



CHEETAH LANDSCAPE IN INDIA

ATLAS OF KUNO-GANDHI SAGAR LANDSCAPE
FOR METAPOPULATION MANAGEMENT OF CHEETAH IN INDIA



2024



ATLAS OF KUNO-GANDHI SAGAR LANDSCAPE FOR METAPOPULATION MANAGEMENT OF CHEETAH IN INDIA

Citation

Qamar Qureshi, Bipin C.M., Nupur Rautela, Dhruv Jain, Bilal Habib, Uttam K. Sharma, G.S. Bhardwaj, Amit Mallick, S.P. Yadav, Rajesh Gopal, Aseem Shrivastav, Subharanjan Sen, L. Krishnamoorthy, Rajesh Gupta, Pawan K. Upadhyay & Virendra R. Tiwari. Cheetah landscape in India- Atlas of Kuno-Gandhi Sagar landscape for metapopulation management of cheetah in India. 2024, National Tiger Conservation Authority, Government of India, New Delhi, Wildlife Institute of India, Dehradun, Madhya Pradesh Forest Department, Bhopal and Rajasthan Forest Department, Jaipur. TR/2024/27.



ACKNOWLEDGEMENT

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We would like to thank the Hon'ble Prime Minister of India, Shri Narendra Modi, for the support to Project Cheetah. We express our deepest appreciation to Shri Shivraj Singh Chauhan, Former Chief Minister of Madhya Pradesh, Shri Mohan Yadav, Hon'ble Chief Minister of Madhya Pradesh, Shri Bhupender Yadav, Hon'ble Union Minister of Environment, Forest and Climate Change, Shri Narendra Singh Tomar, Former Union Minister for Agriculture, Shri Ashwini Kumar Choubey, Former Minister of State for Environment, Forest and Climate Change, Shri Kirti Vardhan Singh, Hon'ble Minister of State for Environment, Forest and Climate Change, Shri Kunwar Vijay Shah, Former Minister of Forest, Madhya Pradesh, Shri Ramniwas Rawat, Hon'ble Minister of Forest, Madhya Pradesh for their facilitation and support to the project. Our deepest appreciation to the Governments of South Africa, Namibia, and Kenya for extending their invaluable partnership to Project Cheetah.

The expert members of Cheetah Project Steering Committee, Shri R. N. Mehrotra - Former Principal Chief Conservator of Forests (PCCF) & Head of Forest Force/Chief Wildlife Warden (HoFF/CWLW), Rajasthan, Shri P. R. Sinha - Former Director, Wildlife Institute of India (WII), Dr. H. S. Negi - Former Additional Principal Chief Conservator of Forests (APCCF) (Wildlife) Madhya Pradesh, Member NTCA, Dr. P. K. Malik - Former Faculty at WII, Member NTCA, Shri G. S. Rawat - Former Dean, WII, Ms Mittal Patel - Social Worker, Founder Vicharta Samuday Samarthan Manch (VSSM), Ahmedabad are greatly appreciated for the guidance, advice and inputs to the project.

Our special thanks to Cheetah Conservation Fund (CCF), Mr. Vincent van der Merwe, Manager, Cheetah Meta-population Project, The Meta-population Initiative, South Africa, Dr. Mike Toft, Kifaru Wildlife Veterinary Services, South Africa, Dr. Andy Fraser, Rooiberg Veterinary Services, South Africa, and Dr. Scott Citino, Senior Veterinarian (of) and Whiteoak Conservation, USA.

We are thankful to the Department of Animal Husbandry and Dairying (DAHD), Ministry of Fisheries, Animal Husbandry & Dairying, GOI for their timely and efficient facilitation provided to the Project. We express our sincere gratitude to Dr. Sobha Jawre, Director, Dr. Nidhi Rajput, Assistant Professor and Dr. Kajal Jadav, Assistant Professor- School of Wildlife Forensic and Health, Jabalpur, as well as Dr. Atul Gupta, Senior Veterinary Officer, Van Vihar National Park for providing continuous veterinary assistance to the project.

We acknowledge Indian Oil Corporation Limited for their support provided to the project as well as Hero Honda Motor Corporation for their support towards protection in Kuno National Park.

We also express our special thanks the staff of NTCA, WII, Kuno Wildlife Division, and Gandhi Sagar Wildlife Sanctuary for their unwavering support and help. We would like to thank the officers of the Forest Divisions and Protected Areas in cheetah landscape in Madhya Pradesh, Rajasthan and Uttar Pradesh. Our wholehearted appreciation for the assistance extended by the staff of all the forest divisions wherever the cheetahs roamed.





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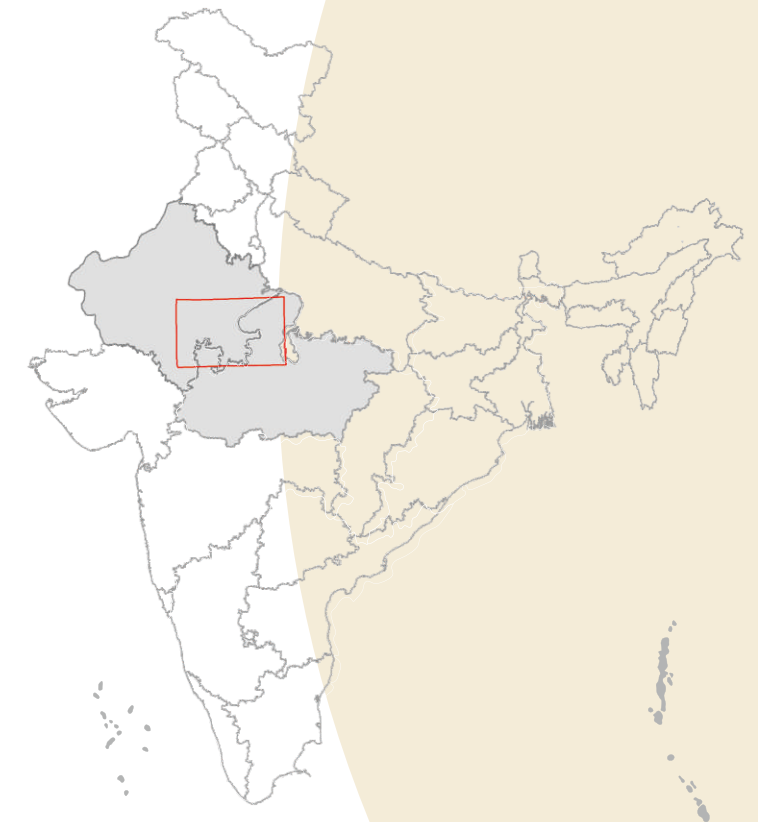
KUNO-GANDHI SAGAR CHEETAH METAPOPULATION MANAGEMENT LANDSCAPE



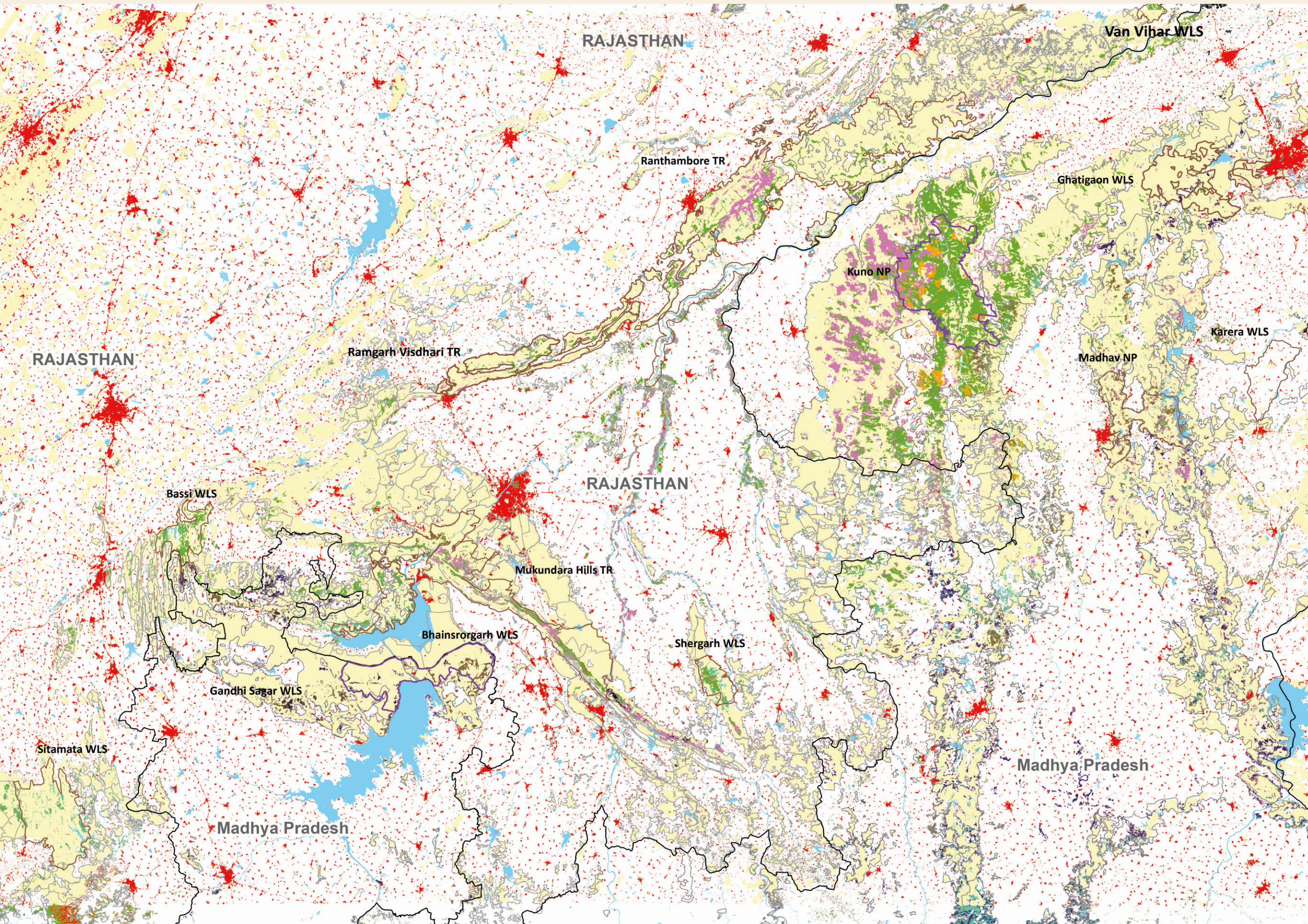
INTERSTATE CHEETAH CONSERVATION COMPLEX

As recommended by the action plan for the introduction of cheetah (*Acinonyx jubatus*) in India (Jhala *et al.* 2021), cheetahs in Kuno National Park (NP), as well as Gandhi Sagar Wildlife Sanctuary (WLS) and their adjacent landscapes will be managed as a metapopulation along with a couple of other sites subsequently. As the landscapes surrounding these two sites abut each other, the combined landscapes of Kuno and Gandhi Sagar together constitute the Kuno-Gandhi Sagar cheetah landscape for metapopulation management of cheetah as an interstate cheetah conservation complex. This area is located along the State border of Rajasthan and Madhya Pradesh (M.P.) with the majority of the area situated in the Chambal River basin. Kuno NP is patchily connected to Gandhi Sagar WLS on the southwest through the territorial forest divisions of Baran, Jhalawar, Kota, and Chittorgarh along with Mukundara Tiger Reserve (TR) in Rajasthan and Mandsaur forest division in M.P. On the northwest, the connectivity is through Ranthambore TR, Ramgarh-Vishdari TR, and the forest division of Bundi and Bhainsrodgarh WLS in Rajasthan. These forest patches cumulatively cover an area of ~17,000 km² in M.P. (Area ~10,500 km²) and Rajasthan (Area ~ 6,500 km²). This larger Kuno-Gandhi Sagar landscape is situated in the districts of Sheopur, Shivpuri, Gwalior, Morena, Guna, Ashoknagar, Mandsaur, Neemuch in M.P.; and Baran, Sawai Madhopur, Karauli, Kota, Jhalawar, Bundi, and Chittorgarh in Rajasthan. Districts of Bhind and Datia in M.P., Dholpur in Rajasthan as well as Lalitpur and Jhansi in Uttar Pradesh adjacent to this landscape would be incorporated as part of the landscape depending on cheetah's movement and use of these areas.

The ungulates and herbivore mammals in the area are chital (*Axis axis*), sambar (*Rusa unicolor*), nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*), chinkara (*Gazella bennettii*), chousingha (*Tetracerus quadricornis*), blackbuck (*Antelope cervicapra*), northern plains gray langur (*Semnopithecus entellus*), rhesus macaque (*Macaca mulatta*), Indian porcupine (*Hystrix indica*) and black-naped hare (*Lepus nigricollis*). Some of the co-predators include tiger (*Panthera tigris*), leopard (*Panthera pardus*), striped hyaena (*Hyaena hyaena*), Indian wolf (*Canis lupus pallipes*), sloth bear (*Melursus ursinus*), golden jackal (*Canis aureus*), ratel (*Mellivora capensis*), and jungle cat (*Felis chaus*).







Map of Kuno-Gandhi Sagar cheetah metapopulation landscape in the States of Madhya Pradesh and Rajasthan

~17,000 Km²

Forested Area

~10,500 Km²

Madhya Pradesh

~6,500 Km²

Rajasthan

1.1.

Map of Cheetah Landscape

- Savannah/Grassland
- Southern Dry Mixed Deciduous Forest
- Teak Forest
- Anogeissus pendula Forest
- Boswellia Forest
- Khair Sissoo Forest
- Northern Dry Mixed Deciduous Forest
- Plantation/TOF
- Builtup
- Agriculture
- Water
- Division
- Kuno NP/Gandhi Sagar WLS
- PA Boundary
- State Boundary

Table 1. Administrative units in the cheetah metapopulation landscape of Kuno-Gandhi Sagar in the States of Madhya Pradesh and Rajasthan

State	Division	District	Tehsil(s)	Forest Division(s)	Protected Areas
Madhya Pradesh	Chambal (Morena)	Sheopur Morena	Sheopur, Karahal, Bijaipur, Beerpur, Baroda Sabalgarh, Kailaras, Joura	Kuno Wildlife & Sheopur Territorial Morena Territorial	Kuno NP Madhav NP Ghatigaon WLS
	Gwalior	Shivpuri Gwalior Guna Ashoknagar	Pohri, Shivpuri, Kolaras, Narwar, Karera, Pichhore, Khaniyadhana Gwalior Guna, Raghogarh, Aron Isagarh, Chanderi, Maungaoli	Shivpuri Territorial, Madhav NP Gwalior Territorial Guna Territorial Ashoknagar Territorial	
	Ujjain	Mandsaur Neemuch	Bhanpura, Garoth Manasa, Jawad	Mandsaur Territorial Neemuch Territorial	
Rajasthan	Bharatpur	Sawai Madhopur Karauli	Sawai Madhopur, Khandar Karauli, Sapotra, Mandrayal	Ranthambore TR, Sawai Madhopur Territorial Ranthambore TR & Karauli Territorial	Ranthambore TR Mukundara Hills TR Ramgarh-Vishdhari TR Bhainsrorgarh WLS National Gharial WLS Shergarh WLS Bassi WLS Shahabad Talheti CR Shahabad CR Sorsan CR Banjh Amlī CR Ummedganj Pakshi Vihar CR Ramgarh CR
	Kota	Baran Kota Jhalawar Bundi	Shahbad, Kishanganj, Atru, Chhabra, Antah, Chippabarod Ladpura (Kota), Sangod, Ramganj Mandi Khanpur, Aklera, Asnawar Bundi, Hindoli, Nainwa, Indragarh, Talera	Baran Territorial & Kota Wildlife Kota Wildlife, Mukandara Hills TR & Kota Territorial Jhalawar Bundi Territorial & Ramgarh Vishdhari TR	
	Udaipur	Chittorgarh	Rawatbhata, Begun, Nimbhera, Chittorgarh	Chittorgarh Wildlife & Chittorgarh Territorial	

TR- Tiger Reserve, NP- National Park, WLS- Wildlife Sanctuary, CR-Conservation Reserve

1.2. Mapping of Human Disturbances and Invasive Plant Species in Kuno-Gandhi Sagar landscape

Based on data collected during the All India Tiger Estimation conducted in 2022, information on human disturbances and the presence of invasive species in Forest Divisions and Protected Areas were collated for the landscape along with the human footprint index (Mu *et al.* 2022) and mapped to identify areas that require management as well as planning for prioritizing actions.

