STATUS OF TIGERS IN INDIA 2011

National Tiger Conservation Authority
Ministry of Environment & Forests

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Aaranyak

WWF-India

Wildlife Trust of India

“Any monitoring program is a compromise between science and logistic constraints”

- Hutto & Young 2003

Monitoring tigers:

- **Vast landscape low density,**
- **Cryptic species, wide ranging**
- **Limitation of professional & technical capabilities.**

Population Estimation and Change Detection

$$\hat{N} = C / \hat{P}$$

N- Population

C- Count / Index

P- Probability of Detection

Two counts (indices) can be compared only if P is constant / known / estimated.

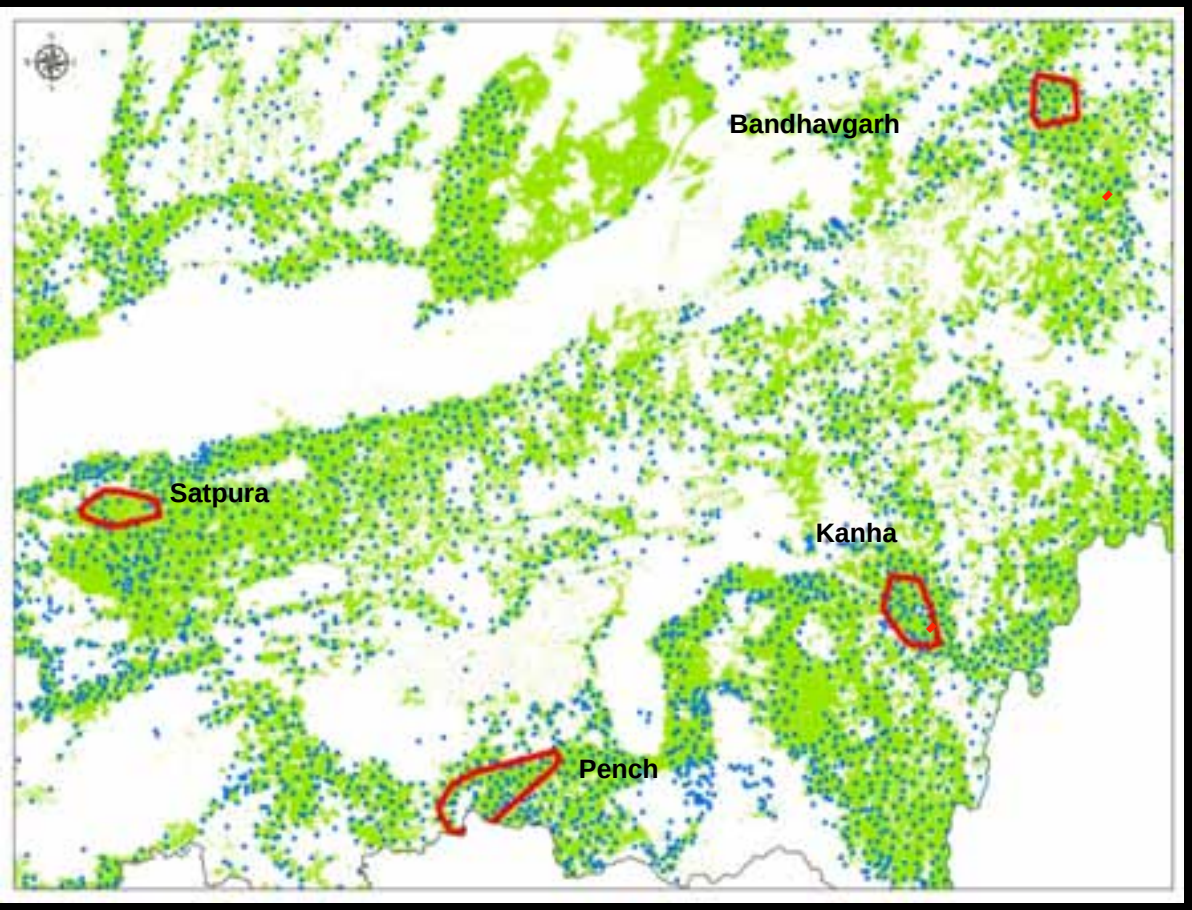
Estimate P - Mark-recapture, Distance Sampling

- Practically impossible to conduct with full coverage in all tiger landscapes

Logical Solution：Double Sampling Approach

- Generate economical and easy to collect index data from all sampling units, e.g. tiger signs, prey encounters, human footprint index, etc.
- Simultaneously sample a subset of above units to estimate absolute abundance by statistically robust methods, e.g. mark-recapture and distance sampling.
- Calibrate indices with known abundance to predict abundance in the larger landscape

Double Sampling Strategy



Indices across entire tiger landscapes
Phase I - Forest Staff

Camera Trap Mark Mecapture, Distance Sampling
Phase III – Wildlife Biologists

Phase I Survey done by Forest Departments across India

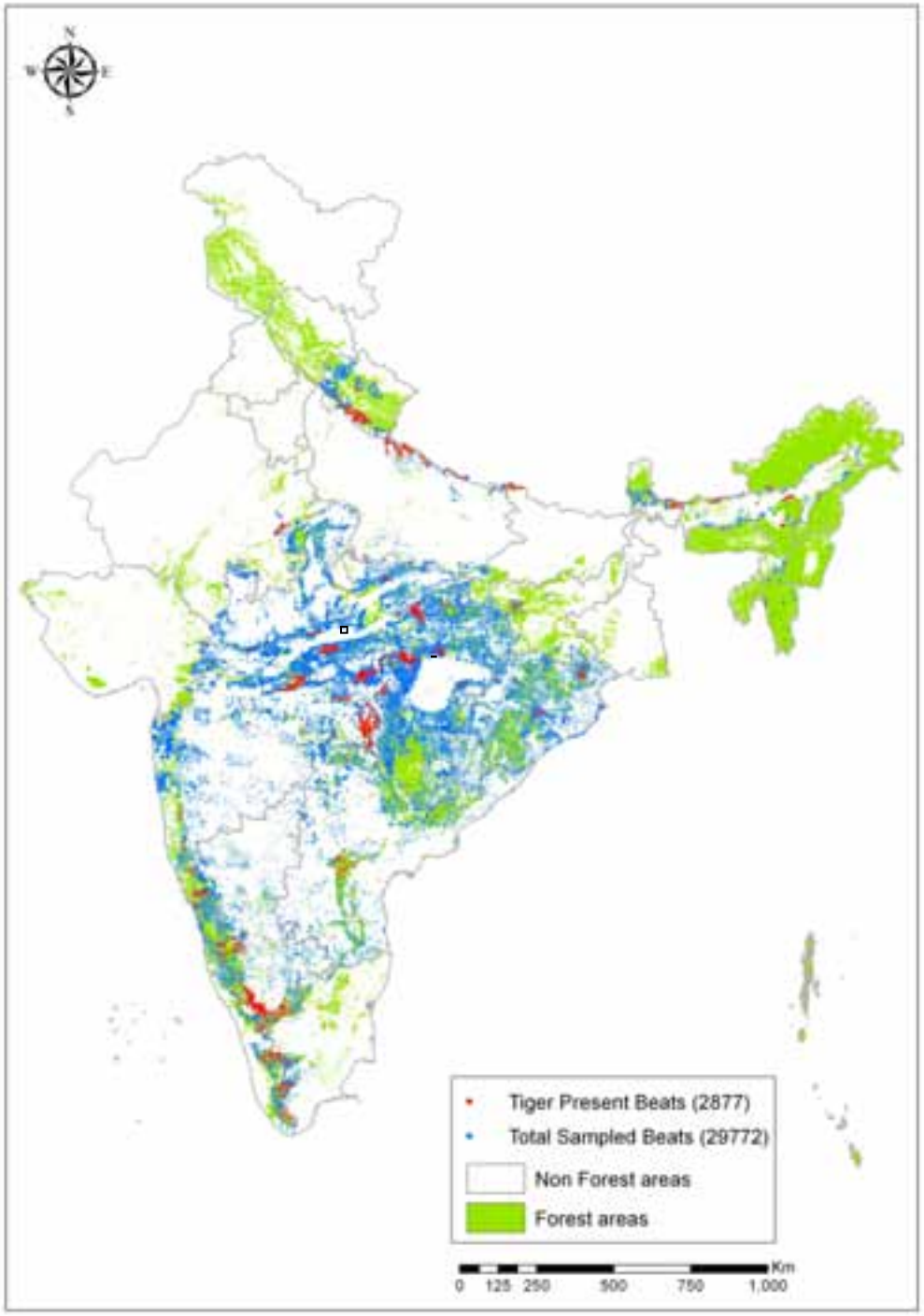
Methodology:

