



Project Tiger

Tiger Task Force (1970) predicted that tiger will be extinct soon if hunting and poisoning will continue.

By 1972, about 1,827 tigers were alive.

Project Tiger was launched on 1st April 1973, with 9 Tiger Reserves as source populations.

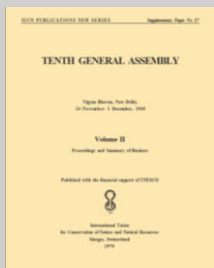
Tiger population increased to ~3000 (Late 80's) and prey as well as habitat was secured.



JC Daniel & Salim Ali



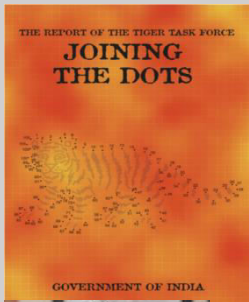
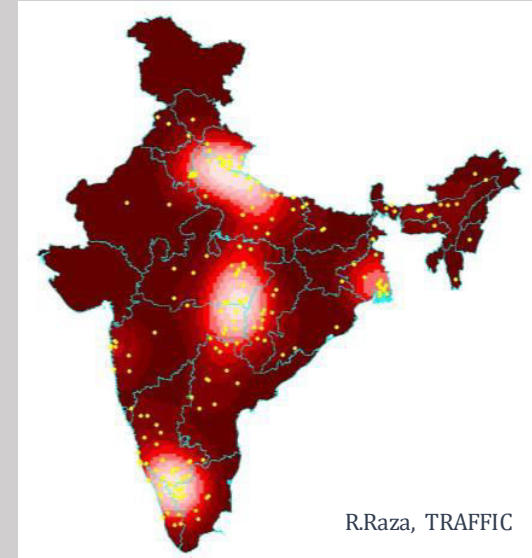
K S Sankhala



R.W.Burton,Phythian-
Adams, Morris, Stracey, E.P.
Gee H.Abdulali, J.A. Singh,

Trade in Tiger Parts By the 1990s, tigers began to vanish rapidly.

Poaching for the traditional Chinese medicine trade had hit the Subcontinent, sparking what was being called “the second tiger crisis.”



Sariska Tiger extinction caused wide scale criticism and Tiger Task Force was setup in 2005.

Beginning of new era for tiger conservation by changing old traditional beliefs of managing tigers.

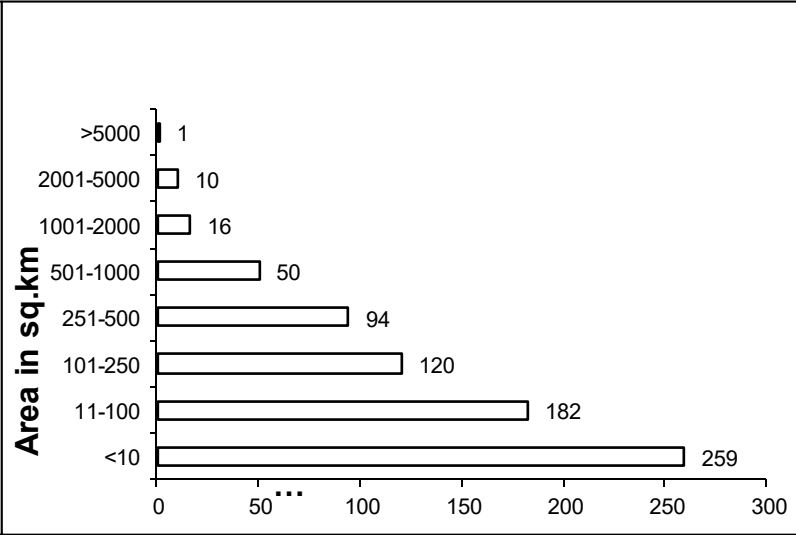
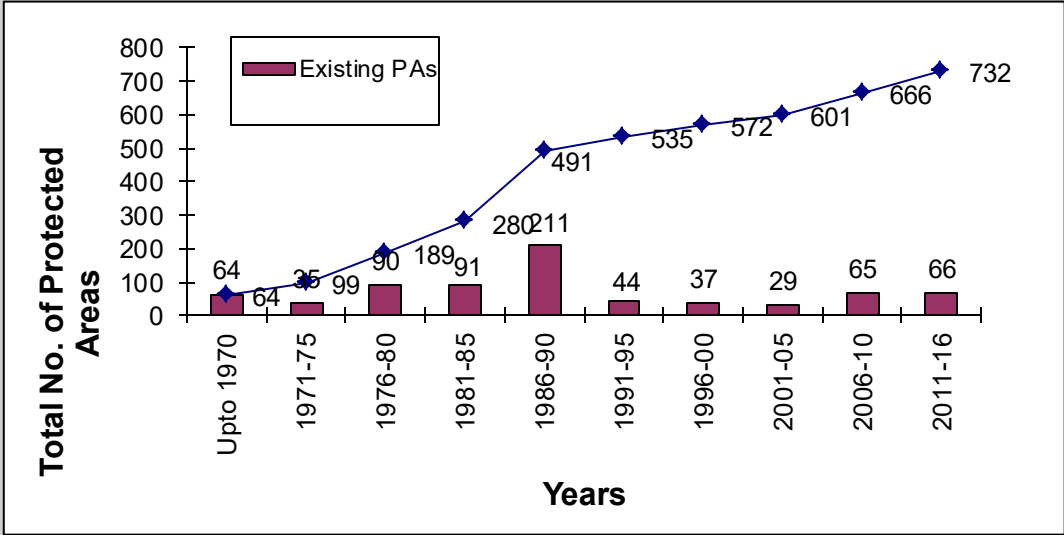
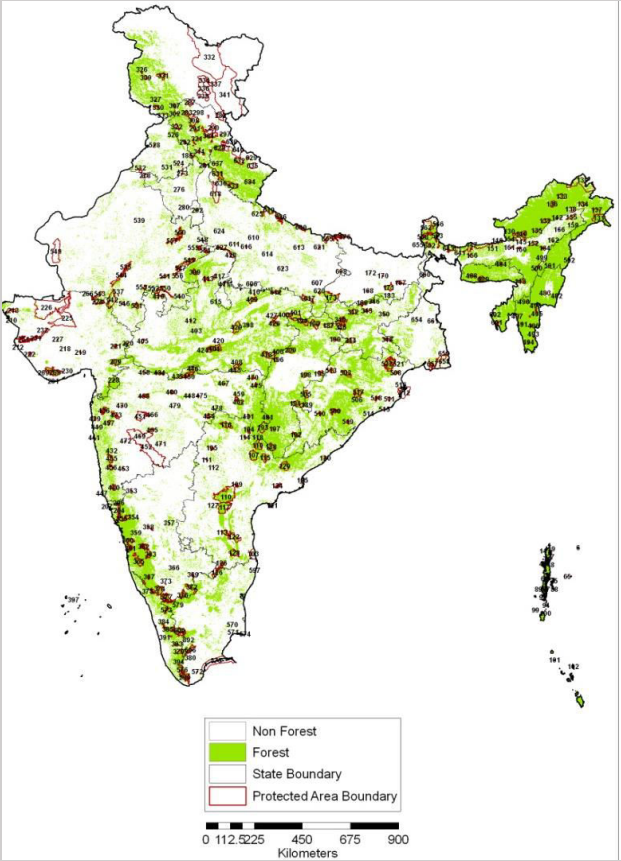


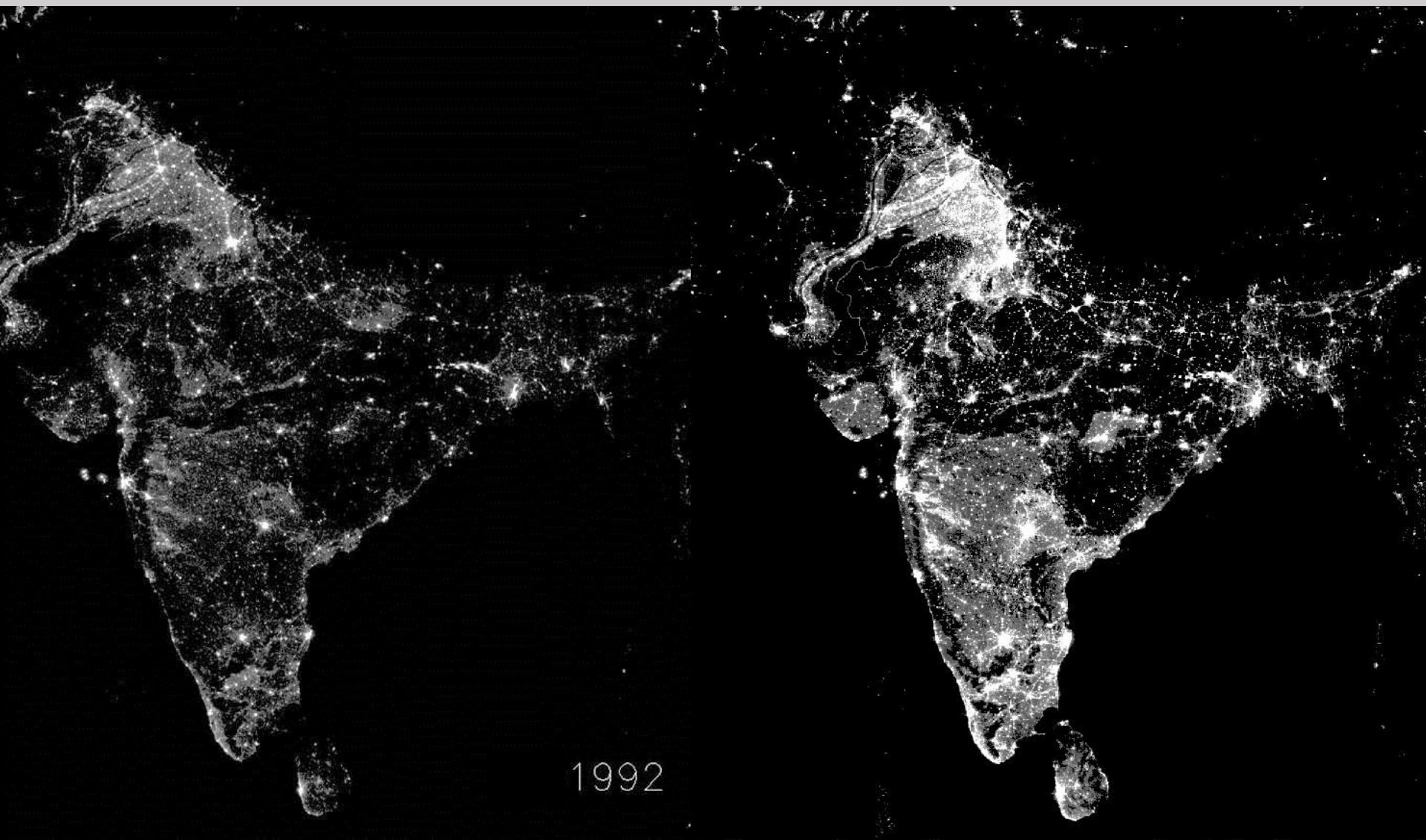
Total forest cover in India at present is 21.7%. 5% area is Under Protected Area (870 PAs)
Average size ~200 sq km

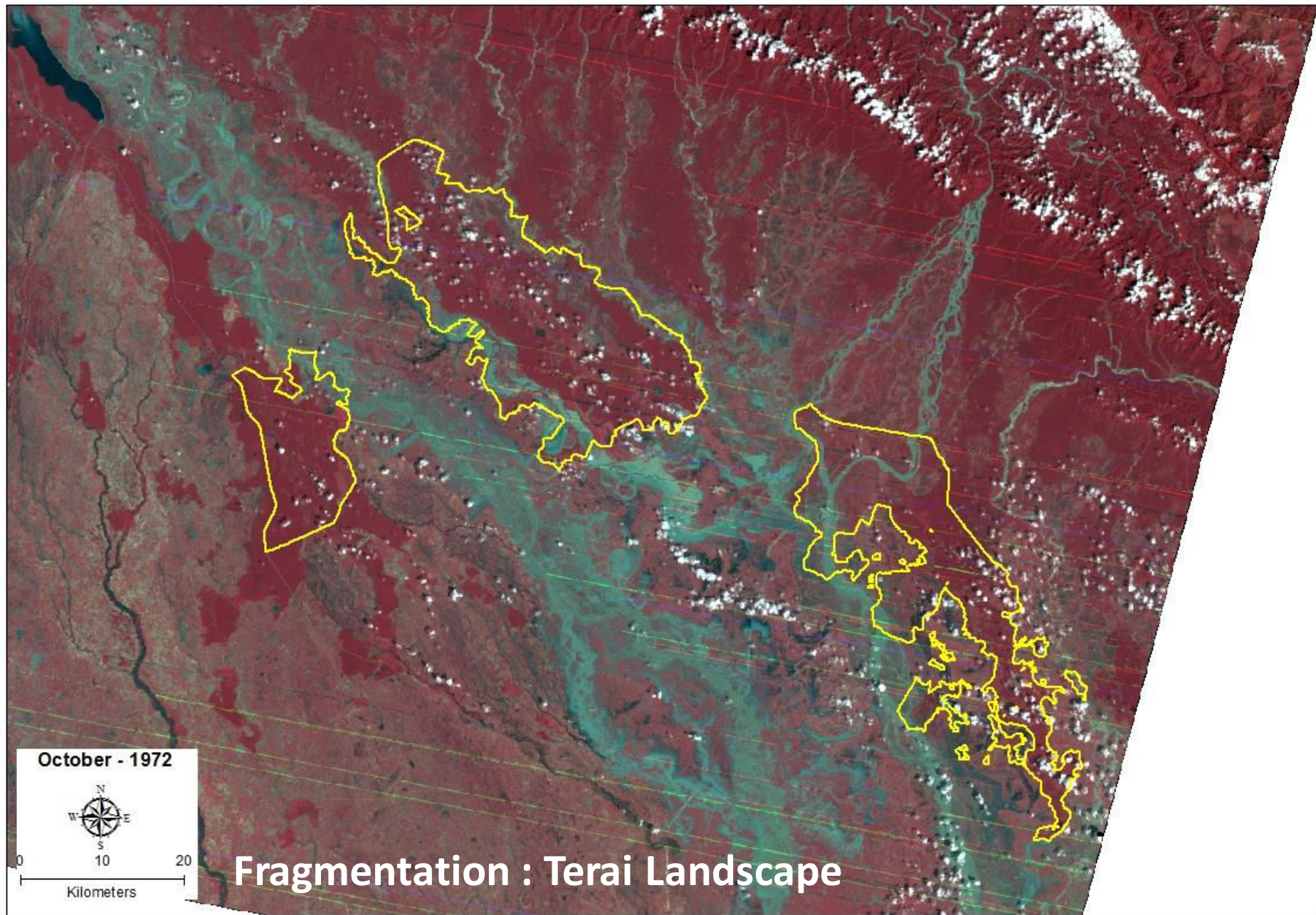
Nine reserves covered an area of 9,115 sq km in 1973 which increased to 50 Tiger Reserves covering 71,027.10 sq.km at present.

