**Grassland Cheetah introduction to Hill forests in India: Habitat analysis error?**

**Abstract**

Due to population viability issues, Cheetah transferred in India from Africa and their Indian progeny is mostly kept in enclosures since 2.5 years, and served livestock meat than permit them to hunt in the open. Grasslands, savanna or semi-arid habitat in western Indian states of Rajasthan or Gujarat may suit Cheetah reintroduction in India than the forested, hilly tracts Madhya Pradesh state like such as Kuno national park, where their currently relocation site from Africa. For, Cheetah mainly dwell or hunt in the plains savanna habitat in Africa and Antelopes (grown up weight<50 kg) or small mammals like hare or livestock such as sheep, goat comprise majority of Cheetah diet in Africa but the later are evicted from Kuno. Their breeding and release in the Cheetah habitat and community participation may be helpful, than the “Chital” i.e. Spotted deer i.e. (full grown weight >80 kg) prevailing at Kuno.

**Keywords:** Ecorestoration, extinct, biodiversity, conservation, policy, wildlife ecology

**Introduction**

Cheetah was one of the “4 big cats” i.e. predators, in India besides lion, tiger, leopard (Prater, 1965). It is primarily found in Africa and to marginal extent in Asia- from Iran to India. Indian subspecies (*Acinonyx jubatus venaticus*  [Griffith](https://en.wikipedia.org/wiki/Edward_Griffith_%28zoologist%29), 1821) went extinct by 1952 with last 3 shot in the Koriya district in 1948 (NTCA, 2022). Only handful- about 20 to 50 remain in Iranian mountains (Jhala, 2022), inhabiting scrub forests unlike savannas in Africa. But these are not transferred to India due to Iran’s hesitation. Cheetahs in Africa initiated more hunts and had a higher success rate in the open woodland savannah compared to other available habitats with thicker bush, as shrubby/ woody vegetation obstructs their chase (Mils et al., 2004). But hill forests, ravines of “Chambal” form the main habitat at Kuno National Park (KNP) in Madhya Pradesh state in India, where the Cheetah from African countries are presently relocated (<https://www.kunonationalpark.org>).

After the past century enormous destruction of wildlife and biodiversity population and habitat, 21st century marked movement towards its ecological restoration in many parts of the world, including reintroduction of locally extinct species (Marker et al., 2024).The cheetah is listed as vulnerable by the World Conservation Union (IUCN) Red List of Threatened Species with two subspecies, the Asiatic cheetah Acinonyx jubatus venaticus,  listed as “critically endangered” (CR) while and African cheetah Acinonyx jubatus jubatus (Schreber, [syn.](https://en.wikipedia.org/wiki/Synonym_%28taxonomy%29) *A. j. raineyi* [Heller](https://en.wikipedia.org/wiki/Edmund_Heller)) is “vulnerable” (VU) across Africa but its subspecies “*A. j.* hecki  [Hilzheimer](https://de.wikipedia.org/wiki/Max_Hilzheimer), 1913” has CR (critically endangered) status in the Northwest Africa alone while [Northeast African cheetah](https://en.wikipedia.org/wiki/Northeast_African_cheetah) (*A. j. soemmeringii*) [Fitzinger](https://en.wikipedia.org/wiki/Leopold_Fitzinger), is “endangerd” (EN, *ibid.*). Cheetah is a “flagship” species of the “grassland” ecosystem and its restoration is crucial to dry, desert tracts even in India (PIB, 2022). For, Namibia, the country of Cheetah origin is named after the desert Namib, meaning “an area with nothing” (https://www.britannica.com/place/Namib). We assess here the issues in its’ reintroduction as a learning for other threatened species eco-restoration in future. DNA analysis has shows that the Indian (Asian) subspecies of Cheetah diverged 72,000 years ago from the African ancestor (Rai et al, 2020). Thus, we call it as “introduction” than “reintroduction”.

