

F. No. NA-13/34/2023-NA
Government of India
Ministry of Environment, Forest and Climate Change
National Compensatory Afforestation Fund Management and Planning Authority
E-mail: adhoc-campa-mef@nic.in

Hall No.1, 4th Floor,
Block No. 3, CGO Complex,
Lodhi Road, New Delhi-110003
Dated the 24th August, 2023

To,

The Member Secretary,
National Tiger Conservation Authority,
Ministry of Environment Forest & Climate Change,

Sub: Submission of Proposal entitled “Conservation Breeding of Cheetah (*Acinonyx jubatus*) in Banni Grassland, Gujarat, India”-reg.

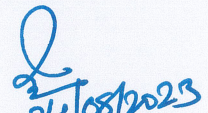
Sir,

I am directed to enclose a copy of the proposal on the subject cited above received from Gujarat Forest Department vide letter no. WLP/T.25/A/565-69/2023-24 dated 23.08.2023 for funding of the project from National fund of National CAMPA.

2. It is requested to examine the proposal at NTCA and forwarded the proposal if found suitable to National CAMPA with recommendations as Programme Division for consideration of the National Authority.

Yours faithfully

Encl. as above


24/08/2023
(B. Abhay Bhaskar)

Dy. Chief Executive Officer
National Authority

Copy to:

Principal Chief Conservation of Forests, Wildlife, Gujarat State, Gandhinagar

No. WLP/T.25/A/ 565-63 /2023-24
Office of the
Principal Chief Conservator of Forests,
Aaranya Bhawan, Wildlife Section,
B-Block, 1st Floor, Sector-10/A,
Gujarat State, Gandhinagar
Date- 23.08.2023

To,
Mr. S. P. Yadav, IFS
The Member Secretary, NTCA
Ministry of Environment, Forest & Climate Change,
Indira Paryavaran Bhavan, Jorbaugh road,
New Delhi-110003

Sub: Submission of Proposal entitled "Conservation Breeding of Cheetah (*Acinonyx jubatus*) in Banni Grassland, Gujarat, India

Giving all due consideration of GoI towards establishing the cheetah population to India, a Captive breeding proposal is submitted for your kind consideration. It is submitted to consider the proposal for funding under the financial outlay of the National CAMPA. The financial requirement of the proposed project is to Rs. 20.31 cr. to be executed in 2 years, Rs.14.70 Cr. In the first year and Rs. 5.61 Cr. in second year.

This is to submit that both in terms of suitable habitat "**Banni Grassland**" do possess an appropriate candidacy and the "**Captive Breeding**" through established method can certainly serve as a blueprint in establishing Cheetah population to its historical range.

Please find attached the proposal detailing the background and the rational, for your kind perusal and consideration, herewith for approval of the project under National CAMPA. It is requested to approve Rs. 14.70 cr. for the first year of the project.



(N. Srivastava)

Principal Chief Conservator of Forests
Wildlife
Gujarat State, Gandhinagar

- Copy submitted to:
1. Principal Secretary, Forest & Environment Department for information
 2. Mr. Subhash Chandra, IFS, CEO CAMPA, New Delhi for information
 3. Principal Chief Conservator of Forests & Head of Forest Force, Gujarat State, Gandhinagar
 4. Additional Principal Chief Conservator of Forests, Land, Gujarat State, Gandhinagar

**Conservation breeding of Cheetah (*Acinonyx jubatus*) in Banni
Grassland, Gujarat, India**



1.1 Introduction

The cheetah, *Acinonyx jubatus*, is a mesmerizing and iconic big cat that captivates the imagination with its unparalleled speed and stunning beauty. Found mainly in the savannas and grasslands of Africa, these remarkable creatures have evolved to become one of the most specialized and distinctive predators on the planet. From their remarkable physical adaptations to their intriguing behaviour and conservation challenges, cheetahs hold a unique place in the natural world. Cheetahs are instantly recognizable due to their slender build, golden fur adorned with black spots, and a distinctive "tear mark" pattern running from the inner corners of their eyes down to the sides of their mouths. Their lithe bodies are built for speed, with elongated limbs, a flexible spine, and large nasal passages that enable efficient oxygen intake during high-speed pursuits. However, the most remarkable aspect of cheetah physiology is their speed. Cheetahs are the fastest land animals, capable of reaching speeds of up to 60 to 70 miles per hour (97 to 113 kilometers per hour) in just a few seconds. This incredible acceleration and top speed are vital for catching agile prey such as gazelles and impalas. Their sharp, non-retractable claws provide traction, and their long tail serves as a rudder-like stabilizer, helping them navigate sharp turns during high-speed chases.

Cheetahs employ an exceptional hunting strategy that relies on stealth and explosive bursts of speed. Unlike other big cats that primarily rely on stalking and ambush, cheetahs opt for daylight hunting and open chases. They use tall grass and terrain features to get as close as possible to their prey before initiating a sprint. The chase itself is a gripping spectacle, often lasting only around 20 to 30 seconds due to the intense energy expenditure involved. If a chase is unsuccessful, cheetahs often abandon their pursuit to conserve energy. This strategy reflects the delicate balance between energy expenditure and success, as repeated high-speed chases could leave cheetahs vulnerable and fatigued.

India, a land rich in biodiversity and cultural heritage, once shared its landscapes with the majestic cheetah (*Acinonyx jubatus venaticus*). However, the cheetah, also known as the Asiatic cheetah or Indian cheetah, has been absent from the Indian wilderness for several decades. The story of the cheetah in India is one of historical significance, conservation efforts, and the ongoing quest to reintroduce this iconic species to its native habitat. The Indian subcontinent was historically home to a thriving population of cheetahs. They were celebrated in ancient texts, art, and literature, showcasing their importance in the cultural fabric of the region. Cheetahs were valued as hunting companions for royalty and nobility, admired for their

grace and speed. However, a combination of factors, including habitat loss, depletion of prey species, and indiscriminate hunting, led to the decline of the Indian cheetah population. By the mid-20th century, the species faced a critical threat of extinction. The last confirmed sighting of a cheetah in India was in 1947, marking the unfortunate disappearance of this magnificent predator from its native landscapes (Figure 1).

