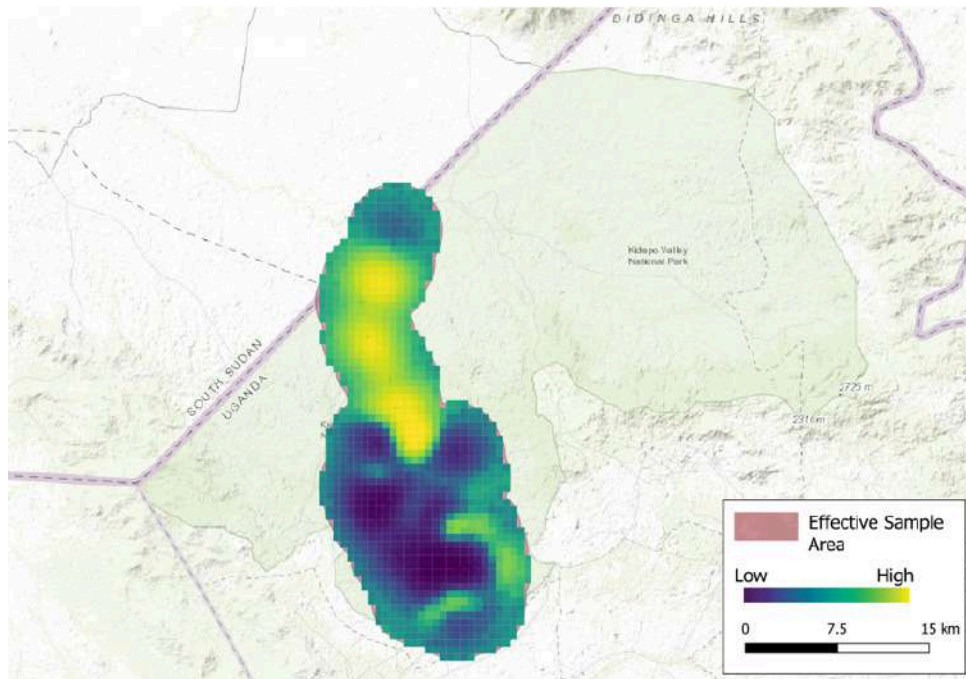
Figure 28. Output from the spatial capture recapture analysis in Kidepo Valley National Park showing pixel-specific spotted hyena density within the effective sample area created by calculating a buffer equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). In this area (423 km2) we estimate a total of 125.68 hyenas (PSD=25.83).

Discussion

The results from the 2022 spotted hyena survey point to the second highest density in the country. The results also depict a hyena population that is more resilient to human pressures than the lion population in the KVNP.

2.3.3.4. Spotted Hyenas in the Lake Mburo National Park

Historic Figures

2018: In 2018 a spotted hyena survey was implemented by Braczkowski et al. (2022) and used 30 camera locations between 26th July 2018 and 16th September 2018; a total of 53 days. This translated into a recorded population density of 10.99 individuals/100 km2 (posterior SD 3.35, 95% with confidence interval range of 5.63 to 17.37 and the posterior mean abundance for the LMNP was 39.07 (posterior SD 13.51).

Current Status

The 2022 survey featured 32 locations and was implemented from 2nd March to 20th April, a total of 50 days, recording a density of 6.15 hyenas/100 km2 (posterior SD = 1.42), and an abundance of 23 individuals in the park.
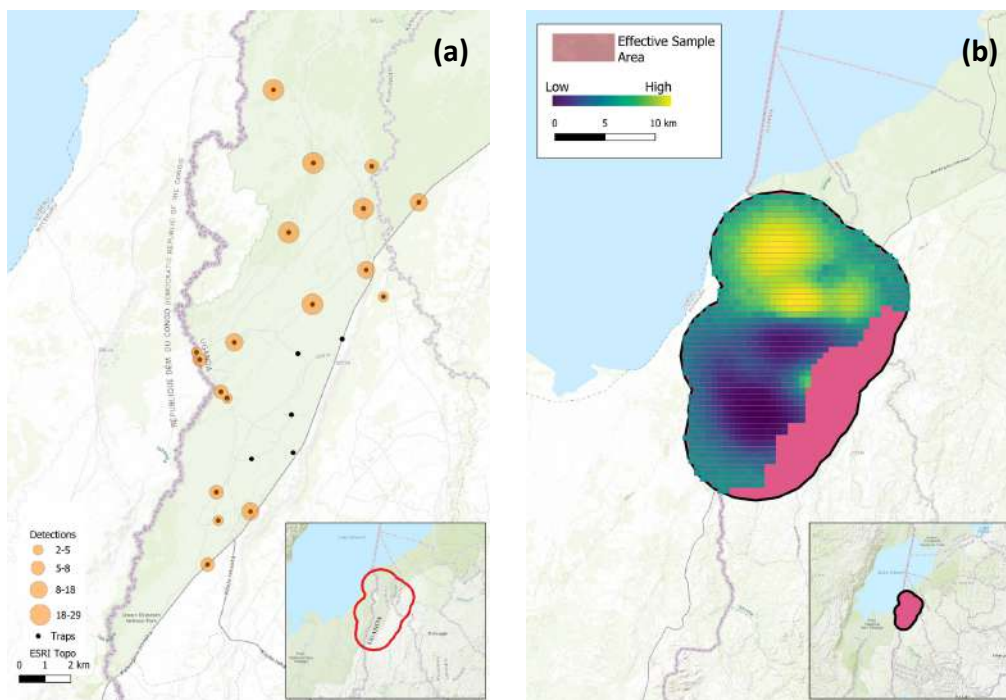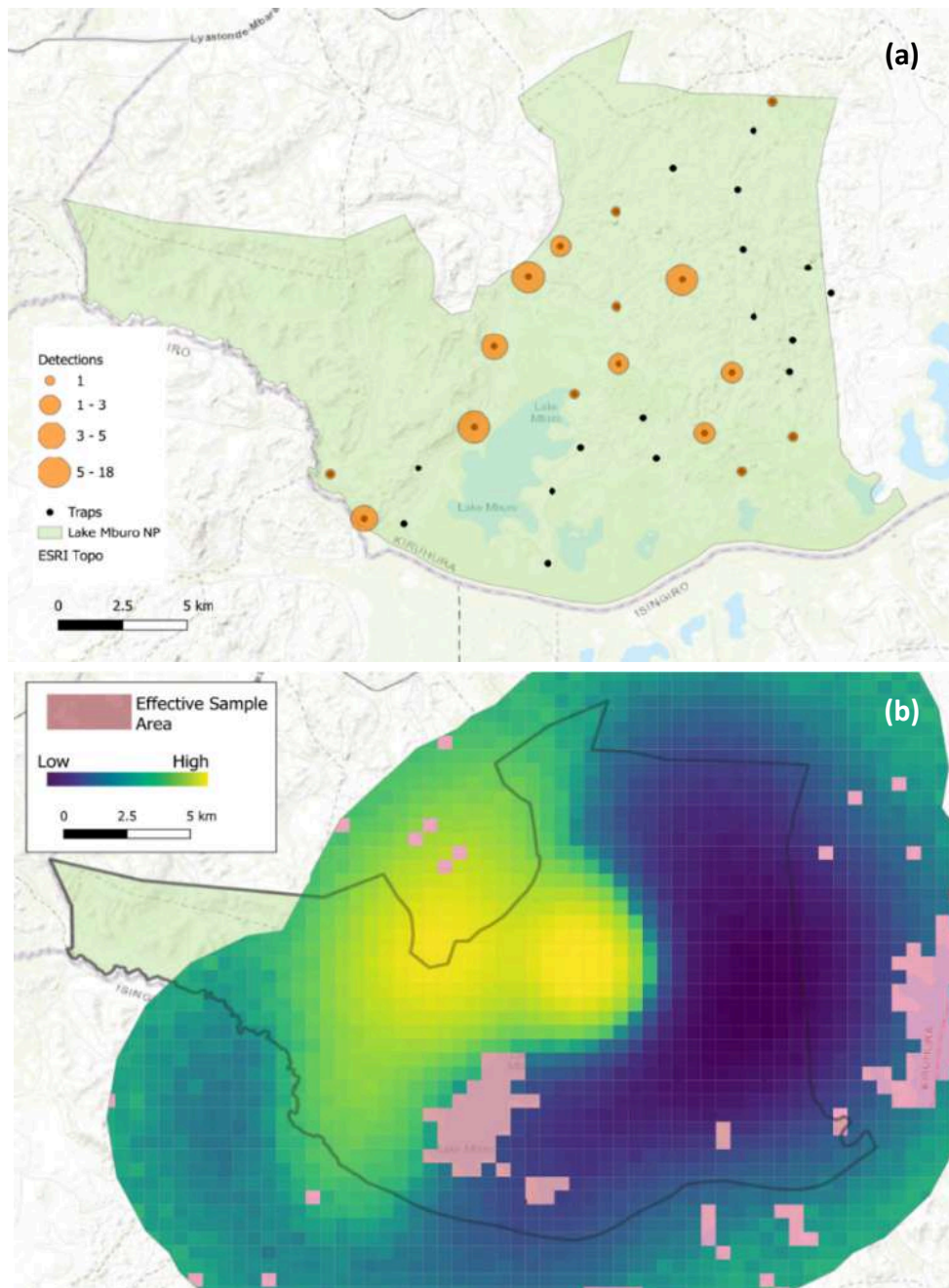
Figure 27. Tile (a) Locations of camera traps in the 2022 Lake Mburo National Park spotted hyena survey along with their corresponding hyena detections. Tile (b) depicts output from the spatial capture recapture analysis in Lake Mburo National Park showing pixel-specific spotted hyena density within the effective sample area created by calculating a buffer equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). In this area (370 km2) we estimate a total of 22.76 hyenas (PSD=5.26).

