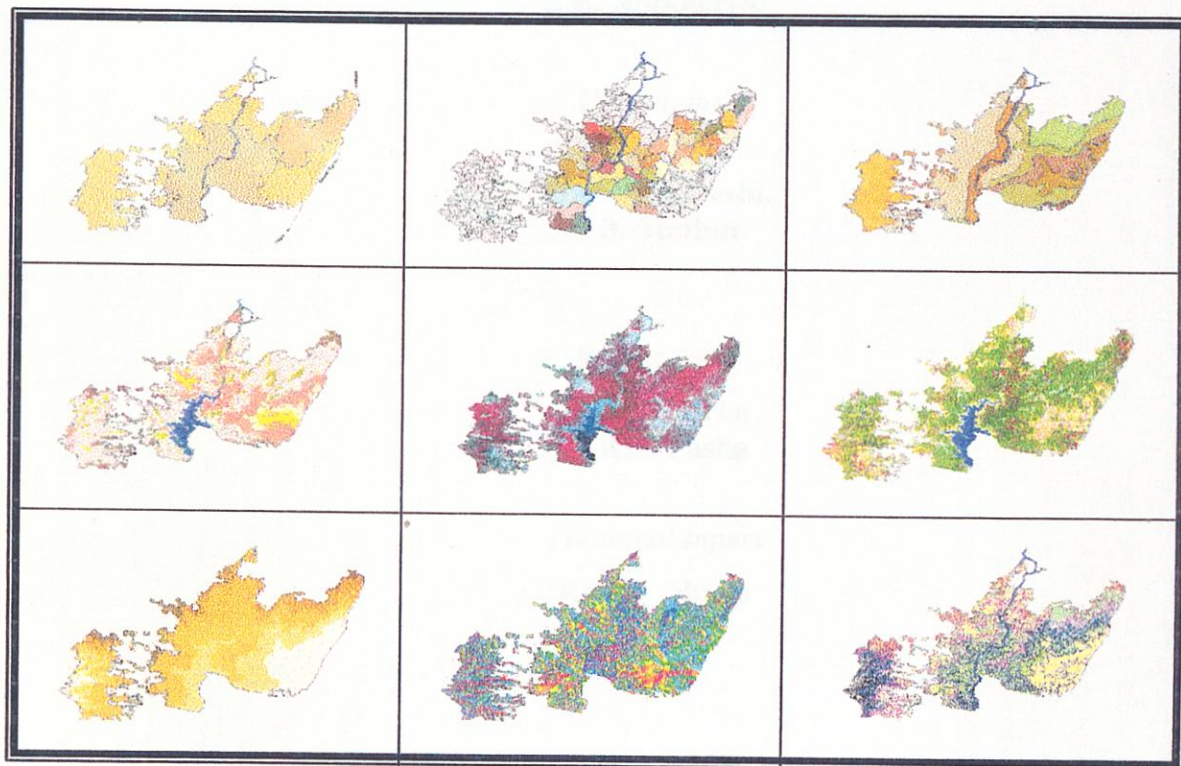


MAPPING OF THE PROTECTED AREA (PA) AND SURROUNDING AREAS IN PENCH TIGER RESERVE, MADHYA PRADESH

*A Consultancy Task Assignment Report Under the India Ecodevelopment Project
for Pench Tiger Reserve, Madhya Pradesh*

FINAL REPORT



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

October 2000

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**भारतीय वन्यजीव संस्थान
Wildlife Institute of India**

October 2000

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A 3D layered database in GIS domain has been prepared that includes 17 general maps, 3 animal distribution maps and 12 thematic maps and a False Colour Composite (FCC) of PTR. This spatial database would form a basis for monitoring changes in subsequent years and also would be of great use for the preparation of Management Plan.

As part of assignment the spatial database developed for the Pench Tiger Reserve has been installed in the PTR office at Seoni. This database will have to be periodically updated by the staff members. It is proposed that the vegetation/land cover map should be updated every five years to monitor the changes. The pre-prepared distribution maps should be annually updated. The update of the thematic layers should be done as per the needs of PTR management. It is also important for the PTR management to identify personnel to be trained for the management of spatial database along with the procurement of appropriate software, for which suggestions have been made in the report.



EXECUTIVE SUMMARY

A one-year consultancy assignment on 'Mapping of the Protected Area (PA) and surrounding areas in Pench Tiger Reserve (PTR), Madhya Pradesh, under the India Ecodevelopment Project was awarded to the Wildlife Institute of India, Dehra Dun in September, 1999 by the Madhya Pradesh Forest Department. The task included the preparation of baseline maps of Pench Tiger Reserve and surrounding areas consisting of features relevant to PA management and ecodevelopment activities. Satellite imagery IRS LISS III (digital data), Survey of India topo-sheets, Soil and Geological maps (1:50,000 scale) for PTR were procured. In addition to this, information on PA boundary, various administrative units, infrastructure and animal census data was obtained from PTR authorities and also through the use of Global Positioning System (GPS) technology. The maps were digitized and incorporated in Geographical Information System (GIS) domain. Ground truthing was carried out for the validation of the field information viz. soil type, geology, geomorphology, ground water potential areas, vegetation and land cover and various PA infrastructure.

A 38 layered database in GIS domain has been prepared that includes 17 general maps, 8 animal distribution maps and 12 thematic maps and a False Colour Composite (FCC) of PTR. This spatial database would form a basis for monitoring changes in subsequent years and also would be of great use for the preparation of Management Plan.

As part of assignment the spatial database developed for the Pench Tiger Reserve has been installed in the PTR office at Seoni. This database will have to be periodically updated by the park-authorities. It is proposed that the vegetation/land cover map should be updated every five years to monitor the changes. The prey-predator distribution maps should be annually updated. The update of the thematic layers should be done as per the needs of PTR management. It is also important for the PTR management to identify personnel to be trained for the management of spatial database along with the procurement of all operational software, for which suggestions have been made in the report.



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1. INTRODUCTION

Better knowledge of the habitats implies information about their extent, composition and potential including their rate of transformation. The principal source of such information has been vegetation mapping. Vegetation maps provide basis for planning and management and for detailed habitat inventories. The design and execution of these comprehensive inventories should be based on a clear definition of management priorities. Vegetation management depends upon a classification of habitats. Regular and continuous monitoring of the habitats permits the detection of change in vegetation components and immediate surroundings.

Remote Sensing and the processing of remotely sensed data through Geographical Information System (GIS) are two most important synergistic technologies which offer ecologists and resource managers, tools of tremendous potential value – to address their needs and process their information (Roughgarden *et al.* 1991 and Sample 1994a). GIS and Remote Sensing allows the processing and viewing the recorded information on different spatial scales. These tools have been termed as geostatistical tools by Rossi *et al.* (1992) and have been described as the tools for modeling and interpreting ecological data in spatial form. Howard *et al.* (1996) has highlighted the importance of the remotely sensed data in linking ecological information recorded from ground, air and space. Cornett (1994) and Sample (1994b) emphasize that GIS and Remote Sensing are catalysts for effective public involvement in ecosystem management planning, analysis and policy making.

Satellite remote sensing data has emerged as a potential tool to study land cover, vegetation type, geomorphology, hydro-geology and human interventions at fine to coarse scales (Haridas *et al.*, 1994; Kim and Weaver, 1994; Krishnmurthy and Srinivas, 1996; Pradeep *et al.*, 1996; Rao *et al.*, 1996; Tripathi *et al.*, 1996; Jain 1998 and Mathur and Naithani 1999). The data provides details on habitat with very high accuracy and in a low cost effective manner. The information base can be judiciously combined with the ground-based studies for comprehensive analysis and modeling. Information content available in the multi-spectral data can form a common database for integrated resource inventories, which are necessary for the habitat characterization, monitoring and

management. Due to the similarity of the temporal data set and repetitiveness, monitoring of the habitat can be accomplished with very high reliability. On the other hand, the GIS data set allows storage, retrieval, and analysis of spatial and non-spatial data in a computer domain. Updating of GIS information base for monitoring purposes is as efficient as well as cost-effective means.

The remotely sensed data obtained from the satellites and the data obtained from Survey of India topographical sheets along with the field information forms an integral part of the GIS database. The outputs obtained with the help of analysis of these multi-layers forms an integral part of the database that comes as a handy tool for the field managers to effectively manage the Protected Areas.

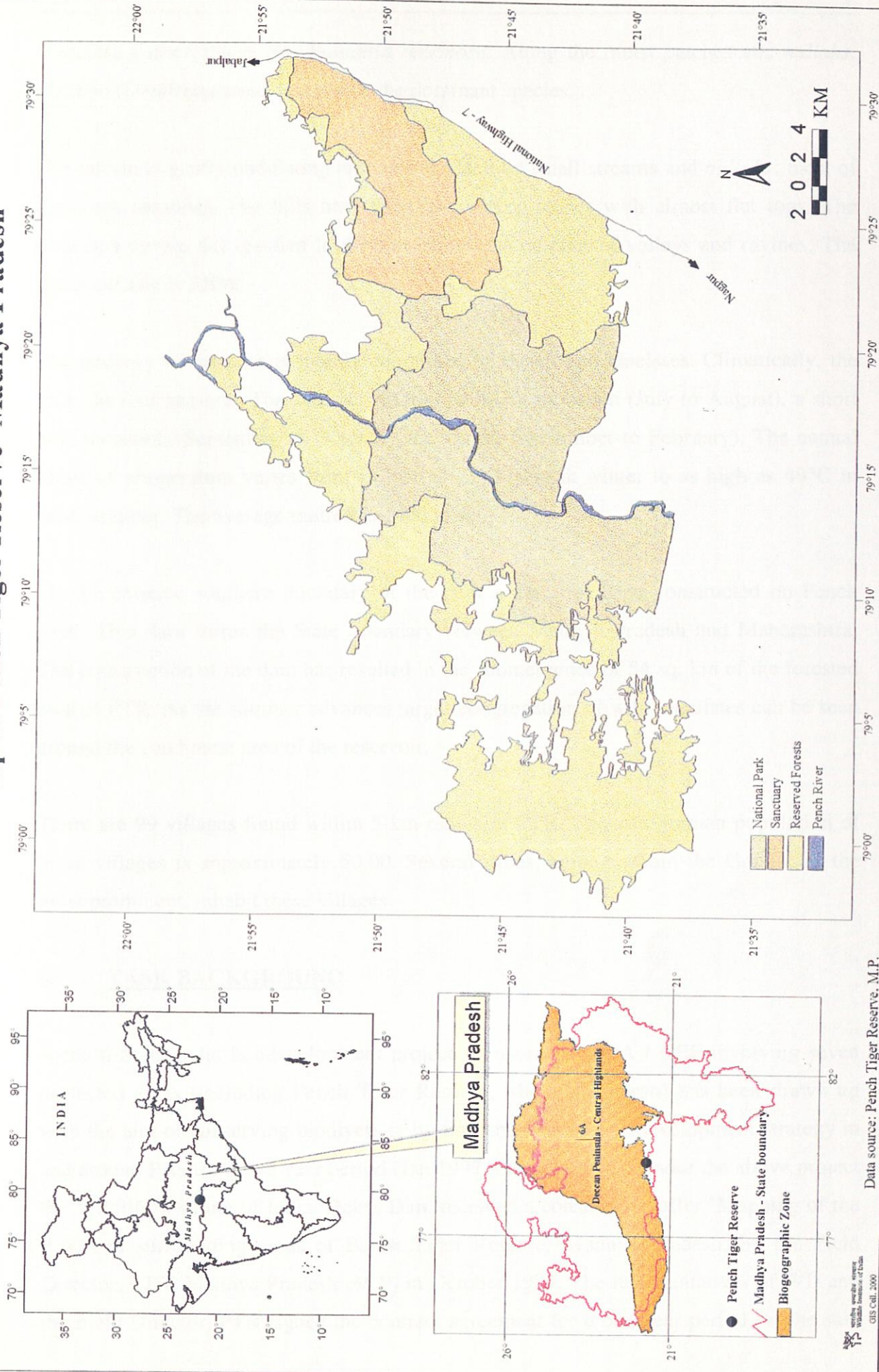
2. STUDY AREA

Pench Tiger Reserve (PTR) (77°55'E to 79°35'E & 21°08'N to 22°00'N), lies in the south-western region of the Madhya Pradesh (Map 1). The Tiger Reserve comprises of the Sanctuary, National Park and Reserved Forest. The total area of PTR is 757.89 sq. km. The Pench River, from which the reserve derives the name, flows through the center of the PA dividing it into the west Chindwara and the east Seoni blocks. Rodgers and Panwar (1988) have classified the area as a part of 6A:Deccan Peninsula – Central Highlands Province of Biogeographic classification of India.

Zoogeographically, PTR is a part of Oriental region. PTR is one of the important habitats of gaur (*Bos gaurus*) in Central India. In addition to gaur, the other wild ungulates occurring in PTR are chital (*Axis axis*), sambar (*Cervus unicolor*), nilgai (*Boselaphus tragocamelus*), barking deer (*Muntiacus muntjac*), chousingha (*Tetracerus quadricornis*), chinkara (*Gazella gazella*) and wild pig (*Sus scrofa*). The carnivore species existing in the area are tiger (*Panthera tigris*), leopard (*Panthera pardus*), wild dog (*Cuon alpinus*), jackal (*Canis aureus*) and jungle cat (*Felis chaus*).

Floristically, PTR belongs to the Indo-Malaya region. The vegetation of PTR is tropical dry deciduous forest (Champion and Seth, 1968). Most of the area is dominated by teak (*Tectona grandis*) or its associates like *Diospyros melanoxylon*, *Lannea coromandelica*, *Grewia tiliacifolia*, *Madhuca indica*, *Lagerstroemia parviflora*, *Anogeissus latifolia*,

Map 1: Pench Tiger Reserve- Madhya Pradesh





Ougeinia dalbergioides and *Bauhinia recemosa*. Along the moist patches and *nullahs*, bamboo (*Dendrocalamus strictus*) is the dominant species.

The terrain is gently undulating and criss-crossed by small streams and *nullahs*; most of these are seasonal. The hills have gradual to steep slopes with almost flat tops. The dissected terrain has resulted in the formation of a number of valleys and ravines. The mean altitude is 550m.

The geology of the area is mainly comprised of Basalt and Gneisses. Climatically, the area has four seasons. The summer (March to June), monsoon (July to August), a short post monsoon (September to October) and winter (November to February). The annual range of temperature varies from as low as -2°C in peak winter to as high as 49°C in peak summer. The average rainfall is 1400 mm.

On the extreme southern boundary of the park a dam has been constructed on Pench river. This dam forms the State boundary between Madhya Pradesh and Maharashtra. The construction of the dam has resulted in the submergence of 54 sq. km of the forested area of PTR. As the summer advances larger congregation of wild ungulates can be seen around the catchment area of the reservoir.

There are 99 villages found within 5-km radius of PTR. The total human population of these villages is approximately 50,00. Several tribes, among whom the Gonds are the most prominent, inhabit these villages.

3. TASK BACKGROUND

A multi-State India Ecodevelopment project sponsored by IDA / GEF involving seven protected areas (including Pench Tiger Reserve, Madhya Pradesh) has been drawn up with the aim of conserving biodiversity by implementing an eco-development strategy in and around PAs for a five year period (Jan 1997 – March 2002). Under the above project the Wildlife Institute of India, Dehra Dun, received a consultancy offer 'Mapping of the P.A. and surrounding areas of Pench Tiger Reserve, Madhya Pradesh, by the Field Director, PTR, Madhya Pradesh (M.P) in October 1999. The representatives of WII and the Field Director, PTR signed the contract agreement for a one-year period for the said



consultancy work on 2.9.99. The work was initiated with effect from 5.10.1999 upon receipt of the first installment of consultancy money by WII as per the Terms of Reference (T.O.R) of the assignment (Annexure I). The inception report giving details about the project initiation by the consultant was sent on 24.11.99 to the Field Director PTR. The mid-term report was submitted on 28.3.2000 and the Draft Final Report on 6.10.2000.

4. TASK OBJECTIVES

The consultancy task has produced baseline maps of the Pench Tiger Reserve, M.P and surrounding areas consisting of:

1. Features relevant to PA management and Ecodevelopment activities.
2. Defining ecological boundaries of the Pench Tiger Reserve

These maps would form a basis for monitoring changes in subsequent years.

5. TASK RESPONSIBILITIES

1. To review and catalogue the availability of satellite imageries, maps and other documents relevant to the production of baseline map of PTR and its surrounding areas up to ecological boundaries.
2. To produce geo-coded baseline maps of PTR and surrounding areas up to ecological boundaries consisting of classified vegetation, topographical and drainage features ecosystems, location of village and town, water bodies and major infrastructure facilities on an appropriate scale using existing maps, digital analysis, satellite imagery and ground truthing.
3. To provide a set of guidelines for periodic updating of the maps.
4. To assist in installation of G.I.S. in PTR for continuous updating and use of such maps by the park authorities.
5. To train staff of PTR in using, interpreting & updating of such maps.
6. To advise on procuring compatible software required for above purposes.

6. METHODS

6.1 Data Acquisition

6.1.1 Procurement of Satellite Imageries: Satellite Imagery IRS – 1C (LISS III digital data) for April, 1999 was procured from NRSA Hyderabad for PTR and its surrounding areas. The data received was in two scenes and the spatial resolution of the image was 23.5 m.

6.1.2 Procurement of topo-sheets: Topographical maps of 1:50,000 scale (SOI 1980) were obtained from Survey of India (SOI) covering the entire park and surrounding areas. The total area of PTR to be mapped falls under the following toposheets: 55 O/2, O/5, O/6, O/9, and 55 K/13 and K/14.

6.1.3 Park boundary, administrative units, infrastructure and animal census data: The official boundary of PTR, administrative units such as forest compartments, beats, circles, and ranges were provided by the PTR authorities (Anon 2000). In addition, location of artificial and natural water-bodies, fire lines, location of ecodevelopment villages, forest rest house, patrolling camps & watch towers and census data on important prey-predators were also provided by the PTR authorities (Anon 2000).

6.1.4 Soil map: The soil map of PTR in 1:50,00,000 scale (NBSS 1996) was procured by the PTR authorities from National Bureau of Soil Survey (NBSS), Nagpur and made available to the consultants.

6.1.5 Geology map: The geology map of PTR in 1: 25,0000 scale (GSI 1978) was procured from Geological Survey of India, Nagpur.

The schematic representation of the process of data acquisition, data analysis using GIS domain and final outcome of various baseline and thematic maps required for PTR management authorities as per the Terms Of Reference (TOR) of the consultancy project is shown in Fig 1. These maps would form a basis for monitoring changes in subsequent years in PTR and also would be of great use for the preparation of Management Plan.

Fig. 1 : Schematic representation of the process of data acquisition, study, processing and final outcome.

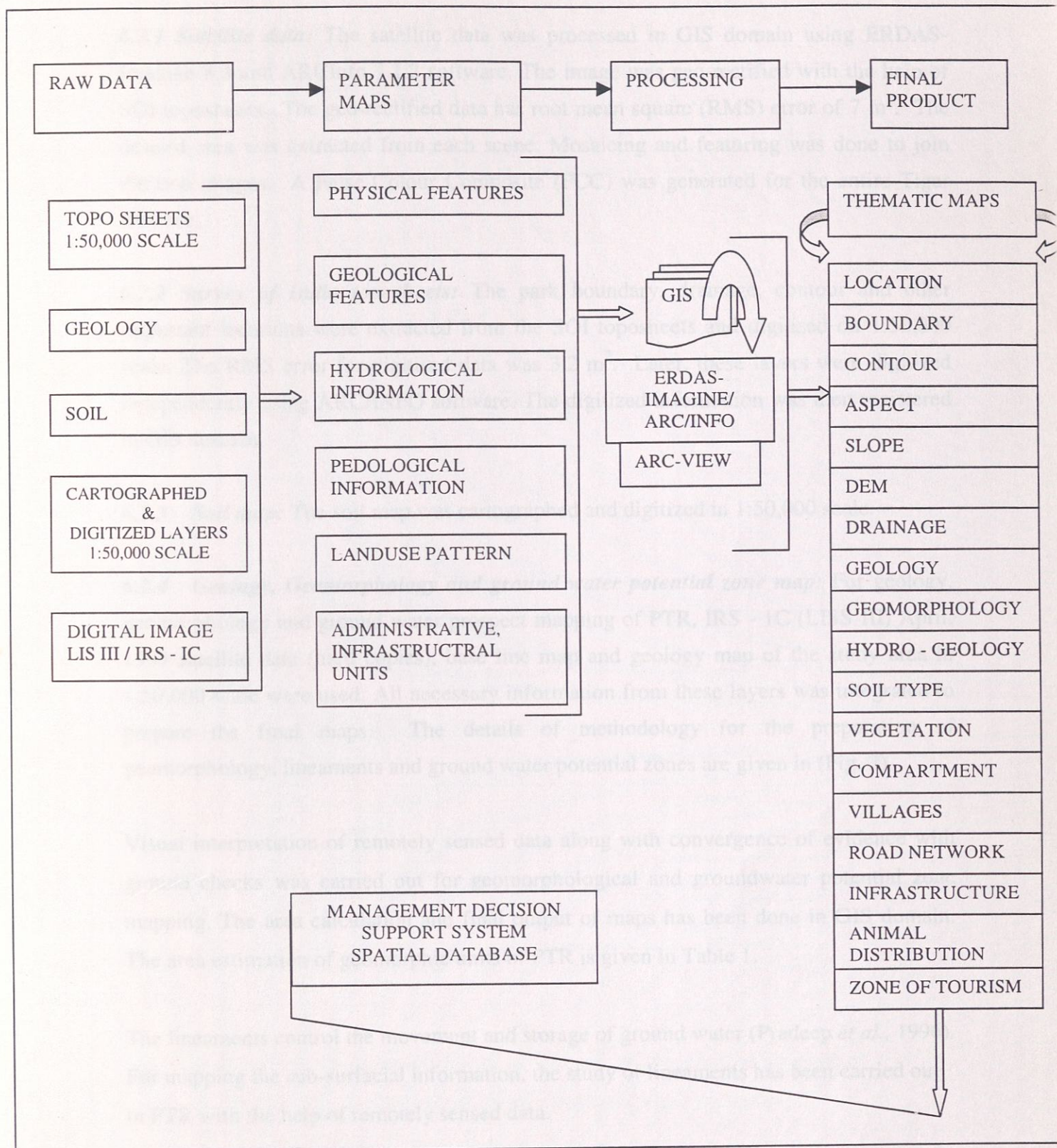


Fig. 1 : Schematic representation of the process of data acquisition, analysis, processing and final outcome.



6.2 Data Processing and Analysis

6.2.1 Satellite data: The satellite data was processed in GIS domain using ERDAS-Imagine 8.3 and ARCInfo 7.1.2 software. The image was geo-rectified with the help of SOI toposheets. The geo-rectified data has root mean square (RMS) error of 7 m². The desired area was extracted from each scene. Mosaicing and featuring was done to join the two images. A False Colour Composite (FCC) was generated for the entire Tiger Reserve.

6.2.2 Survey of India toposheets: The park boundary, drainage, contour and other important locations were extracted from the SOI toposheets and digitised on 1:50,000 scale. The RMS error for digitised data was 3.2 m². Later, these layers were digitized independently using ARC/INFO software. The digitized information was then registered in GIS domain.

6.2.3 Soil map: The soil map was cartographed and digitized in 1:50,000 scale.

6.2.4 Geology, Geomorphology and ground water potential zone map: For geology, geomorphology and ground water prospect mapping of PTR, IRS - 1C (LISS III) April, 1999 satellite data (hard copies), base line map and geology map of the study area in 1:50,000 scale were used. All necessary information from these layers was integrated to prepare the final maps. The details of methodology for the preparation of geomorphology, lineaments and ground water potential zones are given in (Fig. 2).

Visual interpretation of remotely sensed data along with convergence of evidence with ground checks was carried out for geomorphological and groundwater potential zone mapping. The area calculation and final output of maps has been done in GIS domain. The area estimation of geomorphic units of PTR is given in Table 1.

The lineaments control the movement and storage of ground water (Pradeep *et al.*, 1996). For mapping the sub-surficial information, the study of lineaments has been carried out in PTR with the help of remotely sensed data.

Table 1. Area estimation of geomorphic units in Pench Tiger Reserve

Geomorphic Units	Area in Sq. Km
Burried Pediment	35.11
Broken Ground or Bedland	1.24
Reservoir	30.44
Shallow water zone	17.42
Denudational Hill	37.12
Water body/Lake/Pond	1.57
Sand near river bed	1.18
Islands within river	0.09
Plateau/Mesa	10.13
River	3.00
Dissected valley slope	377.387
Denudational hill within reservoir	0.75
Mesa	1.82
Bute	0.21
Inselbergs	0.48
Alluvial Plains	28.16
Pediments	172.83
Plateau	38.15
Bouldery Bed	0.81
Total	757.89

6.2.5 Vegetation and Land Cover Mapping : The LISS III digital data was processed using unsupervised maximum likelihood classification procedure. Thirty classes were extracted for field validation. A map with different colour tones for 30 classes was prepared. This map was carried to the field and interpretation of each colour tone classes was done. The ground truthing for vegetation and land cover was conducted from October 1999 to June 2000. In total, 1050 circular plots (10 m radius for trees and 5 m radius for shrubs) were laid randomly all over the park. GPS locations were taken for all the sampled plots to help in classification of different vegetation types and accuracy assessment. Necessary correction was then incorporated on unsupervised map and accordingly the final rectification was done. The colour classes were merged depending

on the similarity in vegetation types. The map was further improved using supervised maximum likelihood classifier to incorporate unclassified and misclassified data. Twelve vegetation and land cover classes were identified in the final map output. The overall classification accuracy is determined to be 85%.

6.2.6 Park Infrastructure Mapping: Between November 1999 and July 2000 fieldwork was carried out in PTR for the infrastructure mapping. Location of major roads in Sanctuary and National Park, firelines, management units like forest rest houses, watch towers, wireless stations, natural and artificial water bodies, patrolling camps were being taken with the help of Global Positioning System (GPS). A data base file of all GPS locations taken for the infrastructure was created and linked to the spatial data in GIS domain.

6.3 Results and Interpretation of Maps

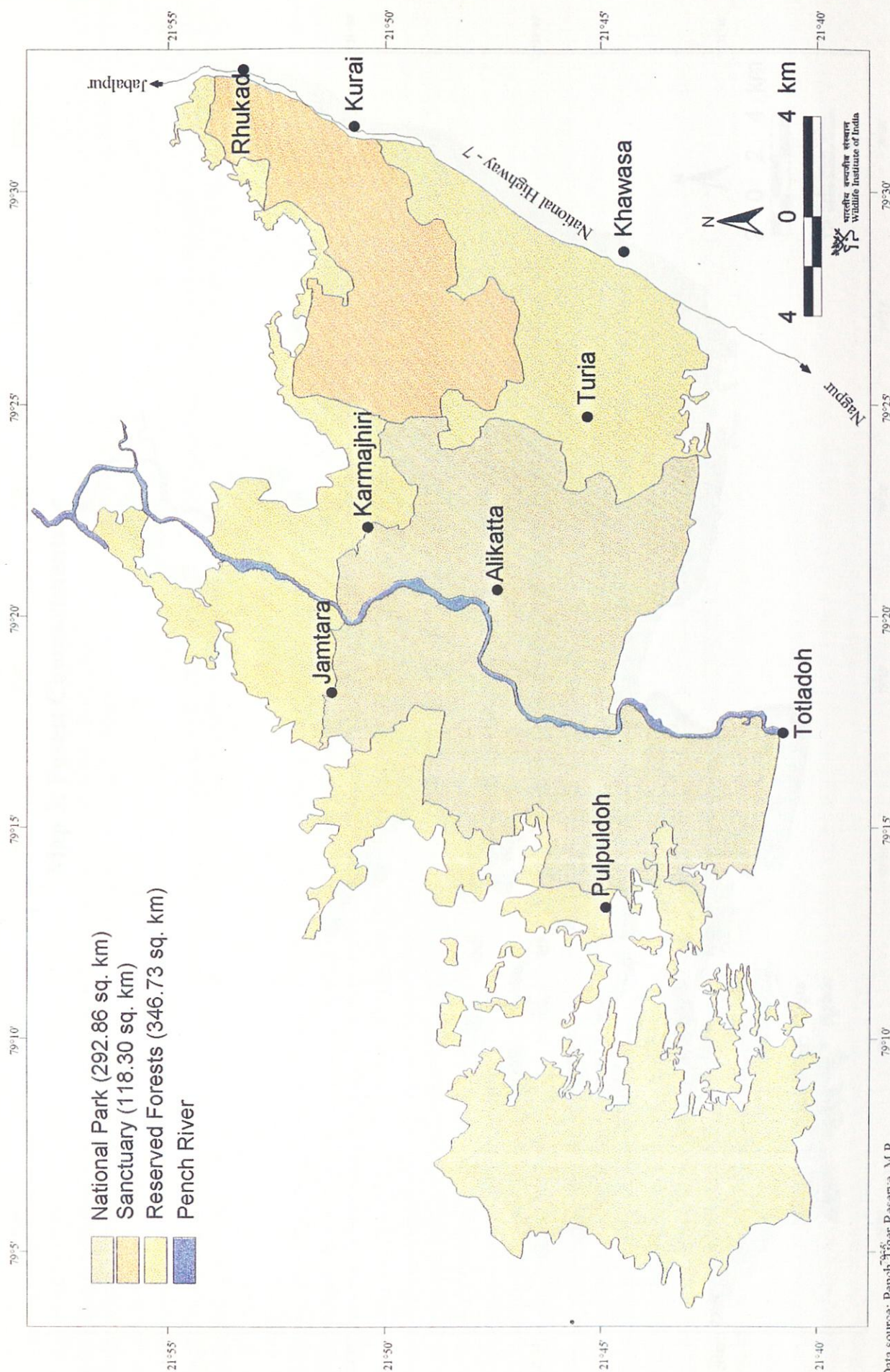
6.3.1 General Maps

6.3.1.1 Pench Tiger Reserve Location and Administrative Boundaries: The geographical location of PTR within the country, Madhya Pradesh State, and Biogeographic Zone is given in Map 1. Map 2 gives the details of major administrative boundaries, the Sanctuary, National Park and the Reserved Forests. Location of some important places within the Park is also given in this map. The total area of the Tiger Reserve is 757.89 km², of which the Sanctuary, National Park and Reserved Forests occupy 118.30 km², 292.86 km², and 346.73 km² respectively.