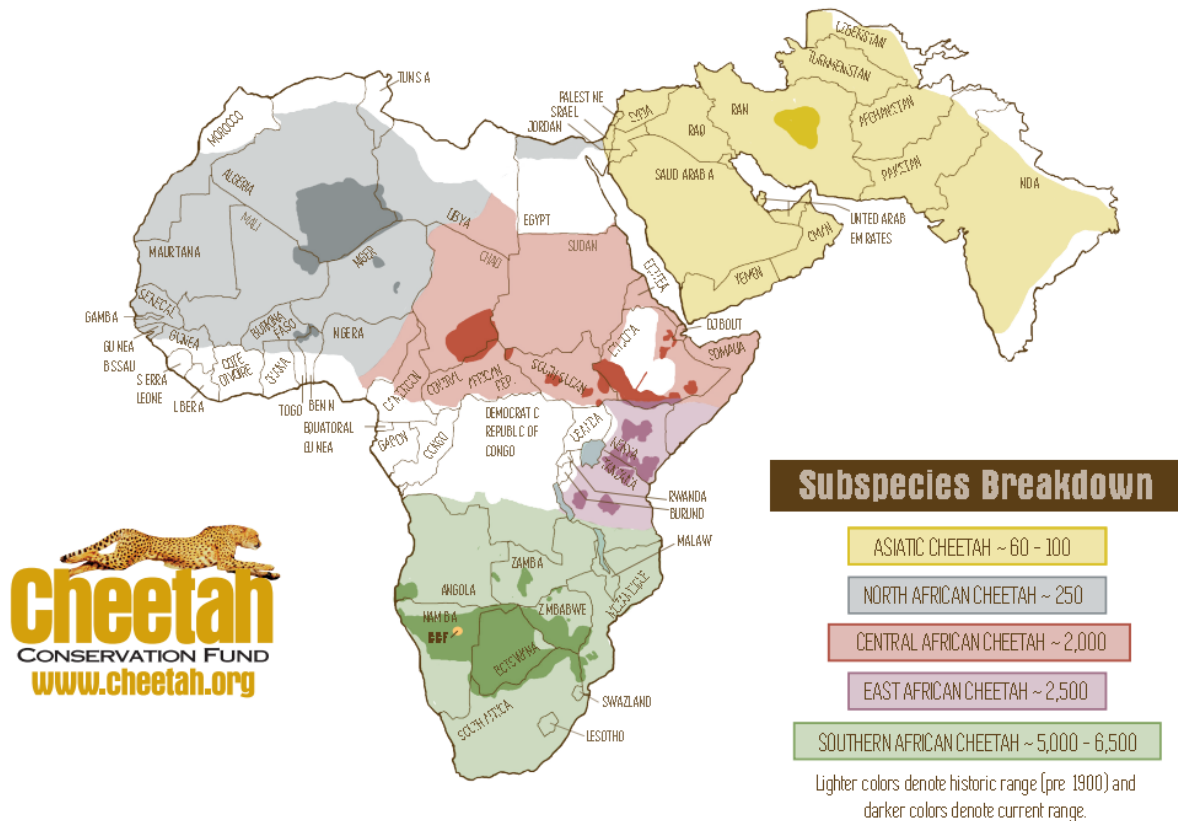


Figure 1. Cheetah distribution in relation to subspecies. Light colour indicates historic range while dark colour indicates current range

The loss of the Indian cheetah spurred efforts to reintroduce the species to its homeland. Conservationists, researchers, and governmental agencies recognized the importance of bringing back this apex predator to restore ecological balance and preserve India's natural heritage. In recent years, there have been discussions about reintroducing the cheetah to India. The potential reintroduction sites include areas with suitable habitats and adequate prey availability. Kuno Wildlife Sanctuary in Madhya Pradesh has been considered a potential reintroduction site due to its similarities to the cheetah's historical habitats. The return of the cheetah to India would be more than just an ecological triumph. It holds cultural and emotional significance for the people of India, reconnecting them with a species deeply rooted in their heritage. The presence of cheetahs could also contribute to ecological balance by controlling herbivore populations, ultimately benefiting the entire ecosystem.

The historical distribution of cheetahs in India, as depicted in Figure 1, covered the entirety of the country except for high mountain regions, coastlines, and the northeast area. This encompassed a span from the western regions of Bengal in the east to the western edges of Pakistan, extending into Afghanistan and Iran in the west. Additionally, it ranged from Punjab in the north down to the north western parts of Tamil Nadu in the south (Durant et al. 2016).

The discourse surrounding the reintroduction of cheetahs to India was revisited in 2009 by the Wildlife Trust of India. This occurred during a two-day international workshop held in Gajner, Rajasthan, India, on September 9th and 10th. The workshop aimed to discuss the potential reintroduction of cheetahs in India, focusing on the historical range states prioritized for cheetah reintroduction, namely Gujarat, Rajasthan, Chhattisgarh, and Madhya Pradesh.

Following this, under the guidance of the Ministry of Forest & Environment (Government of India), field surveys were conducted between 2010 and 2012. These surveys covered ten sites located within seven landscapes across the states of Chhattisgarh, Gujarat (Banni Grasslands), Madhya Pradesh, Rajasthan, and Uttar Pradesh (Jhala et al. 2021).

Captive breeding as a method for restoring the cheetah population is poised to serve as a blueprint or paradigm for re-establishing the original cheetah habitats and recovering local biodiversity. This approach aligns with India's National Wildlife Action Plan of 2017, as well as the recommendations put forth by the National Forest Commission of the Government of India, which underscore the importance of heightened protection for grasslands and the flagship species associated with them.



Figure 2. Historical distribution of cheetah in India

1.2 Banni as an area for cheetah captive breeding

The Banni Grasslands Reserve, also known as Banni grasslands, constitutes a distinctive arid grassland ecosystem located along the southern periphery of the Rann of Kutch, a marshy expanse within the desert in the Kutch District of Gujarat State, India (Figure 3). It stands as the largest grassland expanse within the Indian subcontinent, recognized for its abundant wildlife and diverse biodiversity. Encompassing an impressive area of 3,847 km², this region is characterized by the coexistence of two distinct ecosystems: wetlands and grasslands. The grass cover within the Banni area can be categorized under the *Dichanthium-Cenchrus-Lasiurus-Sporobolus* type.

Traditional practices entailed the rotational grazing management of the Banni grasslands, ensuring the sustainable use of this resource. The geographical setting of Banni places it within an arid climate zone, where high temperatures are predominant for a significant portion of the year. The peak temperatures, soaring to a maximum of 46°C – 48°C, are experienced during the months of May and June. In contrast, the winter season sees temperatures plummeting to the range of 5°C - 8°C in the months of December and January. The prevailing climatic conditions bring an arid climate to Banni, with an average annual rainfall of merely 315 mm, predominantly occurring between the months of June and September.

In the present context, the translocation of cheetahs to the Kuno National Park in Madhya Pradesh has been orchestrated, taking into account a spectrum of climatic considerations. The decision to relocate was influenced by diverse factors, including climate. To facilitate a comparison between the physiognomic attributes of Kuno and the envisaged landscape of Banni, there is evidence indicating congruence.

As such, the ecological dynamics and climatic factors play a pivotal role in conservation decisions and strategies, such as those directed towards the preservation of the cheetah population. The intricate interplay between geographical, climatic, and ecological facets underpins the endeavour to safeguard and restore these remarkable species within their native habitats.