Line transects to estimate prey base density

Sign surveys to detect indirect evidences of carnivores

Vegetation: Canopy cover estimation

Ungulate pellet counts



Distribution of Sampled and Tiger Occupied Beats in India

Phase I

Total sampled beats – 29,772

Tiger occupied beats – 2,877

Search paths (km) – 4,46,580

Transect (km) – 1,78,632

Total km walked – 6,25,212

Total man-days – 4,76,352

Total Area covered > 500,000 km^2

Accounting for Imperfect Detection and Covariates

	Wild prey	livestock	canopy	lopping	Human trail	Wood Cutting	AIC
1	NA	NA	NA	NA	NA	NA	2164.474
2	0.118	NA	NA	NA	NA	NA	1717.563
3	0.122	-0.14	NA	NA	NA	NA	1644.416
4	0.118	-0.133	0.697	NA	NA	NA	1611.508
5	0.12	-0.125	0.71	-0.857	NA	NA	1584.266
6	0.114	-0.115	0.776	-0.782	-0.269	NA	1573.893
7	0.114	-0.115	0.777	-0.714	-0.264	-0.107	1575.497

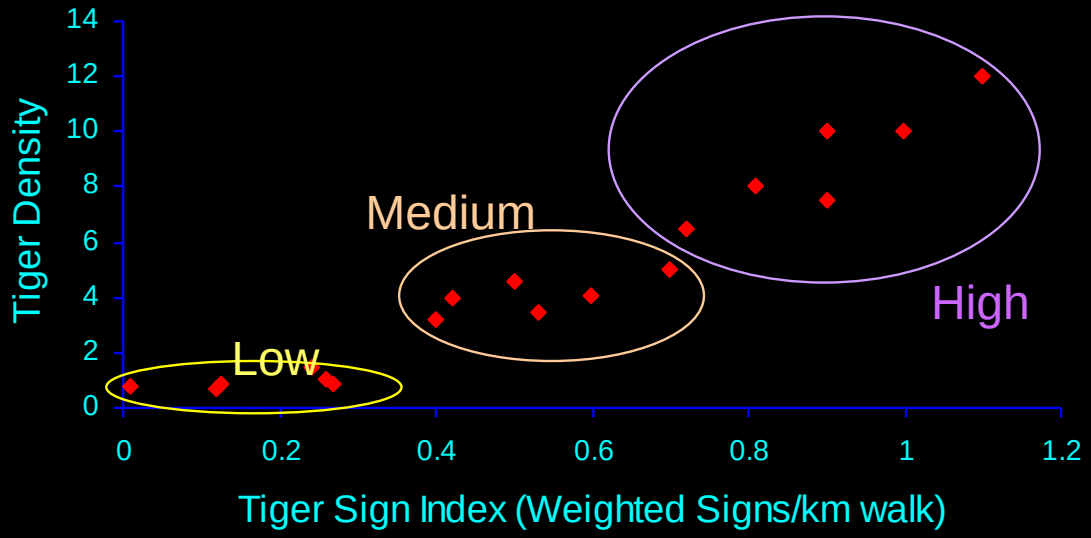
Detection Probability of tigers 0.75 to 0.85

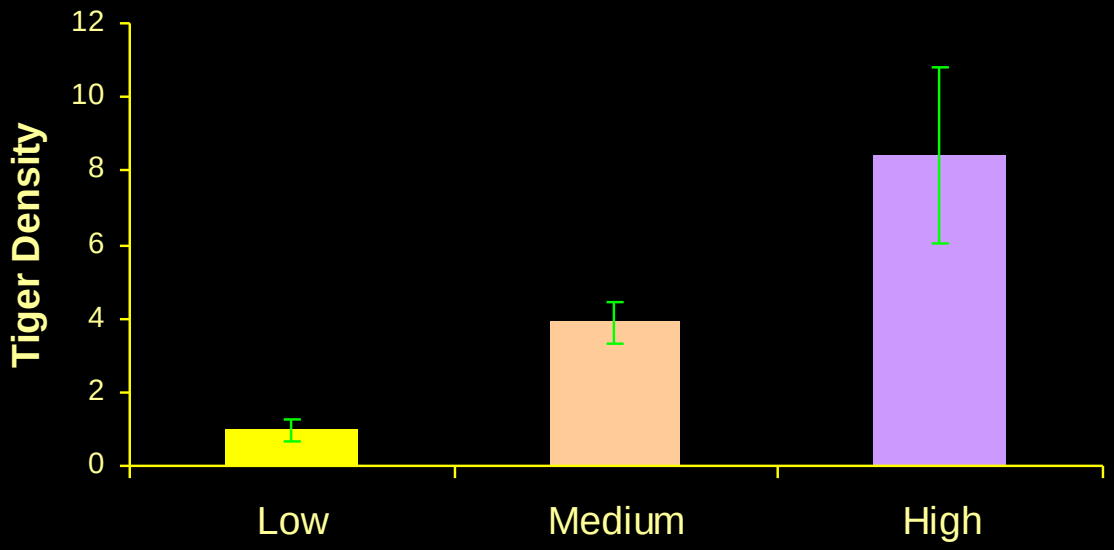
Camera Trap – Mark-Recapture Population Estimation

Sighting-Re-Sighting Statistical Models

Population Estimation Within Primary Periods & Survival Between Primary Periods

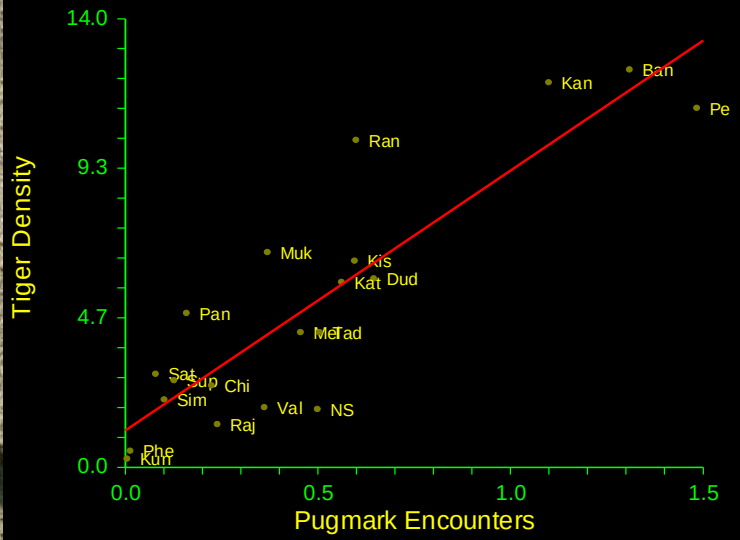
Calibrating Tiger Signs with Tiger Density

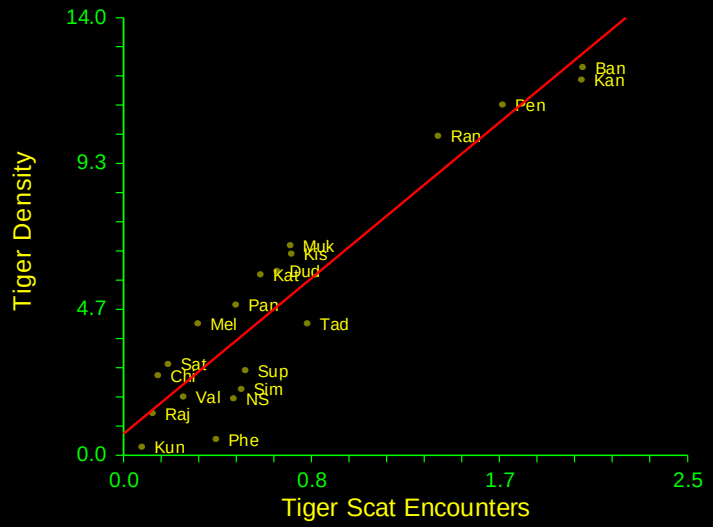




Tiger Abundance Estimated from Indices

Independent Variables	Slope	P value	R^2	Adj. R^2	PRESS R^2
Pug mark	4.85(0.2)	0.001			
SqRt. (Scat)	3.22(0.6)	0.001	0.97	0.97	0.999
Intercept	0.30(0.5)	0.58			