**Historical Cheetah habitat**

Cheetah occurrence was recorded from grasslands/ scrub forests in western and central India since long as also in western Asia besides similar ecosystem in Africa and the race "*venaticus* (Griffith)" occurs in India. Prater (1965), the British wildlife expert also opined that “Cheetah may have entered India from the west and for centuries, is tamed and trained for hunting sport. Its Breeding habits are unknown in India*”.* Tritsch (2001) also wrote that in Punjab, prior to agriculture and human settlement encroaching on the thorn forests, intermixed with grasslands had many herds of blackbuck; and their main natural predator, the Asiatic cheetah. Later, habitat loss, prey depletion, and trophy hunting caused extinction of the Asiatic cheetah. Figure 1 depicts the widespread distribution of Cheetah across India based on such literature but their numbers are unknown. Only few of these belong to the “pet” category viz. Gujarat, Maharashtra, Rajasthan states.

Figure 1- **Distribution map of Cheetah across India based on literature records**



Kings of various princely states harboured and even imported Cheetah into India from African markets in the 19thcenturyfor hunting sport, such as from Nairobi by the Maratha King Shahu Maharaj, ruling the Kolhapur estate, Maharashtra state (Jhala et al., 2022). Subsequent large population decline of the majestic cats viz. Lions and Tigers triggered the enactment of the Indian wildlife conservation act, 1972 which banned wildlife hunting and established national parks and sanctuaries country wide(Gadgil andGuha, 1995). Forest logging and human, livestock activities were barred in these protected areas (PA).

Consequently, the Tiger population rose dramatically by 150% from 1,411 in 2010 to 3,167 in 2022 (Bhattacharya and Roberts, 2023). “Human wildlife conflict” (HWC) as the wildlife spill over to villages and even cities, led to livestock depredation, human causalities and crop loss, increased as in Africa too (Marker, 2002) The growing wildlife population and its frequent sighting also promoted eco-tourism with famous wildlife reserves such as Kanha, Bandhavgarh (Both Madhya Pradesh state) and generated local employment, developed the local economy and built forest department/ PA revenue and visibility, including international tourists and wildlife researchers visiting it. So wildlife tourism lured the policymaker’s, as in the Cheetah case and with its impressive track record and systems set up, M. P. State bagged the Cheetanh’s relocation project.

**Cheetah reintroduction planning process**

Threatened species recovery and even reintroduction has been attempted worldwide for some charismatic, flagship species albeit with limited success for ecosystem recovery (Weise et al, 2015). Cheetah was also similarly sought to be reintroduced in India since long (NTCA, 2022) A charismatic species, known as the fastest running mammal on land with amazing sprint, it makes a wildlife lovers’ or policymaker’s dream project. Its rehabilitation could make India proud, look “green” globally and also promote eco-tourism. Wildlife Institute of India (WII), the premier wildlife research agency of Indian Government conducted Cheetah reintroduction feasibility study for the National Tiger Conservation Authority (NTCA). WII surveyed 6 protected areas, comprising 3 each in Madhya Pradesh (Kuno NP, Gandhisagar wildlife sanctuary- WLS, Madhav NP) and Rajasthan states (MukundaraNP, ShergarhWLS, Nauradehi WLS, Jhala et al., 2022). Kuno NP was found as best, followed by Gandhisagar WLS, based on prey density, low human density and less cost for fencing etc. But wildlife researchers argued that the social survey criteria focussed on compensation (Joshi et al., 2025) and Kuno was pre-decided, habitat survey was conducted later. Cheetah also face the agony of habitat change and many veterinary medicine doses, they criticise. Other also questions the conflict arising due to the traditional forest rights (Kabra et al, 2023).

Next, Cheetah reintroduction plan in India was crafted by NTCA (2022) with WII lead and with other expert inputs. Foreign authorities were consulted to lend Cheetah and Namibia consented translocate them to India. Later South Africa also agreed too. African wildlife experts also visited KunoNP and expressed satisfaction regarding habitat suitability and prey availability (Walker, 2022). The Cheetah were brought in India in 2 batches- 1stbatch of 8 adult animals on 17th September 2022 from Namibia and the 2ndbatch of 12 adults from south Africa in February 2023 (NTCA, 2023.). Both coalitions are kept in fenced enclosure called “boma” to acclimatize them. They may be released free in the wild once prey population buildup was adequate- 35 animals/ sq km, it was said then (Siddique, 2023) and 5 Cheetah were released in the wild in December 2024 and 2 more in February 2025.

