



Leopard Ecology & Conservation

Annual Report 2025



VISION

A Kalahari where big cats and people coexist sustainably as part of a healthy ecosystem.

MISSION

To strive for a thriving leopard and lion population through research, education, and community-based conservation projects.





OBJECTIVE

Leopard Ecology & Conservation strives to make a meaningful contribution toward the long-term conservation of large felid predators as key components of a healthy, functioning ecosystem in Botswana. This requires an understanding of status and habitat needs of leopards and lions both within and outside formal conservation areas, as well as the development of appropriate and effective strategies to address the threats they face.

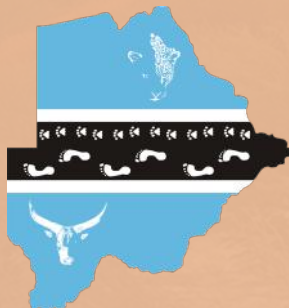




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A map showing most of the places mentioned in the text can be found on page 42.

LETTER FROM LEC FOUNDER: MONIKA SCHIESS-MEIER



Twenty-five years ago, we began working in the vast landscapes of the Kalahari with a simple aim: to better understand and protect the region's leopards and lions. Leopards, in particular, were at the heart of those early efforts, and studying these elusive animals soon revealed how much there was still to learn about predators and the landscapes they share with people. What started as a small research project has since grown into a long-term programme that combines science, traditional tracking knowledge, and community engagement to address the complex challenges of living alongside wildlife in this remarkable ecosystem.

Throughout these years, one principle has remained constant. Our work has always been built on collaboration with the skilled San trackers who know this land so intimately. Their expertise continues to guide our research and conservation efforts, often revealing patterns and insights that technology alone cannot provide. In 2025, we took another step in strengthening this knowledge exchange by launching a Junior CyberTracker initiative, supporting the next generation of trackers in developing both traditional and digital tracking skills.

At the same time, advances in technology continue to transform how we study wildlife and understand human–wildlife conflict. By combining field observations, tracking expertise, and new analytical tools, our team is able to gather increasingly detailed insights into how predators and people share this landscape. These insights are most powerful when they are used not only for research, but also to inform practical solutions that support coexistence.

A good example of this approach is our new collaboration with the Zoological Society of London (ZSL), which focuses on community-led approaches to reducing human–wildlife conflict (see p. 32). By bringing together research, community engagement, and local knowledge, this project reflects our belief that conservation can only succeed when local communities are actively involved in shaping solutions.

2025 was also an important year for the continued growth of our team. We were delighted to welcome Dr Shannon Finnegan and Webster Mwaanga to LEC, strengthening our work in the field. We also celebrated the achievements of several team members: Trevor Balone completed his Postgraduate Diploma in International Wildlife Conservation Practice at the University of Oxford, Seitshiro Pule began an MSc at BIUST, and Alessandro Araldi transitioned into a PhD building on his research with LEC.

These developments reflect our long-standing commitment to strengthening local expertise and supporting the next generation of conservation professionals.

As we look ahead, the challenges facing wildlife and communities in the Kalahari remain significant. Yet the dedication of our team, the knowledge of our tracking partners, and the strength of our collaborations give us confidence that meaningful progress is possible.

With this in mind, I am pleased to present our 2025 Annual Report and thank all those who continue to support and share in this journey.

M. Schiess-Meier



WHAT WE DO

The **LEC Research Programme** is made up of six core projects (see p. 7) studying the habitat of leopards and lions, their population status, and the human-predator conflict that exists between them and the local community. These core projects have produced long-term datasets on predator ecology and human-wildlife conflict, providing a longstanding perspective on the evolving ecological needs of, and threats to, predators in the Kalahari.

While we maintain continuity in data collection methods, we also adapt and modify our activities to ensure that the research topics and methodologies remain relevant and up to date, allowing us to inform current management strategies appropriately.

The **LEC Community & Education Programme** employs a team, made up of local residents and individuals with expertise in social science and community-based conservation. They work with farmers and herders to provide education about livestock predation mitigation measures. They also work with residents of the local village, Kaudwane, on a number of community projects, such as an organic vegetable garden, a community conservation club, a solar cooker project and practical animal husbandry education. LEC is particularly proud of the relationship which has developed over the past 25 years with the local community.

2025 IN NUMBERS

Organisation



25 years operational

31 staff from Botswana working at LEC

16 active international collaborations

4 external training sessions delivered to LEC staff

3 international postgraduate students and interns hosted

4 Botswana students hosted for undergraduate placements

Leopards

40 individual leopards detected during camera-trap survey



7 livestock predation events by leopards

299 camera-traps deployed

across a survey area of **4435** km²

18 lions collared or re-collared

Lions



44 unique individuals sighted greater than

1 years old

7 litters detected from

6 females

1094 lion observations

Community and Education

165 indigenous trees planted in the community

35 Environmental Education Club members trained in tree planting

70 hours volunteered by Community Conservation Club members

236 farmers attended workshops

24 horses taking part in the horse evaluation



77 dogs and cats vaccinated against rabies

18 dogs sterilised

106 visits to cattle posts



6 cattle post lessons conducted

518 livestock trimmed



Promoting young talents

45 school children from Botswana participated in an educational game drive in Khutse GR

8 school children recognised for academic excellence and awarded prizes

Research Capacity Building & Collaboration

5 DWNP and

1 SSG staff trained in Track and Sign (CyberTracker)



13 DWNP officers and

8 NGO representatives attended Drone Workshop hosted by LEC

4 DWNP Officers from Central district provided training in GPS collar programming and geofencing

RESEARCH PROGRAMME

Research is one of the founding pillars of LEC. Understanding how leopard and lion populations respond to environmental change, prey dynamics, and human pressures requires robust long-term data collected at appropriate spatial and temporal scales. Across six core projects, LEC combines long-term ecological monitoring with applied research to generate management-relevant insights into predator ecology and human–wildlife coexistence in the Kalahari.

LEC’s research programme brings together Botswana-based field expertise, traditional ecological knowledge, and collaborations with leading national and international research partners. By integrating long-term field experience with evolving technologies and analytical approaches, LEC strengthens both the scientific value and applied conservation relevance of its work.

These six core monitoring projects generate the consistent, long-term datasets required to assess wildlife populations and their environment in the region. Together, they provide the foundation for detecting ecological change over time and informing conservation management and policy decisions in the Kalahari ecosystem.



Project 1:

Landscape and habitat monitoring

- To define the Khutse landscape in terms of the key environmental features and their interactions.
- To monitor changes in landscape conditions that are biologically relevant, and which vary in both space and time.
- To monitor key climatic drivers of landscape change.

Project 2:

Prey Availability

- To monitor the distribution and relative abundance of potential prey species.
- To monitor the demographics (age class and sex ratios) and physical condition of the principal leopard and lion prey species.

Project 3:

Predation

- To describe leopard and lion predation patterns across the study area.
- To identify drivers that best predict leopard and lion predation patterns across the study area.
- To quantify the extent to which domestic and wild prey sources contribute towards the diet of leopards and lions in the study area.
- To quantify predation of livestock in terms of prey species, age class and sex.

Project 4:

Predator Movement and Habitat Selection

- To determine leopard habitat selection patterns inside and outside the protected area.
- To identify key resources across the study area for leopards and lions.

Project 5:

Predator Demographics

- To calculate population size of leopard and lion populations inside and outside the protected area.
- To understand sex ratios and age classes of both territorial and dispersing leopards.
- To determine the population structure, pride size and pride structure of the lion population, and how these change over time.

Project 6:

Human-Predator Conflict

- To identify the intensity and trends of human-predator conflict in the study area.
- To determine environmental and social factors affecting the coexistence of human activities and wild carnivores.
- To identify effective mitigation strategies.

Project 1. Landscape and Habitat Monitoring

Landscape and habitat conditions underpin the entire ecosystem we study in Botswana’s Kalahari – from where prey species occur, to how predators move, and where conflict with people is most likely to arise. Rainfall, temperature, and vegetation structure shape the availability of food and water across the landscape, often in highly variable and unpredictable ways. By monitoring these environmental drivers over time, LEC builds the ecological context needed to interpret changes in wildlife populations and to understand how broader climate patterns influence conservation outcomes in and around Khutse Game Reserve.

In 2025, LEC monitored landscape and habitat conditions across the Khutse system using a combination of environmental and observational datasets. This included rainfall data from a network of rain gauges and a permanent weather station at camp, monthly fixed-point photography to document changes in vegetation, and the recording of elephant sightings as an indicator of large herbivore responses to rainfall and water availability.

Weather conditions in the Khutse study area during 2025 were characterised by a notably strong rainy season, likely increasing vegetation growth and surface water availability across the reserve. Mean daily temperatures recorded at the LEC camp ranged from approximately 12.5°C to 25°C over the course of the year (Figure 1.1), reflecting typical seasonal variation for the southern Kalahari, with cooler winter months and warmer summer conditions.

Rainfall patterns showed substantial temporal variation but were marked by a particularly productive wet season. In 2025, we recorded a total of 1’193 mm of rain at the Davis weather station at our camp. Monthly accumulated rainfall ranged from 0 to approximately 330 mm based on Davis weather station data, and 0 to 269 mm from the camp rain gauge (Figure 1.2). The January–March period experienced especially high rainfall, resulting in widespread vegetation growth and extensive flowering across Khutse Game Reserve. This strong end to the rainy season likely improved forage availability and surface water persistence throughout much of the landscape.

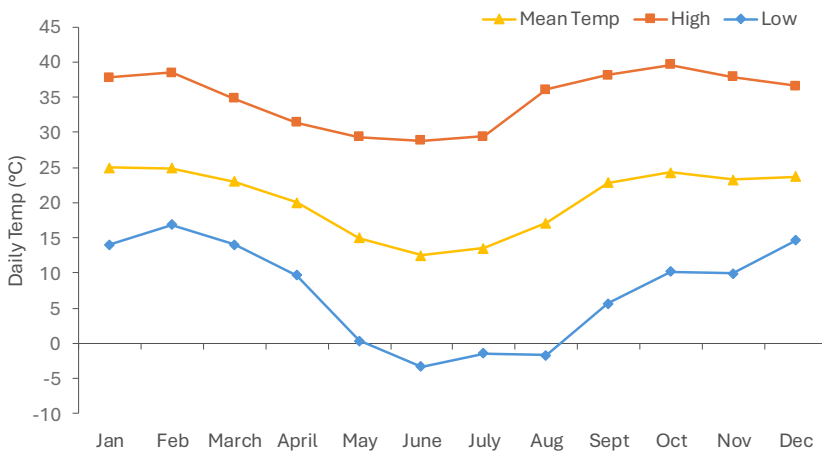


Figure 1.1. Daily mean, high and low temperatures from 2025 at Leopard Ecology & Conservation camp, by the entrance of Khutse Game Reserve, based on Davis weather station data.

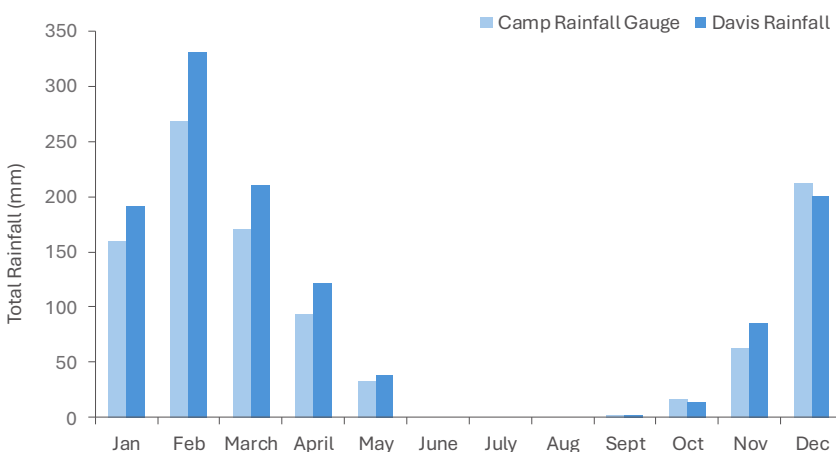


Figure 1.2. Monthly accumulated rainfall in 2025 recorded from the LEC camp rainfall gauge and the Davis weather station data.

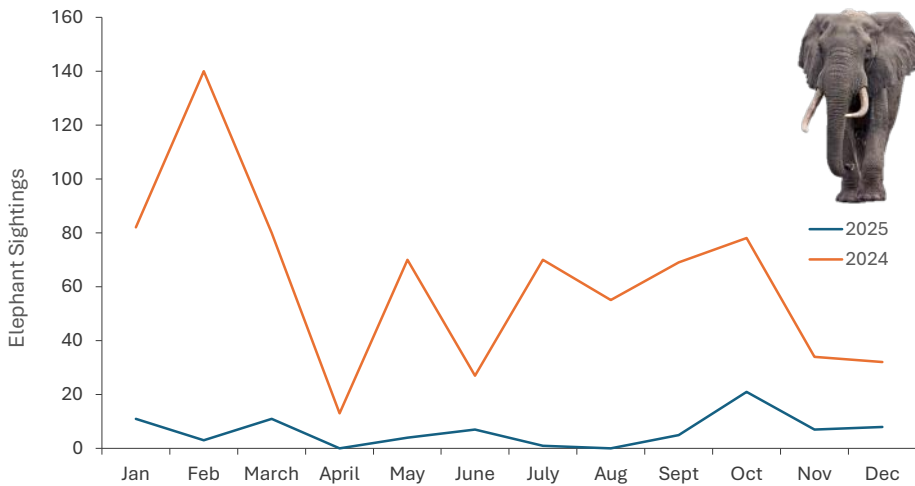


Figure 1.3. Number of elephant sightings recorded by the LEC team in 2024 and 2025 inside Khutse Game Reserve.

Elephant sightings declined sharply in 2025, likely reflecting reduced reliance on permanent water points following high rainfall during the wet season (Figure 1.3). In 2024, elephant observations peaked at over 135 sightings in February, whereas during the same period in 2025, sightings dropped to fewer than five. Changes in elephant presence provide a useful indicator of how large herbivores respond to rainfall and water availability at the landscape scale and are particularly relevant in the Khutse Game Reserve, as elephants have only established in the region more recently and have caused observable changes to habitat and vegetation structure.

Fixed Point Photo (FPP) monitoring forms a core component of LEC's long-term landscape and habitat monitoring programme in Khutse Game Reserve. The photographs create a visual archive of environmental change that complements quantitative datasets and allows habitat condition to be tracked over time in an intuitive and transparent way. FPPs were collected on a monthly basis in 2025 to document temporal changes

in vegetation structure, ground cover, surface water availability, and habitat condition across key savannah and pan systems.

From October 2025, FPP data collection was substantially expanded to coincide with the initiation of the monthly spoor and prey surveys. This integration increased both spatial coverage and sampling intensity, with photographs collected along each survey route inside and outside the protected area. Between October and December 2025, FPPs were collected at 25 locations inside Khutse Game Reserve (20 savannah and 5 pan sites) and 12 savannah locations outside the reserve, representing a marked increase compared to earlier quarters.

Together, these datasets form the environmental baseline for interpreting ongoing prey, predator, and conflict monitoring, and will continue to be expanded to support long-term assessments of climate-driven change in the Khutse system.



Project 2. Prey Availability

Prey availability is a key determinant of whether carnivore populations can be sustained in the Kalahari ecosystem. This harsh environment supports a wide diversity of prey species, but often at low densities and with high seasonal variability. While much of LEC's work focuses on lion and leopard ecology, these predators do not exist in isolation. Their survival, movements, and hunting behaviour are closely tied to the abundance and distribution of prey. Changes in prey availability can also influence patterns of human-carnivore conflict, as carnivores may increasingly target domestic livestock when wild prey becomes scarce or less accessible.

Historically, LEC's understanding of prey abundance and distribution in the Khutse system has been built on systematic prey counts and spoor surveys conducted along road transects every four years, providing long-term indices of herbivore presence inside and outside protected areas. Since 2021, these surveys have combined direct prey observations with the recording of spoor, allowing prey distributions to be monitored alongside predator records. The latest round of monthly spoor and prey surveys resumed in October 2025 and forms a core component of LEC's ongoing prey monitoring programme.

In parallel, camera trapping has become an increasingly important complementary tool for studying prey dynamics in the Khutse system. Camera traps are motion-activated cameras placed throughout the study area, capturing images of animals as they move naturally across the landscape. In Khutse Game Reserve and the southern Central Kalahari Game Reserve (CKGR), LEC established a large-scale grid of camera traps in 2023-2024 covering more than 4,000 km², primarily to generate a leopard population estimate. This grid was re-deployed in 2025 following the same design, with the addition of data on the camera viewshed at each station. Recording the area visible to each camera allows us to apply analytical approaches better suited to unmarked prey species, which cannot be individually identified in the same way as leopards. An important and valuable byproduct of both surveys has been the collection of thousands of images of prey species. These data provide insight into prey distributions, activity patterns, and potential behavioural responses to predators, that cannot be captured through transect-based surveys alone.

