



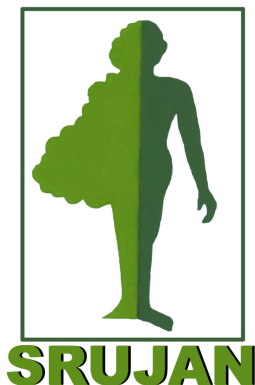
# KANHA-PENCH LANDSCAPE SYMPOSIUM

*Advancing the Conversation on Conservation*

February 16-18, 2014

Mocha Village, Kanha Tiger Reserve

[www.kanhapenchlandscape.com](http://www.kanhapenchlandscape.com)



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## EMERGENCY CONTACT INFORMATION

General questions at the symposium may be directed to a member of the Organizing Committee. For emergencies, please contact:

- Meghna Agarwala: (0) 9424505960 (Organizing Committee member)
- Tuli Tiger Resort: (0748) 9611006 (symposium location)

## ACKNOWLEDGMENTS

Kanha Pench Landscape Symposium would like to thank its supporters and well-wishers that made this event possible.

Funding was provided by the DeFries Bajpai Foundation, whose mission is to support scientists working towards sustainable solutions in developing countries. Additional funding was provided by Worldwide Fund for Nature India (WWF-India).

Swati Thakare, SRUJAN, WWF-India Mandla Office and Tuli Tiger Resort in Kanha contributed through on-ground logistical support. The symposium would also like to thank Pallavi Agarwala for logo design.



## WELCOME NOTE

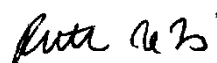
Dear symposium participants,

We are delighted that you are able to participate in the Kanha-Pench Landscape Symposium. This beautiful and magical landscape in central India encompasses critically-important tiger reserves as well as lands outside protected areas. The landscape faces many competing objectives for conservation, livelihoods of local people, and infrastructure to meet development goals. Balancing these objectives presents managers of the landscape with difficult trade-offs.

The symposium grew from a seed of an idea over a year ago, when a group of researchers working in the landscape met informally to exchange views and share results. This small group identified some critical needs: a forum for researchers to communicate among themselves and, perhaps more importantly, a means to interact with managers and NGOs who are facing the challenging task of managing the many competing objectives in the landscape.

Through mutual understanding and dialogue between researchers and managers, research can contribute to science-based conservation and better outcomes for both wildlife and people. This symposium is an initial step towards defining these research needs and strengthening communications.

We hope that the symposium provides a platform for future collaborations and continued dialogue aimed towards the long-term health and well-being of both wildlife and people living in this incredible landscape.



Ruth DeFries

Chair, Organizing Committee



## PROGRAM

### SUNDAY, FEBRUARY 16

- 4:00 PM–6:00 PM **Arrival and registration**  
Welcome table in the Tuli Tiger Resort lobby
- 6:15 PM–6:30 PM **Welcome**  
**Ruth DeFries** (Columbia University), Chair of Organizing Committee
- 7:30 PM–9:30 PM **Welcome reception and dinner**

### MONDAY, FEBRUARY 17

- 7:30 AM– 8:30 AM **Breakfast**
- 9:00 AM–9:30 AM **Introductory remarks**  
**Ruth DeFries** (Columbia University), Chair of Organizing Committee
- 9:30 AM–10:00 AM **Keynote address**  
*Kanha-Pench Corridor and the larger issues beyond*  
**HS Panwawr**, Member of the National Tiger Conservation Authority and Retired Founding Director of the Wildlife Institute of India
- 10:00 AM-10:30 AM **Coffee break**
- 10:30 AM–12:00 PM **Session 1: Wildlife in the landscape – Connectivity and conservation**  
Session Chair: **John Seidensticker** (National Zoological Park)
- Jyotirmay Jena** (WWF-India): Tiger occupancy in the Kanha-Pench Corridor
- Prachi Thatte** (National Centre for Biological Studies): Theoretical perspective on genetic differential in mammals in the fragmented Central Indian landscape
- Trishna Dutta** (Clemson University): Genetic diversity and population structure in tigers, leopards and sloth bears in the Satpura-Maikal Landscape
- Sandeep Sharma** (Clemson University): Are forest corridors functional in the Satpura-Maikal Landscape?
- Facilitated panel discussion with speakers
- 12:30 PM–2:00 PM **Lunch**



- 2:00 PM–3:30 PM **Session 2: *Wildlife in the landscape – Species status and monitoring***  
 Session Chair: **R Shukla** (Kanha Tiger Reserve)
- Ujjwal Kumar** (Wildlife Institute of India) – Role of Kanha-Pench in sustaining landscape dynamics
- Neha Awasthi** (Wildlife Institute of India) – Abundance and spatial distribution of ungulate community in Kanha Tiger Reserve
- Belinda Wright** (Wildlife Protection Society of India) – Poaching in the Kanha-Pench landscape
- Jennie Miller** (Yale University) – Attack risk modeling as a tool for predicting and preventing tiger and leopard livestock depredation in Kanha Tiger Reserve
- Facilitated panel discussion with speakers
- 3:30 PM–4:00 PM **Coffee break**
- 4:00 PM–5:30 PM **Session 3: *People and livelihoods in the landscape***  
 Session Chairs: **JS Chauhan** (Kanha Tiger Reserve) and **HS Pabla** (Former PCCF, Madhya Pradesh Forest Department)
- Archana Sharma** (Aranya) – The nomadic hunting tribes of Madhya Pradesh: Possibilities to wean from poaching by addressing challenges in rehabilitation
- Forrest Fleischman** (Texas A&M University) – Understanding forester decision-making for improving landscape management in the Kanha-Pench region
- Pinki Mondal** (Columbia University) – Winter crop sensitivity to inter-annual climate variability in central India
- Meghna Agarwala** (Columbia University) – Forest degradation: Drivers, quantification and management
- Aditya Dhanwatay** (TigerTrails Jungle Lodge – Tadoba) – Concept of ecotourism
- Facilitated panel discussion with speakers
- 5:30 PM–6:30 PM **Keynote address**  
*Conservation in the Kanha-Pench Landscape*  
**JS Chauhan**, Field Director of the Kanha Tiger Reserve
- 6:30 PM–7:30 PM **Panel on public-private partnerships across sectors**  
 Moderator: **Kartikeya Singh Chauhan**  
 Panel: **Sahas Kumar** (Madhya Pradesh Forest Department), **HS Pabla** (Former PCCF, Madhya Pradesh Forest Department) and **Dilip Khatau** (The Corbett Foundation)
- 7:30 PM–9:30 PM **Reception and dinner**



