



Central Indian Landscape Symposium

Reconciling development, livelihoods and
conservation goals in the landscape

December 14-17, 2016

Kiplings Court, Pench Tiger Reserve, Madhya Pradesh

#CILS2016

www.centralindianlandscape.com

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Network for
Conserving Central India





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Symposium Theme

Following this year's theme, "Reconciling development, livelihoods and conservation goals in the landscape", our symposium will explore the multiple and complex dimensions of conserving wildlife habitat while achieving development goals and improving welfare for people in the landscape.

Acknowledgments

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) and logistical support was provided by the Satpuda Foundation. We also thank Pallavi Agarwala for our logo design.

Emergency Contact Information

- General questions: Member of the Organizing Committee (page 35)
- General logistics: Mr. Ajay Poddar at (+91) 07769815619 or 09829373649
- Travel bookings: Mr. Amit Chawla at (+91) 09371181073
- Kipling's Court (Symposium venue): (+91) 07122442378 or 07123259000





Welcome Note

Dear symposium participants,

We are delighted that you are able to participate in the Central India Landscape Symposium. This beautiful and magical landscape encompasses critically important tiger reserves and supports livelihoods for millions of people. The landscape faces many competing objectives, among them conservation, forest resources, agriculture, and infrastructure to meet development goals. Balancing these objectives presents managers of the landscape with difficult trade-offs.

This gathering builds on the first symposium in 2014. Then, as now, our aim is to provide a forum for researchers, managers and those working in NGOs to interact and think together about the challenging task of managing the many competing objectives in the landscape. Our community has grown since the last symposium and changes in the landscape have proceeded at a rapid pace. Through mutual understanding and dialogue, we hope that this symposium can contribute to science-based conservation and positive outcomes for both wildlife and people.

We look forward to fruitful discussions, collaborations, and friendships, forged by our shared aspirations for the long-term health and well-being of both wildlife and people living in this incredible landscape.

Ruth DeFries
Chair, Organizing Committee
Professor, Columbia University





Notes: All events will be held at Kiplings Court unless otherwise noted.

WEDNESDAY, DECEMBER 14

- | | |
|----------------|--|
| Morning | Self-arranged optional safari |
| 3:00 – 6:00 PM | Registration at welcome table at Kiplings Court |
| Afternoon | Self-arranged optional safari |
| 6:00 – 9:30 PM | Reception and welcome dinner |

THURSDAY, DECEMBER 15

- | | |
|----------------|---|
| 7:30 – 9:00 AM | Breakfast |
| 9:00 – 9:15 AM | Welcome and introductory remarks
Release of Special Issue on Central Indian Highlands in <i>Regional Environmental Change</i>
Ruth DeFries , Columbia University, Chair of CILS Organizing Committee |

PLENARY KEYNOTE ADDRESSES

Chairs: Kishor Rithe and Amrita Neelakantan

- | | |
|---------------------|--|
| 9:15 – 9:45 AM | <i>Tiger Reserve management in the Satpura-Maikal landscape</i>
Subharanjan Sen , Field Director, Pench Tiger Reserve |
| 9:45 – 10:15 AM | <i>Tiger conservation through human development</i>
Praveen Pardeshi , Principal Secretary, Chief Minister's Office (Maharashtra) |
| 10:15 – 10:45 AM | Tea/coffee break |
| 10:45 – 11:15 AM | <i>Coexistence with large carnivores: What does it look like and how do we reach it?</i>
John Linnell , Senior Research Scientist, Norwegian Institute for Nature Research |
| 11:15 AM – 11:45 AM | Questions and Discussion |



11:45 AM – 12:00 PM Women's Guide Group

12:00 – 1:15 PM Lunch

1:15 – 1:30 PM Group photograph

SESSION ON CO-EXISTENCE OF PEOPLE AND WILDLIFE

Chairs: Jennie Miller and Vidya Athreya

1:30 – 1:50 PM **Vidya Athreya**, Wildlife Conservation Society – India: *Navigating the presence of large cats in human use landscapes in India*

1:50 – 2:10 PM **Anish Andheria**, Wildlife Conservation Trust: *Management of large cats outside protected areas in Central India*

2:10 – 2:30 PM **Dharmendra Khandal**, Tiger Watch: *Village Wildlife Watcher Programme in Ranthambore Tiger Reserve: Relevance for Central India*

2:30 – 2:50 PM **Poonam Dhanwatey**, Tiger Research and Conservation Trust: *Tigers beyond boundaries - Mitigation of human-large carnivore conflict through local community participation and leadership*

2:50 – 3:20 PM Tea/coffee break

3:20 – 3:40 PM **Shivani Agarwal**, ATREE: *Comparing the socio-ecological impacts of forest protection by local and state institutions in Central India*

3:40 – 4:00 PM **Biljana Macura**, Stockholm Environment Institute: *All that glitters is not gold: The effect of top-down participation on conservation knowledge, attitudes and institutional trust in a Central Indian tiger reserve*

4:00 – 4:20 PM **Vinay Varman**, MP Ecotourism Development Board: *Using eco tourism for involving local people in wildlife conservation*

4:20 – 5:00 PM **Panel discussion**

5:00 – 5:30 PM Break

5:30 – 7:00 PM **Poster presentations and reception**
*Please see final program page for list of presenters

7:00 – 9:30 PM Reception and dinner

FRIDAY, DECEMBER 16

7:30 – 9:00 AM Breakfast



PLENARY KEYNOTE ADDRESS

Introduction: Ruth DeFries

9:00 – 9:45 AM *Landscape Scale Scenario Planning: Using predictive modeling to guide sustainable development*
Joe Kiesecker, Lead Scientist for the Conservation Lands Team, The Nature Conservancy

SESSION ON FUNCTIONALITY OF CORRIDORS

Chairs: Sandeep Sharma and Jimmy Borah

9:45 – 10:00 AM **Jyotirmay Jena**, WWF-India: *Critical linkages and factor affecting connectivity in Central Indian Landscape*

10:00 – 10:15 AM **Soumya Dasgupta**, Wildlife Trust of India: *Measuring the impact of conservation activities across a vast fragmented landscape, connecting multiple tiger source populations: A methodological approach*

10:15 – 10:30 AM **Trishna Dutta**, Columbia University: *Mapping corridors and barriers to improve connectivity for tigers in central India*

10:30 – 10:50 AM **Indranil Mondal**, Wildlife Institute of India: *Triage of means – options for conserving tiger corridors beyond designated protected lands in India*

10:50 – 11:10 AM **Raghuandan Singh Chundawat**: *The Stepping Stone Corridor - A new approach with triple benefit: provides connectivity, increases viability of PA tiger populations and materially includes local communities in conservation*

11:10 – 11:30 AM Tea/coffee break

11:30 – 11:50 AM **Sawan Bahekar**, Gondia: *Observations on tiger movement and dispersal in Human-dominated corridors.*

11:50 AM – 12:05 PM **Prachi Thatte**, National Centre for Biological Sciences: *Connectivity in a fragmented landscape: a tale of two species.*

12:05 – 12:25 PM **Ishan Agrawal**, Foundation for Ecological Security: *Human nature interaction in the periphery of Kanha National Park*

12:25 – 12:45 PM **Debi Goenka**, Conservation Action Trust: *Landscape connectivity and corridors*

12:45 – 1:15 PM **Panel discussion**

1:15 – 2:30 PM Lunch



SESSION ON THE FUTURE OF WATER, CLIMATE AND AGRICULTURE

Chairs: Pinki Mondal and Ishan Agrawal

- 2:30 – 2:50 PM **Monoranjan Mohanty**, Indian Institute of Soil Science: *Climate change and agriculture: Impact studies on some field crops of Madhya Pradesh*
- 2:50 – 3:10 PM **Pinki Mondal**, Columbia University: *Implications of agricultural intensification for diet and nutrition in central India*
- 3:10 – 3:30 PM **Benjamin Clark**, Columbia University: *Intra-annual dynamics of water stress within the central Indian landscape from 2002-2012*
- 3:30 – 3:50 PM **Barna Baibhaba Panda**, Foundation for Ecological Security: *Sustainability in Sustainable Land Management projects in Madhya Pradesh*
- 3:50 – 4:10 PM Tea/coffee break
- 4:10 – 4:20 PM **Dharam Pal Singh/Manvendra Singh**, Reliance Foundation: *Present tense to future perfect! – Mutual co-destruction to co-operation*
- 4:20 – 4:40 PM **Milind Watve**, Indian Institute of Science Education and Research, Pune: *An alternative community operated protocol for assessment and compensation of crop damage by wild herbivores*
- 4:40 – 5:20 PM **Panel discussion**
- 5:20 – 6:00 PM Break
- 6:00 – 7:00 PM *Workshop on visions for the Central Indian Landscape (optional)*
Joe Kiesecker, The Nature Conservancy
- 7:00 – 9:30 PM Reception and dinner
- 9:00 – 10:00 PM Saila tribal dance from Sawara Village