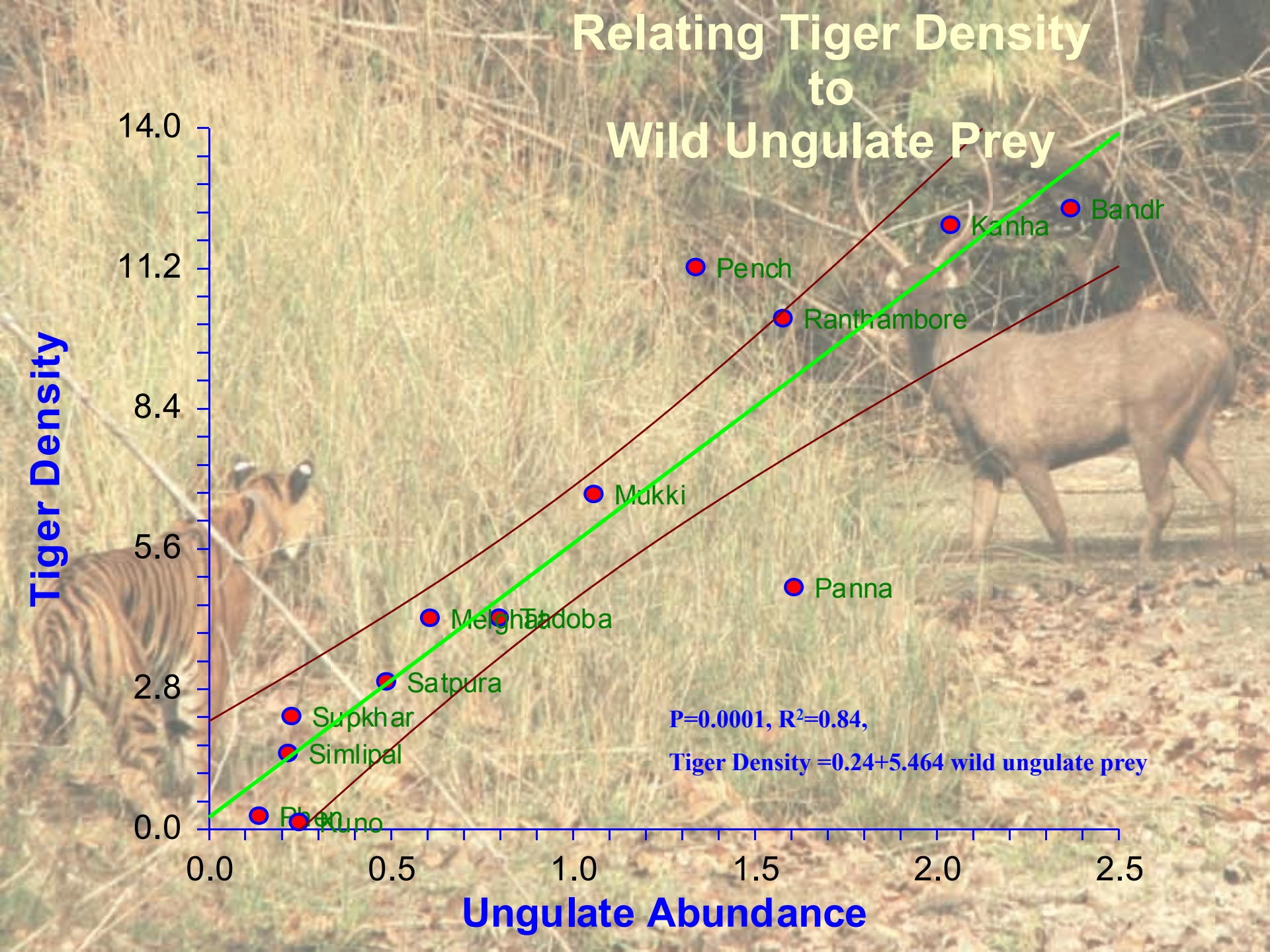
Journal of Applied Ecology doi: 10.1111/j.1365-2664.2010.01901.x

Can the abundance of tigers be assessed from their signs?

Yadvendradev Jhala[1]*, Qamar Qureshi[1] and Rajesh Gopal[2]

[1]*Wildlife Institute of India, PO Box 18, Dehradun 248001, India; and* [2]*National Tiger Conservation Authority, Bikaner House, New Delhi, India*