## **TUESDAY, FEBRUARY 18**

- 7:30 AM–8:30 AM **Breakfast**
- 9:00 AM–10:00 AM **Keynote address**  
*Building a collective engagement conservation platform in the Central Indian Highlands: Are we to be visionaries or undertakers?*  
**John Seidensticker**, Head, Conservation Ecology Center, Smithsonian Conservation Biology Institute, National Zoological Park
- 10:00 AM – 12:00 PM **Session 4: Coexistence between wildlife and people in the landscape**  
Session Chair: **Suhas Kumar** (Madhya Pradesh Forest Department)  
**Madhu Verma** (Indian Institute of Forest Management) – Economic valuation of tiger reserves in India  
**HS Pabla** (Former PCCF, Madhya Pradesh Forest Department) – Wildlife corridors in India: An impossible dream  
**Pragateesh Athiappan** (EIA Resource and Response Center, Nilgiris) – Impacts of National Highway-7 on habitat use and movement of wild animals in Kanha-Pench corridor, Madhya Pradesh  
**G Krishnamurty** (Madhya Pradesh Forest Department) – Myths & realities of ecological effects of roads on sensitive habitats  
**HS Mohanta** (Madhya Pradesh Forest Department) – Minimizing animal deaths in the Kanha-Pench Corridor  
Facilitated panel discussion with speakers
- 12:00 PM – 1:30 PM **Photo and lunch**
- 1:30 PM – 3:30 PM **Session 5: Coalitions towards conservation in the landscape**  
Session Chairs: **Madhu Verma** (Indian Institute of Forest Management)  
**Ishan Agrawal** (Foundation for Ecological Security) – Reconciling biodiversity and livelihood demands in the KPC  
**Kartikeya Singh Chauhan** – Reversal of local extinction of gaur in Bandhavgarh: A leading example of public private partnership to achieve conservation victories  
**Aniruddha Dhamorikar** (Corbett Foundation – Kanha) – Initiatives to secure wildlife in Kanha-Pench landscape through research and community based interventions  
**Chittaranjan Dave** (WWF-India) – Conservation issues in a landscape: Experiences from the Satpuda Maikal landscape in central India  
**Keshav Varma** (Former Director, Global Tiger Initiative) – What does it take to be an effective business model in conservation? – Lessons from the Global Tiger Initiative



- Facilitated panel discussion with speakers
- 3:30 PM – 3:45 PM **Coffee break**
- 3:45 PM – 5:00 PM **Open brainstorming session**  
Discussion with all participants about symposium outcomes and future directions
- 5:00 PM – 5:15 PM **Closing remarks**  
**Ruth DeFries** (Columbia University), Chair of Organizing Committee
- 7:30 PM – 9:30 PM **Reception and dinner**

**WEDNESDAY, FEBRUARY 19**

- Morning **Optional safari in Kanha Tiger Reserve**
- 7:30 AM – 8:30 AM **Breakfast**



## KEYNOTE SPEAKER BIOGRAPHIES

### **HS Panwar, Member of the National Tiger Conservation Authority and Retired Founding Director of the Wildlife Institute of India**

### **JS Chauhan, Field Director of Kanha Tiger Reserve**

Presently Field Director of the Kanha Tiger Reserve, Madhya Pradesh, India, Mr. JS Chauhan is an officer of the 1987 batch of the Indian Forest Service. He also holds a Post-Graduate Diploma in Wildlife Management from the Wildlife Institute of India, Dehradun. Besides being an able administrator and managing several technical forestry entities, Mr. Chauhan specially commands tremendous experience in the management of wildlife protected areas, and has held senior positions in the Kanha Tiger Reserve, Lion Project and Van Vihar National Park. He has shown commendable foresight in the conservation of the endangered hard ground barasingha at Kanha by taking special conservation initiatives, notably improvement of grassland habitat and its expansion by relocation of several forest villages. He has also streamlined a wide range of conservation practices in the tiger reserve resulting in positive trends in the tiger population of the protected area. Mr. Chauhan also supervised the Asiatic Lion Re-introduction Project in Kuno Wildlife Sanctuary in northern Madhya Pradesh and provided technical control over the interstate trans-boundary National Chambal Sanctuary established for conservation of aquatic ecosystem of the Chambal River and the Ghatigaon Wildlife Sanctuary established primarily for the conservation of Great Indian Bustard. He is also credited with amicably relocating 24 villages from the Kuno Wildlife Sanctuary. Mr. Chauhan also managed and improved in-situ facilities for representative faunal species of central India, including captive carnivore and free ranging herbivore species, and was instrumental in training and upgrading of wildlife rescue squads at the state level, and introducing wildlife health management plan. He has also been instrumental in leading the wildlife translocation programmes taken up in the country for the first time. Gaur (*Bos gaurus*), Blackbuck (*Antelope cervicapra*) and release orphaned tiger cubs into the wild after having brought them up in captivity. He has also undertaken many study tours in India and abroad and has participated at a wide range of workshops/symposia on wildlife conservation. He has also been honoured with the “Wildlife Service Award” by the ABN AMRO, Sanctuary Asia for his services to wildlife conservation.