Human disturbances include tree cutting/lopping, grass/bamboo cutting, presence of humans/ livestock and their trails. Additionally, the road and railway network in the landscape was mapped. The invasive species depicted here include *Lantana camara*, *Prosopis juliflora*, *Parthenium hysterophorous*, *Senna tora*, *Ageratum conyzoides*, *Mesophaerum suaveolens*, and *Xanthium strumarium*. The length of roads and railway track inside the Forest Divisions and Protected Areas within the landscape is 26,808.82 km and 957.97 km respectively, whereas the total length of roads and railway track in the landscape is 111,730.15 km and 3972.68 km.

Table 2. Human footprint index (Mu *et al.* 2022) with length of Road and Railway Network in the Forest Divisions and Protected Areas of Kuno-Gandhi Sagar cheetah metapopulation landscape

Forest Division/Protected Area name (State)	Human footprint index	Road length	Railway track length
Kuno Wildlife Division (including Kuno NP) (M.P)	8.06	241.57	0.00
Sheopur (M.P)	9.04	708.39	54.24
Morena (M.P)	11.00	342.22	40.80
Shivpuri (M.P)	11.40	1253.04	107.69
Ranthambore TR Division II (Raj.)	12.40	534.10	0.00
Madhav NP (M.P)	13.06	121.92	0.00
Gwalior (including Ghatigaon WLS) (M.P)	13.12	919.56	261.15
Mandsaur (M.P)	13.20	688.48	0.00
Neemuch (M.P)	13.63	1242.96	0.00
Ashoknagar (M.P)	13.89	387.54	36.13
Shergarh WLS (Raj.)	14.46	35.11	0.00
Ramgarh Vishdari TR (Raj.)	15.08	214.86	0.00
Guna (M.P)	15.59	4428.91	27.09
Bhainsrorgarh WLS (Raj.)	15.98	164.37	0.00
Chittorgarh (Raj.)	16.13	2000.56	7.17
Mukundara Hills TR (Raj.)	16.17	645.81	18.62
Ranthambore TR Division I (Raj.)	16.31	1214.79	33.97
Baran (Raj.)	16.33	2715.20	41.67
Karauli (Raj.)	16.63	973.13	26.49
Bundi (Raj.)	18.97	1876.39	139.68
Jhalawar (Raj.)	20.59	2512.08	33.64
Sawai Madhopur (Raj.)	22.35	406.55	30.97
Kota (Raj.)	24.00	3181.28	98.66
Total		26,808.82	957.97

TR- Tiger Reserve, NP- National Park, WLS- Wildlife Sanctuary, M.P.-Madhya Pradesh, Raj.- Rajasthan

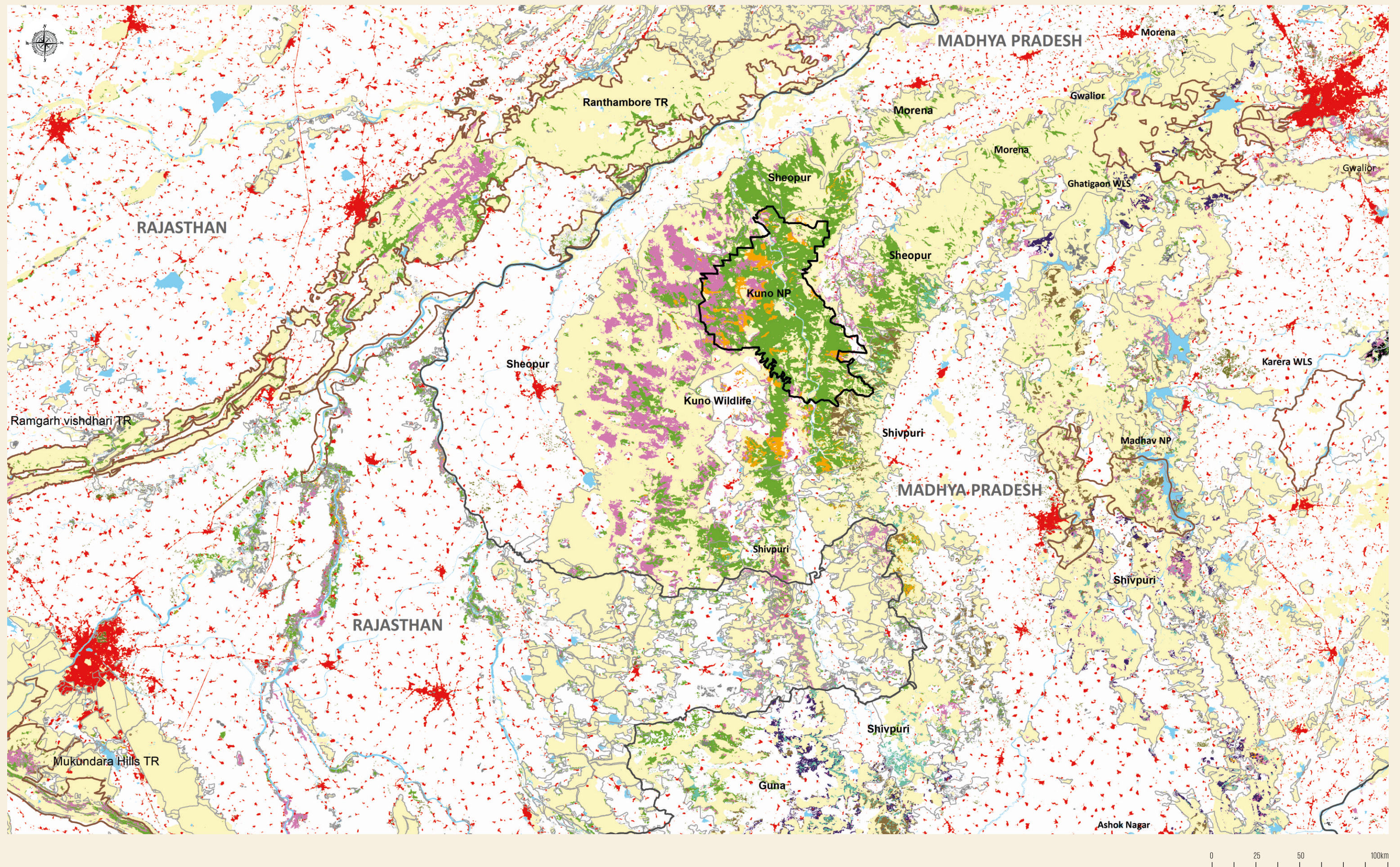
KUNO CHEETAH LANDSCAPE

2

The forest patches in the Kuno landscape span an area of ~11,500 km² spread across M.P. (Area~8833 km²) and Rajasthan (Area~2733 km²). In the landscape, contiguous forested habitat covers an area of about 6800 km², within which an area of over 3200 km² has high potential for cheetah occupancy. The predominant livelihood of the region is crop agriculture and livestock rearing. The human population density of the districts in the landscape is 242 per km² ranging from 104 per km² in Sheopur district to 445 per km² in Gwalior district. Livestock density of large stock (cattle and buffalo) is 91 animals per km², whereas the density of small stock (goat and sheep) is 39 animals per km². The largest urban centre of the landscape is Gwalior city followed by Shivpuri and Sawai Madhopur cities.







Map of Kuno Cheetah Landscape
in the States of Madhya Pradesh
and Rajasthan

11,566 Km²

Forested Area

8,833 Km²

Madhya Pradesh

2,733 Km²

Rajasthan

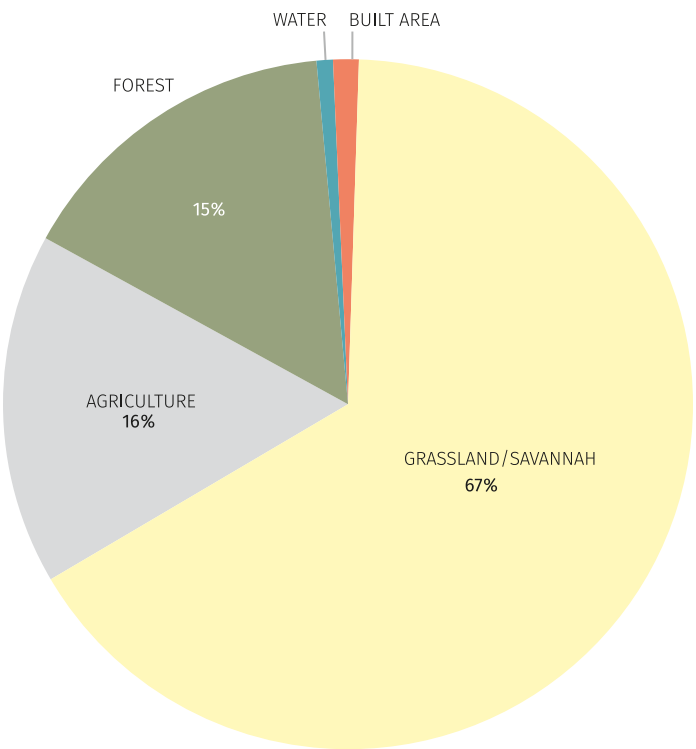
2.1.

Map of Kuno Cheetah Landscape

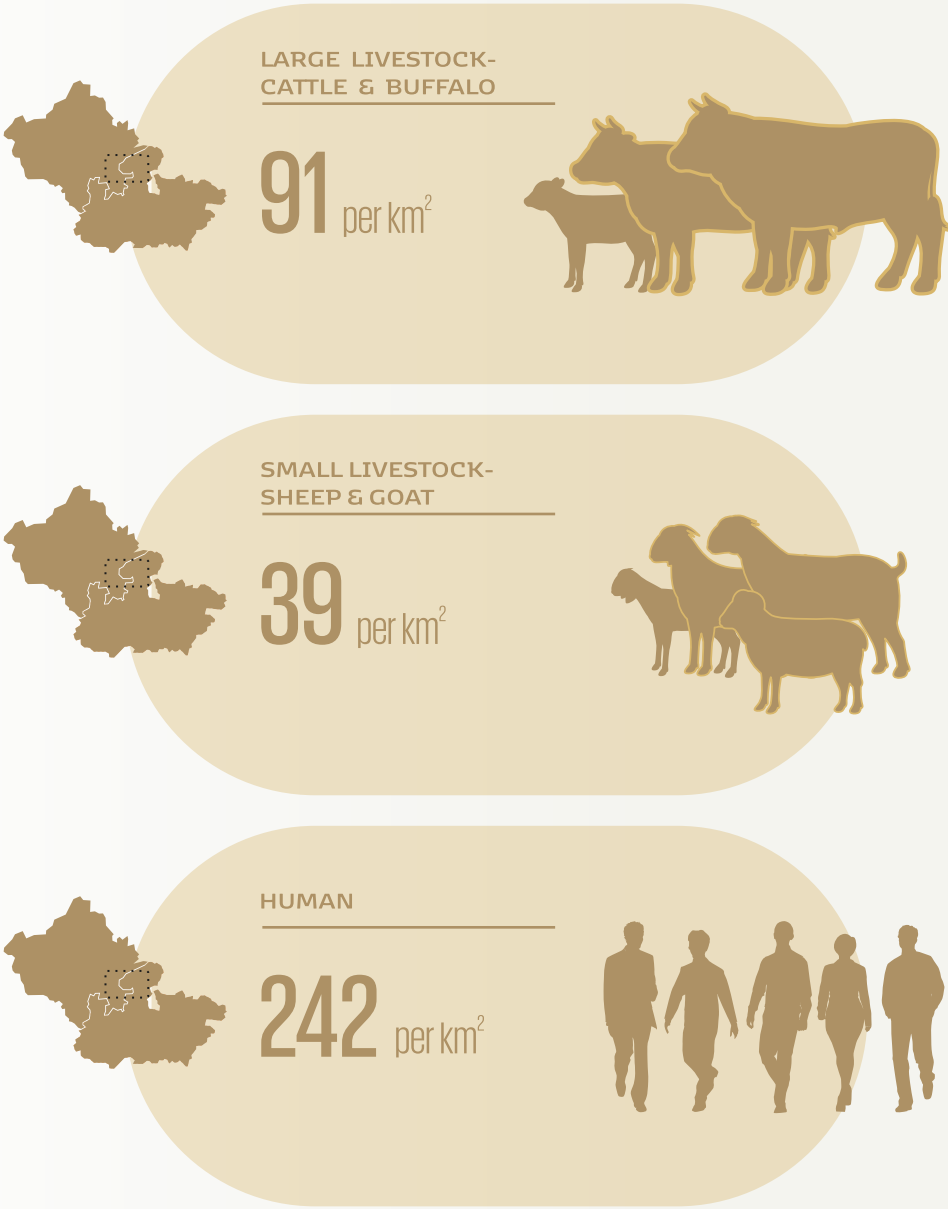
- Savannah/Grassland
- Southern Dry Mixed Deciduous Forest
- Teak Forest
- Anogeissus pendula Forest
- Boswellia Forest
- Khair Sissoo Forest
- Northern Dry Mixed Deciduous Forest
- Plantation/TOF
- Builtup
- Agriculture
- Water
- Division
- Kuno NP
- PA Boundary
- State Boundary

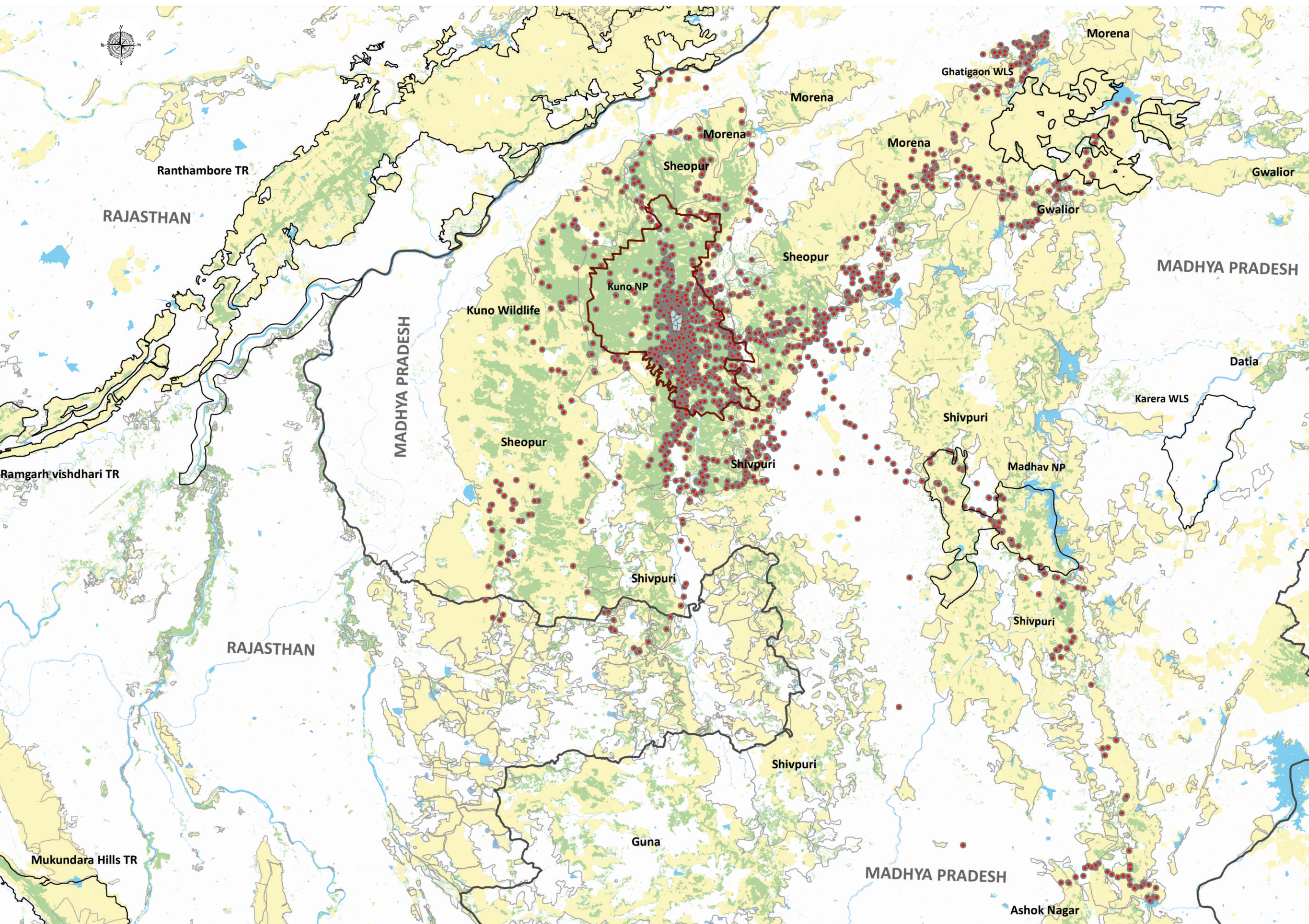
Kuno Landscape

Land use/Land cover (Karra, Kontgis *et al.* 2021) in
the Protected Areas and Forest Divisions of Kuno
cheetah metapopulation landscape



Population density of humans and
livestock in Kuno Landscape





Maximum aerial distance moved
by cheetahs from release area

46 Km

RANTHAMBORE TIGER RESERVE

93 Km

MORENA DIVISION

35 Km

SHIVPURI DIVISION

103 Km

ASHOKNAGAR DIVISION

64 Km

BARAN DIVISION

27 Km

SHEOPUR DIVISION

2.2.