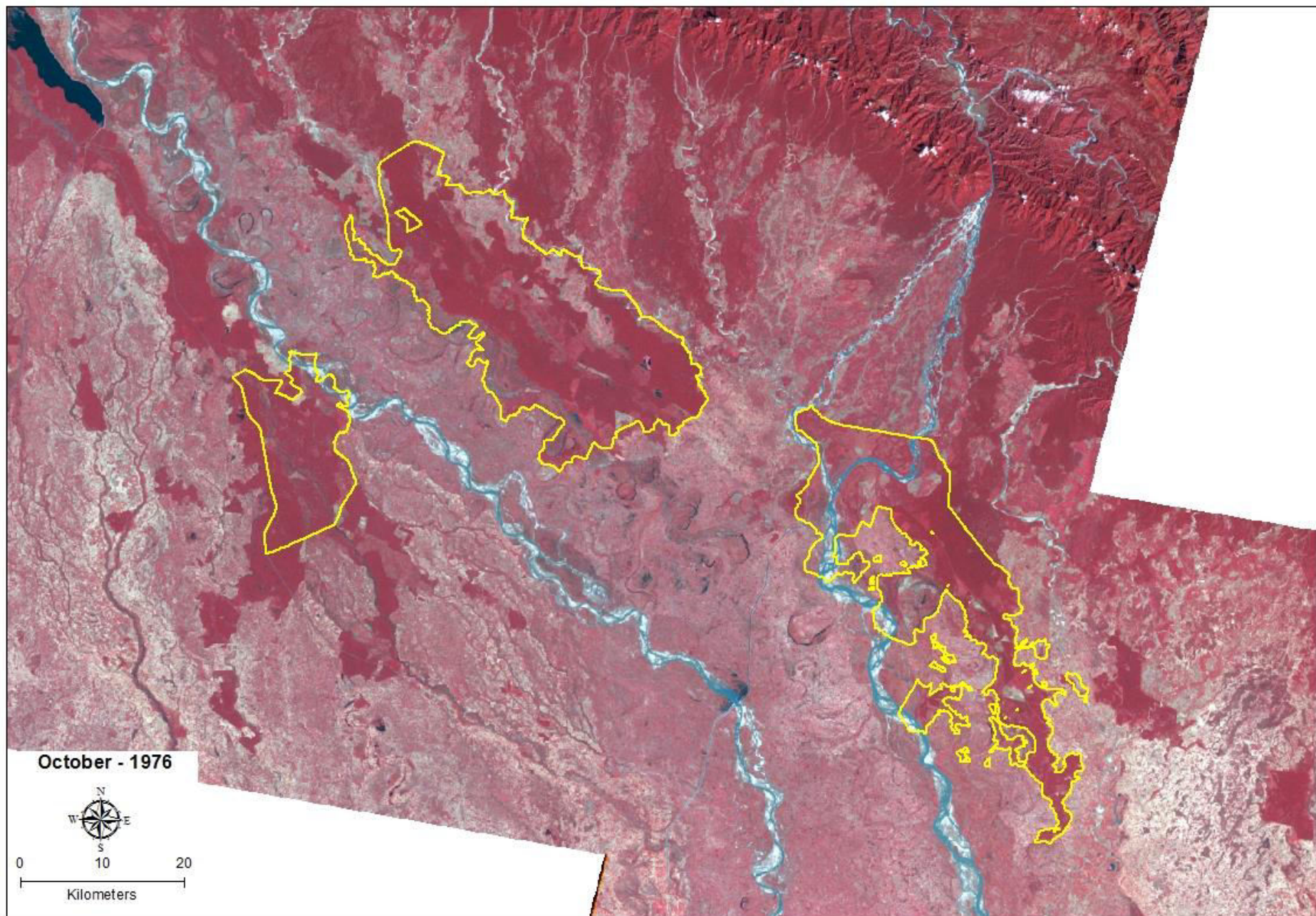
Average size ~1400

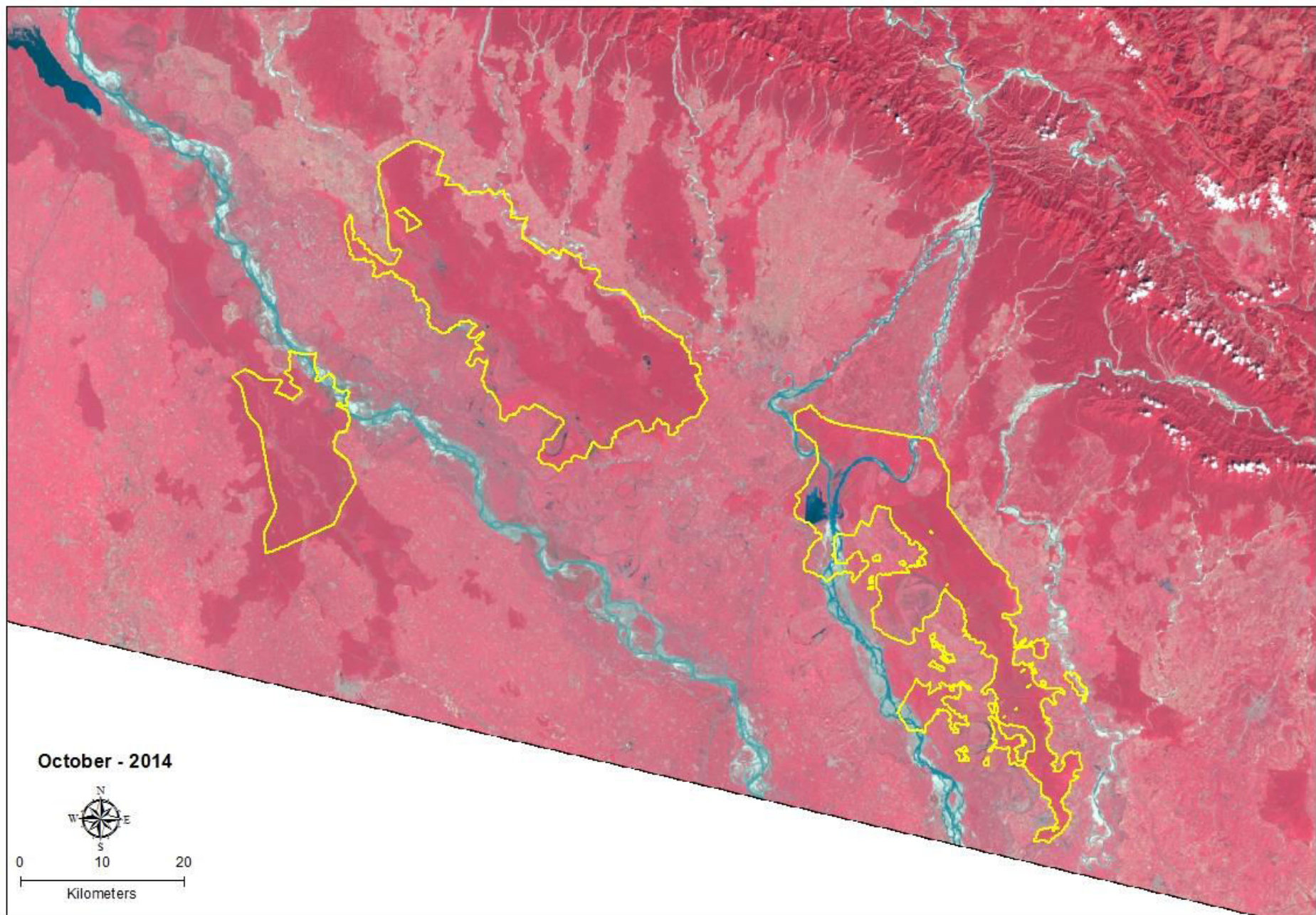
Till 2017 >Rs 500 crore were spent.



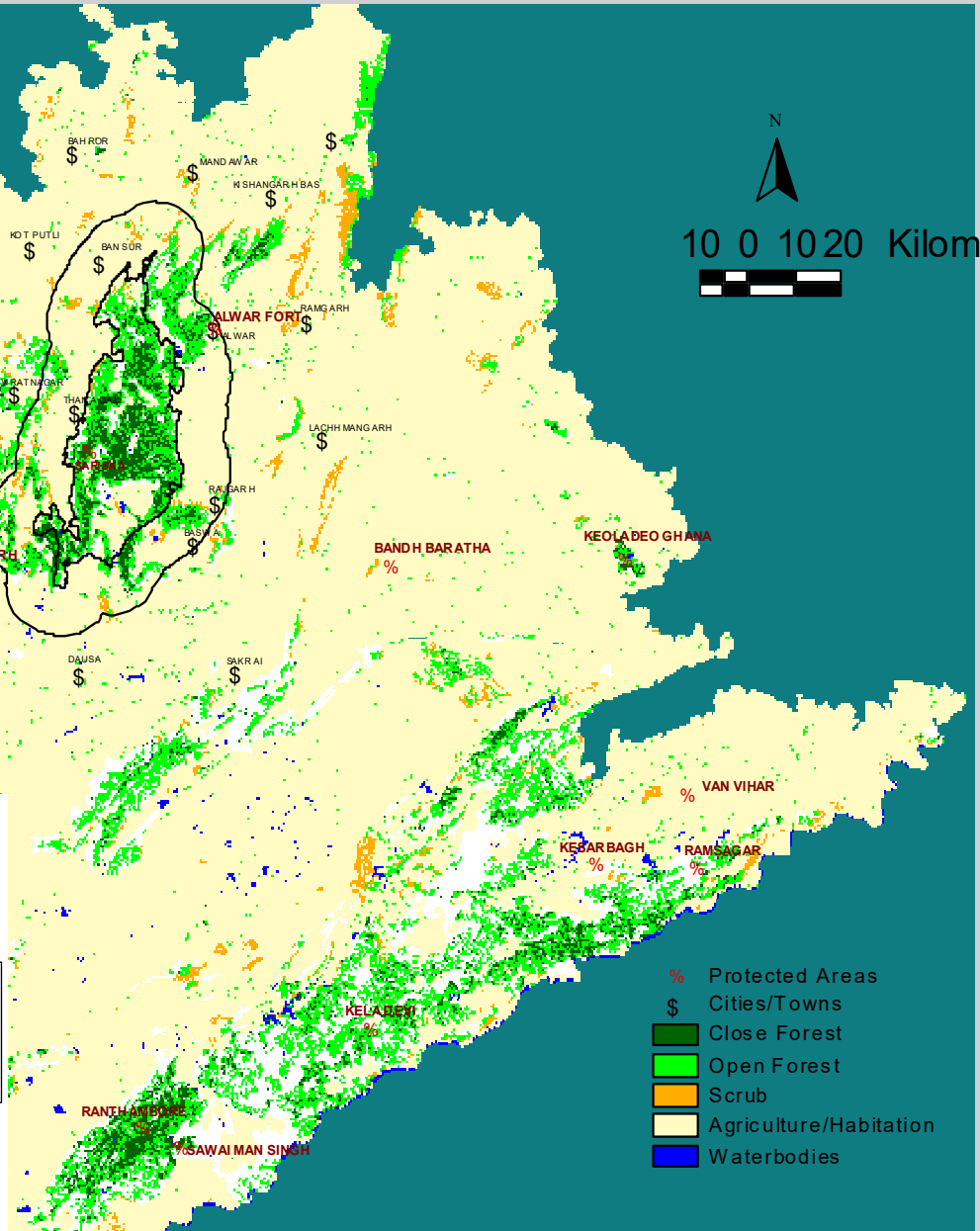
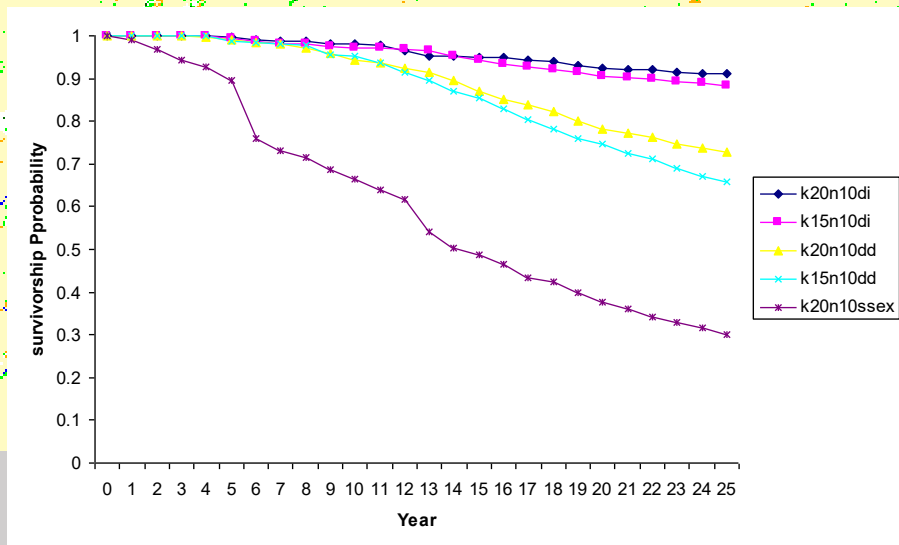








The extinction probability was estimated to be 26% (carrying Capacity = 15 tigers) with 1-2 tigers poached each year.



Mining

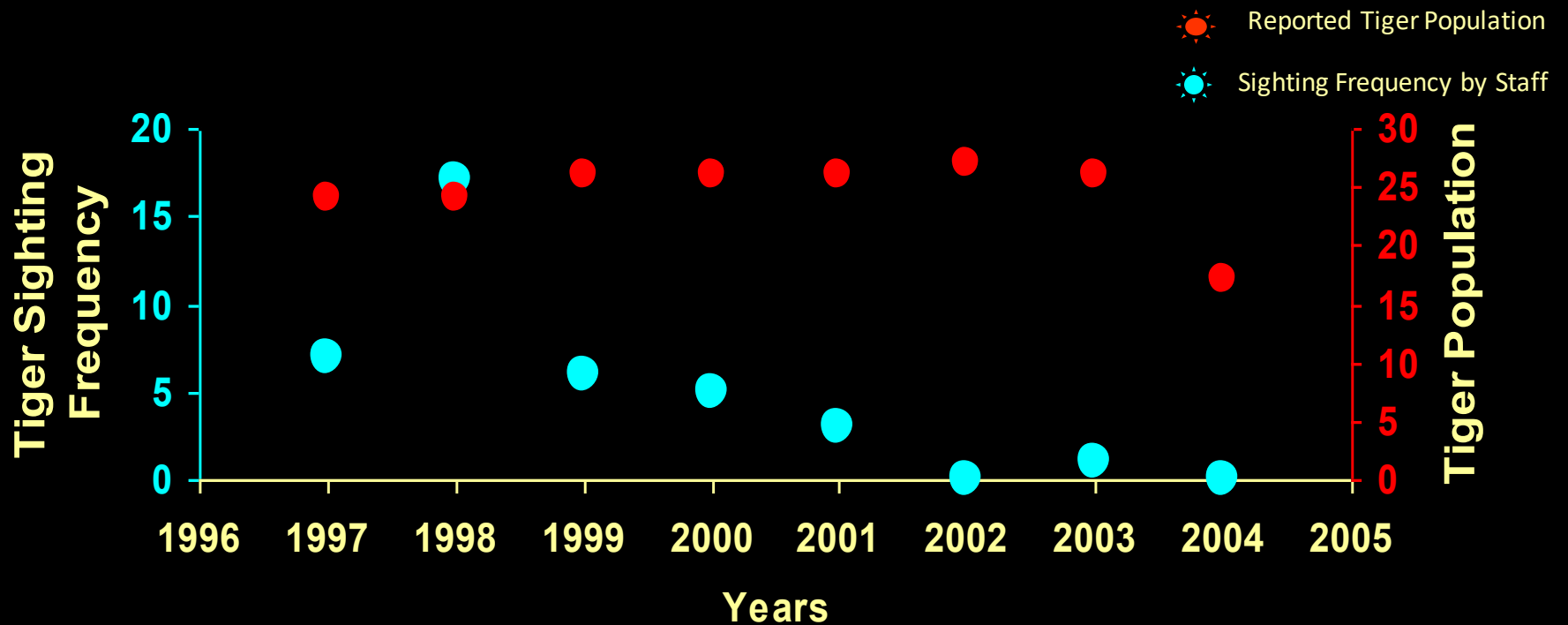
Most mining districts have more than 30% of their area under forest

Average forest cover of the 50 major mineral producing districts is 28 per cent. The national average of forest cover in each state is 20.6% .



Tiger Extinctions

Poor Monitoring Mechanism





STATUS OF TIGERS IN INDIA-2018

2967

Tiger Status Assessment & Monitoring

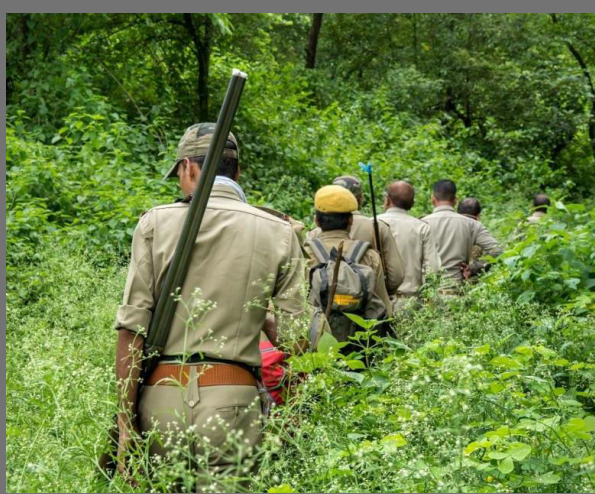
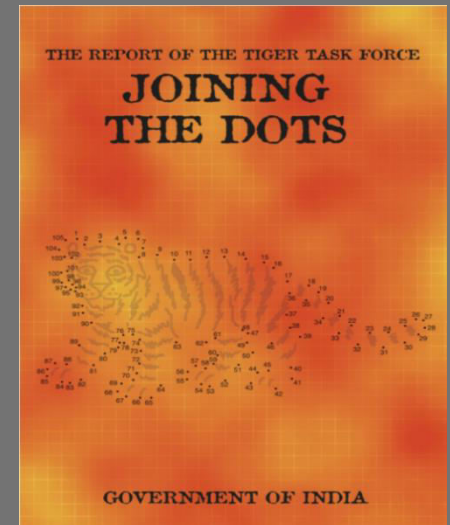
- Ratified by the Tiger Task Force (2005) &
- Peer Reviewed in 2006 by International Experts Appointed by IUCN