### **John Seidensticker, Smithsonian Conservation Biology Institute**

John Seidensticker has served as the Senior Independent Advisor to the GTI and a member of the GTI core team, a voluntary position, since its inception. In fact, he and two colleagues were the people who first approached the World Bank to request assistance in conserving the wild tigers when their slide toward extinction seemed inevitable with the business-as-usual approach to saving them. As Independent Advisor, he advised Mr. Zoellick, other senior Bank officials, Keshav Varma and the GTI team, and range country ministers and officials, on strategies for tiger conservation. He has helped organize all of the GTI's international workshops and conferences including the Tiger Summit. He co-drafted the





Global Tiger Recovery Program, and fostered the Smithsonian-World Bank Institute Global Support Program for capacity development, and engaged international partners. He co-authored the paper that demonstrates how the St. Petersburg Declaration's goal of doubling the number of wild tigers can be achieved. Dr. Seidensticker is Head of the Conservation Ecology Center of the Smithsonian Conservation Biology Institute and has been working to study and conserve wild tigers and other carnivores since the 1960s. He is considered one of the world's most prominent tiger conservationists.



## ABSTRACTS

### KEYNOTE SPEAKERS

**HS Panwar, Member of the National Tiger Conservation Authority and Retired Founding Director of the Wildlife Institute of India**

*Kanha-Pench Corridor and the larger issues beyond*

**JS Chauhan, Field Director of Kanha Tiger Reserve**

*Conservation in the Kanha-Pench landscape*

**John Seidensticker, Smithsonian Conservation Biology Institute**

*Building a collective engagement conservation platform in the Central Indian Highlands: Are we to be visionaries or undertakers?*

The central India highlands supports 20 percent of India's tiger population, and thus is a global priority tiger conservation landscape where we struggle to free tigers from the extinction vortex. This conservation icon has lived here for ten millennia, but the extent and connectivity of its habitat is collapsing, and relentless killing continues. Our mounting wants for energy, fiber, water, and supporting extracting infrastructure drive into this last vestige of wild India, crashing against the reality of a frontier ended, and upending the myth of the unending frontier. Tigers are overwhelmed. Saving and restoring tigers in this human-dominated landscape is conservation action that demands mutually reinforcing bottom-up and top-down cooperation. This new collective-impact conservation paradigm unites supportive government partners with NGOs, individuals, and economic interests who understand and value the tiger's ecological and long-term survival requirements. Collective impact overarches isolated interventions by individual organizations and usually frustrated and isolated government departments, with the goal of long-term tiger population persistence and the sustainability of the biodiversity tigers represents. Conditions for collective success are a common agenda, shared measurement system, mutually reinforcing activities, continuous communications, backbone support organization, and funding for collective best practice impacts. Collective impact conservation builds on partnerships, in which trust is based on science-based verification, and at the heart of our science understanding and explanation is to know what causes provoke what effect, by what means, at what rate. Informing collective impact conservation, science-based verification required continuous communication between scientists, practitioners, constituents, and community leaders. Collective impact conservation cannot be imposed from above; it is ultimately driven by local interests, skills, traditions, wants, and needs. New knowledge and innovative sensible solutions are conceived when diverse stakeholders with different interests, knowledge, and skills come together to share experience, learn from one another, and participate in decision-making processes. Collaboration and dialogue facilitate a deeper shared understanding of the challenges, and reduce potential for conflict and redundancies. Collective impact conservation is the platform to achieve viable, long-term relationships in human and natural systems. Collective impact actions to maintain tiger habitat connectivity and other innovative and best practices are discussed. Time is not on our side.



## **SESSION SPEAKERS**

### ***SESSION 1: Wildlife in the Landscape – Connectivity and Conservation***

**Jyotirmay Jena, WWF-India**

*Tiger occupancy in the Kanha-Pench Corridor*

A survey was conducted to determine tiger occupancy and to identify use of the corridor by tigers and associated animal species in Kanha-Pench Corridor (KPC) during the dry season in 2010. Habitat occupancy of tigers was assessed using a spatially replicated survey. Ecological predictions about tiger presence were confronted with sign detection data generated from occupancy sampling of 100 km<sup>2</sup> sized grids. Sign surveys were carried out in each spatially replicated segments within each grid. 1700 km<sup>2</sup> area was intensively surveyed and a total of 391.17 km was search effort. Grids with less than 10% tiger habitat and forest fragments of less than 10 km<sup>2</sup> were excluded from the survey. The number of spatial replicates in a grid (sampling effort) varied from 2 to 7, depending on the extent of habitat within the grid. Tiger signs were found in 13 grid cells out of 17 surveyed, giving a naive occupancy of 76%. The proportion of replicates with prey signs, different habitat types and human/livestock sign was used as additional covariates in to assess factors influencing tiger presence. The overall sign encounter rate for tiger was 0.12 signs/km, while it was 0.15 signs/km for leopard and 0.10 signs/km for dhole. The major habitat blocks and the weak linkages between them in the corridor were identified from the survey. These linkages are crucial for maintaining connectivity and needs immediate attention to ensure protection, and thus secure movement of tigers in this vital corridor.

**Prachi Thatte, National Centre for Biological Studies**

*Theoretical perspective on genetic differentiation in mammals in the fragmented Central Indian landscape*

Populations of many species are sub- divided into smaller units because of natural or anthropogenic fragmentation. Distribution of genetic variation within and between these sub populations depends upon effective population size and gene flow between them. Gene flow between populations is a function of the species' dispersal ability. Dispersal ability scales with body size and trophic level. Actual dispersal between sub- populations also depends on the nature of the surrounding landscape. Landscape in central India is heterogeneous; patches of forest are embedded in a matrix of agricultural fields, built up areas, villages, roads and rivers. Each of these elements offers different amount of resistance to movement through them, which in turn affects geneflow. I am interested in looking at whether different mammalian species show different patterns of spatial distribution of genetic variation, given the same landscape context. Using classical population genetics theory to build hypotheses about genetic differentiation in a complex landscape can become intractable. I am using simulations to build predictions and will be presenting preliminary results of the same, focusing on the Kanha Pench Landscape.