Map of Cheetah
Movement in Kuno
Cheetah Landscape

- Cheetah Location
- PA Boundary
- Division Boundary
- State Boundary
- Kuno NP
- Savannah/Grassland
- Forest
- Non Forest
- Water

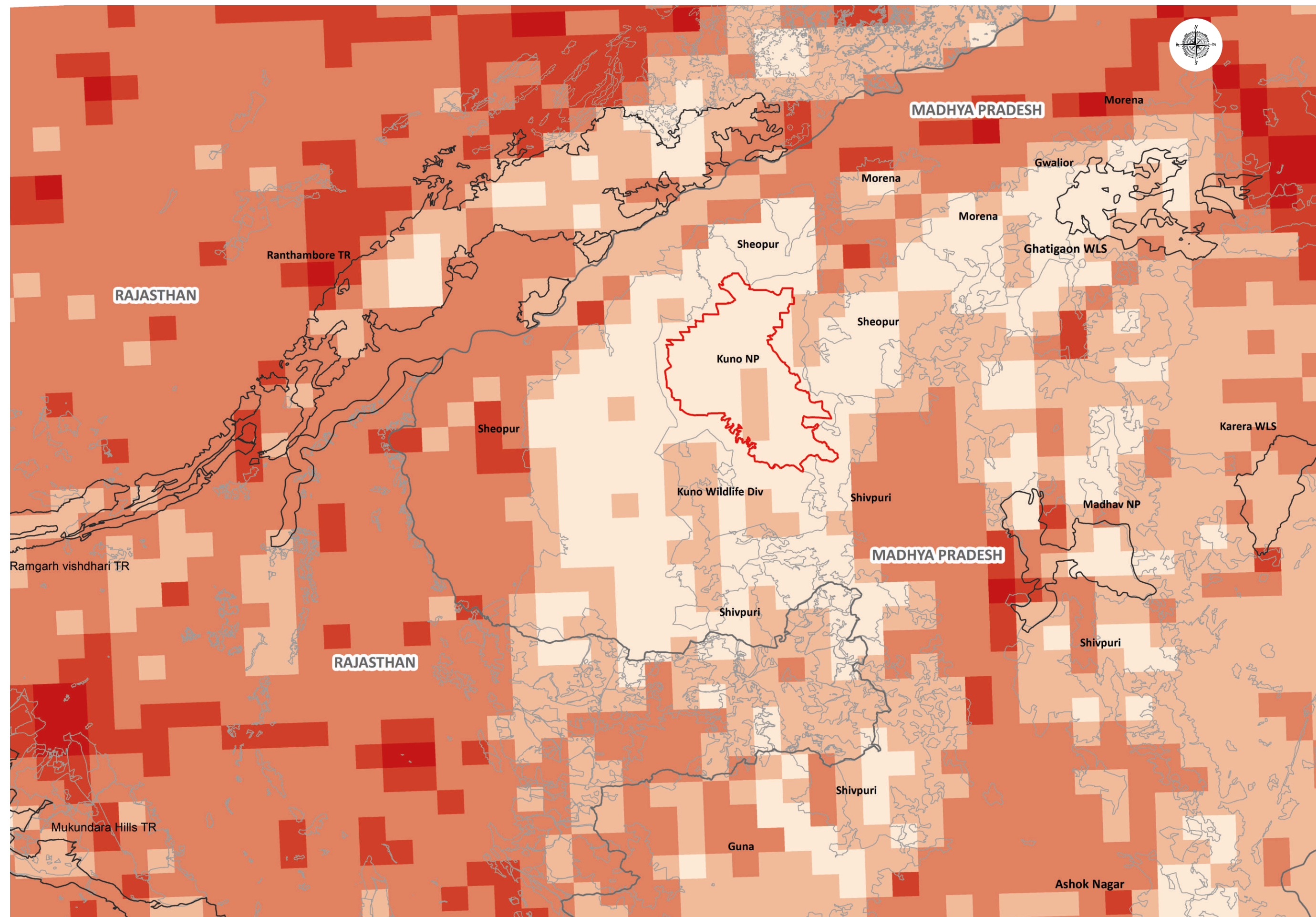
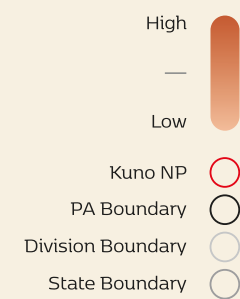


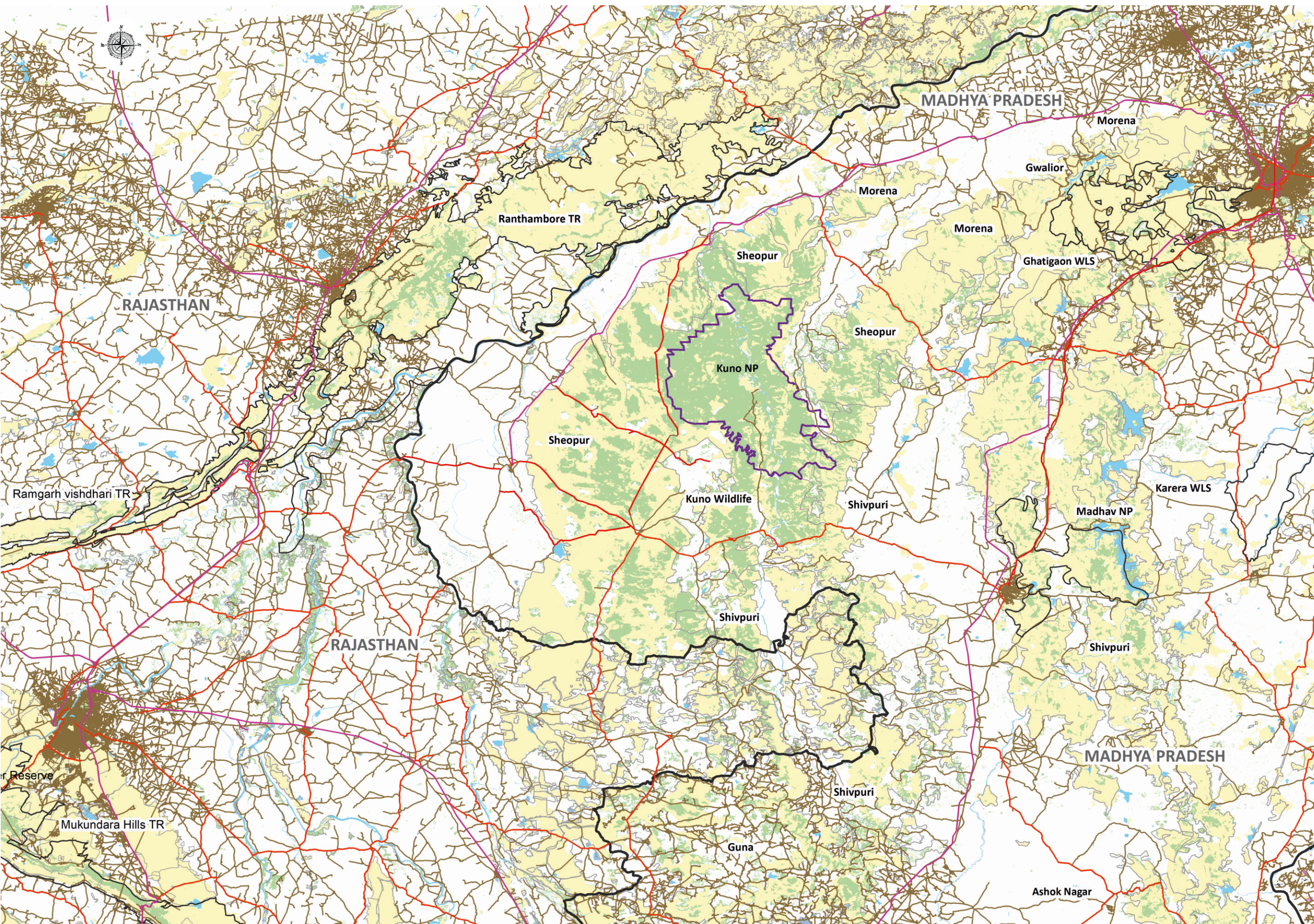
2.3.

Map of Human Disturbances in Kuno Cheetah Landscape

Composite map of human footprint index derived from night time light/ built-up, and development projects, along with information on human disturbances such as tree cutting/lopping, grass/bamboo cutting, presence of humans/ livestock and their trails obtained from Phase I survey of All India Tiger Estimation (2022)

Human Disturbance



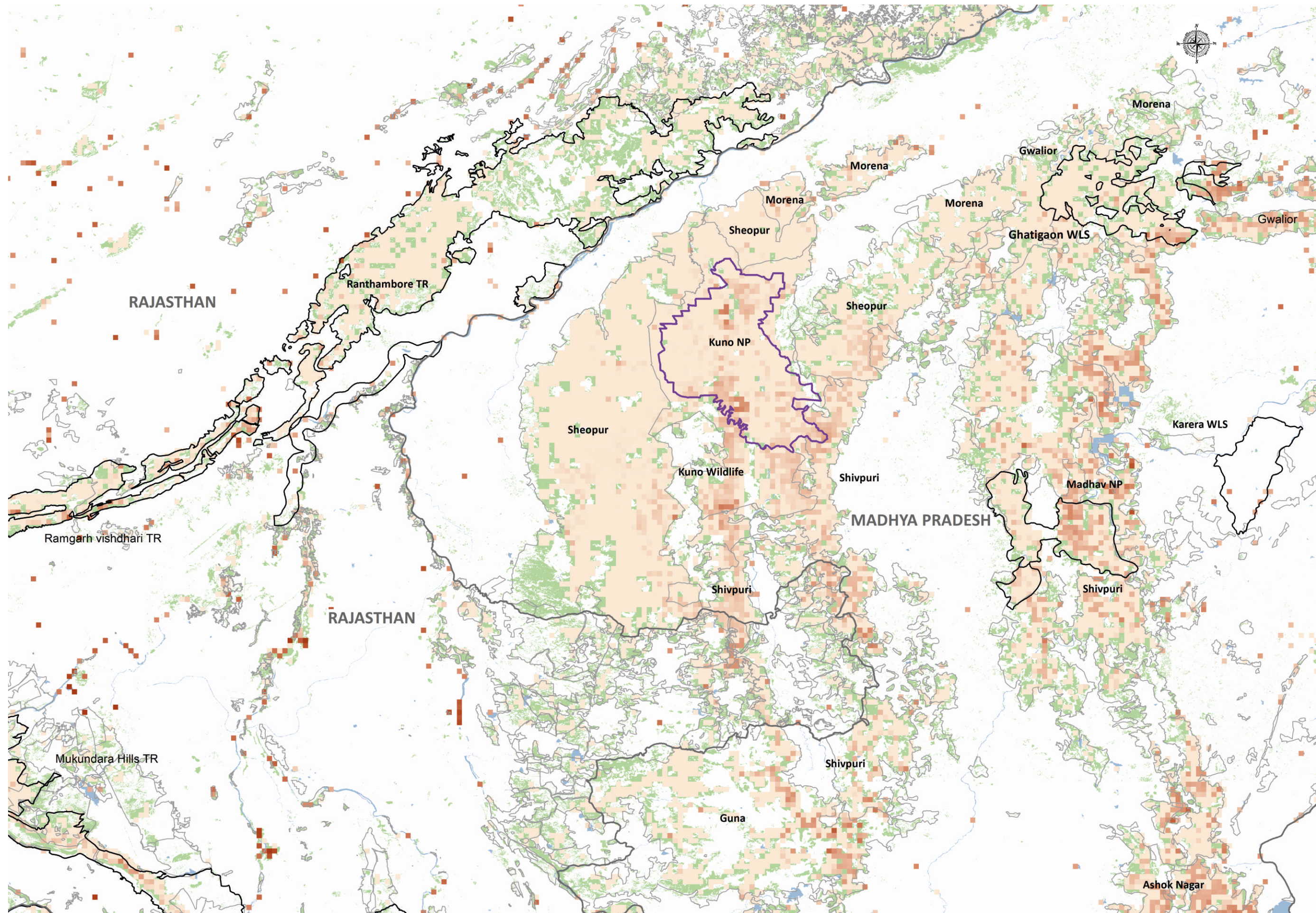
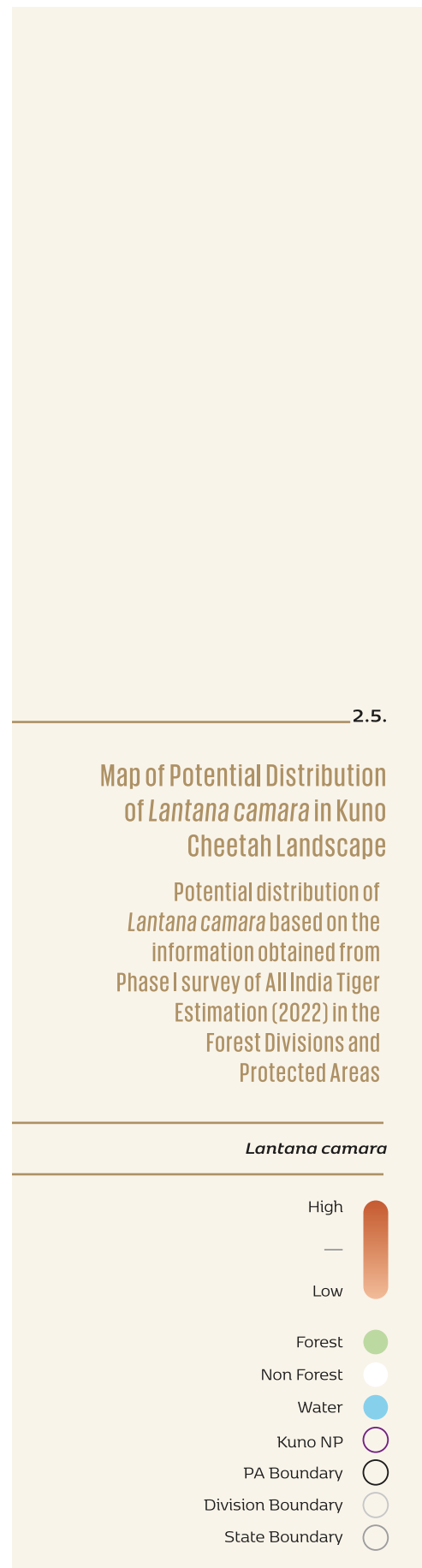


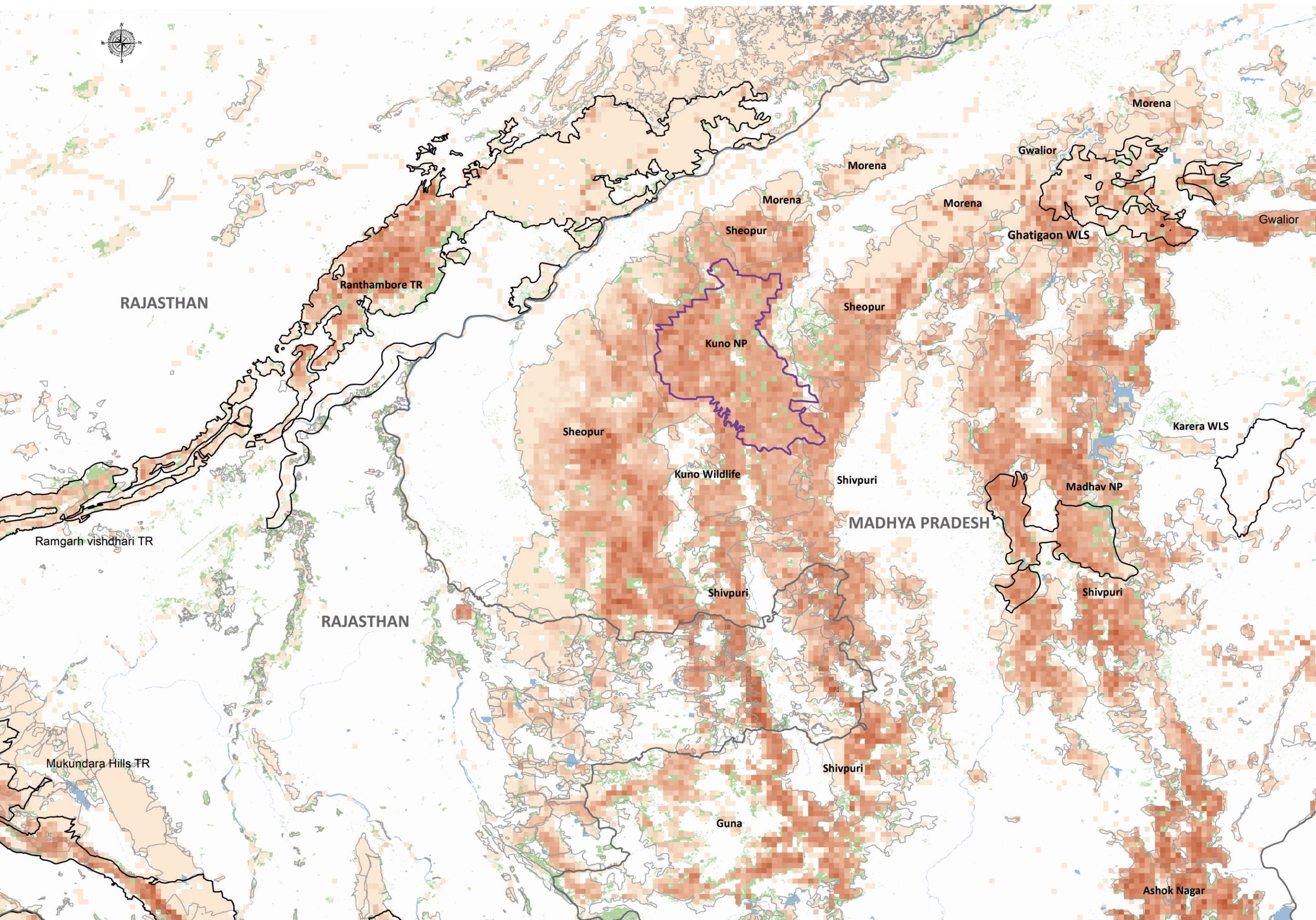
2.4.