Most importantly, cheetah natural habitat preference from Africa which includes grassland, savannah and scrub land (Broomhall et al. 2003). Habitat conditions of Banni perfectly matched with the habitat requirements of cheetah.

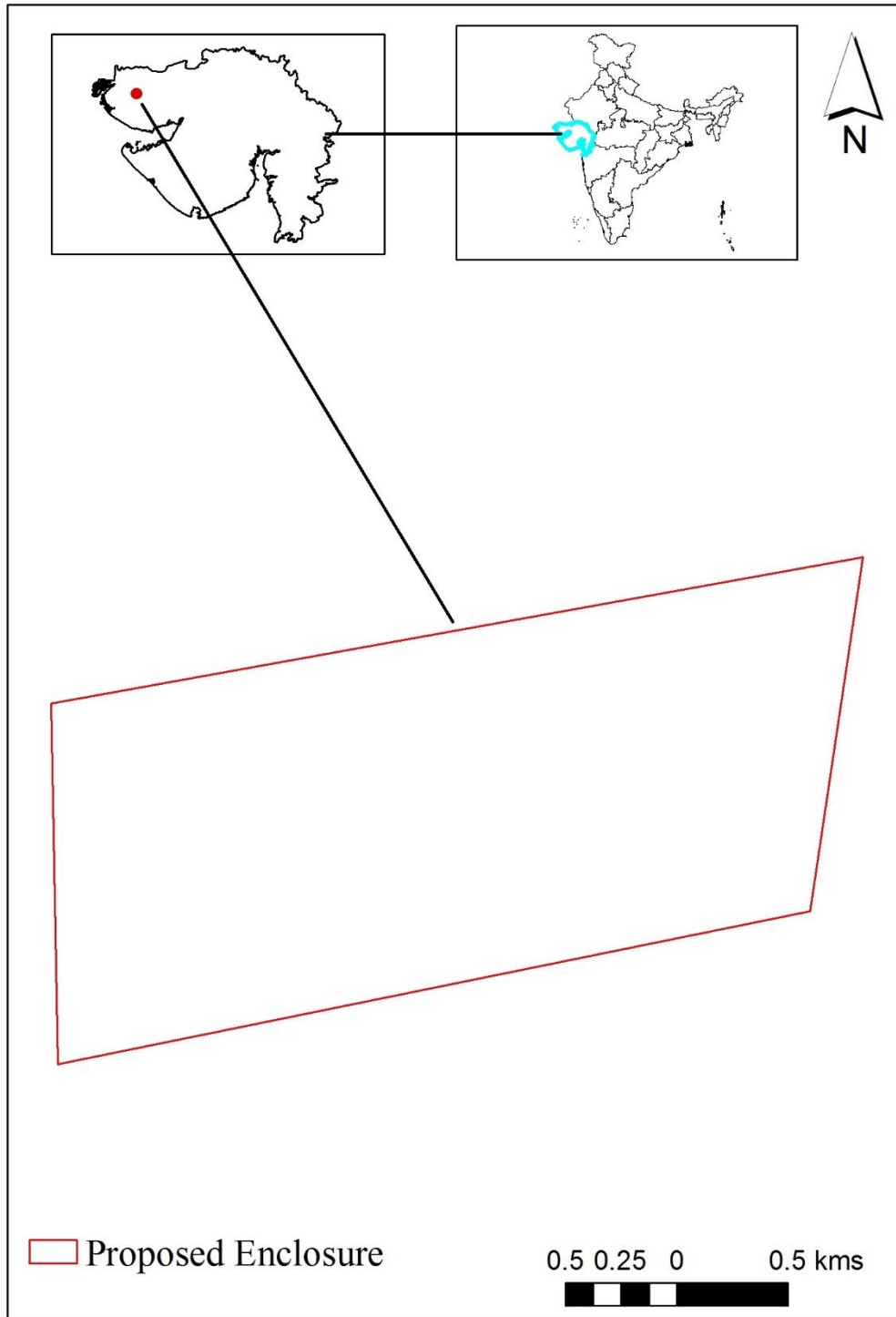


Figure 3. Location of cheetah enclosure in Banni, Gujarat, India



A view of Banni grasslands



A Cheetah image from the Africa

2. Enclosure for the conservation breeding of the cheetah in Banni

Designing suitable enclosures for cheetahs in captivity is essential to provide them with a safe, comfortable, and stimulating environment that promotes their physical and mental well-being. Here are some key considerations that will be kept in mind while designing cheetah enclosures in Banni

1. Size and Space of enclosure
2. Fencing and Containment in enclosure
3. Shade and Shelter in enclosure
4. Mimicking natural system for conservation breeding
5. Natural Habitat Simulation in enclosure
4. Enrichment Opportunities in enclosure
6. Viewing Areas in enclosure
7. Water Sources in enclosure
10. Safety Measures in enclosure
14. Collaborate with Experts
15. Veterinary facilities in the enclosure

2.1. Size and Space of enclosure

Cheetahs require ample space to move, run, and explore. Enclosure should be spacious enough to allow for short sprints, climbing, and play. Size and space of the enclosure will decide the future breeding success of the cheetah

2.2.a. Size of the enclosure: Area of the enclosure would be **500 hectares approximately**; such large area has been already used in Devalia safari park for lions and have proven efficient for the conservation breeding of lions (Figure 4). Since cheetah is a need ample area for sprint and roam such large area therefore will benefit the cheetah. The approximate length of the enclosure would be around **9830 running meters**. Following is a rough sketch of the enclosure