Discussion

The results indicate that the hyena population in this protected area has declined and this is in line with reports of recent poisonings by farmers on the edge of the national park (Ralph Schenk pers. comm.). It should be noted that spotted hyenas in LMNP are the main conflict species that cause the most financial damage in the farming communities neighbouring the Park (Braczkowski et al. 2022a).

2.3.3.5. Spotted Hyenas in the Pian Upe Wildlife Reserve

Historic Figures

Pian Upe until recently was a relatively unstable wildlife area, with very little information available on its predators and prey base.

Current Status

We present the results of a hyena survey implemented from 23rd February to 23rd April 2022; a total of 61 days in the tourism and hunting zone of the reserve. Spotted hyena density for PUWR was estimated at 16.13 hyenas/100 km2 (PSD=4.50) and an abundance of 151.47 (PSD=42.29) was estimated in an area of 939 km2.
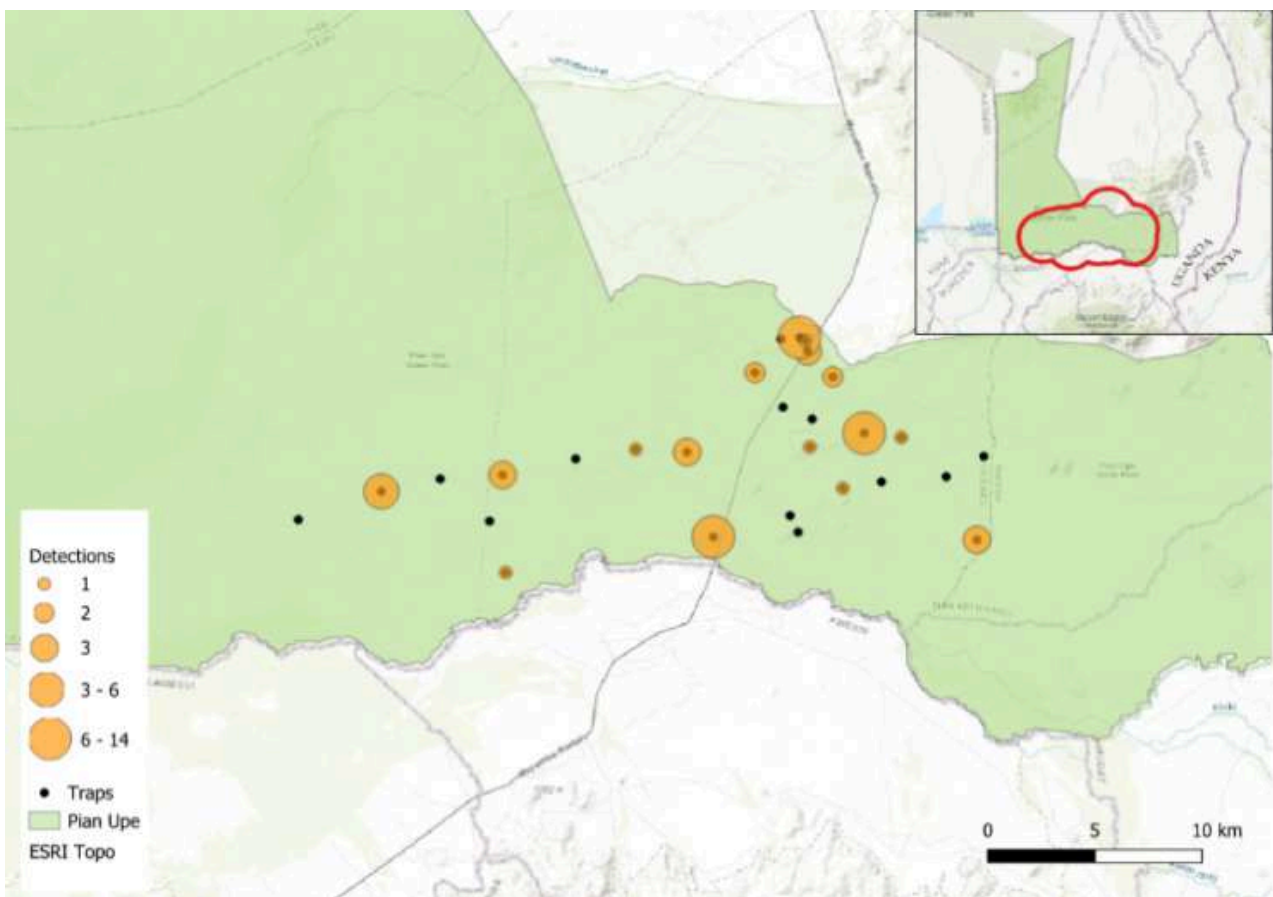
Figure 28. Locations of camera traps in the 2022 Pian Upe Wildlife Reserve spotted hyena survey along with their corresponding hyena detections.
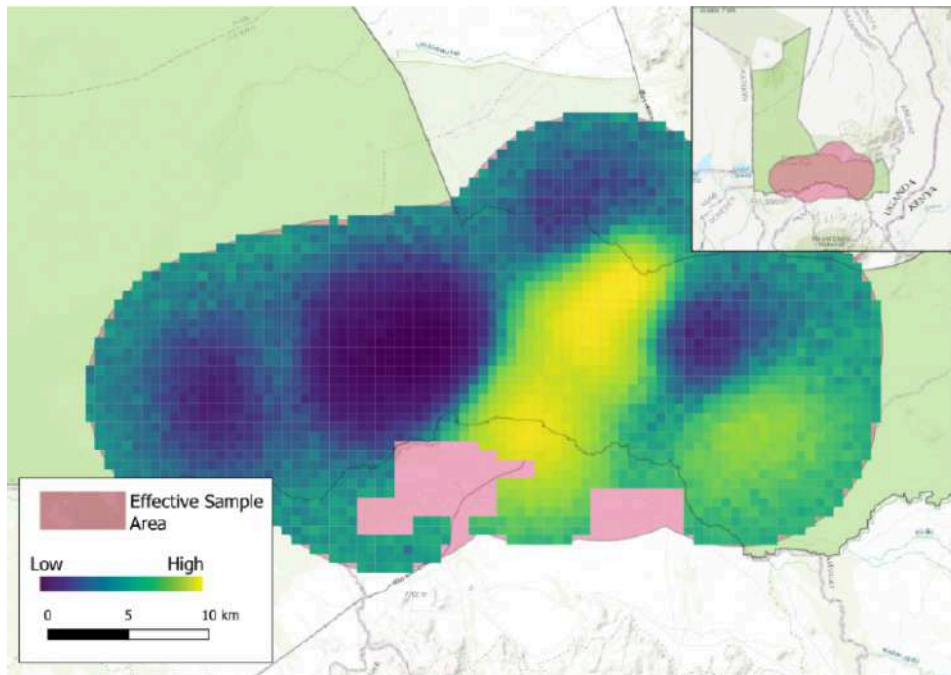
Figure 29. Output from the spatial capture recapture analysis in Pian Upe Wildlife Reserve showing pixel-specific spotted hyena density within the effective sample area created by calculating a buffer equivalent to 2.44 * the estimated value of sigma (an estimated parameter that is informative about movement). In this area (939 km2) we estimate a total of 151.47 hyenas (PSD=42.29).

Discussion

It is hypothesized that the presence and evident recovery of large prey layer may be buoying the hyena population here when compared to leopards which rely on smaller prey, as well as the localised extinction of African lions.

2.3.3.6. Spotted Hyenas in the Toro Semliki Wildlife Reserve

Historic Figures

There are no credible historic data available on the status of hyenas or any large carnivore in the Toro Semliki Wildlife Reserve.

Current Status

This was the last survey site implemented as part of the nationwide survey in 2023. 25 camera locations were deployed across the tourism network between January and March 2023. Despite the camera traps recording 407 nights of survey effort we detected no spotted hyenas.

Discussion

There may be hyenas present in the Toro Semliki area but it is likely they occur in very low numbers.