In low-density systems such as the Kalahari, no single method can fully capture prey abundance, distribution, and condition. Integrating information from spoor

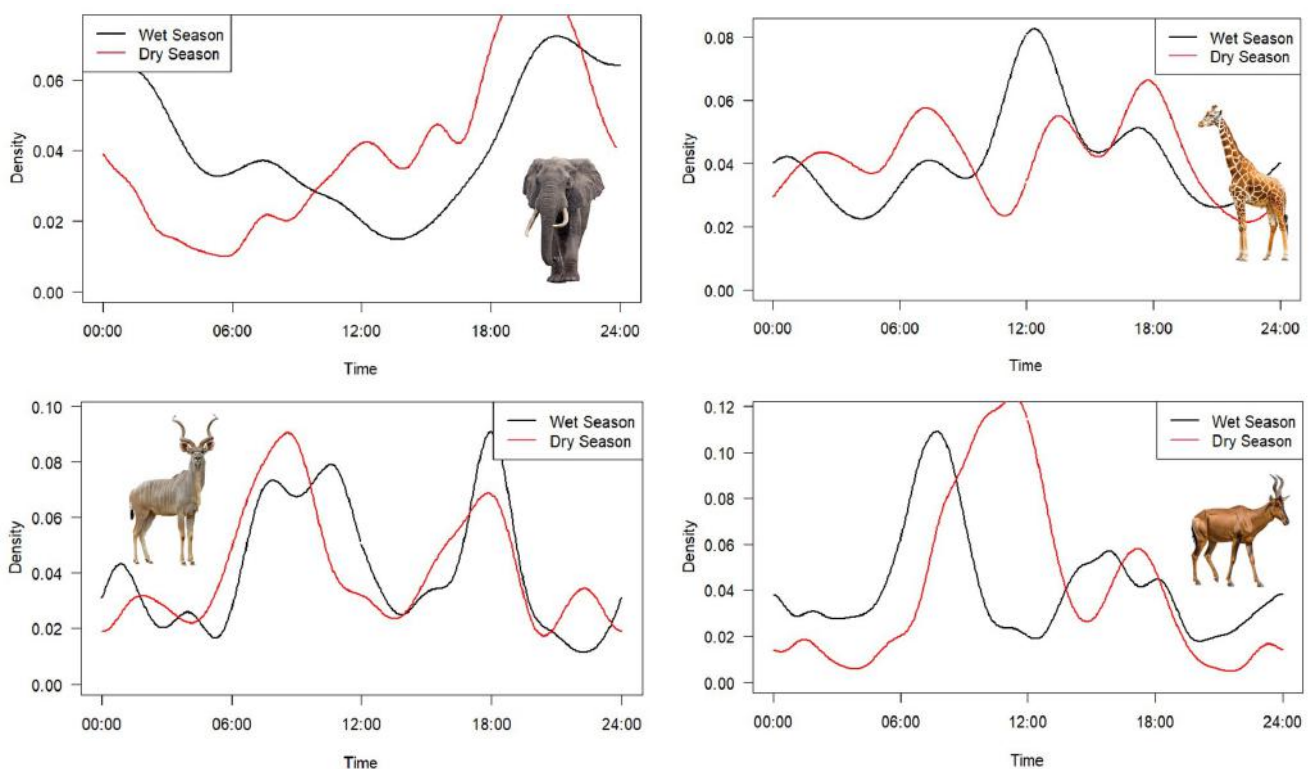


Figure 2.1. Daily activity patterns of elephants, giraffe, kudu and red hartebeest during the wet (dark line) and dry (red line) seasons in Khutse Game Reserve and Southern CKGR during 2023/24.

surveys, direct counts, camera traps, and (looking ahead) aerial surveys allows LEC to build a more holistic understanding of prey dynamics across space and time. While spoor and count data are well suited to tracking broad-scale distribution and trends, camera traps provide fine-scale information on activity patterns, species interactions, and body condition, helping to place predator behaviour and conflict risk into ecological context.

In 2025, LEC completed the analysis and species tagging of all prey images recorded during the 2023/2024 camera trap survey. From these images, we derived Relative Abundance Indices (RAIs) for prey species across the study area and examined diel activity patterns, comparing wet and dry seasons when climate and resource availability differ markedly. We also used approaches that compare how similar activity patterns are between species to explore potential temporal avoidance between predators and prey.

Clear differences in activity patterns were observed among species and between seasons. Elephants were most active at dusk and during the early evening in both seasons but showed a marked reduction in overall daily activity from 57% in the wet season to 39% in the dry season, potentially reflecting reduced surface water availability and constrained movements. Giraffes exhibited activity peaks from midday through to early evening (6 pm), particularly during the wet season. Kudu displayed consistently crepuscular activity patterns, reducing activity during the hottest part of the day in both seasons. Red hartebeest showed activity peaks between early morning (6 am) and midday, with a more pronounced midday peak during the dry season (Figure 2.1). Together, these patterns suggest that prey species adjust their activity in response to a combination of climate conditions, access to water, and ecological pressure like predation and that there may be differences in the strategies between species.

These differences in activity patterns likely reflect the distinct ecological strategies and constraints faced by different prey species in the Kalahari. Larger-bodied species such as elephants and giraffes experience relatively low predation risk as adults and may therefore structure their activity primarily around

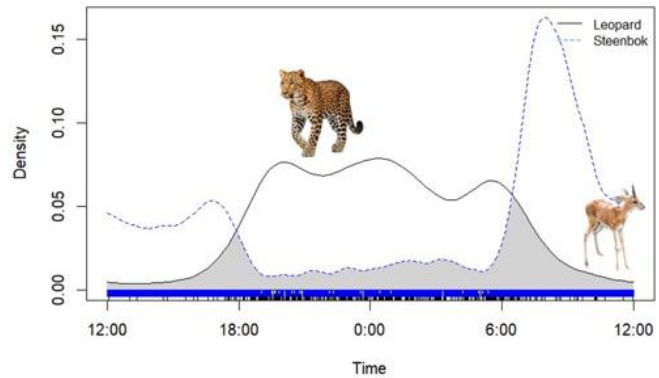


Figure 2.2. Daily activity patterns of leopards and steenbok showing the coefficient of overlap (36%) in Khutse Game Reserve and Southern CKGR during 2023/24.

access to forage and water, as well as thermoregulation. In contrast, medium-sized antelope such as kudu face higher predation risk and appear to concentrate activity during crepuscular periods, balancing foraging opportunities against the need to avoid both heat stress and predators. Grazing species such as red hartebeest may be more tightly constrained by forage availability and quality, particularly during the dry season, leading to shifts in activity toward periods that maximise feeding efficiency despite increasing temperatures. Together, these patterns highlight how prey species trade off forage acquisition, water dependence, thermal constraints, and predation risk when organising their daily activity in this semi-arid, low-productivity system. Camera trap data also allow us to explore temporal niche partitioning among prey species as a potential strategy to reduce predation risk by examining overlap in activity patterns between predators and their key prey species. For example, we found moderate temporal overlap between gemsbok and lions (coefficient of overlap $\Delta=0.58$, 95% CI = 0.55–0.62). In contrast, steenbok showed substantially lower temporal overlap with leopards ($\Delta = 0.36$, 95% CI = 0.30–0.37), indicating greater separation in activity patterns (Figure 2.2). For context, an overlap value of zero indicates complete temporal avoidance, while a value of one represents complete overlap in activity. While resource availability and interspecific competition can also shape activity patterns as a form of niche partitioning, predation risk is likely a key driver of the reduced temporal overlap factor observed between steenbok and leopards.

Patterns of temporal overlap between prey and predators further suggest that species differ in how they manage predation risk, with smaller, more vulnerable prey showing greater separation in activity from their primary predators than larger or better-defended species, for whom temporal avoidance may offer fewer benefits.

During the 2023–2024 wet season, a total of 12'450 camera trap nights were recorded. Small- to medium-sized antelope showed the highest relative abundance (RAI), with duiker (RAI = 14.80) and steenbok (RAI = 14.53) being the most frequently detected species, followed by oryx/gemsbok (RAI = 12.68). Larger-bodied species such as elephant (RAI = 7.12) and giraffe (RAI = 1.92) were detected less frequently, while eland, wildebeest, and springbok exhibited comparatively low RAI values (<1) (Table 2.1).

RAI values represent an index of relative activity or site use rather than true population density and are best interpreted comparatively across species, sites, or time periods. Despite these limitations, RAIs provide a useful proxy for prey availability and complement information derived from spoor surveys and direct counts.

Analysis of data from our 2025 camera survey is currently underway and expected to be completed in 2026. Looking ahead, LEC will be undertaking a herbivore-focused camera trap survey in 2026, alongside aerial survey counts, to estimate prey population densities and evaluate how different monitoring approaches compare and can be integrated. These investments will allow LEC to directly contrast aerial counts, spoor-based indices, and camera-derived metrics, strengthening confidence in prey estimates and improving our ability to detect ecological changes in this low-density system. This planned herbivore camera trap survey is being carried out in close collaboration with colleagues at the Max Planck Institute of Animal Behavior, whose support has been instrumental in expanding the camera trap infrastructure and highlighting the value of LEC's growing research network. Stay tuned for some exciting prey data coming your way.

Together, these complementary approaches will provide a more robust foundation for interpreting predator ecology, prey condition, and human-wildlife conflict dynamics in and around Khutse Game Reserve.

Table 2.1. Number of Independent detections and relative abundance index per 100 camera trap nights for prey species in Khutse and Southern CKGR during the 2023/24 camera trap survey.

Species	Independent Detections	Relative Abundance Index
Duiker	1842	14.80
Steenbok	1809	14.53
Oryx- Gemsbok	1579	12.68
Elephant	887	7.12
Red Hartebeest	345	2.77
Giraffe	239	1.92
Eland	116	0.93
Wildebeest	48	0.39
Springbok	20	0.16



Project 3. Predation

Predation is a central ecological process shaping predator behaviour, prey populations, and ecosystem dynamics. Understanding where, when, and how predators make kills provides critical insight into hunting strategies, energy acquisition, and interactions with prey, as well as into the broader consequences for conservation and coexistence with people. In low-density, semi-arid systems such as the Kalahari, predation dynamics can differ markedly from those observed in more productive ecosystems, making long-term, fine-scale monitoring particularly important.

At LEC, predation research also plays a key role in understanding human-wildlife coexistence. Livestock depredation by large carnivores represents one of the most significant challenges faced by communities living alongside wildlife in and around Khutse Game Reserve. While the social, economic, and management dimensions of these interactions are addressed in detail under the Human-Wildlife Conflict project (Project 6, p. 30), documenting predation events themselves is a crucial foundation for understanding risk, mitigation, and ecological drivers.

LEC's predation dataset is built primarily on systematic follow-ups of GPS collar clusters from lions and leopards, which allows us to locate and identify kill sites with high accuracy. These cluster investigations form the core of our predation records and provide detailed information on prey species, kill locations, and hunting context. Additional predation records are obtained through opportunistic observations in the field, as well as from documented livestock depredation events reported by farmers and during cattle post visits. Together, these complementary data sources provide a robust picture of predation patterns across wildlife and livestock systems.

This work has been developed through long-term collaboration with international partners, including researchers at the Max Planck Institute of Animal Behavior. Since 2017, LEC's predation research has combined GPS collar data, systematic field investigations, and Indigenous tracking expertise to better understand lion and leopard hunting behaviour in the Kalahari. Integrating GPS technology with expert tracking skills has been particularly valuable in the Khutse system, where low animal densities, large home ranges, and challenging conditions can limit the effectiveness of any single monitoring approach. In 2025, this collaborative approach contributed to the publication of an extended abstract in the African Journal of Wildlife Research, based on a conference presentation, highlighting how integrating traditional ecological knowledge with modern tracking technology can reveal complex aspects of lion behaviour that are difficult to detect using technology alone. The paper demonstrates how predation and hunting behaviour can be studied in challenging, low-density environments while embedding research within a community-based natural resource management framework.

LEC's predation project has also played a key role in training and capacity building. In 2025, LEC's research assistant Trevor Balone completed his Postgraduate Diploma in International Wildlife Conservation Practice with the Wildlife Conservation Research Unit (WildCRU) at the University of Oxford. Trevor's research draws directly on LEC's long-term predation dataset and reflects both the scientific value of this work and LEC's commitment to supporting the professional development of local researchers. His selection and successful completion of the qualification represent a major achievement for the LEC research team and highlights the global relevance of data generated in Khutse.



During the programme, Trevor completed a research project titled “Foraging Behavioral Shifts of Lions at the Interface of Reserve and Cattle-Post Landscapes” based on LEC’s ongoing work in and around Khutse Game Reserve. The project drew on long term monitoring data and applied analytical approaches developed during the course, with a focus on understanding patterns of lion predation at the reserve boundary. Trevor will be presenting this research at the annual Savannah Science Network meeting in March 2026.

Lion predation around Khutse Game Reserve shows a strong and repeatable spatial pattern centred on the reserve boundary. GPS movement paths and kill locations indicate that when lions hunt livestock outside the reserve, their activity is tightly clustered along the fence line, whereas movements and kills inside the reserve are more spread out and extend deeper into the protected area. This contrast is reinforced by hotspot analyses, which identify concentrated zones of high predation risk immediately adjacent to cattle posts south of the fence (Figure 3.1). Together, these patterns clearly point to the reserve edge as a focal area for human–lion conflict.

Movement metrics suggest that lions adjust where they use space after a kill rather than how they move through the landscape. Cluster radius was consistently larger inside the reserve than at cattle posts, reflected by a strong positive effect of reserve area on cluster size ($\beta = 0.69$, $p < 0.001$). Clusters were also larger during the wet season compared to the cool-dry season ($\beta=0.45$, $p = 0.026$). In contrast, sex had no detectable effect on cluster radius, and interaction terms were not statistically significant, indicating that the reserve–cattle post difference was broadly consistent across sexes and seasons.

Despite these differences in clustering behaviour, lions showed remarkably similar movement structure across conditions. Path tortuosity did not vary strongly by area, season, or sex, with only a marginal area-by-sex interaction ($p = 0.050$). Pre-cluster movement length likewise showed no significant effects, although males tended to travel farther before clustering than females, a pattern that fell short of statistical significance. Taken together, these results suggest that lions do not fundamentally change how they move when hunting livestock versus wild prey. Instead, they concentrate their activity into smaller, more localized areas near the reserve boundary.

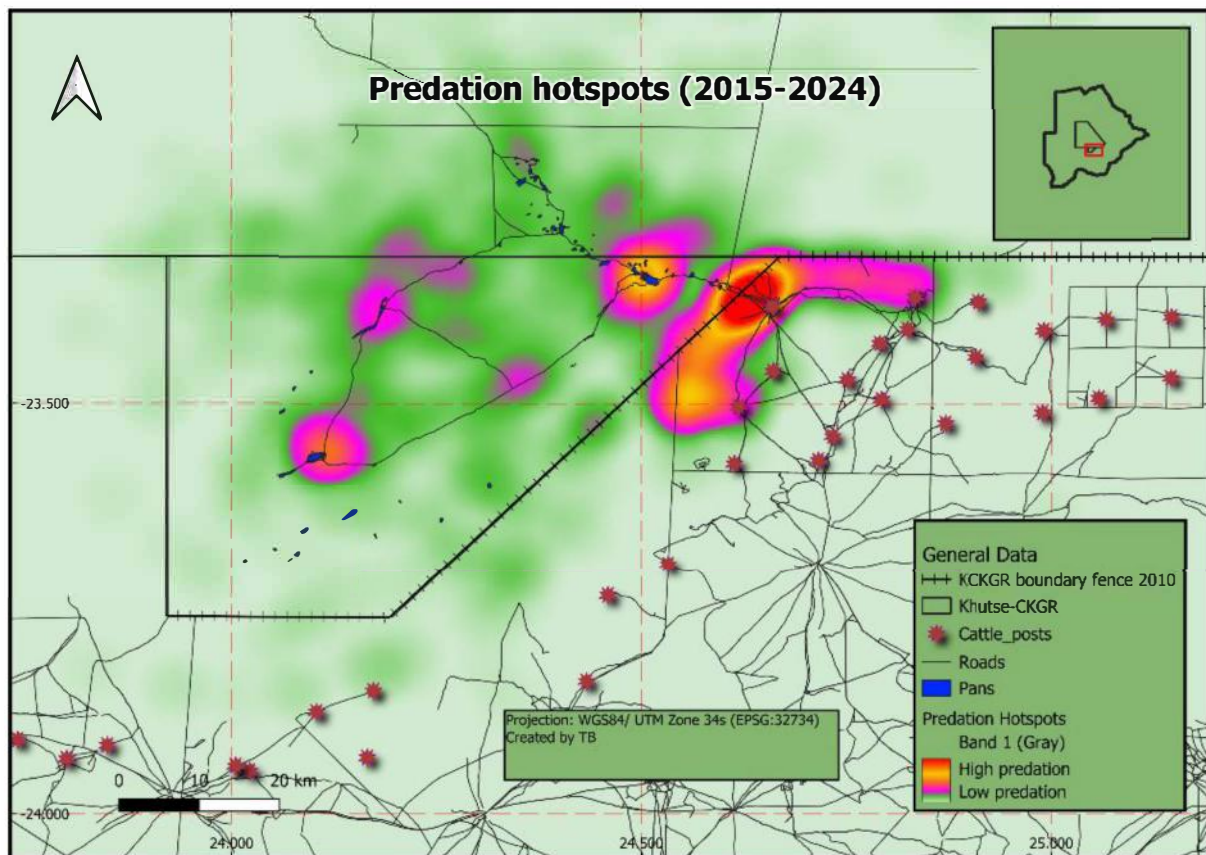


Figure 3.1. Spatial predation patterns informing human–lion conflict mitigation. High-predation hotspots (red) adjacent to cattle posts identify priority areas for intervention. The concentration along the reserve boundary suggests fence permeability and edge effects influence predation distribution, with implications for conflict management strategies in communal lands surrounding protected areas.

In 2025, we saw a reduction in the number of reported livestock predations by leopards outside of Khutse Game Reserve (Table 3.1). We did not have any leopards collared inside the reserve during 2025; therefore, no leopard predation information was collected from cluster follow-ups. We are planning to collar new leopards in 2026.

Table 3.1. Livestock losses attributed to leopard predation outside of Khutse Game Reserve in 2024 and 2025.

Prey	Leopard 2024	Leopard 2025
Cattle	10	5
Chicken	0	0
Donkey	0	0
Goat	1	0
Horse	4	1
Sheep	1	1
TOTAL	16	7

In contrast, we continued to document high levels of livestock losses to lion predation outside of the reserve in 2025. A total of 110 livestock losses were reported this year, comparable to the 112 losses recorded in 2024. However, the composition of livestock losses shifted notably. Cattle predations declined substantially, from 85 cases in 2024 to 45 in 2025, while donkey predations increased sharply from 12 to 32. Most donkey losses were attributed to Poona and her group, which appeared to specialise on this prey type during the year.