**Trishna Dutta, Clemson University**

*Genetic diversity and population structure in tigers, leopards and sloth bears in the Satpura-Maikal Landscape*

Information of genetic diversity and genetic population structure in endangered species occupying a fragmented habitat is crucial for landscape-level conservation planning and devising effective conservation strategies. We studied three large carnivores: tigers, leopards, and sloth bears in 5 tiger reserves in the Satpura-Maikal landscape, a stronghold for all these carnivore species, and a global priority landscape for tiger conservation. We traversed 8000 km and sampled about 2000 large carnivore fecal and hair samples. We genotyped these samples and identified 273 individual tigers, 217 leopards, and 55 sloth bears. Based on these samples we investigated the genetic variation and genetic structure in these species. We found various degrees of genetic variability and structure in tigers, leopard, and bear populations, and our analysis showed that the connectivity is functional for these three species in this landscape.

**Sandeep Sharma, Clemson University**

*Are forest corridors functional in the Satpura-Maikal Landscape?*

Mammalian carnivores can be excellent focal organisms to evaluate the degree of functional connectivity in a landscape because of their wide ranging movements and sensitivity to habitat fragmentation. Corridors have rarely been tested for their functional effectiveness in the Indian sub-continent. We used multi-locus genotypic data from 273 individual tigers and 217 leopards from 5 tiger reserves in the Satpura–Maikal landscape of central India to determine whether the corridors in this landscape are functional. We estimated contemporary and historical gene flow among these populations and inferred their evolutionary history. We found that both the tiger and leopard metapopulations in central India had high rates of historical gene flow, and the highest rates of contemporary gene flow were seen in populations that are connected by forest corridors. The tests for population history reveal that tigers populated central India about 10,000 years ago. Their population subdivision began about 1000 years ago and accelerated about 200 years ago owing to habitat fragmentation, leading to four spatially separated populations. This information is highly relevant to conservation practitioners and policy makers, because deforestation, road widening and mining are imminent threats to these corridors. We suggest protection of forest corridors and the need for an integrated landscape-level management policy for effective management and conservation of these carnivores.

**SESSION 2: Wildlife in the landscape – Species status and monitoring**

**Ujjwal Kumar, Wildlife Institute of India**

*Role of Kanha-Pench in sustaining landscape dynamics*

The role of source populations for sustaining landscape scale occupancy is of crucial importance. In case of low density large carnivores that are targeted by poachers the sources can be depleted rapidly affecting the dynamics across the entire landscape. Regular monitoring of abundance and occupancy of these carnivores ensures timely response by



management and law enforcement agencies to prevent declines. We monitored abundance of tiger and leopard populations within the Kanha source population using camera traps on an annual basis. We placed our camera traps in an array of 870 km<sup>2</sup> area at Kanha tiger reserve. Mark recapture frame work was used to estimate the population of tiger and leopard. Tiger and leopard both can be uniquely identified through their unique marking on their body i.e. stripes and rosettes respectively. Occupancy surveys across the entire landscape were conducted once every 4 years. Using occupancy probability as an index of habitat suitability / permeability we modelled movement corridors using circuit theory and least cost pathways. This analysis permitted the delineation of corridor habitats between source populations and helped identify bottlenecks in corridors for restorative inputs. We document an average density of tigers at  $5.32 \pm 0.68 / 100 \text{ Km}^2$  and leopards at  $6.32 \pm 0.82 / 100 \text{ Km}^2$  within Kanha Tiger Reserve. The tiger population within Kanha showed a dramatic decline during 2010 suspected to have been caused by targeted poaching of tigers. Once these declines were brought to the notice of managers, vigilance and law enforcement efforts were strengthened and subsequently the tiger population bounce back to  $67 \pm 6$  in 2013. The leopard population has remained stable at  $96 \pm 20$ . The modern tools of Spatially Explicit population estimation permitted the generation of density maps of tigers and leopards. These spatially explicit density maps provide insight into habitat and other factors that support tigers and leopards.

**Neha Awasthi, Wildlife Institute of India**

*Abundance and spatial distribution of ungulate community in Kanha Tiger Reserve*

The study of distribution and abundance of animals helps in understanding species specific responses towards factors like habitat features and anthropogenic disturbances. Distance sampling is a key method for obtaining estimates of density for ungulates that address incomplete detections. Recent advances in program DISTANCE permit inclusion of covariates to model individual detections. Herein, we assessed the abundance and spatial distribution of ungulates in Kanha Tiger Reserve through systematic stratified distance sampling on 150 spatial line transects with an effort of 900 km walk. We used different design and analytical approaches like conventional (CDS), habitat stratified approach and multiple covariate distance sampling (MCDS). Among ungulates, chital  $32.87 \text{ (SE } 4.62) / \text{km}^2$  was most abundant followed by sambar  $8.04 \text{ (SE } 0.94) / \text{km}^2$ , wild pig  $5.70 \text{ (SE } 0.93) / \text{km}^2$ , gaur  $4.42 \text{ (SE } 0.85) / \text{km}^2$  and barking deer  $2.43 \text{ (SE } 0.26) / \text{km}^2$ . Stratifying habitat gave more ecological meaningful vegetation type specific density estimates relevant for management. However, MCDS estimates are considerably more precise than other two approaches. We identified the factors which were potentially responsible for variation in the abundance and distribution of ungulates like terrain, vegetation type, water availability and anthropogenic factor such as distance from villages. We generated surface densities maps using spatially explicit models for ungulates in R package density surface modeling.

**Jennie Miller, Yale University and Wildlife Institute of India**

*Attack risk modeling as a tool for predicting and preventing tiger and leopard livestock depredation in Kanha Tiger Reserve*

Tiger and leopard attacks on livestock is a primary driver of carnivore decline and livelihood loss in the Kanha-Pench landscape and many parts of India. Livestock compensation is the



primary method of conflict mitigation yet offers retroactive relief rather than proactive prevention. A more preemptive and cost-efficient strategy would be to avoid livestock kills by grazing livestock in habitats where large cats are less likely to attack. We developed attack risk models for Kanha Tiger Reserve to assist livestock grazing management and carnivore conservation by identifying the landscape features where large cats frequently kill livestock and mapping future tiger and leopard attacks.