6.3.1.2 Forest Compartment: In total, there are 162 Forest Compartments found in PTR (Map 3). The number of Forest Compartments found in National Park, Sanctuary and Reserved Forests is 101, 38 and 23 respectively. The smallest compartment is # 158 located in the Sanctuary and the largest is # R-38-B located in the Reserved Forest.

6.3.1.3 Beat, Circle and Range: Beat, Circle and Ranges found in Sanctuary and National Park is given in Map 4.1, 4.2 and 4.3 respectively. In total there are 42 beats, 9 Circle (Alikatta, Dudhgaon, Gumtara, Khamreet, Karmajhiri, Kurai, Murer, Rhukad, Pulpuldoh) and 3 ranges (Gumtara, Kurai, Karmajhiri).

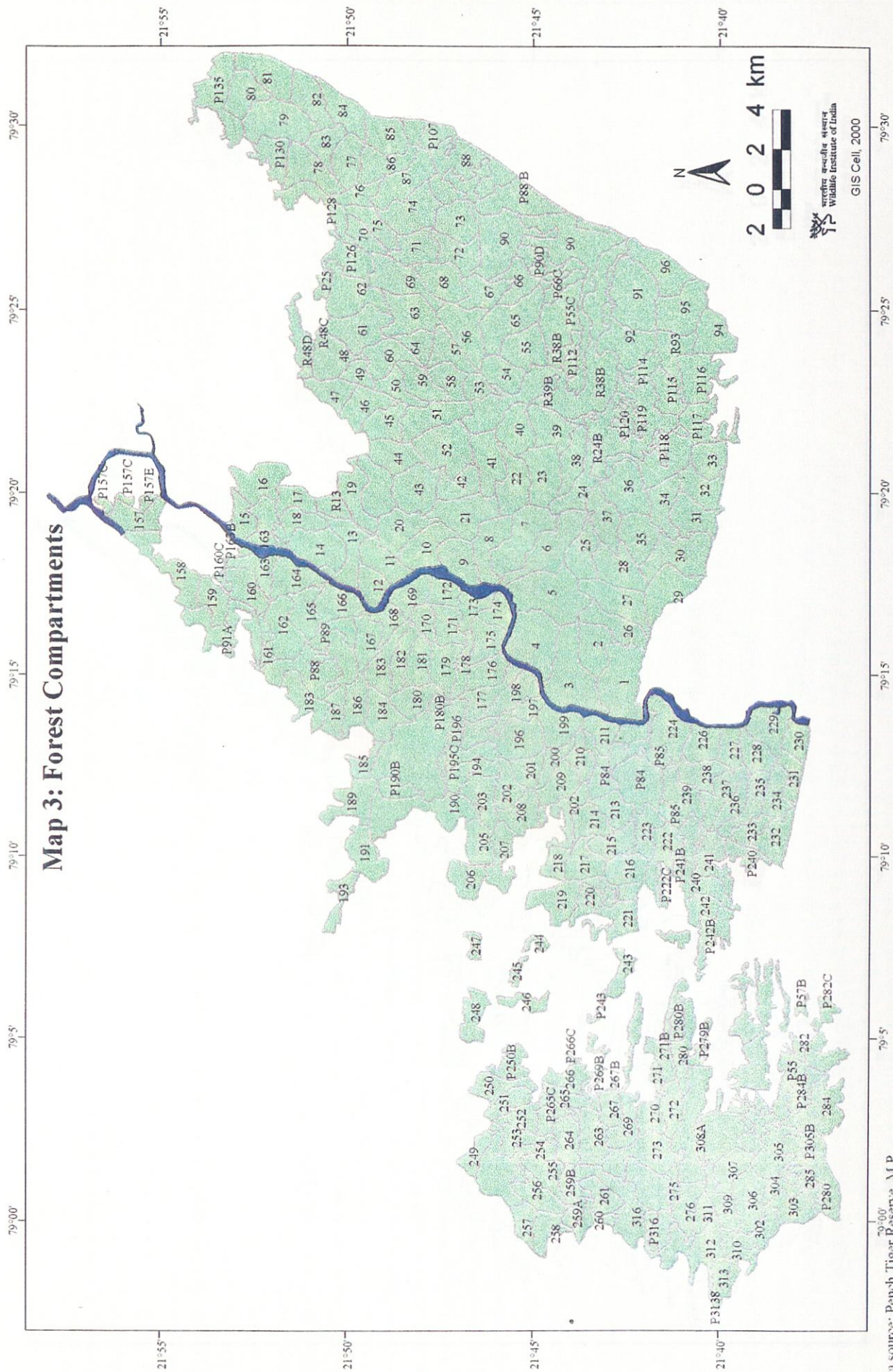
Map 2: Pench Tiger Reserve- Madhya Pradesh



Data source: Pench Tiger Reserve, M.P.

Pench Tiger Reserve, Madhya Pradesh

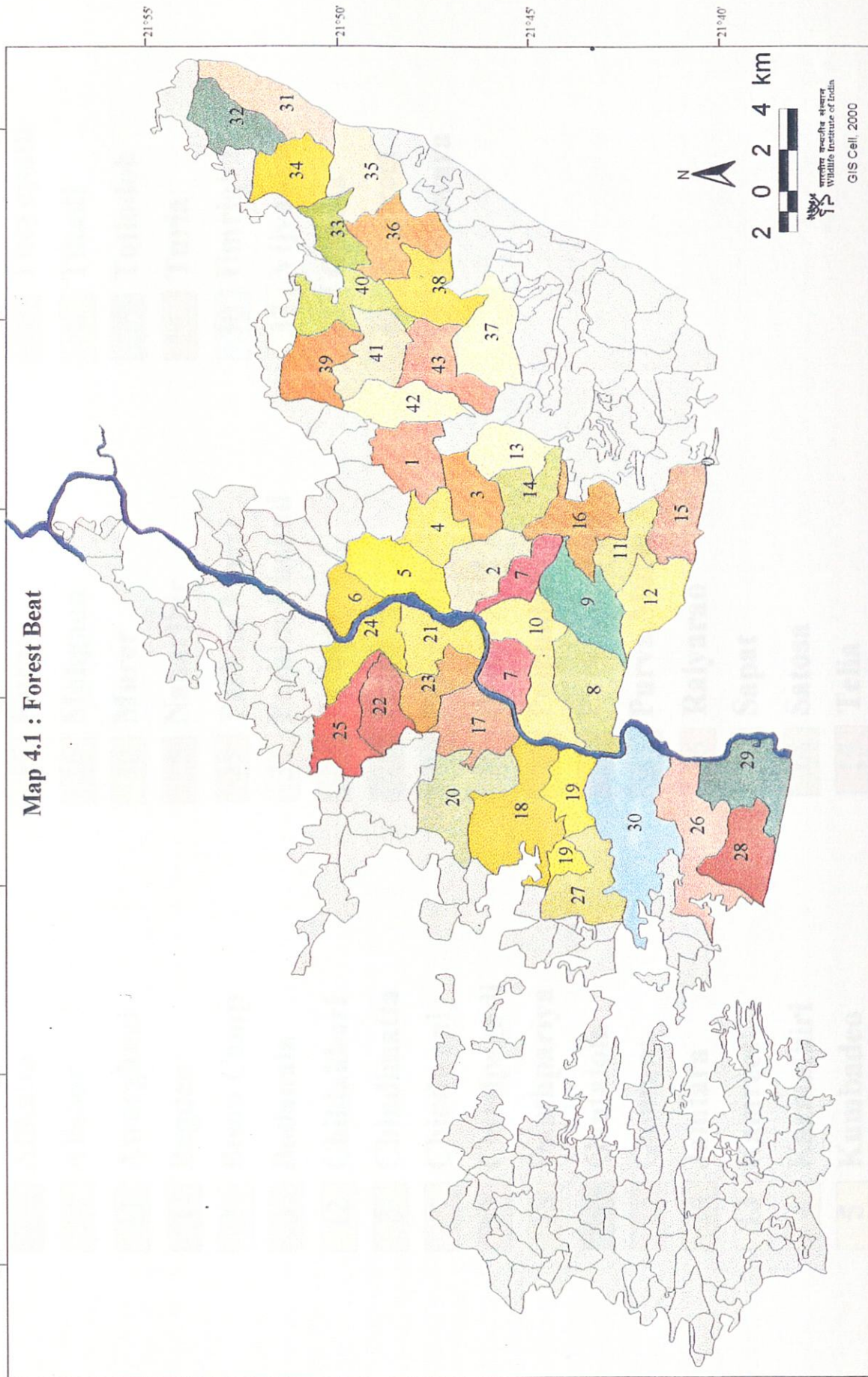
Map 3: Forest Compartments



Data source: Pench Tiger Reserve, M.P.

Pench Tiger Reserve, Madhya Pradesh

Map 4.1 : Forest Beat



Data source: Pench Tiger Reserve, M.P.

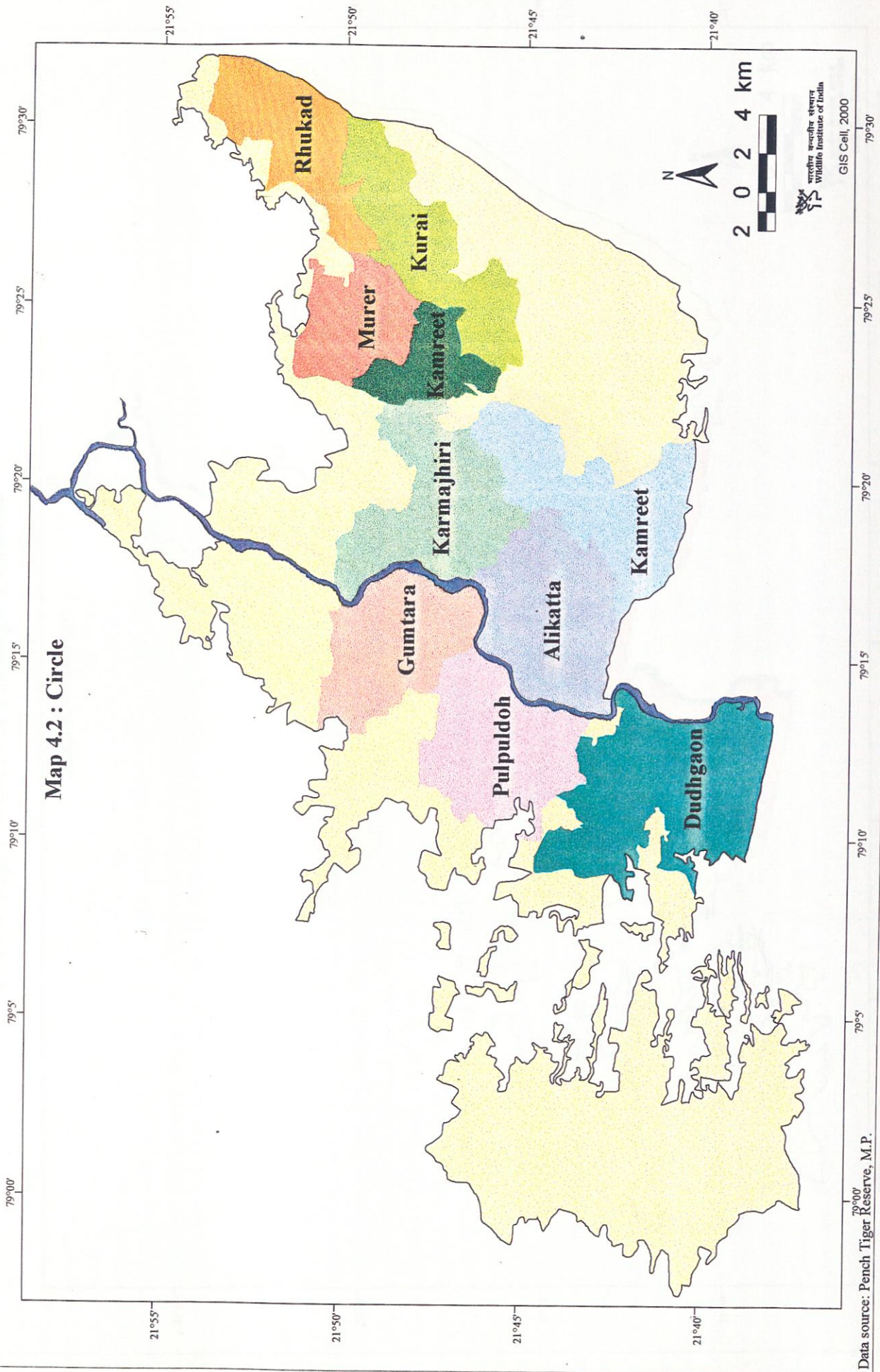
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Wildlife Institute of India
GIS Cell, 2000

Legend : Beat

7	Alikatta	35	Kurai	28	Theyupani
34	Alisoor	26	Mohgaon	6	Tikadi
11	Awarghani	40	Murer	29	Totlodoh
1	Bagdeo	25	Naharjhir	16	Turia
2	Bison Camp	39	Pashim Murer	30	Umrightat
3	Bodanala	31	Pashim Rhukad	37	Vijyapani
12	Chiklakhari	33	Pathrai	21	Chedia
8	Chindimatta	20	Patra	42	Kamreet
17	Chindwani	9	Piyarthadi	19	Kokiwara
22	Chitalpagadi	38	Potiya		
18	Danthpariya	27	Pulpuldoh		
32	Gantatola	43	Purv Kamreet		
23	Guntara	41	Purva Murer		
24	Jamtara	36	Raiyarao		
13	Kamreet	10	Sapat		
4	Karmajhiri	14	Satosa		
5	Kumbadeo	15	Telia		

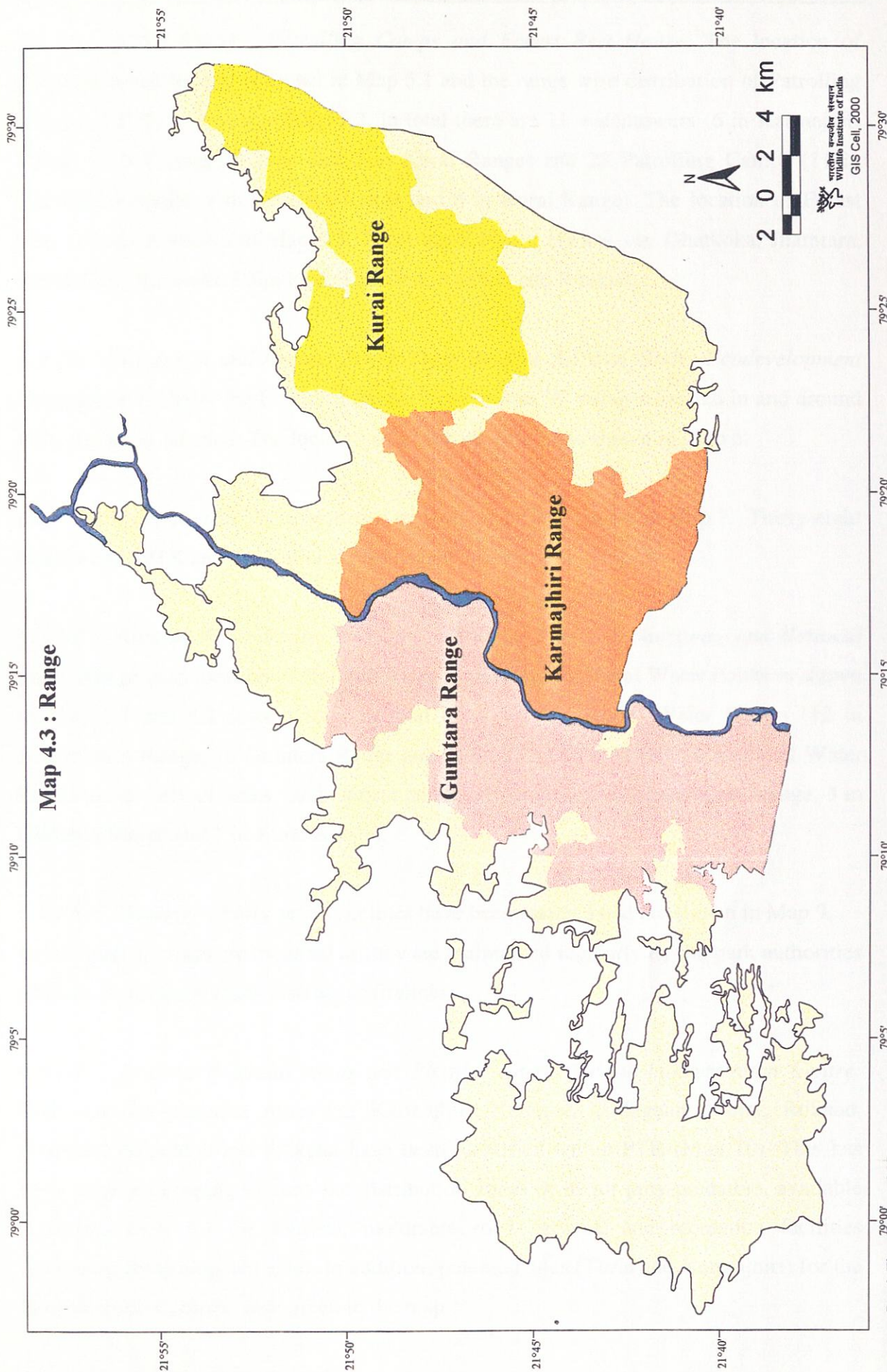
Pench Tiger Reserve, Madhya Pradesh

Map 4.2 : Circle



Pench Tiger Reserve, Madhya Pradesh

Map 4.3 : Range





6.3.1.4 Watch Towers, Patrolling Camps and Forest Rest House: The location of different watch towers is shown in Map 5.1 and the range wise distribution of Patrolling Camps in PTR is shown in Map 5.2. In total there are 11 watchtowers (6 in Karmajhiri Range, 3 in Guntara Range and 2 in Kurai Range) and 28 Patrolling Camps (11 in Karmajhiri Range, 9 in Guntara Range and 8 in Kurai Range). The location of Forest Rest Houses is shown in Map 5.3. There are 8 Forest Houses viz. Ghatkoka, Jhamtara, Karmajhiri, Khawasa, Pulpuldoh, Totladoh, Alikatta and Rhukad.

6.3.1.5 Villages in and Around Pench Tiger Reserve Selected Under Ecodevelopment Programme : Under the Ecodevelopment Programme, 99 villages located in and around PTR are being selected. The location of all the 99 villages is shown in Map 6.

6.3.1.6 Major Roads: The major road network in PTR is shown in Map 7. Thirty-eight roads within PTR and the National Highway # 7 have been mapped.

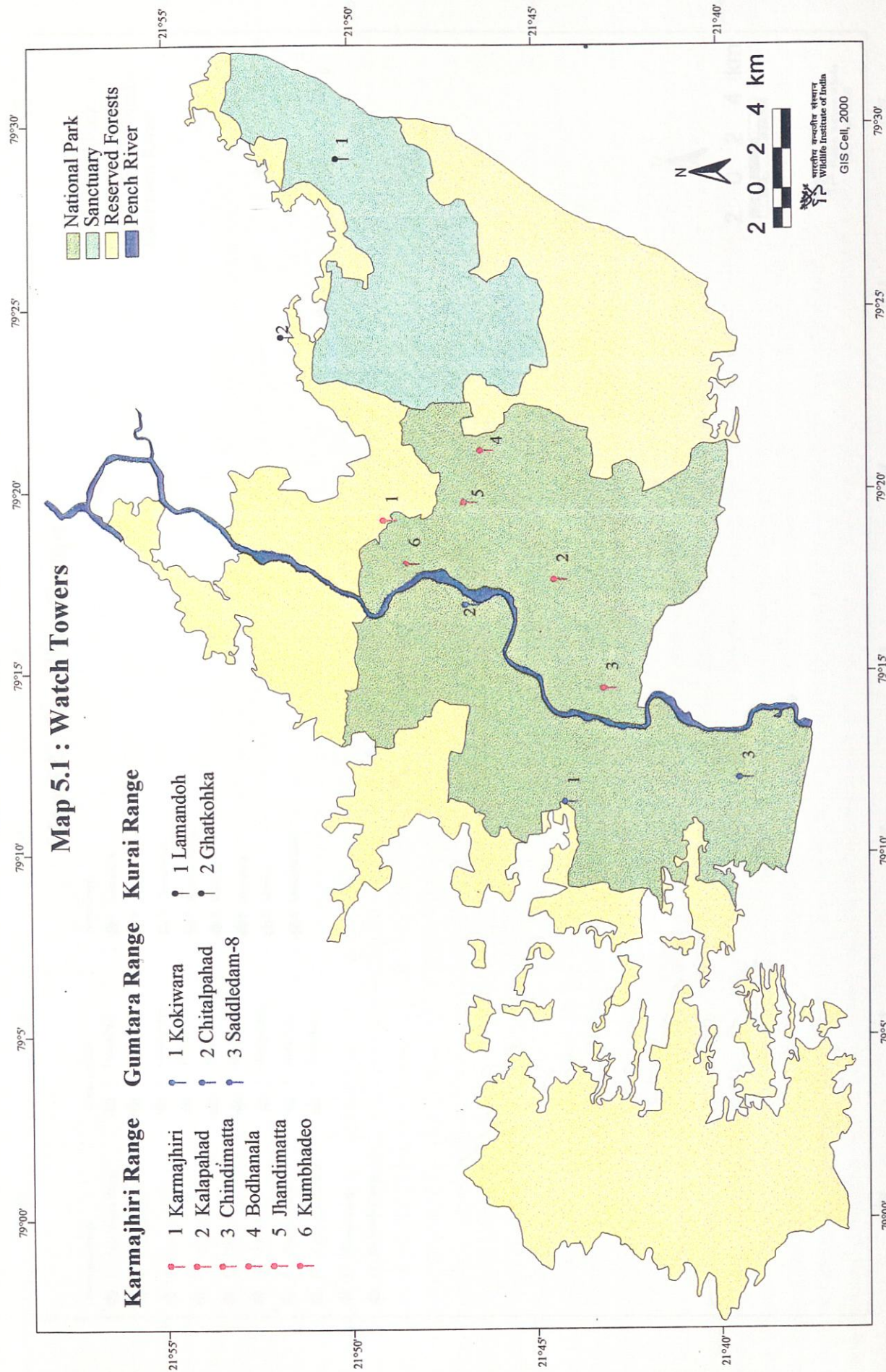
6.3.1.7 Natural Water Bodies and Artificial Water Points in Sanctuary and National Park: Range wise location of Natural Water Bodies and Artificial Water Points is shown in Map 8.1 and 8.2 respectively. In total there are 43 Natural Water Bodies (12 in Kharmajhiri Range, 10 Guntara Range and 21 in Kurai Range) and 14 Artificial Water Points in the form of tanks, talab, anicut and hand pumps (10 in Kharmajhiri Range, 3 in Guntara Range and 1 in Kurai Range).

6.3.1.8 Firelines : Forty seven firelines have been mapped and are shown in Map 9. In this map 35 roads are included as they are maintained regularly by the park authorities and as a result these roads also act as firelines.

6.3.1.9 Tourism Potential Areas and Possible Site(s) for the Interpretation Centre: Eight tourism potential zones viz. Karmajhiri, Kamreet, Dudhgaon, Murer, Rukhad, Guntara, Pulpuldoh and Alikatta have been identified within PTR (Map 10). This has been prepared keeping in view the distribution zones of major prey-predators, available accommodation for the tourists, motorable road network and recreation facilities (including camp elephant ride). In addition, potential sites (Turia and Karmajhiri) for the Interpretation Centre is also given in the map.

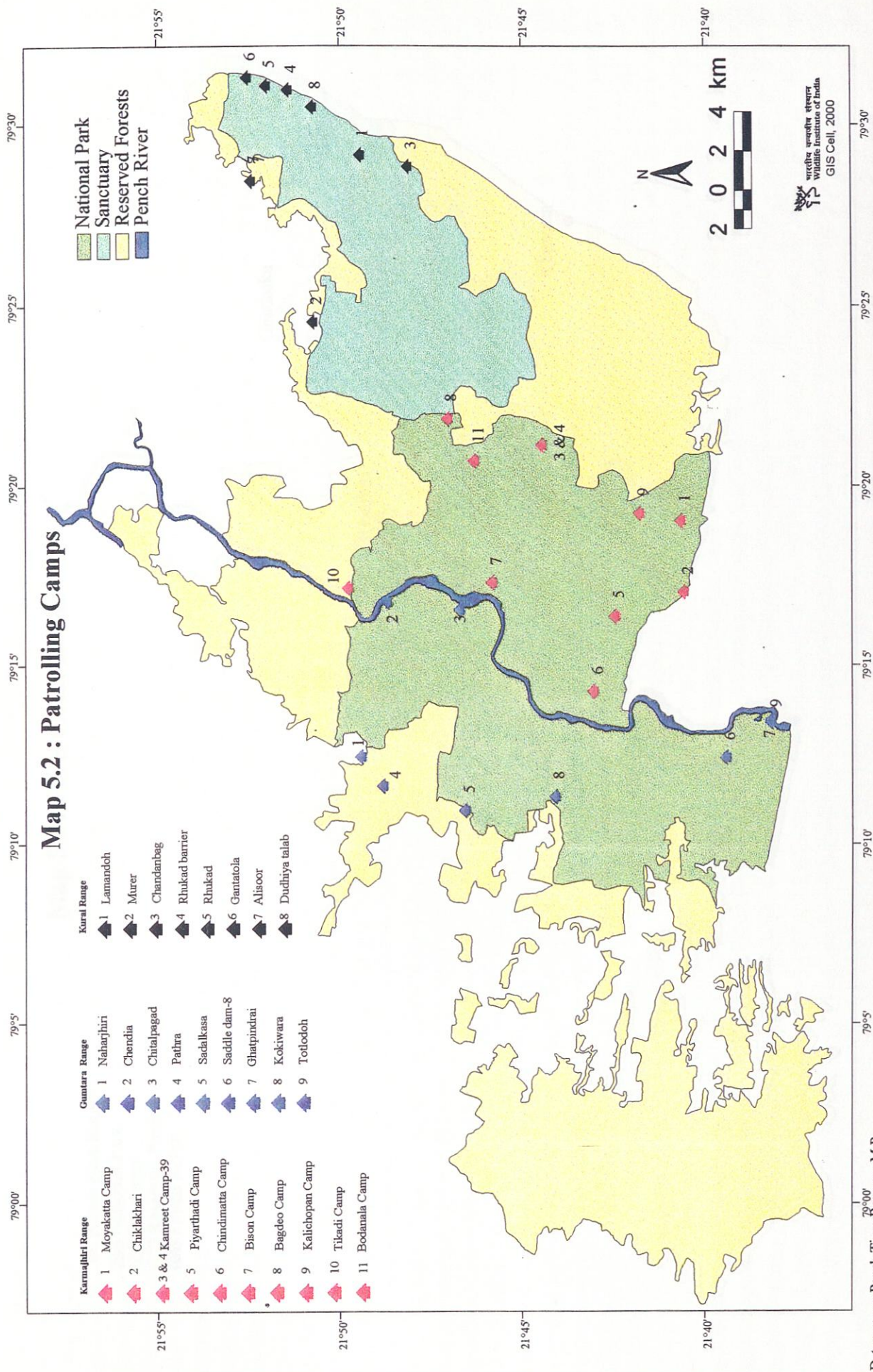
Pench Tiger Reserve, Madhya Pradesh

Map 5.1 : Watch Towers



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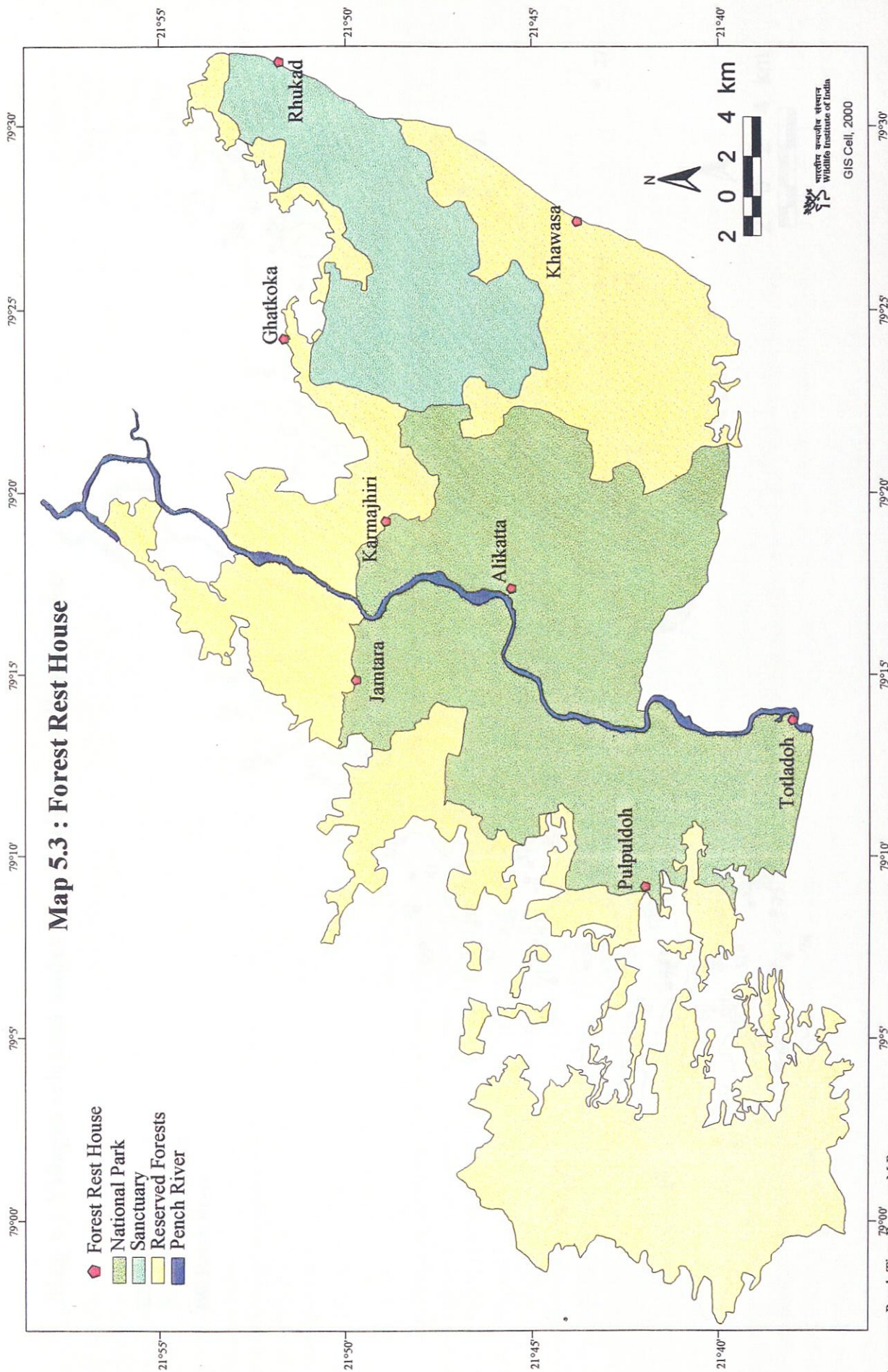
Map 5.2 : Patrolling Camps



Data source: Pench Tiger Reserve, M.P.