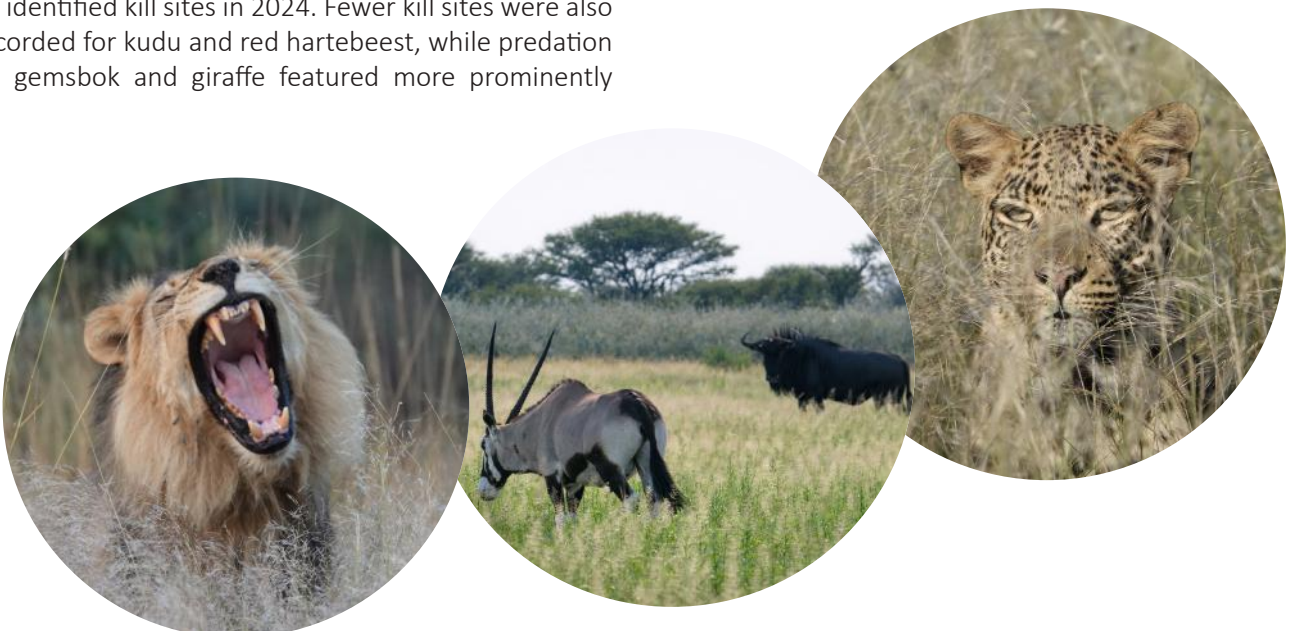
Within the reserve, we also documented patterns in lion predation on wild prey during 2025. Recorded eland predations were notably lower than in the previous year, with four identified kill sites in 2025 compared to 42 identified kill sites in 2024. Fewer kill sites were also recorded for kudu and red hartebeest, while predation on gemsbok and giraffe featured more prominently

among the documented events (Figure 3.2). In total, we visited 80 confirmed lion kill sites inside the reserve during 2025. When interpreting these patterns, it is important to note that substantially fewer kill sites were investigated this year compared to 2024, when 253 wildlife predation events were recorded. This difference reflects variation in field effort and priorities between years. As a result, these observations should be interpreted as indicative rather than directly comparable measures of prey selection across years.

Looking ahead, from 2026 LEC will enter a new phase of collaborative predation research with colleagues at the Max Planck Institute of Animal Behavior, building on existing datasets and expanded collar deployments. This work will focus on fine-scale hunting behaviour and on understanding why cooperative hunting is so rare in this low-density lion population in Khutse, a pattern that contrasts with many well-studied lion populations elsewhere.

Future research will also place greater emphasis on quantifying the role of small prey in the diets of both lions and leopards - an important but often under-appreciated component of predator ecology in prey-scarce systems such as the Kalahari. Expanded collaring efforts, which also support human-wildlife conflict monitoring, will increase opportunities to document predation events and strengthen links between ecological research and applied conservation.

Together, this work will deepen understanding of predation processes in low-density systems and provide critical ecological context for prey dynamics, predator behaviour, and human-wildlife coexistence in and around Khutse Game Reserve.



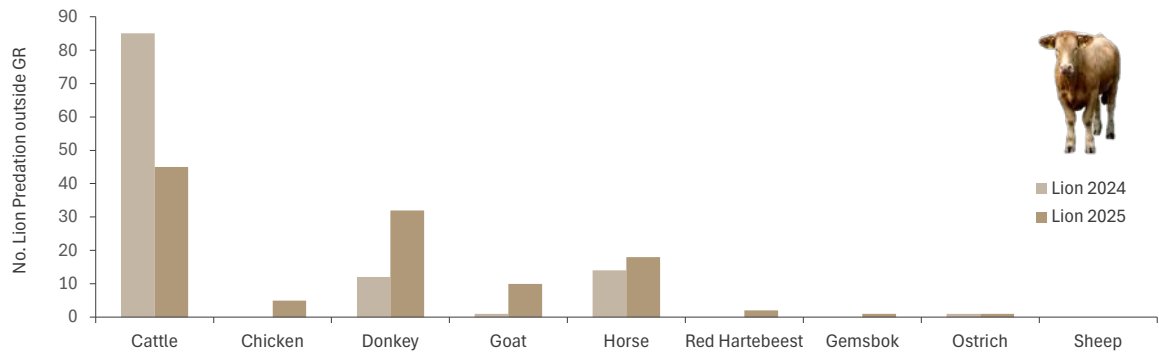
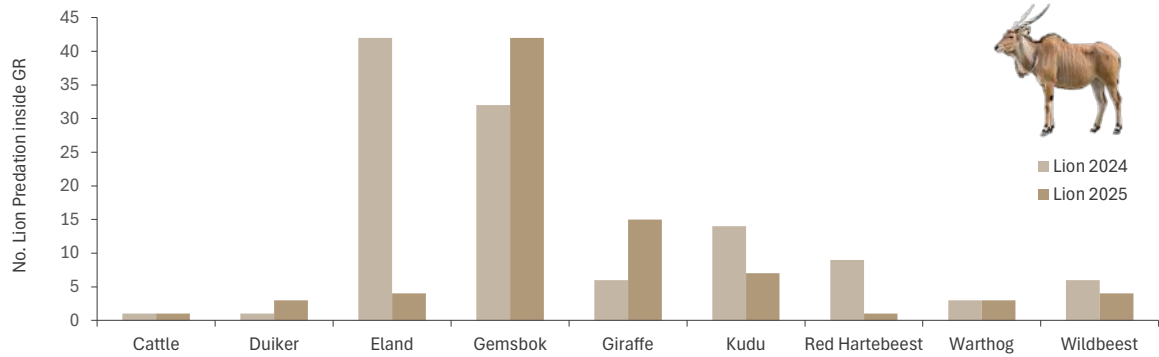


Figure 3.2. Lion predations on wild and domestic prey inside (upper figure) and outside (lower figure) of the Khutse Game Reserve/ Southern CKGR in 2024 and 2025.



Project 4.

Predator Movement and Habitat Selection

Understanding how predators move through the landscape and select habitat is essential for interpreting their ecology and for managing coexistence with people. Movement patterns influence access to prey and water, exposure to climatic stress, and the likelihood of encountering humans and livestock. In semi-arid systems such as the Kalahari, predators living near reserve boundaries range across a mosaic of protected areas and surrounding landscapes, and movement and activity patterns reflect trade-offs between ecological needs and environmental constraints.

While fine-scale GPS data and traditional ecological knowledge have provided some of our deepest insights into predator movements and behaviour, non-invasive camera traps also offer an important window into their daily lives. Although LEC's 2023/24 camera trapping survey was primarily designed to generate a leopard population density estimate, the bycatch data created an opportunity to examine activity patterns across a broader large carnivore guild. Using these data, we assessed daily activity patterns of leopards, wild dogs, lions, and brown hyenas during the 2023/24 survey period, providing insight into how predators may use temporal behaviour to navigate climatic stressors, such as high daytime temperatures, or to reduce direct competition (Figure 4.1). In this system, the wet season is warmer and more humid, while the dry season includes the coldest months of the year, making seasonal differences in activity particularly relevant for understanding thermal constraints on predator behaviour.

Both leopards and lions exhibited strongly nocturnal activity patterns, with sharp increases in activity beginning after approximately 7 pm. This nocturnal activity peak was more pronounced for leopards during the dry season, when daytime temperatures are cooler. Activity levels for both species declined after 6 am, although lions showed a slightly extended activity period into the morning during the dry season. Across seasons, leopards were active for approximately 52–56% of the daily cycle, while lions were active for 42–47% of the time. Wild dogs displayed more crepuscular activity patterns, with pronounced peaks between 5–8 am and 5–9 pm, whereas brown hyenas were highly nocturnal, with a steep increase in activity after 6 pm that closely overlapped with leopard activity.

Seasonal differences in activity patterns likely reflect a combination of climatic conditions and ecological

context rather than a single driver. While both lions and leopards remain predominantly nocturnal across seasons, subtle shifts in the timing and distribution of activity suggest flexibility in how predators allocate movement across the 24-hour cycle. These differences may be influenced by seasonal changes in prey behaviour, resource availability, or movement pathways, as well as by detectability effects inherent to camera trap data. However, importantly, the high degree of temporal overlap observed between leopards and lions suggests that temporal avoidance is unlikely to be a primary mechanism facilitating coexistence in this system. Instead, differences in space use, hunting strategy, and dietary differences may be used to reduce direct competition in this system. The high temporal overlap may reflect the spatial scale and low density of the system, where predators can reduce competition through space rather than time.

Additional insights into predator movement and habitat selection were provided by MSc student Badou Nicola Kouate, University of Zurich, who examined long-term GPS tracking data from lions and leopards in the Khutse Game Reserve and surrounding communal lands as part of his dissertation research in 2025. His work showed that both species actively adjust how and where they move to reduce risks associated with people. Rather than using the landscape randomly, predators consistently avoid areas with high human density, open vegetation, and heavy daytime activity. Movements are more concentrated at night, when human presence is lower, and animals preferentially travel through denser vegetation that provides cover. Roads and cattle posts, while sometimes used as travel routes, are also associated with higher risk, and predators tended to cross these features quickly rather than remain nearby. These patterns highlight that predators are not simply attracted to livestock or infrastructure but are constantly balancing access to resources with the need to minimise human-related threats.

This research also revealed clear differences in how predators use protected areas versus communal lands. Inside game reserves, lions and leopards move more freely, travel longer distances, and use a wider range of habitats. In communal areas, their movements become more restricted and tortuous, reflecting cautious behaviour in response to people,

livestock, and human activity. Both species showed strong selection for areas with higher vegetation cover and avoided open landscapes during periods of high human use. Importantly, access to key resources such as water and prey still draws predators toward communal lands, particularly during the dry season, creating zones of overlap with livestock.

Together, these findings help explain why conflict risk is concentrated along reserve boundaries and near cattle posts. They also reinforce the importance of managing human activity and livestock practices in these high-risk areas to reduce predator mortality while maintaining ecological connectivity.

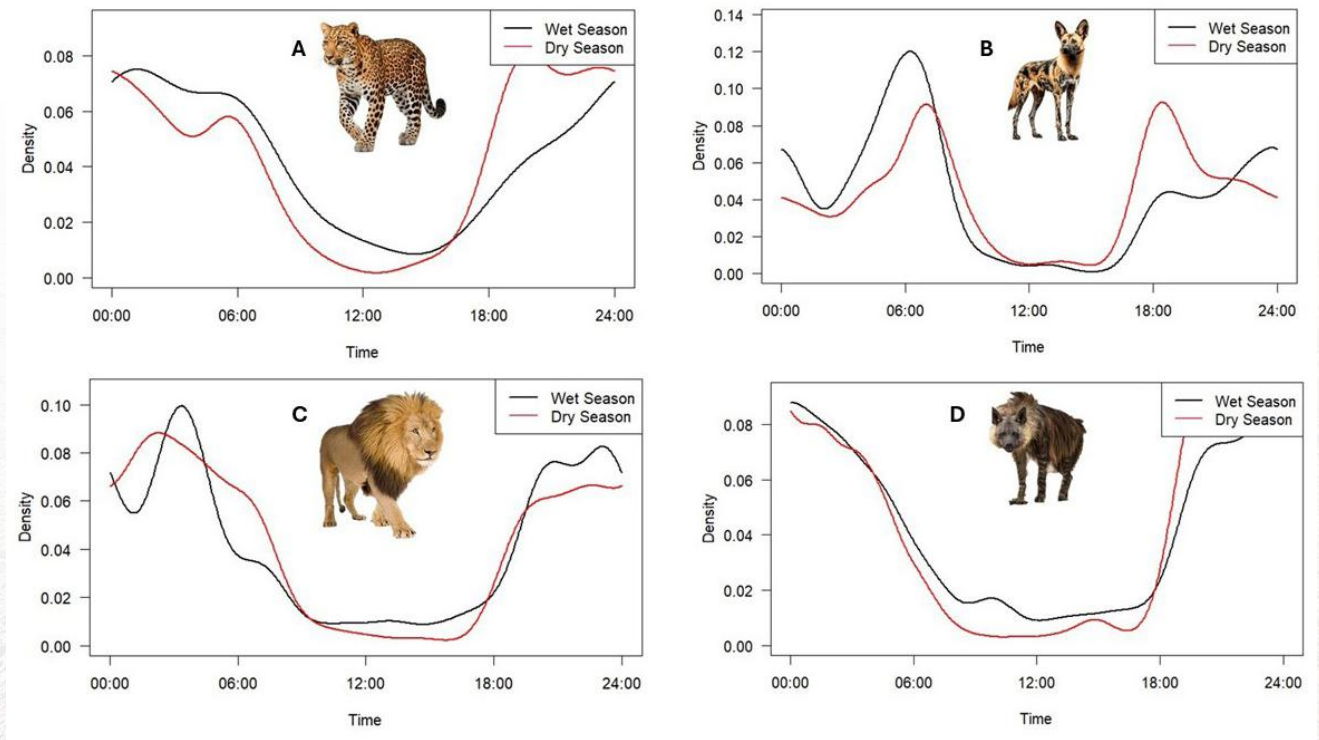


Figure 4.1. Daily wet and dry season activity patterns for leopard, wild dog, lion and brown hyena, estimated from camera trapping data from the 2023/24 survey in Khutse Game Reserve and Southern CKGR.



Project 5. Predator Demographics - Leopard

In line with our long-term goals of studying Kalahari leopards, the 2025 leopard camera-trap survey followed the same method as the 2023–2024 survey to ensure methodological consistency and comparability of results. The survey employed an identical camera-trap grid, station spacing and a combination of single and paired cameras to increase the likelihood of capturing both flanks of individual leopards. This works well for Spatially Explicit Capture–Recapture (SECR) analysis, which is a statistical method used to estimate animal population density from spatial detection data, such as geo-referenced camera-trap images. The approach allows key parameters, such as detectability and movement, to vary according to biological and sampling-related variables such as sex or survey session. Each individual is assumed to have an activity centre, with detection probability declining as distance from this centre increases.

The 2025 leopard camera-trap survey represented a substantial field effort, building on the established long-term leopard monitoring. A total of 299 camera traps were deployed across the study area. Cameras operated continuously during the dry season, resulting in over 120 days and provided consistent spatial coverage across the landscape.

This deployment generated a large volume of data, with more than 462'000 photographs captured during the survey period. All images were uploaded, processed, classified, and tagged using TrapTagger software by WildEye. This software is an image-based data management platform used to process large wildlife camera-trap datasets. Large carnivore detections were dominated by leopards, with 245 leopard capture events recorded. Other large carnivores detections included lions, cheetahs, brown hyaenas and wild dogs.

The survey also contributed significantly to capacity building and local skills development. A total of six students (four local and two international) and one staff member were trained through direct involvement in field deployment, image processing, and data management, supported by an in-house technical team.

Leopard density for the 2023/2024 survey model assumed constant density across seasons, while allowing detectability (λ_0) and spatial scale of movement (σ) to vary by sex and season. This model was best supported by the data according to Akaike Information Criterion (AIC), indicating that while encounter processes differed temporally and between males and females, overall population density

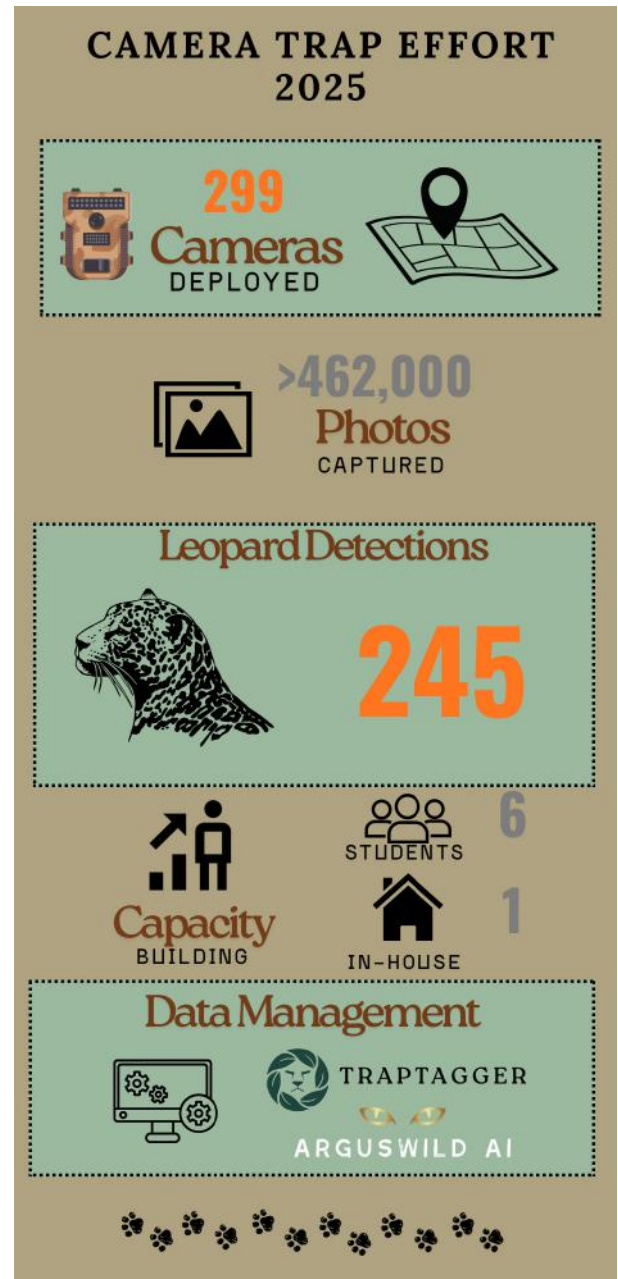


Table 5.1. Number of individuals identified from the 2025 leopard camera trapping survey in Khutse Game Reserve and Southern CKGR.