We built attack risk models by surveying 392 livestock kill sites and 450 no-kill control sites in the Kanha core and buffer and then characterizing these sites based on 15 land-use, topography, and anthropogenic features. We identified the features that tigers and leopards actively select when hunting livestock and used these features to model and map attack risk from each carnivore species. We found major differences in the locations where tigers and leopards target livestock. Tigers commonly targeted prey in high, patchy shrub and dense forest away from villages and roads and close to the core zone boundary, whereas leopards attacked livestock in scrublands near open forest and did not avoid human-dominated areas when hunting. Maps revealed areas of high tiger attack risk ringing the core boundary and higher leopard attack risk in the thinner forests and scrublands around agricultural fields. We recommend that managers utilize attack risk models as guides for designating livestock grazing fields, village land-use, and guard anti-poaching patrol routes.

### ***SESSION 3: People and livelihoods in the landscape***

**Archana Sharma, Aranya**

*The nomadic hunting tribes of Madhya Pradesh: Possibilities to wean from poaching by addressing challenges in rehabilitation*

Bagadiyas, Bawadiayas, Bahelias, Monghiyas, Pardhis. Found across all districts of Madhya Pradesh, these nomadic communities have a livelihood based predominantly on hunting and fowling for meat. Till the Green Revolution they had a major role in ensuring societies' food security. With nationalization of wild fauna in 1972, they lost on the only livelihoods they ever knew. Unfortunately they were never brought under any kind of rehabilitation program by governments. As they can no longer pursue their traditional livelihood of hunting without falling foul of the law; and because they have no opportunity to access other dignified livelihood due to their historical criminal tag, their alternative livelihood options are limited to rag-picking, petty thefts, begging, petty trade, and to a very small extent cultivating poor quality lands with predominantly uncertain titles. All poorly remunerative. They therefore still continue to hunt on the sly. Because trapping alive is a rare skill, they are the procurement source for organized wildlife traders. Most big cats in India are hunted by them. It is not just big cats but huge volumes of small birds and animals such as quails, partridges, hares, deer & antelopes of all kinds, monitor lizards etc., that pose a great threat to conservation of wild fauna. Their rehabilitation therefore is key to wildlife conservation. This paper reviews the constraints and potential approaches for their rehabilitation with learnings from Aranya's engagement with the Pardhi community.

**Forrest Fleischman, Texas A&M University**

*Understanding forester decision-making for improving landscape management in the Kanha-Pench region*

Government foresters play a crucial role in implementing conservation strategies in India, yet there is little study of what influences their decision-making. In this paper I present the results of a year-long ethnographic study of forester decision-making in Vidarbha and Telangana, and explore the implications of these results for the management of the Kanha-Pench landscape. I find that foresters working in the field exercise significant amounts of discretion in the implementation of government programs. Although orders from the hierarchy are an important influence on decision-making, foresters are also deeply influenced by their interactions with the broader political system and by their personal values. I show that in policy arenas where local political influences are strong, these dominate over either forester values or the bureaucratic hierarchy. In areas where political influences are weak forester decision-making is determined by the interaction between individual values and bureaucratic hierarchy. Individual values are themselves shaped by service experiences, such that foresters' values tend to echo those of the broader political and bureaucratic system. Management of landscapes for ecosystem conservation is not valued by political actors who are able to exert strong influences on foresters, and it is poorly understood by most of the bureaucratic hierarchy. Thus, even foresters who personally value ecosystem conservation are often unable to take strong action to promote the cause. Building broad grassroots support for ecosystem conservation and/or developing much deeper ecological expertise within the forest department will greatly facilitate the ability of foresters to implement programs that promote landscape-scale conservation.

**Pinki Mondal, Columbia University**

*Winter crop sensitivity to inter-annual climate variability in central India*

Agricultural production from crops grown during the winter season have increased six-fold in India over the past five decades, enabling intensification through double cropping. Yet, India is predicted to be one of the most vulnerable regions in terms of agricultural sensitivity to current and future climate changes. Climate models predict an increase in annual precipitation from 4% to 14% and temperature by 1.7°C to 4.8°C by the 2080s. We examine the sensitivity of winter cropping systems to inter-annual climate variability in order to identify the relative importance of temperature and precipitation, focusing on a local market and subsistence-based agricultural system in central India. We use satellite time-series data to quantify inter-annual variability in climate parameters and in winter crop production, which is predominantly wheat and pulses in the study region; agricultural census data to quantify irrigation; and field observations to identify locations for specific crop types. We developed mixed-effect models for each crop type, wheat and pulses, to identify correlations between crop production and 22 climate and environmental parameters for 2001-2013. While winter irrigation has a positive impact on overall crop production, seasonal daytime mean temperature for winter (November–January) is the most significant negative factor for winter crop production, irrespective of the crop type or access to irrigation. Wet season start or end date have less significant and varied effects depending on the crop type. Heat-tolerant winter crop varieties are needed to reduce



vulnerability of smallholder farmers that practice double-cropping in this region to future climate variability.

**Meghna Agarwala, Columbia University and Wildlife Institute of India**

*Forest degradation: Drivers, quantification and management*

Understanding forest degradation and its drivers in the Kanha-Pench landscape is important to help formulate effective policies that promote future ability of forests to provide local livelihood needs, wildlife habitat and ecosystem services. Forests that are used by local communities may not be able to provide the same services in the future as they do now. This study identifies local ecological drivers that impact the forest in a manner that alters present-day biomass, structure and species diversity as well as long-term forest composition. It finds that increasing human use is associated with higher regeneration of fire-resistant and cattle resistant species at the cost of other species. It also finds that use for local construction is associated with decreases in transition of species to large size classes, thus altering long-term forest composition. The study also uses remote sensing techniques (Landsat and ALOS-PALSAR) to quantify forest degradation at large-scales, and examines change in forest degradation from 2002 to present to assess the impact of transferring state-managed forests to Joint Forest Management (JFM). It identifies institutional attributes that increases awareness and participation in JFM, and practices by village-level forest protection committees that reduced forest degradation. External monitoring, possible using remote sensing, may be key to motivating local people to protect their forest.