2.3.4. Cheetahs and African Wild Dogs

Cheetahs continue to persist in at least two protected areas of Uganda: KVNP and PUWR. During the 86-day-long survey of African leopards and spotted hyenas in Kidepo from 14th September to 8th December 2022, we detected a coalition of two male cheetahs in the Narus Valley on multiple occasions. These individuals appear to be the same coalition regularly sighted by tourists in the valley. In PUWR a female cheetah and her three sub-adult cubs were detected during a two-month camera trap survey in early 2022 in the Napadet region of the reserve. A young male near the Mukalazi barracks in the same reserve was also photographed. African wild dogs have been feared extinct in Uganda, however on the 1st of June 2023 a pair was photographed in the Narus Valley of the Kidepo Valley National Park (see: https://phys.org/news/2023-06-african-dogs-uganda-decades.html). The pair are likely transient from neighbouring Kenya or South Sudan.

Figure 30. Three subadult cheetah cubs in the Napadet region of the Pian Upe Wildlife Reserve photographed on February 28th 2022.

Chapter 3

3.1. Threat Analysis by Protected Area

Stakeholders attending the consultative Action Plan workshop in Kampala identified several key problems facing the conservation of large carnivore species in Uganda. Focused group sessions detailed these problems not only by protected area but also by threat priority. They represent a blend of social and ecological threats, but at their core they are socioeconomic in nature and interlinked. A threat analysis for each protected area is given below as well as a summary of the key threats in each site. This is to delineate the priority threats and site-specific contexts which may not be relevant of other conservation areas (e.g. Murchison Falls' unique oil extraction situation is vastly different to the cattle farming activities within Queen Elizabeth and vice versa).

These threats and their associated conservation actions for large carnivore species conservation in Uganda are built around a theory of change which recognises that urgent policy and management are required to reduce and/or reverse threats that have exacerbated their declining population trends over the past decade (especially for lions).

3.1.1. Queen Elizabeth Conservation Area (National Park and Wildlife Reserves)

The Queen Elizabeth Conservation Area (QECA) is arguably the most complex protected area system in Uganda. The conservation area has approximately 60,000 people living within its borders, mainly distributed across its 11 fishing villages. Some of these villages like Hamukungu and Kasenyi have large livestock populations yet, these are the regions where the highest densities of lions exist.

Figure 31. Hamkungu village in QENP shows the complexity of having a fishing village with cattle in the heart of some of the best lion habitat. Originally demarcated as fishing villages, many of these now have large cattle populations which directly conflict with lions and other carnivores.

The recent African lion surveys indicate that lion densities are on a rapid decline and this can be attributed to; 1) human-lion conflict and the retaliatory killings by pastoralists contributing to lion declines, 2) snaring of lions and prey, particularly in the Ishasha and Kigezi regions of the park, and 3) habitat loss. There is a plethora of examples of lions losing limbs, being wounded or being killed in wire snares in these regions and this has contributed to the fracturing of lion prides.

3.1.2. Murchison Falls National Park

The recent carnivore population survey indicates that MFNP is by far the best protected area for large carnivore persistence in Uganda. This could be due to not only its large size (4500 km2) but also the largely absent feature of large cattle farming communities within the park and on its borders. Where livestock communities overlap with high density lion areas, the lion populations tend to decline over time in Uganda but also throughout lion rangelands (Schutte et al. 2013). Studies have advocated for minimizing overlap between livestock and lion habitats to reduce conflict (Beattie et al. 2020).

Figure 32. Bulldozers and compacters line up on the road construction project stretching from Tangi gate to the Nile River bridge crossing. This road extends through the heart of the park and will facilitate large tankers in their oil delivery activities. Photograph: Alamy.

The Murchison Falls National Park seems to benefit from this lack of significant overlap. Surprisingly, for all the three carnivore species, densities are highest in the broader area within and around where oil activities are ongoing. This is despite oil exploration and extraction activities that include 3D seismic tests, test drilling and exploratory oil well drilling and infrastructure development including major roads and oil pad constructions which would be considered as destructive to the environment. Except for short-lived displacement reported by Mudumba and Jingo (2015), and other wildlife displacement reported by Ayebare (2011), there has not been any evidence of negative impacts of oil extraction on lions so far.

Ironically, this same area of MFNP that proved to have the highest density of lions also had the highest snaring levels in the park. Thus, UWA and other key anti-poaching NGO's focus their activities in this region (including UCF, Snares to Wares). At 56 snares/km2 (the highest in Africa to date) there is immense pressure for bush meat in Murchison, but law enforcement and de-snaring activities seem to have a net-positive impact and holding off the tide of pressure. However, it is difficult to know the baseline lion, leopard, and hyena numbers 15-20 years ago because the methods used to estimate lion population then are not comparable or no studies were done at all. This poor population monitoring implemented in the Park has led to several years without population estimates and adds credence to the need to develop a robust framework to monitor lions and other carnivores in a standard and regular way.

3.1.3. Kidepo Valley National Park

Figure 33. The vast expanse of the Kidepo Valley National Park's Narus Valley. Despite significant prey numbers in the Narus itself lions have almost completely disappeared from the park as evidenced by the 2022 lion survey. Photograph: Wikimedia Commons.

Located at the northernmost edge of the country, Kidepo Valley National Park is one of Uganda's most remote parks, with low human densities and associated pressures from livestock farming. However, there are transhumant cattle keepers that occasionally traverse the Kidepo Valley section of the Park. Therefore, despite its remoteness and healthy buffalo populations that can sometimes be more than 1,000 individuals in a single aggregation in the Narus Valley, the lion population surveys revealed extremely low densities of African lions in the Park. Evidence collected during the 2022 population survey of carnivores in the park revealed at least three lions were killed by two poachers in Karenga village in just over three months, suggesting lions may be targeted in this park for their body parts. More information and data is needed to confirm this. Spotted hyena densities which are over 10x higher than for lions lend some further evidence that lions are being disproportionately targeted.

3.1.4. Pian Upe Wildlife Reserve

Population surveys of large carnivores in this region highlighted the potential for their conservation and recovery, especially for African lions which became locally extinct decades ago. The spotted hyena survey revealed that densities of this species reached 16.13 individuals/100 km2 which is the fourth highest density out of the six protected areas that were surveyed. This suggests that there is a good large-sized prey base in the region, especially species like waterbuck, hartebeest, roan antelope, and buffalo. Contrastingly, leopard densities were found to be low at 1.6 individuals/100 km2. However, this is likely the result of the very low densities of small to medium-sized prey (e.g. Uganda kob, impala) with some oribi present west of the Reserve and headquarters camp area. Through a co-management agreement with Space for Giants and UWA and the involvement of a sport hunting concession the strategic plan recommends that this area should be intensively managed and monitored over the next ten years to examine the possible recovery of wild prey and carnivore species populations currently happening here.

3.1.5. Lake Mburo National Park

Lake Mburo, although one of the smallest protected areas in Uganda, appears to be locally important for African leopards with densities that appear to be not only stable but possibly increasing. Importantly however, the surveys from 2018 and 2022 indicate that hyenas are likely on the decline. This corresponds to recent reports of hyena clan poisonings on the edge of the park (Ralph Schenk, pers.comm). Hyenas prefer larger prey and this includes cattle, which may drive hyena-farmer conflict and result in retaliatory killing. This may explain the better population performance of leopards (Braczkowski et al. 2022 showed that leopards preferred smaller prey when feeding on domestic stock, mainly goats). It should be noted that a key threat in this region is the loss of habitat on the park edge and outside the park boundary – this cattle grazing thicket matrix is becoming increasingly modified to increase the capacity of cattle grazing in the region.

3.1.6. Toro Semliki Wildlife Reserve

This wildlife reserve recorded no large carnivores despite 39 days (407 trap nights) of camera trap survey effort. Reports from UWA scouts and field guiding logbooks from Semliki Safari Lodge shows a decline in African lion, leopard and hyena sightings over time. Snaring appears to be a key concern in this region as is the presence of cattle farmers on the park boundary.

3.2. Prioritised Key Threats facing Large Carnivore Species Conservation in Uganda

The analysis of threats to large carnivore species conservation in Uganda revealed that key threats include; habitat degradation and fragmentation (driven by climate change, invasive species, infrastructure development, extractive industries, among others), loss of migratory corridors, human-carnivore conflicts, diseases, retaliatory killings, poaching, illegal trade in carnivore parts e.g. lion body parts, among others. During the consultative stakeholders' workshop, a questionnaire was administered. One of the parameters assessed from participants was the main causes of the declining trends of large carnivore species populations in Uganda. Results showed that majority of respondents identified poaching as the main cause of the decline of carnivores. This included the retaliatory killing of carnivores, killing for their body parts as well as the killing of prey thereby diminishing the available prey base. A total of 37% of respondents indicated that poisoning was a major cause, usually as a retaliatory killing. Habitat loss and habitat degradation accounted for 54% of the causes indicated by participants due to encroachment by people and cattle as well as invasive species. A last major listed contributor to the decline of large carnivores was inadequate law enforcement and general poor management of protected areas for carnivore species conservation.