Map of Road and Railway Network in Kuno Cheetah Landscape

The network of Railway tracks and roads including primary, secondary, tertiary, residential, under construction and highways in Kuno Cheetah Landscape

- Railway Network
- Major Roads
- Road Network
- Kuno NP
- PA Boundary
- Division Boundary
- State Boundary
- Forest
- Savannah/Grassland
- Non Forest
- Water





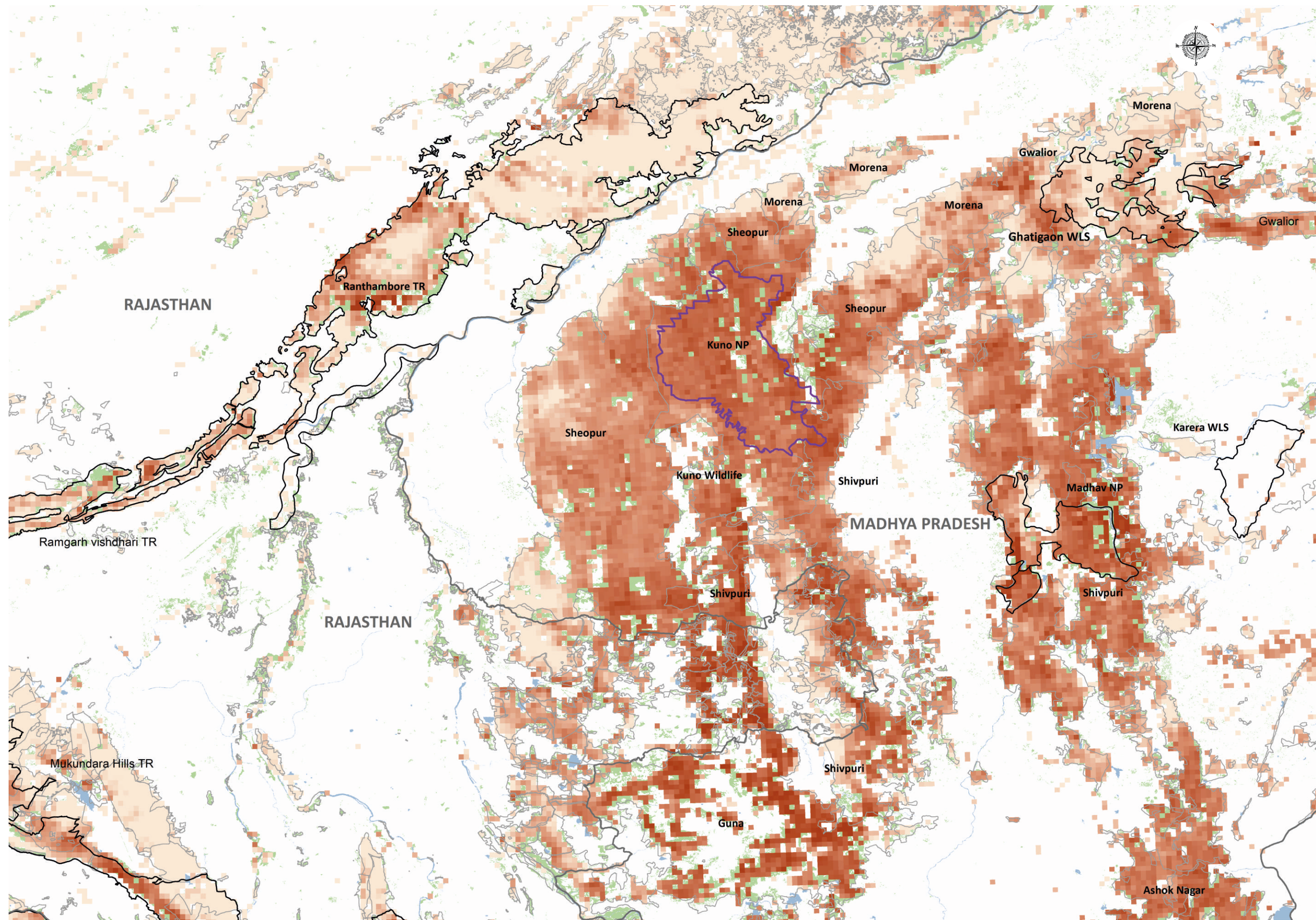
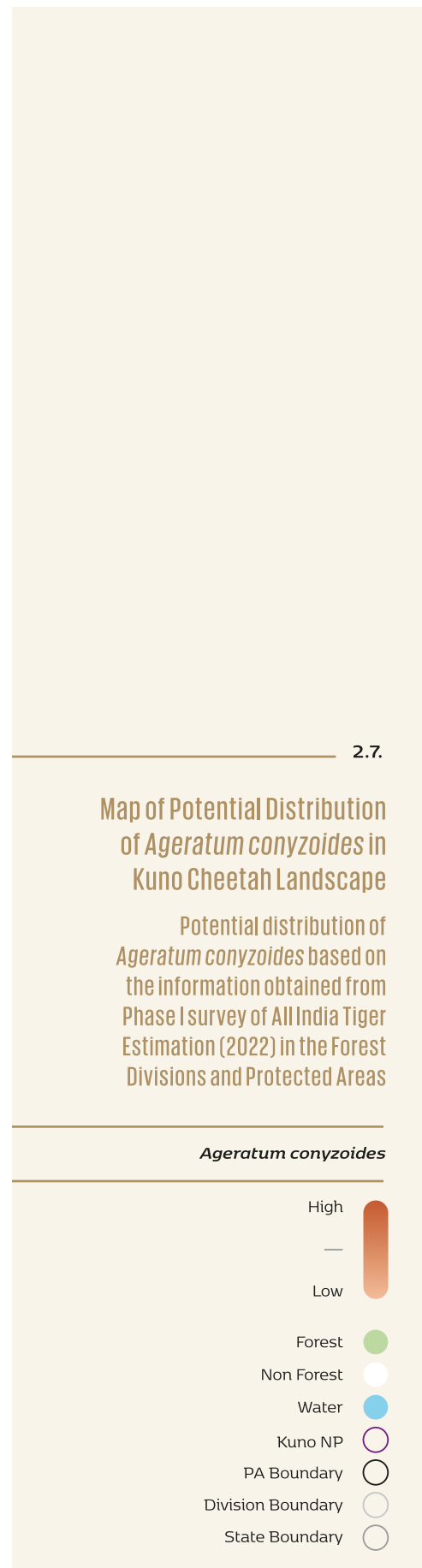
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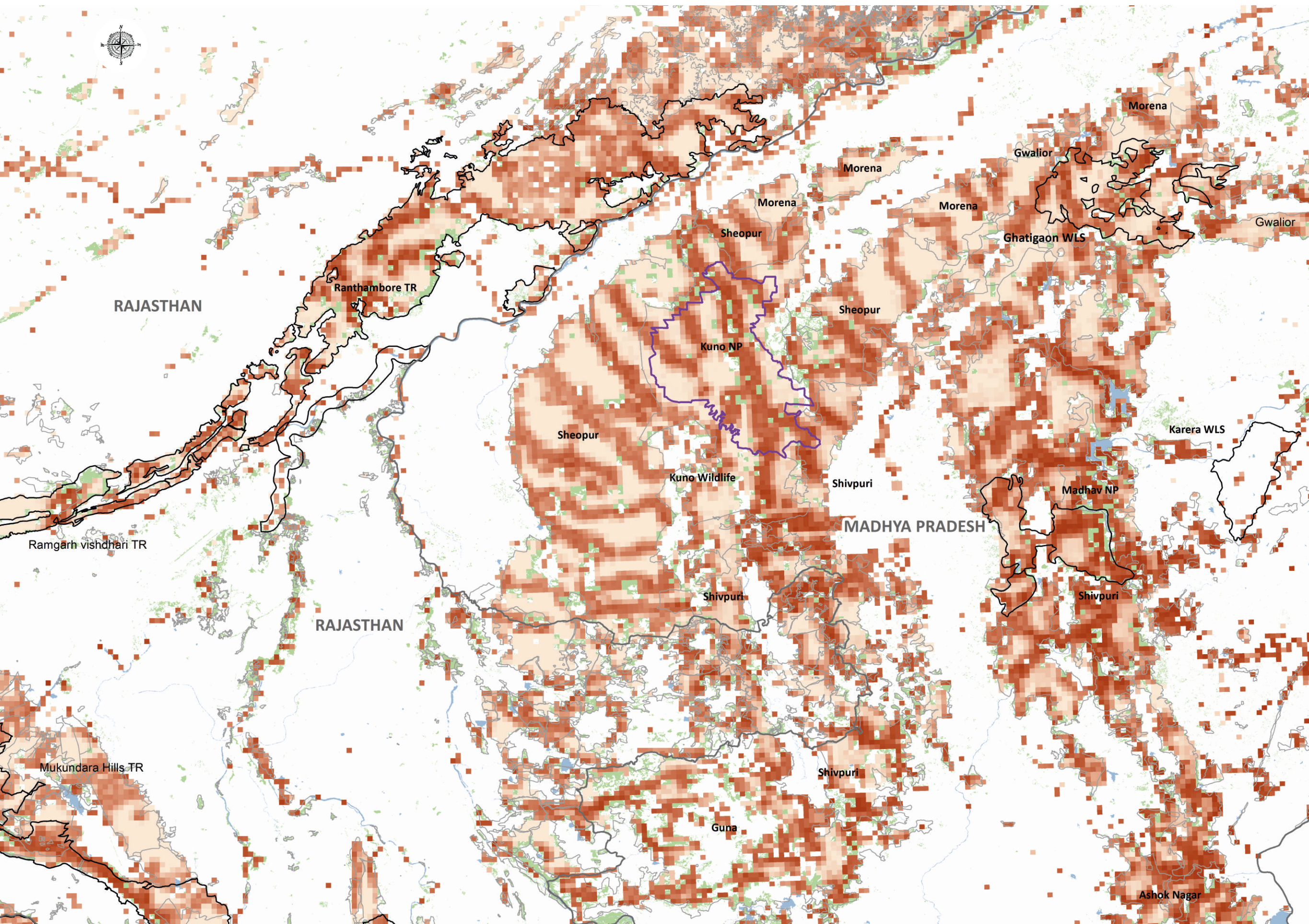
Map of Potential Distribution of *Parthenium hysterophorus* in Kuno Cheetah Landscape

Potential distribution of *Parthenium hysterophorus* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Parthenium hysterophorus