Category	Number
Adult males	17
Adult females	15
Adult unknown sex	2
Subadult/Juveniles	6
TOTAL	40

remained stable during the study period. The estimated leopard density was 0.5 individuals/100 km² (95% CI: 0.4–0.7 individuals/100 km²). When extrapolated across the total surveyed area of 4'435 km², this corresponds to an estimated population of approximately 22 resident leopards (95% CI: 18–31 individuals). Restricting the estimate to the Khutse Game Reserve alone (approximately 2'500 km²) suggests a resident population of 13 leopards (95% CI: 10 - 18 individuals). These density estimates are low but consistent with expectations for arid and semi-arid Kalahari ecosystems, where prey availability is limited and leopard home ranges are large. The estimated density is slightly higher than that reported in the most recent spoor-based survey conducted in the region but still ranks among the lowest leopard densities recorded in Botswana.

The 2025 survey builds directly on the last camera-trap survey from 2023 - 2024, using the same camera-trap design and deployment protocols to ensure comparability with the 2023- 2024 dataset. At present, all images from the 2025 survey have been uploaded, processed, and classified to species level. Leopards were identified at individual level to estimate leopard population density using SECR analyses. A total of 40 different individuals were detected across the 190 camera-trap stations

in the 4 survey blocks. These include 17 adult males, 15 adult females, 2 adults of unknown sex and 6 subadults/juveniles (Table 5.1.). Not all the identified individuals are permanent residents in the study area as there is no physical barrier to isolate the area. The highest number of leopard detections was recorded around the Moreswe area inside Khutse (Figure 5.1).

For the density estimate only adult individuals were considered. The multisession SECR analysis allowed to combine data from the three seasons (Dry in 2023, Wet in 2023-2024 and Dry in 2025) to improve the estimate precision. The leopard population density is constant across the three season with 0.51 individuals/100 km² (95% CI 0.42-0.63; Half Relative Confidence Relative Width 20.67%) confirming a low-density but stable population.

Through the estimate of σ (movement parameter from SECR analysis), we could also confirm that there is a significant difference in movement between females (4.53 km, 95% CI 4.03 - 5.10) and males (8.41 km, 95% CI 7.83- 9.04) and across seasons. The aim is to repeat this camera-trap survey design at regular intervals to track changes in leopard density and space use over time.

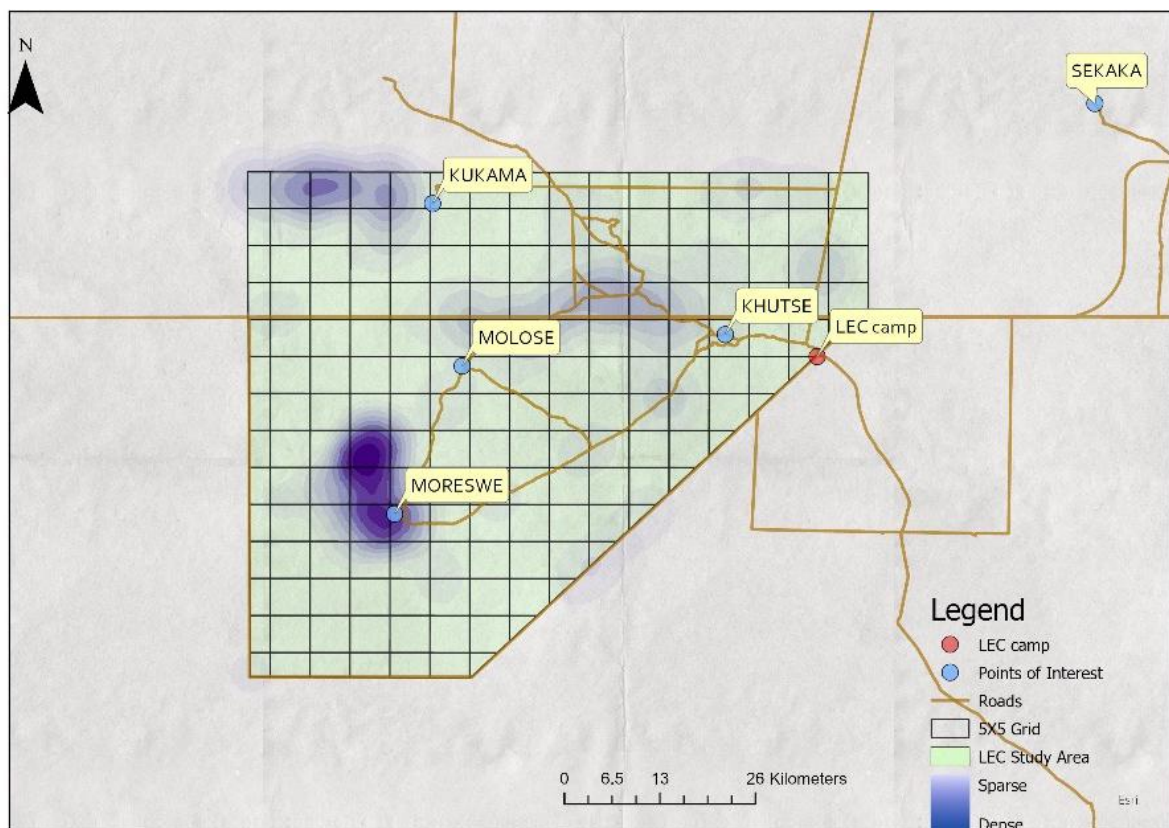


Figure 5.1. Leopard detections hotspots from the 2025 camera trapping survey inside Khutse Game Reserve and Southern CKGR.



Predator Demographics - Lions

LEC lion population monitoring is based on a long-term programme of field research designed to estimate the population size and structure, as well as key demographic rates which measure population change over time. These include the number of lions present, their age and sex composition, how often cubs are born, how many survive to adulthood, dispersal and how many individuals are lost through natural causes or conflict with people.

In the Kalahari, these demographic processes operate very differently from higher-density, prey-rich systems such as East Africa. Lions in the Khutse and southern Central Kalahari occur at some of the lowest densities recorded anywhere in Africa. They range over extremely large areas, live in smaller and more fluid social groups, and reproduce more slowly than lions in prey-rich ecosystems. As a result, population recovery from losses is slow, and the removal of even a few individuals can have long-lasting effects on population stability.

LEC has monitored the lion population since 2007 using a combination of spoor (track) surveys, GPS collaring, direct observations, and long-term individual identification. Track surveys conducted approximately every four years show a clear long-term decline in lion density both inside protected areas and, more dramatically, in the surrounding communal grazing lands. Following the completion of the veterinary fence in 2010, lions have been almost entirely removed from the communal grazing areas, with densities declining from approximately 0.36 lions per 100 km² to near zero. Inside Khutse Game Reserve, lion densities have also declined by roughly 40% compared to levels recorded in 2007-2009.

Long-term demographic monitoring of known prides shows that cub recruitment does occur, and when cubs survive their first year, longer-term survival can be relatively high. However, recruitment is inconsistent, females often do not successfully raise cubs until relatively late in life, and losses from human-wildlife conflict remain a major constraint on population growth. Together, low reproductive rates and continued adult and subadult mortality place the long-term viability of the local lion population at risk.

What We Learned in 2025

In 2025, LEC continued intensive monitoring of lion demographics across the study area, with particular focus on births, survival, mortalities, and changes in group composition. In 2025, we recorded at least 71 individual lions across all observations, including 27 cubs, 27 adults and 17 sub adults. The majority of cubs observed were less than six months old, reflecting a year with multiple breeding events across different prides and groups during the year (Table 5.2).

Several litters were born during 2025, most notably within the East Khutse and Molose pride systems (Table 5.3). However, cub mortality was high. At least 16 cubs born in 2025 were confirmed dead by the end of the year, including the loss of entire litters in some cases. These losses occurred primarily during the first few months of life, a period known to be the most vulnerable for lion cubs, particularly in harsh, low-prey environments such as the Kalahari.

Adult and subadult mortality was also recorded in 2025. One adult female, Tuelo, died during the year from unknown causes, along with two subadult males born in 2023 who died during DWNP translocation attempts. Several additional young males from earlier cohorts disappeared following dispersal attempts, with their fate unknown.

Despite these challenges, some positive signs were observed. Several adult females successfully raised cubs beyond the early denning stage, and stable male coalitions continued to hold tenure over parts of the reserve. However, male turnover remains low, and dispersing males face high risks, particularly near the edges of the reserve where conflict with livestock owners is most likely.

Overall, 2025 reinforced patterns observed over the past decade: lions in the Khutse and southern Central Kalahari are persisting at very low densities, with reproduction occurring but often offset by high cub mortality and continued losses of older individuals. The proximity of core lion ranges to communal grazing lands continues to act as a major pressure point, creating an “attractive sink” where lions are drawn toward livestock but face a high likelihood of lethal removal.

Table 5.2. Number of known and unidentified individual lions observed and in brackets () number of recorded mortalities in 2025.

	Adult Male	Adult Female	Subadult Male	Subadult Female	Juveniles
Known	10	13 (-1)	10 (-2)	6	27 (-16)
Unidentified	2	2	0	1	0

Table 5.3. Summary of observed lion litters in the last six years (2019- 2025).

Mother	Age of Mother [y]	Pride	Litter size (max observed)	Born (approx.)	No. survived to year 1	No. survived to year 3.5 (possible age of first reproduction)
Alice and / or Alexa	5	Molose	5	Mar-19	0	0
Nina	9.5	East Khutse	4	Sep-19	3	3
Notch	10	East Khutse	3	Dec-19	0	0
Sarah	10	East Khutse	3	Jan-20	0	0
Peggy	10	East Khutse	3	Jan-20	3	1
Alice	6	Molose	4	Mar-20	0	0
Alexa	6.5	Molose	3	Sep-20	3	3
Alice	6.5	Molose	4	Oct-20	3	3
Notch	11	East Khutse	3	Nov-20	0	0
Desi or Joyce	8	Molose	3	May-21	3	3
Desi or Joyce	8.5	Molose	2	Oct-21	2	2
Verity	14	East Khutse	2	Jan-21	0	0
Sarah	11.5	East Khutse	2	Apr-21	0	0
Notch	11.5	East Khutse	2	Apr-21	0	0
Tuelo and / or LF076	5	NA	5	Nov-22	5	NA
Poona	3	East Khutse	4	Oct-22	0	0
Sarah	13	East Khutse	4	Jan-23	4	NA
Poona	3.5	East Khutse	2	Apr-23	2	NA
Alice	9	Molose	4	Jul-23	2	NA
Alexa	9	Molose	4	Aug-23	2	NA
Desi	10.5	Molose	4	Oct-23	3	NA
Joyce	10.5	Molose	3	Nov-23	3	NA
Viva or Lora	7.5	East Khutse	1	Jan-24	0	0
Viva	8	East Khutse	2	Aug-24	0	0
Lora	8	East Khutse	2	Aug-24	0	0
Lora	9	East Khutse	4	Mar-25	NA	NA
Viva	9	East Khutse	4	Jun-25	NA	NA
Poona	5	East Khutse	5	Jun-25	0	0
Alice	11	Molose	2	Aug-25	0	0
Tuelo	8	Sekaka	4	Aug-25	0	0
Poona	5	East Khutse	4	Oct-25	0	0
Alexa	11	Molose	4	Nov-25	NA	NA

Predator Demographics - Other Carnivores - Wild Dog and Cheetah

LEC remains an active member of the Botswana Carnivore Forum, and the LEC research team has contributed to national population status updates for several large carnivore species in Botswana. These assessments are fundamental tools used by the Department of Wildlife and National Parks (DWNP) in the development of wildlife management strategies and also feed into regional and global species status assessments.

Long-term datasets derived from extensive track surveys conducted inside and outside Khutse Game Reserve (GR) have provided population trends spanning 2007–2022. In addition, the first systematic camera-trap survey carried out in Khutse GR between 2023 and 2024 has further strengthened our understanding of resident and transient populations of leopard, cheetah, and African wild dog, including generating density estimates for these low-density species.

Since its establishment in 2000, LEC has consistently recorded the presence of cheetahs (*Acinonyx jubatus*) in Khutse GR and the surrounding areas, albeit always at very low densities. Track survey data indicate that cheetah presence within the protected area has remained relatively stable over time. In contrast, we observed a negative trend in the already small cheetah population inhabiting the communal grazing lands around Kaudwane (Fig. 5.2). Although this decline is not statistically significant, the trend - combined with the near-complete absence of reported livestock predation by cheetahs - suggests that no resident cheetahs currently occupy the Kaudwane grazing areas.

The density estimate obtained through spatially explicit capture–recapture (SECR) analysis of the 2023–2024 camera-trap survey ($D = 0.11$ individuals/100 km²; 95% CI: 0.06–0.20) is consistent with results from the most recent extensive track survey conducted in Khutse GR in 2021–2022 ($D = 0.11$ individuals/100 km²; 95% CI: 0.07–0.17). While these estimates are based on relatively small sample sizes and therefore have wide confidence intervals, this

reflects the extremely low density of cheetahs in the study area rather than insufficient sampling effort. While caution is warranted when interpreting these results, the estimate of approximately five adult cheetahs within the sampled area (4'435 km²) aligns well with the long-term field experience and knowledge of the LEC research team, which has worked continuously in the park for over two decades.

LEC has also conducted research on another emblematic carnivore in Botswana: the African wild dog (*Lycaon pictus*). This species is among the most endangered carnivores in southern Africa and is frequently involved in livestock depredation incidents in Botswana. African wild dogs are also among the most challenging species to monitor and manage due to their large home ranges and complex social structure.

In Khutse GR, wild dogs typically occur in packs averaging 10–12 adults and subadults. During the denning period, up to 10 pups per pack were recorded; however, resightings suggest relatively high juvenile mortality within the first year. Based on camera-trap data from 2023–2024 and opportunistic direct observations, we estimate that two wild dog packs include Khutse GR within their home ranges, which extend northwards into the Central Kalahari Game Reserve (CKGR). The infrequent sightings of these packs within the LEC study area suggest that denning sites are likely located in the CKGR, with Khutse GR primarily used for hunting, particularly in areas around artificial waterholes.

In addition to these two packs, approximately 10 dispersing individuals from other groups were recorded in the LEC study area during 2023–2024. As observed for cheetahs, wild dog populations appear stable within the protected area, while track survey data from communal grazing lands indicate a positive, though not statistically significant, population trend (Figure 5.2.). Most wild dog tracks outside the park were detected along fence lines, suggesting that increased presence in these areas may be linked to individuals temporarily moving out of protected areas to hunt livestock which has grown in numbers along the park boundaries.