SATURDAY, DECEMBER 17

- 7:30 – 9:00 AM Breakfast

KEYNOTE SYNTHESIS

- 9:00 – 9:30 AM *Keynote synthesis*
Dipankar Ghose, WWF-India



SYMPOSIUM REFLECTIONS AND OUTCOMES

- 9:00-10:30 AM **Roundtable and synthesis from the symposium**
Moderators: Sandeep Sharma and Ruth DeFries
Participants (TBD): D. Bhargav, Indian Forest Service; Field Director Kanha MP; D. Goenka, Conservation Action Trust; M.S. Reddy, Field Director Pench MH; K. Rithe, Satpuda Foundation; S. Suchi, Reliance Foundation; B. Wright, Wildlife Protection Society of India
- 10:30-11:00 AM Tea/coffee break
- 11:00 AM – 12:30 PM **Group discussion:** Conclusions and next steps
Moderator: Ruth DeFries
- 12:30 – 2:00 PM Lunch
- Afternoon Self-arranged optional safari

POSTER PRESENTATIONS

- #1 **Harshawardhan Dhanwatey**, Tiger Research and Conservation Trust: *Large carnivore attacks on humans in Central India: A case study from the Tadoba Andhari Tiger Reserve*
- #2 **Aditya Joshi**, Wildlife Conservation Trust: *Large carnivore conservation beyond protected areas*
- #3 **D. P. Srivastava**, University of Delhi: *Human wildlife interactions in Panna Multiple-use Buffer Area*
- #4 **Jennie Miller**, Panthera, Cornell University and University of Cape Town: *Human perceptions mirror realities of carnivore threats to livestock: Opportunities for reducing human-carnivore conflict*
- #5 **Poorva Joshi**, Biome Conservation Foundation, Pune: *Finding solution in the form of non-palatable medicinal plants as an additional crop strategy for control of herbivores around PAs*
- #6 **Vidya Venkatesh**, Last Wilderness Foundation: *Managing human-wildlife conflict around Tiger Reserves*
- #7 **Himanshu Chhattani**, A.V.C. College: *Role of individual and gender-based behaviour of tiger (*Panthera tigris*) and leopard (*Panthera pardus*) in shaping conflict hotspots in Kanha Tiger Reserve, Madhya Pradesh*
- #8 **Uma Ramakrishnan**, National Centre for Biological Sciences: *Genomic methods to address landscape connectivity*
- #9 **Archana Sharma**, ARANYA: *Co-opt or police: The right approach to dealing regular illegal wild fauna harvest by hunting communities*



- #10 **Anil Kumar**, Wildlife Trust of India: *Achievements of WTI's Central India Tiger Habitat Securement Project*
- #11 **Naveen Pandey**, The Corbett Foundation: *Determinants of immunization uptake and the importance of infectious diseases in cattle and buffaloes surrounding the Kanha and Bandhagarh Tiger Reserves, Madhya Pradesh, India*
- #12 **Courtney Dunn**, The Prusten Project: *Wiretapping the wild: Using automated acoustic recorders to monitor wild tiger populations*
- #13 **Swati Saini**, Wildlife Institute of India: *Title TBD*
- #14 **Kishor Rithe**, Satpuda Foundation: *Saving tigers through people's livelihood*
- #15 **Neha Awasthi and Ujjwal Kumar**, Wildlife Institute of India: *The Deer and the Tiger revisited: A Long term monitoring study in Kanha Tiger Reserve*
- #16 **Pankaj Sekhsaria**, Kalpavriksh: *The media and protected areas: A thematic analysis of media reporting from the tiger reserves in eastern Maharashtra*. Co-authors: Trupthi Narayan and Pankaj Sekhsaria
- #17 **G. Krishnamurthy, Anjana Rajput, Aniruddha Majumder and Zeeshan Ali**, Madhya Pradesh State Forest Research Institute-Jabalpur: *Monitoring Tiger and Prey in six Tiger Reserves of Madhya Pradesh*
- #18 **Mayank Makrand Verma, Ankita Shrivastava, P. Anuradha Reddy and G. Krishnamurthy**, Madhya Pradesh State Forest Research Institute-Jabalpur: *Functionality assessment of Kanha-Pench corridor*
- #19 **Sunny Shah**, WWF-India: *Will changing land use patterns affect movement of wildlife in the corridors of RTR: A case assessing land use change and wildlife presence in the Banas-Sewti-Chambal Habitat Block, Ranthambhore National Park, India*
- #20 **Amrita Neelakantan**, Columbia University: *Resettlement of people from protected areas - reconciling social and conservation goals around Kanha National Park (Madhya Pradesh, India)*
- #21 **Trishna Dutta**, Columbia University: *Enhancing the conversation for effective conservation - results from the survey conducted during Kanha-Pench Landscape Symposium (Feb 2016)*. Co-authors: Sandeep Sharma, Pinki Mondal, Jennie Miller, Meghna Agarwala, Ruth DeFries





Keynote Speaker Biographies

Mr. Subharanjan Sen, Field Director, Pench Tiger Reserve

Mr. Subharanjan Sen is the Field Director of Pench Tiger Reserve (Madhya Pradesh). He graduated in 1991 from the Indian Forest Service and has served in the Wildlife division throughout the duration of his career. He previously served for three years each as Director of Satpura National Park (before the park became a tiger reserve), Director of Madhav National Park and Deputy Director of Pench and Kanha Tiger Reserves. Mr. Sen also served on deputation at the Wildlife Institute of India in Dehradun, Uttarakhand, prior to being posted in July 2015 in his current position as Field Director of Pench Tiger Reserve.

Mr. Praveen Pardeshi, Principal Secretary, Chief Minister's Office (Maharashtra)

Dr. John Linnell, Norwegian Institute for Nature Research

John Linnell is a senior researcher at the Norwegian Institute for Nature Research, based in Trondheim, Norway. His work is multi-disciplinary in nature and focuses on the relationship between humans and wildlife, with a special focus on large herbivores and large carnivores. He has worked in many areas of the world, including Scandinavia, eastern Europe, Brazil, Burma and India. During his career his focus has drifted from studying the ecology of wildlife, to studying conflicts between humans and wildlife, and now to a new focus on studying human-wildlife coexistence.

Dr. Joe Kiesecker, Lead Scientist, Conservation Lands Team, The Nature Conservancy

Joseph Kiesecker is a Lead Scientist for The Nature Conservancy's Conservation Lands Team. In this capacity his main responsibilities include developing new tools, methods, and techniques that improve conservation. He pioneered the Conservancy's Development by Design strategy to improve impact mitigation through the incorporation of predictive modeling to provide solutions that benefits conservation goals and development. He also conducts his own research in areas ranging from disease ecology, to the effectiveness of new conservation tools such as conservation easements.