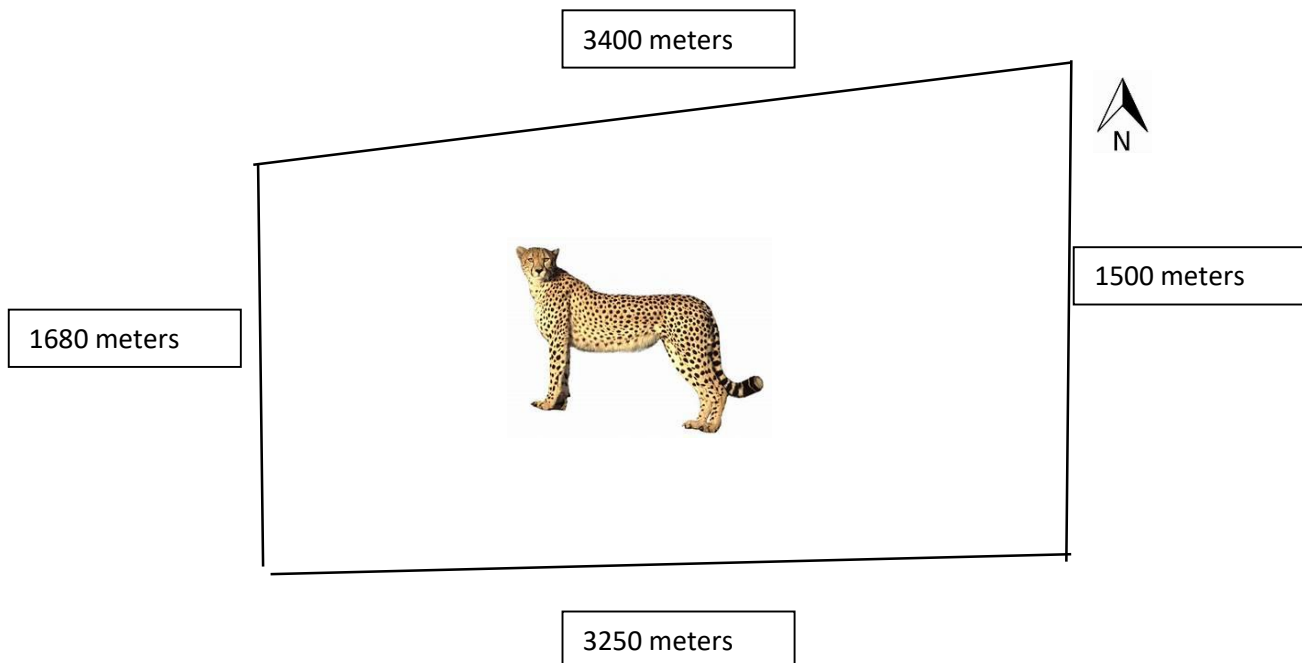


Figure 4. Schematic design of the cheetah enclosure (Not to scale)

2.2 Fencing and Containment in enclosure: Install strong and secure fencing is highly required for two purposes i) to prevent escape and ensure the safety of both cheetahs ii) To avoid infiltration of other large carnivores in the cheetah enclosure which could results in aggressive interactions between the two and could end up in fatal encounters. Therefore, a chain link wire fencing will be carried out across the boundary of the enclosure (Figure 5). Chain-link fencing is generally more affordable than other types of fencing, which can be especially advantageous for larger enclosures. Also, properly installed chain-link fencing is durable and can withstand the wear and tear that large animal like cheetahs may subject it to.

The chain link fencing will consist of the following components

2.2.a Excavation: Carnivores are known diggers, so it's important to have the bottom of the fence reinforced to prevent animals from burrowing under it. It will be achieved by the excavation of foundation up to **1.5-meter depth** including sorting and stacking of useful material and disposed of the excavations stuff up to **50-meter lead**.

2.2.b Bottom Reinforcement: Bottom reinforcement is crucial to have a solid structure since it will not allow other large carnivore inside the enclosure on long term basis. It will be achieved by providing and laying cement concrete ratio of 1:1.5:3 (1-Cement: 1.5 Coarse: 3-graded stone aggregated 20 mm nominal size).

2.2.c Top Design: Top design of the fencing will include a angled top which will be fenced with the barbed wire so that no other carnivore species can enter the enclosure.

2.2.d Height: The height of the fence is critical. It should be tall enough to prevent the carnivores from climbing or jumping over it. Height of the fencing will be **2.50-meter-high** G.I chain link wire fencing with **4.3-meter-long** G.I. 65-micron 60.3 mm chs round pipe 3 mm thick fixed at 3.00 mt c/c.

2.2.e Mesh Size: The size of the chain-link mesh should be small enough to prevent the carnivores from sticking their heads or limbs through, which could lead to injury or escape attempts. Mesh size of the will be **75 X 75 mm** spacing and have **10 gauge**.

2.2.f Visual Barriers: Providing visual barriers between the animals and any potential stressors (such as human activity or other animals) can help reduce the animals' stress levels and prevent aggressive behaviours. Therefore, to reduce the contact between humans and cheetah in the enclosure a green row cover will be all over the mesh in the enclosure.

2.2.g Maintenance: Regular maintenance is essential to ensure the fence remains in good condition. Regular inspections for wear and tear, as well as prompt repairs, will be carried out in the enclosure so that fenced will be maintained.

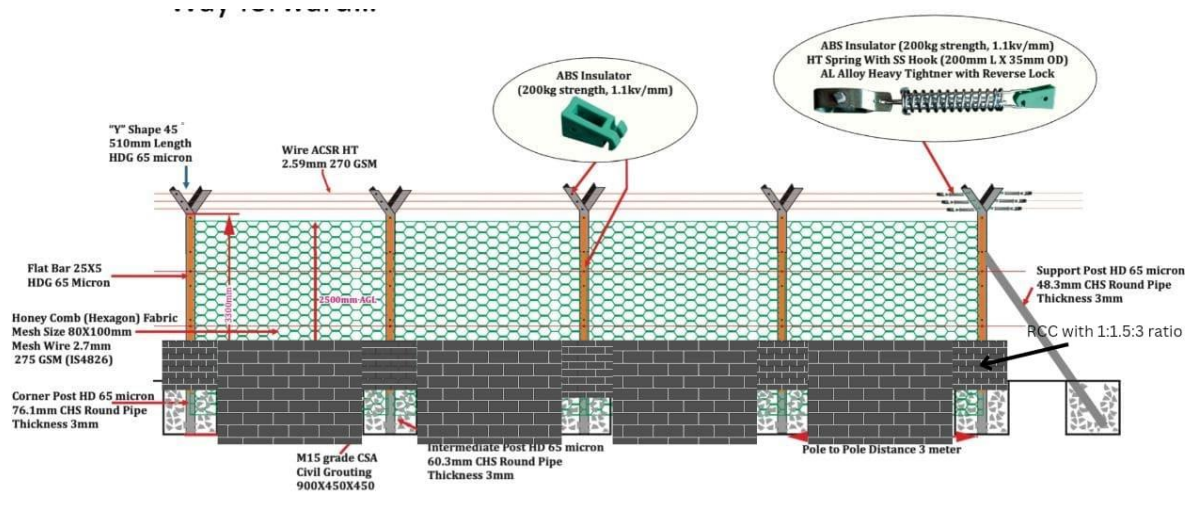


Figure 5. Design of the fencing will be used in the cheetah enclosure

2.3. Shade and Shelter inside enclosure:

2.3.a Resting/Feeding cubicle: Holding area will be created in the enclosure following the central zoo authority. Number of enclosures would be based on the number of cheetahs which need to be put under the enclosure. There are no specifications provided by the central zoo authority regarding the enclosures size for the cheetah and hence cubicle size used for the leopards can be used for cheetah. Size of the cheetah feeding and resting shelter could be 2.0X1.80X2.5 (LXBXH) in meters.

However, successful conservation breeding of the cheetahs depends upon mimicking the cheetah social organization in wild. In the wild cheetah male and female live separately where male cheetahs have coalitions. Therefore, it is of utmost importance to remain male and female separated and stay together during the mating period. Earlier experience in cheetah breeding in the De Wildt Cheetah and Wildlife Centre, South Africa have highest successful breeding and produced around 1005 cubs by following their natural behaviour in wild.