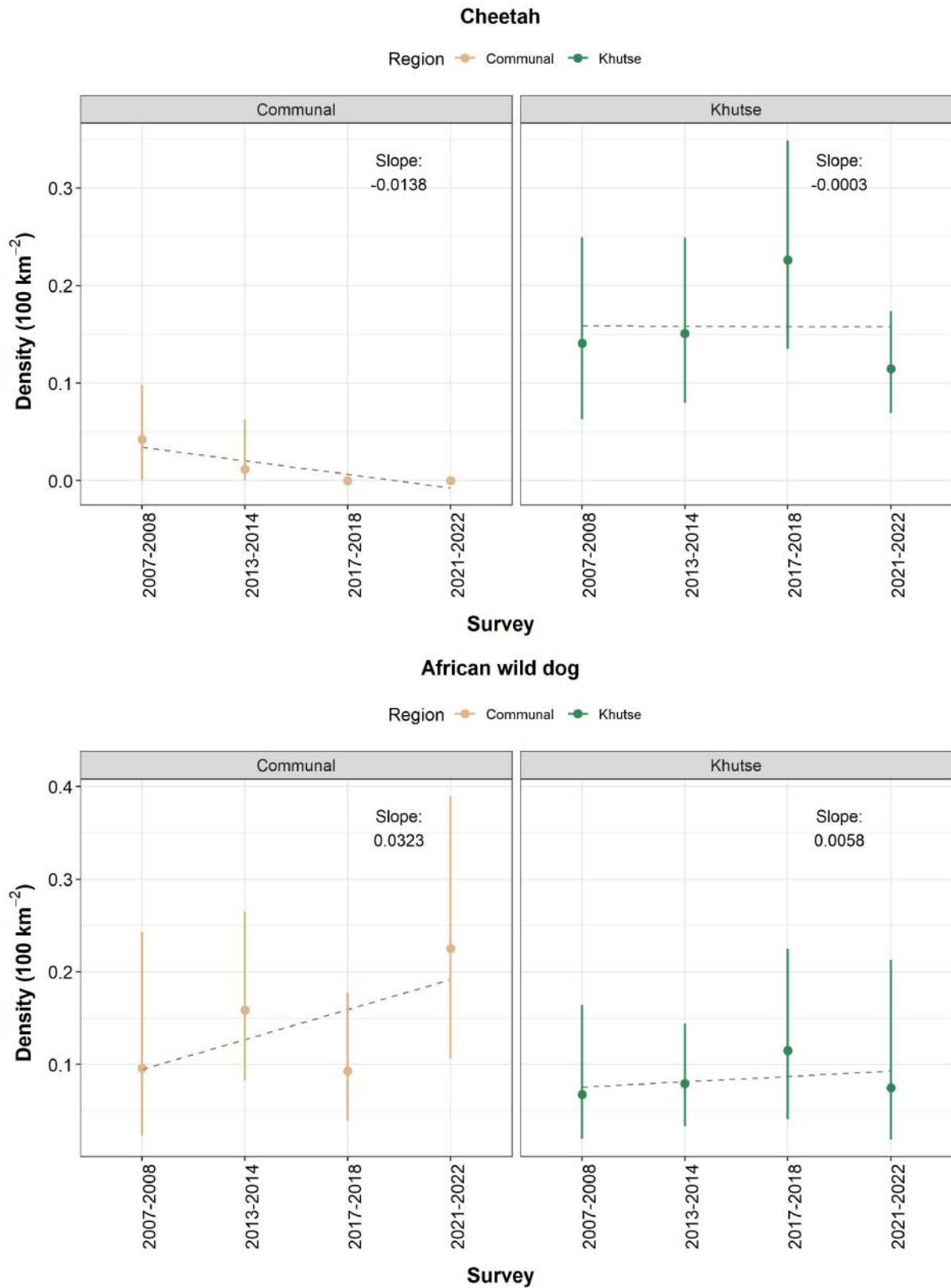


Figure 5.2. Population density estimates and trends derived from extensive track surveys in Khutse GR and the communal grazing lands around Kaudwane for cheetahs (upper figure) and African wild dogs (lower figure).

Meet the class of 2025

East Khutse Pride

The period from late 2024 through 2025, can be considered the beginning of a new phase for lions using the northern part of Khutse Game Reserve and adjacent communal areas. The East Khutse pride was formed from a group of females born between approximately 2007 and 2010 (Verity, Nina, Peggy, Sarah, and Notch) into the Molose pride, before dispersing eastwards. Sarah was the only remaining adult female actively using the East Khutse area in 2024. While other descendants of this broader lineage continue to occur elsewhere in the system, following Sarah's death in March 2024, Poona (a daughter of Peggy), three remaining subadult males from Sarah's January 2023 litter (LM105, LM106, and LM107), and Poona's two male cubs born in April 2023 (LM108 and LM109) were the only individuals from the East Khutse natal pride remaining in regular use of this area. During this period, the group ranged between Khutse 1 pan and the communal grazing lands around Kaudwane. Chocolate was collared in March 2025.

Poona gave birth to five cubs in the area between Sekaka waterhole and Gope Road in June. The den site was later visited after Poona spent several days away from it, but no cubs were found and no clear evidence could be identified to determine their fate. LEC and the Kaudwane Problem Animal Control (PAC) continued efforts to push Poona and the group back into the reserve however, they repeatedly returned to communal areas likely facilitated by multiple gaps along the fenced boundary. By the end of October, Poona gave birth to a further four cubs.

A translocation operation was carried out in November by PAC teams from Molepolole and Kaudwane, accompanied by a DWNP veterinarian, with LEC providing logistical support. Poona was translocated to Piper Pan on the 12th of November and released on the 13th, together with her four dependent cubs (less than six weeks old).

Two subadult males from Poona's group (LM106 and LM108) were subsequently targeted for capture. LM108 was successfully captured and fitted with a GPS collar on 19 November, and was later translocated to Xaxa Pan, where he was released on 21 November. LM106 was captured during the same operation but did not survive the translocation process. A further subadult male, LM107, was captured on the 25th of November but also did not survive the immobilisation. Two additional males (LM105 and LM109) were not captured during the operation and were not subsequently re-sighted.

Following her release, Poona left the release area on the 28th of November and returned to Khutse Game Reserve, where she was already moving by early December.

Two additional lionesses, Viva and Lora, daughters from one of the earlier East Khutse litters born in the mid- to late 2010s, who are assumed to have split from the natal pride at a young age, were re-encountered in February 2024, when Viva was fitted with a GPS collar. They primarily range between Khutse 1 and the second cutline in the Central Kalahari Game Reserve occupying an overlapping but socially separated range from their natal group as is common in female lion dispersal events. In March, Lora was sighted with four cubs; one cub was lost between the end of July and the beginning of August, while three survived. Viva gave birth to four cubs, all of which were still alive at the end of December. Both Viva and Lora frequently associate with the adult males John and Spiderman, who are likely the fathers of both litters.



Sekaka Group

In October 2024, a group consisting of two adult females (Tuelo and LF076) and five two-year-old subadults (three males: Musafa, Dom Dom, Tshumu; and two females: Bullet and LF078) were spotted close to the CKGR fence towards Tshipidi cattle post. The two adult females were part of the litters born between 2017 and 2018 in the East Khutse Pride. Tuelo was collared to monitor the group's movements. By the beginning of 2025, the group was sighted with an additional subadult female, Chaloba. Her natal origin could not be confirmed to date. During March, Tshumu was collared.

In May 2025, the group split into two subgroups. One group consisted of Tuelo, Bullet, and Musafa, while the

second group included LF078, Chaloba, Dom Dom, and Tshumu. Bullet, Musafa, Chaloba, and Dom Dom were collared in June. In August, the two groups split again into pairs: Bullet was moving with Musafa, LF078 with Chaloba, and Dom Dom with Tshumu. Tuelo was sighted alone with her four newly born cubs, while LF076 was not sighted.

Tuelo and her cubs died in September 2025. At her resting spot, evidence showed that she had been feeding on leaves and grass, indicating possible stomach distress. The groups appear to cover extremely large distances and have been very successful in killing large prey. Tshumu and Dom Dom were mostly recorded in the Khutse GR Corner Four area.

Rocket and Snooks

Rocket and Snooks remained active across much of Khutse Game Reserve, despite their tenure being challenged in 2024. In February, Snooks was found with a serious injury to his front left leg. Although he recovered, the injury resulted in a permanent limp; however, this has not prevented him from covering large distances or hunting successfully on his own. Rocket's collar stopped transmitting GPS fixes in June and ceased UHF communication in August, after which he was recollared in November. Snooks' collar stopped functioning in December. The two males were occasionally sighted associating with Alice, Alexa, and Ryna in the Molose area, along with Desi and Joyce.



Spiderman and John

Spiderman and John are two adult males in their prime (8- 9 years old). They were first seen in December 2020 while likely in the early stages of post-dispersal range establishment in the Khukhamma area. Spiderman was collared shortly after the initial observation; however, his collar stopped functioning in January 2022.

Spiderman and John were observed with Viva and Lora and are probable candidates to have fathered Viva's and Lora's litters born in 2025. They move between the Khankhe area and Khutse 1 and have likely established their territory in this section of the CKGR, becoming prime contenders to Rocket and Snook's tenure. Spiderman's collar, which stopped working in January 2022, was lost towards the end of 2024 when the automatic drop-off system was triggered. Attempts were made to recollar him, but these were unsuccessful as he was consistently skittish during collaring operations.

John was collared in March 2025; at the time of collaring, he was with Viva and Lora. Since being collared, John has mostly moved within areas between Khutse 1, Khankhe, and the second cutline. On occasion, he moved north of the second cutline and northeast of Khukhamma.





Molose Pride

Over the past five years, we have been able to continuously monitor two cohorts of females and their offspring moving within the study area. The four older females originate from the large Molose pride, which once consisted of approximately 17 individuals at its maximum size (including cubs and adults) and fragmented around 2017.

In 2025, Alice and Alexa established a core area between Molose and Khukhamma waterhole in the Central Kalahari Game Reserve. They moved with their four cubs born in 2023 (Simba, LM114, LF080, and LF081), as well as with Alexa's daughter Ryna, born in 2020. The group ranged extensively between Khutse Game Reserve and the Central Kalahari, particularly north of Molose. Ryna and Simba were fitted with GPS collars in June. During August, Alice was sighted with two cubs at a den site, which were suspected to be hers based on GPS movement clusters. These cubs were later abandoned, killed, or died of other causes, as Alice was subsequently sighted mating with Snooks and Rocket later that same month. The group split in August, with the three adult females moving independently and the subadults forming a separate group. The subadults further separated in October, when Simba was most frequently sighted with LF080. In November, LF081 rejoined Simba and LF080, and they were later joined by LF085, a subadult female whose origin is currently unknown. Toward the end of November, the three subadult females were collared. Simba separated from the females at the end of November and was thereafter moving alone. Alexa gave birth to a new litter in November, and four cubs were observed. Throughout 2025, Desi and Joyce moved together with their six cubs born in late 2023 (LM115, LM116, LM117, LF082, LF083, and LF084). Their movements covered large areas between Moreswe and Molose, extending across both the eastern and western boundaries of Khutse Game Reserve. An attempt to collar Joyce in June was unsuccessful due to the group's skittish behaviour. Desi's collar stopped functioning in August, and LM115 was successfully collared in November.

Males dispersing from the 2020 litters of Alice and Alexa and the 2021 litters of Desi and Joyce have since formed coalitions ranging between Molose and Khukhamma waterholes. In February 2024, Sepekere was collared while moving with four other males (LM097, LM099, LM100, and LM101). Sepekere and his brother Jimmy (LM097), both offspring of Alexa, were previously associated with Desi and Joyce and their litter during 2022- 2023, which included LM099, LM100, LM101, LM102, and LF074. Mookodi later joined the coalition and has been consistently observed with Sepekere since June 2024. In the same month, the coalition split, with Sepekere, Mookodi, and Jimmy remaining together while the other three males dispersed from the area. Mookodi is the youngest of this group. Sepekere, Mookodi, and Jimmy remained together throughout 2025, ranging primarily north of Khutse Game Reserve corner four, west of Kukamma waterhole, and northwest of Kikao, with occasional movements west of Mothomelo. Sepekere's collar stopped functioning in March, was retrieved in April, and found to be damaged. He was recollared in June, at which time Jimmy was also fitted with a GPS collar.

Project 6. Human-Predator Conflict

Human-carnivore conflict along the Khutse Game Reserve boundary remained a significant management issue in 2025 and represents one of the most direct interfaces between ecological processes and human well-being in the system. While patterns of predation are described under Project 3 (p. 13), this project focuses on how those events translate into conflict risk, management responses, and outcomes for both people and wildlife.

Lion-related livestock losses outside the reserve stayed consistently high, with 110 reported depredation events, comparable to levels recorded in 2024. Although overall losses did not increase, the composition of livestock affected shifted. Cattle predations declined, while donkey losses increasing markedly, reflecting localized prey selection patterns by specific lions using areas adjacent to the reserve fence, particularly along cattle-post landscapes.

Spatial analyses show that livestock predation is strongly concentrated along the reserve boundary, with kill sites clustering close to the fence and nearby cattle posts. These edge-focused patterns contrast with lion predation inside the reserve, where hunting activity is more dispersed across the landscape. This persistent boundary effect underscores the reserve edge as a focal zone for conflict and a priority area for mitigation efforts.

Leopard-related livestock losses were comparatively low in 2025 and declined relative to the previous year. In total, seven leopard predation incidents were recorded outside the reserve, less than half the number documented in 2024. The absence of collared leopards during the year limited finer-scale analysis of leopard conflict dynamics, with renewed monitoring planned for 2026. It is important to note that reduced livestock depredation by leopards does not necessarily indicate reduced conflict risk. Leopards are legally trophy hunted in surrounding areas, and changes in depredation levels may also reflect shifts in leopard presence or local population density rather than changes in behaviour alone. Distinguishing between these possibilities requires independent information on leopard distribution and activity in communal grazing lands. To address this gap, LEC will initiate a large-scale camera-trap survey outside the reserve in 2026. The study will be led by Alessandro Araldi, a PhD student affiliated with the

Centre for Research into Ecological and Environmental Modelling (CREEM), University of St Andrews, and LEC, and will assess leopard presence, space use, and activity patterns in communal areas. This work will help place conflict data into a broader ecological context and improve interpretation of trends in leopard-livestock interactions.

In November 2025, a translocation operation was implemented by the Department of Wildlife and National Parks (DWNP) following ongoing human-lion conflict incidents outside the reserve involving the East Khutse Pride. This operation involved the adult female Poona (LF069), her dependent cubs, and several subadult males from her group. Poona and her four cubs were translocated to Piper Pan in the western Central Kalahari Game Reserve and released on 13 November 2025. Initially, Poona remained in the release area and successfully reunited with all cubs before beginning wider movements later in the month.

Subsequently, efforts focused on the translocation of the subadult males associated with Poona's group. One subadult male (LM108) was successfully captured, collared, and translocated deeper into the CKGR. During these translocation operations, two males unfortunately died during active capture and handling. These mortalities are recorded as outcomes of the translocation attempt and reflect the risks associated with such interventions. Following her release, Poona began moving southward at the end of November and did not return to the release site. At that stage, the fate of the cubs was unclear, but it was assumed at the cubs had died or were abandoned. By December 2025, telemetry data confirmed that she had returned to the Khutse area (Figure 6.1). During this period, Poona resumed ranging outside the reserve boundary, and livestock depredation incidents were again recorded in community areas adjacent to Khutse. One translocated subadult male from Poona's group did not return to Khutse and has remained east of the Central Kalahari Game Reserve. In response, LEC engaged with DWNP and the Cheetah Conservation Botswana (CCB) in Ghanzi to share collar access and movement data for this individual, supporting ongoing monitoring and proactive conflict mitigation in the areas where the male is now ranging.

Recent student research at LEC has further highlighted the social complexity of human-lion coexistence around Khutse. Work by MSc student Badou Nicola Kouate,

University of Zurich, indicates that tolerance toward lions in surrounding communities is shaped by a range of factors beyond direct livestock losses, including fear, perceived risk, and broader livelihood concerns. These findings reinforce the importance of addressing both tangible and intangible drivers of conflict when designing mitigation strategies.

Together, the events of 2025 highlight the logistical complexity and the limitations of reactive tools such as translocation for managing the human-predator conflict in boundary landscapes. They also underscore the importance of coordinated post-release monitoring, cross-agency collaboration,

and the continued development of more proactive, socially grounded approaches to coexistence. In response, LEC has initiated a new collaboration with the Zoological Society of London (ZSL) to apply structured decision-making approaches to human-lion conflict around Khutse. This work, highlighted as a project in focus in this report, brings together local communities, government partners, and conservation practitioners to identify shared objectives, explore alternative management strategies, and transparently evaluate trade-offs, with the aim of developing more durable and locally supported solutions.

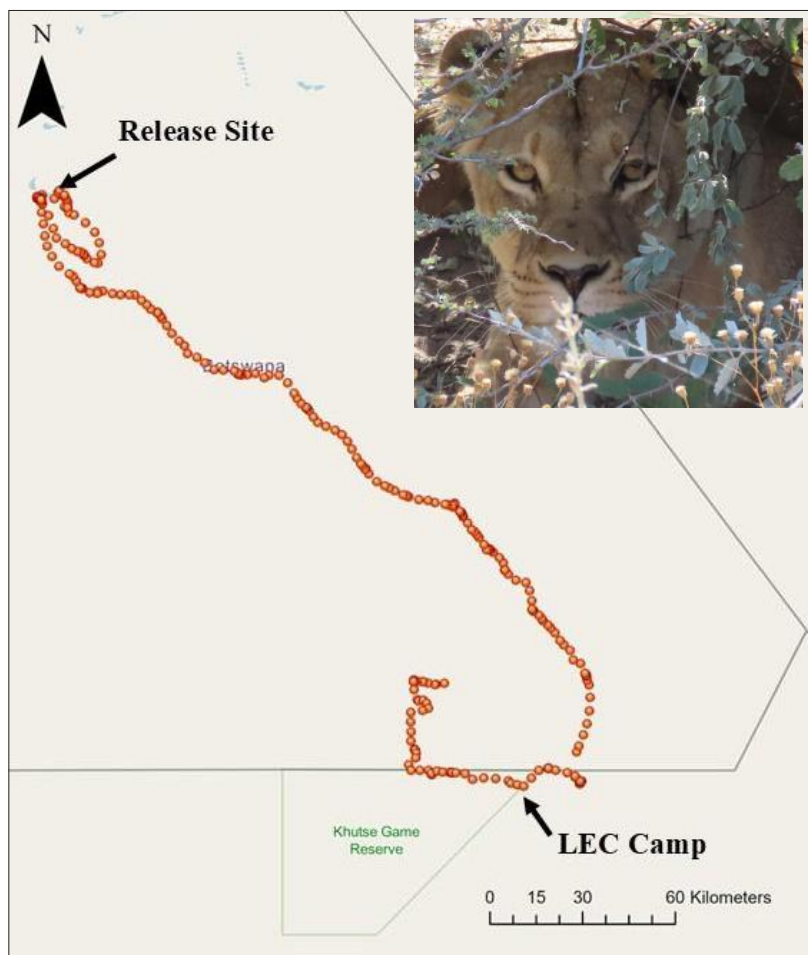


Figure 6.1. Collar data from female lioness Poona showing translocation release site and subsequent movement back to the Khutse area in November-December 2025.

PROJECT IN FOCUS.