1. Ground Surveys

- a. Carnivore
- b. Prey
- c. Habitat
- d. Human Impact

2. Remotely sensed data

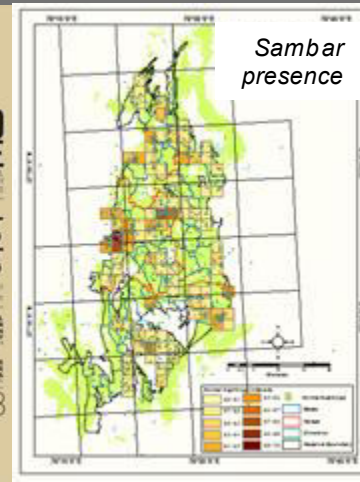
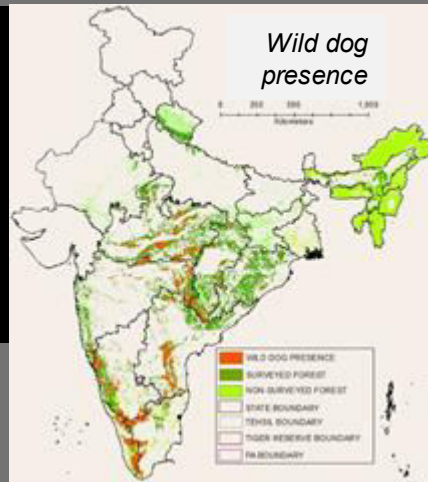
3. Camera Trap data



Technological Advancements

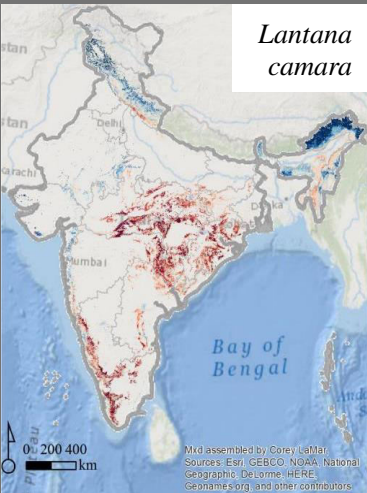
CARNIVORE SIGN SURVEY

Record direct sighting with age & sex info
Indirect signs



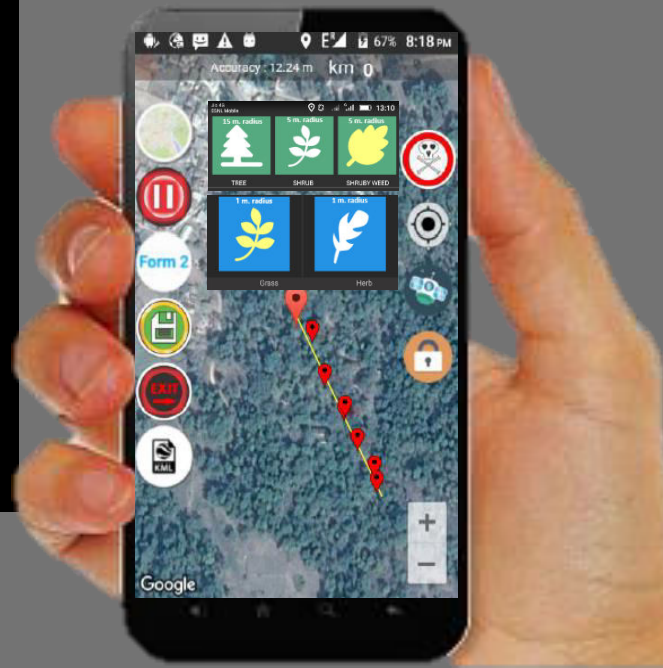
HERBIVORE DENSITIES

Record animal sightings with transect details
Density analysis



HABITAT PLOTS

Native and invasive plant densities recorded with information on cover



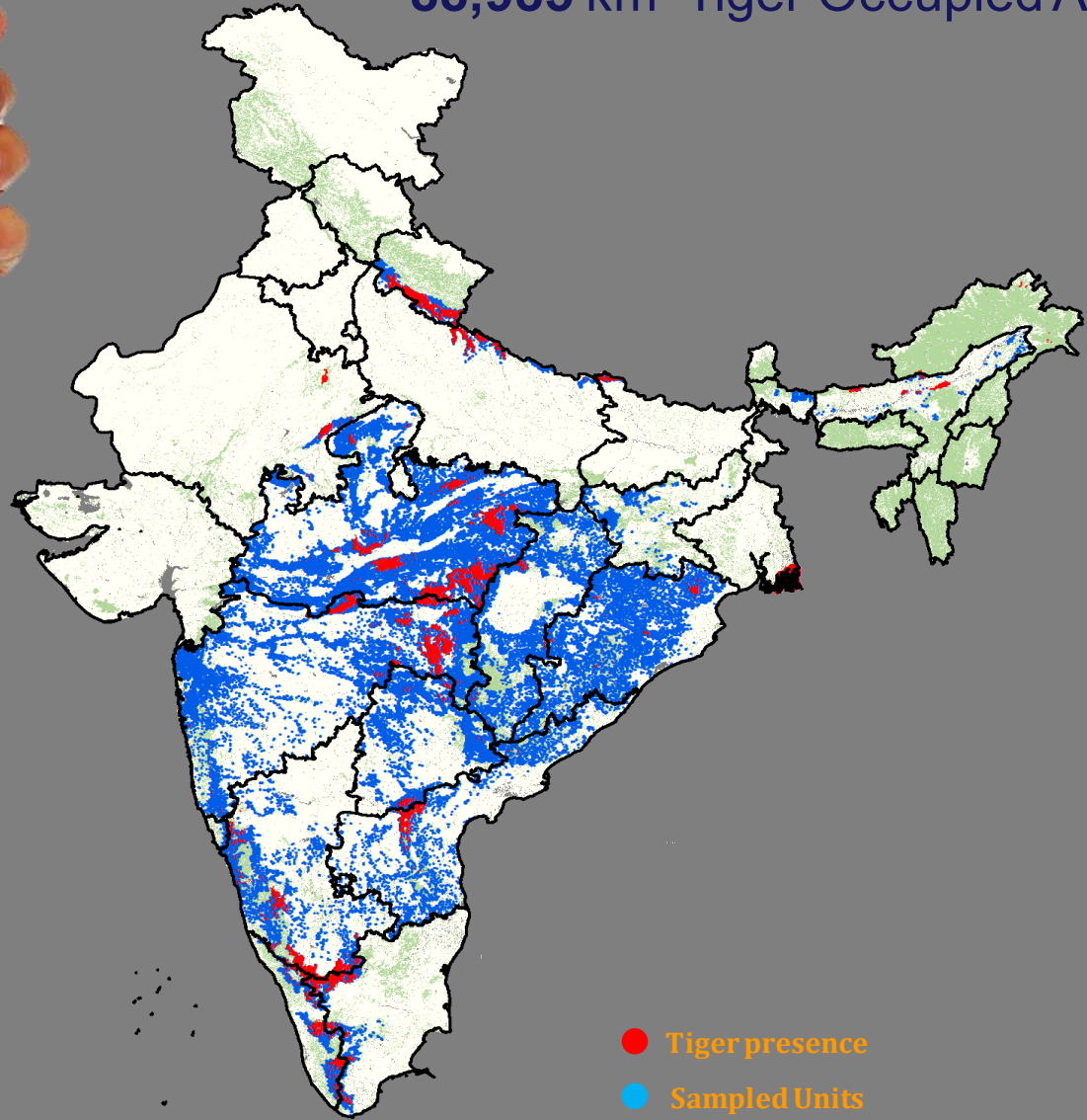
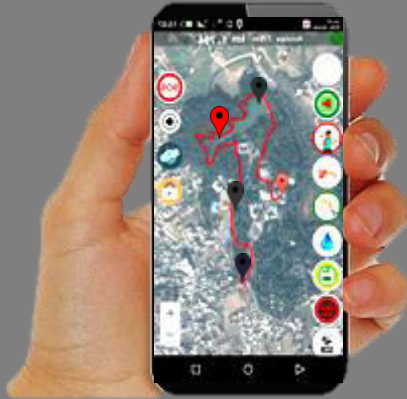
DUNG PLOTS

Densities of dung and pellets recorded as an evidence of habitat use by ungulates



Ground Surveys

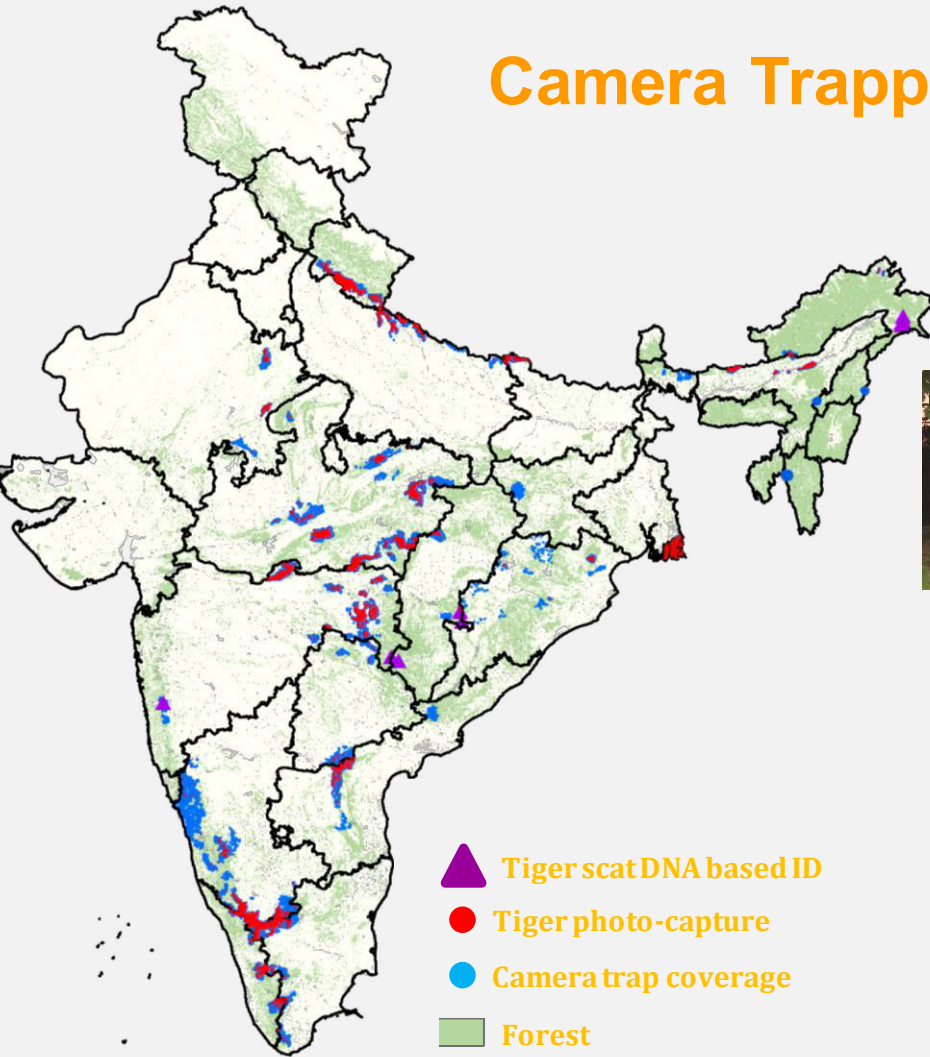
5,22,996 km effort in
3,81,400 km² Forests surveyed
88,985 km² Tiger Occupied Area



- Tiger presence
- Sampled Units
- Forest

Camera Trapping

26,838 CT locations
34,858,623 wildlife images
76,651 Tiger photo-captures



Artificial Intelligence & Machine Learning

- CaTRAT tool in MStrIPES
- Auto-identification of species
- Archive photographs and metadata
- Output camera trap data for analysis of abundance.

State: Uttarakhand Division: Rajaji National Park Range: Chilawali Beat: Guleniasot Transect: 1 Replicate: 1

Observer Name: Terun Singh Date: 02-02-2014 Start Time: 0600 End Time: 1000 Walk: 2.2 Transect Bearing: 12.5 Weather: Clear

Transect Forest Type: Himalayan Moi Transect Terrain Type: Undulating

Start Longitude: 77.938403 Start Latitude: 30.154300 End Longitude: 77.958903 End Latitude: 30.166706

☒ Degrees Minutes Seconds ☐ Degrees Decimal Minutes

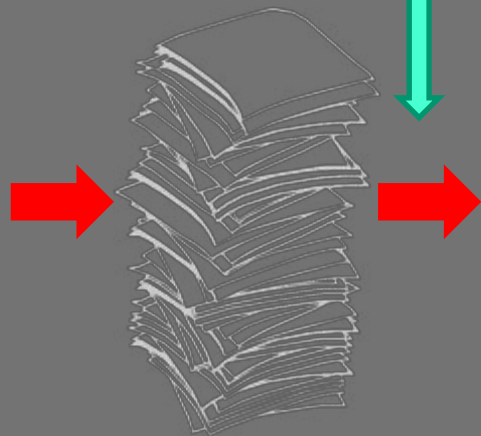
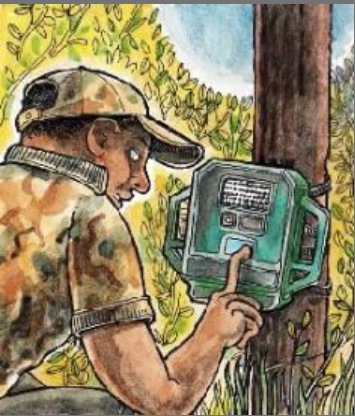
Degree: 30 Minute: 10 Second: Convert 30.166706

Use TAB Button of Keyboard to navigate through Grid

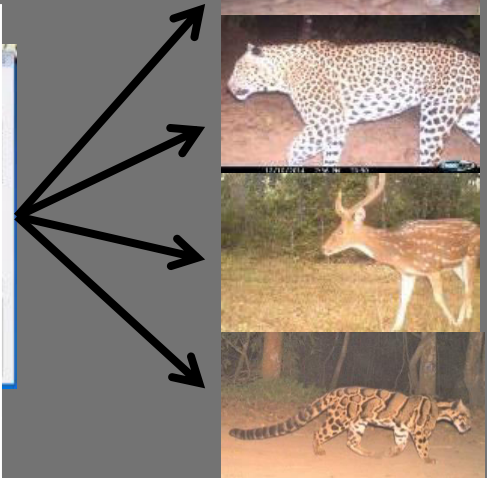
Sl_No	Animal_Type	Time	Adult_with_young	Young_Seen	Forest_Type	Terrain_Type	Animal_Bearing	Angular_Distance	Remarks
1	Chital	0800	4	2	Himalayan Mois	Undulating	102.1	21.0	
2	Gaur	0830	5	4	Himalayan Mois	Undulating			
3	Barasingha	0915	6	4	Himalayan Mois	Valley	85.0	10.0	

Angular Distance is in meters (m)

Machine Learning,
Computing Power

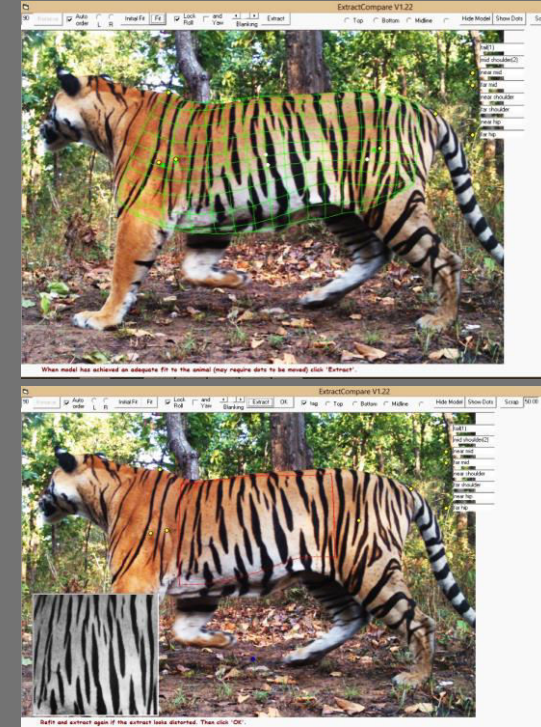


METADATA	
Name	<i>Panthera tigris</i>
Date time	17-03-2015; 08:51
Lat	22.15.37.3
Long	80.31.30.09
Block id	006
UID	2215986742852