3.2.1. Poaching

3.2.1.1. Snaring for Bush Meat – Use of Wheel Traps and Wire Snares for Poaching

Local consumption of bush meat is typically restricted to ungulate species but comprises all terrestrial mammals harvested from the wild (Cawthorn and Hoffman 2015). Bush meat is a subset of vital wild nutrients that millions of people depend on throughout the world. In the global south, bush meat forms a significant proportion of all food intake and some communities would perish without it (Diaz et al. 2006, Thompson and Amoroso 2011). At the same time, global biodiversity including populations of most prey species are declining at unprecedented rates in what some are terming as the 6th mass extinction. This is the first human-driven extinction event and has been attributed to unsustainable use. One of the most common ways of harvesting wild protein is the use of snares. Snares are widespread globally and made from a variety of materials mostly freely sought. Although set to catch ungulate species, snares are indiscriminate and are just as likely to catch non-target species (Mudumba et al. 2021). Given the relatively lower number of non-target species compared to the target species, snares can have a disproportionate impact on species – such as carnivores that occur at lower densities (Mudumba et al. 2021). Poachers also use wheel traps (the North American equivalent of a bear trap) across Ugandan protected areas. This trap regularly kills its victim by trapping or even amputating a limb (see Figure 34).

Figure 34. A poacher with gin trap (or commonly known as wheel trap) apprehended in the Murchison Falls National Park in 2009.

In Uganda, snaring is listed as the major threat to large carnivores, even as a preceding threat to human-carnivore conflict from livestock production mainly because it is pervasive across every major protected area in the country. In-fact, Murchison Falls had as many as 4.58 snares/km2 the highest density recorded globally in some regions of the park (Mudumba et al. 2021). Unpublished field reports show similar snare pressures appear to be operating in Queen Elizabeth

National Park, especially in the Ishasha and Kigezi regions of the park where multiple study and monitoring animals collared by the Wildlife Conservation Society and Uganda Conservation Foundation have been either been maimed or killed in wire snares (Figure 35). This study found a hyena in a wire snare in Toro-Semliki National Park and no other carnivores were recorded (Orin Cornille and Bosco Atukwatse pers. comm). While snaring is not prevalent in Kidepo Valley National Park, Mudumba et al. (Unpublished data) found that the number of snares collected during ranger patrols in KVNP between 2016 and 2022 had steadily increased by 20% per year which highlights snaring as a growing threat in KVNP.

Snaring is also holding the population of lions in the largest protected area (MFNP) at an artificial asymptote (Mudumba et al. 2021). Montgomery et al. (2023) shows that if snare density can be reduced by 2.79 snares/km2 African lions in MFNP could reach the natural carrying capacity within just two generations. Therefore, snaring is the largest threat to the persistence of carnivores in Uganda's savannah parks. This is exacerbated by declining prey numbers, and to a lesser degree declining habitat quantity and quality.

Figure 35. Dr Ludwig Siefert, director of the Uganda Carnivore Program treats a snared lioness named Naturinda from the Kigezi Wildlife Reserve, QENP. Snaring rates in Ishasha and Kigezi are high and often lions are caught in snare wires. Photo: Steve Winter.

3.2.1.2. Targeted Poaching of Carnivores

Evidence points to this threat as an emerging concern in recent years, especially for African lions in the country. It is a critical threat because of the low numbers of lions in Queen Elizabeth and Kidepo Valley National Parks. In 2021 and in 2022 the Uganda Wildlife Authority noted two direct poaching events 1) the poisoning of six lions in the tourism circuit of Ishasha, Queen Elizabeth (these lions were poisoned and their faces, and paws cut off for the lion body part trade, see: https://www.monitor.co.ug/uganda/news/national/killed-lions-were-targeted-for-trade-rdc-3337034), and 2) a poacher in Karenga was caught with a lion in a sack full of meat and another was caught with the head and body parts of a lion collared by the Uganda Conservation Foundation during the lion and carnivore survey in Kidepo in late 2022 (Figure 36).

Figure 36. Tile (a) shows UWA staff and UCF members gather around one of the six poisoned African lion carcasses found in the tourism circuit of Ishasha sector in March 2021. Tile (b) shows a poacher convicted in Karenga district after being found in possession of an African male lion poached in KVNP. This male lion was one of the few individuals photo captured during the 2022 KVNP lion survey.

3.2.2. Human-Carnivore Conflict attributed to Livestock Production

The spatial overlap between livestock and large carnivores is widely known to cause problems to both livestock farmers and big carnivores. Farmers incur economic losses when carnivores prey on their livestock as they are easier to catch than wild game. The carnivores suffer, when livestock farmers retaliate through direct killing or poisoning left over carcasses. Poison not only kills the carnivores, but a horde of other wildlife including birds of prey, mesocarnivores like jackals, foxes, and badgers, which further threatens the larger predator guild in a region. Human-carnivore conflict is particularly rife in Uganda in the regions where cattle, sheep, and goat farming occurs inside or bordering protected areas. The most important regions where this occurs is in 1) QENP (Kasenyi, Katunguru, Hamukungu, Katwe, Kazinga villages, and Bwentare), 2) LMNP (the park is small at ~370 km2 and is surrounded by cattle farming communities), 3) TSWR (this region experiences intense pressure from neighbouring pastoralists and there is little evidence from the 2022/2023 survey that carnivores remain in any appreciable number in this reserve), and 4) PUWR (in Pian Upe, Kenyan Pokot farmers drive thousands of cattle into the wildlife reserve daily). Although this activity is illegal it is a significant clash of cultural herding practiced by a Kenyan tribe and the Ugandan authorities (Figure 37). Similarly, in Toro Semliki the Batuku tribe graze their livestock, mainly cattle within the boundaries of the wildlife reserve.

Figure 37. Pokot herders examining a remote camera trap set during the month of March 2022 as part of the National Carnivore survey in Uganda. Every day Pokot herders bring their cattle from Kenya, and sometimes camp inside the park. This has impacts on large carnivores and their prey inside the reserve, but also creates conflict with the local wildlife authority.

3.2.3. Habitat Loss

Uganda is a small country at just 241,000 km2 and its protected areas are limited in both their size and connectivity. Habitat loss in Uganda is manifested in various forms including habitat loss in the corridors connecting national parks and wildlife reserves due to increasing human populations and expanding human activities. There is also loss of suitable habitat from to the presence and proliferation of invasive species like sickle bush, acacia species, and euphorbias. An example of corridor and habitat loss is around the Lake Mburo National Park which has seen a recent surge of clearing of native species for cattle grazing, while an example of invasive species can be seen in the Mweya peninsula and Kazinga regions of QENP where sickle bush and euphorbia thickets have taken over a region which was historically open grassland. Habitat loss is occurring in several protected areas in Uganda due to expansion of human settlements (as in Queen Elizabeth National Park) and expansion of livestock grazing and other agricultural activities within the borders of conservation areas. Between 2002 and 2022, Uganda lost roughly 7.5% of its total tree cover (see: www.globalforestwatch.org/dashboards/country/UGA).

3.2.4. Insufficient Scientific Monitoring and Collaboration

Although not traditionally thought of as a threat, the planning process observed that lack of robust scientific monitoring of large carnivore populations hinders timely conservation and management decision-making. Robust scientific monitoring has been illustrated elsewhere (e.g. Balme et al. 2009) and shown to be an early warning system of population stress and decline. For instance, Braczkowski et al. 2020 showed that robust population monitoring could identify critical demographic parameters such as sex-specific movement, sex ratio, density and abundance in lion populations and changes in home range sizes which is vital for management intervention. The lack of robust scientific monitoring is best exemplified in Uganda by the results of the Kidepo Valley lion survey. The last time a lion monitoring effort was launched there, was in 2012 during the surveys of the Wildlife Conservation Society (Omoya et al. 2014). This call up survey estimated over 100 African lions to be living in the park. In 2022, a follow-up survey using robust methods which explicitly factor in search effort detected only 5 individuals and estimated that 23 individuals remain in a 2300 km2 area). Although the methods employed in the first study differs from the second, and even accounting for large errors, this is a remarkable change in the population. This large difference can only be attributed to a drastic population decline. This lack of monitoring over a 15-year period demonstrates how population declines can "fly under the radar" of wildlife authorities and conservation stakeholders. Because until now, no urgency has been expressed about the status of the lion population in KVNP and how the population might be on the brink of extinction. This exemplifies what could happen to other protected areas where the monitoring framework is weak, study methods incompatible, and leading research groups working independently of each other making un-corroborated survey data, resulting into estimates that are often defended against others regardless of their scientific underpinning.