FROM CONFLICT TO COLLABORATION: USING STRUCTURED DECISION MAKING TO NAVIGATE HUMAN-WILDLIFE CONFLICT

Coexistence between people and wildlife depends on approaches that meaningfully incorporate Indigenous values, local knowledge, and human well-being. Around Khutse Game Reserve (KGR) in Botswana, lions regularly move beyond the reserve boundary and prey on livestock, creating growing tensions for the local communities in Kaudwane and surrounding areas. Livestock losses and concerns for personal safety undermine local well-being and tolerance for wildlife, while the long-term effectiveness of reactive responses to problem animals (such as lethal control or translocation) remains uncertain.

To explore more proactive and durable approaches to conflict mitigation, our Community & Education and Research teams have been working together on a new collaboration with the Zoological Society of London (ZSL). This new project focuses on engaging local communities and partners to co-develop strategies to

reduce human-lion conflict around Khutse. Guided by decision science specialist Dr Bethany Smith from ZSL, the work applies an approach known as Structured Decision Making (SDM).

SDM is a step-by-step way of addressing complex problems where there is no single “correct” solution. It follows a six-step, iterative framework commonly referred to as the ProACT cycle (Figure F1). The process begins by clearly defining the problem and decision context, followed by identifying objectives that reflect what matters most to people. Possible actions and combinations of actions (alternatives) are then evaluated against these objectives by predicting their likely consequences. Because objectives often conflict and people do not care about the objectives equally, these consequences must be weighed through explicit trade-offs. Once a decision is made, actions are implemented and monitored, allowing learning to feed back into future decision-making.

A key strength of SDM in human-wildlife conflict contexts is its strong focus on values. Rather than starting with predefined solutions, the process begins by asking people what they care about and what success would look like to them. These values are translated into objectives that provide a transparent and defensible basis for comparing options. This helps groups move from disagreement and distrust toward collaborative decisions that are more likely to be understood, supported, and sustained over time.

Although the project is still ongoing, a major highlight to date was welcoming Dr Bethany Smith and Professor John Ewen from ZSL, alongside Dr Mmadi Reuben and Kenosi Nkape from the Department of Wildlife and National Parks (DWNP), to Khutse in November 2025. During their visit, we hosted a two-day community workshop at the local school in Kaudwane, bringing together



Figure F1. Six-step iterative cycle used in Structured Decision Making, commonly referred to as the ProACT cycle.

village residents and farmers, tribal authority leaders, representatives from government and statutory bodies, local tourism operators, and conservation practitioners. The workshop was conducted in both English and Setswana, ensuring participants could fully engage and that all voices were heard. Attendance was excellent on both days, reflecting strong local interest and commitment.

Through a series of interactive activities and group discussions, participants described the challenges they face and expressed what matters most to them. While objectives are still being refined, values identified included sustaining economic benefits from farming and the broader local economy, maintaining culturally important livelihoods, ensuring people feel safe living and working alongside wildlife, conserving viable lion populations, and promoting responsible and

transparent management of problem animals.

Participants also identified a wide range of potential actions to reduce conflict, including improving livestock protection and park fencing, developing early warning systems, creating local employment opportunities, and strengthening coordination around problem animals. Over the coming months, these actions will be organised into alternative strategies and their likely consequences evaluated. This next phase will draw on expert knowledge of lions and human-wildlife conflict through a series of structured expert elicitations.

Overall, the energy and openness demonstrated during the workshop, and the feedback received since, have been highly encouraging, and the team is excited about the potential of this work as it develops.



COMMUNITY & EDUCATION PROGRAMME

Since 2004, Leopard Ecology & Conservation has worked closely with communities in and around the Khutse area through its Community and Education (C&E) team. This long-term engagement is founded on building trust, mutual respect, and strong partnerships with local stakeholders, bearing in mind that successful conservation is inseparable from the wellbeing and involvement of the people who share their landscapes with wildlife. We also acknowledge the crucial role that communities living near protected areas play in the success of our conservation efforts. Their proximity to wildlife habitats often places them at the forefront of both the benefits and challenges associated with conservation.

Central to our work are two interlinked focus areas. The first is fostering sustained interest, understanding, and passion for wildlife and conservation, particularly among community members and young people, through education, awareness, and participatory activities. The second is reducing conflict between people and wildlife by supporting practical, locally appropriate solutions that help safeguard livelihoods while promoting tolerance and coexistence with wildlife.

Through this consistent and collaborative approach, LEC has cultivated a strong and mutually beneficial relationship with the local community and ensured that local voices inform programme design and implementation. These relationships continue to be fundamental in guiding LEC's work and in driving progress towards fulfilling its mission of promoting long-term coexistence between people and wildlife in the Khutse landscape.





Objectives for the period 2020–2025

- Work together with the Research Programme to use the research findings to better inform our conservation and education activities.
- Undertake research to better understand the nature of the conflict between livestock farmers and predators and evaluate practical measures to minimise this conflict.
- Empower farmers and herders, through education and capacity building, so they become knowledgeable and effective managers of livestock and rangelands, to facilitate coexistence.
- Provide disease prevention and livestock management training opportunities, to building positive relationships with farmers and encourage effective and environmentally-friendly livestock production.
- Continue to support the people of Kaudwane via capacity development projects that encourage active community participation in conservation activities and the sustainable use of natural resources.

The Community and Education programme consist of two modules: Education and Capacity Building as well as Community Support and Development.

Education & Capacity Building

We believe that education and capacity building are foundational tools for conservation and coexistence, transforming local communities from passive observers into active stewards of their environment. By imparting knowledge, skills, and empowerment, these initiatives foster a sense of responsibility, reduce reliance on unsustainable activities, and provide practical solutions for sharing landscapes with wildlife.

This year, we focused on engaging farmers through organised gatherings in the form of mini workshops held at individual cattleposts. In total, six mini workshops were conducted at different locations across the study area, with a total of 236 Farmers attending the mini workshops. This approach was adopted to maximise outreach to farmers while allowing for meaningful discussions around the unique challenges experienced at each cattlepost.

In 2024, the delivery of educational programmes to farmers and herders was constrained by several factors beyond our control, with participant unavailability being the main challenge. Poor timing of lessons was frequently cited as the reason for low attendance. Following discussions with farmers, it was agreed that future sessions would be scheduled well in advance and targeted towards those who expressed interest, in order to make more efficient use of time and resources.

The Community and Education (C&E) team will continue engaging farmers, particularly those who have expressed a genuine interest in learning, to collaboratively determine the most effective way

forward for the educational programme in 2026. To further strengthen and improve the programme, plans are in place to involve additional stakeholders in the facilitation of future sessions, with a focus on providing practical and applicable livestock management practices. These ongoing engagements not only create space for structured learning around livestock management, but also provide an opportunity to identify and respond to broader community needs that directly affect animal health and wellbeing. So was for example a request from the Mosime community (see map p. 42) received for LEC’s support in purchasing materials to construct a toilet during one of the farmer engagements. The importance of this request was acknowledged, as the facility will contribute to addressing the current outbreak of cattle measles, which has been linked to poor sanitation and hygiene practices, including contamination of livestock feed when people defecate in or near grazing areas. In response, LEC procured the required materials and delivered them as requested.

The C&E team carries out weekly cattleposts visits to - in addition to the educational aspects- collect numbers of predation events and other mortality cases, to gain a clear understanding of how the conflict evolves with the aim of coming up with relevant mitigation strategies. Based on data collected in 2025, livestock losses attributed to disease and poor management practices were higher than losses caused by predation. A total of 209 livestock were lost to non-predation factors, compared to 135 losses due to predation. Lions remain the leading predator, responsible for 74.8% of predation-related losses. Cattle were the most frequently preyed

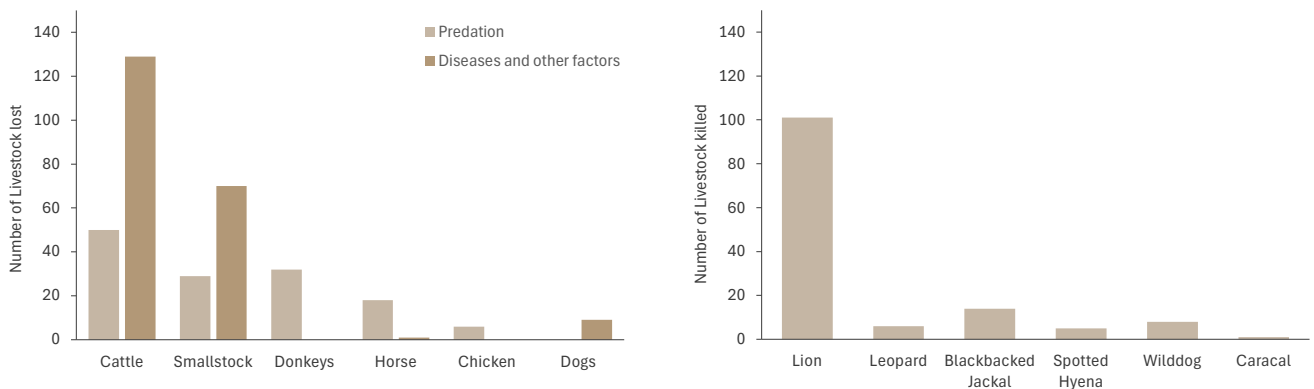


Figure 1. Livestock losses by species and cause in 2025 (left), and predator contribution to livestock losses in the Khutse area in 2025 (right).

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The zoonotic diseases are a major health scare in both developing countries and developed countries and our involvement in dog vaccination against rabies help in preserving human population and wildlife population.

Mphoeng Ofithile, Community & Education Officer

upon species (37%), followed by donkeys (23.7%). The black-backed jackal was also identified as a predator of concern (Figure 1).

Data indicate a slight decrease in livestock losses due to predation compared to the previous year. In 2024, a total of 153 livestock were lost to predation, while in 2025 this figure declined to 135. In contrast, losses attributed to disease and poor management practices increased from 166 in 2024 to 209 in 2025.

Disease-related mortalities were primarily associated with symptoms consistent with *Pasteurella*, accounting for 31.1% of reported cases. However, a significant proportion of disease-related deaths (37.3%) involved symptoms that farmers were unable to identify. Cattle were the most affected species, representing 60.3% of disease-related losses, followed by small stock at 33.4%. Other notable diseases contributing to livestock mortality included heartwater and Lumpy skin.

The data presented was collected in the eight cattlepost in LEC study area; Molilwane, Mangadiele, Mokujwane, Kungwane, Mahuhumo, Makakamara, Ditampana, Tshipidi and Kaudwane village (see map on p. 42).

Overall, the findings indicate that improved livestock management practices could substantially reduce losses, strengthen herd productivity, and minimise preventable mortality linked to neglect and poor animal health management.

LEC continues to support farmers and enhances coexistence

Trimming animal hooves is essential to prevent pain, lameness, and infection by maintaining proper shape, balance, and overall improving animal welfare and farm productivity. In 2025, there was a notable increase in the number of livestock trimmed, we saw an increase from 352 in 2024, to 518 in 2025. The most frequently trimmed animals were small stock such as goats and sheep at 77.4%.

Each of the eight cattle posts in the LEC study area has been issued with a set of hoof trimming tools.

For the fourth consecutive year, LEC partnered with the Botswana Society for the Prevention of Cruelty to Animals (BSPCA) and the Department of Veterinary Services (DVS) to implement a cat and dog sterilisation and rabies vaccination campaign. The initiative aims to improve the overall welfare of domestic animals while reducing roaming and aggressive behaviour, thereby lowering the risk of rabies exposure and transmission to and from wildlife.

As pets in the Khutse area live within a shared wildlife landscape, the likelihood of interaction with wild animals remains high. Vaccination and sterilisation thus play a critical role in minimising the risk of rabies transmission between domestic animals and wildlife. The campaign was implemented in two phases.



The first phase focused on public awareness and education, aimed at changing attitudes and influencing behaviour to improve pet welfare. Education sessions highlighted the dangers of rabies and the risks posed by uncontrolled breeding, particularly among feral and free-roaming dogs. To broaden the project's reach, LEC continued working with settlements within the Central Kalahari Game Reserve (CKGR), namely Kukhamma, Gope, Metseamanong, and Mothomelo, where domestic animals and wildlife coexist in very close proximity (see map on p. 42).

The second phase involved vaccination and sterilisation activities conducted over a two-week period. During this time, a total of 24 animals (18 dogs and 6 cats) were successfully sterilised, and 77 dogs were vaccinated against rabies. The relatively low number of vaccinated animals was due to a limited supply of rabies vaccines worldwide. As a result, the available vaccines were prioritised for dogs in settlements located within the CKGR.

During the exercise, several dogs were identified as being infected with Transmissible Venereal Tumour, a contagious canine cancer. Although euthanasia was recommended as a humane option due to the risks associated with the disease, some owners were

not agreeable to this approach. In such cases, the team provided guidance on the nature of the disease and the potential harm it poses to both affected animals and the wider dog population.

In the Khutse and surrounding areas, farmers largely rely on horses as their primary mode of transport for rounding up livestock for kraaling and for locating animals that may have gone astray. In recognition of this, and to support improved standards of horse welfare, LEC engaged a professional farrier to provide education to horse owners and the wider community on holistic horse care and management. The training focused on key aspects including hoof care, deworming, proper handling, saddling, and safe riding practices.

The farrier was invited to conduct three visits between February and June 2025, during which he met with horse owners at various cattle posts within LEC's study area and delivered hands-on, practical training. As a form of motivation and reinforcement, the third and final visit included an evaluation of participants' progress. Based on this assessment, each participating farmer received a reward aimed at further improving horse welfare. These incentives included saddles, bridles, dewormers, tick grease, and fly sprays. A total of 24 horses were registered and participated in the final horse assessment.

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Through every conservation and education activity we hope to create an impact that outlives our efforts, where conservation and sustainability becomes like second nature to the community and they actively and consciously care for their environment.

KEFILWE MOKGWATI, Community & Education Project Assistant.

Community Support & Development

LEC works closely with local communities on small-scale initiatives aimed at improving quality of life, fostering self-reliance, and promoting positive social change at the local level.

In May 2025, LEC in collaboration with the Special Support Group - Khutse base and the Department of Wildlife and National Parks organised a full-day educational excursion into Khutse Game Reserve for 45 Grade 7 learners. The learners were accompanied by their teachers and a representative from the School Parents-Teachers Association.

The objective of the school game drive was to offer the

learners an experiential learning opportunity that brings classroom lessons in the natural environment, geography, and ecology to life. The activity also aimed to foster environmental awareness, enhance understanding of the importance of protected areas, and allow learners to observe wildlife in their natural habitat, thereby encouraging curiosity and appreciation of ecosystems.

In addition, LEC continues to support Kaudwane Primary School through the donation of funds to purchase awards for learners who perform well across all grades. This initiative serves as both motivation

and recognition of academic achievement, reinforcing the value of education within the community.

The Community Conservation Club is a voluntary group that has been working closely with LEC since 2019. The club primarily focuses on conservation awareness and active participation in LEC's community-based projects. It serves as an important link between LEC and the local community, empowering residents to take an active role as stewards of their local environment.

The club comprises six members from the Kaudwane community who are regularly engaged in LEC-supported community initiatives. As the group operates on a voluntary basis, LEC provides motivation and support through initiatives such as mini-garden projects. Members receive horticulture training and funding for garden materials, with the aim of building practical skills and promoting self-sustainability beyond their active participation period.

World Nature Conservation Day is observed annually on July 28 to raise awareness about protecting natural resources, biodiversity, and ecosystems from threats like climate change, deforestation, and pollution. It emphasizes taking personal, local, and global action to ensure a sustainable, healthy environment for future generations. The aim for this year was to educate the community on the most practical and environmentally friendly ways to manage waste generated in the community. Activities involved ways in which the community could reuse and recycle waste materials, which involves coming up with new uses for items instead of throwing them away or converting waste materials into new products.

To generate interest and motivate community participation, LEC introduced the Waste Material Art and Design Competition, which challenges participants to create functional or artistic items using waste

materials. The completed products were categorised into Plastic, Metal, Cloth, and Paper, with prizes awarded to the best designs in each category.

LEC continues to work closely with the community on habitat restoration initiatives aimed at rehabilitating degraded landscapes and improving the local ecosystem around Kaudwane village. Key activities include tree planting programmes and, more recently, the introduction of a seedball restoration initiative. These efforts are implemented in collaboration with the Department of Forestry and Range Resources (DFRR).

The primary objective of the habitat restoration programme is to mitigate human-induced environmental impacts by restoring lost vegetation and improving degraded ecosystems. Through this collaboration, LEC and DFRR provide community members with practical training on appropriate tree planting techniques, species selection, and basic aftercare, alongside the donation of tree seedlings. This approach not only contributes to ecological restoration but also builds local capacity and promotes long-term stewardship of natural resources.

The seedball project is currently at the planning stage. LEC, in partnership with DFRR, is in the process of developing a pilot programme and a clear implementation plan. Once finalised, the pilot will test the suitability and effectiveness of seedballs as a low-cost, community-driven method for restoring vegetation in highly degraded areas, with the potential for scaling up in future years.



APPENDIX I

Table Lion Telemetry. Animals monitored by LEC during 2025.