Session on Co-Existence of People and Wildlife

Vidya Athreya, Wildlife Conservation Society – India

Navigating the presence of large cats in human use landscapes in India

India provides us many examples of shared spaces with all the four large cats occurring in human use landscapes. Although there is large amount of research on the large cats, we found that most of the research is on tigers, is ecological in nature and located inside Protected Areas. This implies that we know very little about the human dimension of the issue which is relevant not only to resolution of conflict but also for understanding issues related to movement of tigers across human use landscapes in their natural biological urge to immigrate and emigrate. There is also evidence to suggest that people also navigate the presence of the large cats using cultural and social symbols. One such being the worship of the large cat deity by many communities. We hardly understand the role of these cultural symbols which have been ignored in research and ignored to further the cause of conservation in human use landscapes. Livestock loss to the large cats can be a very serious issue to the marginal farmers. However, mitigation measures are largely reactive in nature. We recommend the need to build on the traditional methods of livestock protection as well as shift to proactive methods which aim at prevention of losses. In summary, relevant research on traditional methods of navigating shared spaces are required, shift to proactive mitigation measures are recommended and the cultural aspect of large cats need to be recorded and needs to be used for achieving conservation goals.

Anish Andheria, Wildlife Conservation Trust

Management of large cats outside protected areas in Central India

Dharmendra Khandal, Tiger Watch

Village Wildlife Watcher Program in Ranthambore Tiger Reserve: Relevance for Central India

Poonam Dhanwatey, Tiger Research and Conservation Trust

Tigers beyond boundaries - Mitigation of human-large carnivore conflict through local community participation and leadership

Chandrapur District is known for its high conflict between people and tigers/leopards. TRACT has worked for more than a decade in this human dominated landscape, understanding the reasons for this conflict and ways to mitigate it. Our multi pronged approach for short term and long term solutions for this mitigation and co-habitation with large carnivores with their application includes Awareness and education of local



communities and their participation by building leadership within them; addressing livelihood alternatives and reducing reasons for forest dependence through government schemes; training workshops for the field personnel of the State Forest Department. This has seen a reduction in the conflict and an awareness within the community about their role in the mitigation.

Shivani Agarwal, Ashoka Trust for Research in Ecology and the Environment
Comparing the socio-ecological impacts of forest protection by local and state institutions in Central India

Conservation of forests outside protected areas is justified for biological reasons such as connectivity between wildlife populations and migration corridors. Extension of conservation efforts outside the existing protected area network may escalate existing conflicts between indigenous communities and state promoted conservation programs. Such conflicts arise due to differences in understanding of forest and management the forest resource. In order to fill this gap there is a need to understand the functionality and socio-ecological outcome of these institutions. We conducted a study in a potential corridor region connecting Pench and Tadoba-Andhari Tiger Reserves in Eastern Maharashtra, India. The two main actors are forest department and formal/informal village associations managing the forest resource. We conducted focused group discussions and vegetation surveys in 15 villages selected based on presence and absence institutions. Villages were divided into three categories i.e. monitoring by local people, forest department and no monitoring. We found that even though there is less difference in vegetation in people monitored and forest department monitored forest patches, there are positive social implications in the villages with active local people participation. Rulemaking and resource sharing in people monitored forest is found to be more democratic. Whereas, the bureaucratic system of forest department is alienating the local community from the forest and weakening their motivation to protect the forest. In order to achieve larger conservation goals, the state should bring in democracy in forest management policies that facilitate provision of rights to local communities.

Biljana Macura, Stockholm Environment Institute
All that glitters is not gold: The effect of top-down participation on conservation knowledge, attitudes and institutional trust in a Central Indian tiger reserve

Researchers and policymakers emphasize that people's involvement in forest management can secure their support of conservation initiatives. However, the evidence on the effectiveness of top-down participation is weak. This study uses cross-sectional household data from 16 villages in the buffer zone of Pench Tiger Reserve (Madhya Pradesh) in India to contribute to the evidence base of such assumption. Using a propensity score matching to control for observable bias, we evaluate the effects of two state-driven incentive-based participatory projects, i.e. the Joint Forest Management and Ecodevelopment, on selected social outcomes. Specifically, we measured local people conservation knowledge, biodiversity attitudes as well as trust in and satisfaction with the tiger reserve management authorities. We found that the effects of participatory management on conservation knowledge were positive, but negligible. We found no significant effects on local people's biodiversity attitudes, trust and satisfaction with the tiger reserve management authorities. Top-down and externally induced participation may explain our results. Our findings



clearly indicate that the effectiveness of participatory conservation interventions is conditional on the level and nature of local participation. Top-down participatory projects may not be sufficient to generate local support of conservation.

Vinay Varman, MP Ecotourism Development Board
Using eco tourism for involving local people in wildlife conservation

Session on Functionality of Corridors

Jyotirmay Jena, WWF-India
Critical linkages and factor affecting connectivity in Central Indian Landscape

The central Indian highland is a globally important landscape for tiger meta-population conservation. Tigers have been persisting as a meta-population in the region due to the connected corridors between different source sites. These corridors connecting the source populations in the Protected Areas are vital for future of the tiger in the landscape. However, over last few years these corridors are getting fragmented due to different factors including human presence and developmental pressures. The current study tries to summarize different threats due to various aspects and identify critical linkages in three major corridor within the landscape, namely Kanha-Pench, Kanha-Achanakmar and Satpuda-Pench corridor. The study draws its finding based on several years data gathered systematically as well opportunistically from these corridors. The study also highlights some of the critical areas that need immediate conservation interventions. The study highlights the importance of corridors, habitats, and linkages which are important lifelines for large carnivores, tigers in particular. Authors discuss the current infrastructural development pressure in the area and provide recommendations on critical local linkages to focus conservation efforts to maintain and improve current habitat connectivity for tigers and other carnivores in the area.

Soumya Dasgupta, Wildlife Trust of India
Measuring the impact of conservation activities across a vast fragmented landscape, connecting multiple tiger source populations: A methodological approach

Most Protected Areas in India occur as islands within dense mosaics of multiple land use types, rendering them ineffective in conserving long-ranging territorial species such as the tiger, on the long run. Nonetheless, a number of PAs, such as in the Vidharba Landscape in Maharashtra, still exist within a larger network of interconnectivities, comprising of fragmented forest patches, that act as 'corridors', facilitating gene flow of various wildlife species between PAs. It is today understood that protection of these corridors are vital to the conservation of important flagships, as meta-population within vast landscapes.

While a number of conservation initiatives may be implemented across such interconnected habitats, the impact of such initiatives on wildlife and its habitat is often difficult to ascertain. This is immensely important as corridors are often rendered low protection, and thus widely open to various forms of anthropogenic pressures over time. It is also important to fathom the actual percolation of benefits of conservation activities into improvement of ecosystem health, especially as most conservation activities are cost intensive efforts.



Here, we elucidate how a multitude of quantitative measures can synergistically indicate the on-ground impact of diverse conservation efforts. We thus assessed, anthropogenic disturbance factors, presence and relative abundance of various wildlife species as well as various parameters of vegetation health and regeneration, in Gondia district of Maharashtra, India. We anticipate that systematic monitoring of these different indicators will provide an actual understanding of the efficacy of the different conservation initiatives implemented on the long-run across various sites in this landscape.

Trishna Dutta, Columbia University

Mapping corridors and barriers to improve connectivity for tigers in central India

Protected areas (PAs) are the cornerstone for conservation in Asia, but protecting connectivity between PAs is equally crucial for the long term viability of many wild species. India has one-fifth of the world's human population, and seventy percent of the global wild tiger population. Maintaining large inter-connected landscapes for a wide ranging species such as the tiger is a big conservation challenge in rapidly developing India where PAs are small, forests are fragmented, and the intervening landscape is heavily modified by human activities. We mapped corridors in central India, a global priority landscape for tiger conservation by using a combination of least cost mapping and circuit theory. We identified least-cost corridors, pinch-points, and barriers to tiger movement. Our analyses suggest that there are several opportunities to maintain and improve connectivity in this landscape. We mapped a total of thirty-five linkages in the region and calculated metrics to estimate their quality and importance. We identified barriers at different scales in the landscape, where restoration efforts could improve connectivity in the landscape. Many of these barriers are restorable by strategizing ongoing mandatory reforestation and mitigation programs by infrastructure, mining, and other development sectors. We present ways to apply these results to landscape level conservation planning in this region.