Relating Tiger Density to Wild Ungulate Prey

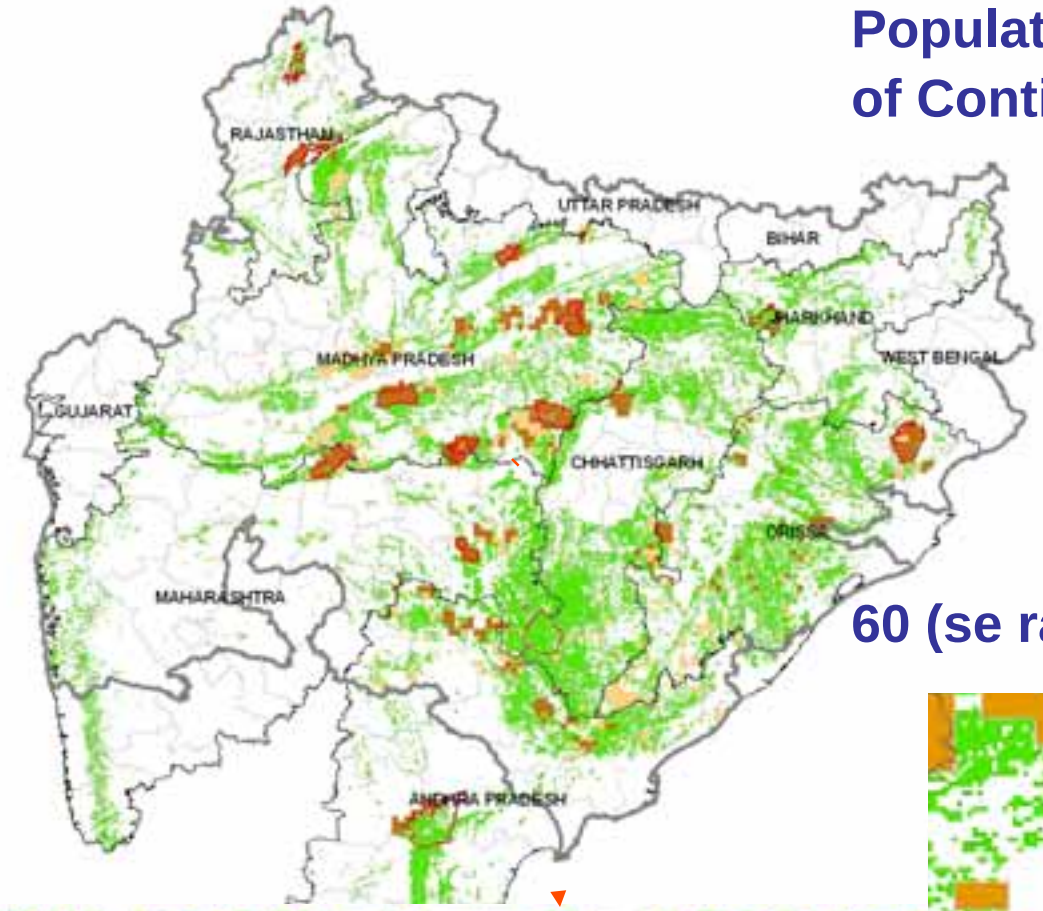


Human Disturbances Tiger Occupancy & Density

Disturbance influence or

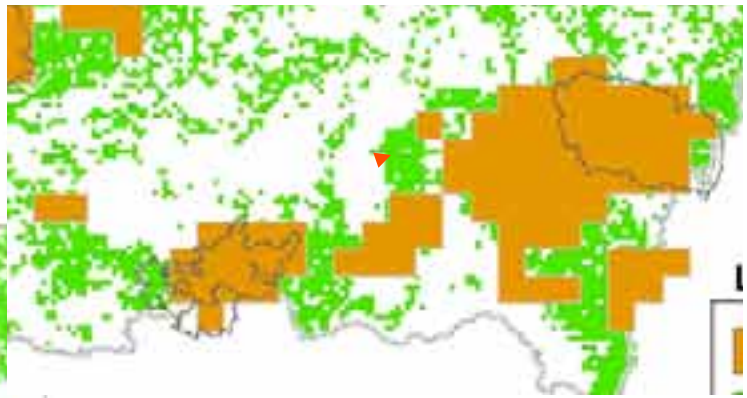
SUPHIKAR
IPAL
NA
0.0
1.5

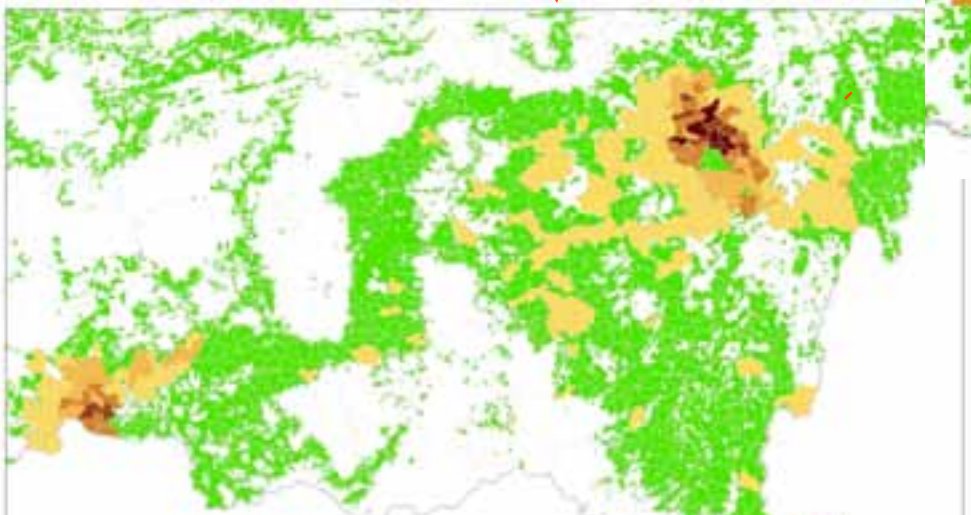
Population Estimates in Forested areas of Contiguous Population Blocks



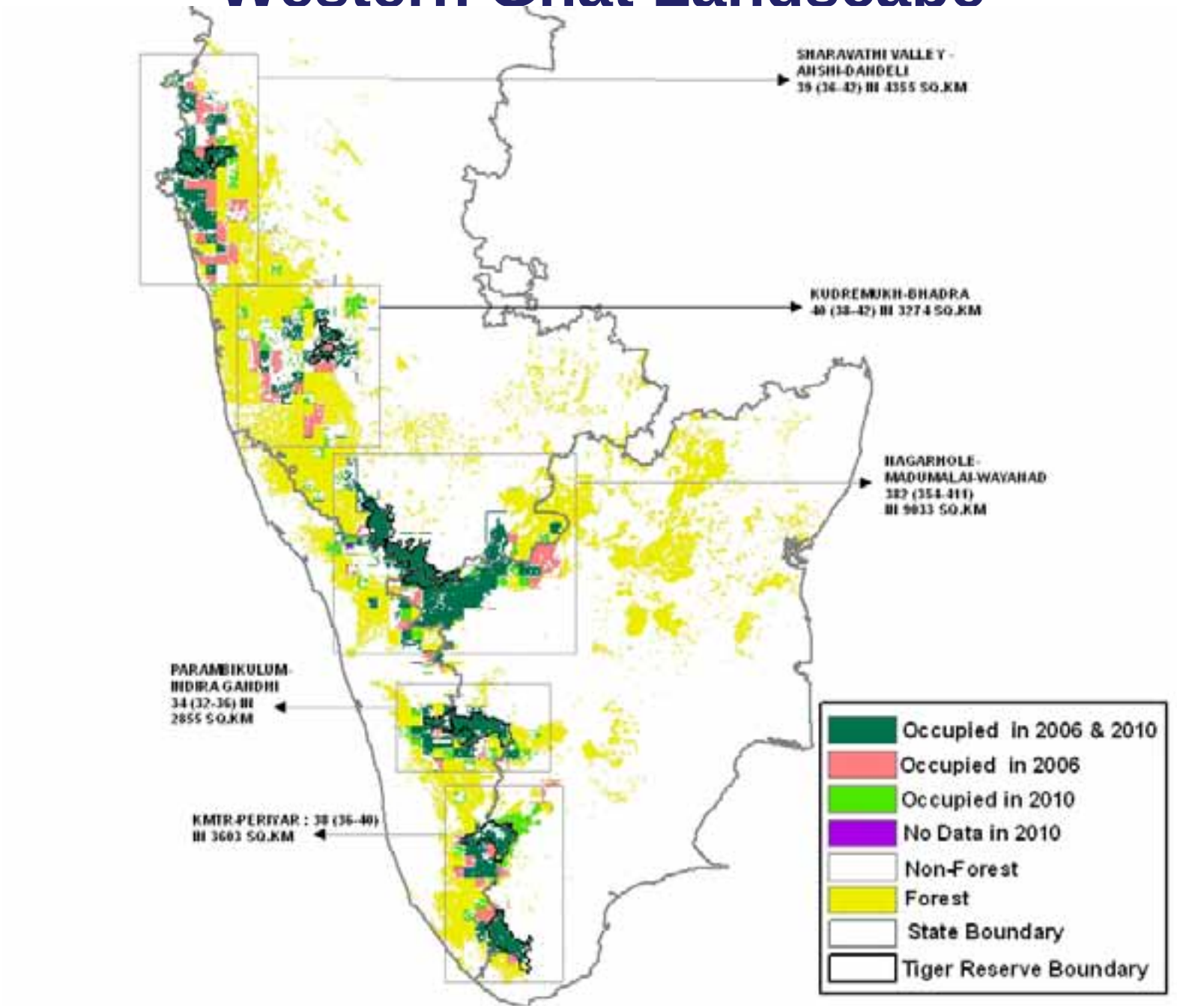
eg. Kanha Landscape - Tiger Population (1837 km^2) estimated at