The relocated Cheetah bred and cubs born in India during 2023-24 but significant mortality was also observed with 8 of the 20 imported Cheetah dying, including by “septicaemia”, a bacterial infection of the blood (Saxena, 2023).This caused experts’ and media debate, thus confining the Cheetah to the Boma. But such high mortality (60%) is noticed in translocation within Africa or even in Namibia (Weise et al., 2015) so is not unexpected. High mortality rate itself may have made Cheetah a rare species. Full acclimatization of the Cheetah is yet awaited in India, and they are fed on culled livestock meat, thus compromising their hunting instinct and skill, argue experts (Chellam, 2024 a).

**Cheetah habitat difference in Namibia/ South Africa and India**

We compare the African and Indian habitats on 2 parameters- a) Geography, c) Prey availability. Table 1 shows that Indian location has double the rainfall as in Africa and forest, hill ecosystem, unlike plain, savannah in Africa. Maximum and minimum temperatures in India are bit higher. Humans exist in and around the Cheetah reserves in Africa, but are relocated in India. Table 1 depicts the habitat and climate parameters of the African source sites of the Cheetah translocated and Kuno NP. It is forested and hilly, ravines landscape, unlike plains savanna in many African sites. The temperature in India also soars to 42 deg. C, so can bother the Cheetah, as its always below 40 deg. C in Africa.

Table 1- **Habitat Differences in the African source sites of Cheetah and Kuno National park**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| COUNTRY  | NATURE RESERVE\*  | VEGETATION TYPE | TOPOGRAPHY  | Rainfall mm/ year | Temp-erature deg. C | REFERENCE |
| India  | Kuno  | Forest | Hills, slope | 760 | 6-42 | Sharma, 2007 \*\* |
| Namibia | Waterberg (8) | Savanna-Woodland | Plateau | 500 | 09-35 | Burke & Strohbach, 2001 |
| South Africa | Waterberg# (3) | Slope-Plateau  | 713 | 14-25 | Van Staden et al., 2021 |
| Phinda (3) | Slope, hilly  | 777 | 10-35  | [Rautenbach](https://www.researchgate.net/scientific-contributions/Anita-Rautenbach-2009097868?_sg%5B0%5D=dup3DKAqNTf1nW1aE3CIyADTLGrG0mhkAF1JGCqiJ5r83ufyhxJyYJjssMk5iCZioLrD1rQ.TzHcmG6cl1dos4ZnKirnpFEEEQqKsjIWENhF2VDBQPyvpGCE-Aa9kRXFCXwPwTb9ccX00d4OZWLXWnnrVg9deg&_sg%5B1%5D=3lvbDnVJbdNEouxx-7qET7mIecKDsRYk7d0BdJnfo4nMQxWA4KcJWhiFJt0OE9StrqAO1Lg.zd60_DJGlvpliE2lhZBTiRZYgiF7TsJ2Kp0Z5M6YSaBzxH89nYyMdP0O9An4dIaP2PCqXz6wLtN6BsndHpaqcQ&_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIiwicG9zaXRpb24iOiJwYWdlSGVhZGVyIn19) et al., 2018, \*#.  |
| Tswalu Kalahari (3) | Bushveld (Savanna) | Plains-Slope | 160 | 6-38 | Tokura et al., 2018 |

#- Thaba Meetse \*- No. of Cheetah transferred to India are indicated in parenthesis \*\* Mark et al (2023). \*#- Mark and Grobler (2016).

Table 2 depicts the African prey average weight as grown up (adults) and its comparison to the Indian potential prey species. Fir. 2 depicts the habitat differences.