Indranil Mondal, Wildlife Institute of India

Triage of means – Options for conserving tiger corridors beyond designated protected lands in India

The latest tiger census conducted in India during the year 2014 shows that it harbors seventy percent of the global tiger population in seven percent of their historic range. India has 1.25 billion people growing at a rate of 1.7% per year. The protected lands which are tiger habitats are geographically isolated and collectively hold tiger population, under tremendous anthropogenic pressure. The protected lands are in themselves not enough to sustain the growing tiger population with individual tiger spilling out while trying to explore or disperse leading to confrontation with humans and ultimately resulting in conflict. These factors – isolation and inadequate size of the protected lands harboring tiger meta populations, highlight the need to connect the tiger habitats and the importance of corridors beyond protected lands. It is imperative to conserve such corridors passing through private lands to safeguard the long term survival of the tigers in India. The goal of long term tiger conservation in India lies in smartly integrating tiger and wildlife conservation concerns in various other sectors where tiger conservation is not the priority. The Central Indian Landscape complex, one of the strong holds for tigers in India, provides an ideal example where long term research has spelled out a plethora of management recommendations to conserve tiger corridors. They include various measures to reduce anthropogenic pressures, habitat restoration and community participation – thanks to



policies of the Indian Government there is a steady flow of funds for conservation and a generally a positive public will towards conservation. The effective tap into all these resources and public will, we must follow triage. This we call “Triage of Means”. This triage is not a prioritization of species, populations or sites to account for non-availability of conservations resource, it is a triage to help channelize available resources (means to achieve conservation) from other sectors where tiger conservation is not the focus. The presentation outlines how to opportunistically amalgamate resources and funds available from various sectors into conservation by prioritizing issues hampering tiger conservation beyond protected tiger habitats.

Raghuandan Singh Chundawat

The Stepping Stone Corridor - A new approach with triple benefit: provides connectivity, increases viability of PA tiger populations and materially includes local communities in conservation

India has successfully protected tiger habitat and its prey within the boundaries of most of the Tiger Reserves and other PAs. But these conservation measures were not sufficient to protect the small and isolated tiger populations of Sariska and Panna, two of India’s premier Tiger Reserves. We have identified that these losses are not the exception but are part of larger trend. On average, the size of protected areas that support tiger is small 366.3 ± 25.5 km². In habitats where tigers require large space, a scale-mismatch exists between the protected area size and space needed. Many of the breeding animals’ ranges extend beyond the protected area boundaries. This results in high adult female mortality rendering these small populations unviable. For this reason, we argue that our PA management must explore new approaches to strengthen the current conservation effort. There are many potential tiger habitats available in smaller units outside the protected area network that are presently not utilized for biodiversity conservation. We suggest restoration of these wildlife-impooverished forest areas for satellite populations to support a small number of breeding units (2-3 female territories within an area ranging between 80-150 km² or larger) around a main source population. When established strategically between two larger units these satellite populations will work as Stepping Stone habitats and bring a corridor alive. We suggest the creation of a series of “Satellite populations” (as small stepping stone tiger habitats) to complement the existing PAs. This approach has the ability to address many of the issues and threats presently afflicting protected tiger populations in the country. PA and satellite populations together will form a larger, viable breeding population with reduced extinction risk; they also provide the potential to bring significant benefit to communities and include them as equal partners in conservation. Legally we do not envisage Satellite habitats as protected areas but as conservation areas, managed for community benefit outside the National Park and WL Sanctuary network system.

Sawan Bahekar, Gondia

Observations on tiger movement and dispersal in Human-dominated corridors

The Central Indian landscape with several confined protected areas and forests dominated by human settlements, forms one of the most significant wildlife corridor in the ecology of wild tigers throughout the continent. The long term sustainability and survival of this species majorly depends upon the unprotected forest areas, which serve as a bridge for two or more source populations, in order to maintain the genetic flow and vigor in the meta-population. We analyzed the existing and potential forest corridors for tigers and studied



dispersal of few individuals from our landscape closely, which included both invasive & non-invasive methods. It revealed a series of facts regarding the movement pattern of the tiger like using underpasses of railway tracks, crossing the broadened four-lane national highways, using the farmlands and its crops for movements where the forest is heavily fragmented, etc. This has been a continuous study for over 5-6 years, which indicated that mortality among the tigers, are highest during such migrations. Also, it is to be noted that Human-Animal conflict is exponential in these areas. Since the entire trajectory of dispersal of tiger revolves around the human dominated areas, there are many hazards associated with these migrations, which ultimately draws the need of a better management and protection plans for these unprotected areas.

Prachi Thatte, National Centre for Biological Sciences
Connectivity in a fragmented landscape: a tale of two species

Habitat loss is the major cause of population decline in most mammals. Large area requirements and longer generation times make large mammals especially vulnerable to habitat fragmentation and isolation. We examined connectivity of two large mammals- tigers and sloth bears in the central Indian landscape. Once considered a stronghold in terms of distribution and abundance of mammals, the central Indian landscape has been undergoing rapid landuse change due to anthropogenic development over the last few decades. We used microsatellite data from non-invasive samples (Tiger: 116 individuals, 12 markers. Sloth bears: 204 samples, 11 markers) to examine genetic differentiation and used this genetic data to infer the resistance-to-movement across different land-use types. We find that both tiger and sloth bear populations show sub-structuring in the landscape. Dense human settlements and high traffic roads were found to offer maximum resistance to tiger movement and other land-use types including low traffic roads and agricultural fields offer very low resistance. We carried out forward time simulations to see how tiger connectivity may be impacted in the future in the face of development. We find that protected corridors preserve tiger genetic diversity and minimize extinction into the next century. Compared to tigers, sloth bears show higher connectivity and seem less impacted by landscape. However they do show a mild but significant isolation by distance. Such research is essential in understanding how different species are impacted by fragmentation in the same landscape context. Our results can be used to prioritize conservation efforts in a rapidly developing landscape, providing a link between science and management.

Ishan Agrawal, Foundation for Ecological Security
Human nature interaction in the periphery of Kanha National Park

Human nature interactions are an integral part of forest management in India as unlike west, there has hardly been a history of wilderness in true sense of the word. Communities have been dependent on forests for different livelihood demands. Recognizing this, Government of India has been undertaking enabling legislations from late 1980s where participation of communities in forest management has been encouraged. However, despite intentions participation of communities in forest management through formal channels has been debated time and again. This study tries to take a deeper look into how communities are interacting with the forests around them, what kind of formal or informal management practices they apply and what is the community's perception about forest management. The study was conducted in 5 villages, namely Khuksar, Pondi, Dungariya, Jhangul and Chapri



and their interactions with 10 forest patches. The sites we covered are predominated by the Gond and the Baiga communities; the former being classified as Scheduled Tribes by the constitution and the latter as Particularly Vulnerable Tribal Groups (PVTGs), with an assortment of various Dalit, OBC and upper caste communities. The characteristic feature of the two tribal communities is their extensive dependence on forests for many of their livelihood needs; a variety of products are collected, ranging from firewood, fodder, medicinal plants, timber for houses and fences, and a host of other NTFPs which provide household essentials as well as cash income. Presented in the sections below are the findings from a preliminary analysis of the data thus collected.

The study indicates that dependence of communities over forests for firewood, timber, fodder, biomass and even food has continued for a vast majority of community. The participation of communities in forest management has not been active one as most villages reported very less meetings with Government officials. However, all villages have informal rules of harvesting of different products. Awareness about joint forest management provisions is also extremely low. Frequency of participation of communities in conservation related activities like seeding, planting trees, clearing bushes, regulating harvesting and removing encroachments has been very low and sporadic. In perception of communities, the forest cover has reduced in last 10 years in most sites.

Debi Goenka, Conservation Action Trust

Landscape connectivity and corridors

In this talk I will address the NH7 road widening issue. I will address the need to look at the needs of "development" versus the need to protect our natural ecosystems and biodiversity as well as the tragedy of how the judicial process was used to bulldoze this anti-environment project. The failure of the statutory agencies, notably the Ministry of Environment, Forests & Climate Change will also be discussed, as well as the shortcomings of expert agencies such as the Wildlife Institute of India.