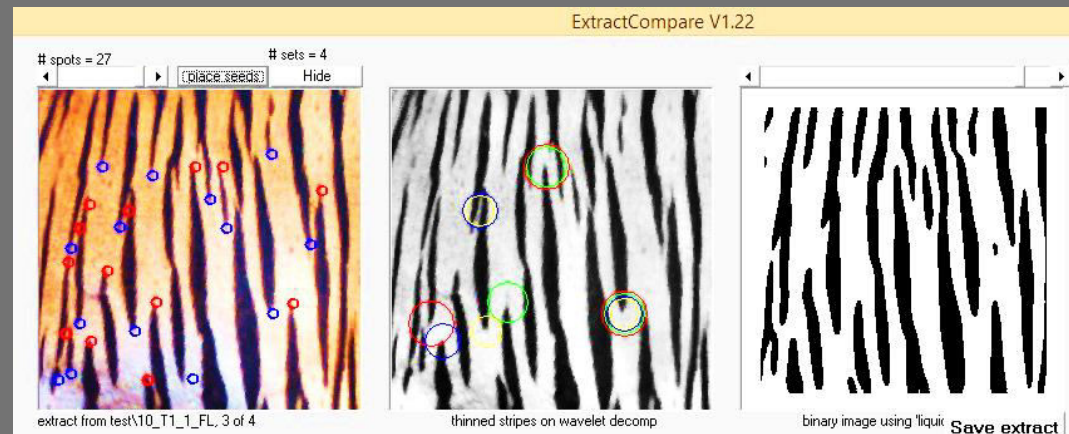
Fingerprinting Tigers

Software Program **EXTRACT COMPARE**

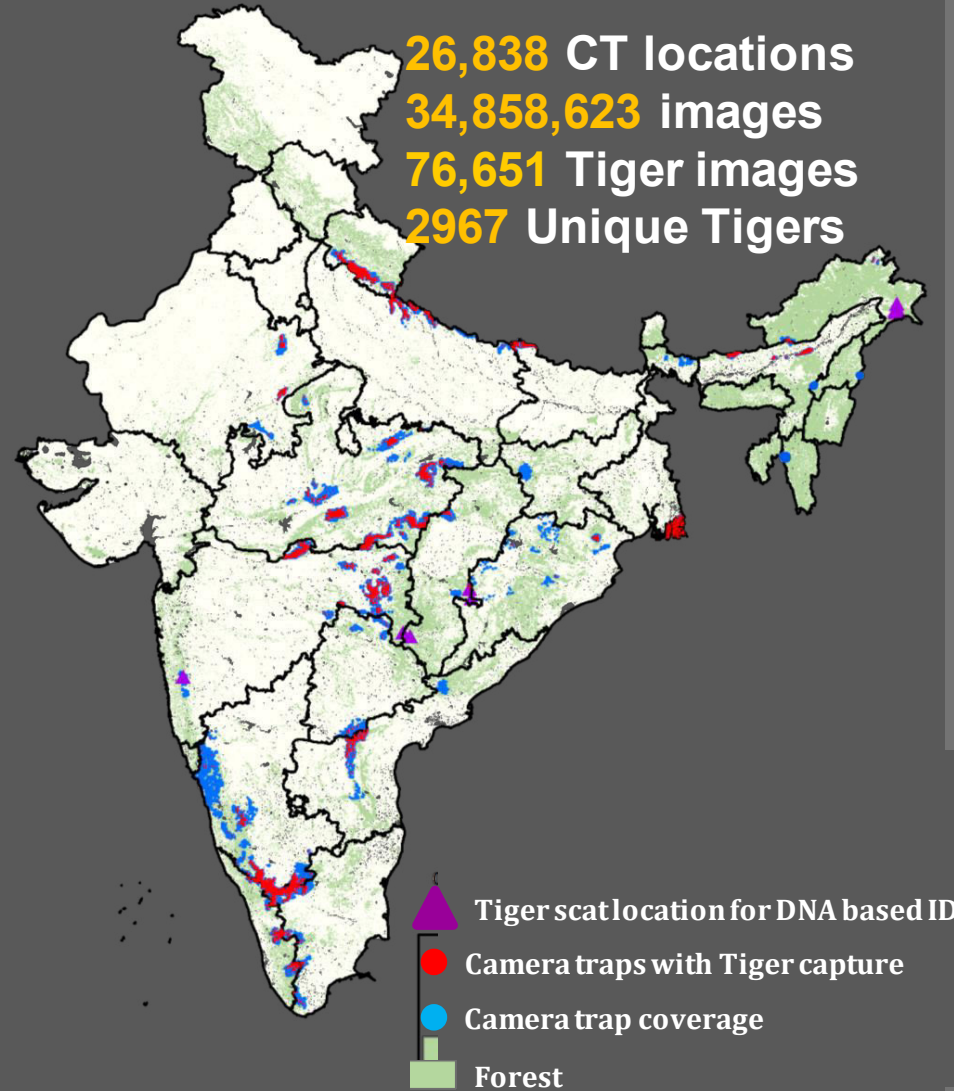
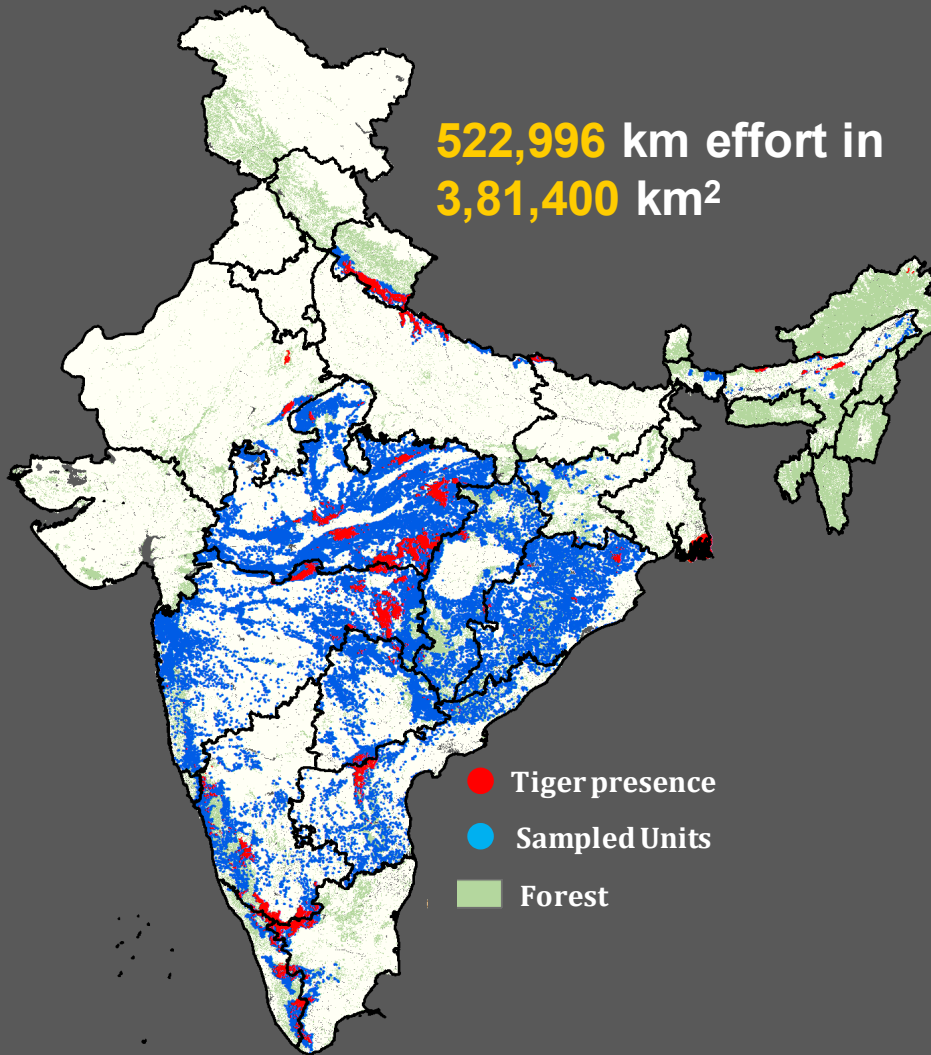


From 76,651 tiger images
2468 Tigers (excluding cubs)
Identified

Population Estimation,
Detect poaching & trade routes,
Dispersal and Demography.

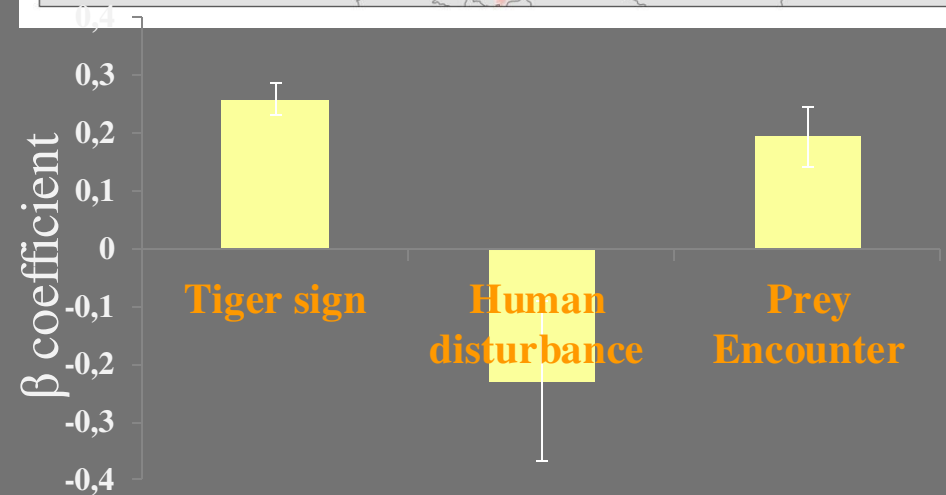
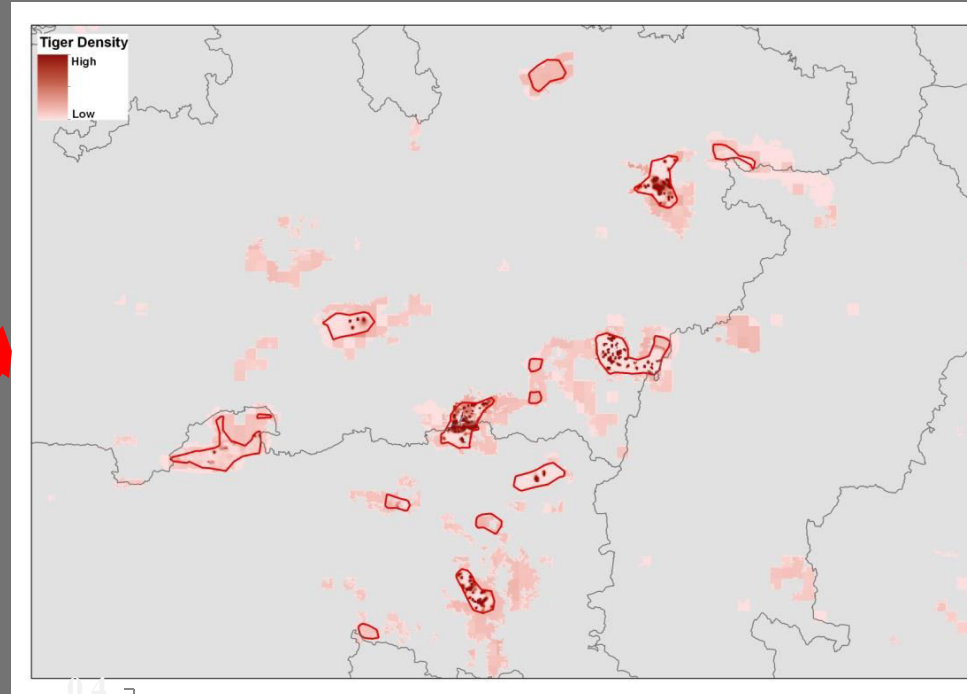
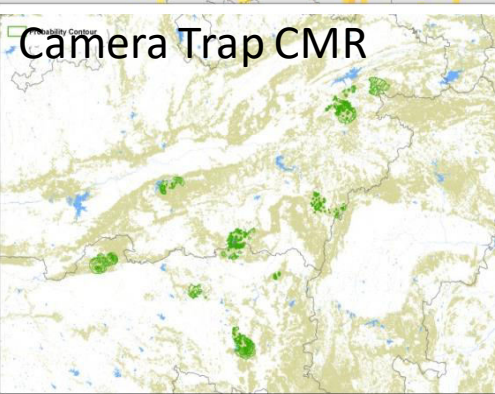
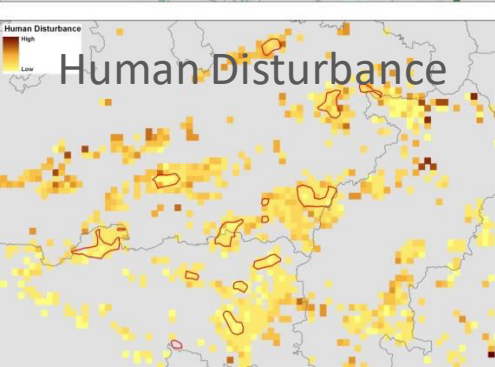
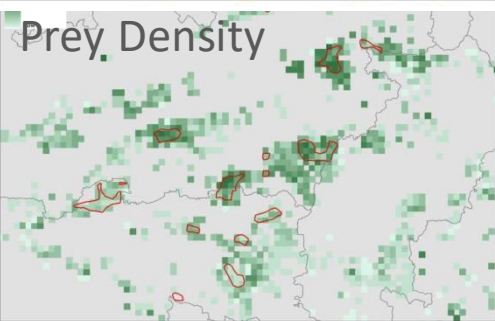
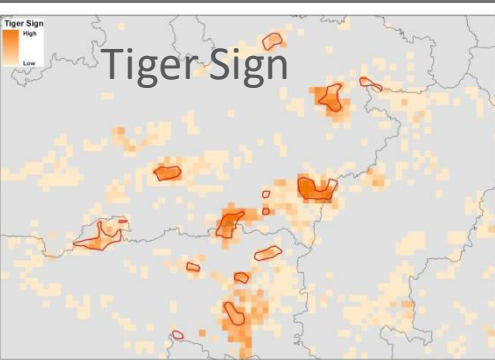


Double Sampling: Ground Samples & Camera Traps



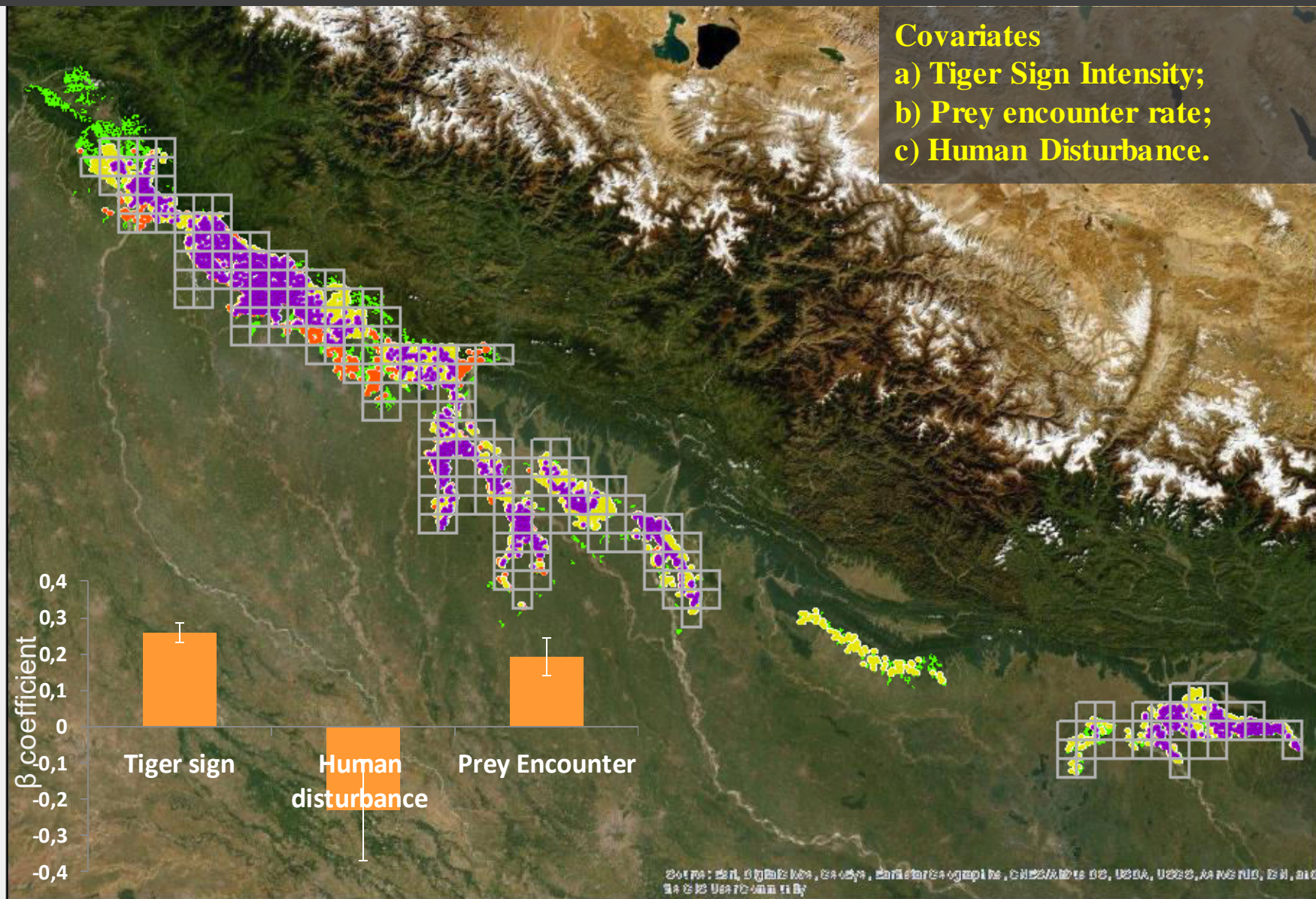
Largest Wildlife Survey Ever in the World

Joint Distribution Spatially Explicit Capture Recapture (SECR)