Fig. 2 **Cheetah habitat difference in Namibia and India**

|  |  |
| --- | --- |
| Picturehttps://the-cheetah.weebly.com/habitat.html | https://www.kunonationalpark.org/about/forest |
| Grassland in Namibia (desert) | Hill forests, Kuno (India)  |

Table 2- **Cheetah Prey Species in South- Western Africa and India**

|  |  |  |
| --- | --- | --- |
| NAMIBIA# | SOUTH AFRICA\*\* | INDIA\*\*\* |
| PREY SPECIES | DIET SHARE %  | WEIGHT kg@ | PREY SPECIES | DIET SHARE % | WEIGHT kg@ | SPECIES | WEIGHT kg |
| 1. **Eland**
 |  10 | 300 | 7. **Impala** | 45-68 | 60 | 10. Chital | 85 |
| Oryx#\*  |  15 | 200 | **Steenbok**++, #\* |  | 50 | 11. Black-buck  | 40 |
| Red heartebeest\*  |  10 | 150 | 8. Duiker  | 49 | 20 | 12. Chou-singa | 40 |
| Steenbok \* |  7 | 50 | **Springbok** | Upto 86% | 50 | 13. Chinkara | 23 |
| Springbok\* |  16  | 50 | Oryx *#\** | (calves)  | 150 (50) | 14. (Blacknaped Hare  | 2 |
| Warthog\*  |  7 | 100 | 9. . **Spring-hares**  |  | 3 | 15. Peafowl)  | 5 |
| Average \*# |  | 33 |  |  | 40 |  | 45#@ |

#- Marker et al., (2024). \*\*- Marnewick et al., 2007, Female Cheetah prefer hunting Steenbock.

\*\*\*- Prater (1965), #\*or Gemsbok (Oryx gazelle) \*#- Average of the majority prey species,

++ Mills et al. (2004) c/f Pienaar (1969), XXX- Mills (1990), (Young- weighs 50 kg), , #@- Blackbuck, Chinkara are few, Chital common, heavy.

@ <https://www.krugerpark.co.za/Kruger_National_Park_Wildlife-travel/explore-kruger-park-buck-and-antelope.html>

The weight indicated is average but the actual animals hunted may be smaller ones .

Note- 1) % diet share in the contribution as quoted by Market et al (2024). 2) The larger diet share (>10%) species mentioned are in bold and underlined. 3) Weigh kg is average weight of adult (mostly male) in kg. 4) If a species is repeated, its zoological name is not repeated. 5) Prey preference of Cheetah in India in the wild is unknown, these are candidates. 6) no. 15 & 16 yet unsure, thus listed in parenthesis, not used to compute average.

Zoological names- 1. Taurotragus oryx, 2.Also called Gemsbok- *Oryx gazelle,* 3.Alcelaphus caama, 4.Raphicerus campestris, 5.Antidorcas marsupialis, **6.**Phacochoerus africanus,

7. *Aepyceros melampus, 8.* *Sylvicapra grimmia*, 9.*Pedetes Capensis* (its actually a rodent looking like hare, but not a hare taxonomically)*.* 10. *Axis axis,* 11*. Antilope cervicapra*, 12. *Tetracerus quadricornis*, 13. *Gazella bennettii,* 14. *Lepus nigricollis,* 15. *Pavo cristatus*

It is seen that Chital (Spotted deer) alone may not suffice as it is heavier than the antelopes that Cheetah hunts commonly in Africa (Steenbok, Springbok, Impala, weighing < 50 kg, Mills et al, 2004). Young ones of heavier antelopes/ mammals are also hunted sometimes, especially by the males. Chital has large, branched, curved horns for defence, unlike Antelopes having small, single horns (Prater, 1965).

But number of antelopes observed in India are just 1-3 per sq. m (Dookia et al., 2009) so may be inadequate. Kuno NP was initially prepared a decade ago (2013) for Lion relocation (Bipin et al., 2013) but it was not conducted despite Supreme court order in 2013 as ungulate density was dropped to 30/ sq. km (Jhala, 2022).The focal species was then changed to Cheetah considering the considerable Government investment in shifting 20 villages outside the forest earlier. So the habitat was selected first and its suitability study for the Cheetah was initiated later! But such an approach needs revision.