ID	Name	Group	Collar active in 2025	Notes
LF041	Desi	Molose	01.01.-03.08.2025	Collar stopped working 03.08.2025
LM113	Simba	Molose	02.06.-31.12.2025	On animal
LM111	Dom Dom	Sekaka	04.02.-31.12.2025	On animal
LM097	Jimmy	Molose	06.06.-31.12.2025	On animal
LF072	Ryna	Molose	02.06.-31.12.2025	On animal
LF079	Chaloba	Sekaka	04.06.-31.12.2025	On animal
LF077	Bullet	Sekaka	05.06.-31.12.2025	On animal
LM110	Musafa	Sekaka	05.06.-31.12.2025	On animal
LF060	Alice	Molose	01.01.-31.12.2025	On animal.
LF061	Alexa	Molose	01.01.-31.12.2025	On animal.
LF064	Viva	East Khutse	01.01.-31.12.2025	On animal
LF069	Poona	East Khutse	01.01.-31.12.2025	On animal
LF075	Tuelo	Sekaka	01.01.-24.09.2025	Retrieved- Animal died on 24.09.2025
LM073	Snooks	Snooks & Rocket	01.01.-31.12.2025	On animal
LM085	Rocket	Snooks & Rocket	01.01.-31.12.2025	On animal. Collar replaced 5.03.2025
LM092	John	John & Spiderman	05.03.-31.12.2025	On animal
LM098	Sepekere	Dispersed males from East Khutse	01.01.-31.12.2025	On animal. Collar replaced 06.06.2025
LM102	Mookodi	Dispersed males from East Khutse	01.01.-31.12.2025	On animal
LM112	Tshumu	Sekaka	07.03.-31.12.2025	On animal
LF065	Lora	East Khutse	19.11.-31.12.2025	On animal
LF078	Savanna	Sekaka	20.11.-31.12.2025	On animal
LF080	Tanja	Molose	21.11.-31.12.2025	On animal
LF081	Fiwa	Molose	21.11.-31.12.2025	On animal
LM108		Molose	19.11.-31.12.2025	On animal
LF085	Salphina	Molose	21.11.-31.12.2025	On animal
LM115	Koatie	Molose	29.11.-31.12.2025	On animal

Abbreviations

ACACF	African Cats & Conservation Foundation	DWNP	Department of Wildlife and National Parks
AIC	Akaike Information Criterion	FPP	Fixed Point Photo
BIUST	Botswana International University of Science and Technology	GR	Game Reserve (as in Khutse GR)
BSPCA	Botswana Society for the Prevention of Cruelty to Animals	HWC	Human Wildlife Conflict
BUAN	Botswana University of Agriculture and Natural Resources	LEC	Leopard Ecology & Conservation
CCB	Cheetah Conservation Botswana	LF	Lion Female (<i>Panthera leo</i>)
C&E	Community & Education	LM	Lion Male (<i>Panthera leo</i>)
CI	Confidence Interval	NP	National Park
CKGR	Central Kalahari Game Reserve	PAC	Problem Animal Control
CLAWS	Communities Living Among Wildlife Sustainably	RAI	Relative Abundance Index
D	Density	SDM	Structured Decision Making
DFRR	Department of Forestry and Range Resources	SECR	Spatially Explicit Capture – Recapture
DVS	Department of Veterinary Services	SSG	Special Support Group
		UZH	University of Zurich
		WildCRU	Wildlife Conservation Research Unit
		ZSL	Zoological Society of London



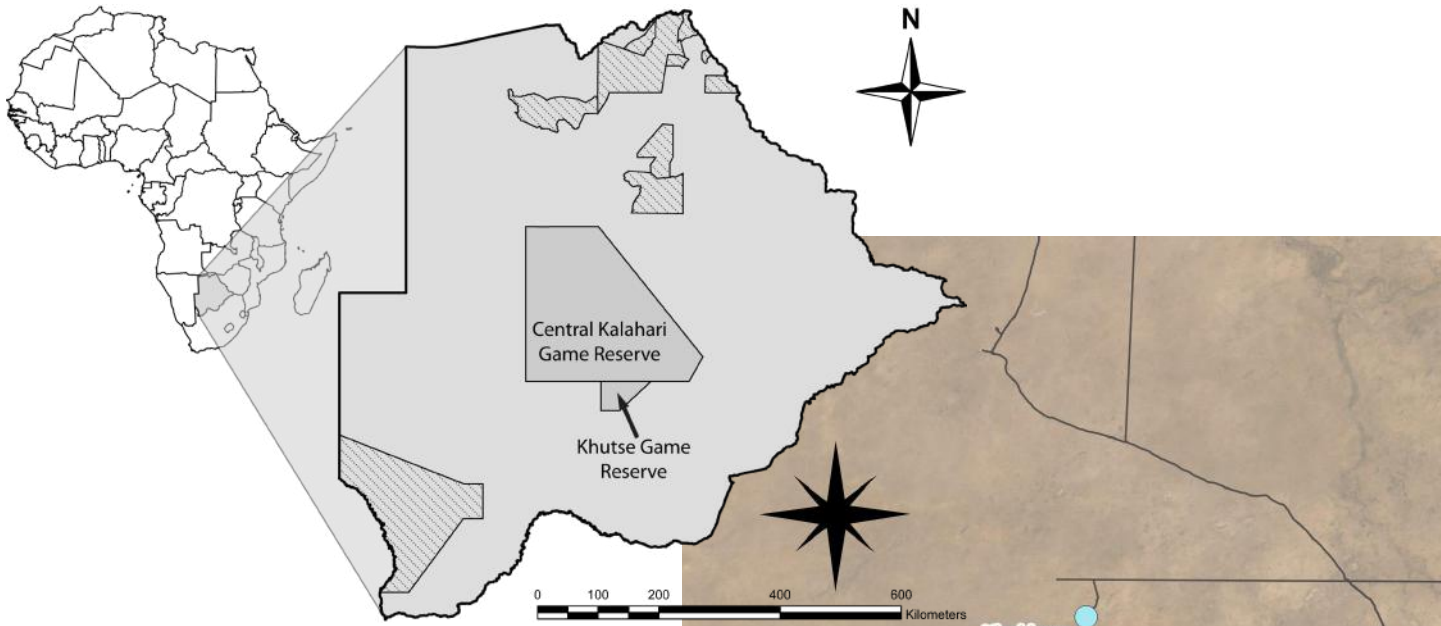
Acknowledgements

The Government of Botswana, through the Ministry of Environment, Natural Resources Conservation and Tourism and the Department of Wildlife and National Parks, has for over 25 years granted permission to Leopard Ecology & Conservation to undertake research and conservation projects. We appreciate the ongoing support received from all levels of these departments.

We also sincerely thank our sponsors for their commitment to the conservation of leopards and lions in the Kalahari. We wish to express our appreciation to the members of the African Cats

& Conservation Foundation, the Leopard Ecology & Conservation Trust, the People and Wildlife Trust and the Act Now for Tomorrow Steering Committee for their ongoing support and guidance. We also value the support provided by the Institute of Evolutionary Biology and Environmental Studies of the University of Zurich. Finally, our success is a direct result of the dedication shown by all members of the Leopard Ecology & Conservation team, both in Botswana and Switzerland, as well as the numerous individuals associated with this project.

STUDY AREA



The study area covers Khutse GR (2'600 km²), the southern part of the CKGR (54'000 km²) and an area of communal land.

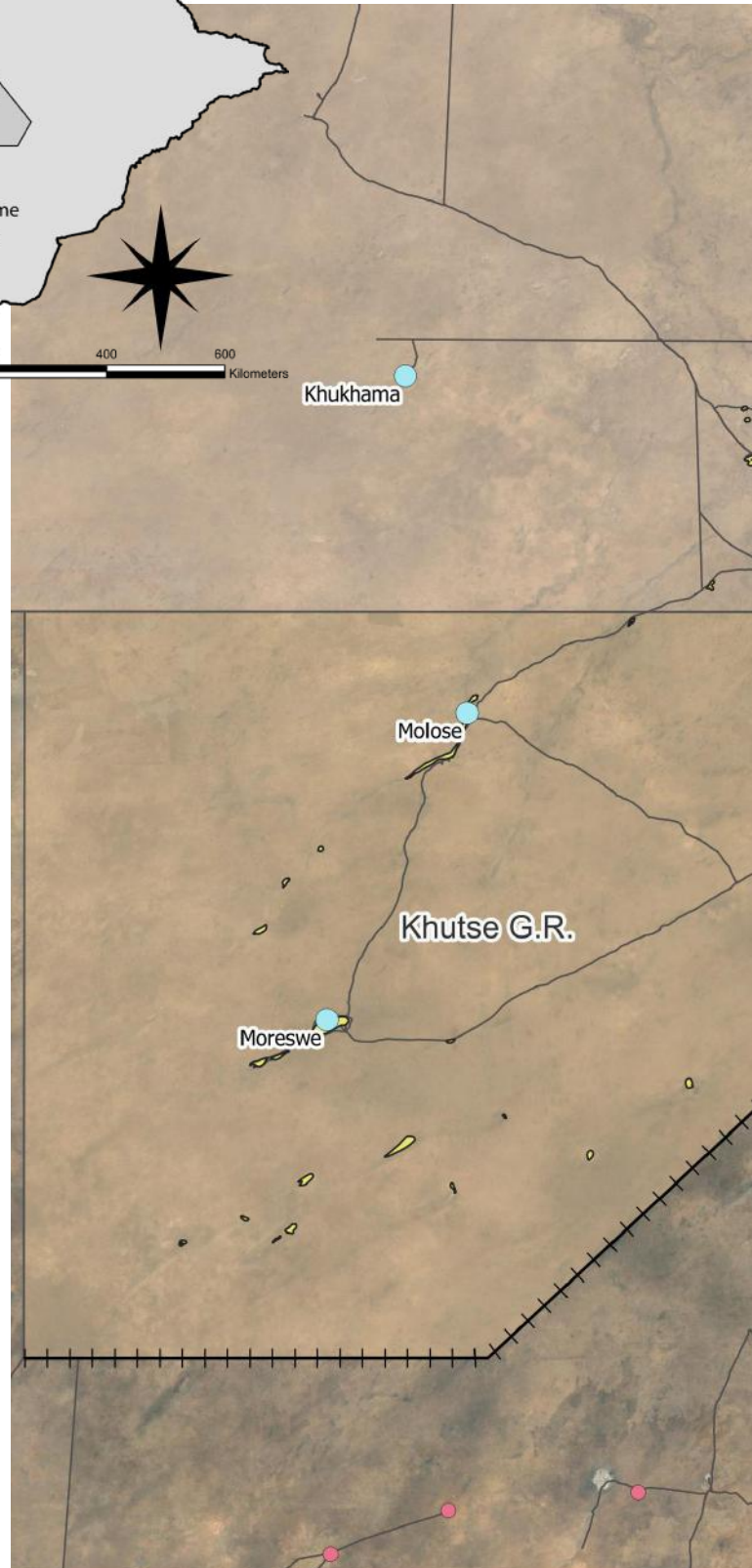
Climatically the area is semi-arid, with four seasonal variations in temperature and precipitation, primarily characterised by a hot and wet summer and a cool and dry winter.

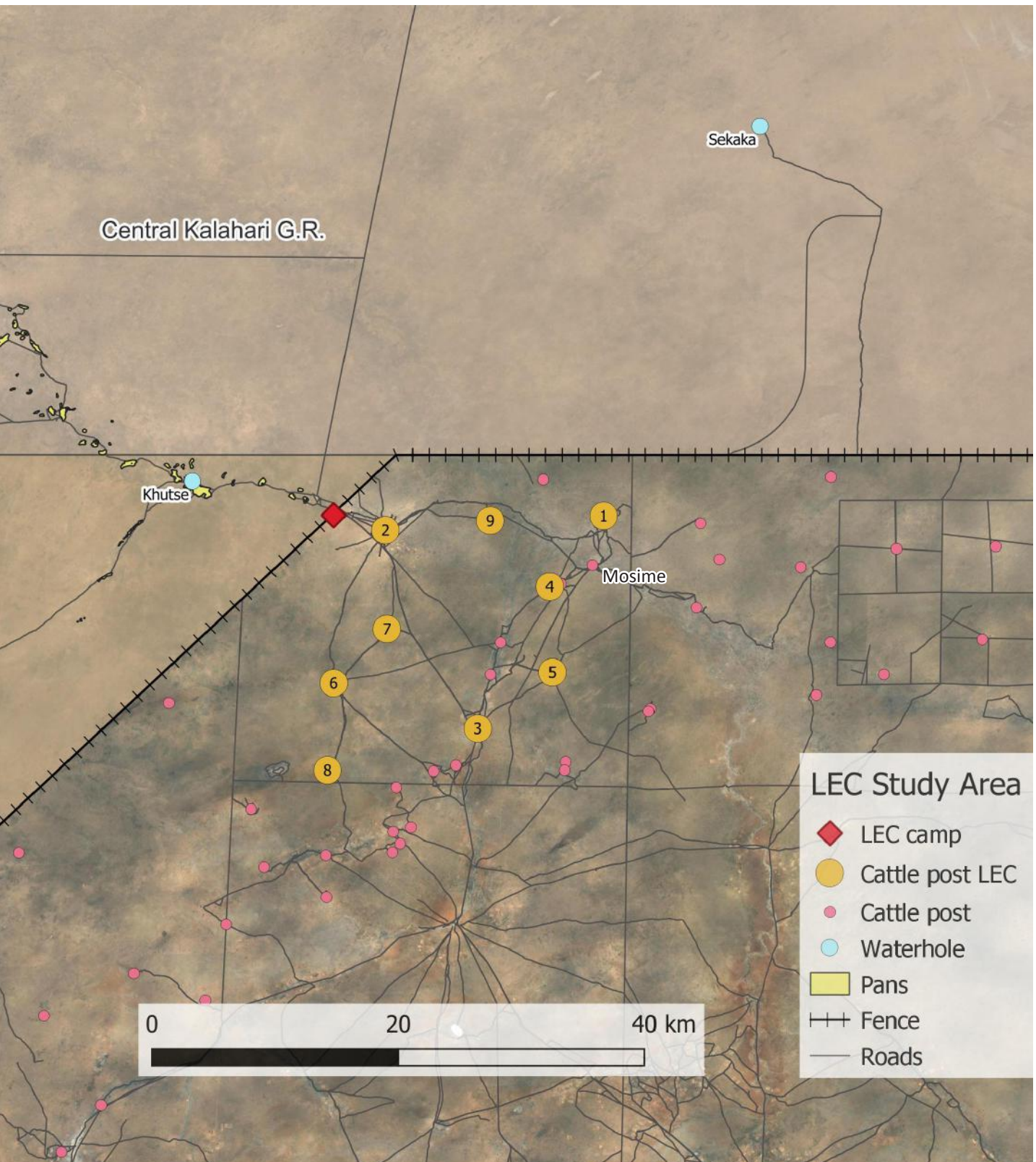
The predator populations here live at low density, with some of the largest ranges exhibited throughout their global distribution.

Surrounding the reserves is the communal land used by farmers for livestock, in some cases directly bordering the reserve. Although there is a fence present at the southeast border, there remains a degree of permeability to predators (Kesch, Bauer and Loveridge, 2013, *Undermining game fences: Who is digging holes in kalahari sands? African Journal of Ecology*). The two reserves in our study system are contiguous and form part of a single large protected area.

Cattle posts LEC:

- 1 Ditampana, 2 Kaudwane, 3 Kungwane,
- 4 Mahummo, 5 Makakamare, 6 Mangadielle,
- 7 Moilwane, 8 Mokuwane, 9 Tshipidi





TEAM, COLLABORATIONS AND STUDENTS

The strength of our organisation lies not only in the expertise and commitment of our staff, but also in the partnerships we cultivate and the students we mentor. Throughout the year, LEC has continued to work closely with government departments, local communities, academic institutions, and other conservation organisations. These collaborations are essential in strengthening conservation outcomes, improving knowledge sharing, and ensuring that our interventions are practical, inclusive, and locally relevant.

In addition, LEC remains committed to supporting students through research supervision, internships, and field-based learning opportunities. By mentoring emerging conservation practitioners and researchers, we contribute to capacity building and the development of future leaders in conservation and environmental stewardship.

Human-Carnivore Coexistence Project

From mid-April 2025, for 3.5 weeks, LEC hosted Mr. Badou Nicola Kouaté, a Master's student from the University of Zurich. His project examined human-carnivore coexistence in communal lands adjacent to the Khutse and Central Kalahari Game Reserves. The project combined a social and an ecological perspective. The purpose of his visit was to gain firsthand understanding of the cultural, social, and ecological context behind the survey data and movement analyses. This experience not only strengthened the scientific robustness of his thesis but also ensured that its conclusions were context-sensitive and practically relevant to LEC's ongoing work.

Drone workshop

In October, LEC and Gazelle Ecosolutions, in collaboration with the Department of Wildlife and National Parks, hosted a drone workshop in Gaborone,

Botswana. Seven presenters delivered a diverse set of talks demonstrating the use of drones across wildlife research and management. Presenters included Shannon Finnegan (LEC), Thoralf Meyer (University of Texas, USA), Blair Costelloe (Max Planck Institute of Animal Behavior / WildDrone project), Elena Iannino (Max Planck Institute of Animal Behavior / WildDrone project), Florian Weise (Communities Living Among Wildlife Sustainably, CLAWS), Wazha Mmereki (Botswana Defence Force), Ty Smucker (Montana Fish, Wildlife and Parks, USA) and Isla Duporage (Princeton University, USA). The workshop aimed to initiate discussions toward developing a proposed structure for drone-use guidelines and a draft permitting process for Botswana, to be presented and refined during a subsequent stakeholder meeting.

Decision Science

In November, LEC in collaboration with Dr. Smith from the Zoological Society of London, hosted a decision science workshop in Kaudwane with local stakeholders affected by human-carnivore conflict. Dr. Rueben and Mr. Knappe from the Department of Wildlife and National Parks were also in attendance. The workshop was very well received by the local community, generating constructive discussion and strong engagement, and this work will continue collaboratively into 2026.

Tapeworm Project

Natalia Grube came back to Botswana in March 2025 to continue her work in the Laboratory of Dr Paganotti at the University of Botswana. Her work focused on extracting DNA from the tapeworms found in lion fecal samples collected in Khutse GR in 2024. She is currently back to the USA to Penn State University to continue her analysis and desk work.



Student Attachments

We thank Gakedirelwe Edward and Tumo Monganja, from BUAN, and Amogelang Thomiso Gaonakala and Emeldah Mobe from BIUST, for completing their student attachments for their degrees with Leopard Ecology & Conservation. During their eight weeks at LEC the students took part in all our ongoing projects, including lion behavioural data collection, fixed point photos and camera trapping. The students also conducted a small vegetation sampling project with the C&E department.