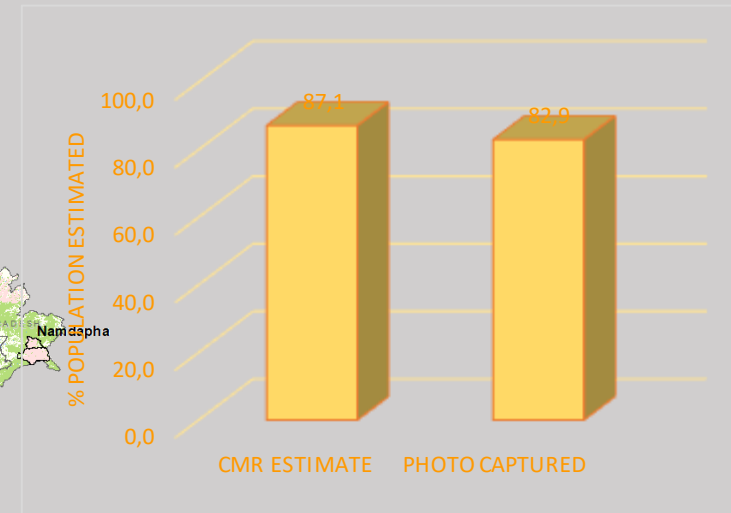




TIGER NUMBERS: SECR-Camera Trapped + Joint Distribution Covariate Model = 646



Tiger Populations and their Extents in India (2018-19)



Most Accurate Estimate Till Date

Wild tiger population 2967 (SE range 2603-3346, >cubs)

Area Occupied by tigers 88,985 km²,

IUCN estimates 3,159 tiger in the world (2015)

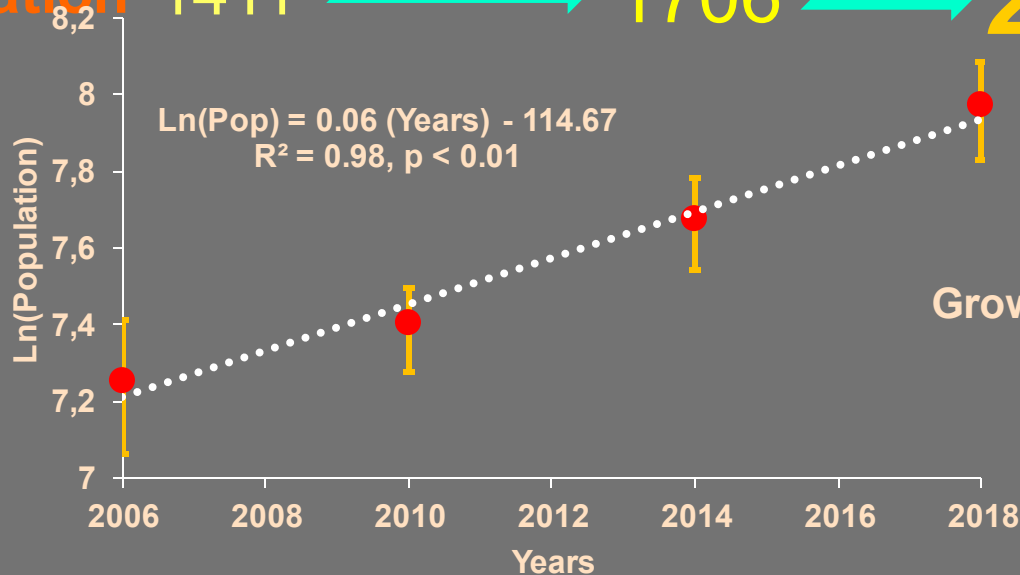
India's wild tigers accounts for majority of the Global tiger population



National Tiger Status Assessments



Population 1411 → 1706 → 2226 → 2967

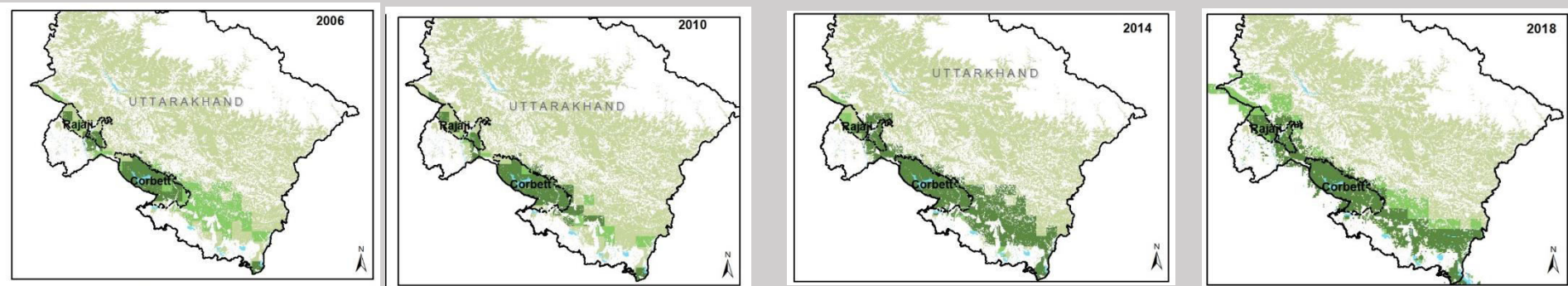


Growth rate: @ 6% per annum

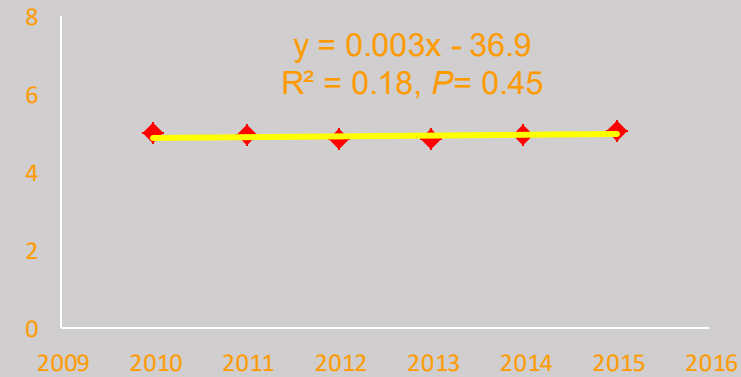
Importance of Source Populations



Corbett TR Source in Western Shivalik-Gangetic Plains



(Ln)Tiger Population



Characteristics of Sources

Good Prey Density

High Density Tigers >> 100 Population

Recruitment >>> Mortality

High Turnover Rate

At or close to Carrying Capacity

Creating Space for Tigers- Relocation of Habitation

Incentivized voluntary relocation @ Rs 1,000,000 / per adult

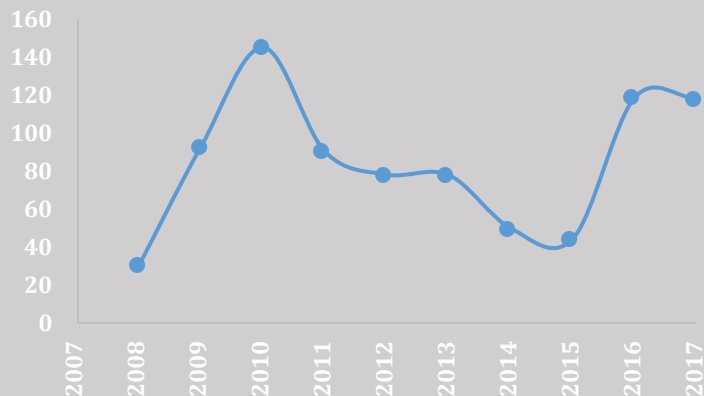


34,312 km² of Critical/
Core inviolate Areas
legally mandated



14572 families
Relocated from
180 villages

Rs *10,000,000



Northeast

Terai Arc

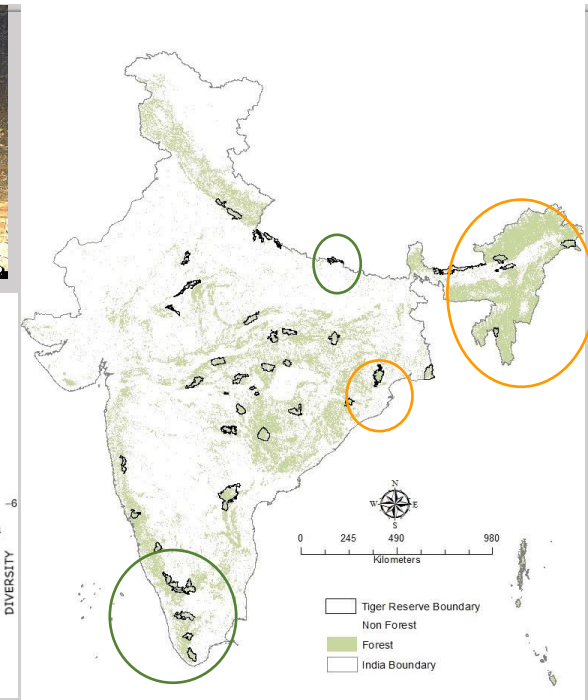
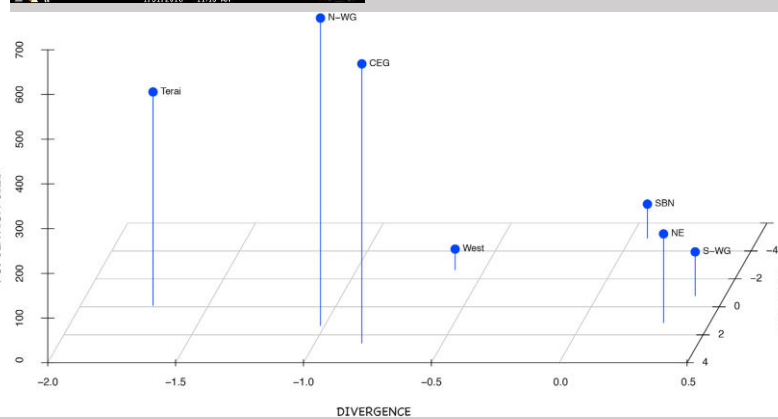
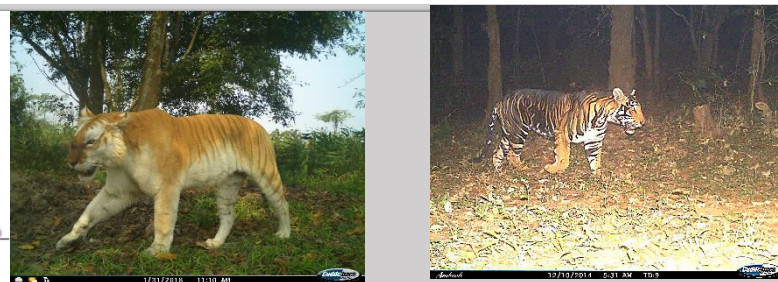
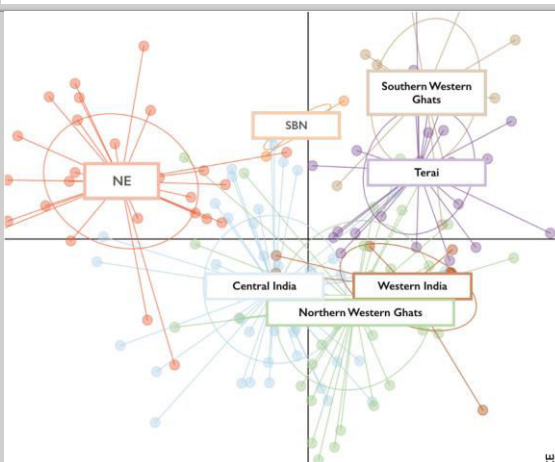
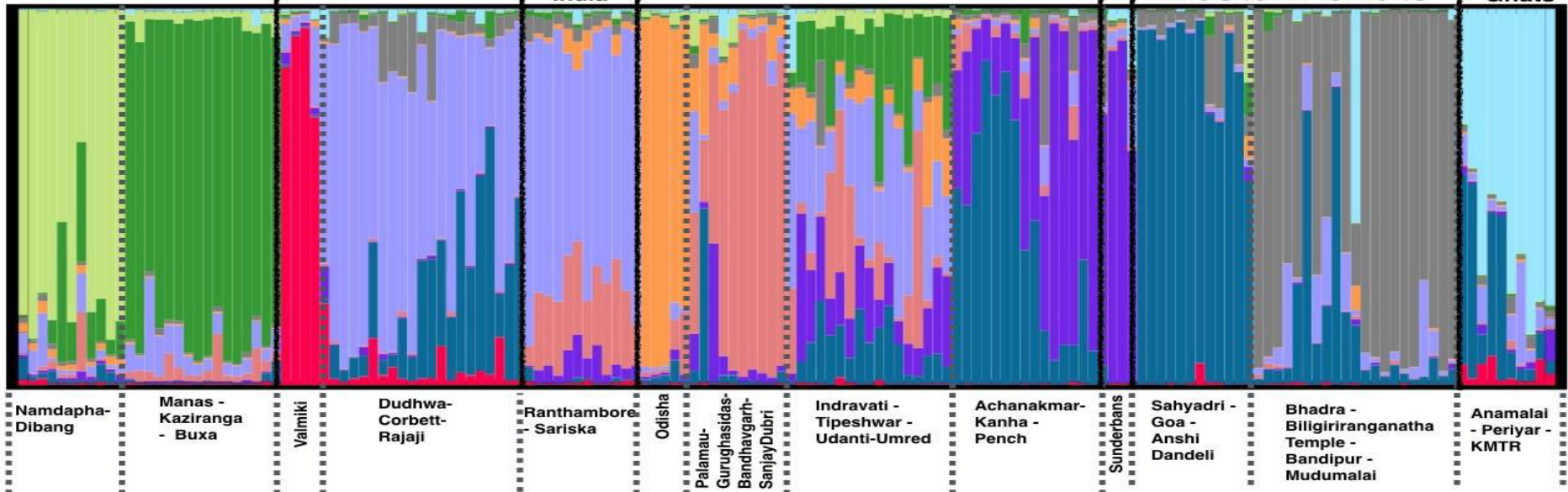
Western India