2.3.b. Breeding or Maternity Area: Since If enclosure is intended for breeding cheetahs, a separate secluded area within the enclosure will be designated for the female cheetah to give birth and raise her cubs. This area will contain dense vegetation and adequate hiding spots for privacy and protection. This area could be of same size of the resting cubicles.

2.3 c. Separate area for the health care: A separate designated area should be given to proper healthcare of the cheetah whenever required. This area should have all the veterinary facilities required for cheetah. This area should also have cages like squeezed cage required for holding the cheetah while the treatment.

2.4. Mimicking natural system for conservation breeding

2.4.a Cheetah behaviour in natural system: Mimicking natural behaviour of cheetah in the conservation breeding enclosure of high importance. Successful example of conservation breeding of cheetah across the globe has been mimic the natural behaviour. Therefore, it is utmost importance to understand the cheetah behaviour in the wild and apply that in the artificial scenario. Males' cheetah in the south Africa holds very large territories while female remains solitary or with cubs from the earlier males (Figure 6). When male and female mate they used to stay around 2-3 days and mate several times with 8 hours between mating events (Caro and Collins 1987; Caro and Kelly 2019). However, this is very difficult to mimic conservation enclosure and there a similar system has to be used to have a successful breeding.

2.4.b Developing an effective process in enclosure for conservation breeding: Since breeding male and female used to stay in separation in wild therefore both adult males and females should live in the different enclosure. A different breeding enclosure should be made apart from the normal enclosure and alternatively male and female should be providing opportunity to utilized this enclosure. They should not allow any direct visual or physical contact at first and should observed according to their reaction to each other's scent. Only after a lot of interest has been shown by both to the other's scent, and the male starts stutter-calling or "yipping", then they should allow visual exposure to one another. Females should be observed once again for any aggression towards the male before physical introductions need to

be allowed. If the female does not roll for the male or display oestrous behaviour then they should once again separate (Beekman et al. 1997; Marker et al. 2018) (Figure 7).

2.4.c Cub rearing: Cheetah cubs are usually kept with the mother until they are at least one year old and early weaning is avoided wherever possible. Since in natural conditions cheetah mother used to separate cubs in den or a den like structure. Therefore, to mimic this system within the female enclosure there should be another small chamber which is like a capsule and scats like a natural den for cheetah (Figure 8). Latter stated separate chamber should have ample amount of the grass as substrate. All new born felids should be weighed to identify and any illness in the cubs.