Session on the Future of Water, Climate and Agriculture

Monoranjan Mohanty, Indian Institute of Soil Science

Climate change and agriculture: Impact studies on some field crops of Madhya Pradesh

Assessing impacts of climate change on different cropping systems in Madhya Pradesh is important in the present context of climate change. In future, there is a possibility of either increasing or decreasing crop yields in central India depending upon many factors like change in rainfall, change in temperature and change in CO₂ concentration. So, the present study was undertaken to study climate change impact on some of the important field crops of Madhya Pradesh. Under balanced fertilisation in soybean and wheat, the change in soil organic C was nonsignificant in all the representative concentration pathway (RCPs) under study. In the year 2050, the soybean yield will increase by 12, 17, 15 and 22% in RCPs 2.6, 4.5, 6.0 and 8.5, respectively. Similar trend in results of soybean grain yield was also observed in the year 2080 in all RCPs under investigation. The yield of soybean was increased by 14, 19, 25 and 37% over base in RCPs 2.6, 4.5, 6.0 and 8.5, respectively. The increased temperature effects in all RCPs and time slices are masked by increase CO₂ concentration, the positive effects of which are reflected in increase soybean yield and minor change in wheat yield. The



wheat yield increased by 2 to 6% in future climate scenarios. Management practices changes the soil organic carbon stratus as evidenced from a 43 year old longterm fertiliser experiment from Jabalpur. Future climate change will alter the soil organic carbon based on the type of tillage, crop residues and nutrient management strategies followed. The management of crops will change the adaptation and mitigation strategies and will define whether there is a need for adaptation and mitigation measures to climate change.

Pinki Mondal, Columbia University

Implications of agricultural intensification for diet and nutrition in central India

Approximately two billion people suffer from nutritional deficiencies despite abundant food production at a global scale. India, in particular, has sustained economic growth without simultaneous improvements in nutrition as occurs elsewhere. Smallholder farmers produce substantial share of global food supply, and an estimated 80% of food consumed in Asia and sub-Saharan Africa. Yet they are paradoxically the most vulnerable to food insecurity. In our current study, we seek to understand how multiple factors – namely crop diversification, off-farm income, and access to the Targeted Public Distribution System – contribute to improved dietary diversity and nutritional adequacy in the central Indian landscape. We collected interviewer-administered semi-quantitative food frequency questionnaire data via a 30-days recall in five districts in central India. A linear programming tool was used to identify nutrients obtained from local diet based on a 24-hour recall, and potential nutrient gaps in the food item combinations available to different agricultural communities. We also collected data on confounding variables including age, gender, household wealth, gender inequality, access to market, education, and household size among others. Multinomial regression analyses were performed to test if diverse sources of food and income are associated with dietary diversity. This ongoing project aims to contribute to the agriculture-diet-nutrition impact pathways by assessing seasonal dietary diversity as influenced by seasonal urban migration, source of income, and type of employment, along with quantifying nutritional adequacy obtained from local diet.

Benjamin Clark, Columbia University

Intra-annual dynamics of water stress within the central Indian landscape from 2002-2012

Water scarcity in India threatens the country's ability to provide adequate water for continued development. This paper applies a data driven approach to estimate the intra-annual dynamics of water stress across the central Indian landscape over the period 2002 to 2012. It further investigates the spatial distribution of different water demand sectors including industry, domestic, irrigation, livestock, and thermal power generations. We also examine the vulnerability of urban centers within the study area to water stress. We find that 74% of the area of the central Indian landscape experienced water stress for four or more months out of the year. The rabi season irrigation drives the intra-annual water stress across the landscape. The Godavari basin experience the most surface water stress while the Ganga and Narmada are water stressed due to groundwater deficits as a result of rabi irrigation. All urban centers experience water stress at some point during a year. Urban centers in the Godavari basin, are considerably water stressed with Achalpur, Nagpur and Chandrapur all water stressed 8 months out of the year. Irrigation dominates water use accounting for 95% of the total water demand, with substantial increases in irrigated land over the last decade. Managing land use to promote hydrologic function will become increasingly important as water stress increases.



Barna Baibhaba Panda, Foundation for Ecological Security
Sustainability in Sustainable Land Management projects in Madhya Pradesh

Large scale degradation of land in Indian state of Madhya Pradesh and serious concerns about soil quality impacting production and productivity have led to interventions by government and civil society organizations aimed at Sustainable Land Management (SLM) in the past two decades. FAO (1993) lists four criteria for SLM namely maintaining production, maintaining quality of soil and water, containing risks and enabling systems that are economically feasible and socially acceptable. SLM projects needed to be examined against these four criteria for achieving their objectives. The projects ranged from treating watersheds to improving livelihoods of dependent population for easing off pressure on land and forest resources to addressing participation of local communities in resource management to reviving vitality of natural systems. Post project sustainability in these projects hinged on robustness in design of the projects, inclusiveness both at the design and implementation phases, collaborative approach, knowledge transfer and extension mechanisms, sharing platforms and integration of action learning and a well nourished institutional architecture at the grassroots. Agro ecological condition as an independent input and human societal action in different socio-economic contexts have also been examined.

Dharam Pal Singh and Manvendra Singh, Reliance Foundation
Present tense to future perfect! – Mutual co-destruction to co-operation

This paper goes beyond normal discourse on Water, Agriculture and Climate to place it in the context of lives – and even more importantly contextualise with rehabilitating ‘Forest Villages’. The Reliance foundation (RF) is engaged in establishing replicable and scalable sustainable rural transformation models through an integrated approach. It has so far reached The RF foundation is having its presence in 12 states and impacting life of more than five million small and marginal households across the India. Working with some 15 tribal agrarian communities over last two years at Satpura tiger reserve and Pench National Park of MP, India clearly indicates that there is a huge opportunity in establishing a co-commitment to sustainable development – which goes far beyond mere allotment of land and transfer of funds – to being with them, thinking with them and experiencing with them – the how, why and what of rediscovering farming and its relationship with water, and climate and in fact larger ecology for its very sustainability. The RF and the Department of forest, MP made this co-commitment. The challenges and opportunities are numerous but can all be listed as two – i. learning to listen; and ii. Right way of Doing Things. And this paper brings out the journey so far “Present Tense and Future Perfect ...”!

Milind Watve, Indian Institute of Science Education and Research, Pune
An alternative community operated protocol for assessment and compensation of crop damage by wild herbivores

Damage to agricultural crops by protected species in the vicinity of wildlife parks is an important but underestimated problem. Since measures to protect crops are generally met with limited success some form of compensation for the damage is necessary to avoid resentment of local farmers. The general method of compensation followed globally is that the victim makes a claim, which is verified or negotiated by the compensating agency and



the agreed amount is paid. The major flaw in this method is that objective and realistic assessment of damage is difficult. Further in areas with high animal density, it exerts excessive demand on personnel for verification of the claims. We suggested an alternative model of compensation, which is based on the net loss in produce, rather than estimate of vegetative damage. In this model the average loss in net produce is estimated over a belt with comparable risk of damage. The compensation payable based on the average loss is paid in proportion to individual farm's produce self-reported by the farmer and verified by neighbouring farmers. Analysis based on principles of behavioural economics shows that this compensation scheme would facilitate good agricultural inputs and honesty in reporting the produce. The payoff structure is such that "if all behave selfishly there will be honesty and justice". The system can be community operated with minimum personnel demand for park managers. Community management is expected to curb "your animal syndrome". A pilot implementation of the novel protocol is currently under planning.

Poster Presentations

Harshawardhan Dhanwatey, Tiger Research and Conservation Trust:

#1: Large carnivore attacks on humans in Central India: A case study from the Tadoba Andhari Tiger Reserve

We examined human and ecological attributes of attacks by tigers *Panthera tigris* and leopards *Panthera pardus* on humans in and around the Tadoba-Andhari Tiger Reserve in the Chandrapur District of central India to provide recommendations to prevent or mitigate conflicts between people and large carnivores. During 2005–2011 132 carnivore attacks on humans occurred, 71 (54%) of which were lethal to humans. Tigers and leopards were responsible for 78% and 22% of attacks, respectively. Significantly more victims were attacked while collecting minor forest products than during other activities. Probability of attack significantly decreased with increasing distance from forests and villages, and attacks occurred most frequently in the forested north-eastern corridor of the study area. Human activities near the Reserve need to be regulated and limited as much as possible to reduce human mortality and other conflicts. Increasing access to alternative fuel sources (e.g. biogas, solar) may reduce the pressure of timber harvesting on protected areas. Residents should be trained in identifying carnivore sign and in ways to reduce their vulnerability when working outdoors.