Pench Tiger Reserve, Madhya Pradesh

Map 5.3 : Forest Rest House



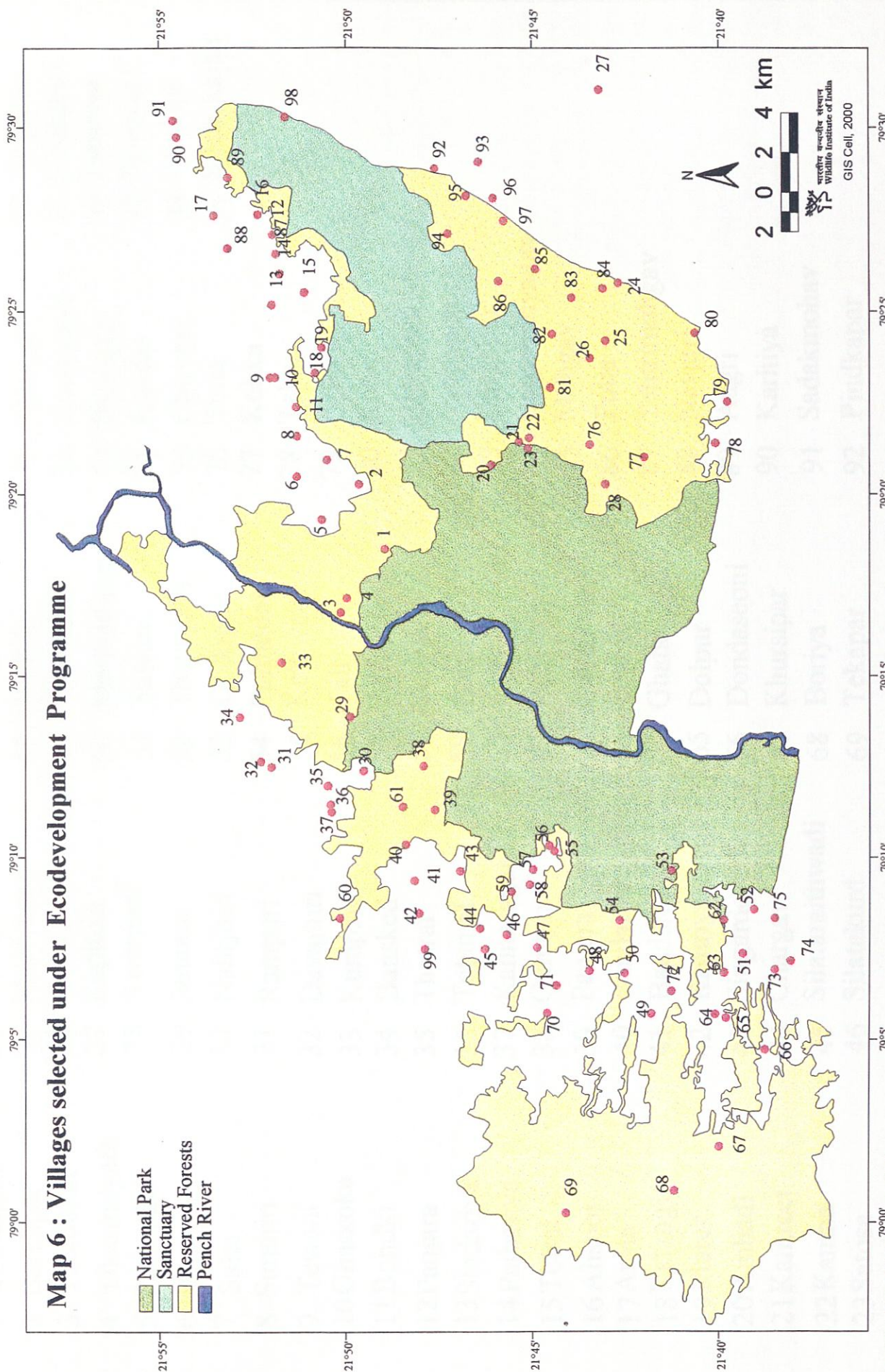
Data source: Pench Tiger Reserve, M.P.

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Map 6 : Villages selected under Ecodevelopment Programme

- National Park
- Sanctuary
- Reserved Forests
- Pench River



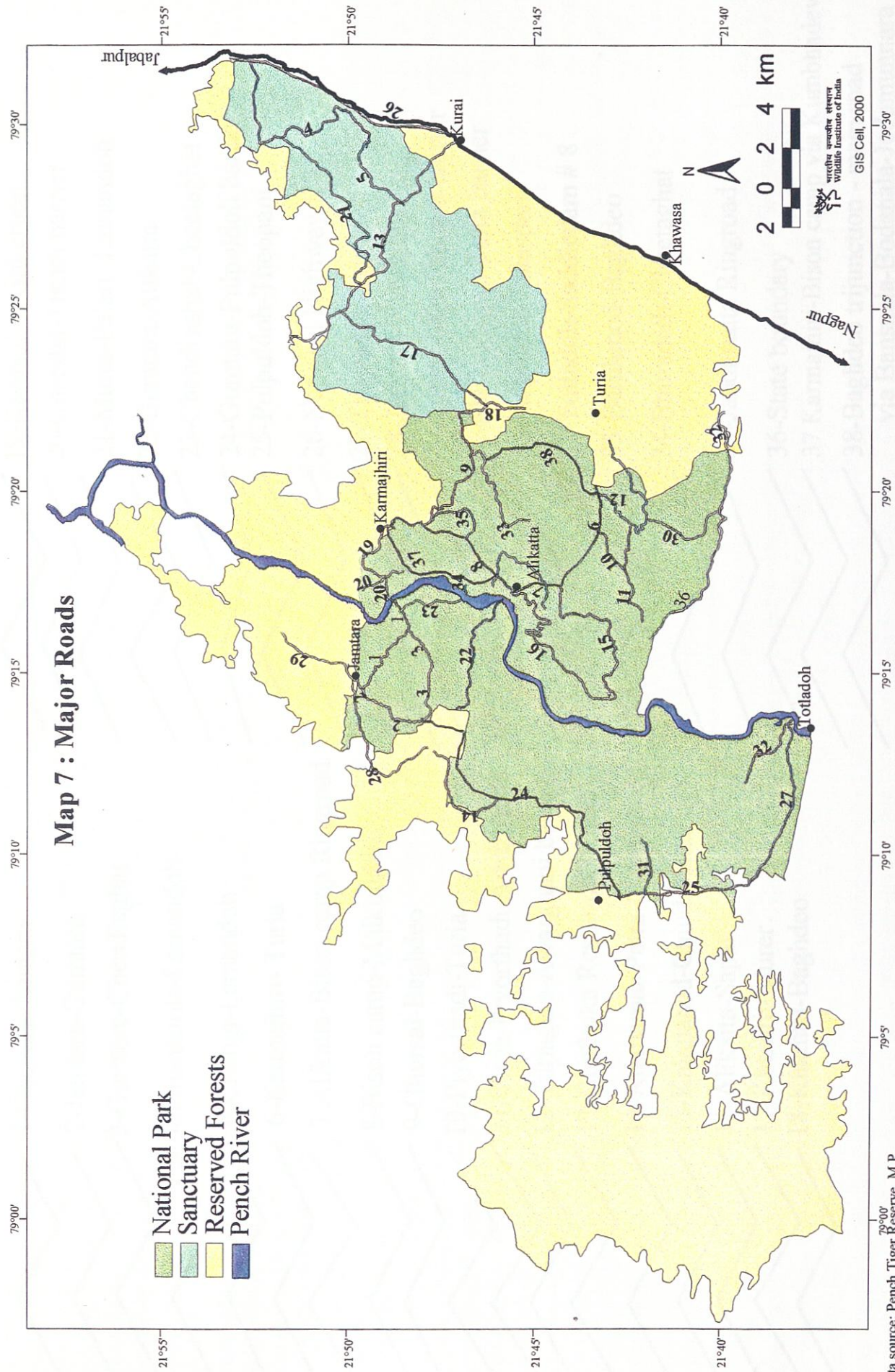
Data source: Pench Tiger Reserve, M.P.

Legend : ● Villages

1	Karmajhiri	24	Pachdar	47	Dogragav	70	Anthra	93	Hardoli
2	Barelipar	25	Mudiyareet	48	Kariya	71	Salivada	94	Raiyarao
3	Tikadimal	26	Ambajhiri	49	Kamarpani	72	Kanhargav	95	Kodajhiri
4	Tikariraiyath	27	Kupitola	50	Marjhathpur	73	Bisanpur	96	Pipariya
5	Paraspani	28	Awargani	51	Sawnri	74	Kundai	97	Setawani
6	Vijyapani	29	Jamtara	52	Thuyepani	75	Chirvani	98	Rhukad
7	Salai	30	Nahrjhiri	53	Dodhgav	76	Turia	99	Silata kalan
8	Sarahiri	31	Rampuri	54	Pulpuldoh	77	Kohka		
9	Tewani	32	Davajhiri	55	Kokiwarra	78	Telia		
10	Ghatkoka	33	Kumpani	56	Tall	79	Arjuni		
11	Bondki	34	Bansked	57	Patrakala	80	Kotar		
12	Panjara	35	Thotrai	58	Surewani	81	Bijyapani		
13	Sindariya	36	Totamal	59	Bordi	82	Jeeriwada		
14	Pathariya	37	Kannasagar	60	Kairanji	83	Durgapur		
15	Totrai	38	Gumtara	61	Patri	84	Banjarnaiyagav		
16	Alisoor	39	Panjara	62	Moagavkurd	85	Mohgav		
17	Arma	40	Bandamal	63	Tewri	86	Potia		
18	Katangi	41	Bandaraiyath	64	Ghatkamptee	87	Tehtrimohgav		
19	Murer	42	Kamriya	65	Dolpur	88	Nearri		
20	Ambadi	43	Singardeep	66	Dondaseoni	89	Aagri		
21	Kamreet	44	Chargav	67	Khursipar	90	Karhiya		
22	Kamha	45	Silataraitchwadi	68	Boriya	91	Sadakmohav		
23	Satosa	46	Silatakurd	69	Tekapar	92	Pindkapar		

Pench Tiger Reserve, Madhya Pradesh

Map 7 : Major Roads



Data source: Pench Tiger Reserve, M.P.

Legend: Roads

1-Chendia-Jamtara

2-Jamtara-Gumtara

3-Gumtara-Chendiaghat

4-Ghantatola-Lamandoh

5-Katangji-Lamandoh

6-Karmajhiri- Turia

7-Alikatta-Bison camp Ringroad

8-Bison camp-Malkundam

9-Ghursal-Baghdeo

10-Piyorthadi-Turia

11-Turia-Piyorthadi-Awarghani

12-Turiagate-Awarghani barrier

13-Ghatkoka Resthouse-Kurai

14-Ammamai-Patra-Gumtara

15-Kalapahad-Chindimatta

16-Alikatta-Sapat

17-Khamrit-Murer

18-Khamrit-Baghdeo

19-Karmajhiri-Sukerpen

20-Chendia-Tikadi barrier

21-Murer-Palari -Lamandoh

22-Gumtara-Alikatta

23-Chendiaghat-Cheetaghat

24-Gumtara-Pulpuldoh barrier

25-Pulpuldoh-Theopani

26-National Highway-# 7

27-Theyupani-Totladoh

28-Jamtara-Naharjhiri

29-Jamtara-Kumbhpani barrier

30-Markakhassa-Telia barrier

31-Pulpuldoh-Palaspasi

32-Totladoh-Saddledam # 8

33-Barahmod-Baghdeo

34-Bhuradeth-Cheetaghat

35-Jandimatta Ringroad

36-State boundary

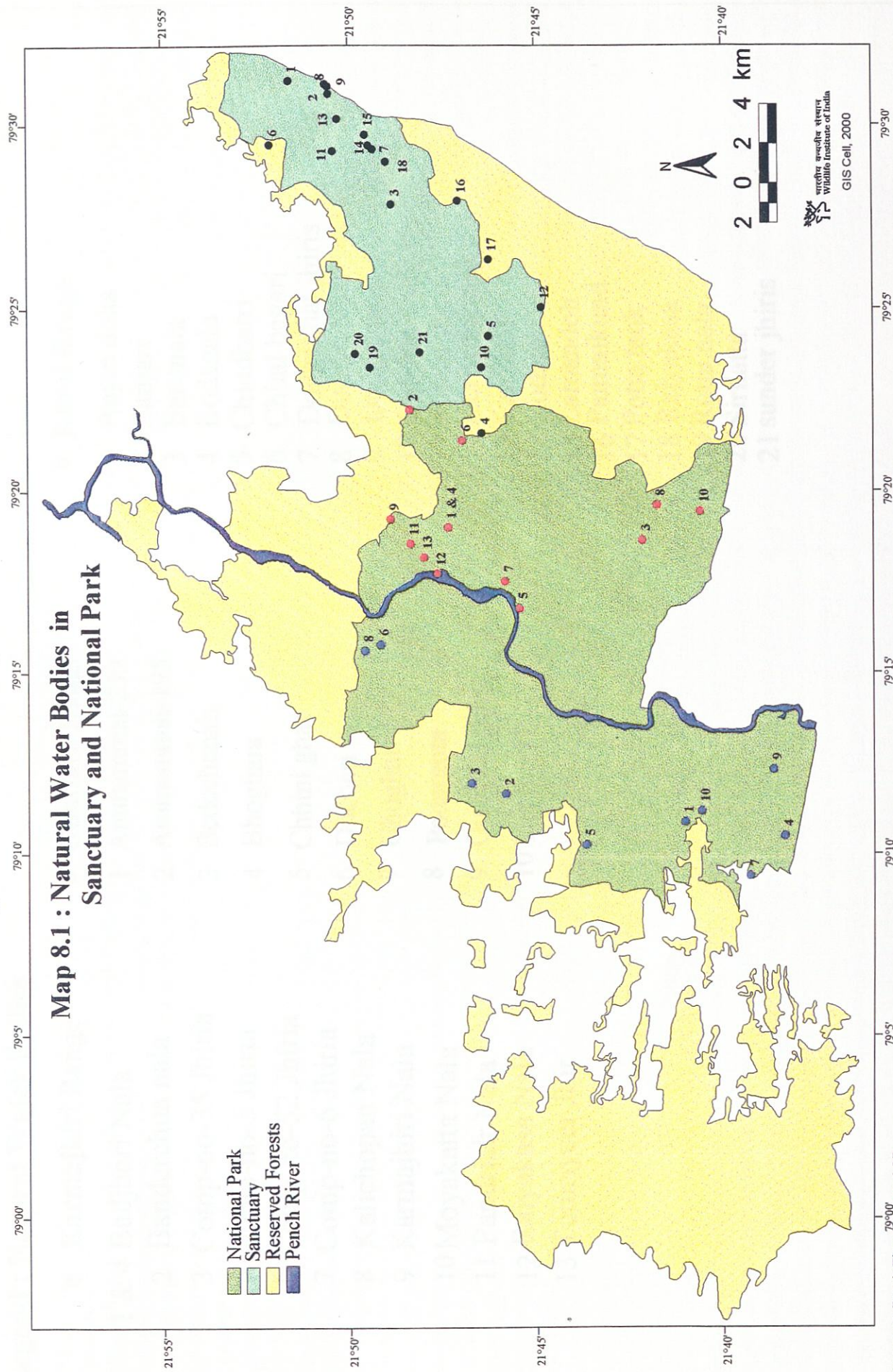
37 Karmajhiri-Bison camp via Kumbhadev

38-Baghdeo trijunction - main road

via Bansnala-Bodanala-Jodamunnara

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Map 8.1 : Natural Water Bodies in Sanctuary and National Park

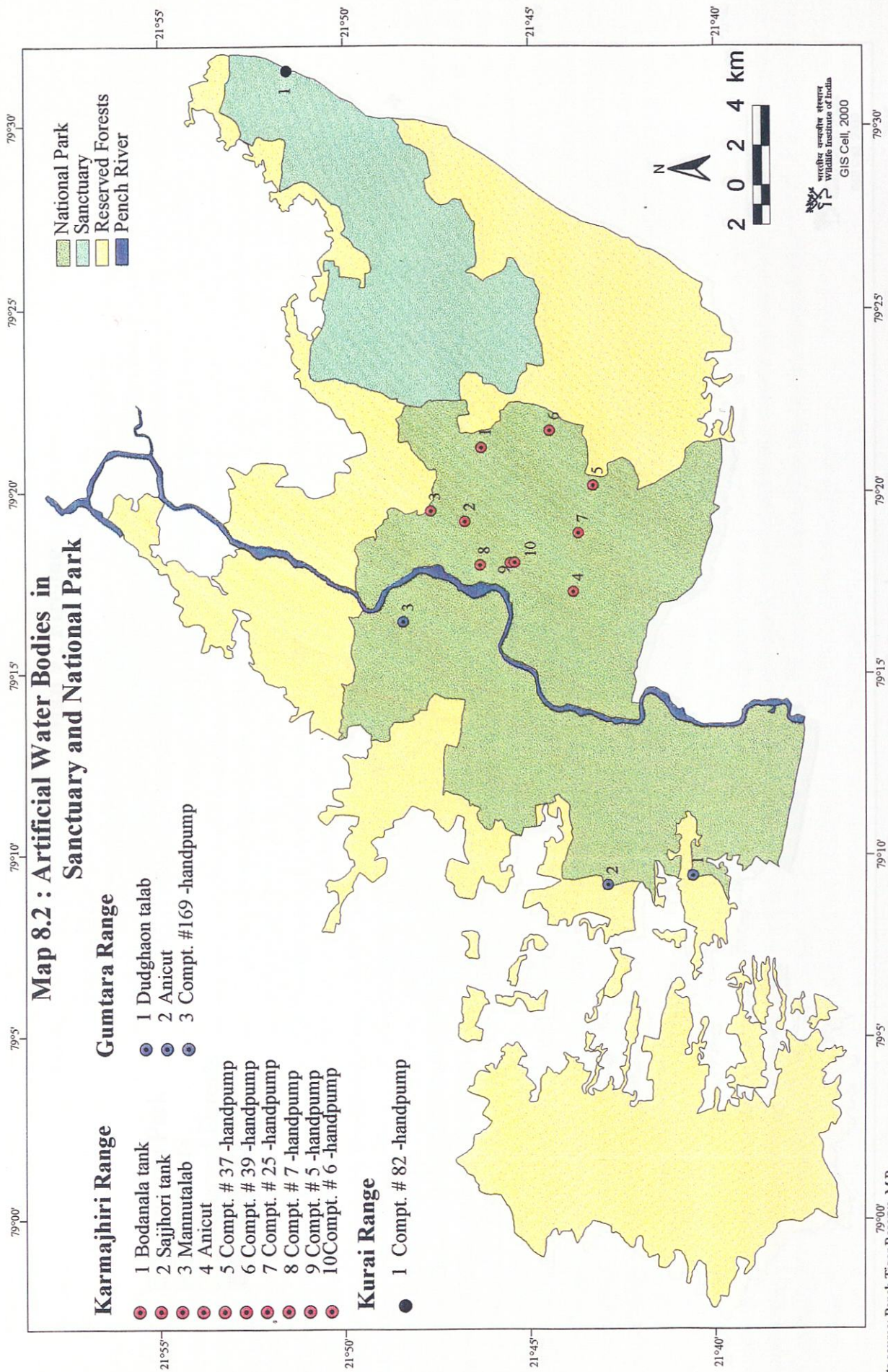


Legend : Natural Water Bodies

- **Karmajhiri Range**
 - 1 & 4 Badjhoiri Nala
 - 2 Banderchua nala
 - 3 Comp-no-35 Jhiria
 - 5 Comp-no-5 Jhiria
 - 6 Comp-no-52 Jhiria
 - 7 Comp-no-6 Jhiria
 - 8 Kalichopan Nala
 - 9 Karmajhiri Nala
 - 10 Moyakatta Nala
 - 11 Pandriair Nala
 - 12 Raiyakasa Nala
 - 13 Tumriyeer Jhir
- **Gumtara Range**
 - 1 Ammammai-239
 - 2 Ammammai-195
 - 3 Bedechunab
 - 4 Bhoghara
 - 5 Chhini ghat
 - 6 Dhobari
 - 7 Ghughat
 - 8 Podargota
 - 9 Quariwal jhiria
 - 10 Tua jhoiri
- **Kurai Range**
 - 1 Anjan doha
 - 2 Banjari
 - 3 Bansnala
 - 4 Bodanala
 - 5 Chindbarri
 - 6 Chital bagari
 - 7 Dongaghat jhiris
 - 8 Dudiya Nala
 - 9 Dudiya tank
 - 10 Gaighat
 - 11 Jamun jhiria-77
 - 12 Jeeriwara tank
 - 13 Karonala
 - 14 Kudam
 - 15 Lamandoh
 - 16 Pannaikund
 - 17 Potia tank
 - 18 Raiyakasa
 - 19 Rotia nala
 - 20 Sirilatta
 - 21 sunder jhiris

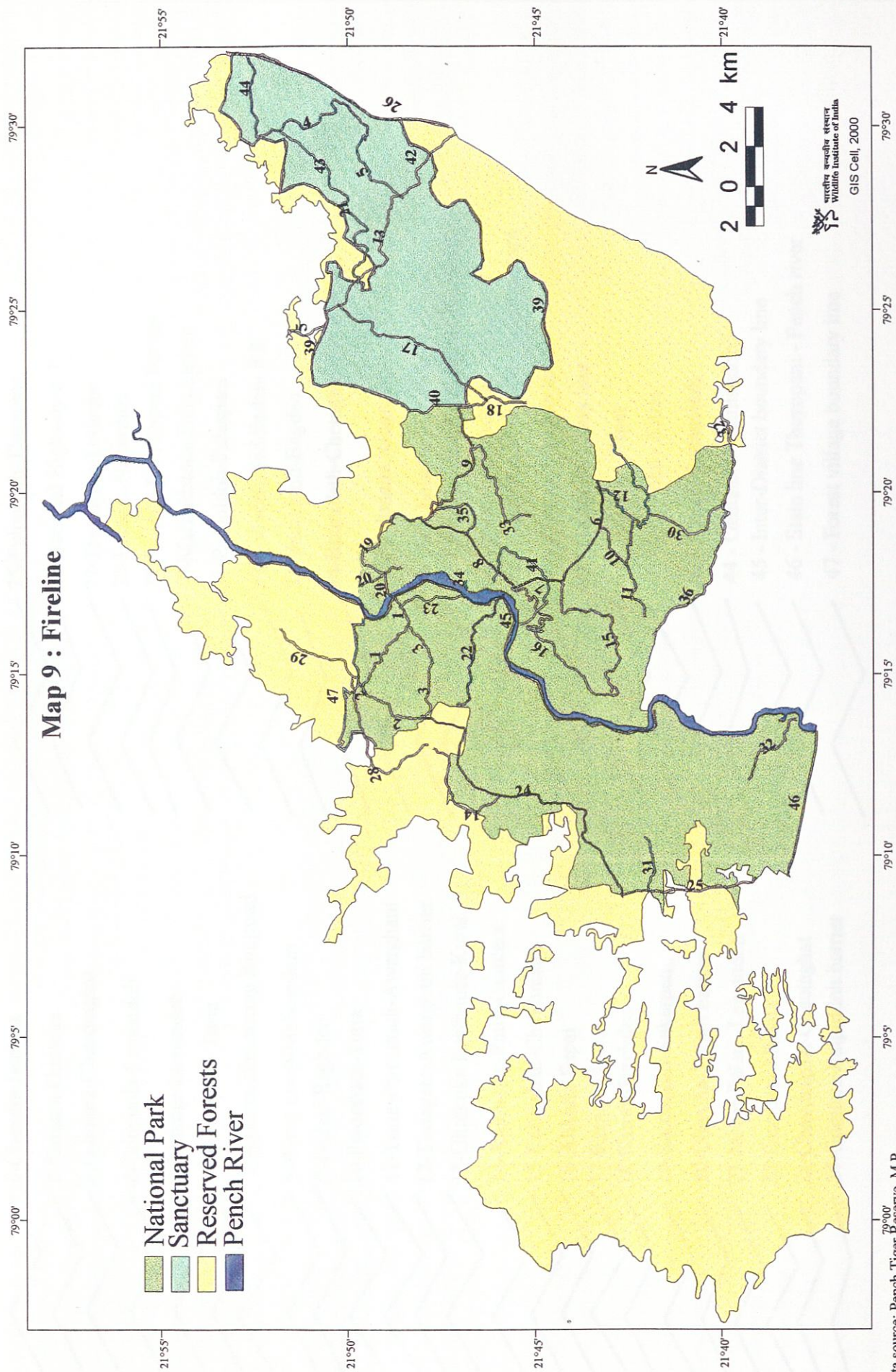
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Map 8.2 : Artificial Water Bodies in Sanctuary and National Park

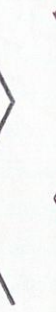
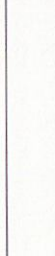
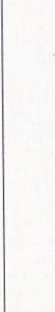


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Map 9 : Fireline



Legend: Fireline

- | | | | |
|---|--------------------------------|--|---|
|  | 1-Chendia-Jamtara |  | 25-Pulpuldoh-Theopani |
|  | 2-Jamtara-Gumtara |  | 26-National Highway-# 7 |
|  | 3-Gumtara-Chendiaghat |  | 27-Theyupani-Totlodoh |
|  | 4-Gantatola-Lamandoh |  | 28-Jamtara-Naharjhiri |
|  | 5-Katang-Lamandoh |  | 29-Jamtara-Kumbhpani barrier |
|  | 6-Karmajhiri-Turia |  | 30-Markakhassa-Telia barrier |
|  | 7-Alikatta-Bisoncamp Ringroad |  | 31-Pulpuldoh-Palaspasi |
|  | 8-Bison camp-Malkundam |  | 32-Totlodoh-Saddledam # 8 |
|  | 9-Gorsal-Baghdoo |  | 33-Barahmod-Bagdeo |
|  | 10-Piyorthadi-Turia |  | 34-Bhuradeth-Chetaghat |
|  | 11-Turia-Piyorthadi-Awarghani |  | 35-Jandimatta Ringroad |
|  | 12-Turiagate-Awarghani barrier |  | 36-State boundary |
|  | 13-Ghatkoka Resthouse-Kurai |  | 37 Karmajhiri-Bison camp via Kumbadev |
|  | 14-Ammamai-Patra-Gumtara |  | 38-Bhagdeo trijunction - main road |
|  | 15-Kalapahad-Chindimatta |  | via Bansnala - Bodanala - Jodamunnara |
|  | 16-Alikatta-Sapat |  | 39 - Reserved Forests line |
|  | 17-Kamrit-Murer |  | 40 - Range boundary line |
|  | 18-Kamrit-Baghdoo |  | 41 - Alikatta - Sapat |
|  | 19-Karmajhiri-Sukerpen |  | 42 - Ghatkoka - Kurai |
|  | 20-Chendia-Tikadi barrier |  | 43 - Murer - Lamandoh |
|  | 21-Murer-Palari - Lamandoh |  | 44 - Gantatola - Lamandoh |
|  | 22-Gumtara-Alikatta |  | 45 - Inter-District boundary line |
|  | 23-Chendiaghat-Cheetaghat |  | 46 - State line Theyopani - Pench river |
| | 24-Gumtara-Pulpuldoh barrier | | 47 - Forest village boundary line |