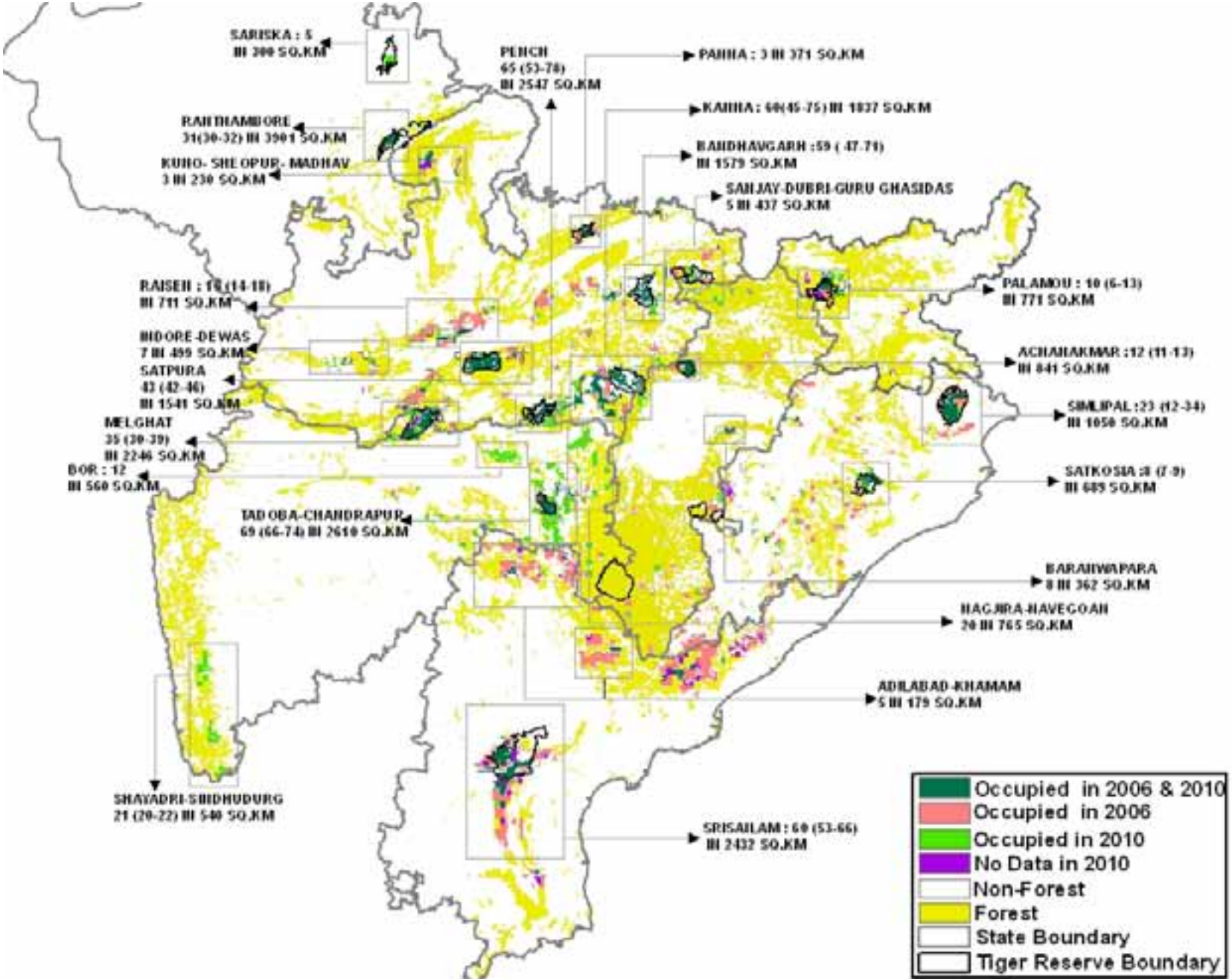
60 (se range 45-75) > 1.5 year old tigers