Chapter 4

4.0. Strategic Action Plan for Conservation of Large Carnivores in Uganda

4.1. Vision, Goals, and Strategic Objectives

During the stakeholders' consultative workshop, a plausible, ambitious and realistic goal was discussed and set for the conservation of large carnivores in Uganda over the next ten years (2024-2034). This was in consideration of the overarching goal of the first edition of the Large Carnivore Action Plan (2010 – 2020), to double carnivore numbers in protected areas, was far from being achieved. It was thus concluded that the overarching goal of the 2024-2034 edition of the conservation of large carnivore species in Uganda would be to achieve a 30% increase in large carnivore species numbers over the next decade.

Vision: Viable and sustainable populations of large carnivores in a healthy ecosystem in Uganda.

Goal: An increase of at least 30% of viable populations of large carnivores in Uganda by 2034.

Indicators: 1. Density and abundance change in viable carnivore population (Numbers, Sex ratio, Genetic diversity and age structure) – through carnivore surveys conducted after every two years. 2. Change in home range size and sigma.

Strategic Objectives

Objective 1. To reduce poaching rates of large carnivores and carnivore prey base inside Protected Areas by at least 50%.

Indicators
- Percentage change in poaching incidences of large carnivores – through UWA wildlife crime reports reported annually, SMART system and Earth Ranger.
- Percentage change in poaching incidences of prey – through UWA wildlife crime reports reported annually and SMART System and Earth Ranger.

Objective 2. To maintain and improve the quality and extent of possible suitable habitats of large carnivores inside and outside Protected Areas.

Indicator
- Percentage change in area of suitable habitat for large carnivores.

Objective 3. To enhance human–large carnivore coexistence inside and outside Protected Areas.

Indicators
- Change in incidences of human-large carnivore conflicts (retaliatory killing, livestock predation, human injury/death, diseases – animals to animals and animals to humans).
- Percentage of community members actively involved in large carnivore conservation.
- Proportion of household with improved economic benefits from large carnivore conservation.

Objective 4. To enhance evidence (scientific, M&E, M&R, RBM, genetics) based decision-making processes for large carnivore conservation.

Indicator
- Decisions made informed by evidence-based information (research and monitoring) e.g. translocations, re-introduction, intensive management, prosecution – forensic, planning patrols.

Objective 5. To establish and operationalise coordination and collaboration mechanisms for large carnivore conservation in Uganda.

Indicators
- Existence of functional coordination mechanisms (species manager or focal office).
- Existence of functional collaboration mechanisms (collaboration policy, MoUs, reports, minutes, budgets, work plans and performance appraisal).

Figure 38. Uganda Wildlife Authority tourism rangers Silva Musobozi and Lilian Namusoke from the Murchison Falls National Park were a key component of the 2022 Murchison National Park lion survey. Their daily safari guiding activities fit in perfectly with the spatial lion survey data collection methods in the park. Collectively they surveyed the entirety of the Nile Delta during the survey.

4.2. Strategic Objectives, Outputs, and Actions

The tables below present strategic intervention, strategic action areas, indicators and associated actors necessary to achieve each of the five strategic objectives. Included in the tables are budget estimates required for the implementation of the strategic interventions. The given figures are simply estimates but will help UWA and the Ugandan Government to identify critical objectives and actions for large carnivore conservation in the country and solicit assistance from funders and potential supporters where required.

4.2.1. Strategic Objective 1: To reduce poaching rates of large carnivores and carnivore prey base inside Protected Areas by at least 50%.

Target: To reduce the proportion of large carnivore numbers illegally killed by 50% within 10 years.

Current situation: There is uncontrolled open access to PAs. Under community conservation programs, there are poorly enforced community access agreements to access resources such as firewood, grass, etc. There is little or no collaboration between law enforcement and community programs. Large carnivores are declining in part because they are outcompeted by humans who come into protected areas to poach prey animals. When carnivores leave protected areas in search of food, they get killed either directly in self-defense or through poisoning. They also get killed when members of the community are involved in poaching for the body parts trade. When community members illegally access protected areas to graze their livestock and large carnivore prey on livestock, carnivores may be poisoned.

Desired situation: Controlled access to protected areas where large carnivores are being conserved. Protected area managers must have capacity to know who has access to PAs, reasons for entering, and ability to monitor their activities while inside the PAs. Where carnivores are being conserved, livestock must be excluded through appropriate fencing and assisting livestock farmers to change their traditional lifestyles such as free-ranging grazing, and live within their space through intensive livestock management such as zero grazing. This will be achieved through closely working with neighbouring communities and using high technology equipment such as unmanned drones and surveillance cameras.

Table 5: Objective 1: Reduce poaching rates by 50%

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
Strengthen law enforcement at PA level	1) Increase ranger capacity – staff and training	1) Number of illegal activities successfully detected through intelligence	UWA in partnership with relevant stakeholders,	1 018 046

Strategic interventions	Strategic action areas	Indicators	Actors	Budget estimates (USD)
	2) Provide specialised equipment i.e. improved conservation technology – UAV, forensic equipment, aircraft, command control, access and control measures on public roads or patrol roads, communication system for rangers, field gears, vehicles, motorcycles, boats, etc. to increase patrol efforts and efficiency	2) Number of arrests from illegal activities 3) Percentage of illegal activities successfully prosecuted 4) Number of law enforcements conducted 5) Increased rates of detecting and effectively preventing crime in PAs	NGOs, UPDF/Police and Judiciary, community or local government institutions	536 804
	3) Support intelligence gathering, investigation and prosecution			335 241
	4) Establish and operationalise a health safety and security and environment (HSSE) - Medical evacuation plans – health and safety.	6) Decreased occurrences of illegal activities in PAs 7) Number of rescued large carnivores.		315 388 TOTAL: 2 205 479

4.2.2. Strategic Objective 2: To maintain and improve the quality and extent of possible and suitable habitats of large carnivores inside and outside Protected Areas.

Targets:

a) To restore and secure new areas for large carnivore conservation
b) To reduce habitat destruction through alternative livelihoods in large carnivore areas
c) To control invasive species in affected areas
d) To mitigate the impacts of climate change on large carnivore conservation
e) To identify the impacts of human development and initiate mitigation measures.

Current situation: Due to a number of factors, habitats are changing and becoming unsuitable for survival of large carnivores. First, there are invasive species taking over formerly open grasslands that favoured grazers, which form a good base for carnivore food. The invasive species are promoting growth of closed thickets. These thickets do not favour grazers, hence negatively impacting the survival of large carnivores.

Desired situation: Intensively managed habitats that will support the survival and multiplication of large carnivores.

Table 6: Objective 2: Maintain and improve quality and extent of possible and suitable habitats of large carnivores inside and outside PAs.

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
a) Improve habitat management for large carnivore habitat in and outside PAs	1) Assess specific large carnivore habitat suitability to guide carnivore management plans development process a) Assess land-use practices around large carnivore conservation areas b) Devise appropriate management intervention measures to modify habitat to suit large carnivores c) Assess impacts of invasive species on conservation of large carnivores.	1) Area of habitats restored for conservation of large carnivores 2) Area of habitats maintained for large carnivore conservation.	UWA, MTWA, NGOs, research and academic institutions	634 000
b) Monitor and mitigate climate change impacts on large carnivore conservation	1) Design research programs to monitor impacts of climate change on large carnivores (weather stations, animal seasonal movement, feeding, phenology/physiology, reproduction, etc.) 2) Develop management interventions based on research findings 3) Monitor, evaluate and re-plan.	1) Research findings/recommendations documented and published 2) Management intervention implemented to address impacts of climate change (preparedness plan – fire, disaster, drought, diseases outbreak).	UWA, UWRTI, WCS, MAK, external scientists	257 923
c) Mitigate impacts of human activities on large carnivores' habitats in PAs.	1) Identify and mitigate the impacts of infrastructure development across large carnivores' home ranges 2) Monitor compliance of developments with national and international best	1) Control measures to regulate use of public roads, e.g. cameras, speed bumps etc. 2) Number of monitoring centres.	UWA, UNRA, NFA, UETCL, ERA	159 278

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
(Power lines, roads, fishing villages, eco-lodges, extractive industries) photographic, research activities, support infrastructure for UWA – ranger posts, vehicles).	practices (such as IFC PS6, EIAs and ESIAs).			

4.2.3. Strategic Objective 3: To enhance human–large carnivore coexistence in and outside Protected Areas.

Targets:

a) To increase numbers of people supporting conservation initiatives for large carnivores

b) To enhance ex-situ conservation of large carnivores for public education and awareness

c) To increase public awareness about the plight and conservation efforts of large carnivores.

Table 7: Objective 3: Enhance human-large carnivore coexistence in and outside PAs.