Aditya Joshi, Wildlife Conservation Trust

#2: Large carnivore conservation beyond protected areas

Till recently, most of the conservation activity in the Central Indian Landscape (CIL) was focused in few important PAs, however with recent insights from connectivity studies, equal emphasis has been given to the importance of corridors. However, given the state of the corridors and the forest blocks surrounding the PAs, the conservation strategy and challenges differ. Here, we would like to present a case study involving multi-season data on large carnivores in a human dominated landscape and its implications for long term survival of species like tiger in the CIL.



D. P. Srivastava, University of Delhi

#3: Human wildlife interactions in Panna Multiple-use Buffer Area

Studying the interactions that take place between human communities and wildlife will allow deeper insights into anthropogenic factors such as human tolerance and human motivation to accommodate wildlife in shared landscapes. Such studies will also allow the assessment of the influence of human land use practices on wildlife. In this poster, we present our findings on human-carnivore interactions from two areas of the North Madhya Pradesh Tiger Landscape (Figure 1). The future of carnivore conservation is linked to the persistence of carnivores outside protected areas. In Madhya Pradesh large stretches of government controlled forests exist outside protected areas (Figure.1). However, these forests are currently used with an anthropocentric land use function, where livestock grazing and fuel wood collection is unregulated. Is it realistic to extend large carnivore's conservation on to landscapes with unregulated human use? What is the current status of human -carnivore interactions on these lands? Will it be possible to regulate land use? In what areas should change take place? And how should managers position such change for successful implementation?

Jennie Miller, Panthera, Cornell University and University of Cape Town

#4: Human perceptions mirror realities of carnivore threats to livestock: Opportunities for reducing human-carnivore conflict

Human-carnivore conflict is challenging to quantify because it is shaped by both the realities and people's perceptions of carnivore threats. Whether perceptions align with realities can have implications for conflict mitigation: misalignments can lead to heightened and indiscriminant persecution of carnivores whereas alignments can offer deeper insights into human- carnivore interactions. We applied a landscape-scale spatial analysis of livestock killed by tigers and leopards in India to model and map observed attack risk, and surveyed owners of livestock killed by tigers and leopards for their rankings of threats across habitats to map perceived attack risk.

Observed tiger risk to livestock was greatest near dense forests and at moderate distances from human activity while leopard risk was greatest near open vegetation. People accurately perceived spatial differences between tiger and leopard hunting patterns, expected greater threat in areas with high values of observed risk for both carnivores. Owners' perception of threats largely did not depend on environmental conditions surrounding their village (spatial location, dominant land-use or observed carnivore risk). Surveys revealed that owners who previously lost livestock to carnivores used more live- stock protection methods than those who had no prior losses, and that owners who had recently lost livestock for the first time expressed greater interest in changing their protection methods than those who experienced prior losses.

Our findings suggest that in systems where realities and perceptions of carnivore risk align, conservation programs and policies can optimize conservation outcomes by (1) improving the effectiveness of livestock protection methods and (2) working with owners who have recently lost livestock and are most willing to invest effort in adapting protection strategies to mitigate human-carnivore conflict.



Poorva Joshi, Biome Conservation Foundation, Pune

#5: Finding solution in the form of non-palatable medicinal plants as an additional crop strategy for control of herbivores around PAs

Andhari Tiger Reserve (TATR) is an important conservation habitat of central India. On the fringes of the park there are issues of human-wild life conflict such as crop raiding by wild animals, which is an underestimated problem. The constant threat of crop predators and perceived loss in crop produce has discouraged intensive agriculture in close vicinity of the wild life park. As farming is the main livelihood for the people here it is necessary to explore alternative options that can contribute to farmer's welfare. Considering the developing medicinal plant demand and its pressure on forest patches there is potential in introduction of non-palatable traded medicinal plant species that are resistant to herbivory. We are facilitating adoption of this model by farmers. The driving force of the project is to channelize the motivation and efforts of farmers to explore such beneficial opportunities. Up till now during interactions with farmers meeting with officials, local NGO representatives we could understand that this model is perceived as beneficial to them but at the same time it has few limiting factors. It is necessary to have an assured market, appropriate value addition knowledge and technology. A buyback assurance by any agency can play a crucial role in sustainability of the cropping choice. Research on details of farming costs and market economics is necessary before promotion of this model.

Vidya Venkatesh, Last Wilderness Foundation

#6: Managing human-wildlife conflict around Tiger Reserves

Himanshu Chhattani, A.V.C. College

*#7: Role of individual and gender-based behaviour of tiger (*Panthera tigris*) and leopard (*Panthera pardus*) in shaping conflict hotspots in Kanha Tiger Reserve, Madhya Pradesh*

Persecution of large carnivores by local communities in response to livestock depredation is a global occurrence and cause of concern for carnivore conservation. An important step for initiating mitigation measures would be to investigate factors that drive conflict. Predation risk modeling is now increasingly being used to understand spatial variation in conflict patterns and to identify landscape features that promote livestock depredation. In order for predation risk modeling to serve as a tool for conflict mitigation, it is critical to understand how risk changes over time and space and how individual and gender based behaviour influence the distribution of conflict hotspots. This insight is especially important for solitary species such as tiger and leopard, where an individual's potential might determine its response to various stress conditions. In our proposed study in Kanha Tiger Reserve, we will investigate differences in behaviour between individuals that depredate livestock and examine the role of individual carnivores in shaping the distribution of conflict hotspots. We aim to identify and characterize individuals that engage in conflicts using a combination of camera trapping and molecular methods. The study has the potential to enhance our understanding of what drives tiger, leopards to depredate livestock and how individual and gender based behaviour affect formation of conflict hotspots.



Uma Ramakrishnan, National Centre for Biological Sciences

#8: Genomic methods to address landscape connectivity

Landscape connectivity is extensively assessed through proxies such as genetic connectivity between populations. Current methods to assess genetic connectivity for species of conservation concern are primarily non-invasive and use fecal samples as a source of DNA or genetic material. Because the DNA acquired from fecal samples tends to be low in quantity and degraded, conservation geneticists tend to base inference of genetic connectivity on a handful of genetic markers. Such approaches lead to region-specific methodologies and laboratory-specific protocols, excluding possibilities of synthesis and establishment of long-term datasets. Acquiring genetic data from several thousands of markers across the genome has become relatively common, though not for non-invasive samples. We have developed novel methods to acquire genetic data from several hundreds of SNP markers from non-invasive samples. I will present results on these novel method to acquire such data from tiger fecal samples. I will highlight how such methods can be cheap, fast and high-throughput, providing scientists with the ability to collect and synthesize data, and hopefully better inform policy.

Archana Sharma, ARANYA

#9: Co-opt or police: The right approach to dealing regular illegal with wild fauna harvest by hunting communities

The erstwhile hunting communities of India have been a bane for wildlife managers. In spite of proactive policing, the tribesmen have had frequent successes in harvesting endangered and protected wild fauna including the big cats. While a section, albeit small, among India's wildlife bureaucracy believes that they need to be co-opted into conservation; majority still believe that they cannot be trusted. Given the existing demand for wild fauna products at lucrative prices, and the lack of alternatives with these hunting communities, many of them are perpetually seeking opportunities and no amount of vigil has been effective in limiting their activities. The paper looks at the perspectives of both the stakeholders and the impact of either approach on wildlife conservation.