Central India

Sunderbans

Northern Western Ghats

Southern Western Ghats



Inviolable Area

For 20 breeding tigresses -800-1000 km²

Total Population in the Core

Tigers = Male 8

Cubs < 1 Year = 10 -15

Cubs 1-2 Year = 10 -15

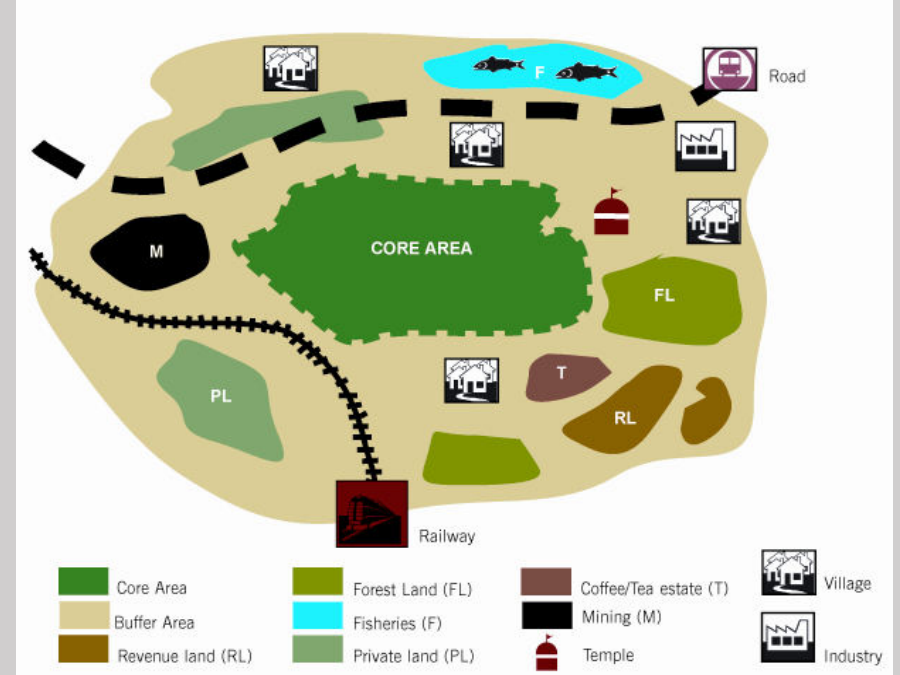
Buffer -- 1000-3000 km²

2-3 Year olds = 10 -15

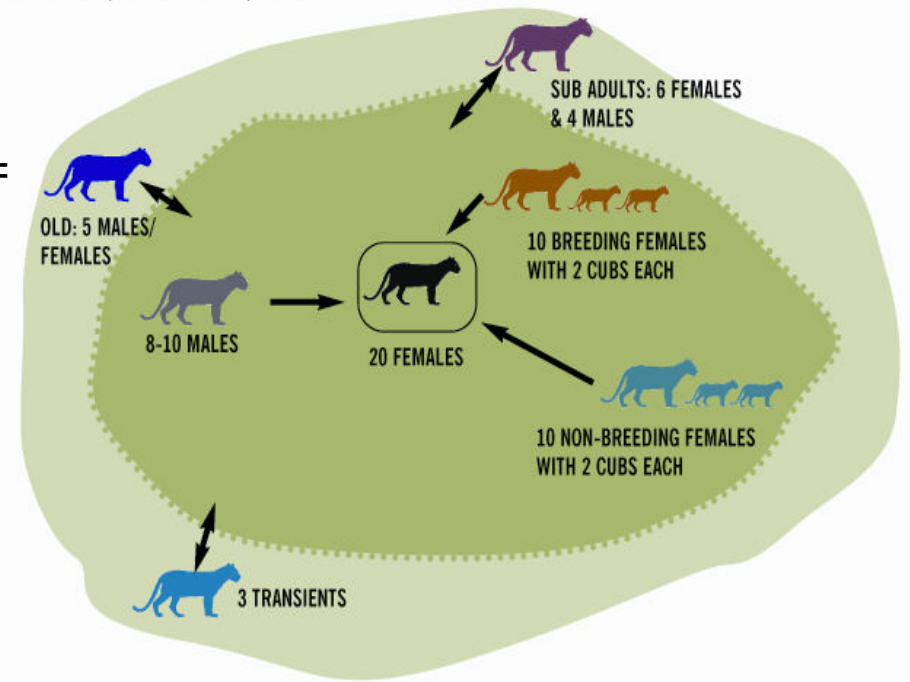
3-4 Year olds = 10 -15

Old tigers & Surplus breeding age Tigers = 10-15

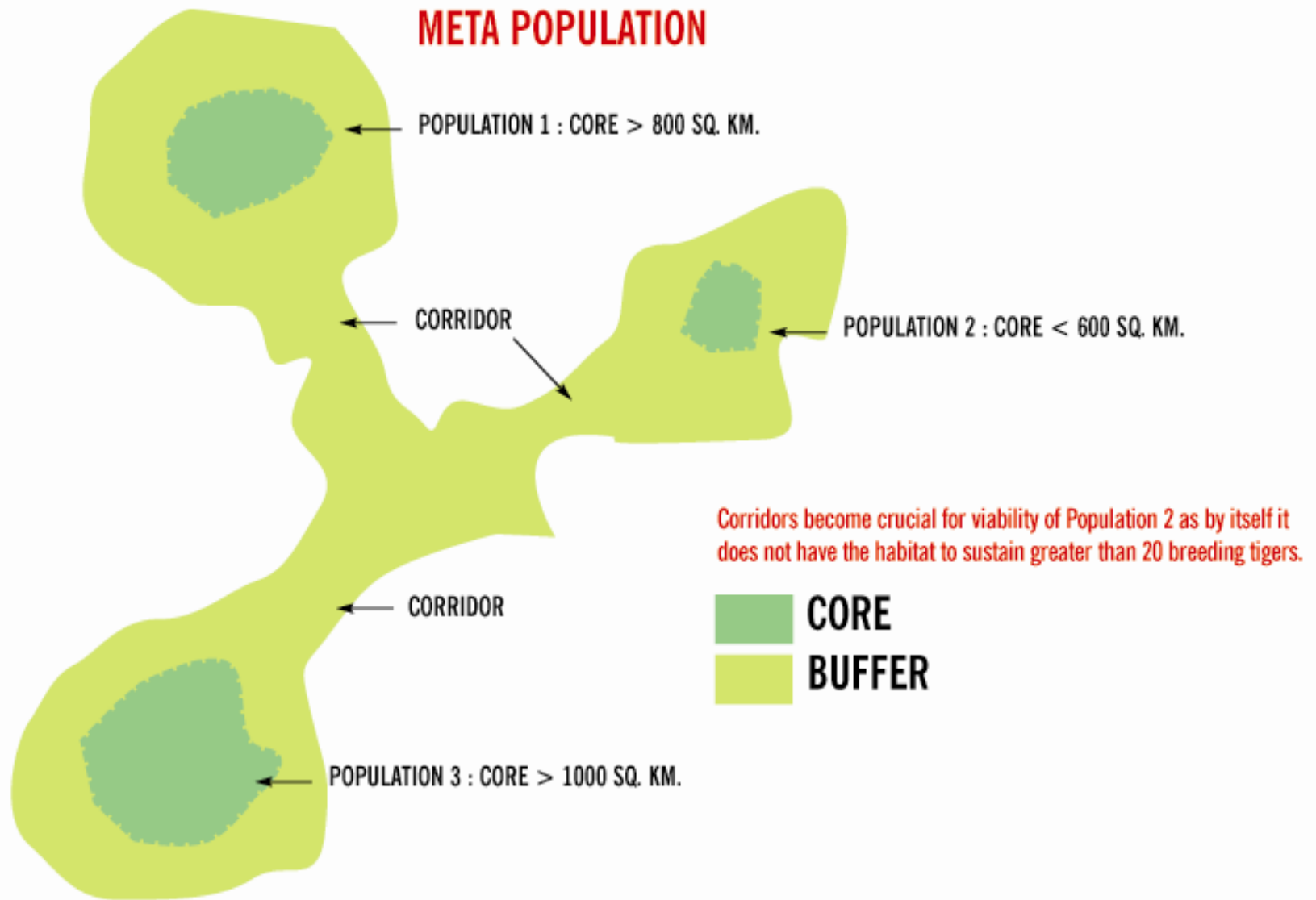
Tot Pop = 75 - 100 Tigers

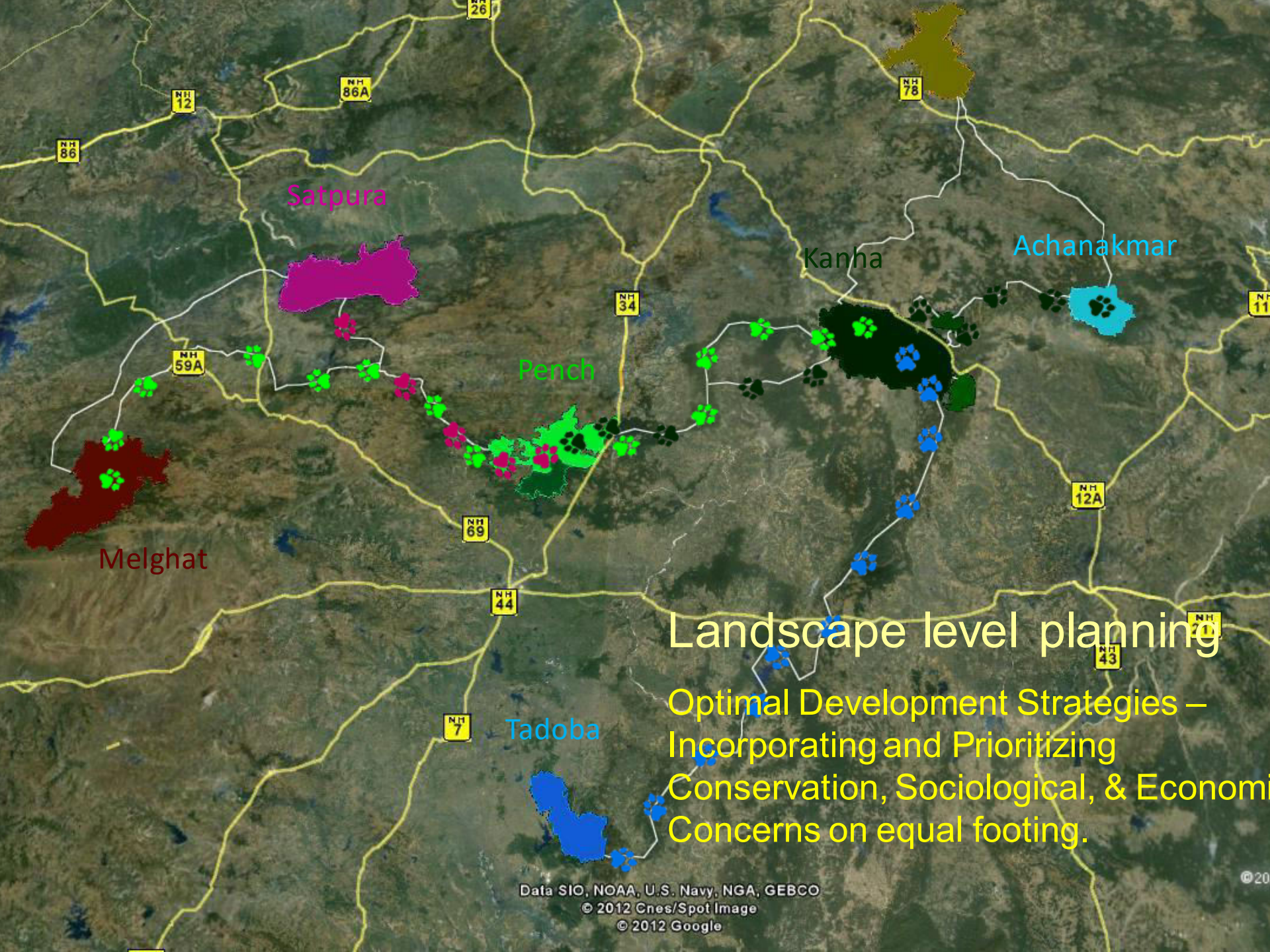


ire an inviolable space of 800-1000 square kilometers



Relevance of Core Size and Corridors for Metapopulation





Satpura

Kanha

Achanakmar

Pench

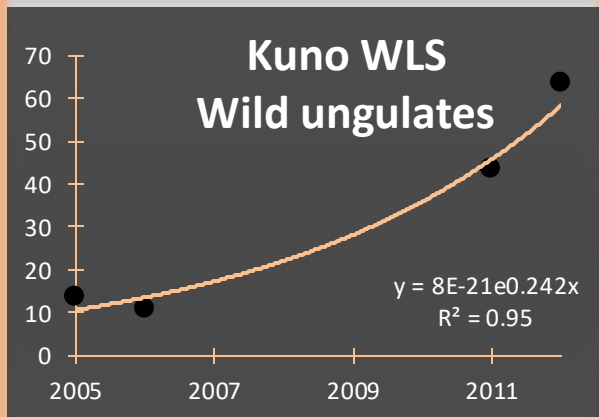
Melghat

Tadoba

Landscape level planning

Optimal Development Strategies –
Incorporating and Prioritizing
Conservation, Sociological, & Economic
Concerns on equal footing.

PREY BASE BUILDING.....



Prey Recovery

- ☐ Village relocation.
- ☐ Habitat management.
- ☐ Law enforcement.
- ☐ Ex. Kuno, Kanha, Pench, Madumalai, Nagarhole, Corbett.



Translocation

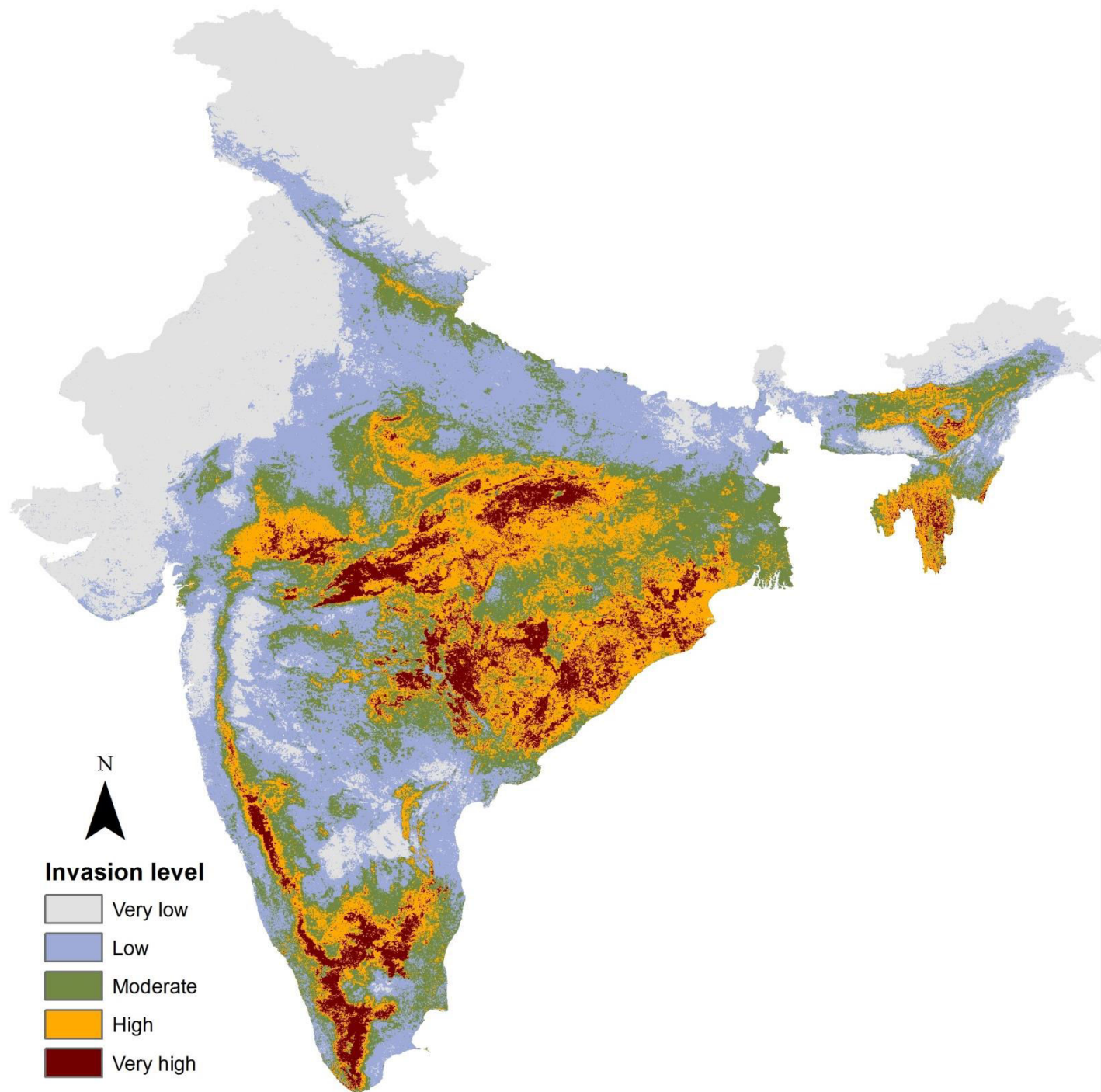
- ☐ Regaining lost species
- ☐ Upgrading protection.
- ☐ Prey Augmentation.
- ☐ Ex. Gaur reintroduction in Bandhavgarh.



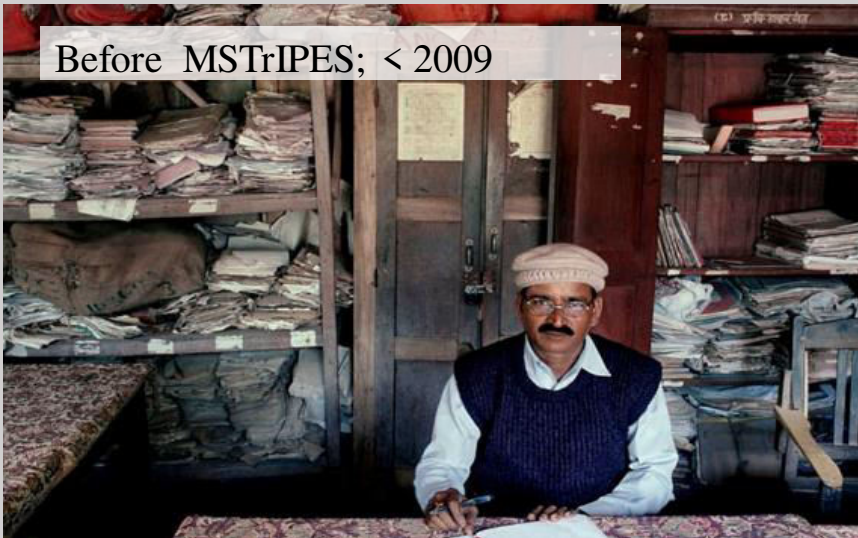
Augmentation

- ☐ Mass breeding.
- ☐ Sustaining populations.
- ☐ Law enforcement.
- ☐ Ex. Barasingha Breeding Program at Kanha