**Wild release- Doubts persist!**

The surviving 12 adult cheetahs of the original 20 imported from Africa and 12 of the 17 cubs born in India are held captive in enclosures at Kuno (Anon, 2024). Chellam (2024 a) estimates about 20 cheetahs will be introduced annually for the next 8-10 years, about 160 animals to be translocated from Africa till 2035. The Cheetah Action Plan states that the project success lies in Cheetah population reaching 21, the maximum carrying capacity of Kuno. It has 748 sq km. area, sufficient for only about 10-15 cheetahs. The cheetah numbers can rise to 21 in 15 years and 36 by say 2060 AD vide theaction plan, if 3,300 sq km more is restored (Nitynaware, 2024 a). In all, 26 Cheetah await release in the wild (Nitnaware, 2024 b). The project has lost 11 cheetahs and welcomed 17 cubs. Kuno National Park’s (KNP) capacity to host cheetahs has been exceeded and the ‘excess cheetahs’ must be relocated to newly created fenced habitats in Madhya Pradesh’s Gandhi Sagar National Park (NTCA, 2023). Kuno has reduced chital population now, dropping from 8,000 in 2021 to about 6,500 in just 1 year, but after importing cheetah, about 1,500 more chital are also released into the park (Nitnaware, 2024 b).

**Carrying capacity estimate**

Cheetah release density was <2 per 100 sq. km. in the within African relocation project, (Marker et al., 2024). So the Kuno NP area of 748 sq. km can only support 15 Cheetah maximum at this rate, if habitat was suitable, but we questioned it. Expert panel of Govt. of India headed by Mr Rajesh Gopal, ex chief, Project Tiger said the Cheetah cannot be released into the wild unless prey population builds up adequately- say 50 animal/ sq. km (Siddique, 2023). Some experts opined that Kuno is unsuitable habitat for Cheetah, including late Mr AJT Johnsingh an ex Dean, WII (ITDA, 2023). Chellam (2024 b), another wildlife expert says Cheetah project has turned into “glorified safari”. Shifting Cheetahs to India from Namibia did not consider its guild ecology, (Singh, 2022). African experts too questioned the hasty shift (Wachter, 2024) though few of them had expressed favourable opinion of Kuno prior to translocation, but they worked at the Cheetah donor agency (Walker, 2022), which represents “conflict of interest””. They had impressive experience of Cheetah translocation within Namibia (Marker et al., 2024) where 17cheetahs achieved independence (68%) while 8 returned to captivity, among the captive-raised orphaned cheetahs (*n* = 25). These were rehabilitated and released into the wild as adults across 3 private reserves in Namibia. The preferred prey was Steenbok, although artificially formed female cheetah coalitions avoided it and primarily killed juvenile eland, a type of Oryx. The prey population density of Cheetah in Africa is high-. Similarly, steenbok density of 0.5-1.5 individuals/ sq km, Springbok 2-5.5 and Eland 1-2.5 totalling 3.5- 9.5 animals/ sq. km are observed at the carrying capacity level in Namibia (anon, n.d.).This is much more than the Indian antelope population density mentioned in the next section.

**Future extension plan and western India options**

Thus, the Government intends to import next batch of Cheetah other reserves such as Gandhisagar or Banni area in Kutch, Gujarat as it has more grassland habitat (Koshy, 2024). , To celebrate the 2 years of completion of the Project Cheetah on 17th September 2024, NTCA announced to extend the project Cheetah to 8 districts in the 3 states, besides Shopur, Shivpuri and Muraina of M. P. state (PTI, 2024). The new 5 districts nearby proposed for extension are Bhind and Datia districts in Madhya Pradesh, Dholpur in Rajasthan, and Lalitpur and Jhansi in Uttar Pradesh. But prior prey population survey there is the prerequisite to avoid repeating the above error. Habitat suitability should decide the choice of site, nit its convenient location/ fame.

Grasslands are abundant in the western Indian plains in the Rajasthan and Gujarat states and support large populations of antelopes vide the census - Blackbuck (25,298), Chinkara (42,590), Neelgai (77,737) besides wild pig (16,933, Anon, 2019). Further, nature conservation is the traditional ethos of the “Bishnoi” ethnic community here such as wildlife e.g. peacock, antelopes and tree called “Khejdi” in vernacular (*Prosopis cineraria)* protecting it by sacrificing their lives by protesting the King’s dictum to fell the trees(Gehlot and Moolaram, 2017). So they may continue the conservation efforts to include Cheetah also through the participatory approch. The antelope density in western Indian Rajasthan state is 10 times higher than in the Kuno NP viz.38 and 13 per sq km at Tal Chhaper WLS (Churu district) and Jarodaclosed area (Nagaur district) respectively (Kumar and Bugasara, 2023). This may help as Cheetah, mainly a gazelle hunter (Ferhadinia et al., 2023).