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
a) Increase appreciation and support for large carnivore conservation	1) Conduct KAP studies to identify knowledge, attitude and practice gaps 2) Undertake cultural analysis to understand relationships between neighbouring communities and large carnivores 3) Design and implement education and awareness programs to address	1) Percentage of community members with improved understanding and awareness of the benefits of large carnivore conservation 2) Percentage change of community members	UWA, UWEC	231 230

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
	identified gaps among targeted audiences (totems, sports tournaments) 4) Formulate appropriate interventions such as public health services (vaccination of livestock, dogs, tick control, etc.) to address drivers of negative attitudes 5) Design and implement a nation-wide large carnivore conservation awareness campaign targeting policy-makers, youth and general public.	expressing positive attitudes towards large carnivore conservation 3) Percentage of community members expressing preference for peaceful means to resolve human-carnivore conflicts.		
b) Implement human-carnivore conflict mitigation measures	1) Fast-track compensation of carnivore kills to avoid retaliatory killings 2) Support community initiatives to protect themselves and their property against large carnivores (Kraals, water, pastures, appropriate barriers).	Number of human carnivore conflict mitigation measures implemented.		766 595

4.2.4 Strategic Objective 4: To enhance evidence-based (scientific, M&E, M&R, RBM, genetics) decision-making processes for large carnivore conservation.

Targets:

a) To establish a regular population monitoring program examining density and abundance of large carnivores in key sites (yearly or bi-yearly)

b) To ensure a healthy population of large carnivores in a healthy environment.

Table 8: Objective 4: Enhance evidence-based decision-making process for large carnivore conservation.

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
Establish and implement a robust	1) Review capacity gaps and establish adequate capacity at UWA in the Research and	1) A functional database for large carnivore populations	UWA, independent researchers,	183 417

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
monitoring and research program for large carnivore conservation.	Monitoring department (personnel, training, computers, budget, etc.) 2) Establish a large carnivore computerised database within UWA 3) Organise regular large carnivore (annual) meetings to review progress and compare notes among all stakeholders 4) Produce policy briefs to policy-makers about large carnivore conservation 5) Conduct habitat suitability and population viability analyses for carnivore and prey populations 6) Analyse and map large carnivore ranging patterns and prey preferences 7) Conduct studies on population genetics of large carnivore populations, animal seasonal movement, feeding, phenology/physiology, reproduction 8) Assess potential disease threats and take precautionary measures 9) Monitor and record stress levels of different species of large carnivores 10) Identify specific sites where large carnivores can be intensively managed in their natural environment.	2) Research publications, reports papers.	partners and collaborators in carnivore conservation.	

4.2.5. Strategic Objective 5: To establish and operationalise coordination and collaboration mechanisms for large carnivore conservation in Uganda.

Target: Establish efficient and effective intervention mechanisms that will deliver conservation objectives of large carnivores in Uganda.

Current situation: The levels of interest to conserve large carnivores is quite high, which is a big strength. This is exemplified by a number of different players involved in the conservation of large carnivores. Some have been undertaking long-term research and others have specific projects and programs to conserve large carnivores. However, the weakness is that there is little collaboration and coordination among these players. This creates duplication of roles and responsibilities, leading to waste of meagre resources as well as creating conflicting relationships among the players.

Desired situation: This strategic objective is desirous of improving efficiency and effectiveness through creation of a coordination mechanism. The objective works towards ensuring respect for all players in conservation of large carnivores. Building trust among all stakeholders through promotion of transparency and accountability for all resources available, dialogue to ensure each player understands respective roles of the other and pooling resources together, so that conservation interventions are effectively coordinated.

Table 9: Objective 5: To enhance coordination and collaboration mechanisms for large carnivore conservation.

Strategic Interventions	Strategic Action Areas	Indicators	Actors	Budget Estimates (USD)
Establish and implement effective coordination and collaborative mechanisms	1) Establish a coordination team 2) Develop terms of reference for the coordination mechanism 3) Operationalise the team (work plans, supervision, regular meetings to discuss progress and challenges) 4) Undertake a stakeholder analysis 5) Develop, implement and update a stakeholder engagement plan 6) Undertake regular meetings 7) Conduct collaborative activities 8) Streamline and align partner activities 9) Design and negotiate possible private partnerships to implement intensive beneficial large carnivore conservation enterprises	Improved dialogue and collaboration among stakeholders	MTTI, UWA and stakeholders	157 923

5.0. Implementation of the National Carnivore Strategy and Action Plan

The emphasis of this 2024-2034 Strategic Large Carnivore Action Plan for Uganda is on two key points, 1) updating the latest status information for carnivores in the country, and 2) identifying actions and partners in order to ensure that the objectives set forth in the Plan are realised. Carnivore conservation and management actions in Uganda continue to be implemented in largely, in an ad hoc manner, with little centralisation, stratification or collaboration. With this Strategic Plan spelling out strategic intervention and action areas, we have identified the most critical interventions as far as the key prioritised threats are concerned. This will enable site-specific managers, in consultations with their stakeholders and partners to be guided in their planning process to address localised threats in each site. The Strategic Plan will also guide the supervising statutory authorities, i.e. the UWA management and the Ministry of Tourism Wildlife and Antiquities to effectively supervise the implementation of this Plan without overlaps and/or replications (e.g. multiple de-snaring teams working in the same area in the Nile Delta of Murchison Falls without any prioritisation, collaboration or stratification of where teams are picking up snares).

Carnivore conservation in the country, and the 30% population increase goal will only work if UWA's management mandate is actively supported both financially and scientifically. The above actions, targets, and strategic objective help to outline this. For any progress on these objectives to be made there is a need for an appropriate structure to oversee the implementation and to monitor progress. Once the Strategy and Action Plan is approved by the UWA Board of Trustees and the Ministry of Wildlife Tourism and Antiquities, it will be officially launched in the presence of stakeholders who will be invited to support its implementation. The successful implementation of this Strategy and Action Plan will require significant financial investment.

The UWA Technical Team on Large Carnivore Conservation will meet twice a year with UWA and all the actors mentioned above, to oversee the implementation of the Strategy and Action Plan, and assess the key priorities to help its realisation.

6.0. Monitoring, Evaluation and Learning (MEL)

The Large Carnivore Action Plan (CAP) will employ an evidence-based approach to ensure continuous improvement, learning, and adaptation, thereby increasing the likelihood of achieving its desired outcomes. Monitoring, Evaluation, and Learning (MEL) will be integral to the CAP and will be implemented through the Results Matrix (See Appendix V). This matrix will detail the program logic, including impacts, outcomes and outputs, along with performance indicators,

baselines, targets, data sources, collection methods, reporting frequency, and responsible institutions.

To establish benchmarks for monitoring performance and assessing the CAP's impact, a baseline study will be conducted. Mid-term and end-of-strategic-plan evaluations will be conducted midway and at the end of the implementation period, respectively, to assess the extent to which the CAP has achieved its desired outcomes and impact. During implementation, quarterly and annual reports will be generated to share progress, challenges, and lessons learned. These reports will inform annual learning and reflection engagements, providing an opportunity to evaluate what is working, what is not, and generate recommendations to continuously strengthen implementation of the CAP.

The Uganda Wildlife Authority Monitoring and Evaluation Unit will lead the implementation of the Results Matrix, with support from other units and conservation development partners such as WCS, WWF, AWF among others and cat experts such as Dr Alex Braczkowski, Dr Nic Elliot and Dr Arjun Gopalaswamy.

7.0. Conclusion

This 2024-2034 edition of the Strategic National Carnivore Action Plan has provided the Uganda Government and conservation stakeholders in Uganda with the latest information on the status and distribution of large carnivores across six of Uganda's largest carnivore protected areas. These data are not only the most recent in their temporal origin but also in the methods they use (cutting-edge spatially explicit capture-recapture statistics). They point clearly to the fact that African lions in Uganda are in a crisis, with two populations under severe pressure and distress (Queen Elizabeth and Kidepo). We also highlight a series of strategic interventions to guide each protected area system to formulate species and site-specific implementation plans that will help to stem some of the declines observed over the last decade. The overarching goal of bringing back densities and abundance of carnivores in protected areas by 30% is more modest and potentially achievable if the identified threats such as snaring and cattle-lion conflict are addressed.

For Uganda to address the declining ecological, socio-cultural and economic footprints following the existing decreasing rate of the large carnivore species populations, abundances and distribution, it needs an ambitious commitment that is supported and adopted by all actors. Implementation of this strategic action will thus require the involvement and participation of stakeholders at all levels of government up to the grassroots.

Appendix I: Terms of Reference for the Strategic Action Plan for Conservation of large Carnivore Species in Uganda Technical Working Group

Introduction

The Technical Working Group (TWG) for implementation of the Strategic Action Plan for Conservation of Large Carnivore Species in Uganda is a multi-stakeholder voluntary technical advisory group. In order to realise the goal of this Strategic Action Plan, there is a need for leadership to provide technical support through the working group to guide and monitor the progress of implementation of the actions.