#### ***SESSION 4: Coexistence between wildlife and people in the landscape***

**Madhu Verma, Indian Institute of Forest Management**

*Economic valuation of tiger reserves in India*

Tiger is a unique animal which plays a pivotal role in the health and diversity of an ecosystem and its protection in forests also protects habitats of several other species. While conservation initiatives till now have largely focused on in-situ conservation of tigers by establishing tiger reserves in India, an important aspect that needs further insight is the economic contribution of tiger reserves to the national economy by ensuring the flow of many life-supporting ecosystem services.

A study is being carried out at Indian Institute of Forest Management with support from The National Tiger Conservation Authority to estimate the economic value of six tiger reserves across India, one of them being the Kanha Tiger Reserve (KTR). The study is currently finalizing the methodological framework to map, physically estimate and value relevant ecosystem services from KTR. The primary and secondary data sources for the study include TCPs, Management Plans, and work done in the region by various research and non-governmental organizations.

While the water flow regulation service provided by KTR will be estimated based on seasonal flows of major streams that either originate or flow close to KTR, carbon sequestration and storage will be estimated using growing stock estimates. Apart from





these, many other important services such as recreation value, provisioning services such as fuelwood, fodder, NWFPs and timber, bioprospecting value, flood mitigation, erosion regulation, pollination and seed dispersal will be estimated. The study also seeks to conduct a nation-wide survey to estimate an average Indian citizen's willingness to pay for tiger conservation in India. The team thus intends to use the Kanha-Pench Landscape Symposium platform to seek inputs of the experts to understand dynamics of the system and to fine tune its methodology.

**Pragateesh Athiappan, EIA Resource and Response Center - Nilgiris**

*Impacts of National Highway-7 on habitat use and movement of wild animals in Kanha-Pench corridor, Madhya Pradesh*

Biodiversity is being lost at an increased rate as a result of human activity. One of the major threats to biodiversity is infrastructure development. Road pose a serious threat to many wildlife populations, directly through mortality and indirectly through habitat fragmentation and destruction. This study aims to evaluate the impacts of National Highway-7 on habitat quality and movement of wild animals in Kanha-Pench corridor, Madhya Pradesh.

During the study use of road side habitats by wild ungulates varied seasonally. The encounter rate of ungulate was low within 600 m of the road verge in winter and high within 1 km in summer. During monsoon, animals were found to be randomly distributed. Water availability appeared to influence the use of habitat by the animals along the road. Biotic pressure extend up to 600 m beyond the road verge. The traffic intensity based on 24 hour cycle varied between 2620 and 3382 vehicle/day. A total of 1035 road kills were recorded in the 9.2 km stretch of the road passing through Pench Tiger Reserve. The frequency of road kills was the highest for reptiles (47%), followed by mammals (21%), amphibians (18%) and birds (14%). Among seasons, 52% of animals were killed during monsoon, 34% during summer and 14% in winter. Of the 36 underpasses located in 9.2 km stretch, 9 underpasses were used by mammals such as jungle cat, wild pig, porcupine, palm civet, hanuman langur and rhesus macaque. Topography, location and size influenced the use of underpasses. The study has both site specific and general implication for addressing road related impact on wildlife species.

**HS Mohanta, Madhya Pradesh Forest Department**

*Minimizing animal deaths in the Kanha-Pench Corridor*

The Kanha-Pench corridor connecting Kanha Tiger Reserve and Pench Tiger Reserve of Madhya Pradesh has been prioritized as a conservation goal primarily to support long term survival and viability of the endangered tiger. Yet the benefits of this corridor extend beyond the tiger and affect many other species. Wildlife mortalities within the corridor area due to road and rail accidents as well as drowning in canals are high and outnumber even poaching incidences. Vast intersections of road networks coupled with the canal system and the conversion of narrow gauge into broad gauge rail track pose serious challenges to minimizing animal mortalities. In particular, this rail and road network involves a series of mountain pass cuttings and construction of bridges and culverts that directly impact animal movement. As the initiatives in Kanha-Pench corridor get going, several management efforts could be implemented to reduce animal mortalities due to human infrastructure. Creating roadside clearings, overpasses and underpasses in the railway network and well-guarded



animal crossing zones, in addition to fencing off the vulnerable stretches and imposing the speed limits of traffic flow could offer instant mitigation of mortalities. Furthermore, protecting the canals and creating waterholes in the vicinity could save the animals falling into these death traps. The success of corridor shall lie in perfect blend of the creation of green infrastructure and the mobilization of people's participation in conservation.

**HS Pabla, Former Principal Chief Conservator of Forests, Madhya Pradesh Forest Department**

*Wildlife corridors in India: An impossible dream*

“Wildlife corridors” is a wonderful idea but it is a sort of misfit in a thickly populated country like India. Our protected areas are small because we have no more lands free from human occupation or use. Very few corridors are inherently intact, and plugging the breaks, especially where lands are owned privately, is virtually impossible.

As corridors are never likely to be as safe as the PAs, we must try to retain animals within PAs as far as possible and should consider corridors as independent wildlife habitats, rather than seeing them as conduits for wildlife transportation between PAs. Moving tigers between PAs mechanically is no longer impossible.

Like the Kanha-Pench corridor, MP has several landscapes, even PAs, already divided, or threatened, by linear development ventures. We cannot stop further widening of these roads, canals and railway lines. Perhaps, the best way to salvage our corridors is to motivate, and cajole, their promoters to build them safe and convenient for animals to cross, rather than seeking a ban on such development altogether.

The protection granted to corridors, under the Wildlife (Protection) Act, 2006, has scared the country to its bones as land-use changes in every inch of India have now to be approved by NTCA and NBWL, in addition to the approvals already required under FCA and EPA. As a result, most of the blame for slowing the national economy is being thrown at our feet. Whether we can afford such confrontation for long is anybody's guess.