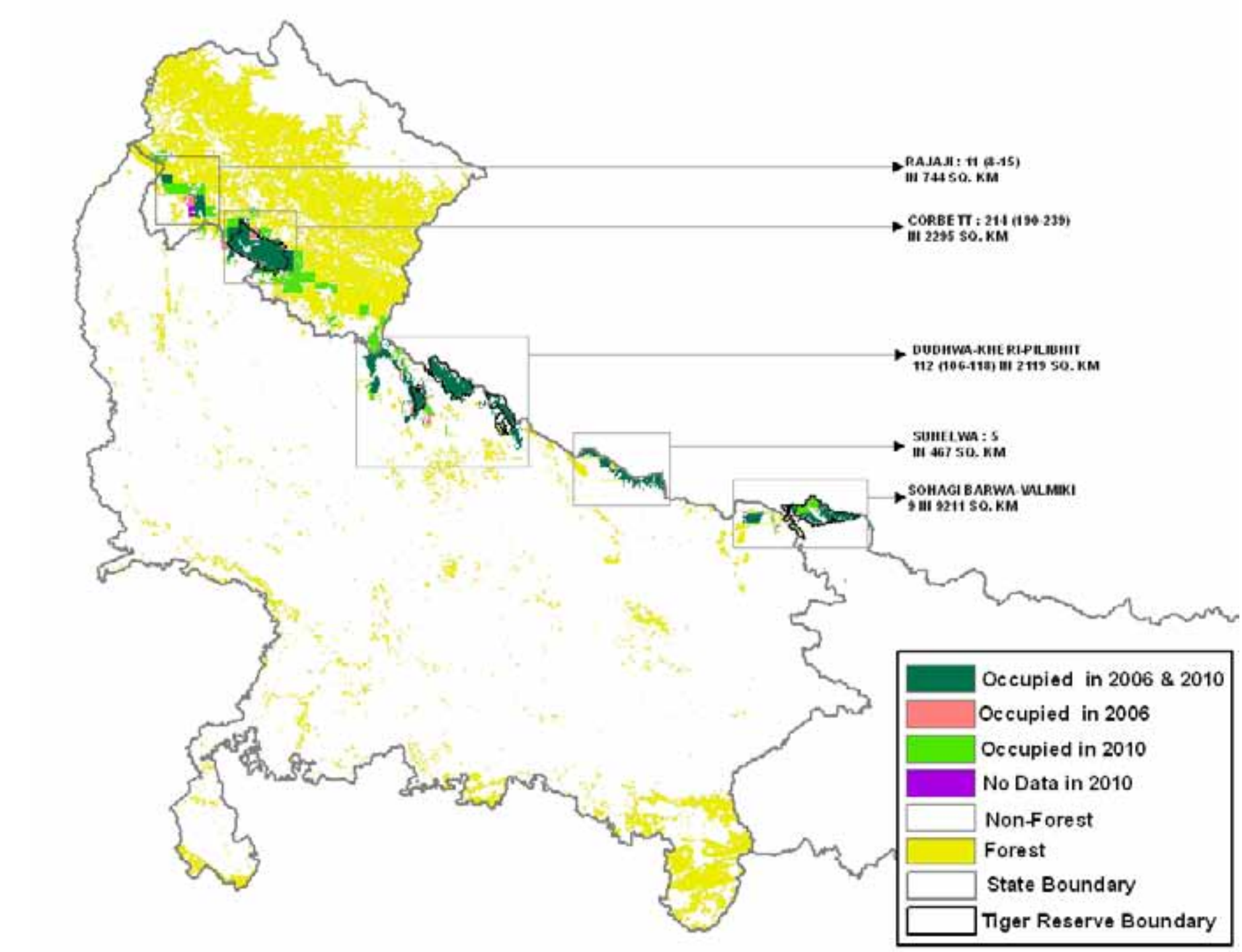


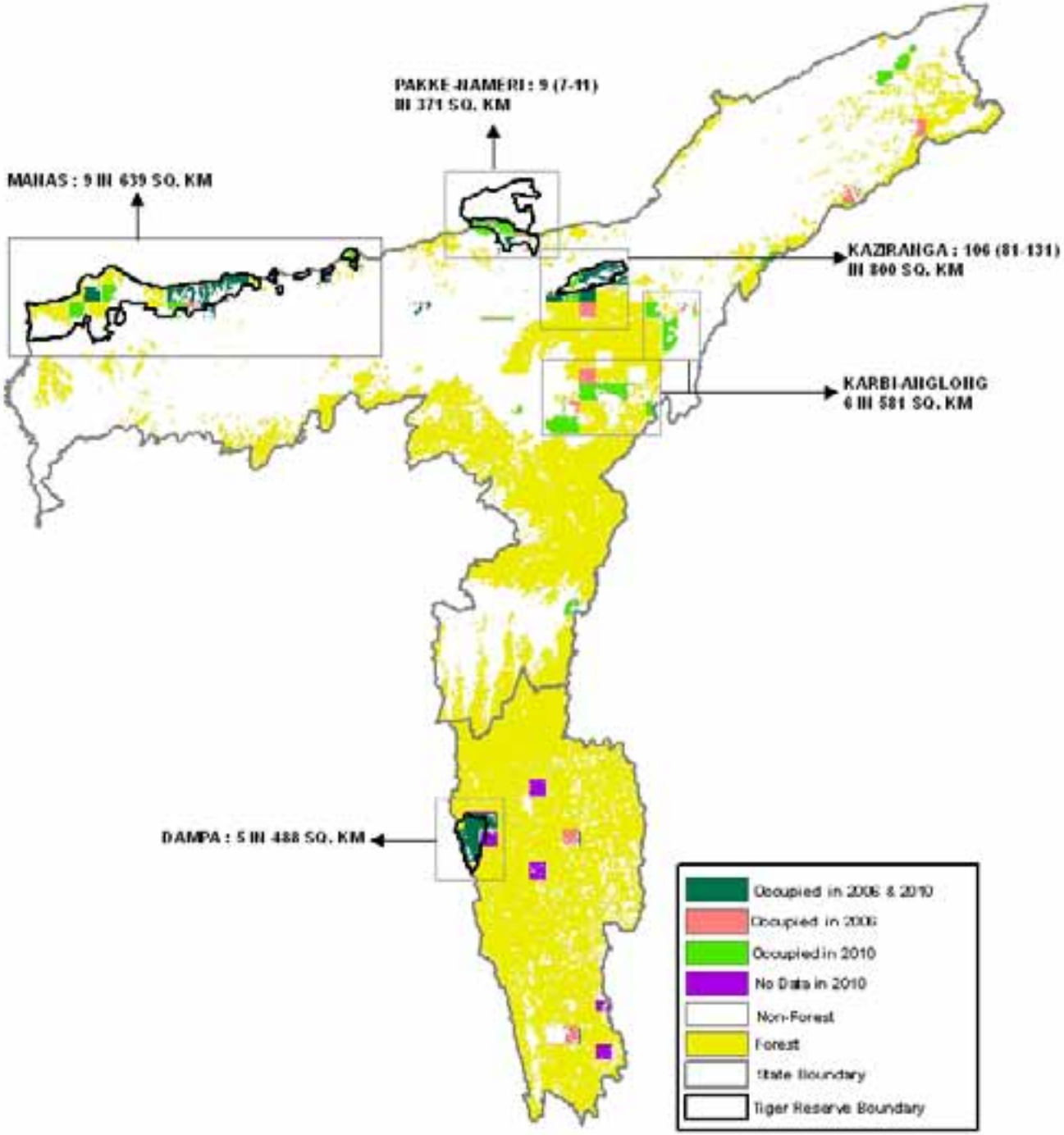


Western Ghat Landscape




SARISKA : 5
III 300 SQ.KM
PENCH
65 (53-78)
III 2547 SQ.KM
PANNA : 3 III 371 SQ.KM
KANHA : 60(45-75) III 1837 SQ.KM
RANTHAMBORE
31(30-32) III 3901 SQ.KM
BANDHAVGARH :59 (47-71)
III 1579 SQ.KM
KUNO- SHEOPUR- MADHAV
3 III 230 SQ.KM
SANJAY-DUBRI-GURU GHASIDAS
5 III 437 SQ.KM
RAISEN : 12 (11-13)
III 711 SQ.KM
PALAMOU : 10 (6-13)
III 771 SQ.KM
BIDORE-DEWAS
7 III 499 SQ.KM
ACHANAKMAR :12 (11-13)
III 841 SQ.KM
SATPURA
42 (42-46)
III 1541 SQ.KM
SIMLIPAL :23 (12-34)
III 1650 SQ.KM
MELGHAT
35 (29-39)
III 2246 SQ.KM
SATKOSIA :8 (7-9)
III 689 SQ.KM
BOR : 12
III 560 SQ.KM
TADOBA-CHANDRAPUR
69 (66-74) III 2610 SQ.KM
BARNAWAPARA
8 III 362 SQ.KM
NAGJIRA-NAVEGOAN
20 III 765 SQ.KM
ADILABAD-KHAMAM
5 III 179 SQ.KM
SHAYADRI-SHIDHUDURG
21 (20-22) III 540 SQ.KM
SRISAILAM : 60 (53-66)
III 2432 SQ.KM
Occupied in 2006 & 2010
Occupied in 2006
Occupied in 2010
No Data in 2010
Non-Forest
Forest
State Boundary
Tiger Reserve Boundary


RAJAJI : 11 (8-15)
III 744 SQ. KM
CORBETT : 214 (190-239)
III 2295 SQ. KM
DUDHWA-KHERI-PILIBHIT
112 (106-118) III 2119 SQ. KM
SUHELWA : 5
III 467 SQ. KM
SOHAGI BARWA-VALMIKI
9 III 9211 SQ. KM
Occupied in 2006 & 2010
Occupied in 2006
Occupied in 2010
No Data in 2010
Non-Forest
Forest
State Boundary
Tiger Reserve Boundary


PAKKE-NAMERI : 9 (7-11)
III 371 SQ. KM
MANAS : 9 III 639 SQ. KM
KAZIRANGA : 106 (81-131)
III 800 SQ. KM
KARBI-ANGLONG
6 III 581 SQ. KM
DAMPA : 5 III 488 SQ. KM
Occupied in 2006 & 2010
Occupied in 2006
Occupied in 2010
No Data in 2010
Non-Forest
Forest
State Boundary
Tiger Reserve Boundary

Sunder Bans – A Challenge

1)**Inter-tidal Zone to be Sampled**

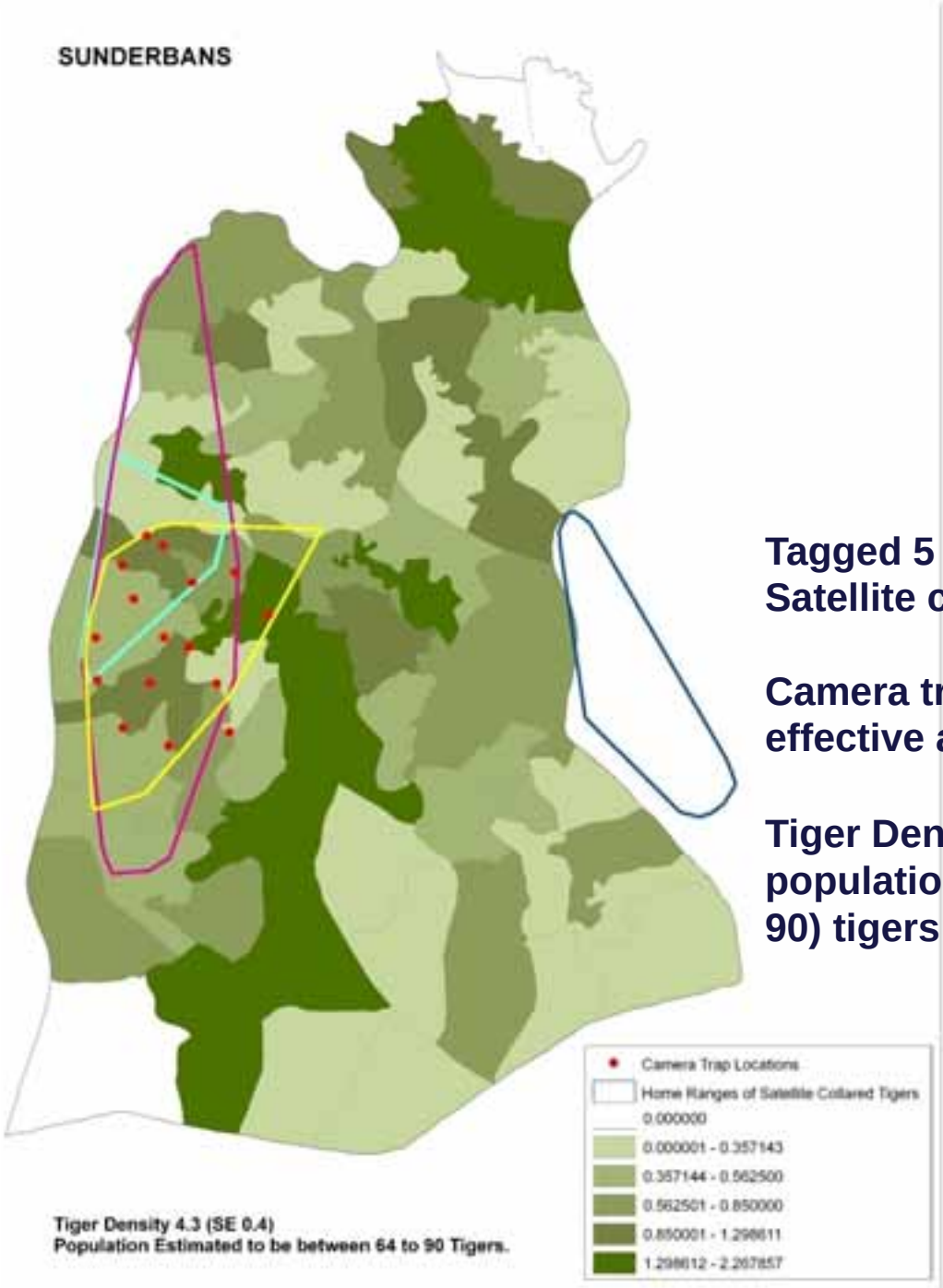
Tiger Sign Density

Tiger Sign Decay – washed away by tide

Tiger Sign Deposition – Intensive monitoring of radio-collared tigers

2) Mark-Recapture based on Intensive Camera trapping and Radio-collaring in limited areas