Anil Kumar, Wildlife Trust of India

#10: Achievements of WTI's Central India Tiger Habitat Securement Project

The mosaic of protected areas (PA), reserve forests and revenue villages and their arable farmland and common areas, make Central India highly amenable to landscape-level conservation of the 600 odd tigers (*Panthera tigris*). Wildlife Trust of India's (WTI) project in this landscape, since 2006, aims at conserving critical corridor areas of tiger movement. The project's studies have divulged a great deal of information that marks the Navegaon-Tadoba corridor stretch as a vital one, enabling tiger's movement from the Pench-Kanha-Nagzira complex on to the Nawegaon-Tadoba-Andhari landscape. WTI identified the possible bottlenecks in movement of tigers between Nagzira-Navegaon and Navegaon-Tadoba and for the first time documented 25 individual tigers in Brahmapuri Forest Division outside Tadoba TR. The project, in addition to enhancing capacity of over 2000 Forest Department frontline forest staff and equipping them, has also focused on integration of local communities of corridor patches of 54 priority villages for conservation, with positive results since 2011. The outcome of WTI's work between Nagzira-Navegaon Corridor include



training of 252 villagers on construction and installation of Improved Cook Stoves (ICS) and installation of 1451 ICS in 22 village households, 25 schools and aanganwadi, which resulted in reduced consumption of fuelwood by 40% within those households. The project also provided training on sustainable collection of NTFPs to 190 villagers and its value addition to two SHGs resulting in their additional income. WTI also formed 27 BMCs in Gondia and the 1st People's Biodiversity Register of the Maharashtra state as per NBA guidelines. It has conducted awareness for 2217 students of 27 schools and for 2575 village people of 27 villages. Recently, three tigers have been sighted and seen pairing in the newly declared New Navegaon Sanctuary which adjoins the Navegaon NP raising hope that with good protection, and increased participation of communities to reduce dependence on corridor resources, the dispersal of tigers through these corridors will see an increase.

Naveen Pandey, The Corbett Foundation

#11: Determinants of immunization uptake and the importance of infectious diseases in cattle and buffaloes surrounding the Kanha and Bandhavgarh Tiger Reserves, Madhya Pradesh, India

Ruminant livestock in the buffer zones of the Kanha Tiger Reserve (KTR) and Bandhavgarh Tiger Reserve (BTR) in Madhya Pradesh, Central India, are commonly affected by three major infectious diseases – Foot and Mouth disease (FMD); Haemorrhagic Septicaemia (HS); and Black Quarter (BQ). Wild animals and domestic cattle frequently utilise the same areas within and around the tiger reserves and transmission of disease from domesticated cattle to wild species is of great concern. In 2012 The Corbett Foundation (TCF), in association with KTR and BTR, initiated an annual immunization programme in the 181 villages of the KTR and the 164 villages of the BTR against FMD, HS and BQ using an inactivated multi-valiant vaccine. In 2016 a questionnaire-based survey was conducted to study the factors affecting vaccination uptake and the perceived importance of disease by cattle owners in KTR and BTR. Awareness of disease was highest for FMD (90%) compared to HS (71%) and BQ (76%). 62% of respondents recognised disease prevention as the main reason for vaccination. 78% of respondents identified newly purchased animals as a source of disease. A majority of respondents (86%) said that they have observed a reduction in disease incidence following vaccination. This vaccination programme has had 58% uptake in the villages of the KTR and BTR buffer zones. The most important source of information to farmers about infectious diseases is Animal Health Workers (also called paravets or go-sewaks or livestock inspectors) who should be visiting the villages regularly to provide treatment and information about the consequences of disease and vaccination.

Courtney Dunn, The Prusten Project

#12: Wiretapping the wild: Using automated acoustic recorders to monitor wild tiger populations

Development of new methods of remote monitoring is essential for more efficient as well as minimally disruptive census of species where dense jungle prohibits visual confirmation. This is particularly important for *Panthera tigris* whose populations have plummeted by over 50% within the past century and whose ranges have been reduced to 7% of their historic lands. With the population decline of many other forest-dwelling species following that of this flagship species, it is important now more than ever to establish an efficient, all encompassing census method for such landscapes. We sought to determine what makes an



individual tiger's call unique in hopes of developing a non-invasive acoustic monitoring system within rangeland countries. To answer this question, spectrogram outputs of 265 bouts from approximately 1,618 hours of recording were analyzed to determine vocal characteristics from eight female and nine male adult Bengal tigers residing in controlled, ex-situ conditions. Volunteers extracted data on minimum and maximum fundamental frequencies, duration of bouts, inter-call intervals, average call duration, first call duration, and the time of day a vocalization occurred. Comparison of acoustic parameters among the 17 individuals revealed a significant difference existed between sexes as well as among individuals. The complexity of vocalizations is enabling a vocal "fingerprint" to be developed for individuals, which in turn will allow for vocal monitoring as well as censusing using microphone arrays placed strategically over the tigers' home ranges and the corridors between them. An array of recorders could also lead to soundscape monitoring of the landscape, providing valuable information about other vocally-inclined species.

Swati Saini, Wildlife Institute of India

#13: Title TBD

Kishor Rithe, Satpuda Foundation

#14: *Saving tigers through people's livelihood*

The socio-economic status of a community is directly reflected by its reliance on agriculture and forests as a major source of income. In order to gain the support of forest-dependent communities living in tiger habitat, to reduce their pressure on tiger habitat, it is vital to provide them with better health, education facilities and livelihood alternatives. Satpuda Foundation has focused its work in 115 buffer villages of six tiger reserves in Satpuda Landscape for past 10 years. After implementing the convergence programme to ensure the above goals, the data shows reduction in anthropogenic pressure on tiger habitat and thereby reduction in retaliatory community actions too. This might be one of the reasons behind increase in prey and predator population around these 115 villages.

Alark Saxena, Yale School of Forestry & Environmental Studies

#15: *Modeling rural livelihood strategies of forest dependent communities*

Evaluating the impacts of various policies on rural systems is challenging due to the inherent complex social ecological dynamics. Commonly used tools such as sustainable livelihood framework are unable to evaluate such dynamics. We demonstrate the potential of using a system dynamics (Livelihood Management System) to evaluate the impact of policies on rural livelihoods of forest dependent communities in central India. Two livelihood activities (income from forest resources and government labor) have been modeled to showcase the complex social ecological dynamics. Model simulation suggests that present extraction of forest resources is unsustainable. Similarly, government's ambitious policy to provide 100 days of employment to each household living below poverty line is unattainable. Simulation of conservation policy suggests significant impact on livelihoods forcing poor households to migrate. While challenges remain, the Livelihood Management System showcases a promising direction to create decision support tools for complex rural social ecological systems.



Neha Awasthi and Ujjwal Kumar, Wildlife Institute of India

#16: The Deer and the Tiger revisited: A Long term monitoring study in Kanha Tiger Reserve

Robust and long term monitoring is crucial for evaluating and guiding conservation investments. We assessed population density and trends of tiger and their prey from year 2010 to 2015 by using camera trap based mark-recapture and SECR and line transects based distance sampling in Kanha Tiger Reserve (KTR). Annual effort ranged between 3104 to 23216 trap nights and 400 km to 1200 km of transect walk on 200 spatial replicates. As a part of this project, we collared 3 tigers (1 Adult resident male, 1 dispersal age male, and 1 sub-adult female) in year 2014 and monitored them intensively for data on habitat use, ranging patterns and dispersal. The resultant pattern shows an increasing tiger population with a rate of 21% in Kanha and 18% in Supkhar. In year 2014-15, tiger density was computed to be 6.10 (SE 0.71)/100 km² in core and 2.01 (SE 0.48)/100 km² in buffer. The estimated 95% Minimum convex polygon (MCP) home range of territorial female tiger was 13.44 km² and that of the adult male tigers was 76 km². Independent sub-adult male had a home range of 20 km². Amongst ungulates, Chital had the highest density of 31.12 (4.85 SE)/km² in core and 13.43 (2.59 SE)/km² in buffer of the Tiger Reserve. Prey density was found to be stable across years. Tiger density was found to vary substantially in different parts of KTR. In the high ungulate density areas, home ranges of tiger were small and densities of tigers were high. While in other low prey density areas, the home ranges were larger with lower density of tigers. In light of our observations, there is potential to increase tiger density within areas of high ungulate density where home ranges of resident tigresses were as small as 10 km². Thus, space limitation is not yet achieved across KTR and there is a scope to increase tiger densities in response to food availability and its source value in the landscape.

Alder Keleman Saxena, Yale University

#17: Agrobiodiversity and food security

Pankaj Sekhsaria, Kalpavriksh. Co-authors: Trupthi Narayan and Pankaj Sekhsaria

#18: The media and protected areas: A thematic analysis of media reporting from the tiger reserves in eastern Maharashtra.