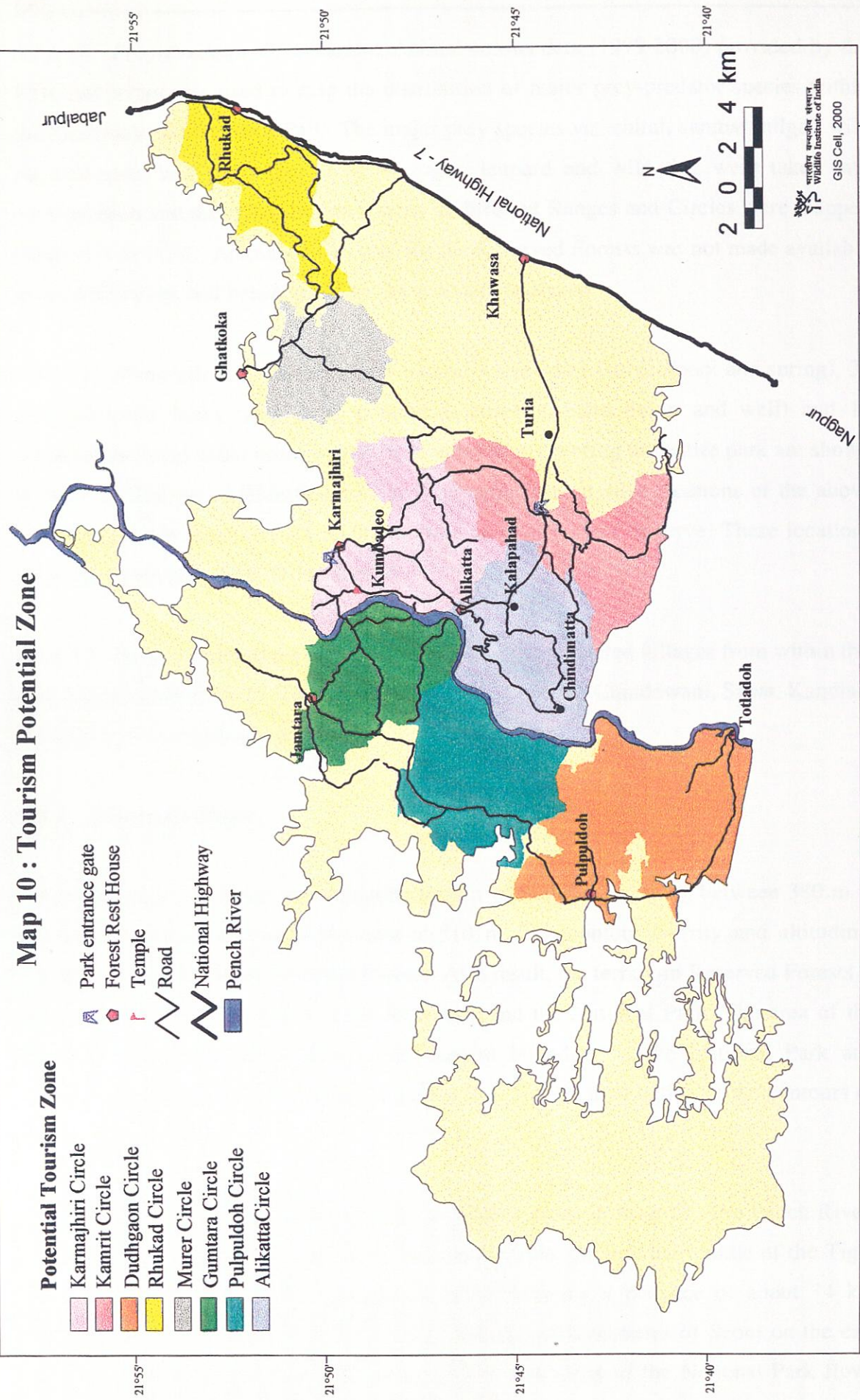
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Map 10 : Tourism Potential Zone

Potential Tourism Zone

- Karmajhiri Circle
- Kamrit Circle
- Dudhgaon Circle
- Rhukad Circle
- Murer Circle
- Gumtara Circle
- Pulpuldoh Circle
- Alikatta Circle

- Park entrance gate
- Forest Rest House
- Temple
- Road
- National Highway
- Pench River





6.3.1.10 *Prey-Predator Distribution:* Animal census data (1999-2000) provided by the PTR authorities was used to map the distribution of major prey-predator species within the Sanctuary and National Park. The major prey species viz. chital, sambar, nilgai, wild pig and gaur, and major predators viz. tiger, leopard and wild dog were taken into consideration and their distribution pattern in different Ranges and Circles were mapped (Map 11.1 to 11.8). Animal census data for the Reserved Forests was not made available to the consultants and hence could not be specially analyzed.

6.3.1.11 *Waterhole distribution:* Sixty natural water holes (stretch/pool and spring), 33 artificial water holes (stop dam, pond/tank, culverts, hand pump and well) and 16 proposed artificial water holes by the park authorities covering the entire park are shown in Map 22. The park authorities provided the compartment wise locations of the above mentioned water points on a 1:50,000-scale map of the Tiger Reserve. These locations were digitized using ARC/INFO software.

6.3.1.12 *Resurrected village sites:* The sites of eight relocated villages from within the park are shown in Map 23. These include Alilatta, Chhedia, Chindewani, Sapat, Kandlai, Umarighat, Piorthadi and palaspani.

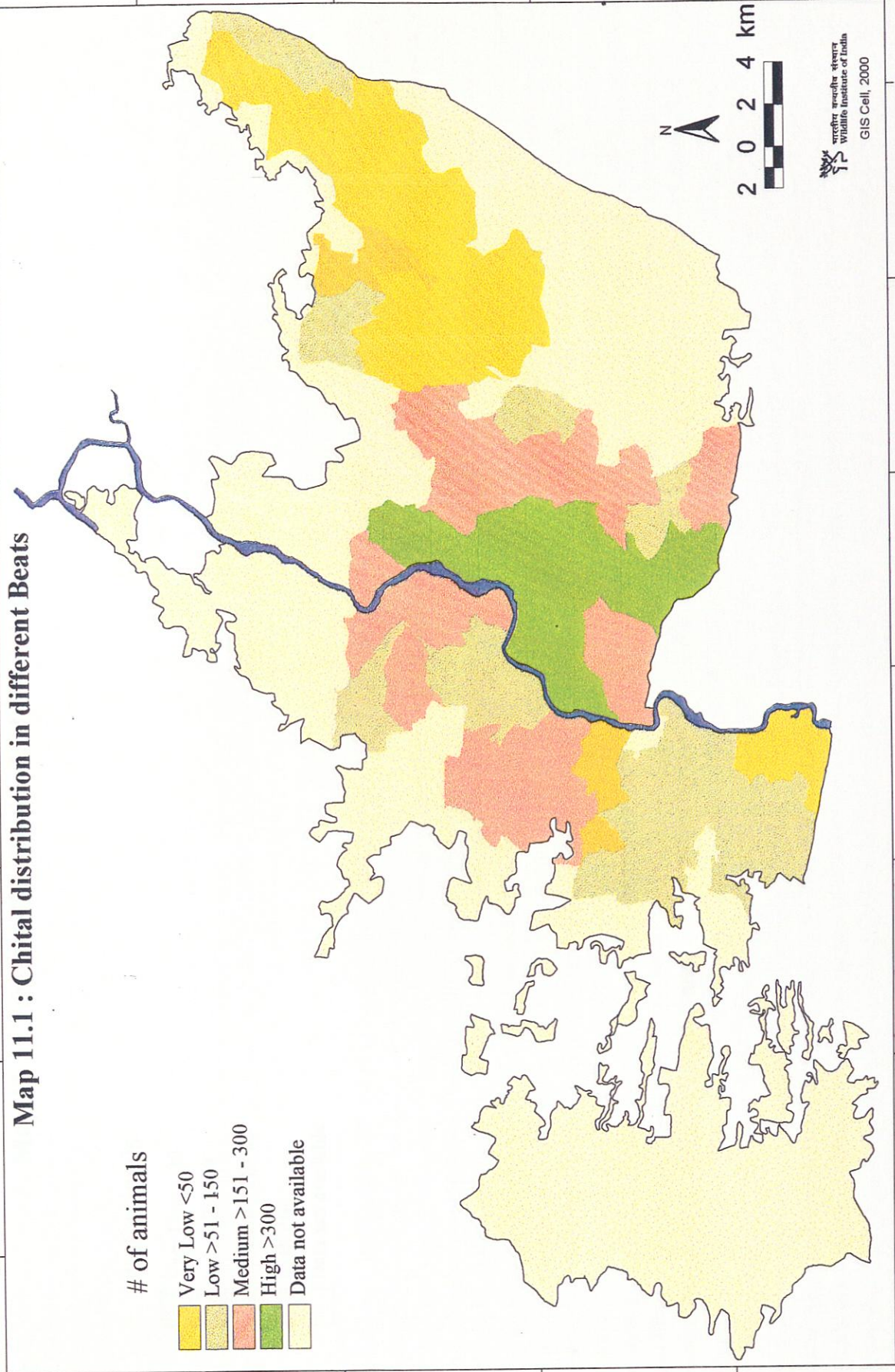
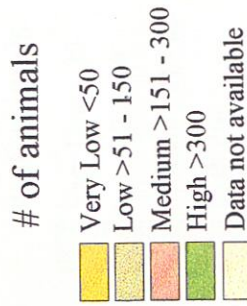
6.3.2 Thematic Maps

6.3.2.1 *Contour:* PTR has an undulating terrain with altitude varying between 380 m to 640 m. The mean altitude of the area is 510 m. The contour density and altitudinal variation is the highest in Reserved Forests. As a result, the terrain in Reserved Forests is comparatively more rugged than the Sanctuary and the National Park. The area of the Reserved Forests lying adjacent to the eastern boundary of the National Park and southern boundary of the Sanctuary is largely flat. The detailed outlay of the contours of PTR is given in Map 12.

6.3.2.2 *Drainage:* The drainage pattern of PTR is given in Map 13. The Pench River, which divides the National Park into equal halves, runs through the middle of the Tiger Reserve. The river flows from North to South covering a distance of about 74 km through the Tiger Reserve. The river forms the district boundaries of Seoni on the east and Chindwara on the west. The drainage from most areas of the National Park flows

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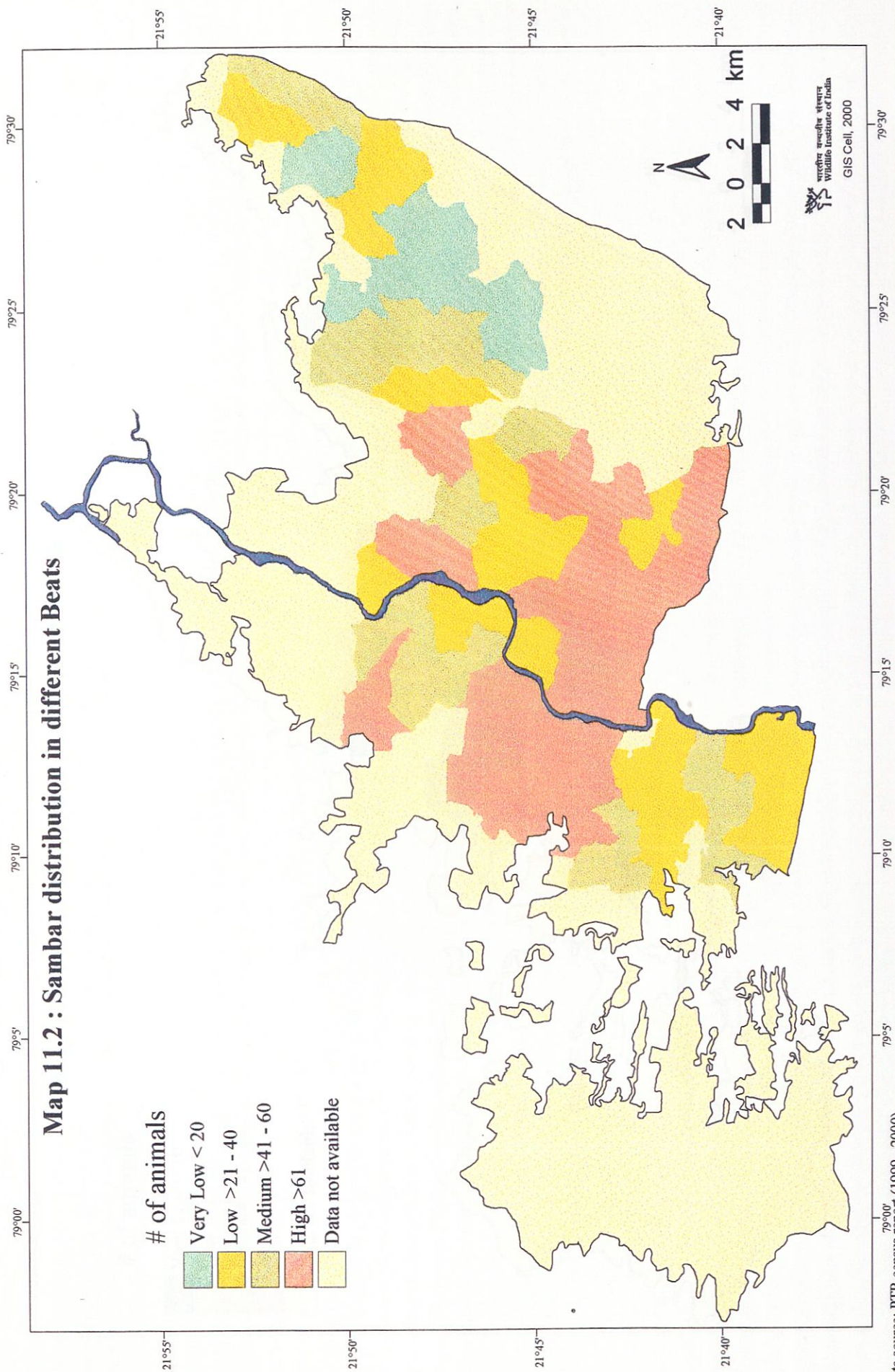
Map 11.1 : Chital distribution in different Beats



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Map 11.2 : Sambar distribution in different Beats

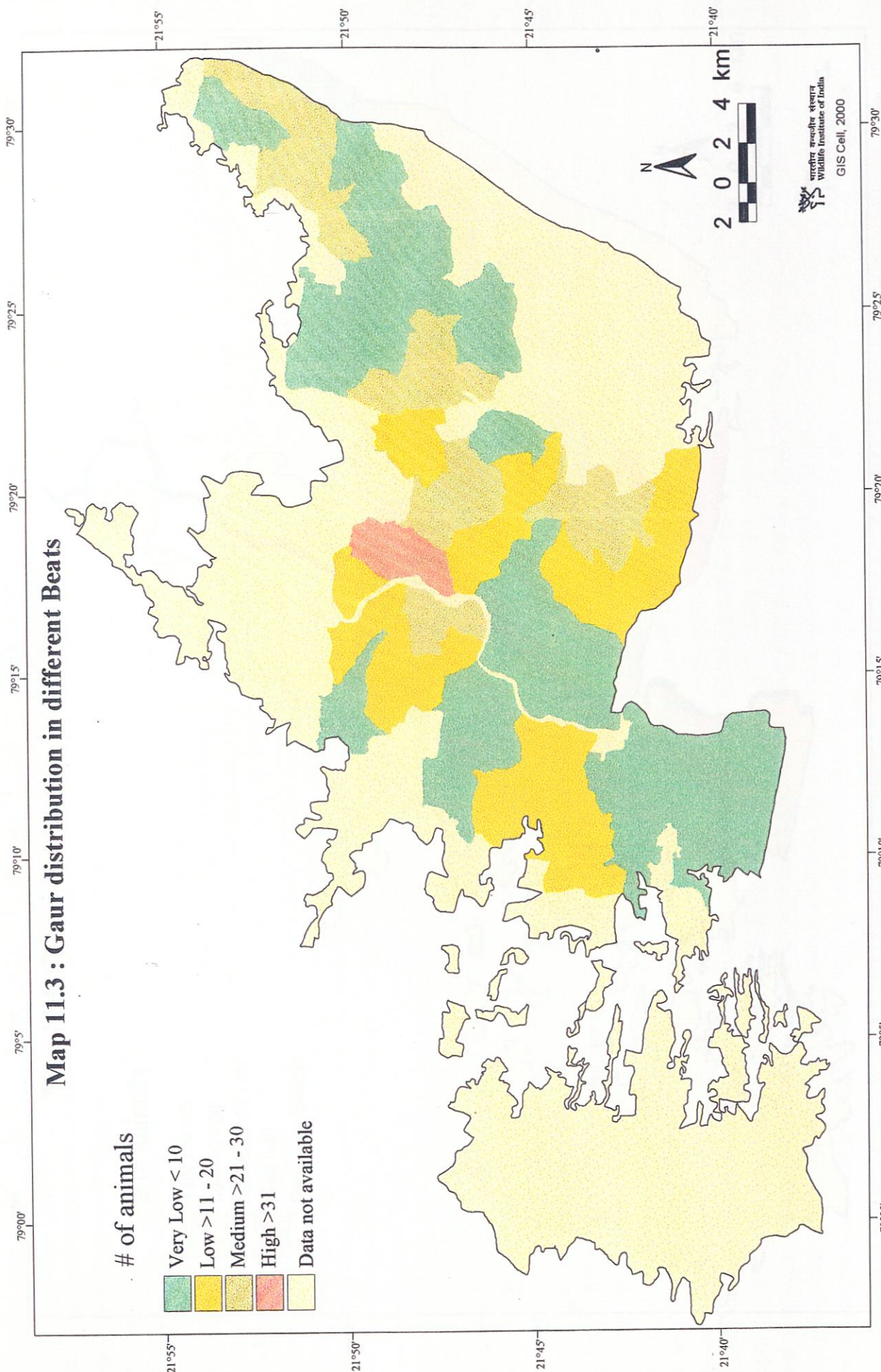
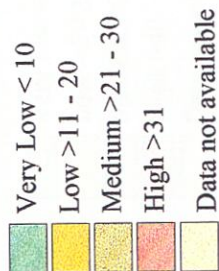


Data source: PTR census report (1999 - 2000)

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Map 11.3 : Gaur distribution in different Beats

of animals

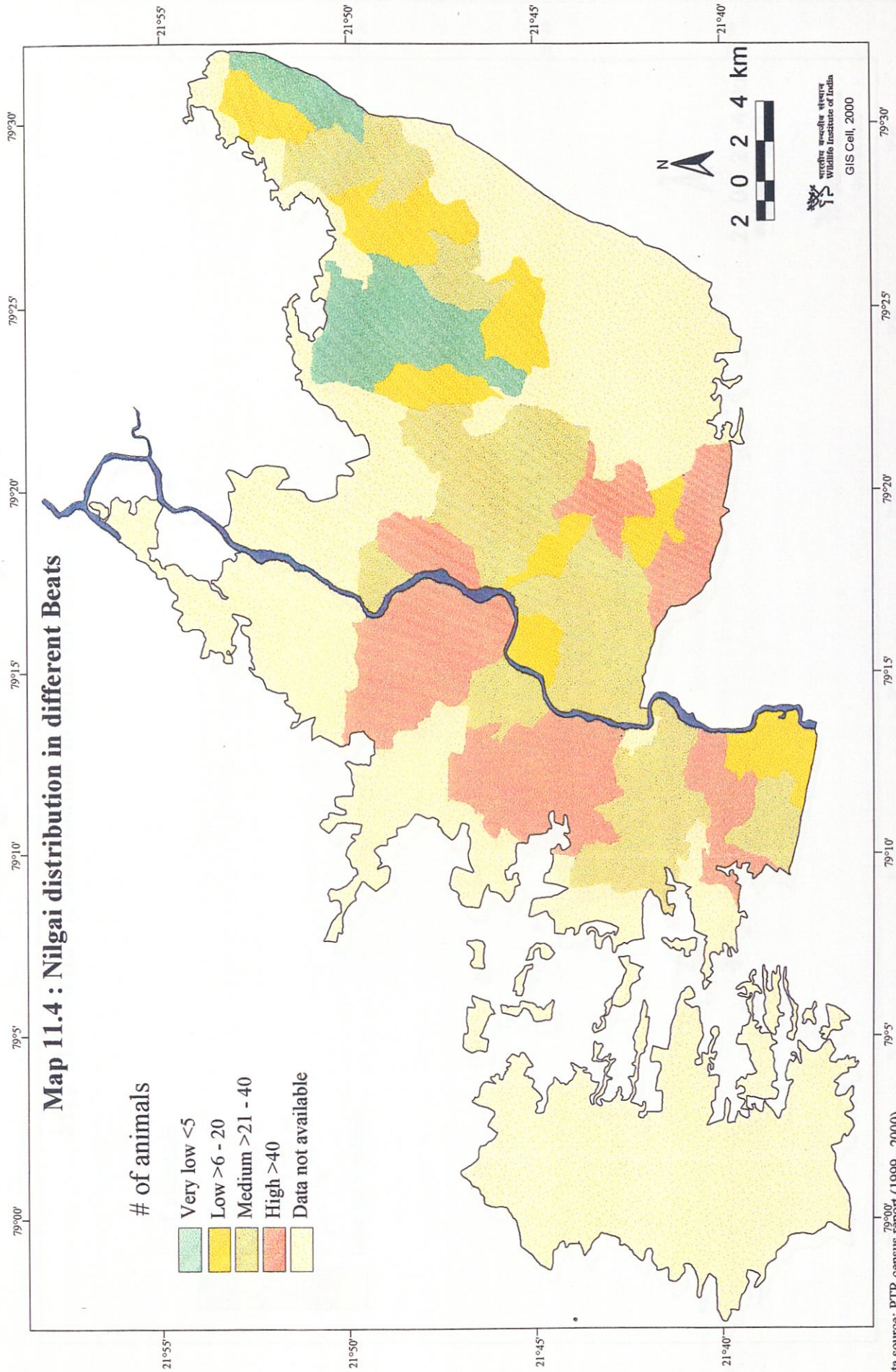
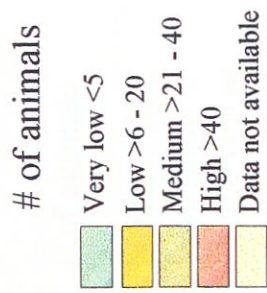


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Data source: PTR census report (1999 - 2000)

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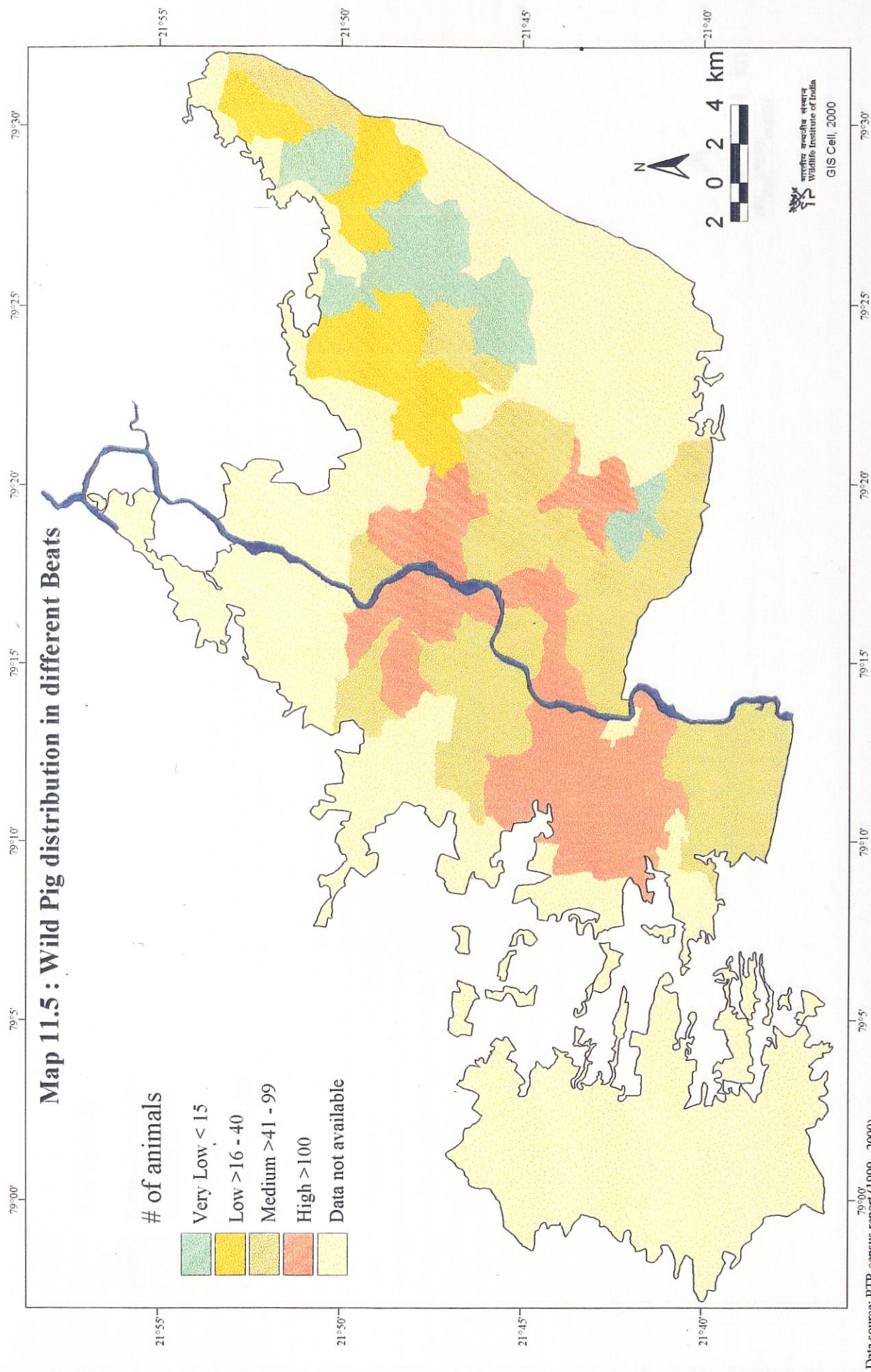
Map 11.4 : Nilgai distribution in different Beats



Data source: PTR census report (1999 - 2000)

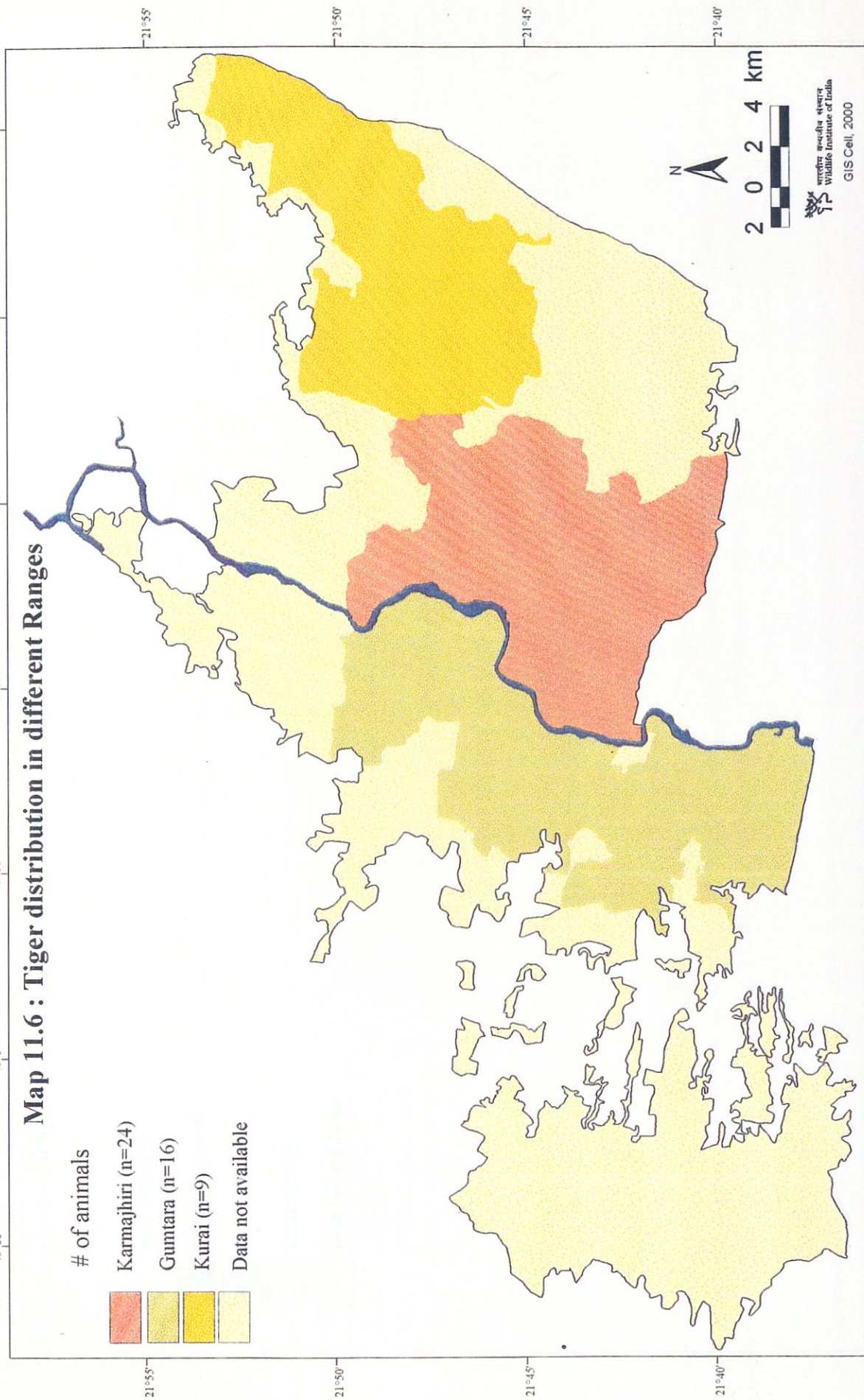
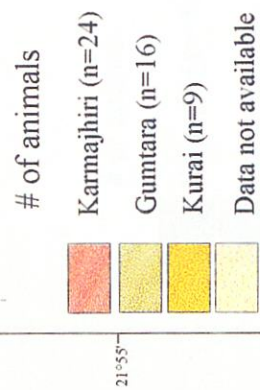
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Map 11.5 : Wild Pig distribution in different Beats



