STATUS OF TIGERS
COPREDATORS & PREY
IN INDIA, 2014
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This is the third round of the country level assessment of Tigers, Co-predators and Prey, using the refined methodology. As a country having the maximum number of tigers and their source area, India also has the unique distinction of embarking on this refined methodology across all forested habitats and tiger States within the country. The state of the art technology has been put to use, involving remotely sensed data, geographical information system and camera traps, besides extensive ground survey. The latest computer application have been used for obtaining the results. This science based monitoring and assessment would further strengthen our efforts to conserve our national animal.

I compliment the tiger States, National Tiger Conservation Authority, Wildlife Institute of India and collaborators outside the government system for this commendable effort.

Prakash Javadekar
Minister of State (Independent Charge)
Environment, Forests & Climate Change
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Appendix – 2: Details of spatial and attribute data used for assessing patterns of tiger distribution
The methodology used consists of:

a) Extensive and intensive surveys at high spatial resolution to determine i) occupancy and distribution of tigers and other predators, ii) distribution and relative abundance of prey species, iii) habitat condition and human impacts;

b) Remotely sensed information on i) landscape characteristics and habitat condition and ii) human footprint;

c) Abundance estimation of tigers and leopards through capture-mark-recapture using camera traps and of prey species through distance sampling on line transects. In extremely low tiger density areas or where camera trapping was not logistically feasible (due to militancy or other reasons), we used fecal DNA to determine tiger presence and minimum numbers.

Surveys (a) for occupancy and relative abundance estimation covered about 4,73,580 km² of wildlife habitat with an effort of 6,72,560 km walk on 87,679 spatial replicates for occupancy surveys and 90,750 transects. Habitat condition and human impacts were estimated from 1,63,292 plots sampled on line transects. We deployed remote cameras across 51 sites at 9,777 locations (c) to obtained 30,922 usable photo-captures of tigers and 17,143 photo-captures of leopards. Computer aided comparisons of stripe patterns and rosettes estimated 1686 individual tigers and 1647 individual leopards from these photographs. We used likelihood based spatially explicit capture-recapture (SECR) in a joint distribution framework with covariates of prey abundance, habitat characteristics, and human footprint in package secr (program R), to estimate tiger and leopard abundance within each landscape.

Tigers were recorded to occupy 89,164 km² in 2014 in India. Correction for imperfect detection of tigers resulted in a marginal increase in occupancy of 2.4 to 6% over the naïve estimate. Occupancy surveys had high detection probabilities ranging between 0.28 to 0.48. Tiger occupancy was best explained by remote...
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undisturbed forests with good prey populations. Tiger population (excluding < 1 year cubs) was estimated to be 2226 (SE range 1945 to 2491) in India (Table 2.1). Amongst tiger reserves Corbett had the largest tiger population estimated at 215 (range 169–261) tigers, four tiger reserves (including Bandipur, Nagarhole and Kaziranga) had over 100 tigers. Tiger Reserves accounted for over 70% of all the tigers in India (Table 2.2).

Leopard population in India was estimated to be 7910 (SE range 6566 to 9181) (Table 2.3). The state of Madhya Pradesh had the highest number of leopards at 1817 followed by Karnataka at 1129 leopards. The leopard population was estimated only within forested habitats in tiger occupied states, therefore, it should be considered as a minimum number since leopards, unlike tigers, are also found outside forests. This is the first attempt to estimate leopard abundance at landscape scales. Distribution range and spatial extent of all major mammalian species are provided in the report.

Tiger occupancy and abundance has substantially increased in the Shivalik Hills and Gangetic Plains landscape, primarily due to improved status of tigers in the state of Uttrakhand. Rajaji-Corbett tiger population is now contiguous with Dudhwa-Pilibhit population since the intervening forests of Haldwani and Terai Divisions along with new protected areas like Nandhor Wildlife Sanctuary have tiger occupancy and reasonable tiger density. The landscape would benefit from supplementation of tigers in Western Rajaji that will assist in the occupancy of Shivalik forests in Uttar Pradesh and Kalesar Wildlife Sanctuary in Haryana. Maintaining and enhancing trans-boundary corridor connectivity between India and Nepal is an essential element of tiger, elephant and rhino conservation in this landscape. This connectivity is threatened by the new India-Nepal border road and special care is needed to ensure that proper mitigation measures are in place.