***SESSION 5: Coalitions towards conservation in the landscape***

**Ishan Agrawal, Foundation for Ecological Security (FES)**

*Reconciling biodiversity conservation and livelihood demands in KPC*

Kanha and Pench Sanctuaries of Central India are home to the last surviving source populations of tigers in the country and are connected by one of the last surviving wildlife corridors. Addressing multilayered issues related to interface of conservation and livelihood in such a landscape, require a comprehensive approach with number of parallel process being undertaken together. The conservation hotspots like protected areas and corridors are required to be perceived within a large landscape perspective through an interactive governance framework. This would mean ensuring greater convergence and interactions of forest authorities and local communities through a co-management approach, strengthening institutional processes for conservation of the tiger landscape and set the direction for biodiversity conservation at the community level in partnership with the forest



department. Strengthening such institutional processes is at the core of the FES work in any forest landscape.

FES is attempting to improve community practices regarding management of natural resources to reduce the net demand over forests. While doing this, we understand that these issues transcend habitation boundaries and require to be addressed at a regional level, emphasis would be on nesting institutions at village and inter-village level.

FES has begun with biodiversity assessments of the Weak link villages identified in Mandla district in Kanha-Pench Corridor's management plan and have also tried to map anthropogenic pressure on these forest patches. Our survey indicates high incidence of *Lantana camara*, and overgrazing. We are organizing village institutions and setting up institutional processes in motion in order to improve governance over natural resources and organizing communities for conservation. We are trying to work upon the themes of agro-forestry, improving crop-residue management for fodder, strengthening farm systems and strengthening diversified portfolio of natural resource based livelihoods.

### **Kartikeya Singh Chauhan**

*Reversal of local extinction of Gaur in Bandhavgarh: A leading example of public private partnership to achieve conservation victories*

Wildlife authorities at Madhya Pradesh forest department, convinced with the idea that the management of PAs should not be limited to simply protecting, intended to prevent local extinctions by more proactive means, such as supplementing dwindling populations; and reintroductions, in places where local extinctions have taken place.

However, despite this conviction nothing could be done for a long time because the country did not have any experience or expertise in the capture and translocation of herbivores at significant scale.

In 2006, for the first time in history, a large herbivore mass capture and translocation operation was launched in India, to reverse a local extinction that had occurred in the Gaur population in Bandhavgarh National Park. &Beyond seconded the KZN Wildlife Translocation experts in training and supporting the Madhya Pradesh Forest Department and the Wildlife Institute of India, and together have spent the 6 years preparing and implementing this operation, which has now set an example to change the way conservation is managed in India forever.

As a pioneer in responsible sustainable tourism, &Beyond's model of restoring and conserving regional biodiversity has often required animal relocations and reintroductions. As a result, the company has considerable experience in this area. With financial and logistic support from Tajsafaris, the success of Gaur translocation in Bandhavgarh is a leading example of public private partnership to achieve conservation victories.

### **Aniruddha Dhamorikar, Corbett Foundation – Kanha**

*Initiatives to secure wildlife in Kanha-Pench landscape through research and community based interventions*

The Corbett Foundation (TCF), a registered public charitable trust established in 1994, has been working towards the conservation of nature and wildlife through its divisions located



in Corbett, Kutch, Kanha, Bandhavgarh and Kaziranga, with the primary objective to preserve, protect, and conserve wildlife by developing grassroots initiatives.

In Kanha a number of programmes have been designed as per the need and the demand of interventions based on socio-economic status of the communities as well as their direct and indirect dependency upon the forests. TCF provides primary health-care treatment to around 50 remote villages in KTR; vocational training and livelihood generation opportunities to forest-dependent communities; and creates awareness amongst schools and villages on wildlife conservation. In 2013, TCF set up a first-ever Tribal Museum at Beherakhar that depicts the culture, art and handicrafts of Baiga and Gond tribes.

To address the danger of transmission of highly infectious diseases such as FMD, BQ, and HS, TCF undertakes cattle vaccination programme in association with KTR for the aforementioned disease, all of which can be transmitted from domestic to wild animals in the reserve. TCF has also intervened by providing weekly primary health treatment via its RMOP and vocational training in about 13 villages which come under two weak-link areas as identified by the Forest Department of Madhya Pradesh, and WWF-India in the Kanha-Pench Corridor. TCF's long-term goal in the corridor is to empower the locals and gain their support in community-driven conservation of the corridor.

### **Keshav Varma, Former Director of Global Tiger Initiative**

#### *Global Tiger Initiative*

The Global Tiger Initiative (GTI) was launched by President Robert B. Zoellick of the World Bank, the Smithsonian Institution, GEF, and an alliance of governments and international organizations in June 2008. The GTI is working to reverse the downward trend in wild tiger numbers, helping the species to recover and repopulate its habitats in sustainable numbers. Today's challenge is to fulfill the economic growth and development needs of people while sustainably managing natural resources, of which the tiger is one. The GTI's business model is to engage and support the governments of the range countries to carry out a comprehensive program – the Global Tiger Recovery Program – that deals with all major threats to tigers and their habitats in the context of a new development paradigm that balances growth with environmental protection.

The GTI has been striving to change the conversation about conservation by bringing key sectors of economic development into decision-making, i.e. those that affect tiger landscapes and tigers themselves, such as transport, extractive industry, hydropower, ecotourism, national and international law enforcement agencies, private business and corporations. India's Wildlife Business Council was launched to pilot business engagement in tiger and wildlife conservation and to influence corporate policies for doing business in tiger conservation landscapes through their corporate social responsibility programs. Educating and influencing the choices of young professionals and youth is another social dimension of tiger conservation. With increasing human population and development pressure on remaining Tiger Conservation Landscapes (TCLs), India must take such a cross-sectoral approach to tiger conservation.