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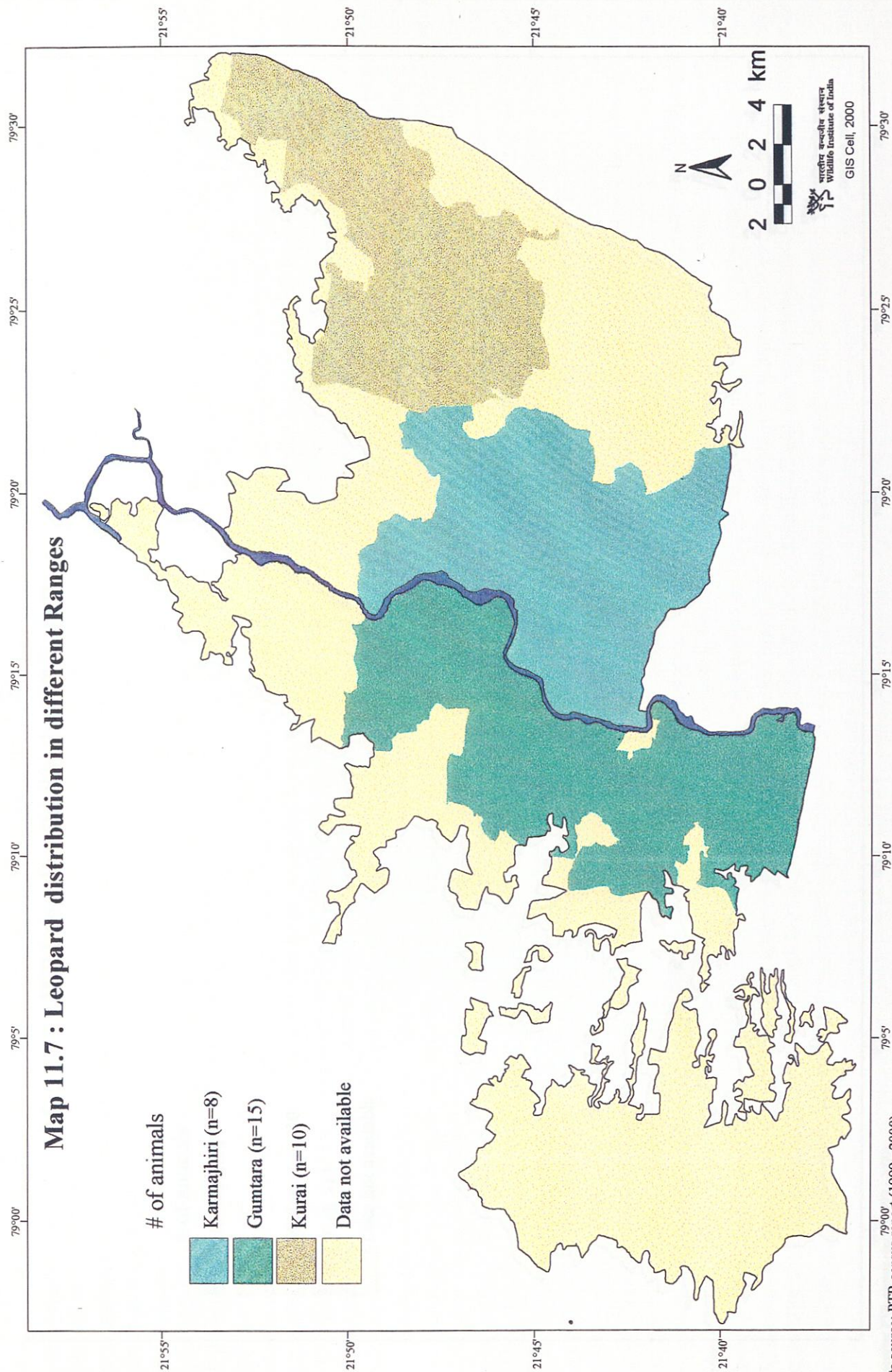
Map 11.6 : Tiger distribution in different Ranges



Data source: PTR census report (1999 - 2000)

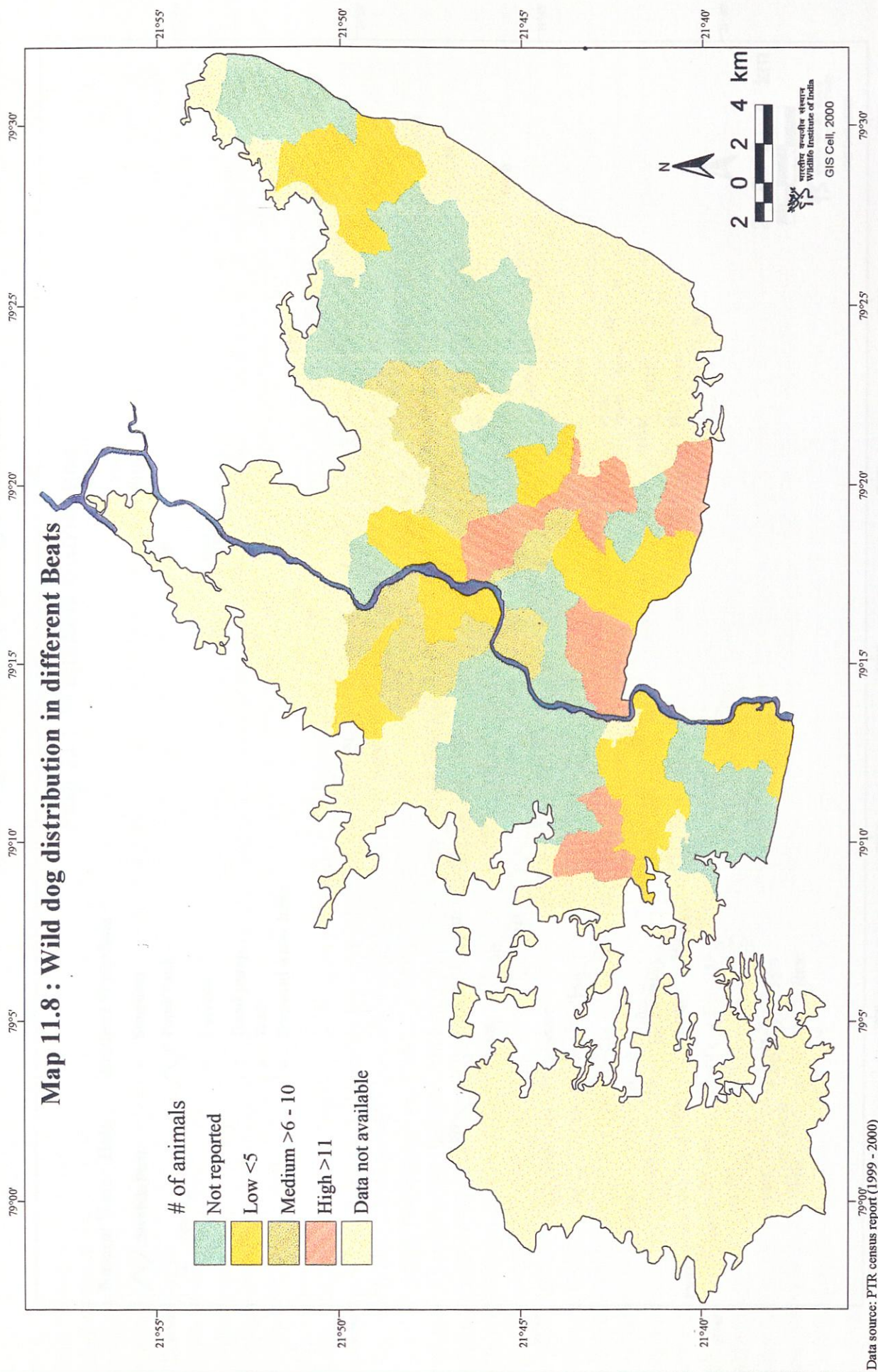
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Map 11.7 : Leopard distribution in different Ranges



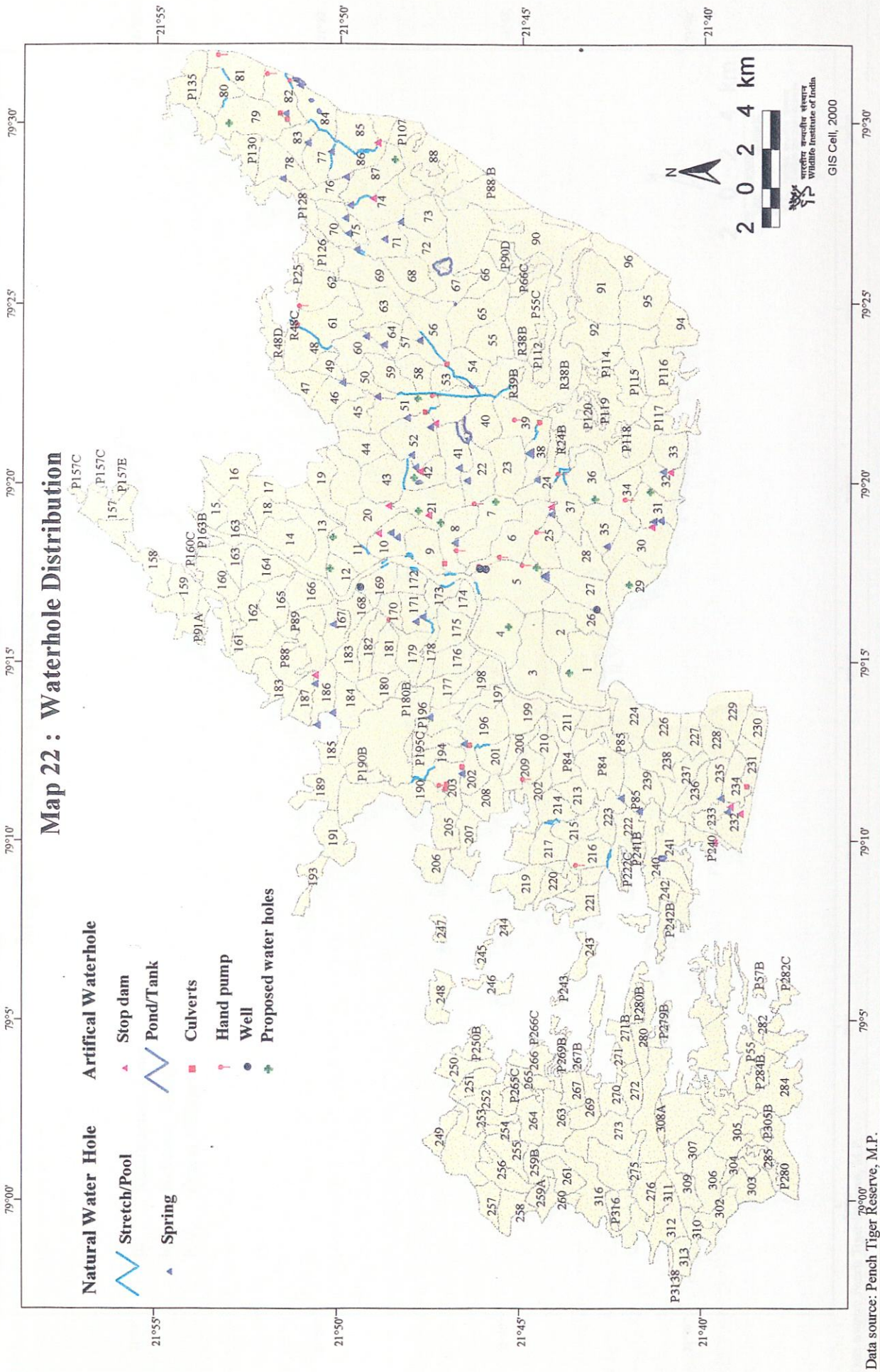
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Map 11.8 : Wild dog distribution in different Beats

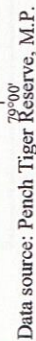


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Map 22 : Waterhole Distribution

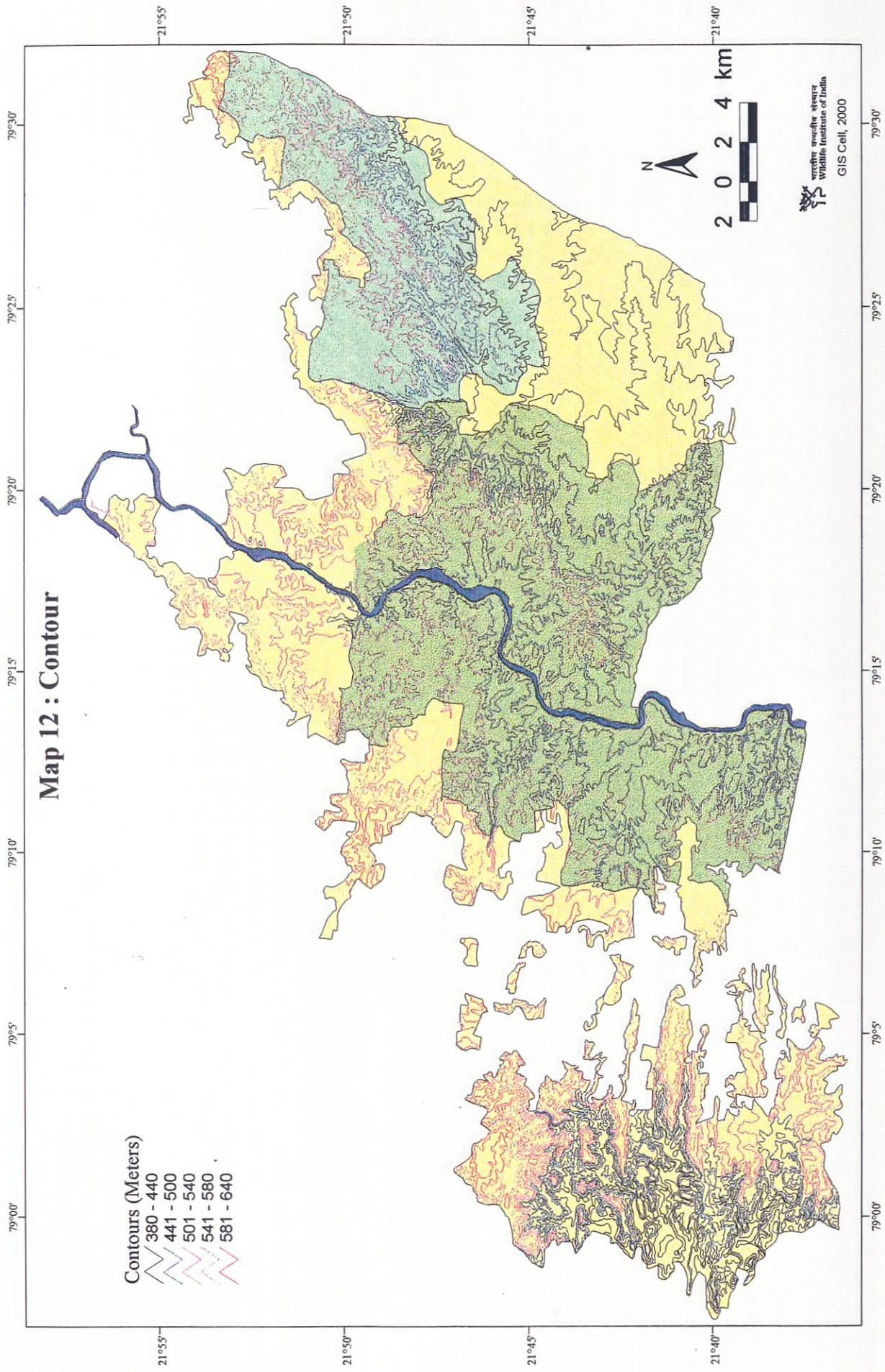


Map 23 : Resurrected Village Sites



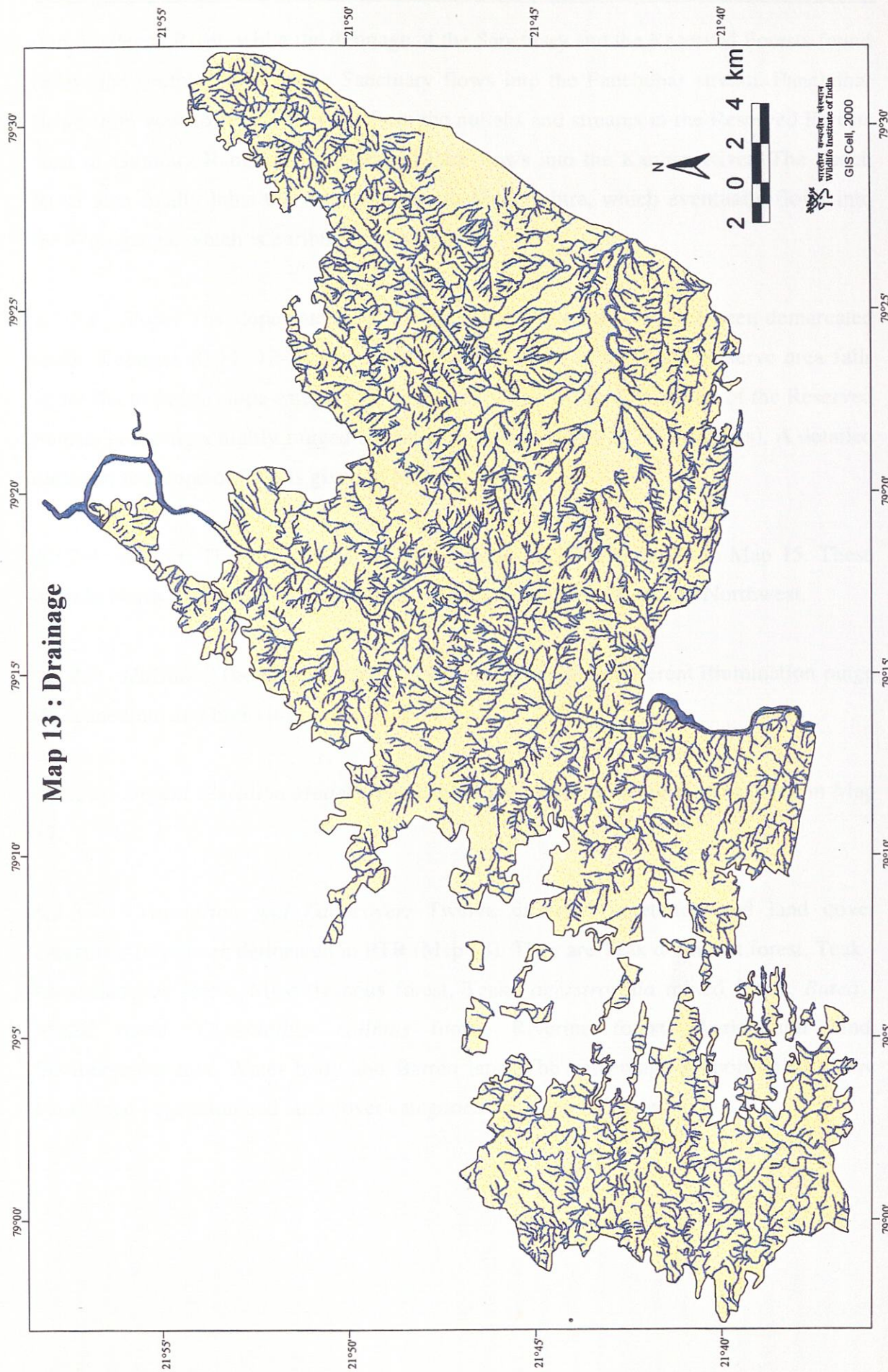
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Map 12 : Contour



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Map 13 : Drainage





into the Pench River, while the drainage of the Sanctuary and the Reserved Forests found below the southern side of the Sanctuary flows into the Panchdhar stream. Panchdhar flows from west to east. The water from the nullahs and streams in the Reserved Forests west of Guntara Range of the National Park flows into the Kanhan River. The Pench River also finally joins the Kanhan River in Maharashtra, which eventually flows into the Wainganga, which is a tributary of Mahanadi.

6.3.2.3 Slope: The slope categories for the entire Tiger Reserve have been demarcated under 3 classes (0-11, 12-22 and 23-34 degrees). Most of the Tiger Reserve area falls under flat to gentle slope category (0-22 degrees). The western most part of the Reserved Forests is having a highly rugged terrain with steeper slopes (23-34 degrees). A detailed outlay of the slope of PTR is given in Map 14.

6.3.2.4 Aspect: The different aspect of the slopes of PTR is shown in Map 15. These include North, Northeast, East, Southeast, South, Southwest, West and Northwest.

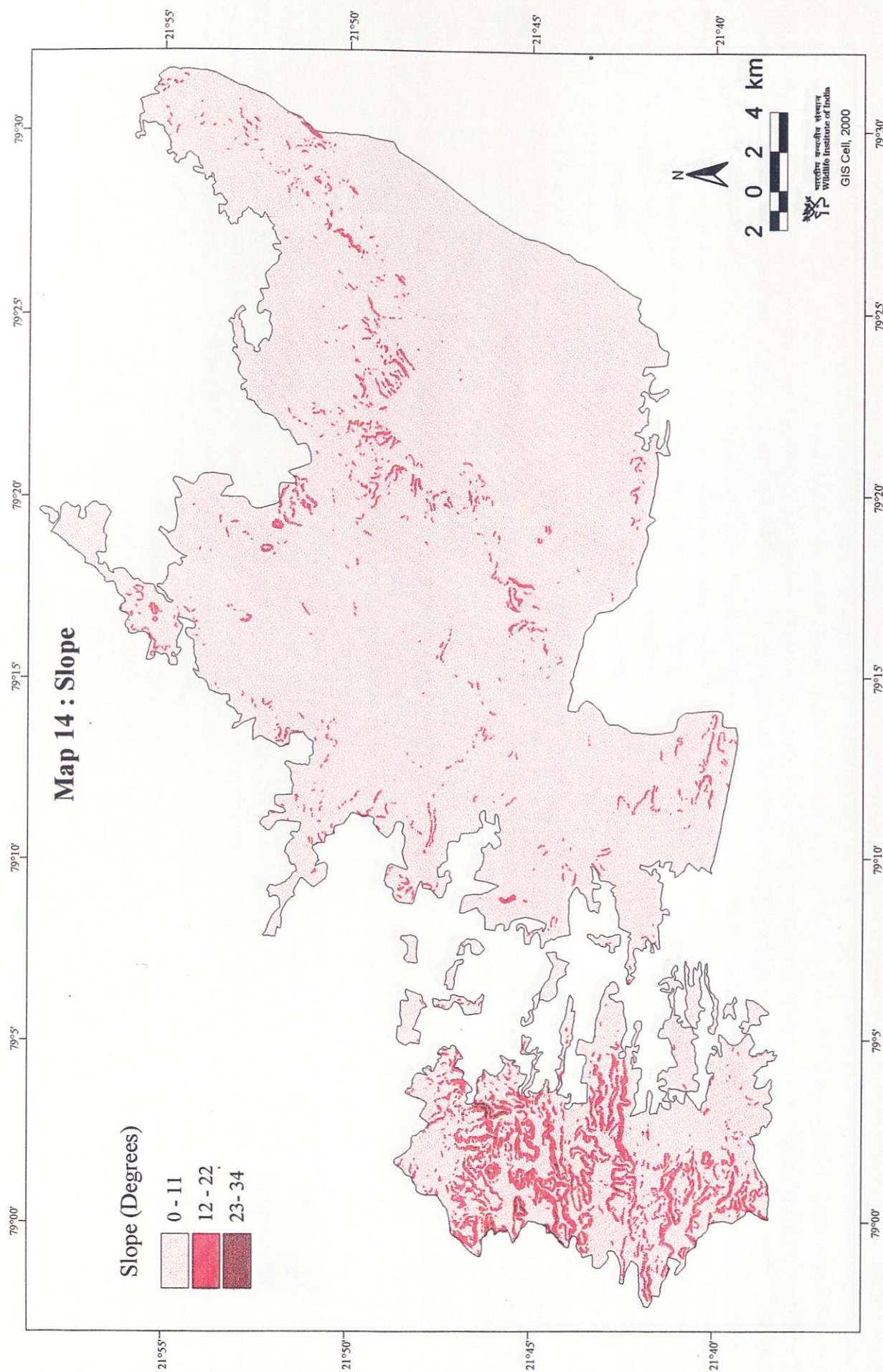
6.3.2.5 Hillside : The hillshade map of PTR showing three different illumination range (low, medium and high) is given in Map 16.

6.3.2.6 Digital Elevation Model : The Digital Elevation Model of PTR is given in Map 17.

6.3.2.7 Vegetation and Landcover: Twelve different vegetation and land cover categories have been delineated in PTR (Map 18). They are Teak dominant forest, Teak - Miscellaneous forest, Miscellaneous forest, Teak-*Lagerstroemia* mixed forest, *Butea* - mixed forest, *Cleistanthus collinus* forest, Riverine forest, Agricultural land, Submergence area, Water body and Barren land. The percentage proportion of above mentioned vegetation and land cover categories are given in Table 2.