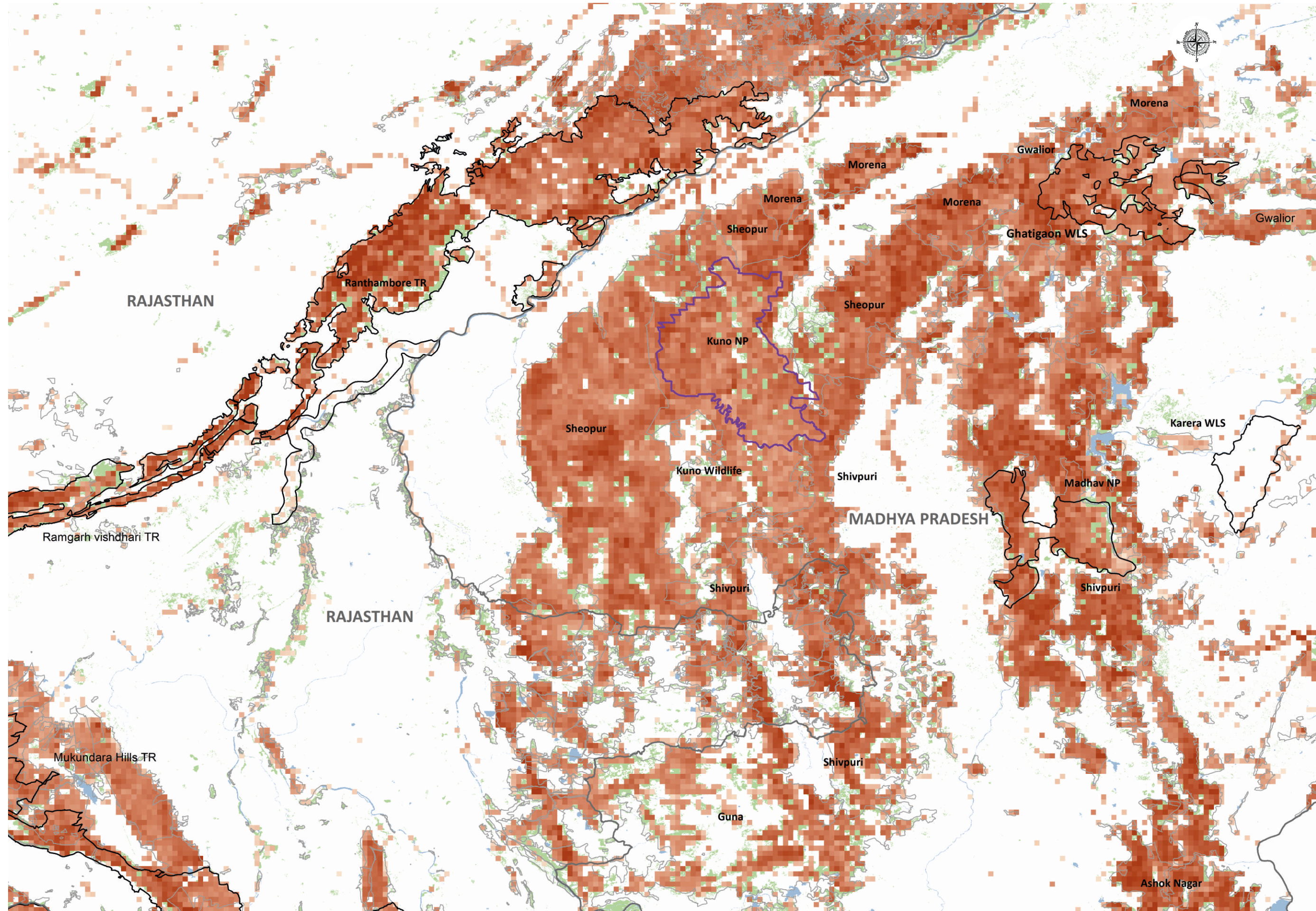
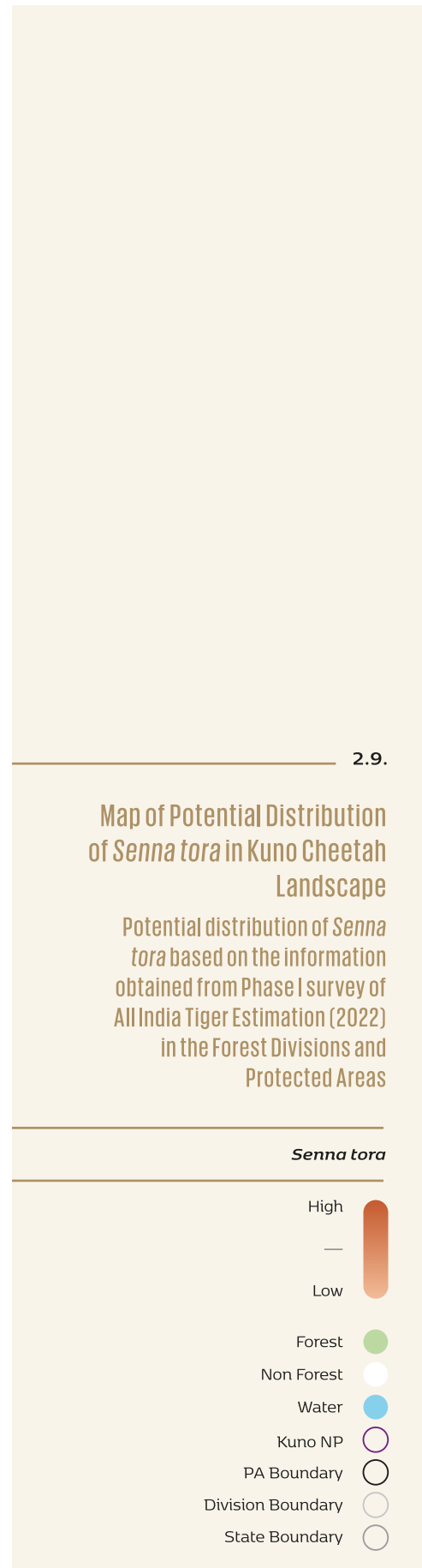
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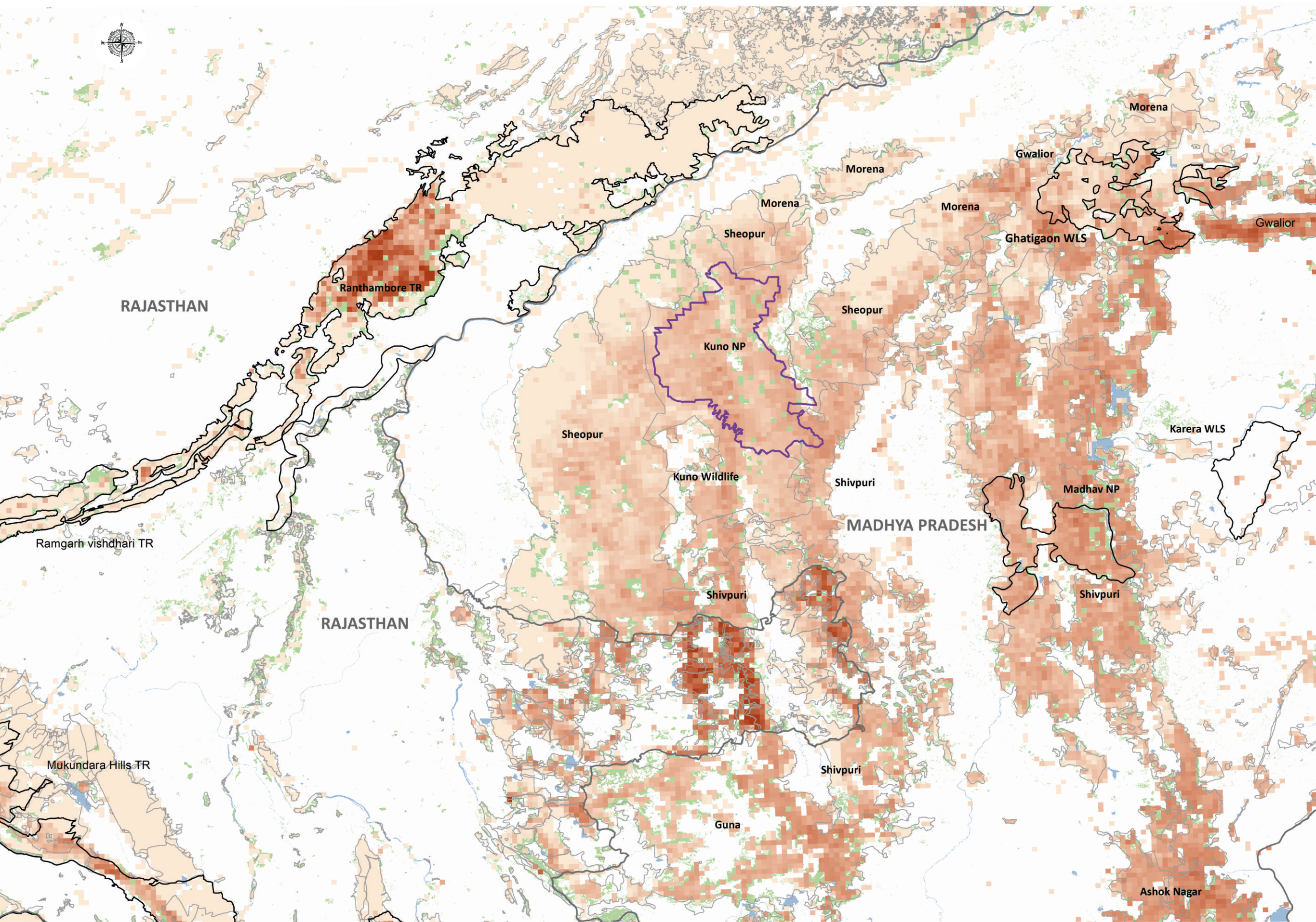
Map of Potential Distribution of *Xanthium strumarium* in Kuno Cheetah Landscape

Potential distribution of *Xanthium strumarium* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Area

Xanthium strumarium







2.10.

Map of Potential Distribution of *Mesosphaerum suaveolens* in Kuno Cheetah Landscape

Potential distribution of *Mesosphaerum suaveolens* based on the information obtained from Phase I survey of All India Tiger Estimation (2022)

Mesosphaerum suaveolens



- Forest
- Non Forest
- Water
- Kuno NP
- PA Boundary
- Division Boundary
- State Boundary



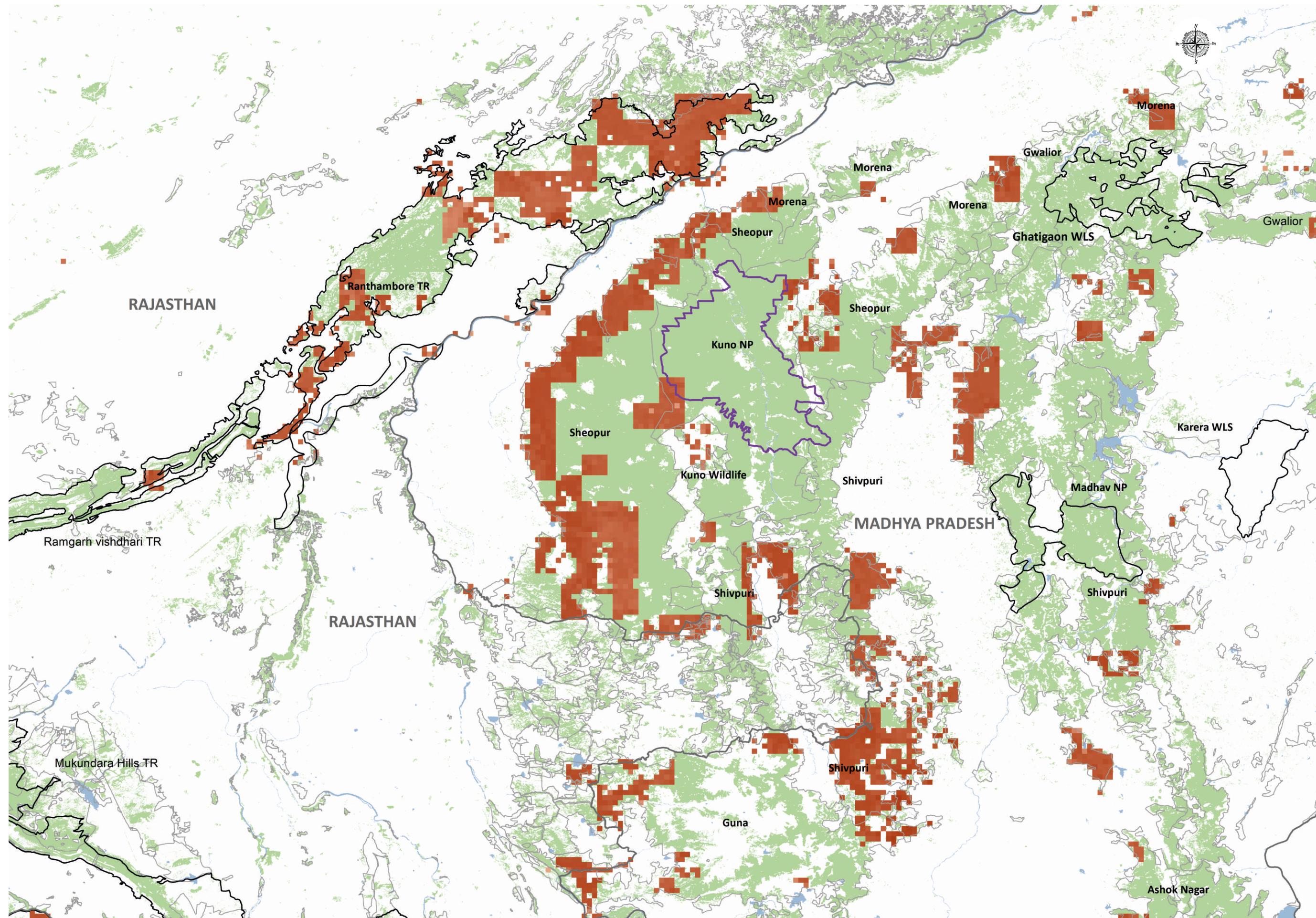
2.11.

Map of distribution of *Prosopis juliflora* in Kuno Cheetah Landscape

Distribution of *Prosopis juliflora* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Prosopis juliflora

- High
- Low
- Forest
- Non Forest
- Water
- Kuno NP
- PA Boundary
- Division Boundary
- State Boundary



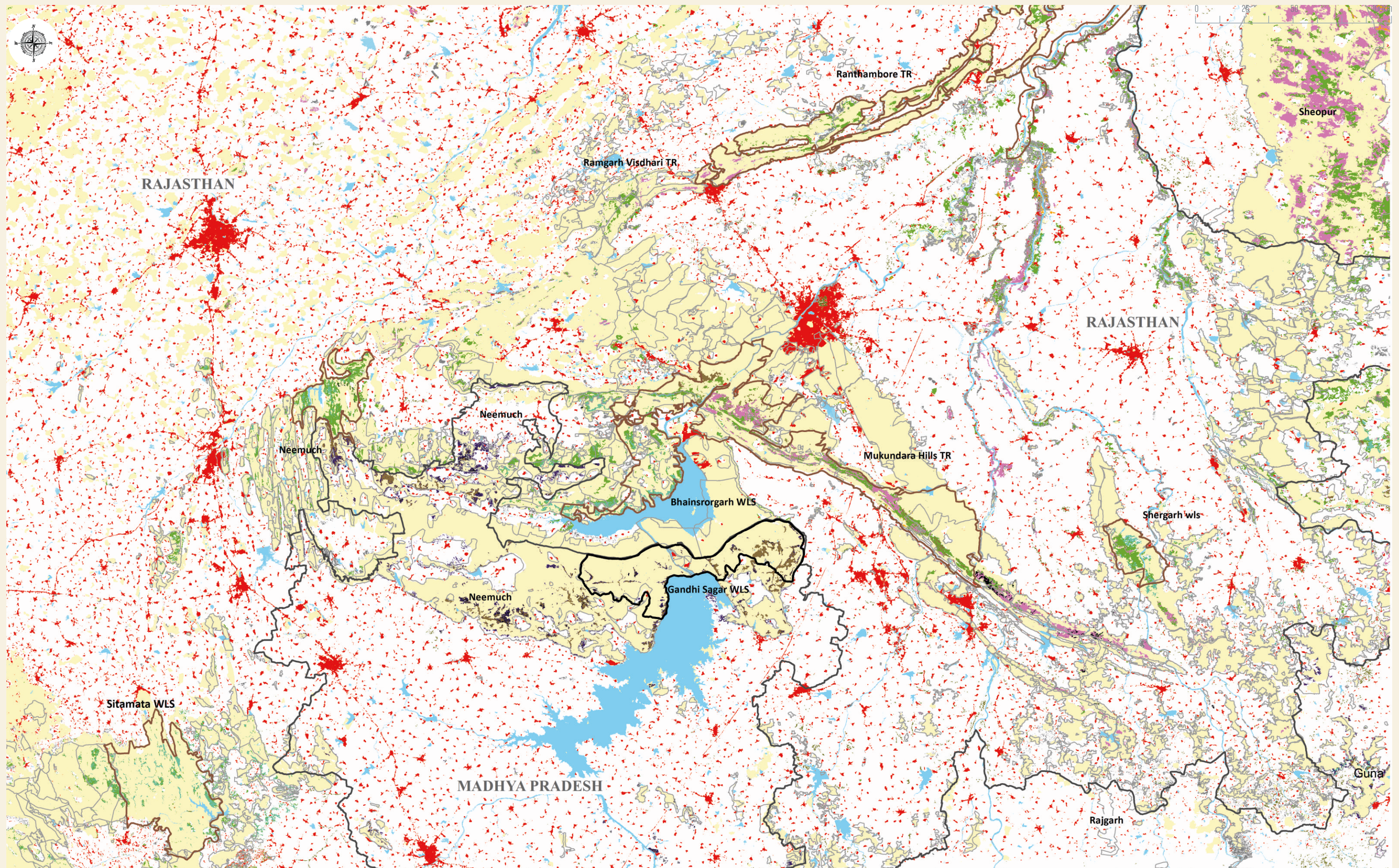
GANDHI SAGAR CHEETAH LANDSCAPE

3

The total forested area in this landscape covers about ~5450 km² across M.P. (~3850 km²) and Rajasthan (~1600 km²). Gandhi Sagar landscape is situated in the districts of Mandsaur and Neemuch in M.P. along with Chittorgarh, Baran, Jhalawar, and Bundi in Rajasthan. Securing a suitable contiguous large landscape area of ~2500 km² potential cheetah habitat can be ensured with efforts towards conservation and sustainable management as a transboundary management unit. the landscape. The human population density of the districts in the landscape is 237 per km² ranging from 193 per km² in Neemuch district to 374 per km² in Kota district. Livestock density of large stock (cattle and buffalo) is 88 animals per km², whereas the density of small stock (goat and sheep) is 45 animals per km². The cities of Kota and Chittorgarh are the largest urban areas in the landscape.







Map of Gandhi Sagar Cheetah Landscape in the States of Madhya Pradesh and Rajasthan

5,450 Km²

Forested Area

3,850 Km²

Madhya Pradesh

1,600 Km²

Rajasthan

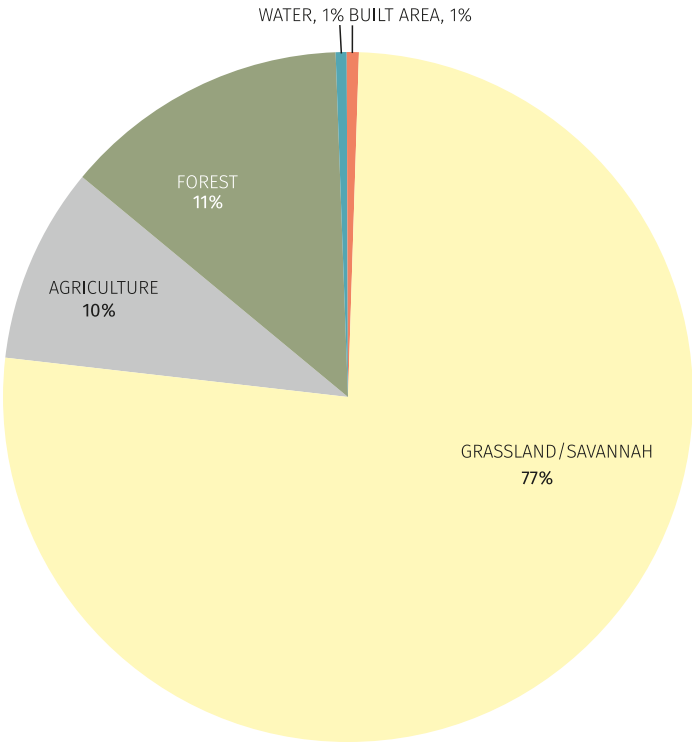
3.1.