3) Home range size and overlap

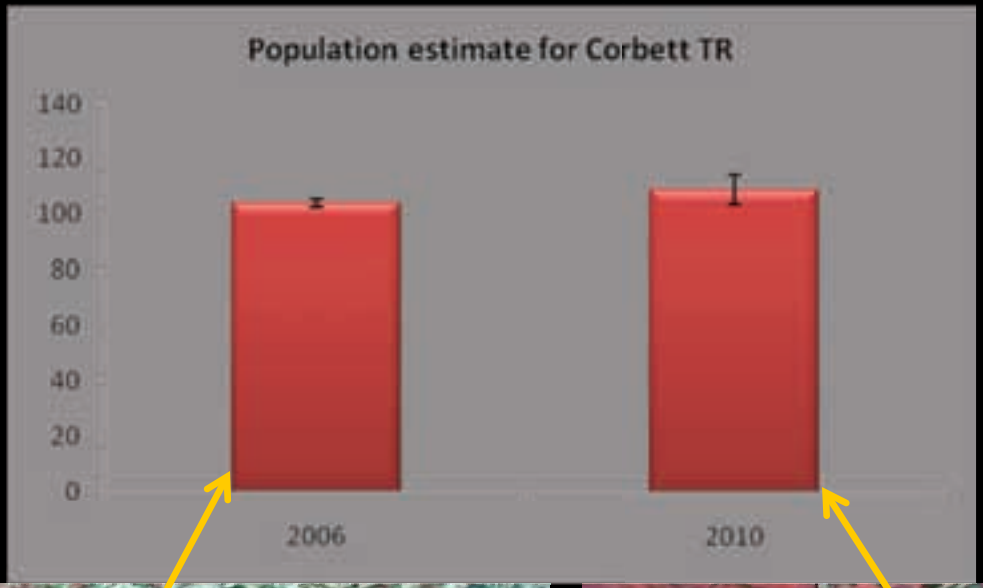


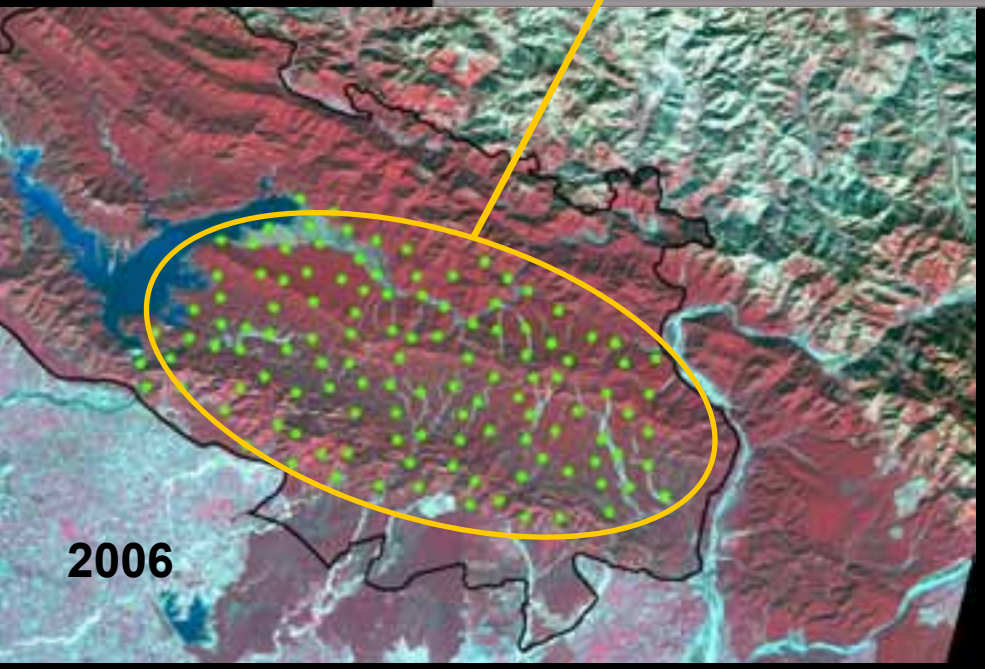
Tagged 5 Tigers with IRIDIUM Satellite collars

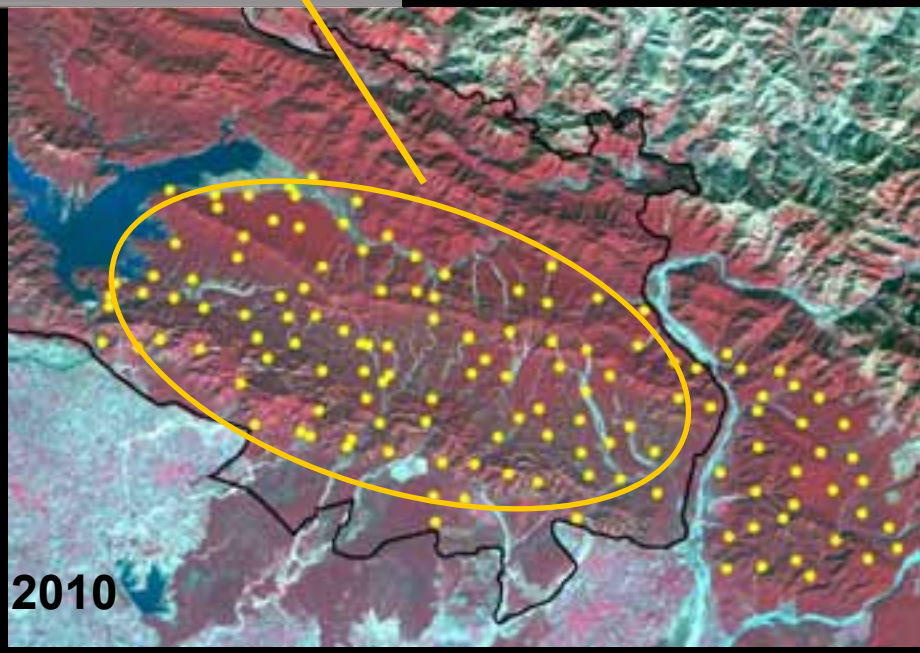
Camera trapped tigers in an effective area of 250 sq km