The roles of the Technical Working Group

The primary function of Technical Working Group is to provide technical and logistical advice on the implementation of key actions, as outlined in the Strategic Action Plan for Conservation of Large Carnivore Species in Uganda. In pursuit of this, the TWG will:

1. Contribute technical information required to guide the effective implementation of the Strategic Action Plan for Conservation of Large Carnivore Species in Uganda. This will include but is not limited to scientific information on species population assessments, trends and conservation status.
2. Monitor the progress of the implementation of actions listed in the Strategic Action Plan.
3. Contribute expert knowledge, skills and experience to the implantation of key action items.
4. Identify emerging conservation issues and opportunities that pertain to large carnivore species conservation.
5. Provide innovative solutions to broad issues that may have an impact on conservation of large carnivore species in Uganda.
6. Meet annually with the primary purpose of developing and assessing activity plans for conservation of large carnivore species in Uganda.
7. Conduct a mid-term review of the Action Plan.
8. Regularly update information on conservation large carnivore species with regard to advances in science.
9. Compile and circulate reports that outline progress and needs assessments for the Strategic Action Plan of Large Carnivore Species in Uganda.
10. Source additional funding for the implementation of the Action Plan.

Governance of the Large Carnivore Conservation Technical Working Group

The TWG will report to the Executive Director and head of research and monitoring. The TWG shall have a Chairperson and UWA focal point as the Secretary. The Chairperson and Secretary shall be responsible for convening and keeping a record of the proceedings of all meetings respectively.

Appointment of members of the Carnivore Technical Working Group and Terms of Representation

During the consultative workshop it was decided that the following individuals shall meet annually to discuss the progress of this action plan and to consult relevant parties in the actions section of this document: Dr Tutilo Mudumba, Mr Aggrey Rwetsiba, Dr Alex Braczkowski, Mr Jan Broekhuis, Dr Nic Elliot, and Dr Arjun Gopalaswamy.

Responsibilities of representatives

All TWG members, including those on working groups, shall:
1. Regularly attend annual meetings or nominate alternative representatives of their organisation to attend;
2. Report back, as necessary, to their nominating organisation and members to encourage wide dissemination and sharing of knowledge about progress and issues;
3. Inform the TWG of any issues/recent information which should be discussed, noted or acted upon;
4. Identify gaps in the knowledge relevant to the TWG; and
5. Make available relevant information held by the organisations they represent to assist and guide the implementation of the National Large Carnivore Conservation Strategy and Action Plan.

Appendix II: Stakeholder Analysis

The stakeholder consultations for the development of a Strategic Action Plan for Conservation of Large Carnivore Species in Uganda identified the key partners and their roles in the conservation and management of large carnivores in Uganda. Some of the stakeholders will fulfil very important day-to-day roles, while others will fulfil more strategic and/or supportive roles, be they local or international. Although the stakeholder consultations noted that the Ministry of Tourism, Wildlife and Antiquities (MTWA), and the Uganda Wildlife Authority (UWA) are the primary partners in the development and implementation of the Action Plan, the UWEC, various other line ministries, non-governmental organisations (NGOs), research and academic institutions, donors, and the private sector were also recognised as key partners. Additionally, the local governments, tourists, the media, and local communities that neighbour Protected Areas with large carnivores are also key stakeholders in the conservation and management of large carnivores in Uganda.
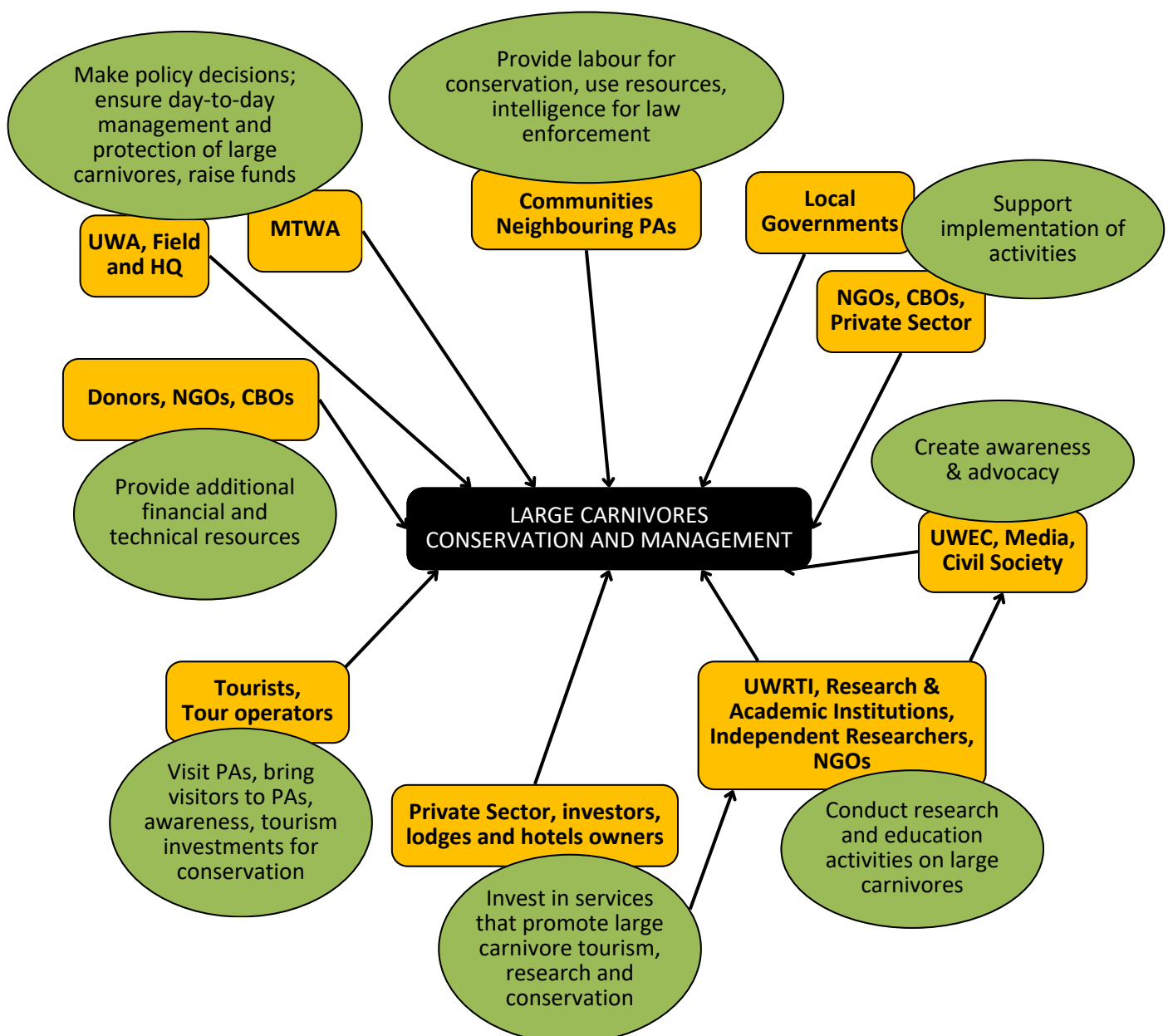
Flowchart 1: Roles and responsibilities of identified stakeholders

Appendix III: Policy Instruments to Aid the Conservation of Large Carnivores in Uganda

1.2 Policy and Legal framework for Conservation of Large Carnivores in Uganda

1.2.1. The 1995 Constitution of the Republic of Uganda: Objective XXVII of the 1995 Constitution of the Republic of Uganda obligates the state including local government to create and develop parks, reserves and recreation areas and ensure the conservation of natural resources. Under Article 237(2b) of the Constitution, Government or a local government as determined by Parliament by law shall hold in trust for the people and protect natural lakes, rivers, wetlands, forest reserves, game reserves, national parks and any land to be reserved for ecological and touristic purposes for the common good of all citizens.

1.2.2. Wildlife Policy (2014): The Wildlife Policy, 2014 provides for sustainable management and development of wildlife resources in a manner that contributes to the development of the nation and the well-being of its people. The theme of the policy is "enhanced wildlife contribution to national growth, employment and socio-economic transformation for prosperity".

1.2.3. The Uganda Wildlife Act (2019): The purpose of the Act is to provide for the conservation and sustainable management of wildlife, strengthen wildlife conservation and management, continue the existence of the Uganda Wildlife Authority, streamline the roles and responsibilities of institutions involved in wildlife conservation and management, to continue the existence of the Wildlife Fund and other related matters.

1.2.4. Uganda Wildlife Conservation Education Centre Act (2015): The Uganda Wildlife Conservation Education Centre Act, 2015 is an Act to promote the conservation of renewable natural resources through education using the Centre, its facilities and programs, both on-site and through extension services; establishment of Uganda Wildlife Education Centre with its trustees as a body corporate and for other matters incidental to or connected with the foregoing.