**Human coexistence possibility**

Human habitations are often viewed as anti-wildlife but, considerable wildlife occurs around human settlements than the protected areas as the census above shows (Anon, 2019). Even in Africa, 75% of Cheetah occurs outside protected area (Kalyansundaram, 2020). Low to moderate human disturbance enhances biodiversity, it is found (Daniels and Gadgil, 1995, Kunte et al., 1999). Livestock such as goat and sheep form notable share (30%) in the Cheetah diet in Africa (Mutaro et al., 2022). Many private Cheetah conservation parks operating in Africa boosting tourism income.The conservation area community needs to be rewarded for such conservation support through payment for ecosystem services (PES) approach as Indian Government has increased and sped up the compensation for the wildlife damage to the livestock or crops (Gulati et al, 2021). Cheetah revival project may succeed with such changed strategies and answer the global experts who doubted it, for strong reasons (Gopalswamy et al., 2024). This can improve India’s image that has taken some beating (Rajvanshi, 2023). An Indo-African research has also criticised the Cheetah project as suffering from social injustice due to relocation, and to the Cheetah due to high veterinary medication, habitat and prey shift (Joshi et al., 2025).

National forest policy, 1988, banned logging, forced forest conservation, timber was replaced by the steel, concrete, plastic etc. and massive afforestation greened 5 million ha till now (Ghate etal, 2023). Tree cover grew by 1/4th from 19% of the Indian land cover to 24% from 1990 to 2020, in the “state of India’s forests” report, 2020 of the forest survey of India based on remote sensing (*ibid.*). With such positive track record, India can make threatened species restoration successful too, if well planned, with Cheetah at start.

**International Criticism**

Zimmerman (2024) questions and contrasts the Cheetah reintroduction setback with the success of the Indian lion project where a population of 600 Asian lions currently co-exists with people in a mixed landscape. It is hoped that the less aggressive cheetah could live together with people in the same way (ITED, 2023).Marnewick et al. (2023) question the statements by the Indian project scientific advisory members that it is actually an "experimental reintroduction of cheetahs into India". This indicates its outcome is uncertain, and raises ethical concerns. They write “1*.The Asiatic cheetah, A. j. venaticus, is extinct in India and replacement by the African cheetah requires appropriate scientific consideration, 2. The Indian plan has No clear exit strategy, IUCN Guidelines for Reintroductions mandate, if the project does not succeed or cause unpredicted harm to other wildlife or humans*”.

African-Indian joint expert team (Cristescu et al., 2024) replied the African critique (*ibid.)* but no wild release is made yet and more global criticism ison rise ! Madhya Pradesh Govt. audit also observed some irregularities in the project management and finance (PTI, 2024). So management needs to improve and be more transparent, accountable in this public project of Indian pride. South Africa has asked for the progress report of the Cheetah transferred earlier recently and postponed the transfer of the next lot of Cheetah (Wire, 2025), underlining the need for critical reappraisal of the Cheetah project.

**Conclusions and policy insights**

The risks of prey deficit, pathogens and depredation by Tiger, Leopard, Hyena etc.has stalled Cheetah release in the wild so far. About 8 i.e. 40% of the 20 Cheetah imported have died, and success rate is 60% which is similar to the translocations within Africa. We suggest (1) exploring grassland prevalent sanctuaries in Gujarat-Rajasthan states (2) release Chinkara, pigs, barking deer, wildboars and hares as prey in the wildlife reserve, not just Chital, (3) enable low human disturbance in the grasslands in KP and surrounding areas, including limited livestock on experimental basis, (4) develop Savanna corridors and network management of wildlife reserves adjoining Kuno (Madhav, Gandhisagar, Ranthambor, Kailadevi) or farther (Tal Chhaper WLS, Churu district and Jaroda closed area, Nagaur district) as the later have antelope population density many times that in the Kuno.

**Constraints and future research**

This is only literature search based study and a key question unanswered is if Cheetah routinely hunt Chital or establishment/ introduction challenges to hares, wild boar and goat, sheep in the wildlife reserve. That can be the future research option.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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