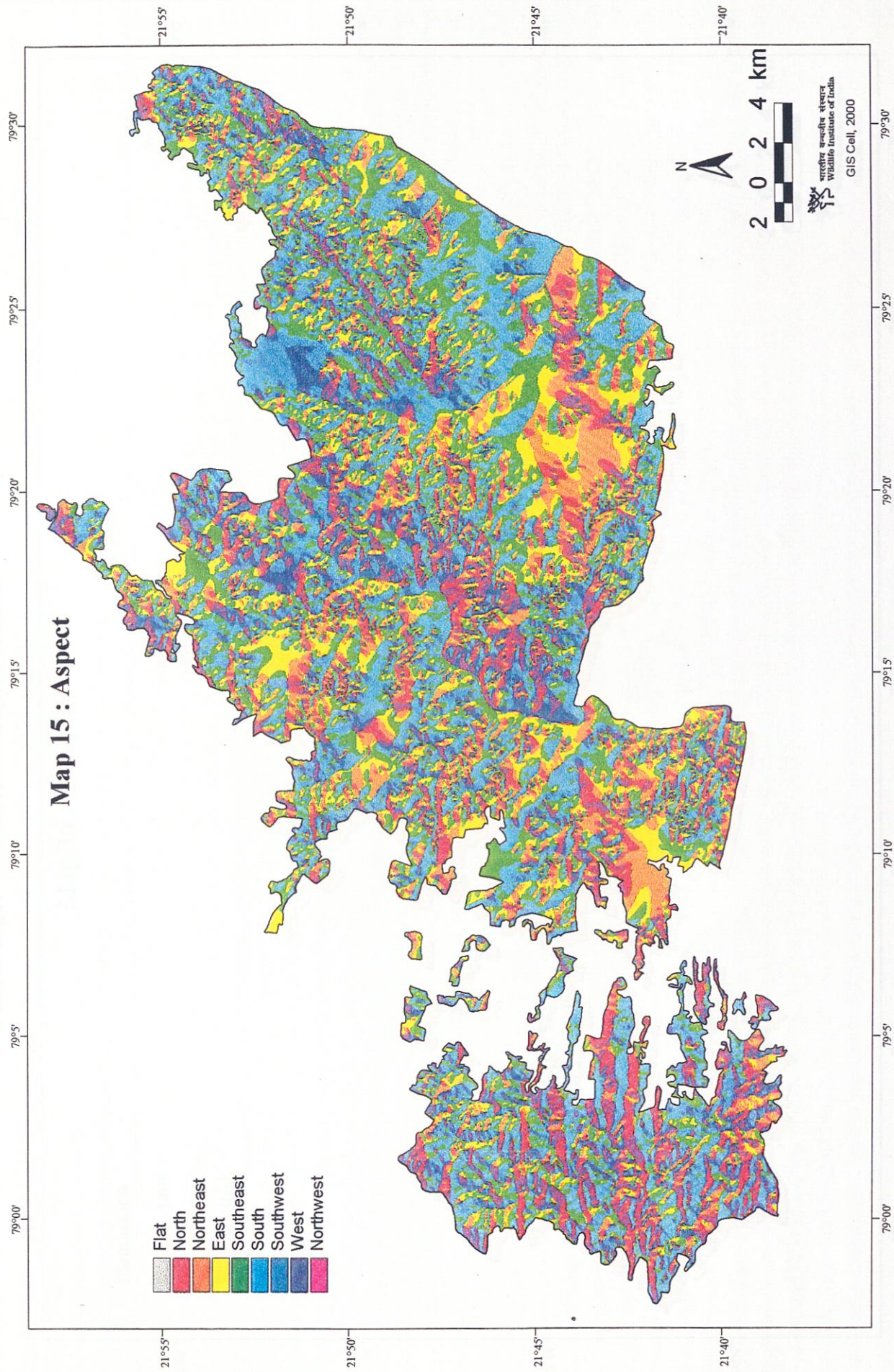
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Map 14 : Slope



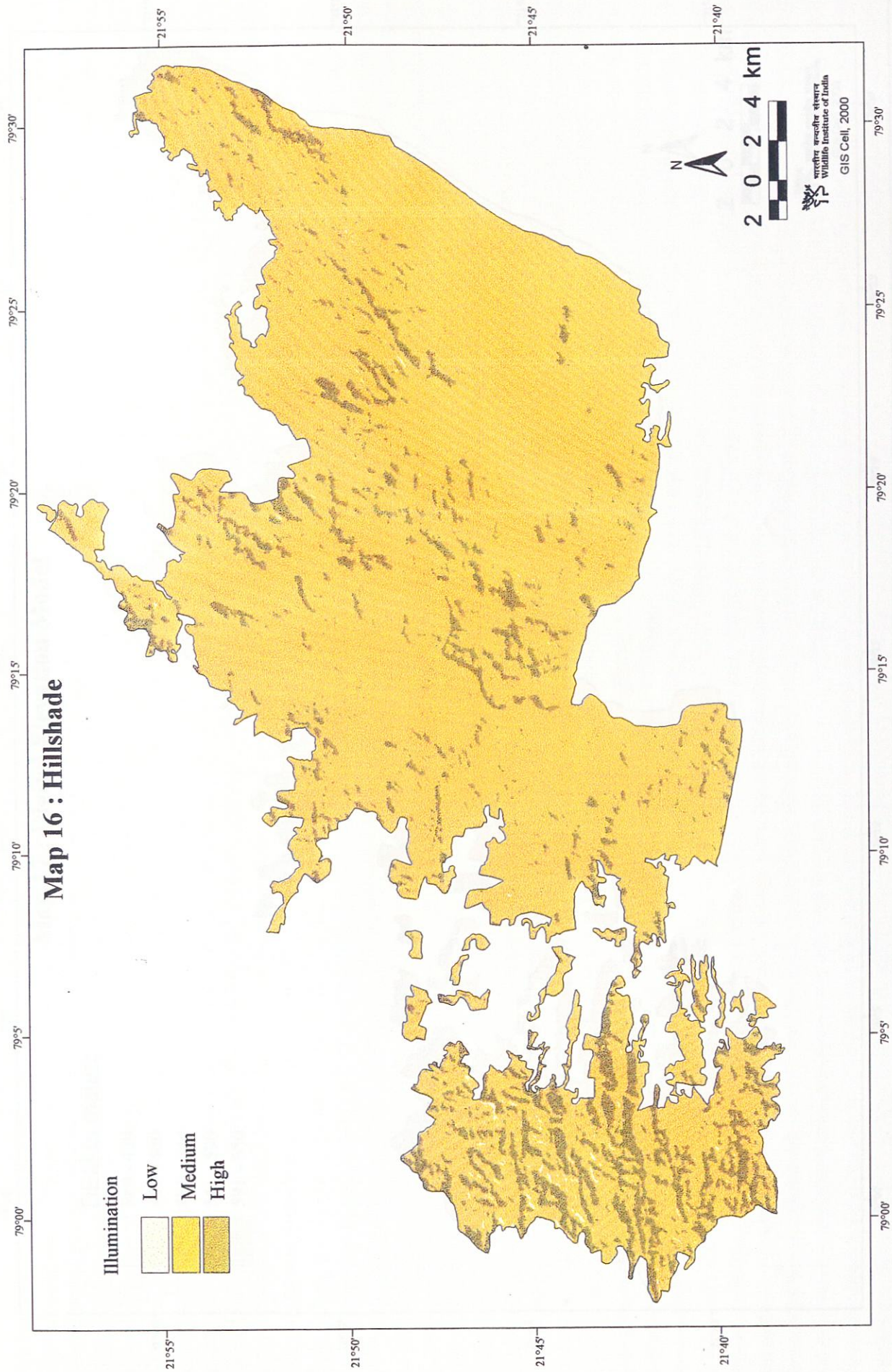
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Map 15 : Aspect



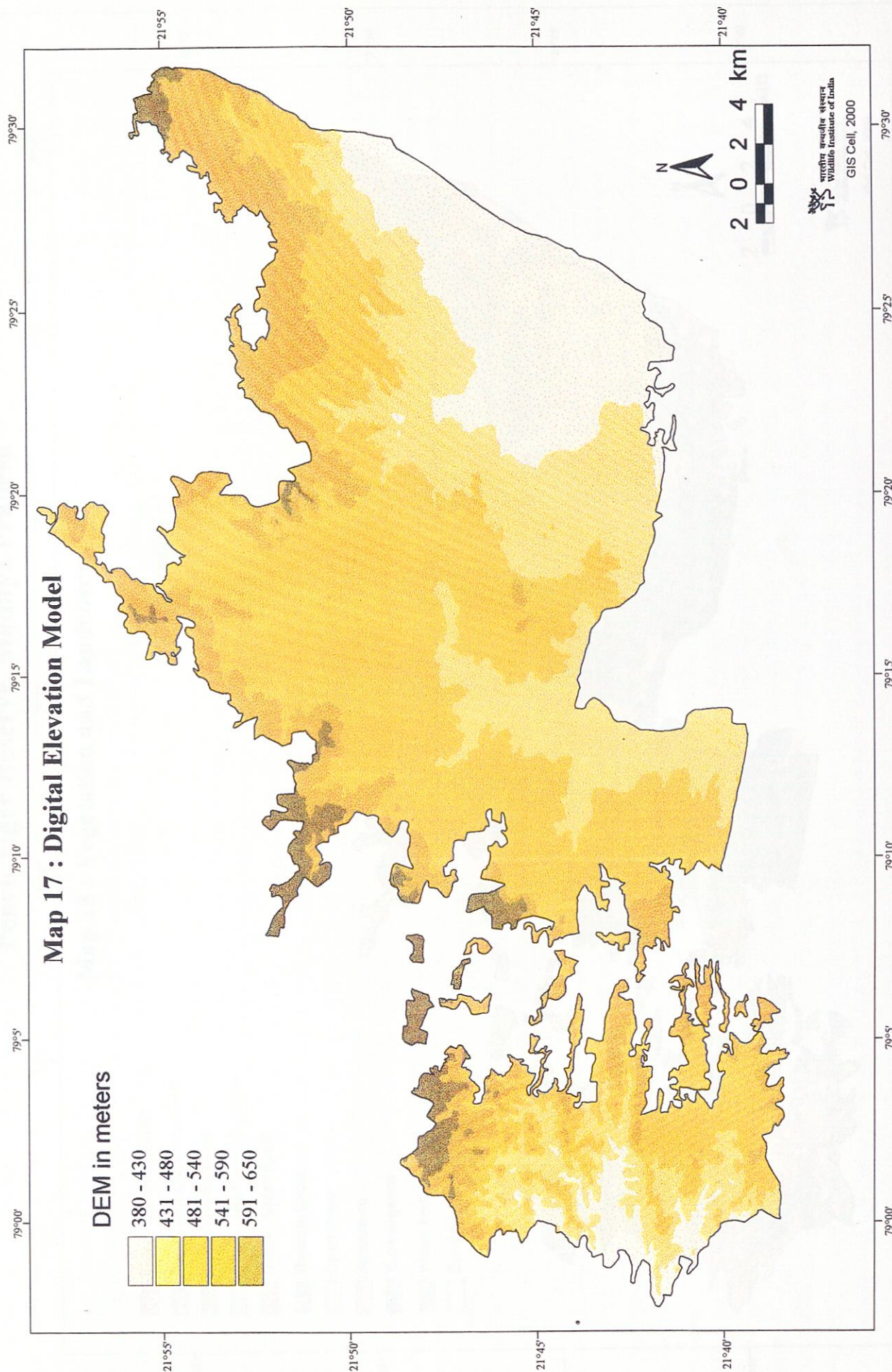
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Map 16 : Hillshade



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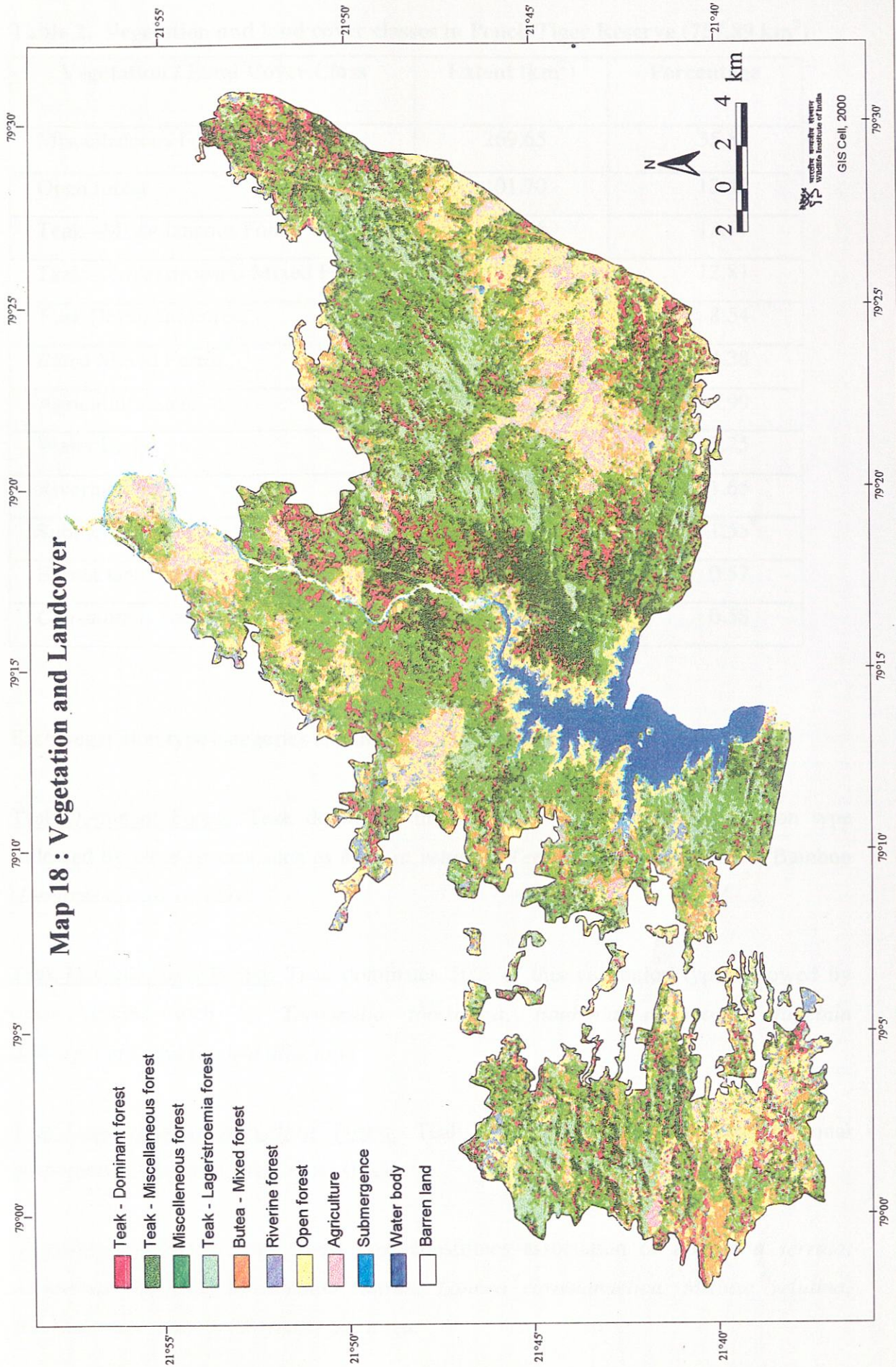
Map 17 : Digital Elevation Model



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Map 18 : Vegetation and Landcover

- Teak - Dominant forest
- Teak - Miscellaneous forest
- Miscellaneous forest
- Teak - Lagerstroemia forest
- Butea - Mixed forest
- Riverine forest
- Open forest
- Agriculture
- Submergence
- Water body
- Barren land



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Table 2. Vegetation and land cover classes in Pench Tiger Reserve (757.89 km²)

Vegetation / Land Cover Class	Extent (km ²)	Percentage
Miscellaneous Forest	269.65	35.57
Open forest	101.70	13.42
Teak –Miscellaneous Forest	99.96	13.19
Teak – <i>Lagerstroemia</i> Mixed Forest	97.08	12.81
Teak Dominant Forest	64.72	8.54
<i>Butea</i> Mixed Forest	33.19	4.38
Agriculture Land	30.23	3.99
Water Body	28.42	3.75
Riverine Forest	12.50	1.65
Submergence	11.74	1.55
Barren land	4.31	0.57
<i>Cleistanthus collinus</i> Forest	4.39	0.58

Each vegetation type categories and their associated species are given below:

Teak-Dominant Forest: Teak dominates in more than 75 % of this vegetation type followed by other species such as *Miliusa velutina*, *Terminalia tomentosa*, and Bamboo (*Dendrocalamus strictus*)

Teak-Miscellaneous Forest: Teak dominates 50% of this vegetation type followed by other species such as *Terminalia tomentosa*, *Bauhinia racemosa*, *Ougeinia dalbergeoides* and *Grewia tiliaefolia*

Teak-Lagerstroemia parviflora Forest: Teak and *Lagerstroemia* occurs in equal proportions along with a few other species

Miscellaneous Forest: This forest type constitutes association of *Boswellia serrata*, *Anogeissus latifolia*, *Buchanania lanzan*, *Lannea coromandelica*, *Miliusa velutina*, *Bauhinia racemosa* and *Soyimida febrifuga*.

Butea Mixed Forest: *Butea monosperma* inter mixed with *Lagerstroemia parviflora*, *Madhuca indica* and very few *Zizyphus mauritiana*.

Cleistanthus collinus Forest: This vegetation type is a monospecific dominant patch where more than 98 % of the species is *Cleistanthus collinus*.

Riverine Forest: Riverine vegetation is an association of *Termanalia arjuna*, *Ixora parviflora*, and *Terminalia tomentosa*.

Open Forest: This forest is present on the fringes of villages close to agriculture land and place like Alikatta and Chendia with patches of grassland. The tree species in this forest type are *Madhuca indica*, *Butea monosperma*, and *Diospyros melanoxylon*.

6.3.2.8 Soil: In PTR 10 different soil types are recognized (Map 19). The codes of each soil type are given in parenthesis. The soil types and their respective proportions of occurrence in PTR are given below:

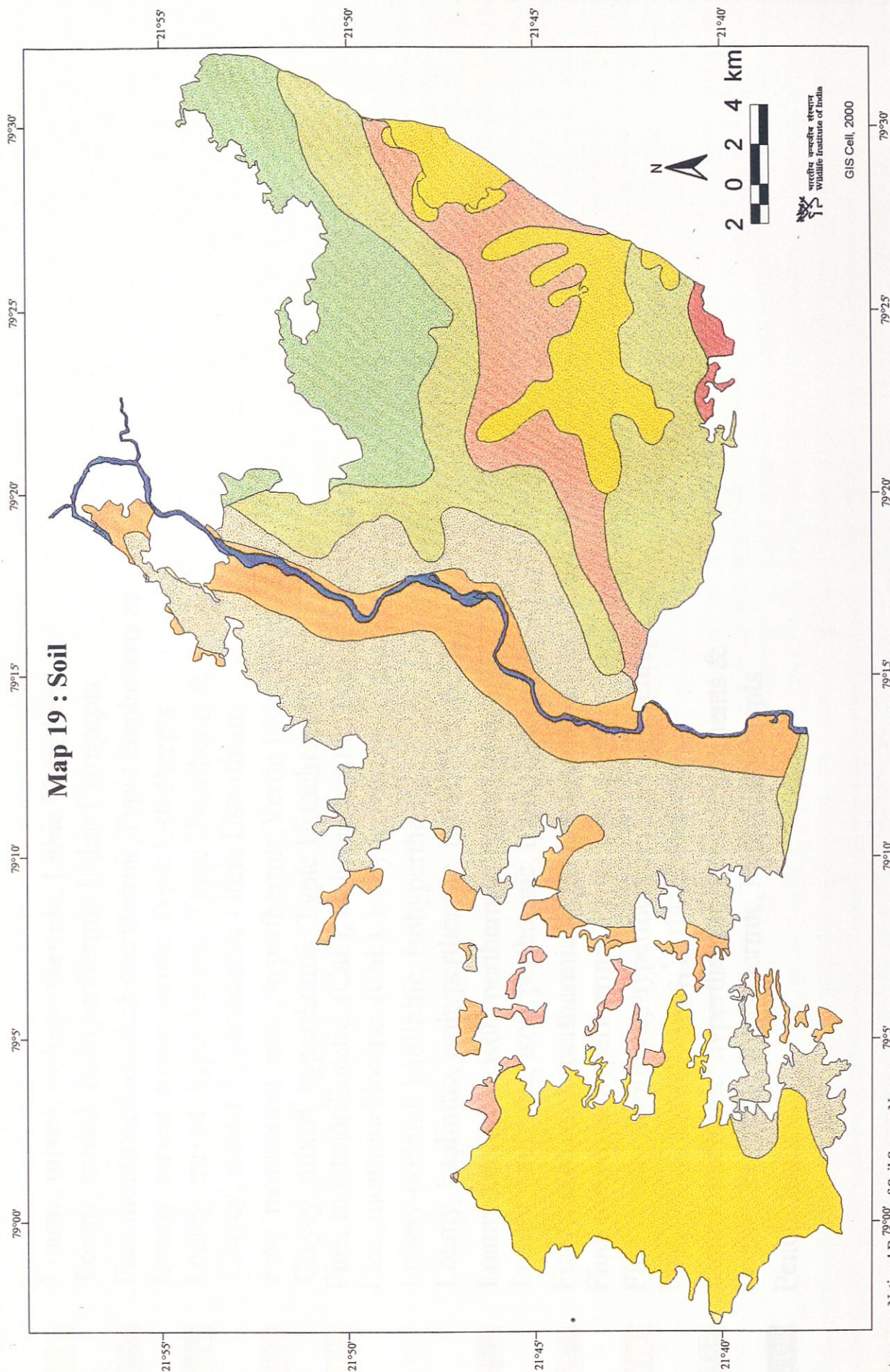
1. Loamy, mixed, isohyperthermic, Lithic Ustorthents, & Loamy, mixed, isohyperthermic, Lithic Ustropepts (6) : Extremely shallow, somewhat excessively drained, loamy soil on steep slopping hills and will range with severe erosion and moderately stony, *associated with* shallow, somewhat excessively drained with loamy soil on steeply sloping with severe erosion and strongly stony. This type of soil is found in 14.21% of PTR.

2. Fine, montmorillonitic, hyperthermic, Typic Haplusterts, & Loamy, mixed, hyperthermic, Typic Ustochrepts (48) : Deep, moderately well drained, clayey soils on gently sloping undulating plateau with mounds, with slight erosion, *associated with:* shallow, well drained, loamy soils on gently sloping with moderate erosion and slightly stony. This type of soil is found in 1.0% of PTR.

3. Loamy, mixed, hyperthermic, Typic Ustorthents & Clayey, mixed, hyperthermic, Lithic Ustorthents (50) : Very shallow, somewhat excessively drained, loamy soils on gently sloping undulating plateau with mounds with severe erosion, *associated with,* very shallow, well drained, clayey soils on moderately sloping with moderate erosion. This type of soil is found in 29.82% of PTR.

Pench Tiger Reserve, Madhya Pradesh

Map 19 : Soil



Data source: National Bureau of Soil Survey, Nagpur

Legend: Soil

- | | |
|------------|--|
| 6 | Loamy, mixed, isohyperthermic, Lithic Ustorthents & Loamy, mixed, isohyperthermic Lithic Ustropepts |
| 48 | Fine, montmorillonitic, hyperthermic, Typic Haplusterts & Loamy, mixed, hyperthermic Typic Ustochrepts |
| 50 | Loamy, mixed, hyperthermic, Typic Ustorthents & Clayey, mixed, hyperthermic Lithic Ustorthents |
| 79 | Fine, montmorillonitic, hyperthermic, Vertic Ustochrepts & Clayey, mixed, hyperthermic Typic Ustochrepts |
| 83 | Fine, montmorillonitic, (Cal.), isohyperthermic, Typic Ustropepts & Fine, montmorillonitic, (Cal.), isohyperthermic, Typic Haplusterts |
| 91 | Loamy-skeletal, kaolinitic, isohyperthermic, Typic Ustropepts & Loamy, kaolinitic, isohyperthermic, Lithic Ustropepts |
| 107 | Loamy-kaolinitic, isohyperthermic, Typic Ustropepts & Loamy, kaolinitic, isohyperthermic, Lithic Ustropepts |
| 108 | Fine, mixed, isohyperthermic, Typic Haplusterts & Fine, mixed, isohyperthermic, Typic Ustropepts |
| 113 | Fine -loamy, kaolinitic, hyperthermic, Typic Ustochrepts & Fine, mixed, hyperthermic, Vertic Ustochrepts |
| 137 | Loamy, kaolinitic, hyperthermic, Typic Ustorthents & Loamy, kaolinitic, hyperthermic, Typic Ustochrepts |
| 10 | Pench River |



4. Fine, montmorillonitic, hyperthermic, Vertic Ustochrepts & Clayey, mixed, hyperthermic, Typic Ustochrepts (79) : Deep, moderately well drained, clayey soils on gently sloping plain land with moderate erosion, *associated with:* Shallow, well drained, clayey soils on gently sloping with severe erosion. This type of soil is found in 10.62% of PTR.

5. Fine, montmorillonitic, (Cal.), isohyperthermic, Typic Ustropepts & Fine, montmorillonitic, (Cal.), isohyperthermic, Typic Haplusterts (83) : Deep, moderately well drained, calcareous, clayey soils on gently sloping plainland with narrow valleys with severe erosion, *associated with:* Deep, moderately well drained, calcareous, clayey soils on very gently sloping with slight erosion. This type of soil is found in 0.00013 % of PTR.

6. Loamy-skeletal, kaolinitic, isohyperthermic, Typic Ustropepts & Loamy, kaolinitic, isohyperthermic, Lithic Ustropepts (91) : Shallow, somewhat excessively drained, loamy-skeletal soils on moderately sloping hills and hill ranges with severe erosion and slightly stony, *associated with :* Shallow, somewhat excessively drained, loamy soils on moderately sloping with severe erosion and slightly stony. This type of soil is found in 17.40% of PTR.

7. Loamy, kaolinitic, isohyperthermic, Typic Ustropepts & Loamy kaolinitic, isohyperthermic, Lithic Ustropepts (107) : Shallow, well drained, loamy soils on moderately sloping beds (slightly dissected) with moderate erosion, *associated with:* Shallow, well drained, loamy soils on gently sloping with moderate erosion. This type of soil is found in 7.81% of PTR.

8. Fine, mixed, isohyperthermic, Typic Haplusterts & Fine, mixed, isohyperthermic, Typic Ustropepts (108) : Deep, moderately well drained, clayey soils on very gently sloping beds (moderately dissected) with moderate erosion, *associated with:* Slightly deep, well drained, loamy soils on moderately sloping with severe erosion. This type of soil is found in 0.608% of PTR.

9. Fine - loamy, kaolinitic, hyperthermic, Typic Ustochrepts & Fine, mixed, hyperthermic, Vertic Ustochrepts (113) : Slightly deep, well drained, loamy soils on moderately sloping undulating lands with valleys with severe erosion, *associated with:*

Deep, moderately well drained, clayey soils on very gently sloping with moderate erosion. This type of soil is found in 6.96% of PTR.

10. Loamy, kaolinitic, hyperthermic, Typic Ustorthents & Loamy, kaolinitic, hyperthermic, Typic Ustochrepts (137) : Soils of undulating to rolling lands, very shallow, well drained loamy soil on gently sloping undulating rolling lands with severe erosion, *associated with*: shallow, well drained loamy soil on gently sloping with moderate erosion. This type of soil is found in 10.129% of PTR.

11. Pench River occupies 1.4% of PTR. (10)

6.3.2.9 Geology: Nine different geological zones are found in PTR, viz. Amphibolites, Basalt, Chorbaoli formation, Gneisses, Lameta formation, Laterite, Lohangi formation and Manganese ore (Map 20.1). Gneisses occupy 72.54% of Park and is the major geological formation. This is followed by Basalt (20.73%), Chorbaoli formation (1.82%), Lameta formation (1.7%), Pench River (1.4%), Lohangi formation (0.82%), Laterite (0.7%), Manganese ore (0.17) and Amphibolites (0.12%).

6.3.2.10 Geomorphology: On the basis of the image characteristics and convergence of evidence the geomorphologic units have been distinctly identified in the study area. They are Denudational Hills, Inselbergs, Pediments, Buried pediments, Alluvial plains and Plateaus (Map 20.2). A detailed account of these geomorphologic units is given below :

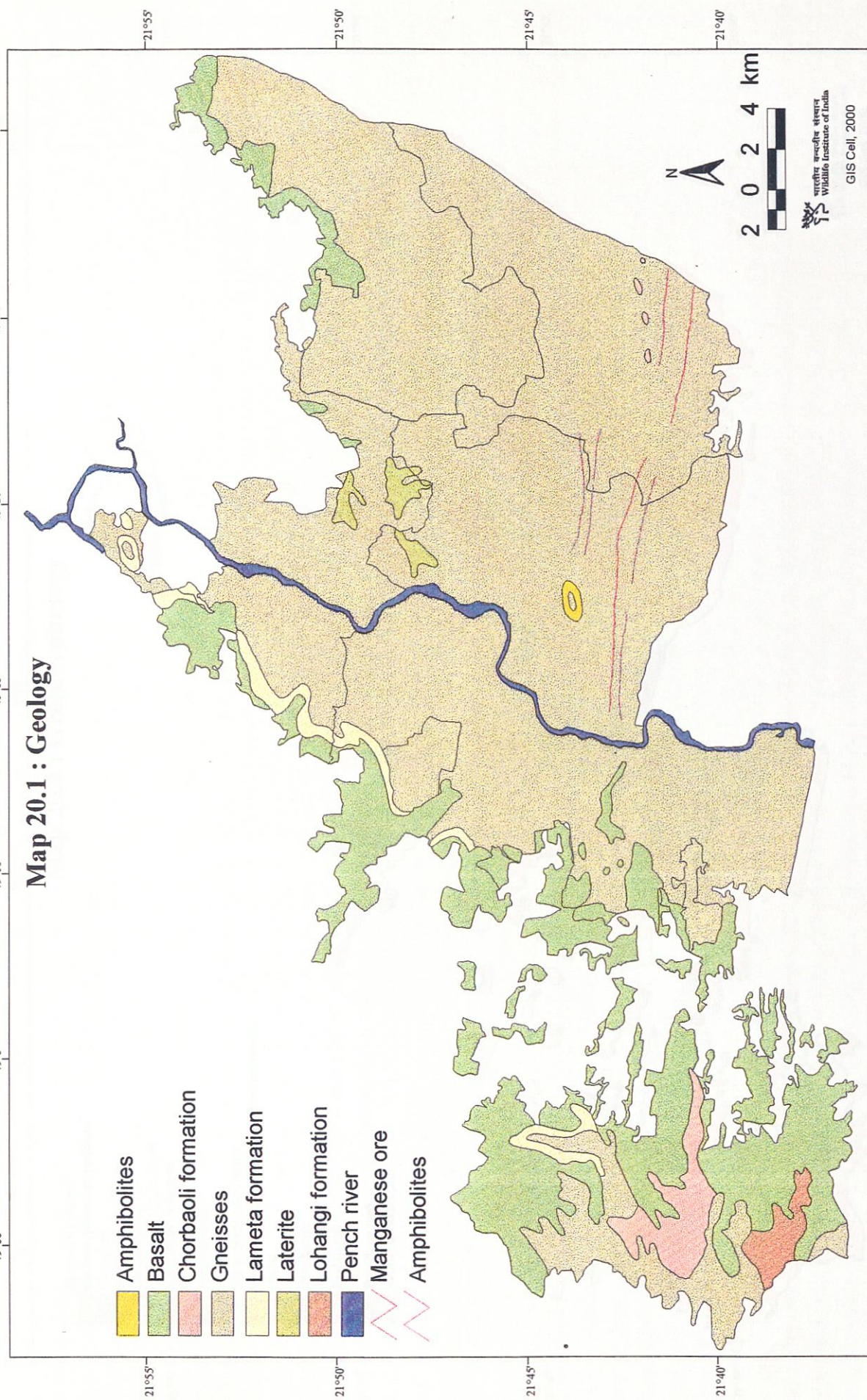
I Denudational Form

A) Denudational Hill: These are the long continuous or isolated hills, showing-weathering residue of the parent rock. Different trends can be found on the top of the hills. These are basically located in the South-East portion of the study area and composed of granite and granitic gneisses. They can rise abruptly from the pediment. The erosion is also prominent on these hilltops.