1.2.5. Uganda Wildlife Research and Training Institute Act (2015): The Uganda Wildlife Research and Training Institute Act (2015) provides for the establishment of a self-sustaining centre of excellence for conducting research, training and consultancy services in conservation and sustainable development of wildlife resources in and outside Protected Areas.

1.2.6. The National Environment Act (2019): The Act is to ensure management of the environment for sustainable development, to continue the National Environment Management Authority as a coordinating, monitoring, regulatory and supervisory body for all activities relating to environment, to provide for emerging environmental issues including climate change, the management of hazardous chemicals and biodiversity offsets, to provide for strategic

environmental assessment, to address environmental concerns arising out of petroleum activities and midstream operations, to provide for the management of plastics and plastic products, to establish the Environmental Protection Force, to provide for enhanced penalties for offences under the Act; to provide for procedural and administrative matters, and for related matters.

1.2.7. International laws: The 1995 Constitution of the Republic of Uganda sets out the principles of foreign policy objective of Uganda as (a) promotion of the national interest of Uganda, (b) respect for international law and treaty obligations, (c) peaceful coexistence and nonalignment, (d) settlement of international disputes by peaceful means, (e) opposition to all forms of domination, racism, and other forms of oppression and exploitation.

Uganda is a signatory to a number of international conventions, treaties and agreements relating to wildlife. These are in line with Uganda's foreign policy which obligates the state to conserve wildlife and wildlife protected areas and promote sustainable development of wildlife resources. International laws which are of immediate importance for the conservation of wildlife and laws to which Uganda is a member state include:

1.2.7.1. Convention on Biological Diversity (CBD) of 1992: The Convention on Biological Diversity (CBD), 1992 obliges member states to establish a system of protected areas, develop guidelines for the selection, establishment and management of protected areas, and promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings and integration of sustainable utilisation of natural resources in national strategies.

1.2.7.2. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) of 1973: CITES obliges member states to regulate international trade in endangered species of fauna and flora through international cooperation. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The Ministry of Tourism, Wildlife and Antiquities is the Management Authority of CITES in Uganda.

1.2.7.3. Convention on Migratory Species (CMS) of 1979: CMS obligates Uganda to conserve migratory species of wildlife across their migratory range. It also requires Uganda to cooperate with other states that form part of the migratory range of wildlife resources found or migrating through Uganda.

1.2.7.4. East African Community Protocol on Environment and Natural Resources (2006): The East African Community Protocol on Environment and Natural Resources (2006) obligates Uganda as one of the Partner States of the East African Community to sustainably conserve wildlife resources in collaboration with the local communities. The protocol requires Uganda to cooperate in the management of trans-boundary wildlife resources, promotion of social and economic incentives for conservation and to conclude agreements aimed at conserving trans-boundary wildlife resources.

Appendix IV: Models Associated with Density and Abundance Results

Species	Model Name	Model Characteristic
African Lions and Leopards	Baseline Model with Heterogeneity (model 1)	No specific behavioral effect, but includes heterogeneity in detection probabilities (Msigma = 1)
	Heterogeneity with Individual-Level Detection Variation (model 2)	No behavioral effect, but includes both heterogeneity in detection probabilities (Msigma = 1) and individual-level detection variation (Msexsigma = 1)
	Sex-Specific Behavioral Effect (model 3)	Includes a behavioral effect related to individual-level sex (Msex = 1), but no heterogeneity in detection probabilities
	Complex Model with Sex-Specific Behaviour and Heterogeneity (model 4)	Includes both a sex-specific behavioral effect (Msex = 1) and heterogeneity in detection probabilities (Msigma = 1, Msexsigma = 1)
Spotted Hyenas	Baseline Model with Heterogeneity and Fixed Spatial Scale (model 1)	No behavioral effect, includes heterogeneity in detection probabilities (Msigma = 1), and the spatial scale parameter Theta is explicitly set to 1
	Baseline Model with Heterogeneity and Estimated Spatial Scale (model 2)	No behavioral effect, includes heterogeneity in detection probabilities (Msigma = 1), and the spatial scale parameter Theta is not explicitly set, allowing for estimation during the modelling process

Appendix V: Large Carnivore Action Plan Results Matrix

Results hierarchy	Indicators	Baseline	Overall target	Frequency of data collection	Data collection method	Data source	Person/Institution responsible
Impact: An increase of at least 30% of viable populations of large carnivores in Uganda by 2034	Percentage change in viable populations of carnivores	To be determined after the baseline (numbers and disaggregate by sex, genetic diversity and age structure)	Targets with details of the sex ratios, genetic diversity and age structure will be determined after the baseline is established	After every 2 years	Census	Census Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Outcome 1: Reduced poaching rates of large carnivores and carnivore prey base inside Protected Areas by at least 50%	Percentage change in poaching incidences of large carnivores	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Wildlife Crime Reports generated from OWODAT and SMART	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Percentage change in poaching incidences of prey	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Wildlife Crime Reports generated from OWODAT	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Output 1.1: Strengthen law enforcement at Protected Area level	Number of illegal activities successfully detected through Intelligence led operations	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Wildlife Crime Reports generated from OWODAT	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Number of arrests from illegal activities	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Wildlife Crime Reports generated from OWODAT	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Percentage of cases successfully prosecuted	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Wildlife Crime Reports generated from OWODAT	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Number of law enforcement operations conducted	To be determined after the baseline is established	To be determined	Annually	Online Wildlife Offenders Database (OWODAT), Earth Ranger Database and the Spatial Monitoring and Reporting Tool (SMART)	Patrol reports from SMART	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Outcome 2: Quality and extent of possible suitable habitats of large carnivores inside and outside Protected Areas maintained and protected	Percentage change in area of suitable habitat for large carnivores	To be determined after the baseline is established	To be determined	Annually	Annual Habitat Assessments	Habitat Assessment Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)

Results hierarchy	Indicators	Baseline	Overall target	Frequency of data collection	Data collection method	Data source	Person/Institution responsible
Strategic Output 2.1: Improve habitat management for large carnivore habitat in and outside Protected Areas	Area of habitats restored for conservation of large carnivores	To be determined after the baseline is established	To be determined	Annually	Annual Habitat Assessments	Habitat Assessment Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Area of habitats maintained for large carnivore conservation	To be determined after the baseline is established	To be determined	Annually	Annual Habitat Assessments	Habitat Assessment Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Output 2.2: Monitor and mitigate climate change impacts on large carnivore conservation	Number of research findings/recommendations documented and published	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Number of management interventions implemented to address impacts of climate change	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Output 2.3: Monitor and mitigate impacts of human activities on large carrnivores' habitats in Protected Areas	Number of control measures implemented to regulate the use of public roads, e.g. cameras, speed bumps, etc.	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Number of monitoring centres	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Outcome 3: Human-large carnivore coexistence in and outside Protected Areas enhanced	Percentage change in incidences of human large carnivore conflicts	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Human Carnivore Conflict Reports	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Percentage of community members actively involved in large carnivore conservation	To be determined	To be determined	Annually	Knowledge Attitudes and Practices (KAP) Survey	KAP Survey Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Proportion of household with improved economic benefits derived from large carnivore conservation	To be determined	To be determined	Annually			UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Output 3.1: Increased appreciation and support for large carnivore conservation	Percentage of community members expressing preference for peaceful means to resolve human carnivore conflicts	To be determined	To be determined	Annually	Knowledge Attitudes and Practices (KAP) Survey	KAP Survey Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Percentage of community members with improved understanding and awareness of the benefits of large carnivore conservation.	To be determined	To be determined	Annually	Knowledge Attitudes and Practices (KAP) Survey	KAP Survey Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Output 3.2: Human-carnivore conflict mitigation measures implemented	Number of human carnivore conflict mitigation measures implemented.	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Human Carnivore Conflict Reports	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Outcome 4: Evidence (scientific, M&E, M&R, RBM, Genetics) based decision-making processes for large carnivore conservation enhanced	Number of initiatives implemented informed by the evidence-based information	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)

Results hierarchy	Indicators	Baseline	Overall target	Frequency of data collection	Data collection method	Data source	Person/Institution responsible
Strategic Output 4.1: A robust monitoring and research program for large carnivore conservation established and implemented	A functional research and monitoring program for large carnivore populations	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Number of research materials (publications, reports, papers etc) produced and disseminated	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Outcome 5: Coordination and collaboration mechanisms for large carnivore conservation in Uganda established and operationalised	Existence of a functional coordination mechanism (Species manager or focal office).	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
	Existence of a functional collaboration mechanism (collaboration policy, MoUs, reports, minutes, budgets, work plans and performance appraisal)	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)
Strategic Ouput 5.1: An effective coordination and collaborative mechanism established and implemented	Number of activities jointly planned and implemented	To be determined	To be determined	Annually	Annual Progress Reporting	Annual Progress Report	UWA and Partners (Cat experts/specialists, experts in genetic studies, WCS, UCF, WWF, B4R)

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