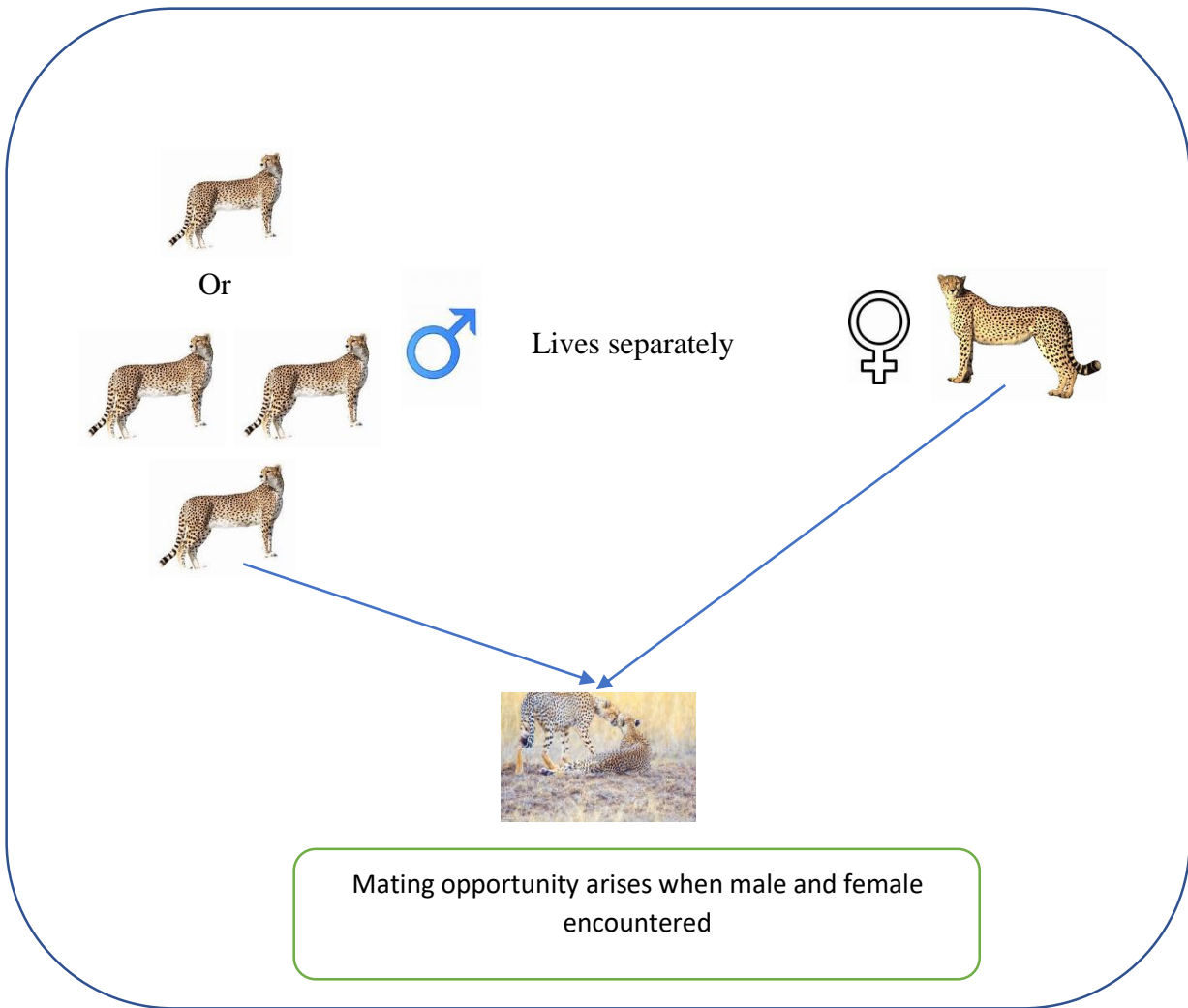


Figure 6: Social organization of cheetah in free ranging conditions

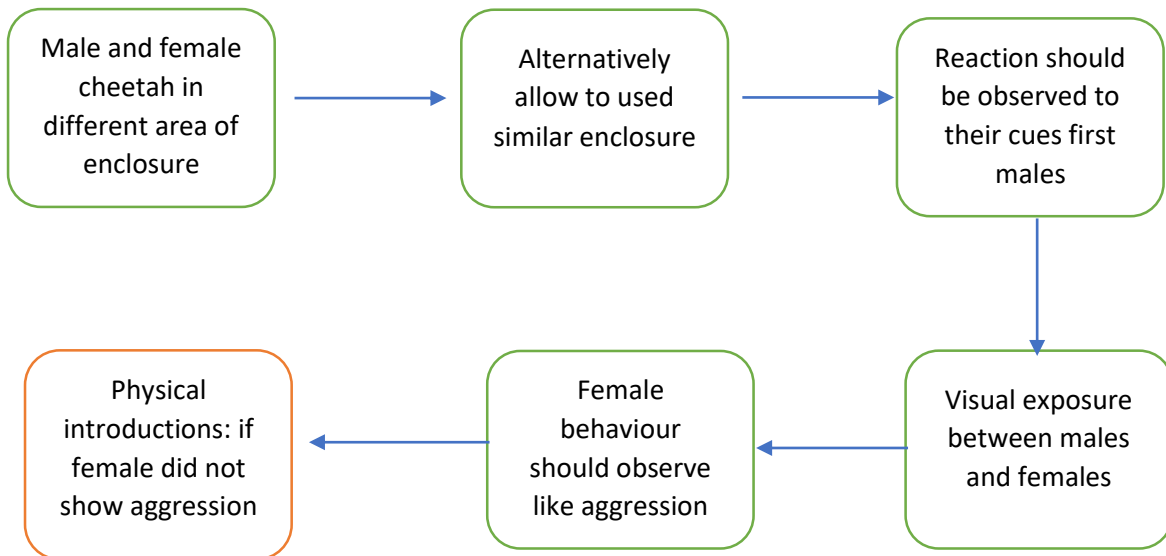


Figure 7. Schematic representations of mimicking natural behaviour of cheetah in enclosure



Figure 8. A small capsule kind of enclosure used for rearing cub by the cheetah mother

2.5. Natural habitat simulation in enclosure: While cheetahs are primarily open habitat animals, providing some vegetation, such as tall grasses, shrubs, and scattered trees, can offer them opportunities for stalking and hiding, which is essential for their natural hunting behaviour. Banni is a Savanah habitat hence well suited for the conservation breeding of the cheetah. But it should be managed properly so that nay succession in the habitat should be avoided. In the free ranging conditions, cheetah used to scent mark trees for territory marking. Therefore, few number of trees should also be present in the enclosure. Also, in Serengeti studies have found that cheetah used to sit on the termite mount to scan the surrounding areas, such mount can also be built in the enclosure.

2.6. Enrichment Opportunities in enclosure.

2.6.a Structural Enhancements: Create a dynamic environment with various structures like rocks, logs, platforms, and hiding spots. These features provide opportunities for climbing, jumping, and perching, which are activities that cheetahs enjoy (Figure 8).

2.6.b Food Enrichment: Employ puzzle feeders, hiding food in different areas of the enclosure, or using devices that dispense food at intervals. These techniques simulate the effort cheetahs would exert in finding and capturing prey in the wild.

2.6.c Toys: Provide a variety of toys that encourage physical activity and mental stimulation. Objects like balls, ropes, and puzzle toys can be used to engage cheetahs in play.

2.6.d Cognitive Challenges: Create puzzles or games that challenge the cheetahs' problem-solving abilities. This can involve hiding food, requiring them to manipulate objects to access treats, or engaging them in activities that encourage curiosity.

2.6.e Soundscape: Incorporate natural sounds or recordings of the cheetahs' natural habitat to create an immersive experience.

2.7 Viewing Areas in enclosure

2.7.a Unobstructed Views: Design the viewing areas to provide unobstructed views of the cheetahs. Use minimalistic barriers or glass, ensuring that they are clean and well-maintained to optimize visibility.

2.7.b Multiple Viewing Angles: Create viewing areas from various angles around the enclosure to offer visitors different perspectives of the cheetahs. This variety enhances the viewing experience.



Figure 8. A cheetah playing in the enclosure with ball (an enrichment method)

2.8. Water sources in enclosure

2.8.a Clean and Fresh Water: Ensure a constant supply of clean and fresh water should be made sure in the enclosure. Access to clean water is essential for hydration, especially in warm climates. This would be ensured by the assigning person for the changing and providing clean water in the enclosure.

2.8.b Multiple Water Points: Water point would be distributed throughout the enclosure to prevent overcrowding around a single watering hole. Multiple water points would also encourage natural behaviours, such as territorial marking.

2.8.c Natural Ponds or Water Features: Naturalistic ponds or water features within the enclosure would also be created. These features not only provide drinking water but also offer opportunities for the cheetahs to cool off and engage in water-related activities.

2.8.d Water Access Points near Resting Areas: Water access points would be assessed near the resting areas to encourage the cheetahs to drink regularly. This can be especially important for pregnant or nursing females.



A Cheetah coalition drinking water

2.9. Safety Measures in enclosure

2.9.a Secure Fencing: Implement strong and high fencing designed to withstand the strength and agility of cheetahs. Double barriers or containment systems can help prevent escapes.

2.9.b Proper Gates: Use secure gates with locking mechanisms that can withstand the force a cheetah might exert. Ensure gates are always closed when not in use.

2.9.c Emergency Protocols: Establish clear emergency protocols for situations like animal escapes, medical emergencies, or extreme weather conditions. Train staff on these procedures and conduct

2.9.d Barriers for Interaction: If there's direct interaction between cheetahs and staff (e.g., during feeding or medical procedures), use secure barriers or protective enclosures to prevent physical contact.

2.9.e Staff Training: Provide comprehensive training for all staff members regarding cheetah behavior, handling techniques, and emergency procedures. Regularly update their knowledge and skills.

2.9.f Personal Protective Equipment (PPE): Require staff to wear appropriate PPE when entering enclosures, conducting medical procedures, or engaging in any activities that involve close proximity to cheetahs.

2.9.g Regular Inspections: Conduct routine inspections of the enclosure, fences, gates, and any equipment to identify and address potential safety issues.

2.9.e Environmental Hazard Management: Remove or secure any potential hazards within the enclosure, such as sharp objects, toxic plants, or other items that could harm the cheetahs.

2.10 Veterinary facilities in the enclosure

2.10.a Veterinary room: Design a dedicated veterinary room within or near the enclosure. This area should be equipped with the necessary medical equipment, supplies, and technology for examinations, treatments, and surgeries.

2.10.b Veterinary doctor: A veterinary doctor assigned with availability for 24X7 hours of monitoring should be assigned in the cheetah enclosure. Veterinary doctor should be well qualified and should have good experience to deal with the large felids in captivity. These veterinarians should also have a strong background in wildlife medicine, anaesthesia, and

surgery. Veterinarians can play a vital role in educating the staff responsible for caring for the cheetahs about proper animal care, disease prevention, and emergency procedures.