B) Plateau: Plateau is an extensive upland region at high elevation with respect to its surroundings. These are vastly spread on the North-West and Western part of the study area. The Deccan Trap Complex (plateau) is made up of Basalt showing weathering

Pench Tiger Reserve, Madhya Pradesh

Map 20.1 : Geology

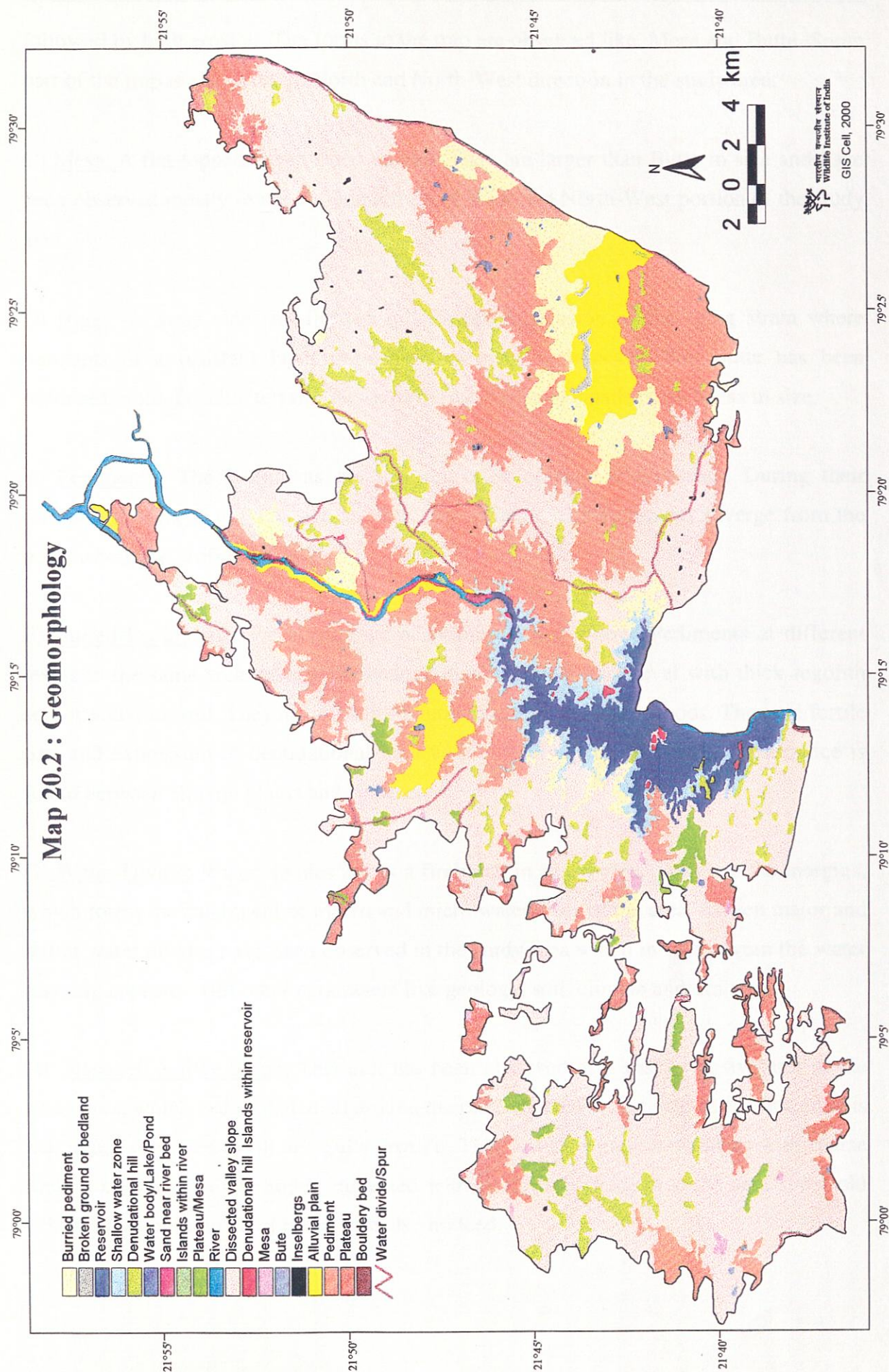


Data source: Geological Survey of India, Nagpur

भारतीय वन्यजीव संरक्षण
Wildlife Institute of India
GIS Cell, 2000

Pench Tiger Reserve, Madhya Pradesh

Map 20.2 : Geomorphology





followed by high erosion. The forms in the trap are observed like, Mesa and Butte. Some part of the trap is also lying in North and North-West direction in the study area.

C) Mesa: A flat-topped, steep sided upland. They are larger than Butte in size and have been observed mostly in the basaltic terrain of West and North-West portion of the study area.

D) Butte: A steep side and flat top hill formed by erosion of flat lying strata where remnants of a resistant layer protect softer rocks underneath. The Butte has been observed in the Basaltic terrain. These forms are basically smaller than Mesa in size.

E) Pediment: The Pediments are the indication of semi-arid climate. During their formation debris of varying size accumulates on them. The Pediments diverge from the point where the profile is convex.

F) Buried Pediments: The occurrence of Pediments and Buried Pediments at different levels in the same area reflects the change in slope, local base level with thick regolith soil or alluvium soil. They are a result of numerous rills and sheet floods. They are fertile part and expression of denudational hills with extensive cultivation. The occurrence is found between alluvial plains and pediment.

G) Water Divide: Water divides act as a firebreak in any region. They are the margins, which forms the catchment of macro and micro watersheds of the area. Eleven major and minor water divides have been observed in the study area which in fact govern the water carrying capacity with other parameters like geology, soil, climate and drainage.

H) Dissected Valley Slope: This unit has been observed as a vast extensive unit in the study area, which is distributed all around the plateau and denudational hills. This zone is maximum subjected to rill and gully erosion. This terrain is more undulating with sparse rocky exposure. This is highly dissected with dendrite pattern. In some area some old debris slides or removal of blocks are also noticed.



I) Inselbergs: These are also isolated denudational ridges, which stand above the surrounding plains. These projections are rather abrupt. These may be conical or dome shapes. The rocks in these forms are of same type.

II. Fluvial Forms

A) Alluvial Plain: These are gentler in slope almost flat with river borne sediments. They are either found on riverbanks or restricted within two large drainage. They show the extensive cultivation on them. The soil type found on these landforms is sand, silt and clay. The river in summer is comparatively sluggish and channel depth is not much and as a result of sand bar the bouldery bed has been deposited and exposed near the bank. Few Channel Islands have also been observed within the river.

B) Erosional Features: Erosion is a term, which is used to denote geological agencies of movement, which remove rock debris and associated materials. The erosional agencies are of various types, of which running water is the predominant. In the study area most of the genesis terrain is subjected to sheet erosion, rill erosion and gully erosion.

C) Sheet Erosion: When water just removes the topsoil from the pediment slopes, this results the irregular patches of country rock. This is a major process in the denudational of the land surfaces.

D) Rill Erosion: These are observed basically on water divides when sheet erosion merges into network of rills. This erosion is confined to particular hilltops.

E) Gully Erosion: Next to rills are the gullies. These have a tendency to have close network and drainage lines. This occurs because of thinning of vegetation cover, climatic change and other man-made interventions. The head-ward erosion may also consider within it.

6.3.2.11 *Ground Water Potential Zones* : Climate, physiography, soil, drainage and geology of the area influence the ground water occurrence (Srinivasan & Mukhopadhyay, 1975). Integration of remotely sensed data with convergence of evidence and ground check helps in establishing the base line information for ground water study.



The ground water potential zones of PTR is shown in Map 20.3. Being a Plateau-cum-Pediment terrain, the potential area for exploration of ground water in PTR is limited. The Pediments are covered by thin veneer of red soil while the buried pediments are covered by darker soil. The infiltration capacity is dependent on sloping pediment. Buried Pediment areas have slow infiltration rate but have high retention capacity. On the basis of geomorphology the ground water potential zones have been delineated in the form of units are as follows:

1. Nil to Very low – Plateau / Mesa, Plateau, Mesa, Bute, Inselbergs, Denudational hill
2. Low – Dissected Valley Slopes
3. Moderate – Pediment
4. Good – Buried Pediment
5. High – Alluvial Plains

The area estimation of ground water potential zones is given in Table 3.

Being a hard rock area, the ground water in PTR is confined to the weathered zones and to joints and fractures system. Pediment, Buried Pediment and Alluvial Plains are the ideal spots for ground water exploration. The PTR authorities provided dugwell data collected from Seoni area for summer 1996-2000 (Table 4).

Table 3: Area estimation of hydro-geomorphological potential zones of Pench Tiger Reserve

Geomorphic unit	Groundwater potential	Area in (km ²)
Plateau/Mesa, Plateau, Mesa, Bute, Inselbergs, Denudationalal hill	Nil to Very Low	88.83
Dissected Valley Slopes	Low	378.027
Pediment	Moderate	173.03
Buried Pediment	Good	83.23
Alluvial Plains	High	31.89
River	-	2.89
Total	-	757.89

Pench Tiger Reserve, Madhya Pradesh

Map 20.3 : Groundwater Prospects

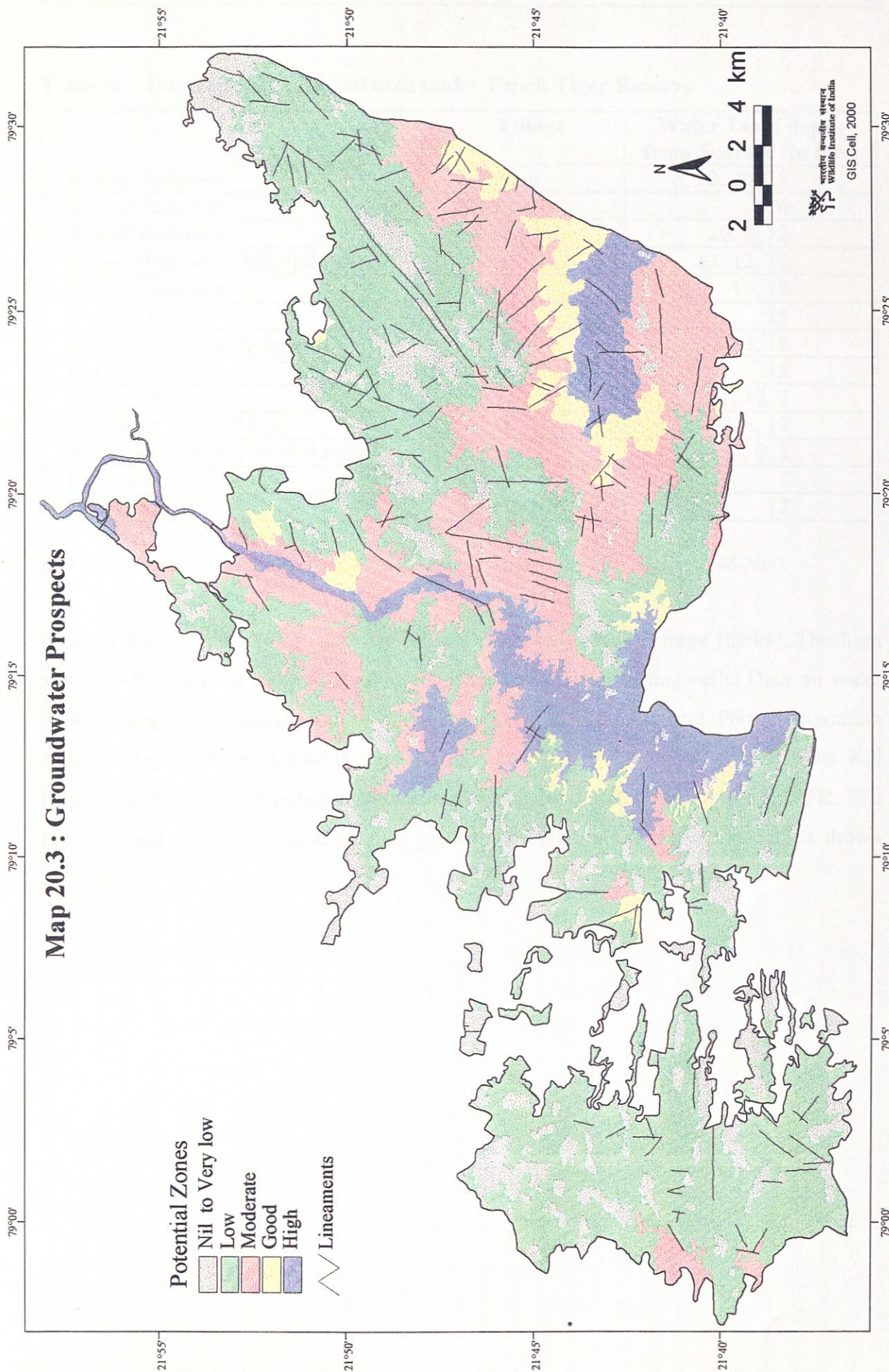


Table 4: Dugwell data of Seoni area under Pench Tiger Reserve

Unit	Village	Water Level depth from Surface (in feet)
Buried Pediment	Badalpar	5, 12, 20, 22
Buried Pediment	Khamba	6, 6
Buried Pediment	Palashpani	20, 5, 12
Buried Pediment/ Alluvial Plain	Turia	12, 12, 12
Buried Pediment	Satosa	10, 10
Pediment	Ambari	15
Buried Pediment/Pediment	Avargani	12, 18
Buried Pediment	Airma	15
Alluvial Plain	Dugarea	11, 12, 7
Dissected Valley Slope	Sagar	15, 8, 17
Buried Pediment/ Alluvial Plain	Durgapur	12, 12, 7, 9, 8
Pediment	Belpeth	7
Pediment	Karmaghiri	12

Source : Kurai Development Block, based on summer water table from the surface, 1996-2000.

Most of the dugwells in the area are located near the surface storage (tanks). The high water level in surface storage leads to the increase of water in dugwells. Data on water depth of dugwells is lacking from Chindwara portion of Tiger Reserve. Periodic updating of water depth data of dugwells found in the entire Tiger Reserve is desired. This will help in identification of potential sites for further ground water exploration in PTR. The ground water occurrence in relation to geomorphologic units of the above data is shown in Table 5.

6.3.2.12 Lineaments

All the lineaments identified in PTR have varying dimensions in length. Two dominant sets of lineaments trending Northeast - Southwest and Northwest - Southeast directions have been observed. The concentrations of lineaments are more in Northeast - Southwest directions and are located in South-Eastern part of PTR (Map 20.4).

6.3.2.13 False Colour Composite (FCC) of Pench Tiger Reserve

A False Colour Composite (FCC) of PTR was prepared using IRS 1C LISS III April 1994 satellite data. Combination of Bands 3,2 and 1 was used to get the final output (Map 20.5).

**Table 5: Ground water occurrence in relation to geomorphological units**

Unit	Lithology/Landform	Potentiality	Depth of Water from Surface (Kurai/Seoni, 1996-2000)
Plateau	Basaltic Terrain	Only in the fractured and highly jointed areas Very Low-Nil	-
Denudational Hill	Granite/Granitic Gneiss's	Only in the fractured and highly jointed areas Very Low-Nil	-
Dissected Valley Slope	Spread on both basaltic and Gneissic Terrain	Only in the fractured and Lineaments with highly jointed areas Low	15-17 feet
Pediment	Spread on both basaltic and Gneissic Terrain	Based on thin Veneer of soil and depth of weathering , porosity and permeability is less Moderate	7-15 feet
Buried Pediment	Mostly between alluvial Plain and Pediment	Depending upon depth of weathering proximity to infilled valley. Good	5-22 feet
Alluvial Plains	River born sediment, sandy soil with silt and clay	Depending upon the thickness of river alluvial and depth of weathered zone. High	7-12 feet

6.3.2.12 Lineaments

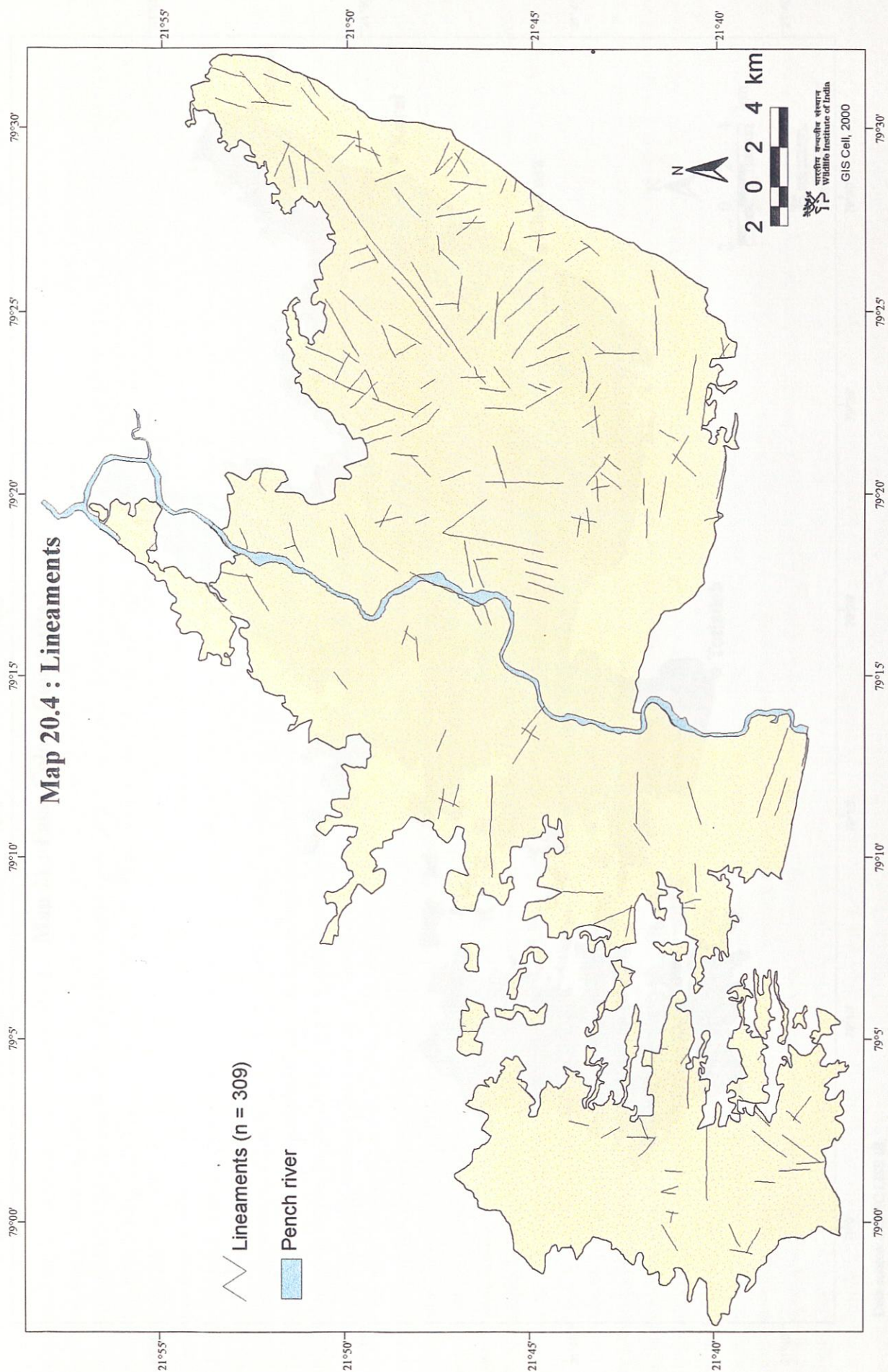
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6.3.2.13 False Colour Composite (FCC) of Pench Tiger Reserve

A False Colour Composite (FCC) of PTR was prepared using IRS 1C LISS III April, 1999 satellite data. Combination of Bands 3,2 and 1 was used to get the final output (Map 21).

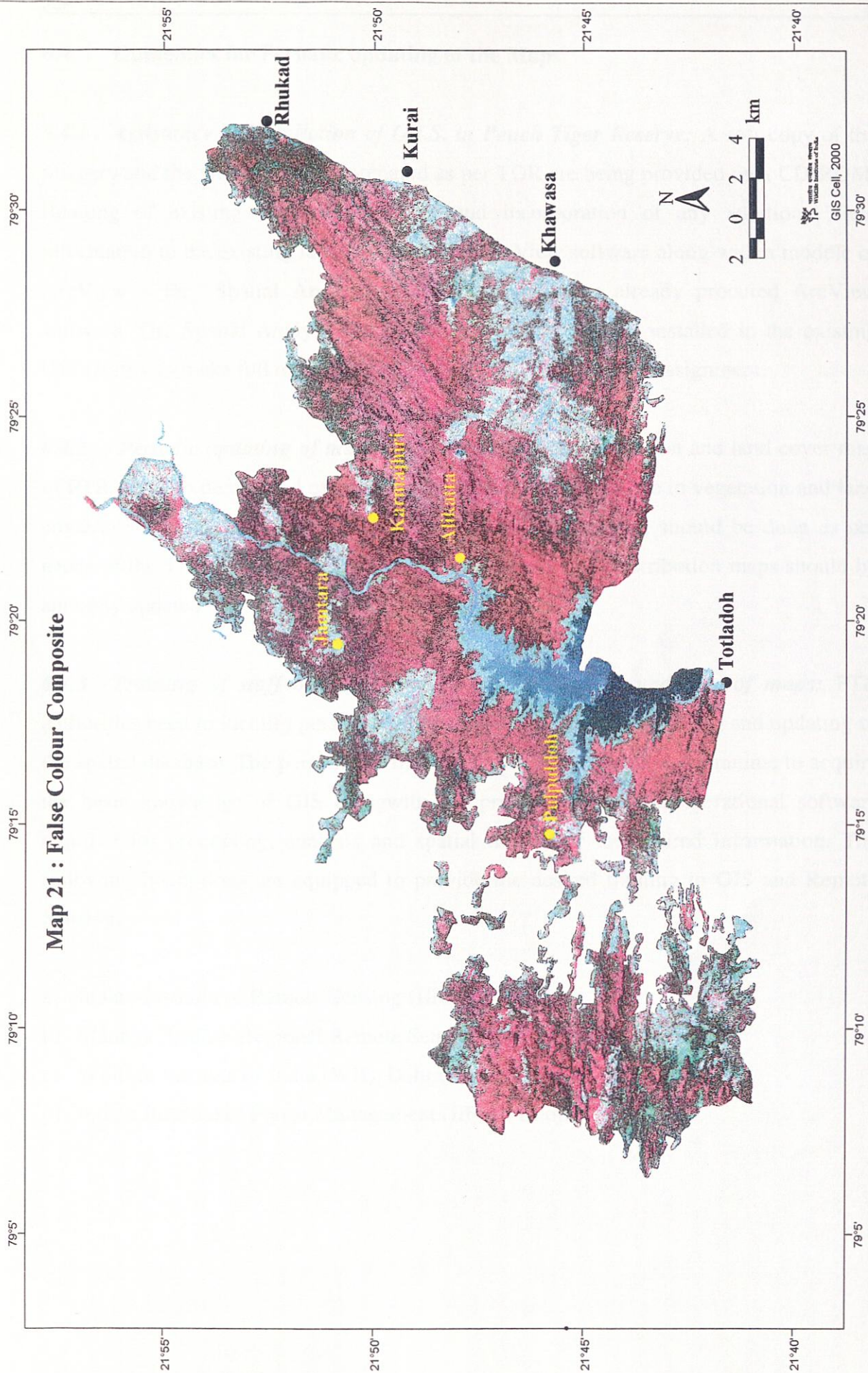
Pench Tiger Reserve, Madhya Pradesh

Map 20.4 : Lineaments



Pench Tiger Reserve, Madhya Pradesh

Map 21 : False Colour Composite



Data source: IRS 1C LISS III



6.4 Guidelines for Periodic updating of the Maps

6.4.1 Assistance in installation of G.I.S. in Pench Tiger Reserve: A soft copy of the imagery and the thematic layers prepared as per TOR are being provided on a CD-ROM. Reading of existing database, updating and incorporation of any additional field information to the existing layers requires the ArcView software along with a module of ArcView – the “Spatial Analyst”. PTR authorities have already procured ArcView software. The Spatial Analyst also needs to be purchased and installed in the existing GIS facility to make full use of spatial database developed in this assignment.

6.4.2 Periodic updating of maps: It is desired that the vegetation and land cover map of PTR needs to be updated once in 5 years to monitor the change in vegetation and land cover/use patterns. The update of the thematic layers prepared should be done as per needs of the Tiger Reserve management. The prey-predator distribution maps should be annually updated.

6.4.3 Training of staff of PTR in using, interpreting & updating of maps: PTR authorities need to identify personnel to be trained for using, interpreting and updating of the spatial database. The personnel will have to undergo a training programme to acquire the basic knowledge of GIS alongwith the procurement of the operational software required for processing, analysis and spatial display of the desired information. The following Institutions are equipped to provide the desired training in GIS and Remote Sensing:

- a) Indian Institute of Remote Sensing (IIRS), Dehra Dun
- b) Madhya Pradesh Regional Remote Sensing Center (MPRRSC), Bhopal
- c) Wildlife Institute of India (WII), Dehra Dun and
- d) Indian Institute of Forest Management (IIFM), Bhopal



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Plate I : Teak dominated forest



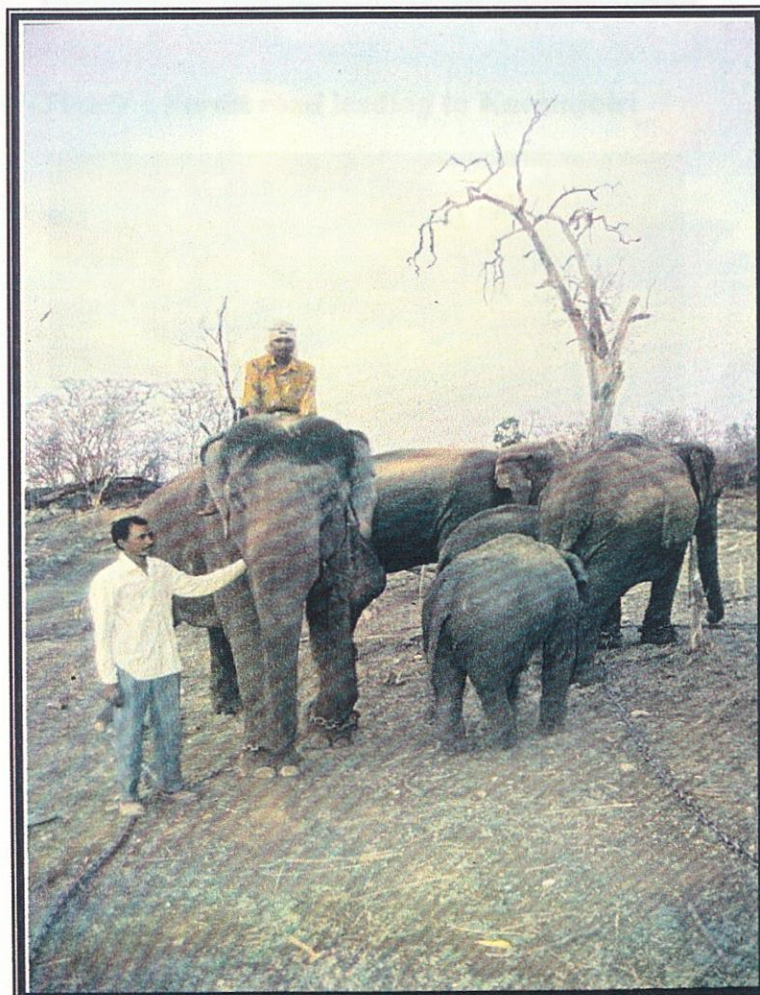
Plate II : Miscellaneous forest



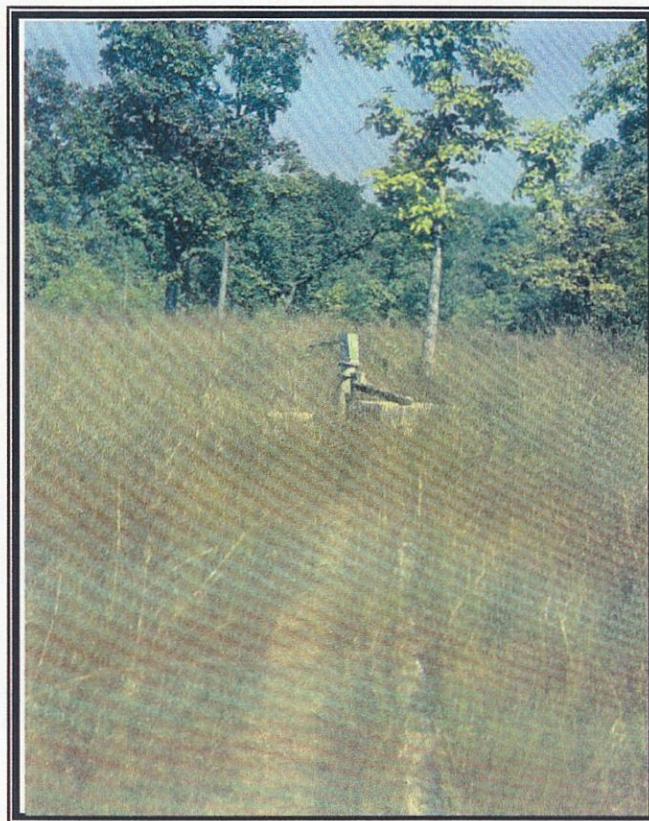
Plate III : *Cleistanthus collinus* forest