Map of Gandhi Sagar Cheetah Landscape

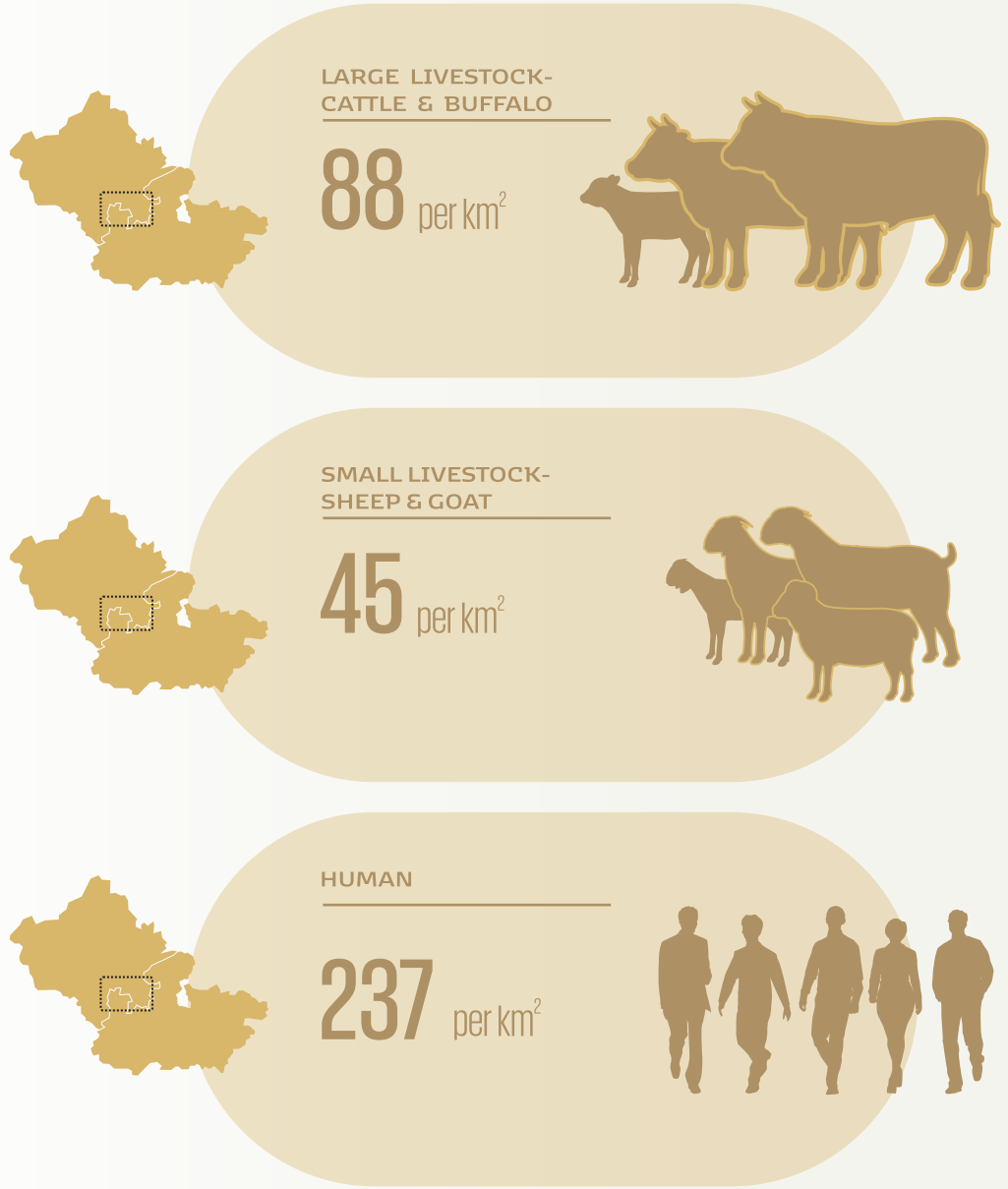
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- Division Boundary
- Gandhi Sagar WLS
- PA Boundary
- State Boundary

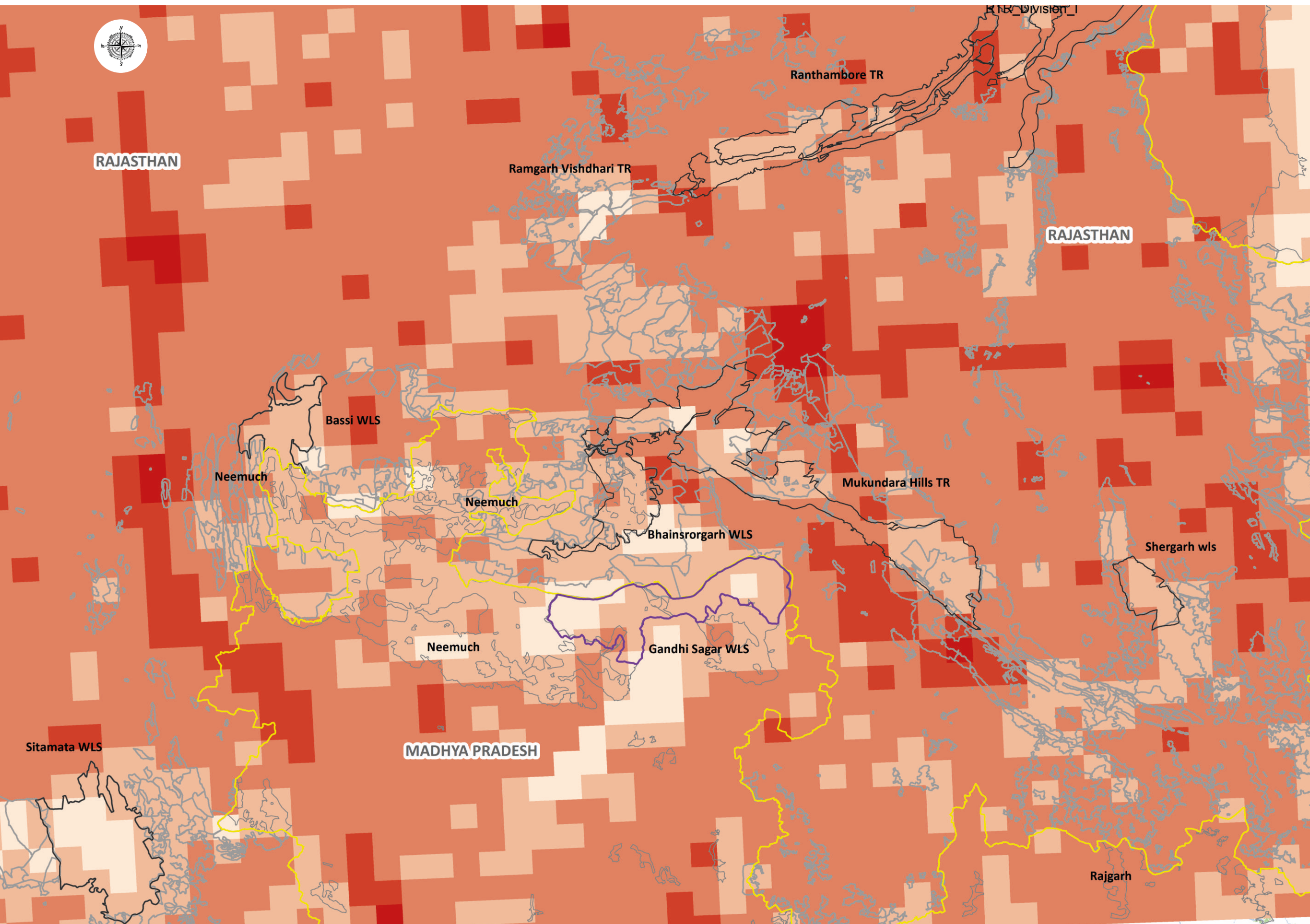
Gandhi Sagar Landscape

Land use/Land cover (Karra, Kontgis *et al.* 2021) in the Protected Areas and Forest Divisions of Gandhi Sagar Cheetah Landscape



Population Density of Humans and Livestock in Gandhi Sagar Cheetah Landscape





3.2.

Map of Human Disturbances in Gandhi Sagar Cheetah Landscape

Composite map of human footprint index derived from night time light/ built-up, and development projects, along with information on human disturbances such as tree cutting/lopping, grass/bamboo cutting, presence of humans/ livestock and their trails obtained from Phase I survey of All India Tiger Estimation (2022)

Human Disturbance



- Gandhisagar WLS
- PA Boundary
- Division Boundary
- State Boundary

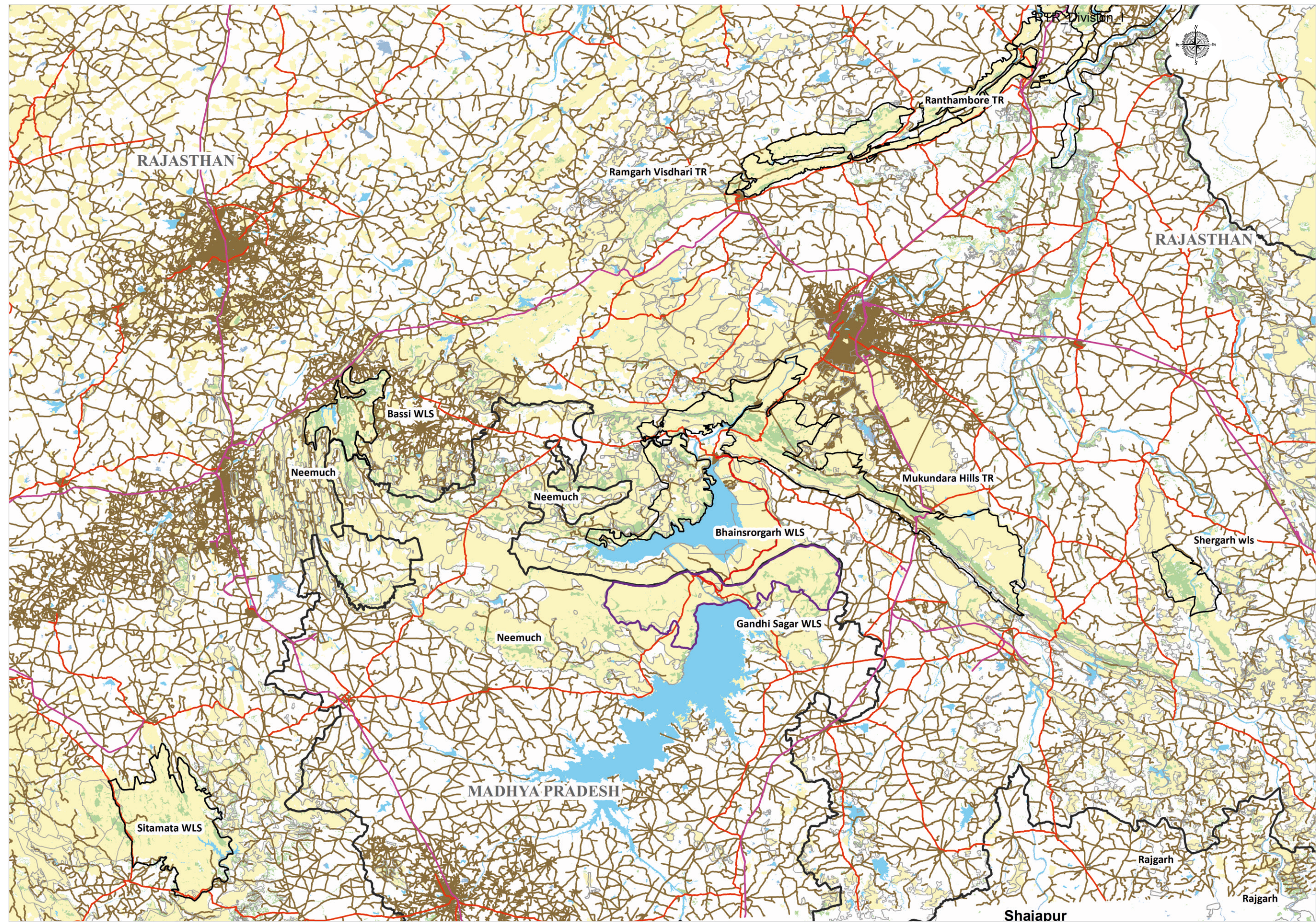


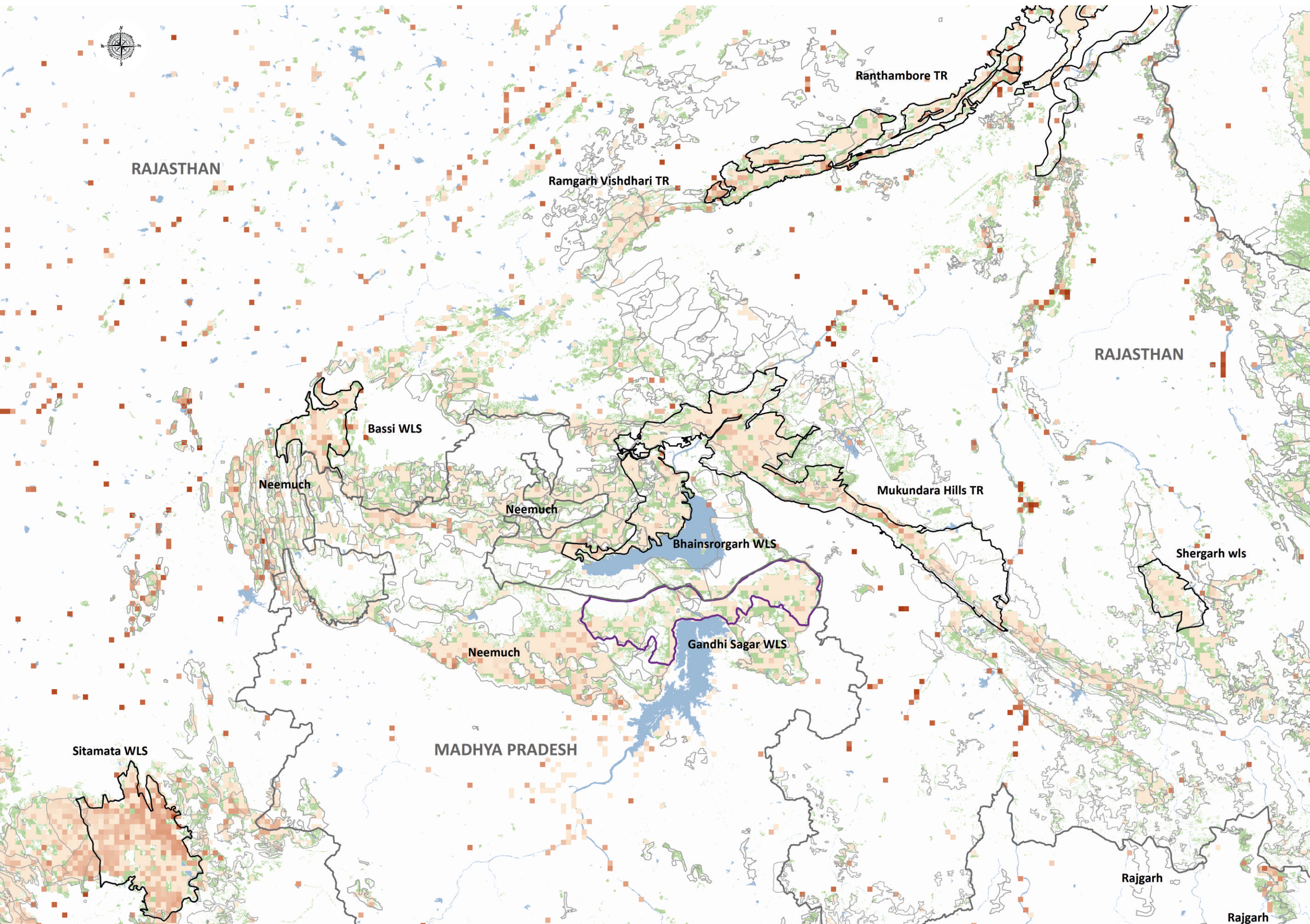
3.3.