India's TCLs, which support nearly half of the global tiger population, are under severe stress that will only increase as economic growth accelerates. The frenzy of urban India is destroying the country's natural, cultural, and historical values. The issue is that at present,



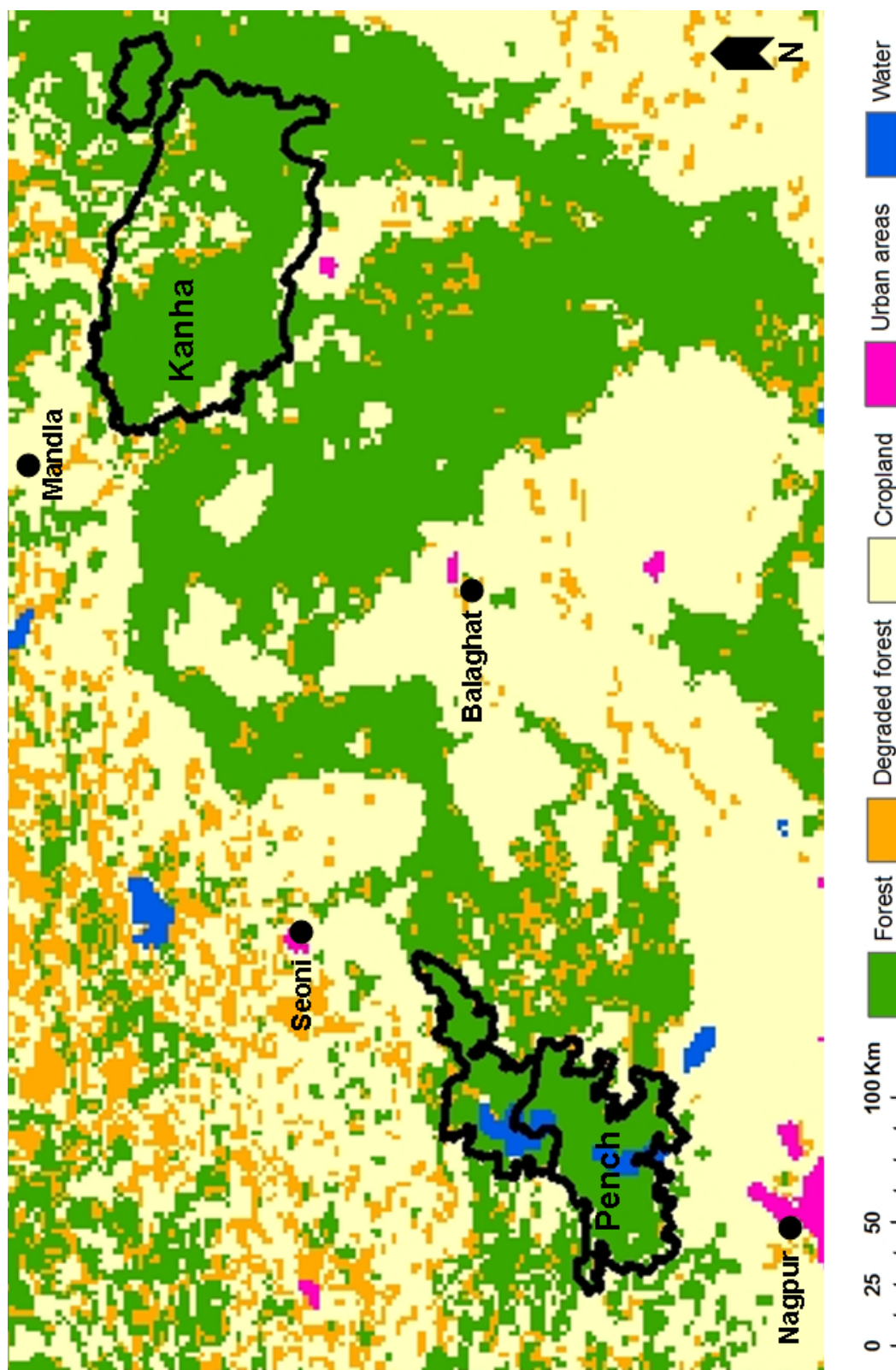
India's leaders, policy makers, and opinion makers do not see or understand the value of biodiversity and perceive its protection as anti-growth. The results of scientific research too often stay within the boundaries of universities and never reach those who decide on the balance of economic development or even those who work on the front lines of tiger conservation. This important workshop will attempt to bridge that gap by informing front line managers responsible for the stewardship of one of the key TCLs in central India about habitat connectivity and its importance. Further, it may serve to highlight this issue to government and corporate leaders.

We need champions and an active consortium that would help to converge science, research and practice. I see this evolving with the GTF/WII/WBI/Clemson/Merced/Mason/Smithsonian coming together on a single platform. We also need business and industry to come in more forcefully along with judiciary and the media to complete the circle. It is important to formulate a communication strategy following this workshop. The citizens of India must understand the value of the ecosystems and landscapes.





# MAP OF THE KANHA-PENCH LANDSCAPE



## **PRESENTATION FORMATTING GUIDELINES**

One of the goals of the symposium is to network with other participants to share findings and establish future collaborations for generating science-informed conservation in the landscape. Please follow the formatting requirements below when preparing your talk.

### **TOPIC**

We request that you focus your talk on your activities within the Kanha-Pench landscape. To help other participants apply your ideas to their own work, please discuss the implications of your activities for other research and management. Finally, please emphasize the way in which your work contributes to science-informed conservation and livelihoods in the landscape.

### **TIME**

You will have 15 minutes for your presentation, consisting of 12 minutes for your presentation and 3 minutes for questions from the audience. Please design your presentation to match this time period. Time limitations will be strictly enforced to enable all participants to present during the symposium, and a timer will be present to assist you during your presentation.

### **FILE FORMAT**

Please make or convert your presentation to a Microsoft's PowerPoint file and save it on a USB Flash "thumb" drive. PowerPoint files created on Macintosh computers should be previewed on a PC to ensure cross-platform compatibility. There will be a computer at the symposium where you will be able to transfer your presentation before the session starts. A laser pointer will also be provided for your use.

### **ABSTRACTS**

Presentation abstracts are available in this booklet and online at <http://www.kanhapenchlandscape.com/talks.html>.



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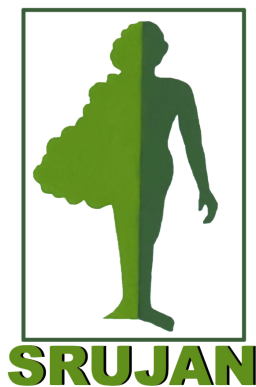
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