Plate IV : Camp elephants in PTR



PlateVI: Artificial waterhole in compartment # 25



PlateV : Forest road leading to Karmajhiri

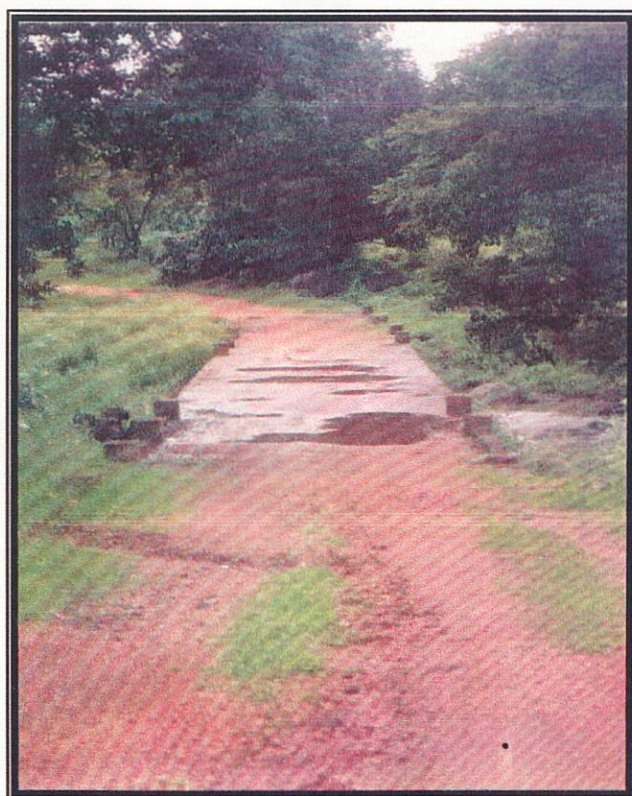




Plate VII : Park main entrance gate at Turia



Plate VIII : Watch tower at Ghatkohka





Plate IX : Tourist cottage at Karmajhiri



Plate X : Fireline at Karmajhiri

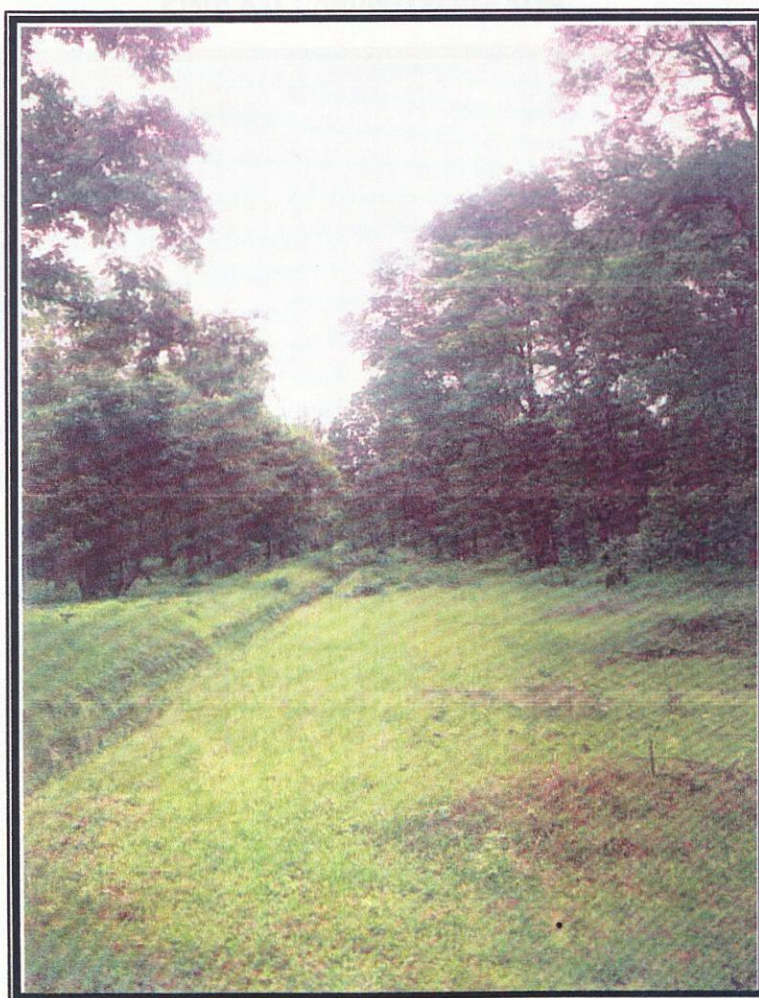
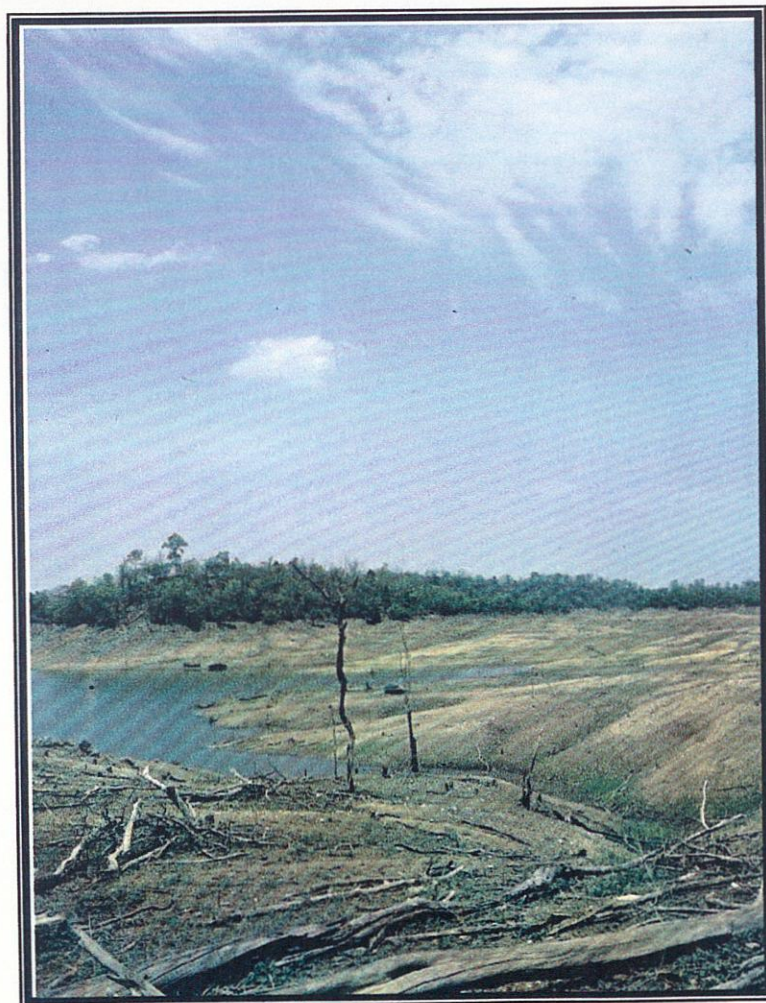




Plate XI : Totladoh reservoir



Plate XII : Submergence area



2.2. Tiger Reserves

(a) The Tiger Reserves are established under the Wildlife Protection Act, 1972. The Government of India has notified 17 Tiger Reserves in the country. The first Tiger Reserve was established in 1973 in the state of Madhya Pradesh. The Government of India has notified 17 Tiger Reserves in the country. The first Tiger Reserve was established in 1973 in the state of Madhya Pradesh.

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ANNEXURE - I

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INDIA ECODEVELOPMENT PROJECT - PENCH TIGER RESERVE
Terms of Reference for mapping of the P.A. and surrounding Areas

1.0 Back ground :

(A) A multi-State Ecodevelopment Project sponsored by IDA / GEF involving seven Protected Areas in as many States has been drawn up with the object of conserving biodiversity by implementing eco-development strategy in and around the PAs over five financial years (Jan. 1997- March 2002). The Project sites are Pench Tiger Reserve in Madhya Pradesh, Gir National Park in Gujarat, Nagarhole National Park in Karnataka, Palamau Tiger Reserve in Bihar, Buxa Tiger Reserve in West Bengal, Periyar Tiger Reserve in Kerala and Ranthambhore Tiger Reserve in Rajasthan.

(B) There are five basic objectives of the Project :

- (i) Improved protected area management by strengthening capacity to conserve biodiversity, increasing opportunities for local participation in protected area management activities and decisions, and reducing negative impacts of protected areas on local people.
- (ii) Village eco-development to reduce negative impact of local people on biodiversity and increased support of local people for conservation.
- (iii) Development of more effective and extensive support for protected area management and eco-development through environmental education and awareness campaigns, monitoring and research to improve understanding of issues and integrating experiences and strengthening the framework.
- (iv) Preparation of other biodiversity projects focused on biodiversity information and ex situ conservation.
- (v) Overall project management to support the project management organisation and activities.

(C) As part of the Deccan Peninsula biogeographic zone, Pench Tiger Reserve has extensive stands of dry deciduous teak and mixed forests typical of the central Indian highlands. The open woodlands and savanna-type habitat support many herbivores and their predators. 38 species of mammals, 168 species of birds, 15 species of reptiles, 3 species of amphibians and 14 species of fishes have been recorded from the park. This Reserve, however, encounters a lot of anthropogenic pressure. There are 99 villages around this Park within a 5 km periphery. The forests have suffered damages due to continuous pressures of human being and cattle for drawal of fuelwood, fodder and other forest products. The fishing, which is illegal in the National Park is one of the major problems. Some areas have also lost natural habitation due to planting of teak by the Forest Department in earlier years. Joint forest management concept is extended to Pench Tiger Reserve very recently and few Forest Protection Committees / Eco-development Committees comprising local villagers have been formed.

(D) The multi-State Project prepared with fund assistance from UNDP was submitted to the World Bank for appraisal and fund support. After appraisal, the World Bank has agreed to finance this Project with a Global Environment Facility (GEF) grant of US\$20 million and IDA soft loan of US\$28 million. The Govt. of India and the State Govts are required to contribute rupee equivalent of US\$15 million and the local people would finance a notional US \$ 4 million. The State Govt. contribution will be in the form of expenditure for salary of staff. The IDA and GEF assistance will flow to the Govt. of India and this will be channelled by the Central Govt. to the States in the form of grants through a Centrally Sponsored Scheme of Eco-development Project.

(E) The Project components in Pench are as follows :--

Improved PA management	Rs. 7.40 Crores
Village eco-development	Rs. 16.75 Crores
Education & awareness and	
Monitoring & Research	Rs. 2.70 Crores
Overall Project management	Rs. 1.05 Crores
Total	Rs. 27.90 Crores

2.0 Objectives:

To produce a baseline map of the Pench Tiger Reserve & surrounding areas consisting of -

- (i) Features relevant to PA management and ecodevelopment activities.
- (ii) Defining ecological boundaries of Pench Tiger Reserve.

Such maps would also form a basis for monitoring changes in subsequent years.

3.0 Responsibilities/Tasks:

- (i) To review and catalogue the availability of satellite imageries, maps and other documents relevant to the production of baseline map, of Pench Tiger Reserve and its surrounding areas up to ecological boundaries.
- (ii) To produce geocoded baseline maps of Pench Tiger Reserve and surrounding areas upto ecological boundaries consisting of classified vegetation, topographical and drainage features ecosystems, location of village & towns, water bodies, major infrastructure facilities, etc. on appropriate scales using existing maps, digital analysis, satellite imagery and ground truthing.
- (iii) To provide a document for interpretation of the map consisting of extent, status and species composition of various vegetation types etc.
- (iv) To provide a set of guidelines for periodic updating of the maps.
- (v) To assist in installation of G.I.S. in Pench Tiger Reserve for continuous updating and use of such maps.
- (vi) To train staff of P.T.R. in using, interpreting & updating of such maps.
- (vii) To advise on procuring compatible softwares required for above purposes.

- 4.0 **Reports to :**
Field Director, Pench Tiger Reserve.
- 5.0 **Durarion :** One year
- 6.0 **Qualification:**
Qualification & experience in the interpretation of satellite & photo imageries particularly relating to natural vegetation and land use. Experience in the preparation of baseline land use maps.
- 7.0 **Schedule of completion of tasks:**
All tasks/responsibility during one year.
- 8.0 **Period of Study/ Contract.**
The consultant will be contracted for one year from the date of assignment.
- 9.0 **Final output.**
- (i) The consultant will submit maps, reports, documents etc. to the Field Director/Deputy Director and Management plan officer Pench Tiger Reserve.
 - (ii) The consultant will also submit a half yearly report to the Review Committee through the Field Director regarding the progress/ performance during the half year period starting from the date of assignment. The report should cover the methodology and findings in respect of tasks out lined in Para 3 above including maps, reports other relevent documents and references as may be necessary.
- 10.0 **Support inputs**
- (i) One Deputy Ranger/ Forester and one forest guard will be associated during field visits.
 - (ii) Accomodation at forest Rest Houses, if available, at rates applicable for forest officers on duty. Otherwise they have to arrange for their stay on their own.
 - (iii) Use of vehicle during field trips.
 - (iv) Necessary maps, literature and records of Pench Tiger Reserve.
 - (v) Office support but all the expenses in connection with production of outputs will be done by the consultants.
 - (vi) No other facility shall be provided by the Field Director, Pench Tiger Reserve, Seoni except as provided in the T.O.R.
- 11.0 **Personnel to liaise with the consultant**
- (i) Additional P.C.C.F. (wild life) and CWLW (Madhya Pradesh)
 - (ii) Field Director, Pench Tiger Reserve, Seoni
 - (iii) Deputy Director, Pench Tiger Reserve, Seoni
 - (iv) Ecodevelopment officer, Pench Tiger Reserve, Seoni
 - (v) Management plan officer , Pench Tiger Reserve, Seoni
 - (vi) Other officers and staff of Pench Tiger Reserve as nominated by Field Director Pench Tiger Reserve Seoni.

12.0 Procedure for submission of progress reports, review and final report :

- (a) The consultant will submit his reports / findings / recommendations / inputs in respect of the assigned tasks to the Field Director/ Deputy Director / Management Plan Officer within the time limit suggested by the concerned authority. The consultant will take into consideration the comments and suggestions made by the said authorities for correction and modification of the course of study / tasks.
- (b) The consultant will submit his half yearly performance reports to the Review Committee through the Field Director, Pench Tiger Reserve within 30 days of the half year period starting from the date of assignment . Amendments / rectifications as suggested by the Committee will have to be carried out by the consultant within the time limit as set out by the committee.
- (c) The consultant will submit his final report to the Field Director within 30 days of the end of the period starting from the date of assignment. The amendments/ rectifications suggested by the Field Director will be carried out by the consultant within stipulated period.
- (d) All reports shall be written in English.

13.0 Composition of Review Committee :

The Committee will comprise of the following :

- | | | |
|-----|---|--------------------|
| (1) | Field Director, Pench Tiger Reserve, Seoni | --Chairman |
| (2) | Deputy Director, Pench Tiger Reserve, Seoni | --Member Secretary |
| (3) | Field Director, Kanha Tiger Reserve, Mandla | --Member |
| (4) | Management Plan Officer, Pench Tiger Reserve, Seoni | --Member |
| (5) | Assistant Conservator of Forest, Pench Tiger Reserve, Seoni | --Member |
| (6) | Superintendent, Pench Wildlife Sanctuary, Seoni | --Member |

Consultancy Services

Draft Letter of Agreement for Small Assignments Carried out by Consultants

Subject : Consultancy services for PA Mapping of the PA and Surrounding Areas.

1. Set out below are the terms and conditions under which W.I.L. Dehradun has agreed to carry out for Field Director, Pench Tiger Reserve, Seoni the above-mentioned assignment specified in the attached Terms of Reference.

2. For administrative purposes Deputy Director Pench Tiger Reserve has been assigned to administer the assignment and to provide W.I.L. Dehradun with all relevant information needed to carry out the assignment. The services will be required in Field Director, Pench Tiger Reserve, Seoni for about 12 (twelve) days/months, during the period from September 1999 to August 2000.

3. The Field Director, Pench Tiger Reserve, Seoni may find it necessary to postpone or cancel the assignment and / or shorten or extend its duration. In such case, every effort will be made to give you, as early as possible, notice of any changes. In the event of termination, the W.I.L. Dehradun shall be paid for the services rendered for carrying out the assignment to the date of termination, and the W.I.L. Dehradun will provide the Field Director, Pench Tiger Reserve, Seoni with any reports or parts thereof, or any other information and documentation gathered under this Agreement prior to the date of termination.

4. The services to be performed, the estimated time to be spent, and the reports to be submitted will be in accordance with the attached Terms of Reference.

5. This Agreement, its meaning and interpretation and the relation between the parties shall be governed by the laws of Union of India.

6. This Agreement will become effective upon confirmation of this letter on behalf of W.I.L. Dehradun and will terminate on 31st August 2000, or such other date as mutually agreed between the Field Director, Pench Tiger Reserve, Seoni and the W.I.L. Dehradun.

7. Payments for the services will not exceed an total amount of Rs. 9.80 lacs

The Field Director, Pench Tiger Reserve, Seoni will pay W.I.L. Dehradun, payable within 30 days of receipt of invoice as follows :

	Amount	Currency (In Indian Rupees)	
1	30% of the contract value	2.94 lakhs	upon receipt of a confirmed copy of this letter.
2	30% of the contract value	2.94 lakhs	upon receipt of intermediate Status Report.
3	Nil	Nil	upon receipt of the draft Final report.
4	40% of the contract value	3.92 lakhs	upon receipt of the final report acceptable to (Name of Borrower)

The above remuneration includes all the costs related to carrying out the services, including overhead and any taxes imposed on W.I.L., Dehradun.

8. The W.I.L., Dehradun will be responsible for appropriate insurance coverage. In this regard, the W.I.L., Dehradun shall maintain workers compensation, employment liability insurance for their staff on the assignment. The Consultants shall also maintain comprehensive general liability insurance, including contractual liability coverage adequate to cover the indemnity of obligation against all damages, costs, and charges and expenses for injury to any person or damage to any property arising out of, or in connection with, the services which result from the fault of the W.I.L., Dehradun or its staff. The W.I.L., Dehradun shall provide the Field Director, Pench Tiger Reserve, Seoni with certification thereof upon request.

9. The W.I.L., Dehradun shall indemnify and hold harmless the Field Director, Pench Tiger Reserve, Seoni against any and all claims, demands, and / or judgements of any nature brought against the Field Director, Pench Tiger Reserve, Seoni arising out of the services by the W.I.L., Dehradun under this Agreement. The obligation under this paragraph shall survive the termination of this Agreement.

10. The Consultants agree that any manufacturing or construction firm with which they might be associated with will not be eligible to participate in bidding for any goods or works resulting from or associated with the project of which this consulting assignment forms a part.

11. All final plans, drawings, specifications, designs, reports and other documents or software submitted by the W.I.L., Dehradun in the performance of the Services shall become and remain the property of Pench Tiger Reserve, M.P. The Consultants may retain a copy of such documents but shall not use them for purposes unrelated to this Contract without the prior written approval of the Client.

12. The Consultant undertake to carry out the assignment in accordance with the highest standard of professional and ethical competence and integrity, having due regard to the nature and purpose of the assignment, and to ensure that the staff assigned to perform the services under this Agreement, will conduct themselves in a manner consistent herewith.

13. The W.L.L., Dehradun shall pay the taxes, duties fee, levies and other impositions levied under the Applicable law and the Client shall perform such duties in this regard to the deduction of such tax as may be lawfully imposed.

14. The W.L.L., Dehradun also agrees that all knowledge and information not within the public domain which may be acquired during the carrying out of this Agreement, shall be, for all time and for all purpose, regarded as strictly confidential and held in confidence, and shall not be directly or indirectly disclosed to any person whatsoever, except with the Field Director, Pench Tiger Reserve, Seoni's written permission.

Place : DEHRADUN

Date : 2 / 9 / 1999
Representative _____

(Signature of Authorized
on behalf of **Director**)

Wildlife Institute of India

Dehra Dun.

(Signature & Name of the Client's Representative)

(**R. S. R. S. R.**)

श्री श्री संजय
नंद गणेश उद्यान
मिशनरी

2. Thematic maps on 1:50,000 Scale

- (i) Hydro-geomorphological map.
- (ii) Soil types map.
- (iii) Land use map.
- (iv) Slope map.
- (v) Forest types map.
- (vi) Surface drainage map including artificial water bodies.
- (vii) Thematic maps 1:15,000 scale for vegetation type, slope compartment, major road network and waterhole, for National Park & Sanctuary.

B. The following items/articles to be submitted by the W.L.L. Dehradun to the Park Management after completion of the final report.

- (i) 4 Hard copies of all map outputs mentioned above will be provided to the Pench Tiger Reserve, Seoni.
- (ii) Digital data and hard copy of the satellite images.

Name of the Consultancy : Mapping of the PA (Pench Tiger Reserve) and surrounding Area

Name of the Consultant : Wildlife Institute of India, Dehradun

The task to be accomplished by the W.I.I, Dehradun would also include the followings:

A. Following maps require to be prepared and submitted to the Park Management by the consultant.

[1] General maps in 1: 50,000 Scale

- [i] PTR map demarcating Core, Buffer and Sanctuary area.
- [ii] Map showing villages in and around PTR, including all Ecodevelopment Village.
- [iii] Management map showing management units, like; F.R.H., buildings, watch towers, wireless towers, block headquarters Janpad Panchayat, Police Station.
- [iv] Fire-line map.
- [v] Compartment map.
- [vi] Tourism potential areas and possible site(s) for the Interpretation Centre.
- [vii] Map showing the location of beat, circle and Range headquarters.
- [viii] Prey-predator distribution map within Core and Buffer area.
- [ix] Major road network in PTR.

2. Thematic maps on 1:50,000 Scale

- [i] Hydro-geomorphological map.
- [ii] Soil types map.
- [iii] Land use map.
- [iv] Slope map.
- [v] Forest types map.
- [vi] Surface drainage map including artificial water bodies.
- [vii] Thematic maps 1:15,000 scale for vegetation type, slope compartment, major road network and waterhole, for National Park & Sanctuary.

B. The following item/articles to be submitted by the W.I.I. Dehradun to the Park Management after completion of the final report.

- (i) 4 Hard copies of all map outputs mentioned above will be provided to the Pench Tiger Reserve, Seoni.
- (ii) Digital data and hard copy of the satellite images.

- (iii) W.I.I. will help PTR authorities in procuring software (eg. Archive, Spatial Analysis, 3D Image Analysis) required for image processing and data analysis for further updating.

C. Information/inputs to be provided by the Park Management to W.I.I., Dehradun

- (i) Prey-Predator population data compartment wise for 1999-2000.
- (ii) Compartment boundary map.
- (iii) Location of artificial water holes major roads, buildings, Wireless tower, watch towers and fire lines.
- (iv) Soil type map in 1:50,000 scale.

Dear Sir,

-----X-----

This has reference to your above cited letter. Please find herewith enclosed the photocopy of the Letter of Agreement (LOA) on hiring the above subject consultancy.

The consultancy service for "Mapping of the PA Pench Tiger Reserve, Seoni and surrounding area" is awarded to the Wildlife Institute of India, Dehradun. You are requested to kindly start the works/jobs conforming the conditions mentioned in the Terms of References (TOR), Letter of Invitation (LOI) and Letter of Agreement (LOA).

A bank draft for Rs. 1,24,000 (Rs. Two Lacks Ninety-four thousands only) has already been dispatched to you vide this office's letter no. STNO/01/533 dated 03-10-99 to meet out the various expenses to be incurred at this regard.

Thanking you

Yours faithfully,

Yours Sincerely,

[Signature]

Field Director

Pench Tiger Reserve,

Seoni (M.P.)

Phone 07692-50794

Office of the Field Director, Pench Tiger Reserve,
Seoni (M.P.), 480661

No/Steno/01/

5590

DWII

DIARY

Sconi/Dated

2.10.99

No. 4559

DATE 13/10/99

To,

The Director,
Wildlife Institute of India, Chandrabani,
Dehradun

Sub: -

Consultancy services for "Mapping of the PA (Pench Tiger Reserve, Ecodevelopment Project)

Ref: -

The World Bank's letter no. Nil dated September 20, 1999 and your office letter no./WB-KS/misc. 99; dated 02-09-99.

Dear Sir,

This has reference to your above cited letter Please find herewith enclosed the photocopy of the Letter of Agreement (LOA) on hiring the above subject consultancy.

The consultancy service for "Mapping of the PA Pench Tiger Reserve, Seoni and surrounding area" is awarded to the Wildlife Institute of India, Dehradun. You are requested to kindly start the works/Jobs confirming the conditions mentioned in the Terms of References (TOR), Letter of Invitation (LOI) and Letter of Agreement (LOA)

A bank draft for Rs. 2,94,000 (Rs. Two Lacks Ninety-four thousands only) has already been dispatched to you vide this office's letter no Steno/01/5533 dated 05-10-99 to meet out the various expenses to be incurred in this regard.

Thanking you

Encl: - As above

Yours Sincerely

[R.C. Sharma]

Field Director

Pench Tiger Reserve,
Seoni (M.P.)

13/10/99

No./Steno/01/

Seoni/Dated

Copy forwarded to:

1. Director, Project Tiger, Ministry of Environment and Forest,
Bikaner House, Shahjhan Road, New Delhi, for favour of
information and necessary actions
2. Additional P.C.C.F. (Wildlife), Van Bhawan, Tulsi Nagar, Bhopal
for favour of information and necessary actions.

sdt
Field Director
Pench Tiger Reserve,
Seoni (M.P.)

Dear Sir,

Please find enclosed herewith two copies of Draft Final Report prepared by the Institution for the above mentioned project. As the request to send the comments on the said report if any, so that we can finalise the report. The final report will be submitted upon receipt of your comments on the Draft Final Report.

The final report will include the following:

1. Four hard copies (A 4 size) of all maps as given in the draft final report and digital data of Satellite Imagery.
2. Four hard copies (A 4 size) of vegetation type, slope, forest compartment, major road network, natural & artificial water bodies and False Colour Composite (FCC) maps and
3. A complete data base information of all the maps in Arc-View format on a CD-ROM.

With regards,

Yours faithfully

(V. H. Sawarkar)

ADDITIONAL FIELD DIRECTOR

Encl: As above

Copy to: The Additional P.C.C.F. & Chief Wildlife Warden, Govt. of M.P., Van Bhawan,
Tulsi Nagar, Bhopal - for their information & use
File No. 338041 or 33761

Post Box No. 18, Chhindwara, Madhya Pradesh - 482001, India

TELEPHONE: 031-2542011, 2542012, 2542013, 2542014, 2542015, 2542016, 2542017, 2542018, 2542019, 2542020, 2542021, 2542022, 2542023, 2542024, 2542025, 2542026, 2542027, 2542028, 2542029, 2542030, 2542031, 2542032, 2542033, 2542034, 2542035, 2542036, 2542037, 2542038, 2542039, 2542040, 2542041, 2542042, 2542043, 2542044, 2542045, 2542046, 2542047, 2542048, 2542049, 2542050, 2542051, 2542052, 2542053, 2542054, 2542055, 2542056, 2542057, 2542058, 2542059, 2542060, 2542061, 2542062, 2542063, 2542064, 2542065, 2542066, 2542067, 2542068, 2542069, 2542070, 2542071, 2542072, 2542073, 2542074, 2542075, 2542076, 2542077, 2542078, 2542079, 2542080, 2542081, 2542082, 2542083, 2542084, 2542085, 2542086, 2542087, 2542088, 2542089, 2542090, 2542091, 2542092, 2542093, 2542094, 2542095, 2542096, 2542097, 2542098, 2542099, 2542100

E-Mail: chhindwara@mp.gov.in



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

No. /WB-KS/ Misc. 2000

Dated: 6.10.2000

To

Sh. R.C. Sharma, I.F.S.
Field Director
Pench Tiger Reserve
Barapather P.O.
Seoni - 480 661
MADHYA PRADESH
Fax # 07692-50204

Sub : Consultancy Services for 'Mapping of P.A. and Surrounding Areas in
Pench Tiger Reserve, Madhya Pradesh' under India Ecodevelopment Project
- Draft Final Report

Dear Sir,

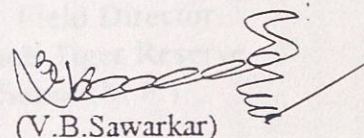
Please find enclosed herewith two copies of Draft Final Report prepared by the Institute for the above consultancy project. You are requested to send us the comments on the said report if any, so that we can finalize the report. The final report will be submitted upon receipt of your comments on the Draft Final Report.

The final report will include the following:

1. Four hard copies (A 4 size) of all maps as given in the draft final report and digital data of Satellite Imagery.
2. Four hard copies (A 0 size) of vegetation type, slope, forest compartment, major road network, natural & artificial water holes and False Colour Composite (FCC) maps and
3. A complete data base information of all the maps in Arc-View format on a CD-ROM.

With regards.

Yours faithfully



(V.B.Sawarkar)

ADDITIONAL DIRECTOR

Encl: As above

Copy to: The Additional P.C.C.F & Chief Wildlife Warden, Govt. of M.P., Van Bhavan,
Tulsi Nagar, Bhopal - for kind information please.

Fax # 0755-550942 or 573752

Post Box No.18, Chandrabani, Dehradun - 248001. India

EPABX: +91-135 - 640111 to 640115, 640990; FAX: 640117; GRAM: WILDLIFE

E-Mail: wii@wii.gov.in

**Office of the Field Director, Pench Tiger Reserve, Seoni
(M.P.) 480661**

No./Steno/01/6014

Seoni/Dated 4 -012-2000

To,

**The Director,
Wildlife Institute of India,
18, Chandrawani
Dehradun.**

Subject:- Consultancy services for "**Base line Mapping of the PA and Surrounding Area**" under Ecodevelopment Project, Pench Tiger Reserve, Seoni, (M.P.)

Ref:- Your letter no. Nil dt 6/10 2000.

D/ Sir,

The draft report submitted for the above consultancy services is hereby accepted.

It is requested to kindly dispatch the final copy of the above report for further action.

Thanking you,

Yours faithfully

[R.C. Sharma]

Field Director & Conservator of Forest
(Wildlife), Pench Tiger Reserve
Seoni (M.P.) 480661

No./Steno/01/

Seoni/Dated -12-2000

Copy forward to Additional Principal Chief Conservator of Forest (Wildlife), Van Bhawan, Tulsi Nagar, Bhopal for favour of information and necessary action.

sd/-

Field Director,
Pench Tiger Reserve
Seoni (M.P.)

G:\Saxena\Eco\letter\B Mapping consul.doc

Dr. V.B. Mathur
Dr. Sankar

For n/y action pls.
M. Mathur
T. Mathur

1/11/2001
T. Mathur