Map of Road and Railway Network in Gandhi Sagar Cheetah Landscape

The network of Railway tracks and roads including primary, secondary, tertiary, residential, under construction and highways in Gandhi Sagar cheetah Landscape

- Rail Network
- Major Roads
- Road Network
- Gandhisagar WLS
- PA Boundary
- Division Boundary
- State Boundary
- Savannah/Grassland
- Forest
- Non Forest
- Water





3.4.

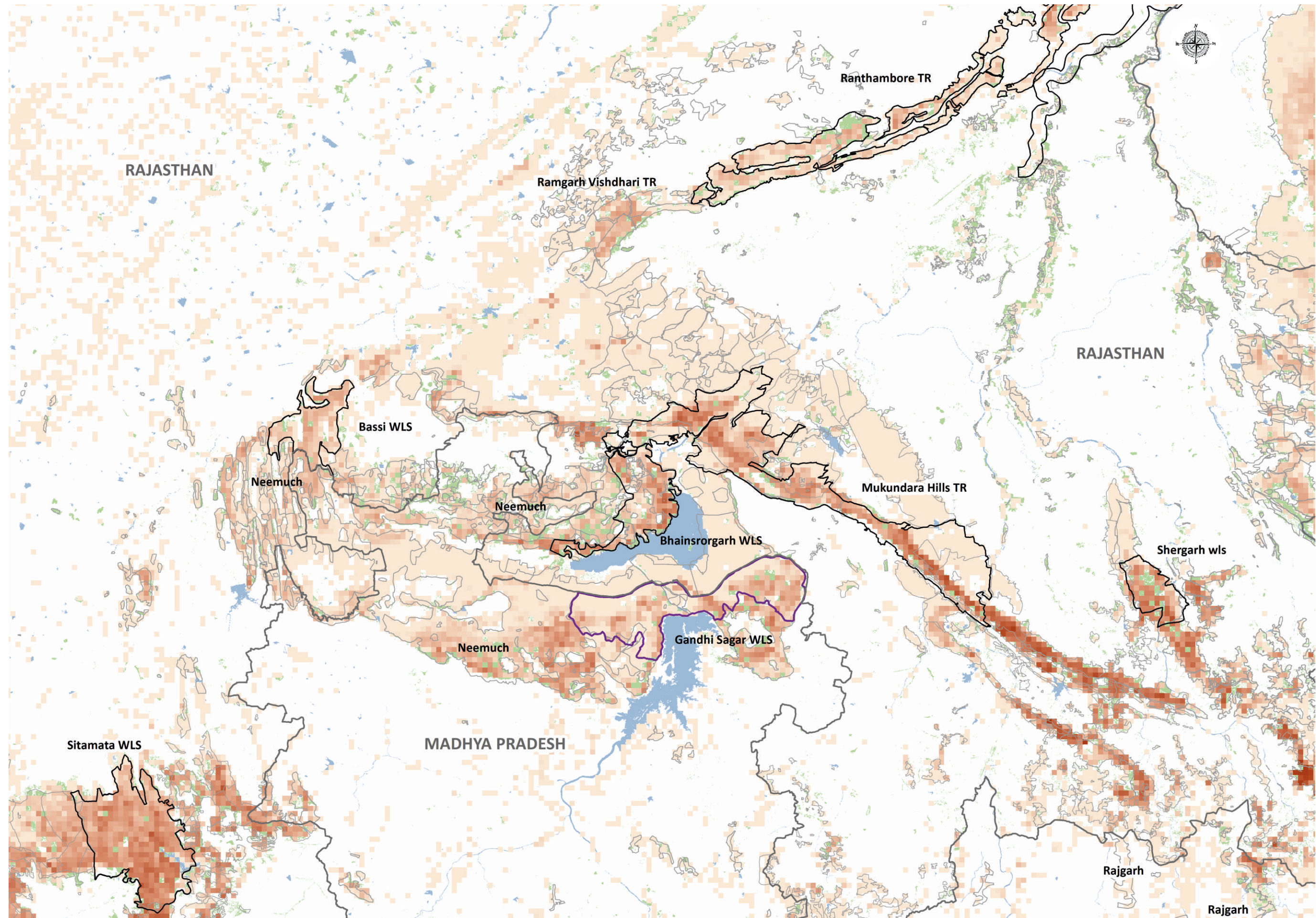
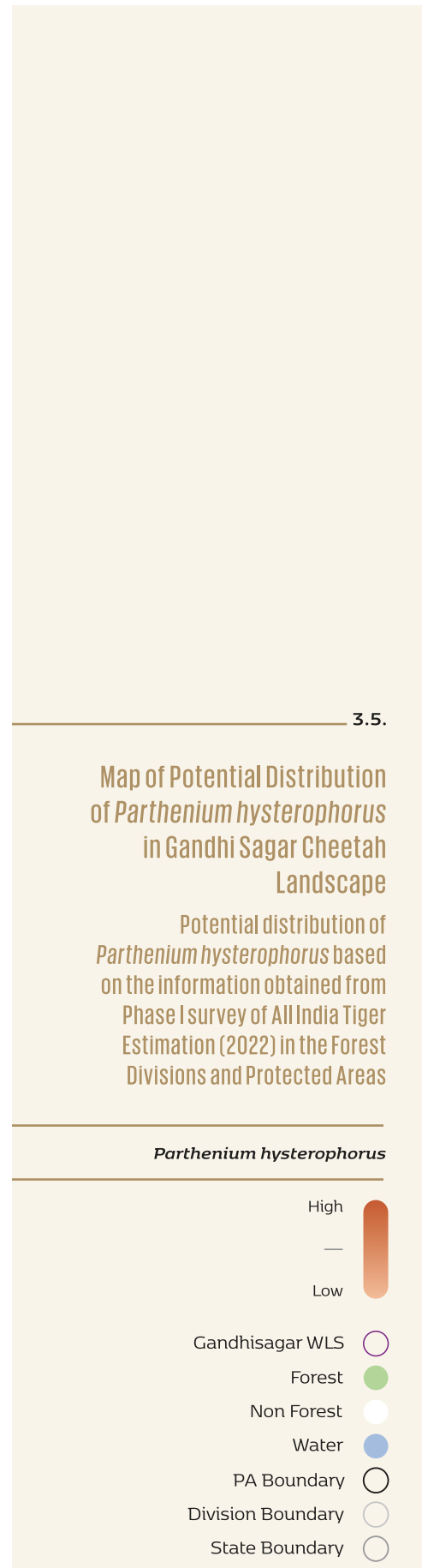
Map of Potential Distribution of *Lantana camara* in Gandhi Sagar Cheetah Landscape

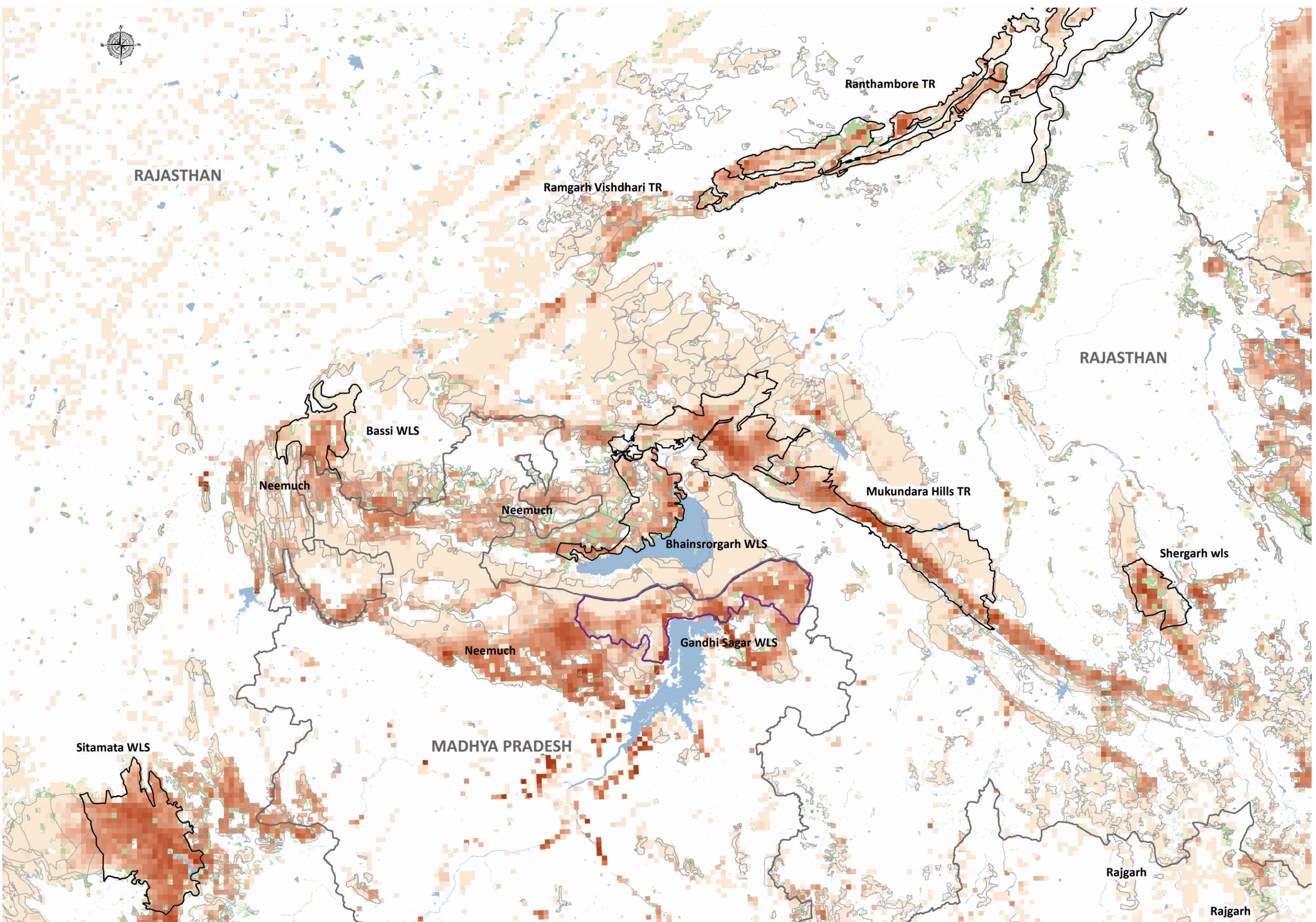
Potential distribution of *Lantana camara* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Lantana camara



- Gandhisagar WLS
- Forest
- Non Forest
- Water
- PA Boundary
- Division Boundary
- State Boundary





3.6.

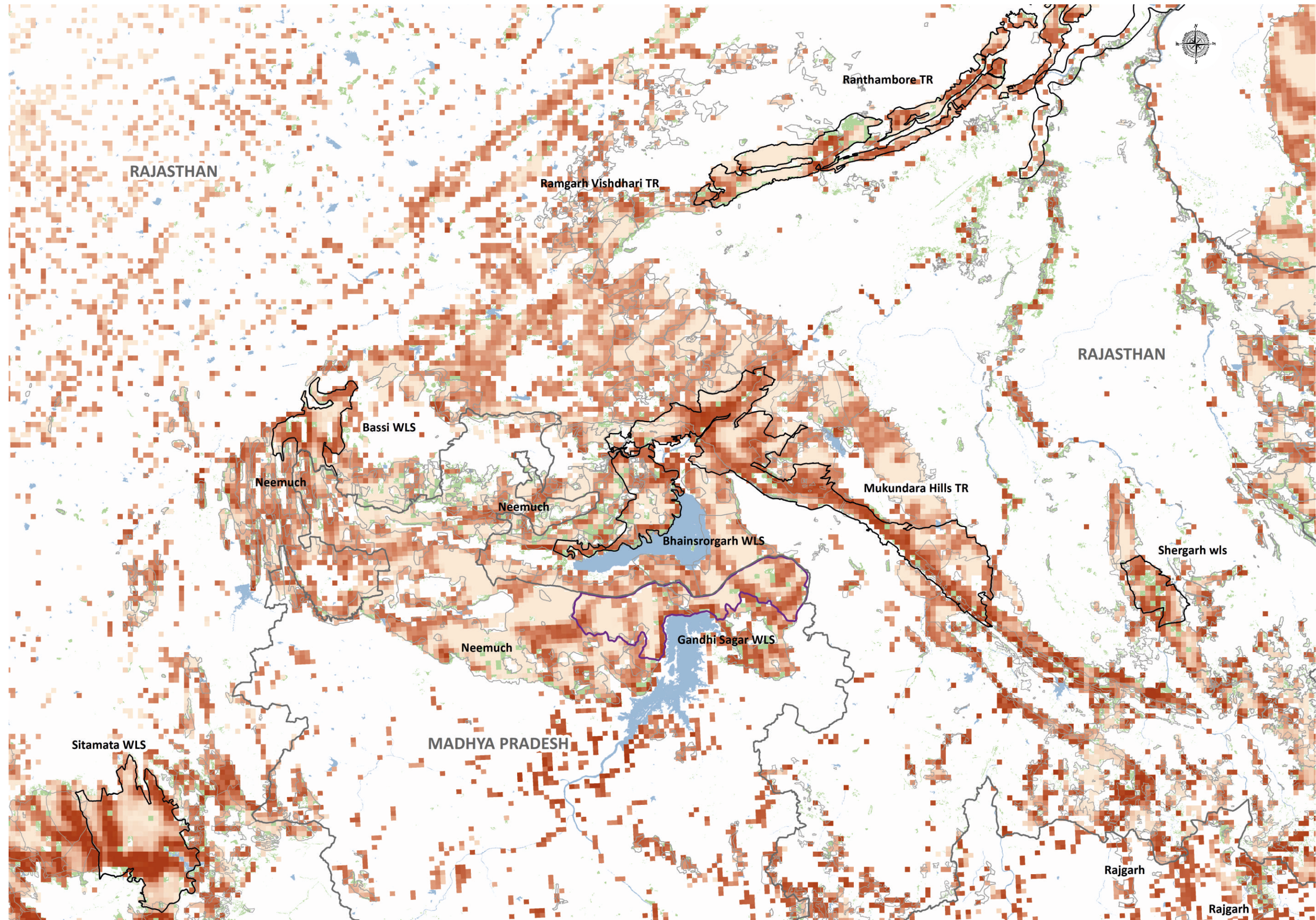
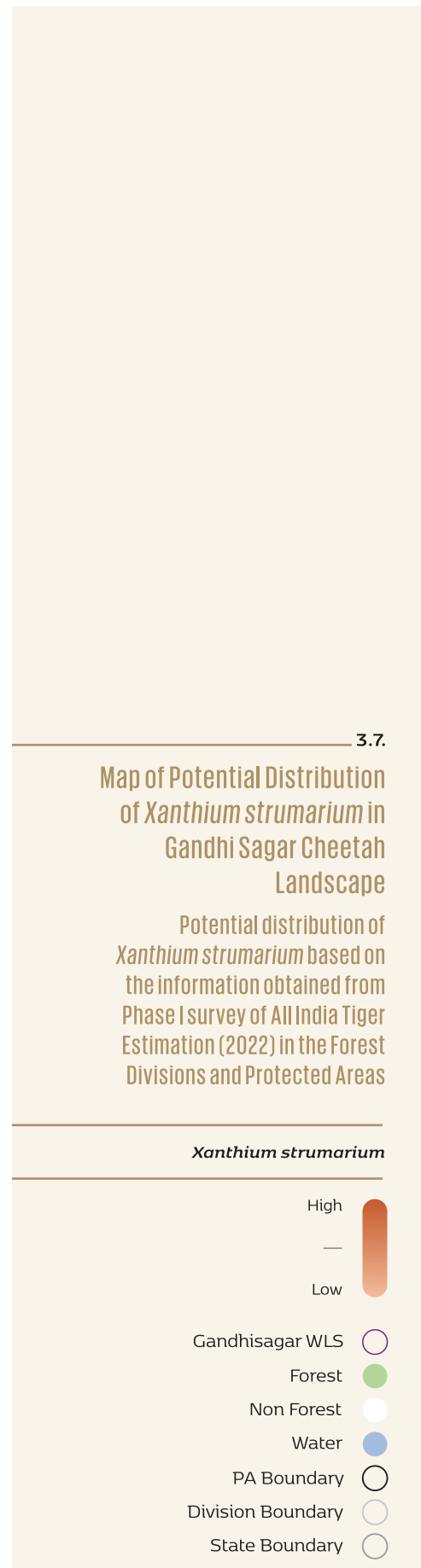
Map of Potential Distribution of *Ageratum conyzoides* in Gandhi Sagar Cheetah Landscape

