

Modernization at the cost of biodiversity and traditional livelihood in Kachchh

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Kachchh is virtually an island, separated by the Arabian Sea in west, Gulf of Kachchh in south and Rann (seasonally inundated with sea water) in north and east. Such island condition, persisting for thousand years, has imparted uniqueness to its livelihoods and wilderness. Its broken arid plains are rich in flora and fauna, and a paradise for nature lovers. It experiences environmental fluctuations and consequently landuse changes within short time periods. Researchers of Wildlife Institute of India guided by Dr. Y.V. Jhala have been investigating how these changes affect wildlife by studying their population, habitat and behaviour in Abdasa tehsil during 2005–11. Annual rainfall and agro-infrastructure have increased simultaneously during these years, reducing grassland habitats and adding environmental toxicity.

Bustard populations of Indian subcontinent are rapidly declining due to habitat loss and hunting. The Critically Endangered great Indian bustard (*Ardeotis nigriceps*) density has declined from 9 to 5 birds per 100 km² between 2007–11. Given that only ~300 birds are left globally, such continued decline is alarming. These birds prefer undisturbed, flat, grassland patches during breeding season but range widely in accessible and productive agro-grass-scrub patches during non-breeding season. Various life-history activities require characteristically different habitats, indicating that large heterogeneous patches need to be conserved. Birds show strong fidelity to breeding sites, which occur in grasslands with a mix of sparse cover for displaying males and moderately tall cover for nesting females. Here males' mating territories are strategically placed, where long-term female usage is also high, implying that their destruction can cause serious conservation problems. Population of the Endangered lesser florican (*Sypheotides indica*) is

concentrated within ~130 km² prime habitat. Their density varies from 7 to 17 birds per 10 km² between years, corresponding with local rainfall patterns. They prefer remote grasslands with ample herbaceous cover. As agriculture is spreading into interiors, preservation of dispersed grassland patches within agricultural matrix is crucial for their persistence. Vulture populations of Indian subcontinent have also faced rapid decline due to diclofenac prevalence in livestock husbandry. Researchers conducted advocacy program among local users, replacing diclofenac by friendly drug meloxicam, and subsequently husbandry use of diclofenac was officially banned (2007–09). Parallel monitoring of white-backed vulture (*Gyps bengalensis*) breeding shows that nest counts have declined from 4–7 nests per village in 2004–06 to 2–3 nests per village in 2008–11. Interestingly, nesting success has reduced from 71% in 2004–05 to 13% in 2008–09 but later increased to 53% in 2010–11. Whether vulture populations recover after diclofenac ban or not need to be monitored in the coming years to assess the efficacy of conservation efforts.

Radio-telemetry of the large and elusive striped hyaena (*Hyaena hyaena*) has provided first-hand insights into their life history. These animals range over 54 km² area for daily needs. Their foraging movements are definitive between den/refuge sites and known village food sources. Village livestock contribute to about 30% of their diet and reduce search efforts, promoting stronger sociability among clan members. All members participate in cub rearing (providing food, guarding and playing with cubs) but male sub-adults disperse earlier (6–7 months since cub birth) than female sub-adults (12–13 months). While communities' livestock husbandry benefit hyaena, accessing these resources through agro-infrastructure developed areas



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increase mortality risks. Four out of seven collared animals have been killed in snares for agricultural pests and one in road-accident within last three years. The smaller carnivore, Indian fox (*Vulpes bengalensis*), is known to be adaptable and generalist. Their population has ranged between 25 to 40 individuals per 100 km² between years, with no clear trend across years, rainfall and cropping intensity. Radio-telemetry of 12 individuals shows that they range over 1.8 km² area for daily needs. They prefer grassland over fallow fields, savanna, scrub and ravine habitats. While savanna is preferred over fallow fields during daytime, a reverse trend is observed at night, probably for foraging benefits under less disturbance. Pups are born in January and raised in dens excavated in grassland during the next 4-5 months after which they disperse. Diet is chiefly composed of arthropods, rodents, reptiles, fruit and crops. From 2006 to 2010, a threefold decrease in reptile biomass and fivefold increase in fruit-crop biomass has been observed in their diet that coincides with decreasing lizard density and increasing agricultural food in the environment. Thus, results show that fox can adapt to some rainfall-landuse perturbations, but they are also specialized to grasslands for crucial life history needs.

Spiny-tailed lizard (*Saara hardwickii*) is an important prey and Schedule II species poached for alleged aphrodisiac properties. Their population density has declined from 91 to 31 lizards per hectare between 2007 and 2010. They prefer grasslands and moderate livestock grazing but avoid >1m tall vegetation and cropped areas. Rainfall-landuse perturbations have antagonistic influence on lizards; while lag-year rainfall increases their food resources, cropping intensity reduces their burrowing substrate.

Low intensity agro-pastoralism is the traditional livelihood of Kachchh that is threatened by agricultural intensification facilitated by recent modernization. Questionnaire survey reveals that pastoralists constitute only 6% of village households, while remaining 94% population have negligible economic stakes (but significant cultural stakes) on grassland resources. Institutional arrangements are weak among pastoralist communities, which compounded with small unevenly distributed stakes and external economic forces may have led to open access of grassland resources. Evidences suggest that villages with relatively strong institutions face less threat from landuse conversions. Although traditional livelihoods are compatible with wildlife, under current scenario it is unlikely that communities' internal social mechanisms can achieve those conservation objectives. Hence managers must consolidate traditional livelihoods by enforcing legal land tenure rules and providing external aides such as agro-environmental incentive schemes.

These results provide a holistic view of species-environmental responses in this understudied ecosystem. Rainfall-landuse cycles have been an integral part of this landscape, but the prevailing one is more permanent and leading to loss of biodiversity and traditional livelihoods. Arresting these habitat disruptions through policy changes and community sensitization is the most critical conservation need for Kachchh.

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