2.10.c Diagnostic Tools: Equip the clinic with advanced diagnostic tools, including digital radiography (X-rays), ultrasound machines, endoscopy equipment, and a well-equipped laboratory for blood work and other sample analyses.

2.10.d Pharmacy: Maintain a well-stocked pharmacy with a wide range of medications suitable for cheetahs, including anesthetics, antibiotics, pain relief, and other essential drugs.

2.10.e Surveillance and Monitoring: Cameras and monitoring systems should be installed in the enclosures to observe the cheetahs' behavior, feeding patterns, and overall health. This surveillance helps detect any issues early.

2.10.f Post-mortem room: The post-mortem room should be a dedicated space separate from the living areas of the cheetahs to maintain biosecurity and prevent any risk of disease transmission. Strict biosecurity protocols should be implemented to prevent the spread of diseases, both within the cheetah population and to other animals or humans.

2.10.g Cages: Different type of cages used for holding the animal should be used in the enclosure. This includes normal cages for holding the animal while separating him or other things. For the veterinary treatment purposes squeezed cages are used so that animal can be treated effectively without getting injured.

2.11 Food requirements of cheetah in enclosure

2.11.a Diet of cheetah: In their natural habitat, free-roaming cheetahs have a diverse diet consisting of different types of whole vertebrate prey. They consume various parts of the prey, including muscle, skin, fur or feathers, internal organs, and bones. This balanced diet in the wild is challenging to recreate in captivity because the prey provided to captive cheetahs has a distinct diet from those in the wild and may belong to different species. Cheetahs are strict carnivores that specialize in the wild in antelopes of medium size (between 20-60 kg) and complement their diet with other small mammals or birds.

2.11.b How much to eat: In captive environments, adult cheetahs are provided with food to sustain their physical condition, as stated by the AZA in 2017. The daily energy intake typically falls within the range of 335 to 875 kJ per kilogram of body weight raised to the power of 0.75. Adult male cheetahs averaging 40 kg require 9.21 MJ/day (maintenance energy) and females

averaging 30 require 7.54 MJ/day and on average, the cheetahs eat about 1.4 kg daily meat. Therefore, and meat around 1.4 kg daily/per cheetah will be required in the enclosure.

2.11.c Type of meat should be provided: Free roaming cheetahs consume a variety of whole vertebrate prey: eating muscle, skin, fur/feathers, viscera and bones in the process. The use of solely supplemented meat in captivity leads to a marked decrease in variation of consumed animal tissue since in the most of the captivity meat consist of muscle mass. Therefore, a mixture of whole prey and correctly supplemented meat should be considered which reduces the risk of mineral imbalances due to the challenges of appropriately supplementing a meat only diet.

2.11.d Fasting of cheetahs: Obesity is rather common in cheetahs kept at captivity and zoos. Therefore, control of energy intake, in combination with stimulation of appropriate physical exercise, should be implemented to improve (or maintain) animal health status. To evaluate the adequacy of energy intake in cheetahs it is important to monitor their body condition score (BSC) on a regular basis (monthly) (Figure 9, 10). Hunting in wild, cheetahs normally occur every 3-7 days. Free roaming cheetahs do not feed every day, or at fixed intervals. Therefore 7 days fasting interval would be perfect for cheetahs. if a fasting day is implemented, facilities are advised to conduct behavioural observations of the animals on fasted and fed days, and a comparison made; if the practice is to be continued it must be confirmed that there is no increase in abnormal or stereotypic behaviours on fasting days. If an increase is detected, either removal of the fasting day, or increased dietary provision on the day prior to the fast may be necessary.

13. Scientific Research

13.a. Genetic Diversity and Health Assessment: Genetic diversity is essential for a long-term survival and adaptation of cheetah. Research should involves assessing the genetic makeup of cheetahs bring for conservation breeding to identify potential issues with inbreeding and low genetic diversity. Genetic testing and analysis can help make informed decisions about breeding pairs to maximize genetic variability.

13.b Population Management: Scientific research helps guide the management of captive cheetah. Use of pedigree analysis and demographic data to make recommendations on breeding pairings, preventing the negative effects of inbreeding depression and maintaining genetic diversity.

13.c Behavioural Studies: Understanding cheetah behaviour is crucial for their successful conservation breeding. Researchers should send to African ecosystem to understand their natural behaviours, hunting techniques, and social dynamics helps design captive environments that mimic natural conditions and successful breeding.

13.d Reproductive Biology: Cheetahs can face reproductive challenges in captivity due to stress, behavioural issues, and other factors. Scientific research on their reproductive biology will be required to develop effective breeding protocols, including artificial insemination and embryo transfer techniques, to increase breeding success.

13.e Disease Management: Captive cheetah populations are susceptible to diseases that can impact breeding success and overall health. Research into cheetah diseases, immune system function, and preventative measures helps maintain healthy individuals in captivity.

14. Summary

In summary, following will be the key points

1. Enclosure will be divided in two enclosure one for male and one for female.
2. Female enclosure will also consist of den for resting and a cub raising capsule
3. A separate chamber will be made for the utilization of male and female alternately
4. A separate area would be dedicated for the veterinary facilities in the enclosure
5. Enclosure area would consist of savannah and open habitat.
6. A pictorial sketch is depicted in the Figure 9