Tiger status has improved within the Central Indian landscape with an increase in tiger occupancy and numbers. This increase is contributed primarily by the states of Maharashtra and Madhya Pradesh. Indravati Tiger Reserve in Chhattisgarh was assessed for the first time. Sampling was limited to accessible areas of Palamau Tiger Reserve in Jharkhand. Conservation efforts need to focus on tiger populations in Orissa (Simlipal-Satkosia tiger reserves), Palamau landscape and in Northern Andhra Pradesh (Kawal Tiger Reserve). Sanjay-Guru Gasidhas-Palamau landscape holds promise for future expansion of tiger population provided planned conservation investment continues. Tiger populations in Central Indian landscape are highly fragmented and some are quite small in numbers, therefore, their survival is dependent on corridor connectivity. Corridors in this landscape are threatened by developmental activities like mining and infrastructure. Appropriate safeguards and mitigation measures need to be implemented for development projects in this region so as to ensure that corridor connectivity between tiger populations is not compromised. Madhya Pradesh has also taken initiative to provide resources for corridor restoration by implementing corridor specific management plans.

Western Ghat Landscape has maintained its tiger status across all the three states of Karnataka, Kerala and Tamil Nadu. The world’s largest tiger population (Nagarhole-Bandipur-Mudumalai-Wayanad-Satyamangalam-BRT) has further increased to about 585 tigers covering 10,925 km². New Protected Areas declared by Karnataka on the boarder of Goa has assisted in tiger dispersal into Goa and their movement further north into Radhanagri and Sahayadri Tiger Reserve. This region needs more conservation focus as it
holds great potential for tiger and biodiversity conservation. It would be timely to consider declaring inter-state tiger reserve between Karnataka, Goa and Maharashtra. There is loss in tiger occupancy in the intervening habitat between Kudremukh–Bhadra and Anshi–Dandeli, threatening to disrupt connectivity between these tiger populations. Populations south of the Palghat gap (Parambikulam–Anamalai, Periyar, and Kalakad Munduntherai) have improved; attention is needed to conserve forest connectivity between these three major populations.

Only select areas were sampled in the **North Eastern Hills and Brahmaputra Flood Plains landscape**, therefore, tiger occupancy and numbers from this region are minimal estimates. The tiger population in Kaziranga–Karbi Anglong–Paake–Nameri–Orang is the largest source in this landscape (about 163 tigers) and should be managed as a single metapopulation with strategies to address movement corridors between these populations. Dibang and Namdapha were assessed through Scat DNA and opportunistic camera traps and show good promise for tiger and biodiversity conservation but need more conservation investment. Manas–Buxa along with areas of Bhutan landscape have potential for sustaining higher number of tigers and are currently below their carrying capacity. Enhanced protection in this region will help build prey and subsequently tiger population in the long-term. However, the management focus for these Protected Areas should be for forest biodiversity and not become tiger centric, since tiger density in many of these close canopy forests would be inherently low.

The entire **Sundarban tiger reserve** and parts of the Twenty Four Parganas were camera trapped in 2013–14. Tiger population of about 76 (62 to 92 tigers) has remained stable since 2010 and is likely to be near its carrying capacity. Sundarban tiger population is contiguous with that of Bangladesh and transboundary management including anti-poaching strategy and management of ship traffic in specific water channels needs to be implemented for long-term conservation of this unique tiger.

**Genetic analysis** based on a panel of 11 micro-satellites of 158 tiger individuals from across India has shown that at the country scale the tiger population of the North–East is genetically different. The most unique genetic unit of tigers are from Odisha and these need high conservation priority as their population is on a declining trend. The western–arid zone tigers of Ranthambore–Sariska showed a different genetic composition from those of terai and central Indian tigers with some genetic contribution from both these regions. At the local scale the tiger populations south of the Palghat gap differed from the Northern Western Ghat population. The tigers from Sahyadri (northern Western Ghats) shared their genetic makeup with tigers from central India. This preliminary country scale genetic analysis shall assist in planning reintroduction and supplementation strategies for tigers in the future and to prioritize conservation investments to target unique gene pools.

Reduction in tiger and prey poaching and incentivised-voluntary relocation of human settlements from core areas of tiger reserves have been the primary drivers for the improved tiger status in India. These schemes and activities need continuous resource allocation for ecosystem maintenance and restoration. The implementation of MSTriPEs, landscape scale tiger management plans inclusive of buffer and corridors, and use of green infrastructure for mitigating impacts of development especially on corridors, need to become the norm across India. Tigers are conservation dependent species, political will driven by public opinion to ensure proper resource allocation is essential for their continued survival.