Postgraduate Diploma

Trevor Balone graduated from his Wildlife Conservation Research Unit (WildCRU) Postgraduate Diploma in International Wildlife Conservation Practice at the University of Oxford (Feb - Oct 2025), fully supported by a WildCRU scholarship and additional LEC funding. During the programme, Trevor completed a research project titled “Foraging Behavioural Shifts of Lions at the Interface of Reserve and Cattle-Post Landscapes” based on LEC’s ongoing work in and around Khutse Game Reserve. The project drew on long term monitoring data and applied analytical approaches developed during the course, with a focus on understanding patterns of lion predation at the reserve boundary. Trevor received a distinction in his course and is now back working full time at LEC.

Elephant Impact in Khutse Game Reserve

In 2025, Seitshiro Pule began his MSc in Biological sciences and biotechnology with BIUST in collaboration with LEC. His research is on the topic

“Comparative Analysis of Herbivore Assemblage Dynamics, Behavioral Responses, and Spatio-temporal Waterhole Utilization Pre- and Post-Elephant Immigration into Khutse Game Reserve”. Seitshiro will carry out field work for his project with LEC in 2026.

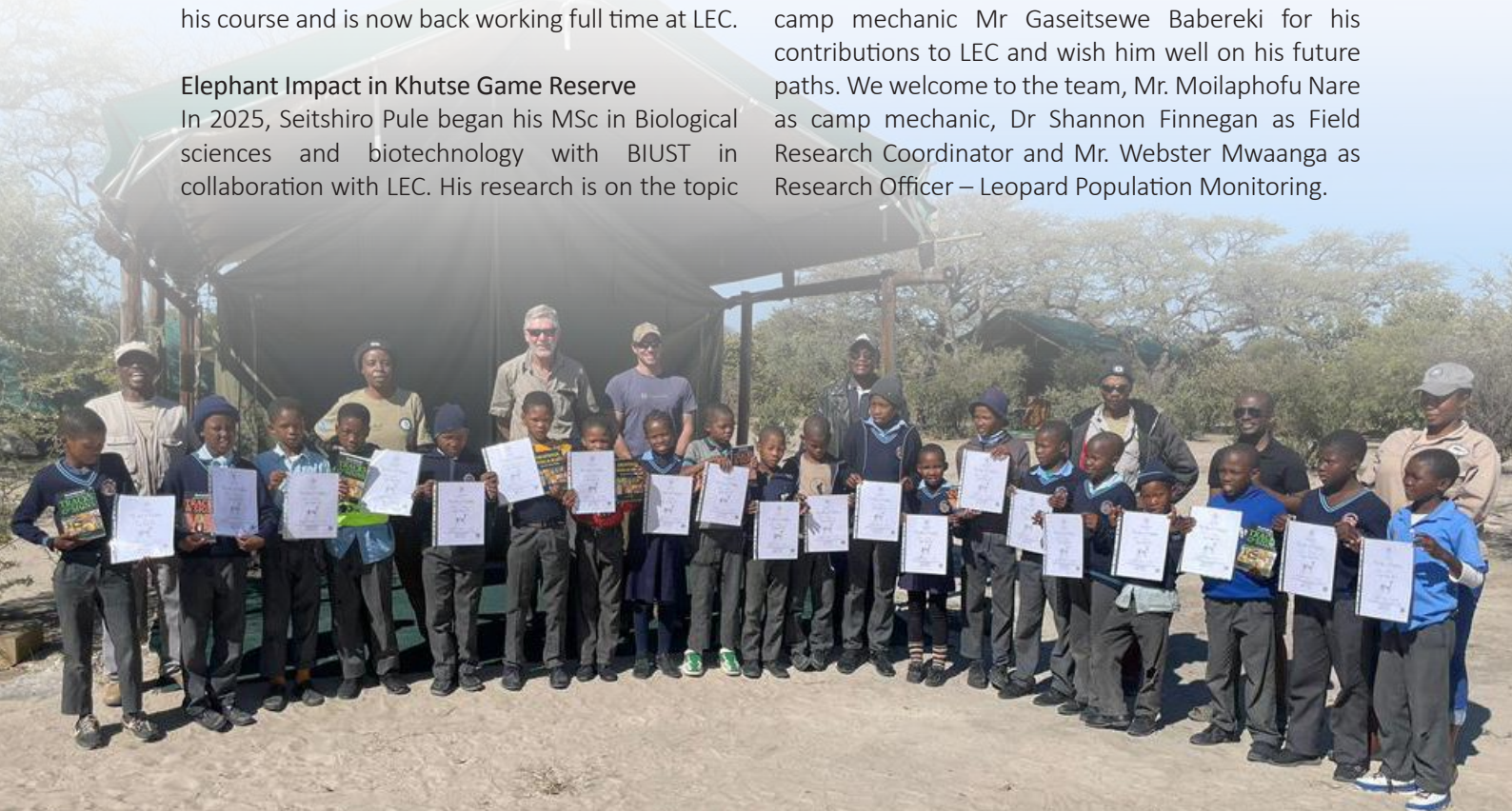
Wildlife Veterinarian

We extend thanks to Dr. Annette Roug and Dr. Gerry Morris for their assistance with lion capture and collaring operations in 2025.

Cybertracker training

The CyberTracker training workshop took place in August 2025 and was a big success. Participants included the Research and C&E departments, two trackers from Cheetah Conservation Botswana (CCB), four staff from DWNP central, one local DWNP gate staff and one local Special Support Group (SSG) team member. In 2025 we also hosted the first ever junior CyberTracker event with 20 local school children from Kaudwane. The research and C&E departments aim to continue hosting junior CyberTracker every year starting in 2026. We thank Adriaan Louw and Andrew Kearney for the CyberTracker evaluations in Khutse in 2025.

Besides all the ongoing and new collaborations in the research and C&E department, our own team also went through some changes in 2025. We thank camp mechanic Mr Gaseitsewe Babereki for his contributions to LEC and wish him well on his future paths. We welcome to the team, Mr. Moilaphofu Nare as camp mechanic, Dr Shannon Finnegan as Field Research Coordinator and Mr. Webster Mwaanga as Research Officer – Leopard Population Monitoring.



APPENDIX II

The Leopard Ecology & Conservation Team

- Araldi, Alessandro, PhD student, Belgium
- Balone, Trevor, Research Officer, Botswana
- Banopi, Mompoloki, Camp Manager, Botswana
- Boupegile, Sheila, Housekeeper, Botswana
- Chepete, Donald, Groundskeeper, Botswana
- Etna, Project Cat, Botswana
- Dr Finerty, Genevieve, Head of Research, UK
- Dr Finnegan, Shannon, Field Research Coordinator, Ireland
- Gabanapelo, Tefo, External Community & Education Advisor, Botswana
- Gabotshwanelwe, Sebakeng, Housekeeper, Botswana
- Gagosimologe, Tshoganetso Ernest, Community Conservation Programme Officer, Botswana
- Gakedirelwe, Edward, Student attachment, Botswana
- Gana, Moisaopodi, Tracker, Botswana
- Gaonakala, Amo, Student attachment, Botswana
- Haas, Fabian, Head of Community & Education Programme, Switzerland
- Ithuteng, Goitseone, Camp Administrator, Botswana
- Ithuteng, Masente, Camp Maintenance and Mechanic Assistant, Botswana
- Ithuteng, Pogiso Africa, Research Officer, Botswana
- Dr Kalberer, Stephanie, Co-Managing Director, Switzerland
- Kegakilwe, Phana Segametsi, Administration and Operations Manager, Botswana
- Köpfler, Marianne, Administration, Switzerland
- Kouate Badou, MSc student, Switzerland
- Majafe, Kobe, Maintenance Officer, Botswana
- Mamou, Mosepele, Tracker, Botswana
- Mobe, Emeldah, Student attachment, Botswana
- Mokgwathi, Kefilwe, Community & Education Programme Assistant, Botswana
- Monganja, Tumo, Student attachment, Botswana
- Monnaanoka, Supula, Tracker, Botswana
- Motsididi, Komano, Community & Education Assistant, Camp Administration, Botswana
- Mosikare, Neo, Cook and Housekeeper, Botswana
- Mosweu, Kebaabetswe Alfred, Community & Education Programme Coordinator, Botswana
- Mwaanga, Webster, Research Officer, Zambia
- Nkadima, Phalatsa, Senior Tracker, Botswana

- Ndove, Kevin, Administration Assistant, Botswana
- Obotseng, Obakeng John, Education Liaison Officer, Botswana
- Ofitlhile, Mphoeng, Community & Education Programme Officer, Botswana
- Podidaroma, Sokwa, Tracker, Botswana
- Pule, Setshiro, Local University Liaison Officer, Botswana
- Rampepele, Lebogang Sophie Seolwana, Accounts and Administration Officer, Botswana
- Schiess, Philipp, IT Specialist, Switzerland
- Schiess-Meier, Monika, Founder and Managing Director, Switzerland
- Seganaphofu, Duella, Contracted Driver, Botswana
- Speedy-Dusty, Project Dog, Botswana
- Tshiamo, Mpho, Tracker, Botswana
- Tshiamo, Meno, Tracker, Botswana

Academic collaborations

- Dr Basupi, Vincent, School of Earth Sciences and Engineering, Botswana International University of Science and Technology (BIUST), Botswana
- Dr Borrego, Natalia, Lion Research Center, University of Minnesota, USA, and MPI-AB, Germany
- Dr Chamaille-Jammes, Simon, Centre d'Ecologie Fonctionnelle et Evolutive, Centre National de la Recherche Scientifique (CEFE-CNRS)- Montpellier, France
- Prof. Crofoot, Meg, Ecology of animal Societies, Max Planck Institute of Animal Behavior, Germany
- Dr Dithlogo, Marks, Department of Biological Sciences, University of Botswana (UB), Botswana
- Prof., Ewen, John, Institute of Zoology, Zoological Society of London, UK
- Gielen, Marie-Charlotte, Quantitative Conservation Biology, Université catholique de Louvain, Belgium
- Grube, Natalia, PhD Student, Anthropological Genomics Laboratory, PennState University, USA
- Dr Kotze, Robynne, WildCRU, University of Oxford, UK
- Dr Jewell, Zoe, WildTrack, USA
- Garbeli, Jary, molecular genetic analysis, Institute of Evolutionary Biology and Environmental Studies, University of Zurich, Switzerland
- Dr Kenup, Caio, Institute of Zoology, Zoological Society of London, UK
- Prof. em. König, Barbara, Department of Evolutionary Biology and Environmental Studies, University of Zurich, Switzerland

- Prof. Manser, Marta, Department of Evolutionary Biology and Environmental Studies, UZH, Switzerland
- Dr Morris, Gerrald, project veterinarian, Botswana
- Dr Neo-Mahupeleng, Gosiamo, Wildlife Ecology lecturer, Botswana University of Agriculture and Natural Resources, Botswana (BUAN), Botswana
- Prof. Packer, Craig, Lion Research Center, University of Minnesota, USA
- Prof. Rampart, Melusi, Department of Range and Forest Resources, Botswana University of Agriculture and Natural Resources, Botswana
- Roggia, Yari, Fondazione Zoom, Italy
- Dr Sianga, Keoikantse, Department of Wildlife and Aquatic Resources, Botswana University of Agriculture and Natural Resources
- Dr Smith, Beth, Institute of Zoology, Zoological Society of London, UK
- Prof. Sutherland, Chris, Centre for Research into Ecological & Environmental Modelling, University of St. Andrews, UK
- Prof. em. Zucchini, Walter, Department of Economic Sciences, Georg August University Göttingen, Germany

Collaborating Institutions from Botswana

- BirdLife Botswana
- Botswana Carnivore Forum
- Botswana Society for the Prevention of Cruelty to Animals
- Cheetah Conservation Botswana (CCB)
- Community of Kaudwane
- Community Conservation Club, Kaudwane
- Department of Animal Production
- Department of Veterinary Services
- Department of Wildlife and National Park (DWNP) (Groups: Community Service and Outreach, Parks, Problem Animal Control, Research, Veterinary)
- Kalahari Research and Conservation
- Kaudwane Primary School
- Kuanghoo Community Trust
- Kweneng Lang Board
- Letlhakeng Sub-District Council
- Village Extension Team and Village Development Committee (Kaudwane and Salajwe)

International Collaborating Institutions

- African Carnivore Wildbook, Vancouver, Canada
- Conservation AI, Liverpool, UK

- CyberTracker, South Africa
- EarthRanger, Seattle, USA
- WildEye Conservation, TrapTagger, South Africa

Support in Botswana (permits, information and logistics)

- Department of Animal Production
- Department of Forestry and Range Resources, Letlhakeng Forestry Tree Nursery
- Department of Research, DWNP
- Department of Veterinary Services, DWNP
- Ministry of Environment, Natural Resources, Conservation and Tourism, Research and Development Department
- Ministry of Environment, Natural Resources, Conservation and Tourism, Environmental Affairs Department
- Special Support Group, Khutse Base Camp
- Dr Flyman, Michael, Food and Agriculture Organisation
- Munyadzwe, Mercy, Regional Wildlife Officer Molepolole
- Sekhute, Stephen, Park Manager, Khutse GR
- Mr Siku & Mr Tibi, Farrier
- Batshabang, Moemi Raeshimane, Director, DWNP
- Solar International and Solar West, Botswana
- Toyota Motor Centre, Botswana

International Support (Professional, logistical and material support)

- Aebersold Digitaldruck, Switzerland
- BGS-Architekten, Switzerland
- Feusi Optik AG, Switzerland
- FlyAway Reiseerlebnisse GmbH, Germany
- Dr. Forrer Mathias, Schulthess Klinik, Switzerland
- Holzinger, Rosmarie, Switzerland
- Kupferschmied, Basil, Switzerland
- Lobatse Canvas, Botswana
- Maier, Reto, Universität Zürich, Switzerland
- Nakano, Michel, technical support, University of Zurich, Switzerland
- neuco – architectural lighting, Switzerland
- Dr Roug, Annette, Veterinarian, USA
- Schiess, Fritz, Switzerland
- Schmid, Peter & Susanne, Switzerland
- Wagner Elicar, Luxembourg
- Vectronics Aerospace GmbH, Germany

Leopard Ecology & Conservation Trust

- Schiess-Meier, Monika (Chair), Switzerland
- Schiess, Fritz, Switzerland
- Gutmann, Dieter, Germany
- Kegakilwe, Phana Segametsi, Botswana

People and Wildlife Trust

- Gabanapelo, Tefo (Chair), Botswana
- Dr Flyman, Michael, Botswana
- Schiess-Meier, Monika, Switzerland
- Haas, Fabian, Switzerland

African Cats & Conservation Foundation Switzerland

- Bissegger, Eveline (Chair), Switzerland
- Gutmann, Dieter, Germany
- Oeri, Catherine, Switzerland
- Schiess-Meier, Monika, Switzerland
- Schrepfer, Willi, Switzerland

Educational Project (ANFT) Steering Board

- Director of Animal Production, Department of Animal Production, Botswana
- Chief Wildlife Officer, Community and Extension Services, Department of Wildlife and National Parks, Botswana
- Deputy Director, Department of Veterinary Services (disease control), Botswana
- Chief Forest Resources Officer, Department of Forestry and Range Resources, Botswana
- LEC, C&E Programme Coordinator, Botswana
- LEC, C&E Assistant, Botswana
- LEC, Managing Director
- People and Wildlife Trust (Mr. Gabanapelo, Dr. Flyman)
- Farmer representatives (Sebolao, Peter and Gaothetswe, Mmitsa), Botswana
- Dintle, Edwin, Botswana Housing Corporation,
- Dr. Matsika, Albertinah, Botswana University of Agriculture and Natural Resources (Department of Wildlife & Aquatic Resources)
- Mr. Mosinki, former Kweneng Land Board Employee
- Mr. Sekano, Ngwato Land Board

Scientific Publications & Conference presentations

- Borrego, N. et al. (2025). Beyond observation: Indigenous tracking explores complex lion behaviour in challenging environments. *African Journal of Wildlife Research* 55(Issue si2)
- Chakrabarti, S., Finerty, G.E., Borrego, N. et al. (accepted for January, 2026). Beyond The Serengeti Lion: Addressing ecological and systemic biases in behavioural research through horizontal comparison. *Animal Behaviour*

- Bauer, D.T. et al. (in prep). ‘Sex and age predict habitat selection in the world’s most geographically extensive lion population.’
- O’Malley, K. et al. (in review) ‘Kill site distribution and habitat selection of two apex predators in the central Kalahari, Botswana.’
- Stracquadanio, L. et al. (in review) ‘Using long-term data to investigate the influence of environmental factors on large predator prey selection in the central Kalahari, Botswana.’
- Finerty, G. “Tracking the Pride: Integrating Technology and Traditional Knowledge to Study Lions in Semi-arid systems”. Institute Seminar, Max Planck Institute of Animal Behaviour, Konstanz. 15th July 2025
- Finerty, G. “Lion Movement, Behaviour, and Conservation in the Kalahari”. Senckenberg Biodiversity and Climate Research Centre Lecture Series, SBIK-F, Frankfurt. July 8th 2025
- Finerty, G. and Borrego, N. “Beyond Observation: Emerging technologies unlock new frontiers in lion behavioural ecology”. South African Wildlife Management Association Conference 2025, Port Elizabeth. September 2025
- Chakrabarti, S., Borrego, N. and Finerty, G.E., “Understanding Lion Societies: the role of comparative research”. XXXVIII International Ethological Congress: Behaviour 2025, Kolkata. August 2025.

Workshops

- CyberTracker Workshop, August 2025
- Drone Workshop for Wildlife Applications, October 2025
- Strategy Workshop by Melissa Davies, December 2025

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