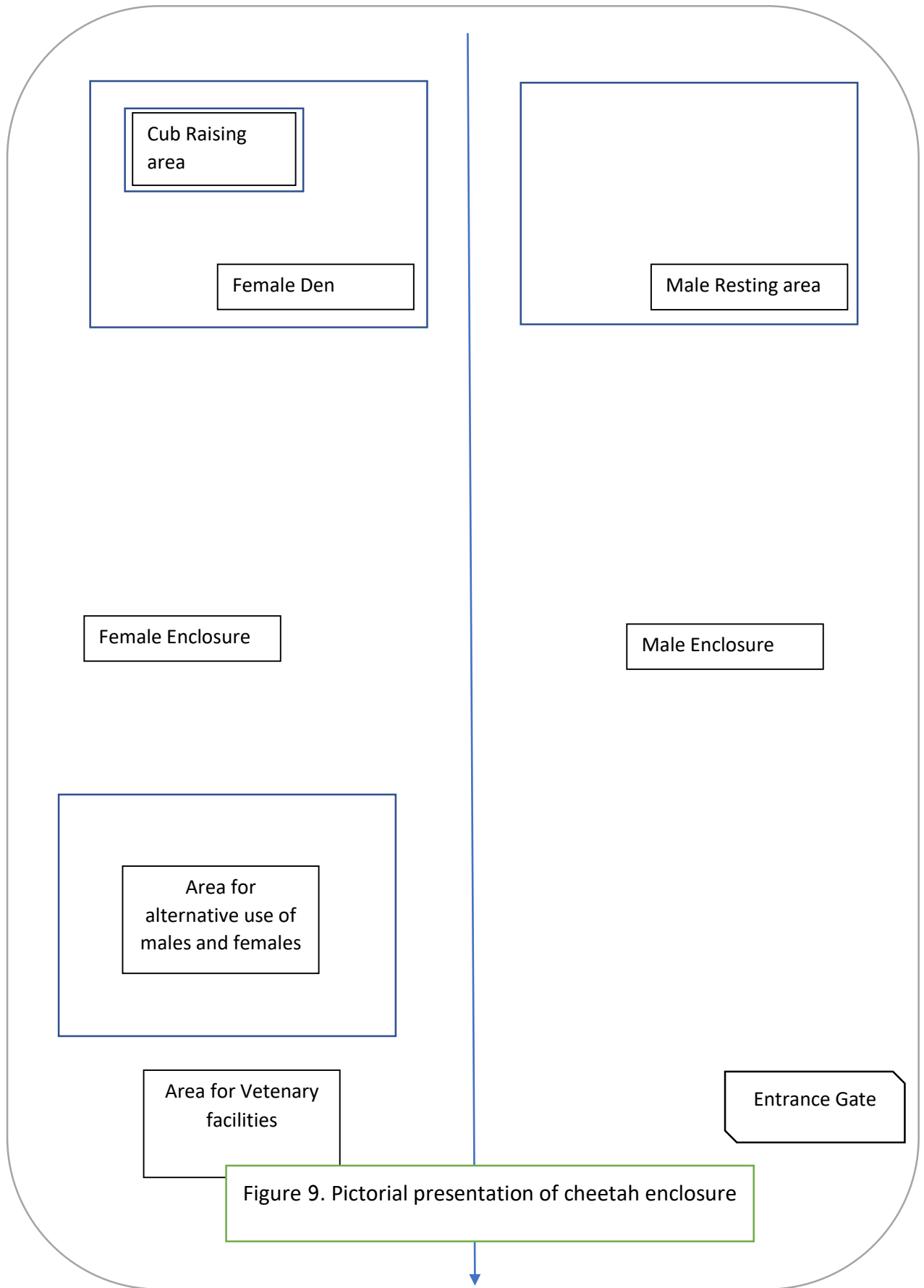


Figure 9. Pictorial presentation of cheetah enclosure

Key references

Durant et al. (2016). The global decline of cheetah *Acinonyx jubatus* and what it means for conservation. Proceedings of National Academy Sciences, 114: 528-533. <https://doi.org/10.1073/pnas.1611122114>

Jhala, Y.V., Bipin, C.M., Jhala, H.Y., Yadav, S.R., Chauhan, J.S. (2021). Assessment of cheetah introduction sites and proposed actions. Wildlife Institute of India, Forest Department of Rajasthan and Forest Department of Madhya Pradesh. Technical Note.

Broomhall, L.S., Mills, M.G.L., Toit, J.T. (2003). Home range and habitat use by cheetahs (*Acinonyx jubatus*) in the Kruger National Park. Journal of Zoology, 262: 119-128. <https://doi.org/10.1017/S0952836903004059>

Caro, T.M., Kelly, M.J. (2019). In Lee Alan Dugatkin (edited): Model system in behavioural ecology. Princeton University Press, New York.

Caro, T.M., Collins, D.A. (1987). Male cheetah social organization and territoriality. Ethology, 74: 52-64. <https://doi.org/10.1111/j.1439-0310.1987.tb00921.x>

Marker et al. (2018) In Marker, L., Boast, L.K., Kuntzel, A.S. Cheetahs: Biology and Conservation. Academic Press. U.K.

Beekman, S.P.A., Wit, M.D., Louwman, J., Louwman, H. (1997). Breeding and observations on the behaviour of Cheetah *Acinonyx jubatus* at Wassenaar Wildlife Breeding Centre. Journal of Zoology, 35: 43-50. <https://doi.org/10.1111/j.1748-1090.1997.tb01187.x>

Cost involves in the preparation of enclosure

S.No	Item	Cost (in lakhs/annum Approx.)
1.	Construction cost of enclosure with chainlink Fencing	830.00
2.	Separate of enclosure for females and males`	120.00
3.	Resting enclosure for males and females	120.00
4.	Cub rearing enclosure for cheetah	40.00
5.	Utilization chamber for both males and female cheetah	50.00
6.	Isolation chambers	60.00
7.	Habitat improvement	40.00
8.	Patrolling route alongside of enclosure	65.00
9.	Roads and Path inside the enclosed area	80.00
10.	Approach road to the breeding centre	40.00
11.	Vetenary setup in enclosure	40.00
12.	office building	40.00
13.	Staff quarters	30.00
14.	Storage room	50.00
15.	Gate	20.00
16.	Parking	25.00
17.	Animal Monitoring System	25.00
18.	CCTV	15.00
19.	Creating water facilities	25.00
20.	Overhead water tank	40.00
21.	Water connection within enclosed area	75.00
22.	R.O. Facility	20.00
23.	Electricity connection	30.00
24.	Solar lights	15.00
25.	Feeding cost for cheetah	30.00
26.	Man power for managing the enclosure	20.00

27.	Vetenary manpower for the enclosure	6.00
28.	Training and Workshop	20.00
29.	Computers, printers and other device	5.00
30.	Recurring cost	50.00
31.	Research activities in the enclosure	5.00
Total		2031.00

YEAR WISE FINANCIAL REQUIREMENTS

Sr.No	Item	Cost (in lakhs/annum Approx.)
FIRST YEAR		
1.	Construction cost of enclosure with chainlink Fencing	830.00
2.	Separate of enclosure for females and males`	120.00
3.	Resting enclosure for males and females	120.00
4.	Utilization chamber for both males and female cheetah	50.00
5.	Isolation chambers	60.00
6.	Habitat improvement	40.00
7.	Approach road to the breeding centre	40.00
8.	Vetenary setup in enclosure	40.00
9.	Creating water facilities	25.00
10.	Overhead water tank	40.00
11.	Water connection within enclosed area	75.00
12.	Electricity connection	30.00
TOTAL		1470.00
SECOND YEAR		
1.	Gate	20.00
2.	Parking	25.00
3.	Cub rearing enclosure for cheetah	40.00
4.	Patrolling route alongside of enclosure	65.00
5.	Roads and Path inside the enclosed area	80.00
6.	office building	40.00
7.	Staff quarters	30.00
8.	Storage room	50.00
9.	Animal Monitoring System	25.00
10.	CCTV	15.00
11.	R.O. Fecility	20.00
12.	Solar lights	15.00
13.	Feeding cost for cheetah	30.00
14.	Man power for managing the enclosure	20.00
15.	Vetenary manpower for the enclosure	6.00
16.	Training and Workshop	20.00
17.	Computers, printers and other device	5.00
18.	Recurring cost	50.00
19.	Research activities in the enclosure	5.00
TOTAL		561.00
Grand Total		2031.00