Tiger Density at 4.3 (se 0.4) and population estimated at 70 (64 to 90) tigers

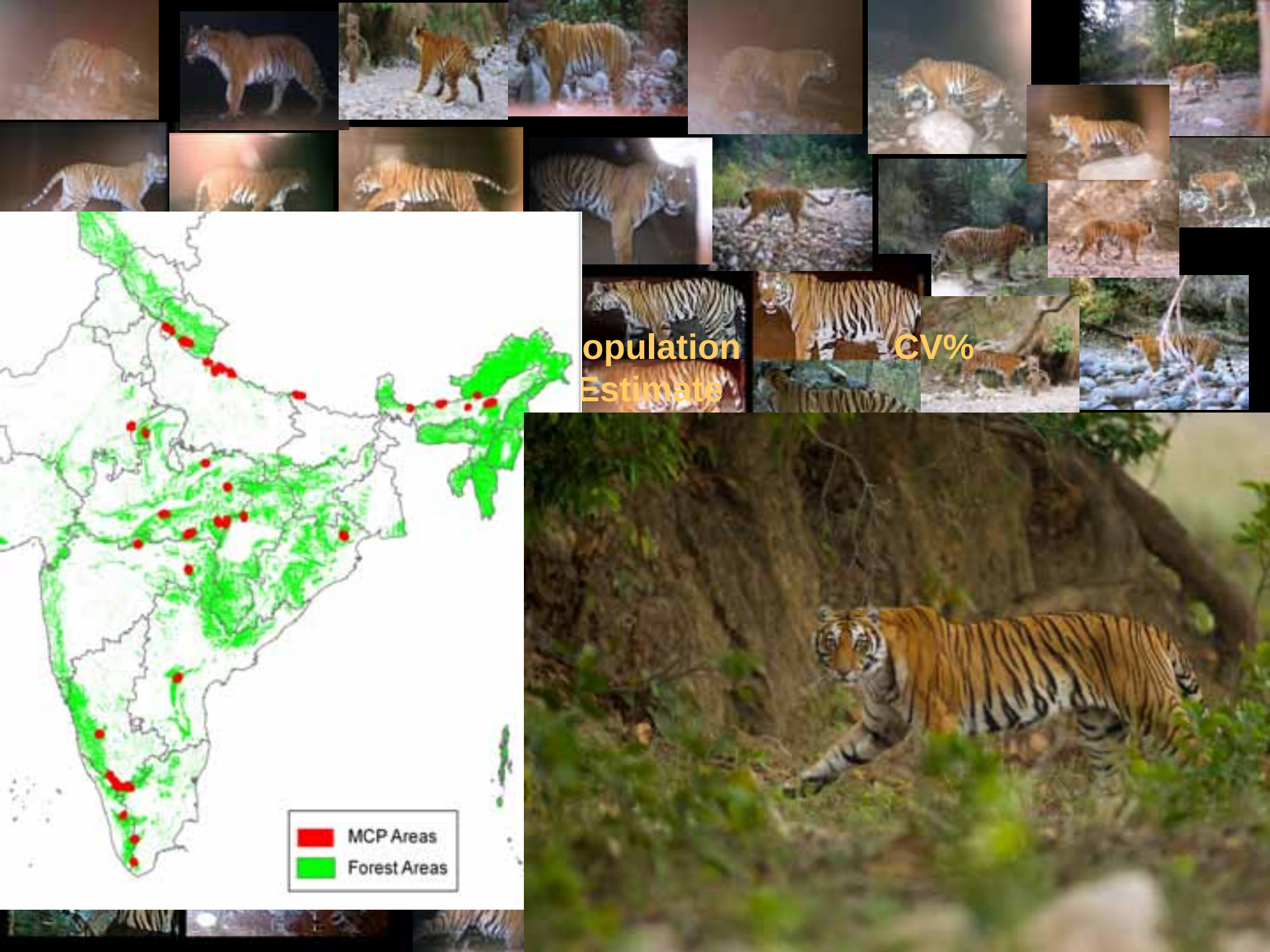
Monitoring Source Populations



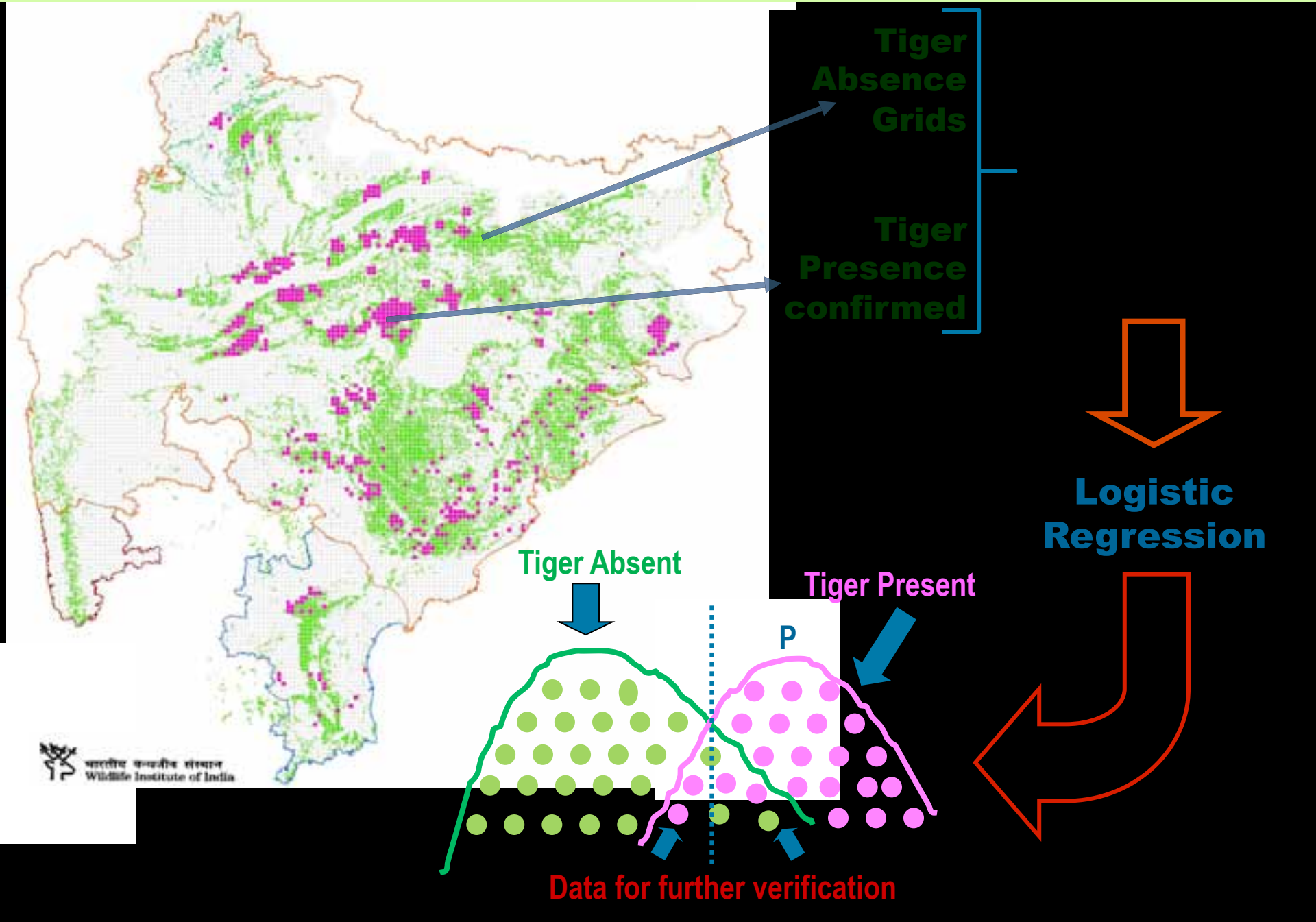




Assessing Source Sites


opulation
CV%
Estimate
MCP Areas
Forest Areas

Detecting Discrepancies and Understanding Characteristics for Tiger Occupancy



Requirement for Scientific Monitoring and Conservation

- Occupancy (Time & Space)
- Population Extent & Size
- Change Detection
- Indication of factors responsible for status and change

Sundarban Tiger Estimation

Salient Points

- Tiger population in India is between 1571 to 1875 (above 1.5 years).
- Comparing the same areas assessed in 2006 the estimate shows a 12 % increase .
- New areas assessed are Sundarbans (70), parts of Maharashtra, Uttrakhand, and Assam.
- Decline in tiger occupancy from 93600 to 72800 km^2 is alarming. Losses are from outside of Protected Areas resulting in isolation of source populations. Need for conserving corridor habitats for long term viability of source populations.

Salient Points ctd..

- Most source populations are stable. Some populations outside the Protected Areas e.g. Moyar-Sigur-Satyamangalam, Ramnagar, Pilibhit, are increasing.

- Increase in tiger populations in high human use areas e.g. surrounds of Corbett, Ranthambore, Tadoba, Bandhavgarh, Bor, have heightened human-tiger conflict. Policy and management strategies to mitigate are essential for continued survival of these tiger populations