Weed Invasion level



Before MStrIPES; < 2009



MStrIPES Ver. 1; 2010-2016



MStrIPES Ver. 2; > 2016



MSTrIPES

For Law Enforcement & Monitoring

PATROL MODULE



- Smart patrol
- Sensitization
- Law enforcement

ECOLOGICAL MODULE



- Systematic Monitoring
- Spatio-temporal changes
- Species management

CONFLICT MODULE



- Spatial conflict database
- Verification
- Mitigation & compensation

Modular program

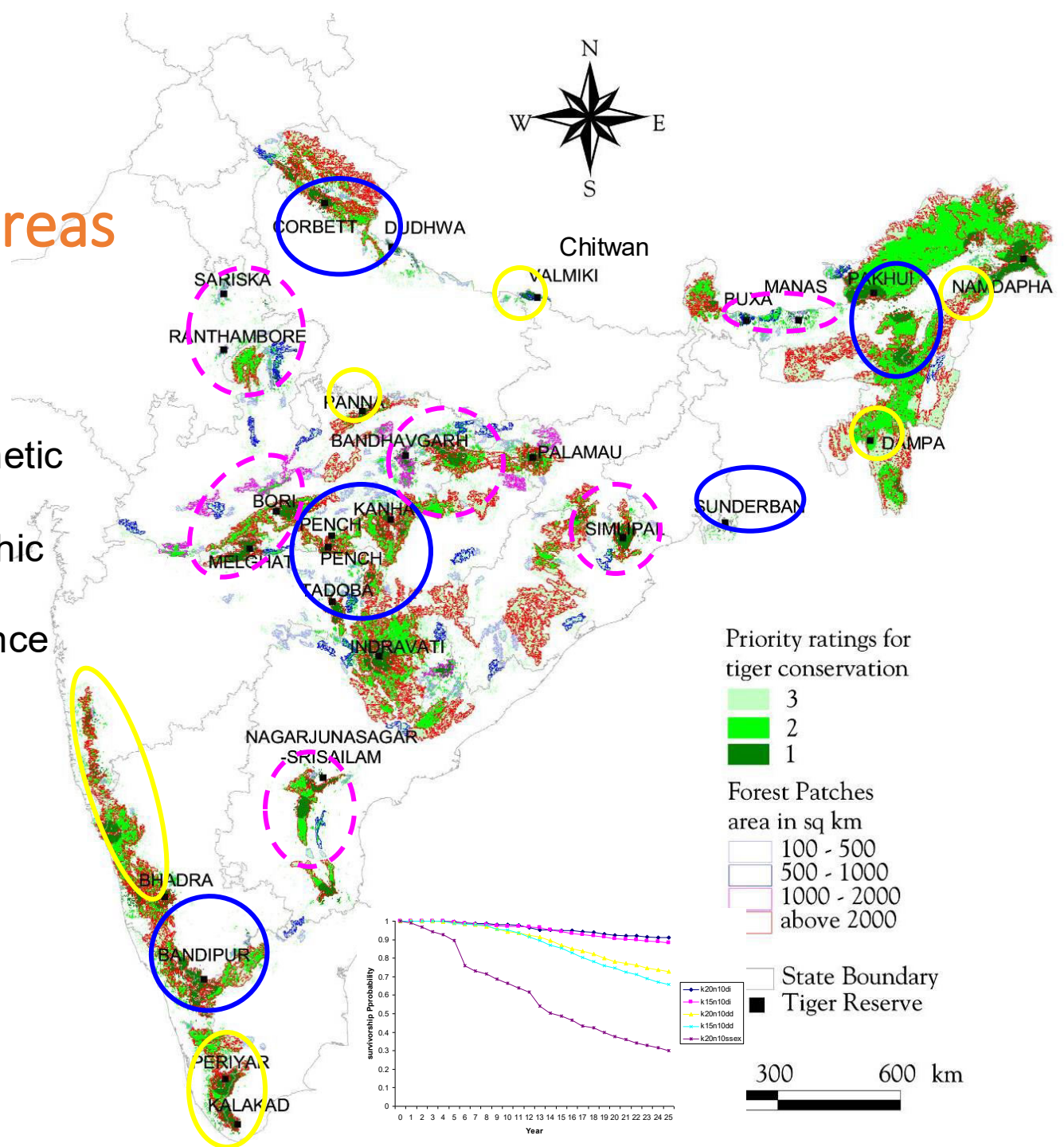
3 Mobile apps, **desktop** and central **server**

Priority Tiger Conservation Areas

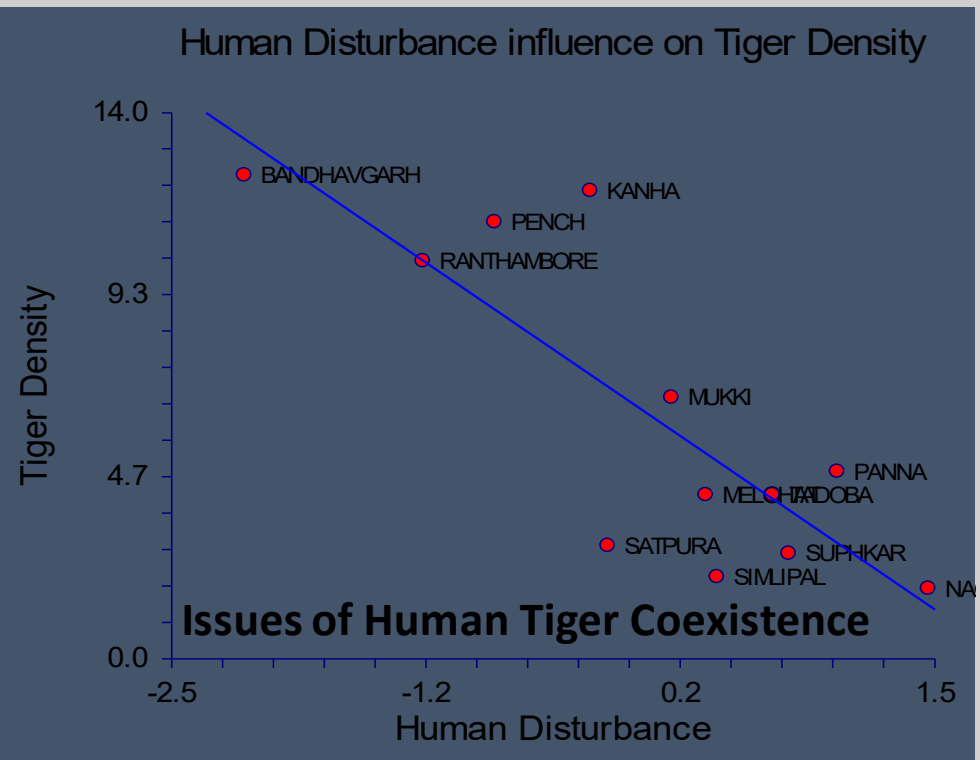
Populations having

- Demographic & Genetic Viability
- Potential Demographic & Genetic Viability
- Ecological Significance

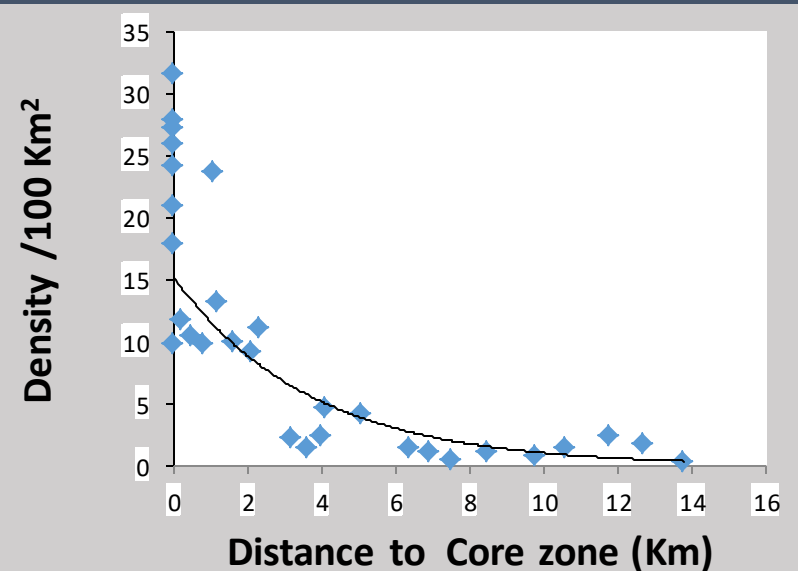
Incorporates Source Population, Tiger Occupancy Potential, Forest Patch Size and Connectivity.



Future of Tiger Conservation



Relation of distance from protected area to tiger density

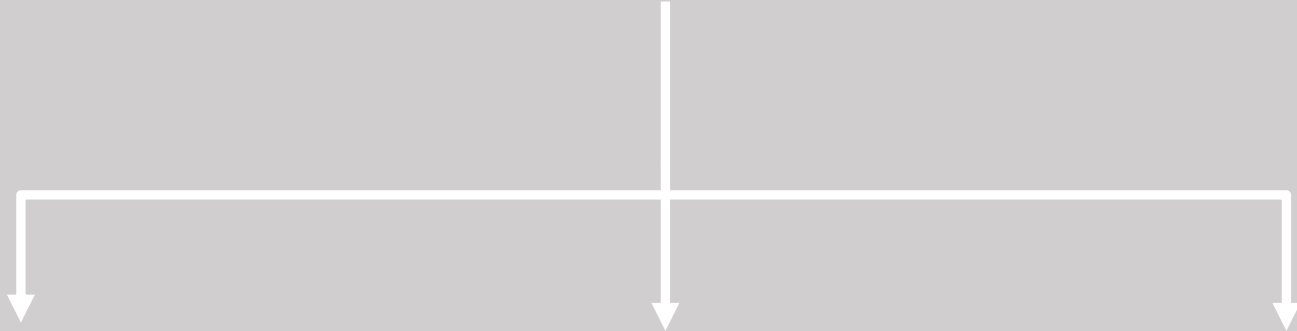


- Sustain and improve protection
- Maintain connectivity
- Improve habitat in ~40 Tiger Reserves
- Adopt Green infrastructure development program

Our objective is not to contrive glorified Safari Parks, for the tiger or for that matter our wildlife in general. Our endeavor, on the contrary, must be to retain the pristine or climax conditions of these areas with all the wonder and variety of its living forms, not just as a primordial relic of a distant past but as a dynamic and vital requirement for a quality of life that the most enlightened level of human thinking can conceive.

H.M Patel Union Minister and Chairman Steering Committee, Project Tiger

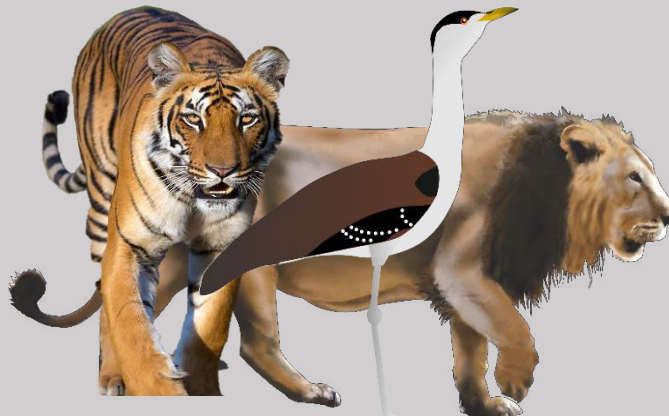
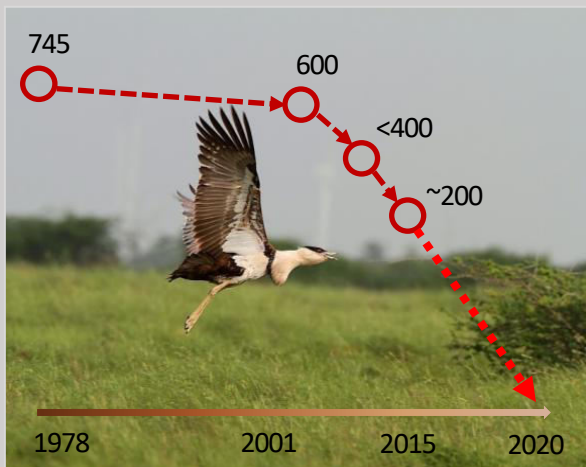
Need for Monitoring



Assess Success of Conservation Effort

Prioritize Conservation Investment

Ecologically Sustainable Development



Three publications which criticized All India tiger Monitoring

Methods in Ecology and Evolution



Methods in Ecology and Evolution 2015, 6, 1055–1066

doi: 10.1111/2041-210X.12351

An examination of index-calibration experiments: counting tigers at macroecological scales

Arjun M. Gopalswamy^{1, 2, 3*}, Mohan Delampady⁴, K. Ullas Karanth^{2, 3, 5}, N. Samba Kumar^{2, 3}
and David W. Macdonald¹



[Journal of Agricultural, Biological and Environmental Statistics](#)

June 2017, Volume 22, Issue 2, pp 111–139 | [Cite as](#)

Bayesian Methods for Estimating Animal Abundance at Large Spatial Scales Using Data from Multiple Sources

Authors

[Authors and affiliations](#)

Soumen Dey, Mohan Delampady , Ravishankar Parameshwaran, N. Samba Kumar, Arjun Srivathsa, K. Ullas Karanth

Conservation Letters

A journal of the Society for Conservation Biology

[Open Access](#)

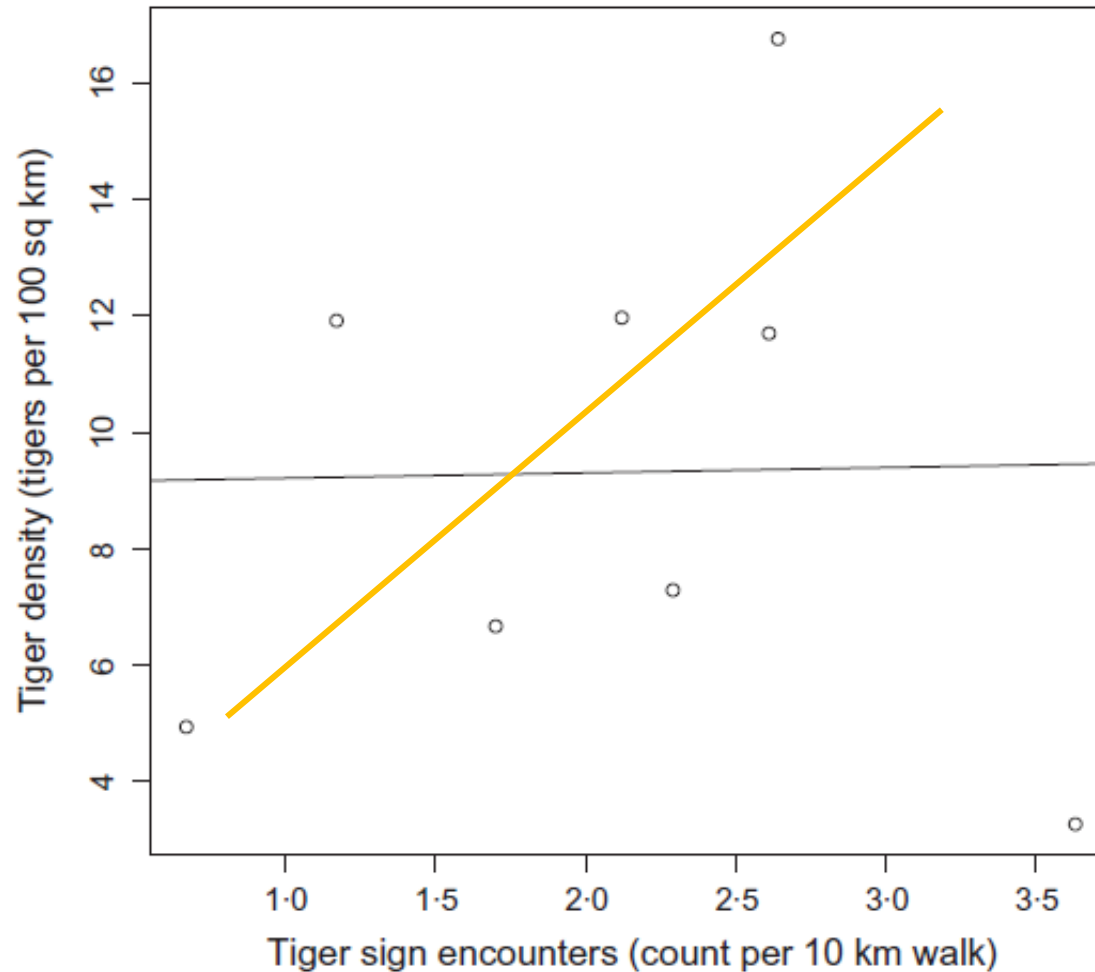
VIEWPOINT

Defensible Inference: Questioning Global Trends in Tiger Populations

Abishek Harihar^{1,2}, Pranav Chanchani^{3,4}, Milind Pariwakam⁵, Barry R. Noon^{3,4}, & John Goodrich¹