The Protected Area Update has chronicled conservation news reporting in India since 1994. On analysing 269 media stories pertaining to Maharashtra for the period 1995 to 2015,, we found that tiger reserves in the central Indian landscape, namely Tadoba-Andhari, Melghat, Bor, Pench and Nawegaon-Nagzira, have had very good media coverage with 104 stories. A thematic analysis revealed that the displacement of local people living with the reserves was the single most widely reported issue. This was followed by reports of poaching, which focused mainly on large charismatic carnivores such as the tiger. The third topic that was deemed news worthy was human-wildlife conflict. There was a strong human-centric focus in the reportage overall. Significantly, research projects in these tiger reserves were covered more extensively than in all other protected areas of the state put together.

The forest department was the most frequently cited actor. There was a strong underdog bias, with the media giving voice to the concerns of local people. Surprisingly, non-governmental organizations found a strong mention – one hypothesis is that NGOs partner with the media in order to publicise and amplify their efforts in spite of limited resources.



Media content analysis is a useful tool because the media is the first interface for the general public on issues of wildlife conservation and plays an important role in shaping public opinion. Understanding the reportage can provide insights into the bias of the media at the same time as indicating themes and issues that are perceived to be important both to the public and the media. To our knowledge, ours is the first such state-wide study and we believe that this could be very important in shaping the conservation discourse in the country.





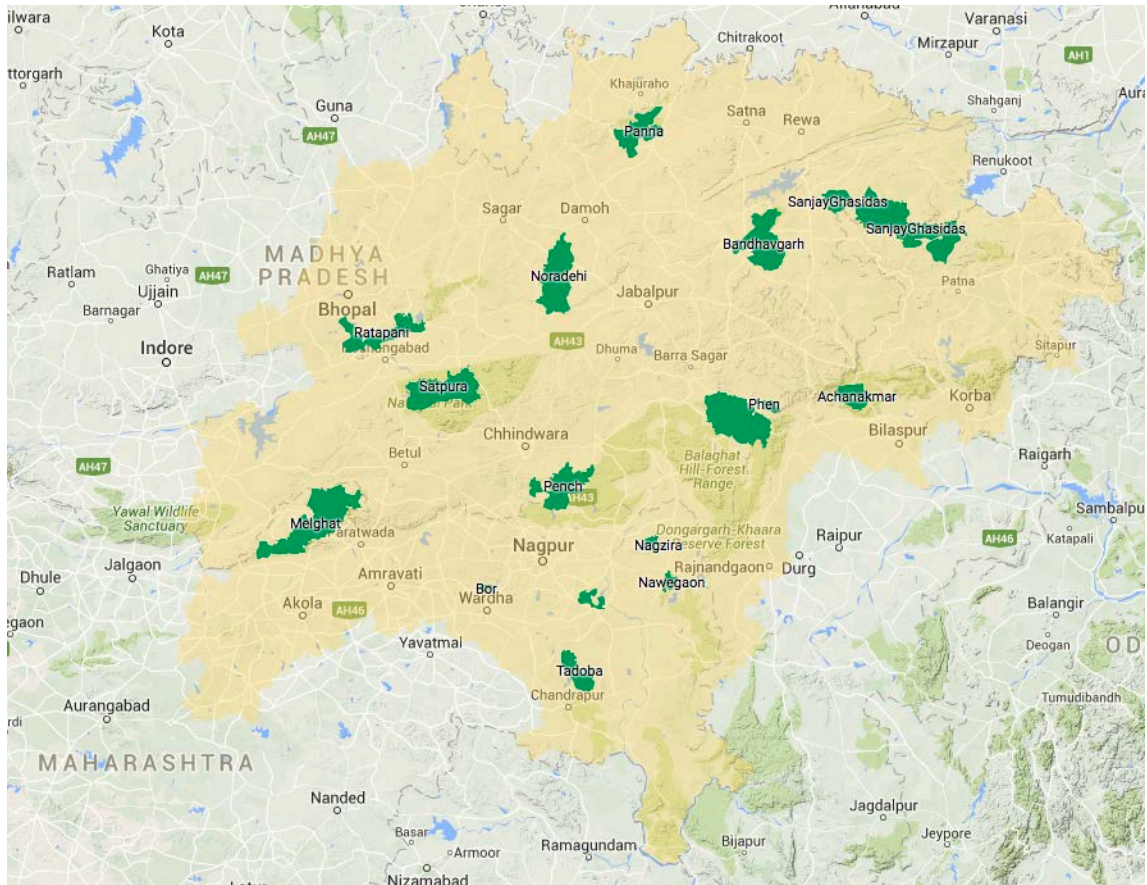
The Central Indian Highlands consists of a continuous landscape in Central India across the states of Madhya Pradesh, Chattisgarh, Maharashtra and Andhra Pradesh where tropical deciduous forests form a major land cover. This landscape includes several protected areas (Kanha, Satpuda, Pench, Melghat, Tadoba and Achanakmar) and forest corridors that are essential for wildlife movement and genetic continuity across the landscape. The Central Indian Highlands are particularly important for tiger (*Panthera tigris*) populations (they support 17% of the country's tiger population), as well as populations of leopard (*Panthera pardus*), sloth bear (*Melursus ursinus*), gaur (*Bos gaurus*), and swamp deer (*Cervus duvacelli*).

The landscape also serves as the headwaters to several rivers, including the River Narmada, which is one of seven major rivers in India, and is essential for meeting the irrigation, industrial and urban needs of the region. The forests in this landscape support local livelihoods: 60% of the income of local people in non-protected areas is based on these forests. Important forest products include fodder for cattle, tendu (*Diospyros melanoxylon*), mahua (*Madhuca indica*), awla (*Phyllanthus emblica*) and other ingredients essential for the herbal medicine industry.

The people of this landscape live and support themselves through a range of activities, including agriculture, forest produce collection, tourism and urban activities. This landscape has been the focus of recent development which includes introduction of new crops and development of new roads, rails, mines, tourism and other infrastructure. Simultaneously, studies on larger processes such as climate change suggest that this region will be highly vulnerable to climate change, and higher temperatures and altered precipitation may disrupt the existing environmental and economic system.

Science-based management of the landscape is needed to achieve a balance among multiple objectives in the present and the rapidly changing future, including improving the well-being of local communities; conserving habitat for wildlife; protecting watersheds; tourism; and accommodating development needs for improved infrastructure.





Map of the Central Indian Landscape





Network for Conserving Central India

Join Us!

Website: www.conservingcentralindia.org

Email group: centralindianlandscape@googlegroups.com

Twitter: @Conserving_CI

Facebook group: Network for Conserving Central India



The Network for Conserving Central India is a group of researchers, NGOs and managers dedicated to conserving biodiversity, improving livelihoods, and fostering sustainable development in the landscapes of the Central Indian Highlands through the application of science.

Our network formed as an outcome of the Kanha-Pench Landscape Symposium (KPLS) held in February 2014, out of the desire to establish a more direct method for communicating news and resources relevant to management and conservation in the Central Indian Landscape.

We encourage you to join us so that we continue to stay connected. We are also looking for members who wish to help us expand our reach and innovate new ways to keep in touch, connect as a group and actively contribute to the sustainability of our landscape. Please contact one of the CILS Organizers if you are interested in playing a larger role in the group!





Organizing Committee

Chair:

Ruth DeFries, Faculty, Department of Ecology, Evolution and Environmental Biology, Columbia University

Members:

Meghna Agarwala, Postdoctoral Researcher, Earth Institute Center for Environmental Sustainability, Columbia University; Research Affiliate, Wildlife Institute of India

Jimmy Borah, Regional Initiative Lead, Wildlife and Wildlife Crime, WWF-Greater Mekong

Soumen Dey, Team Leader, Satpura Maikal Landscape, WWF-India

Trishna Dutta, Postdoctoral Research Scientist, Department of Ecology, Evolution and Environmental Biology, Columbia University

Jyotirmay Jena, Senior Project Officer, WWF-India

Jennie Miller, Postdoctoral Researcher, Panthera, Cornell University and University of Cape Town

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