Oxford Study 2015- Karanth & colleagues

Index-calibration experiments: counting tigers 9



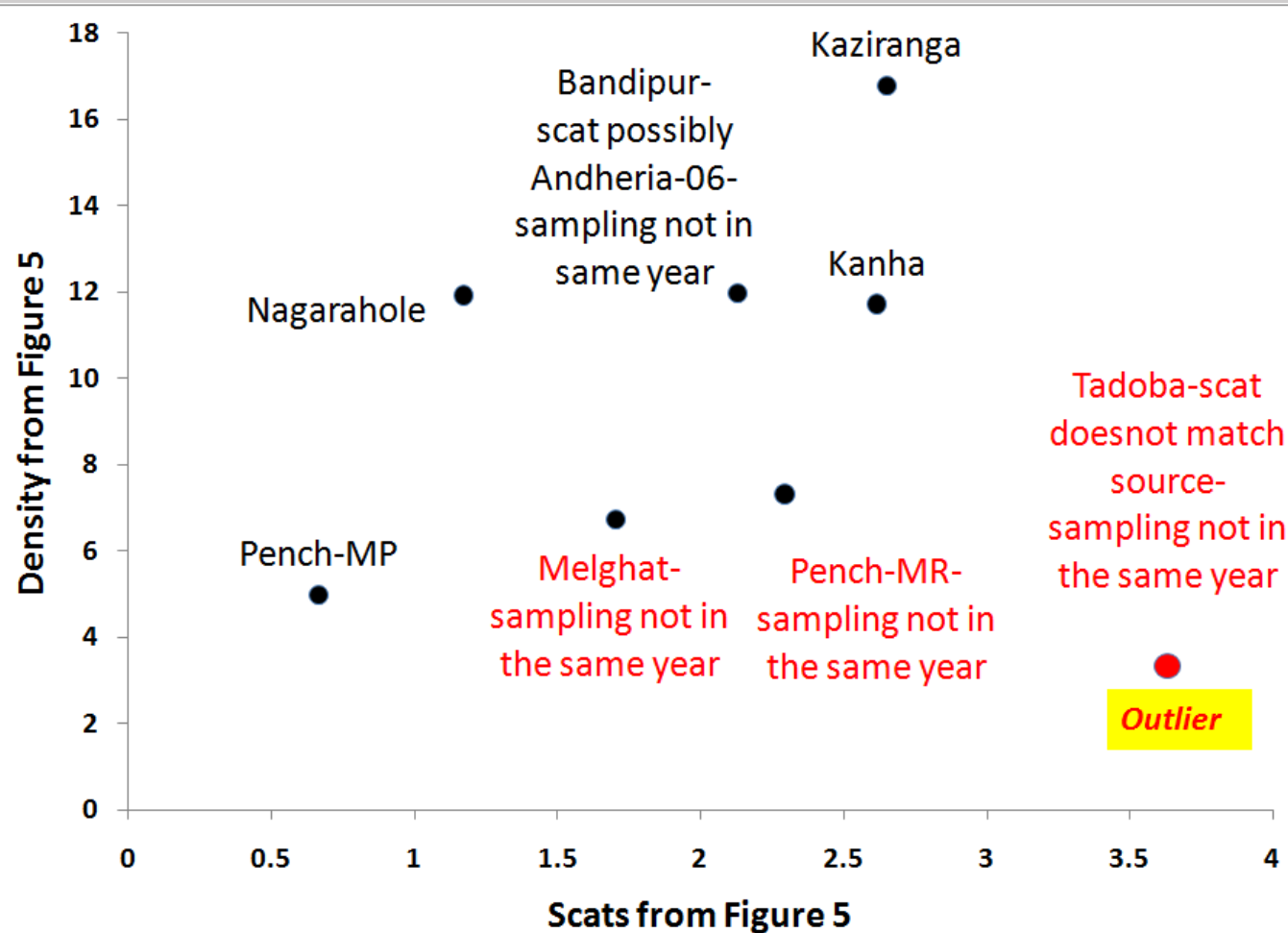
R^2 (Karanth)=0.0001

R^2 (Adjusted)=0.34

Improvement in
relationship is 3400%

Fig. 5. Plot of the relationship between tiger sign encounter rates and estimated tiger densities from 8 different sites in India (from Karanth & Kumar 2005). The line represents the estimated regression line.

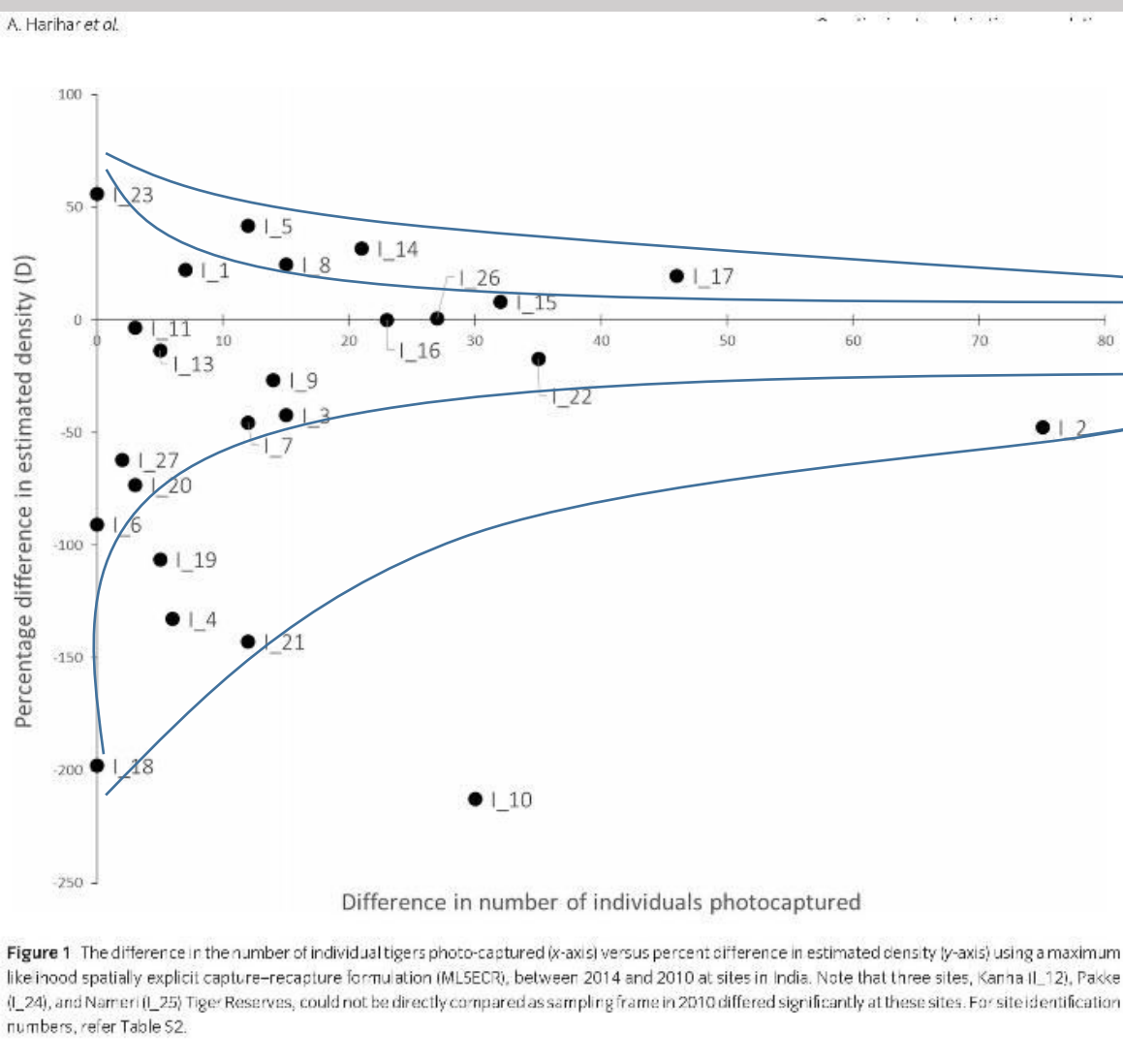
Recipe for cooking data



Scientific ethics code

- 1) Unrepresentative samples used
- 2) Misinterpreting results
- 3) Selective reporting of data
- 4) Unsupported conclusion
- 5) Sensationalised headlines

Response: Mathematistry may get one in trouble if ecology is not in sight



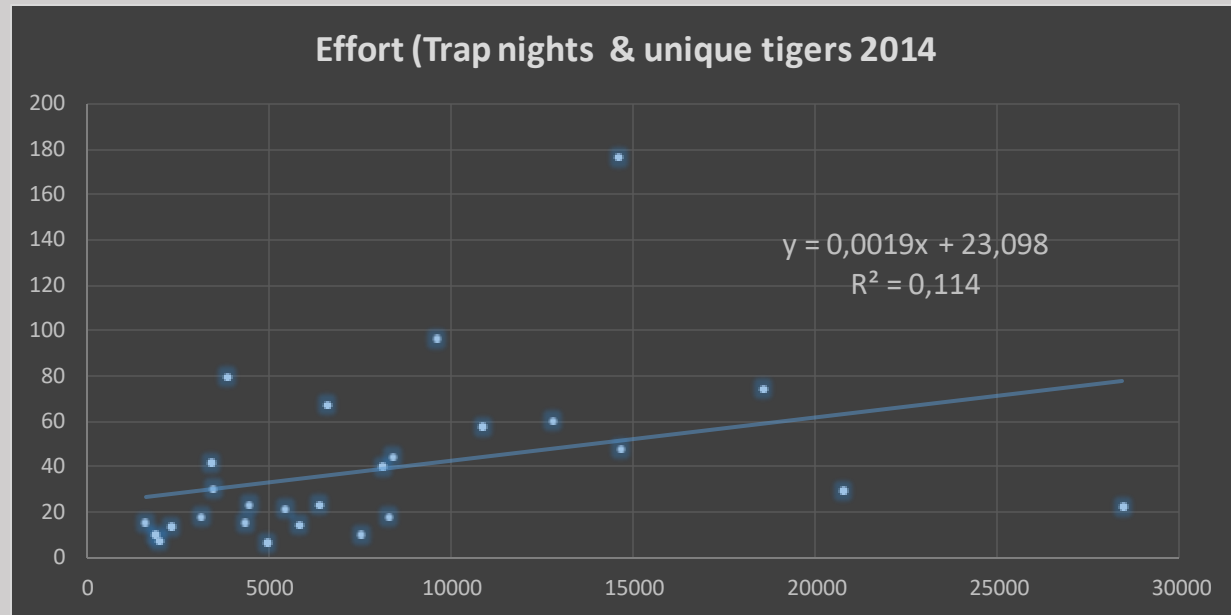
Harihar Interpretation:
Larger the difference
in tiger photocaptures
higher will be the
difference in density.

Observation: Larger
the difference in
number of tigers
photocaptured smaller
The difference in
density.

More complex interaction going on which include capture probability and sampled area.
Robust abundance method should be invariant to unique individuals captured.

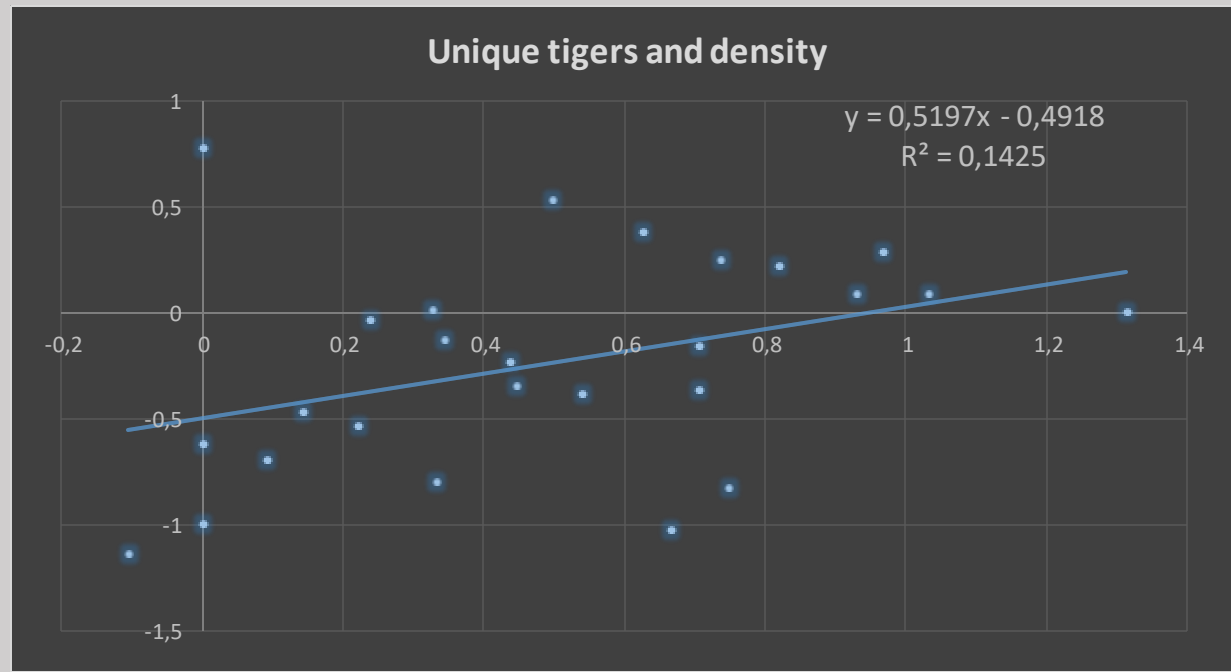
Harihar et al:
Increase in trap nights
results in increase in tiger
population.

AITM: There is no
relationship between
($R^2=0.11$) trap nights and
unique tigers captured.



Harihar et al: Increase in
unique tigers will result in
increased density.

AITM: There is no
relationship between
($R^2=0.14$) unique tigers
captured and density.



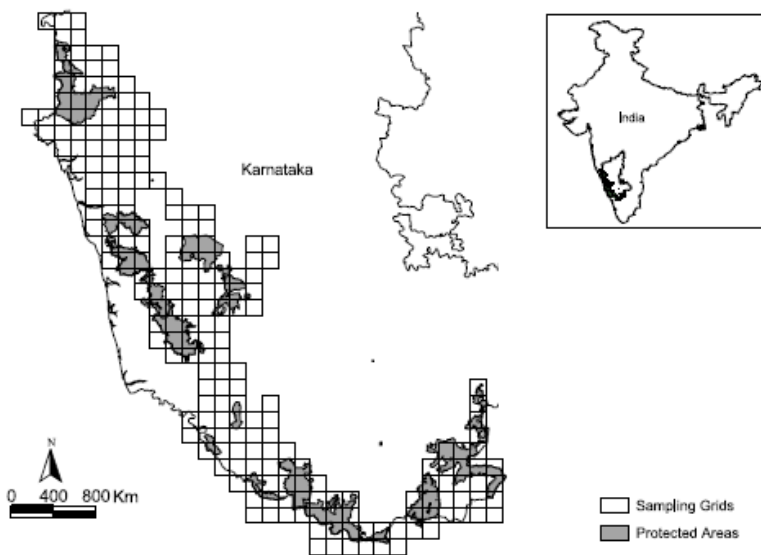
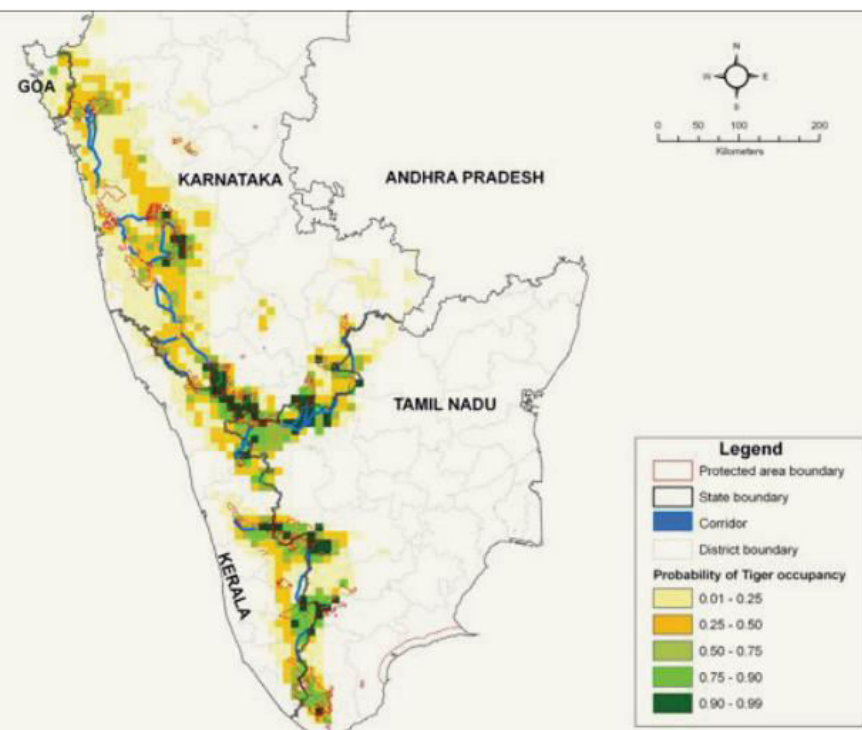


Figure 1. MTL Map.

Table 1. Distribution of sites in different clusters across MTL.



Occupancy	Bayesian	AITM
Sites	205	861
Cell Area (sq km)	188	100
Walks	205	1,170
Length (km)	4174	49,900
Naïve Occupancy %	19.6	34.26
Detection Prob. %	17 (se 17)	39.2(se 0.89)
Estimated Occupancy	66	34.6
Area Covered (sq km)	38,540	49,900
Tiger area (sq km)	14,076	20,800
Camera Trap		
Units	71	230
Population	391 (se 57)	300 (se 20)
Sampling interval between occupancy and camera trapping	7 yrs	<1 yr

Tiger Sources & Potential Habitats

- **Source Population within each landscape with Habitat Connectivity essential for long-term Tiger Survival**
- **Habitat available for expanding Tiger Population : requires conservation investments**