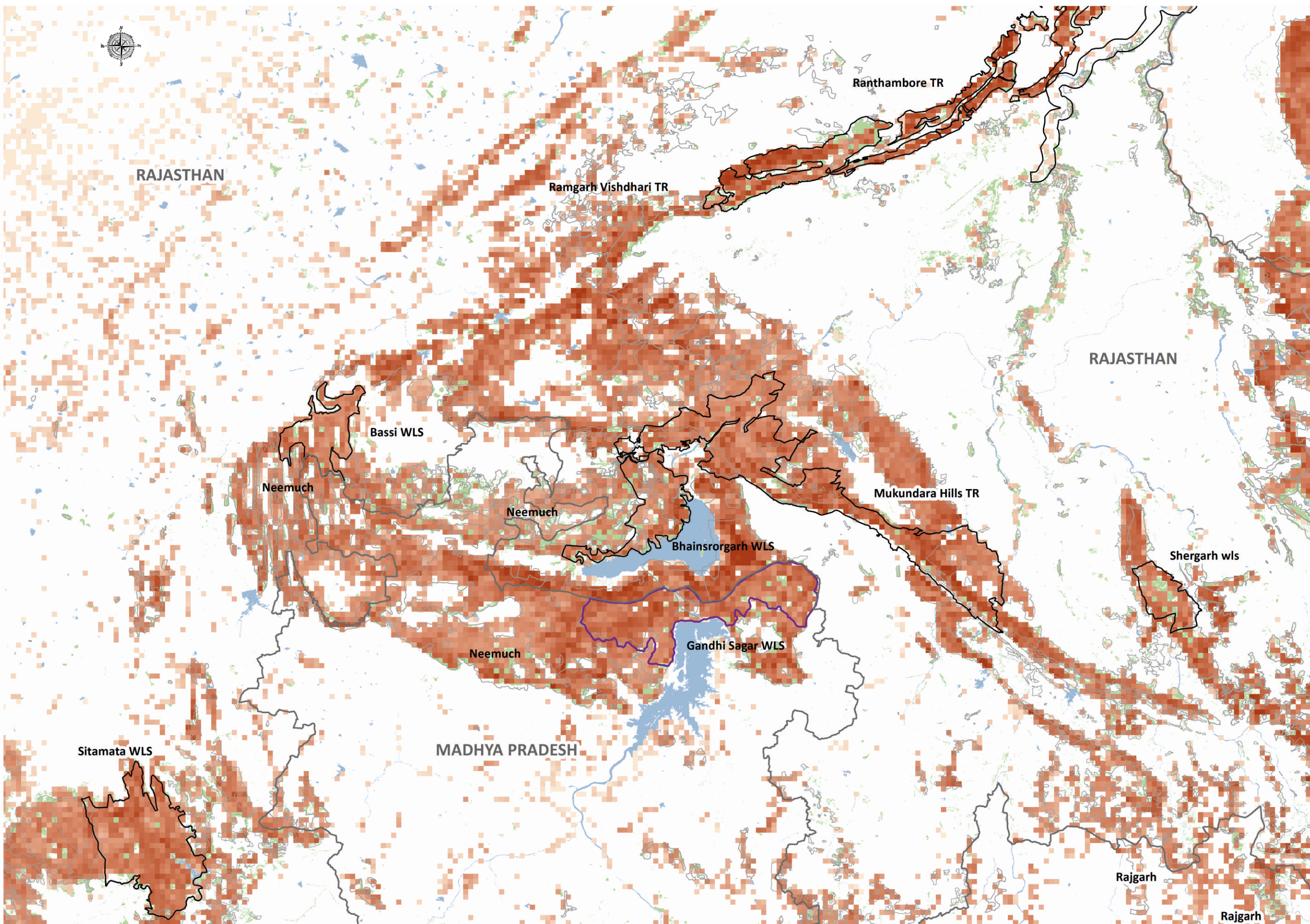
Potential distribution of *Ageratum conyzoides* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Area

Ageratum conyzoides



- Gandhisagar WLS
- Forest
- Non Forest
- Water
- PA Boundary
- Division Boundary
- State Boundary





3.8.

Map of Potential Distribution of *Senna tora* in Gandhi Sagar Cheetah Landscape

Potential distribution of *Senna tora* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Senna tora



- Gandhisagar WLS
- Forest
- Non Forest
- Water
- PA Boundary
- Division Boundary
- State Boundary

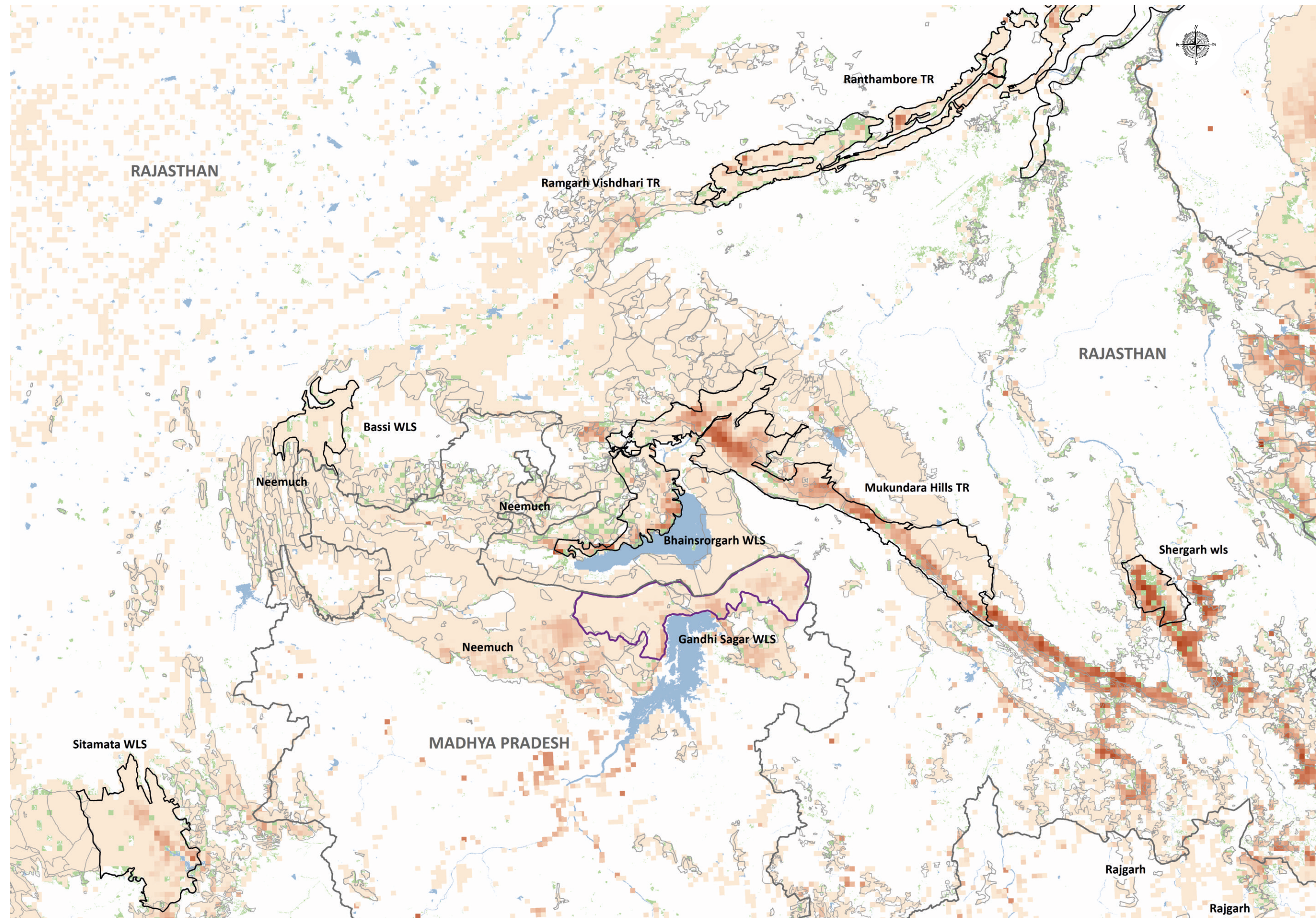
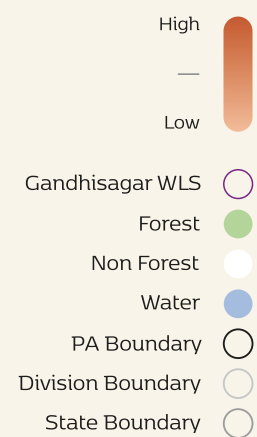


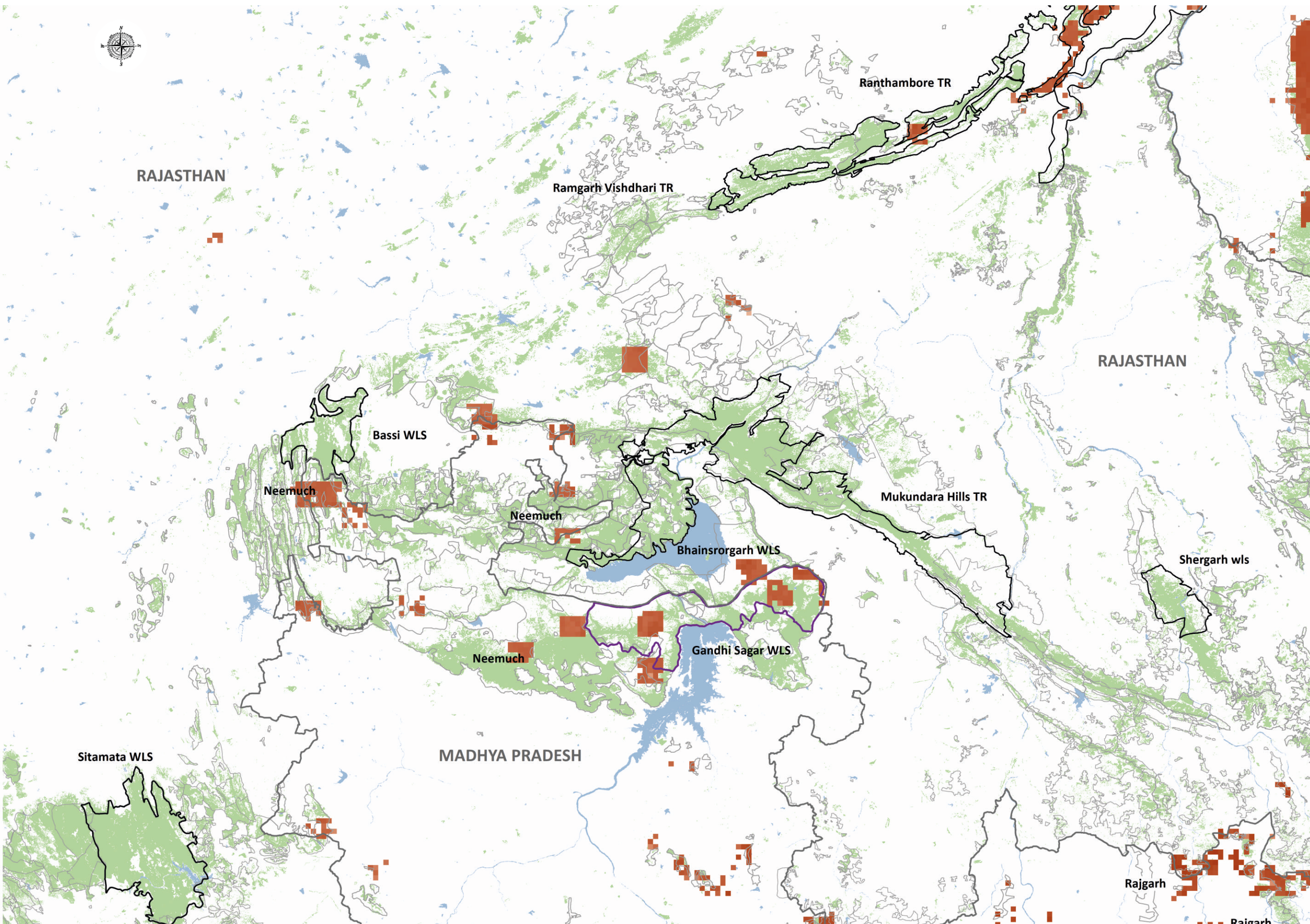
3.9.

Map of Potential Distribution of *Mesosphaerum suaveolens* in Gandhi Sagar Cheetah Landscape

Potential distribution of *Mesosphaerum suaveolens* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Mesosphaerum suaveolens





3.10.

Map of Distribution of *Prosopis juliflora* in Gandhi Sagar Cheetah Landscape

Distribution of *Prosopis juliflora* based on the information obtained from Phase I survey of All India Tiger Estimation (2022) in the Forest Divisions and Protected Areas

Prosopis Juliflora



- Gandhisagar WLS
- Forest
- Non Forest
- Water
- PA Boundary
- Division Boundary
- State Boundary

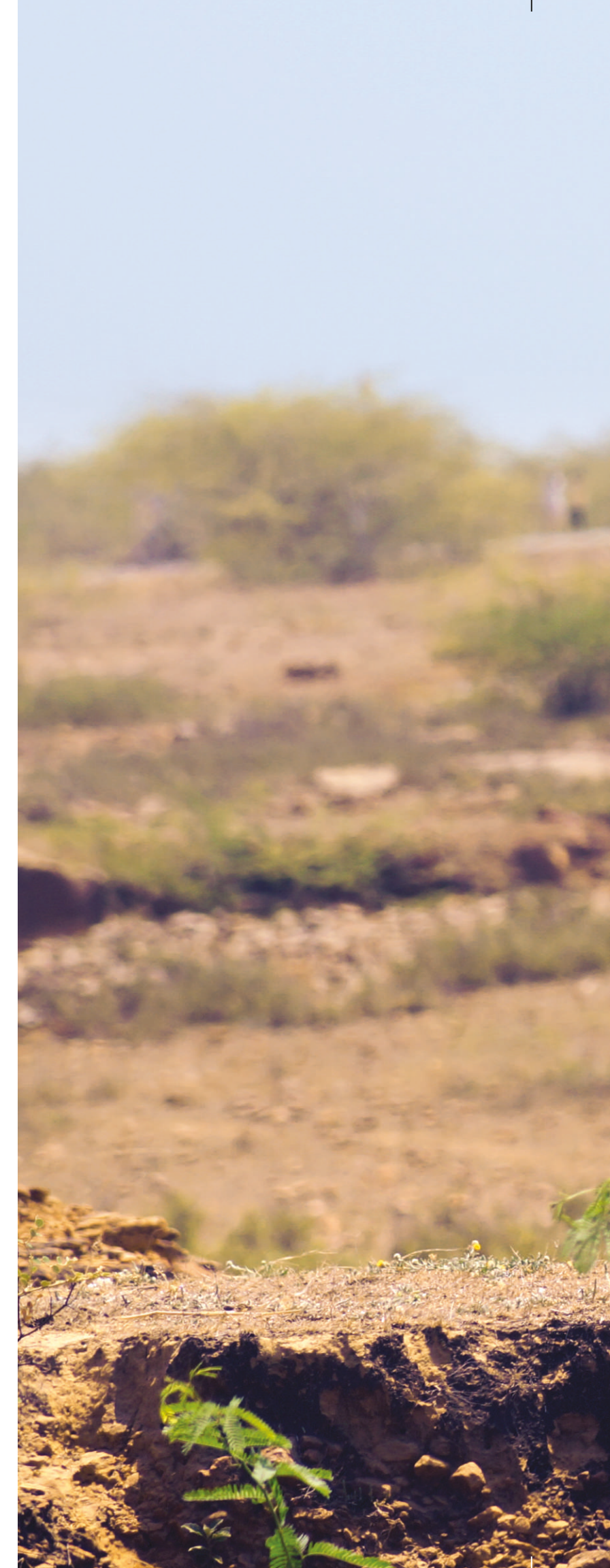


ACTIONS REQUIRED IN KUNO - GANDHI SAGAR CHEETAH METAPOPOPULATION LANDSCAPE

4



- Under the umbrella of cheetah conservation, developing a multi-sectoral masterplan for effective coordination of forest department with other government departments such as district administration, police, agriculture, revenue, animal husbandry, fisheries, transportation, panchayat and rural development, social welfare, tribal welfare etc. incorporating legal, administrative and financial mechanisms for implementation and monitoring (Gopal *et al.* 2023) with delegation of roles and responsibilities as well as accountability overseen by a competent authority.
 - Constitution of multiple cheetah Rapid Response teams at the Forest Division/ Protected Area level to provide safe passages for cheetahs in human-dominated areas of the landscape.
 - Continuous awareness and sensitization programs at schools, colleges, and villages about wildlife, biodiversity, and nature emphasizing on the cheetah as well as biodiversity conservation issues and various schemes available with the forest department and other departments aligning with wildlife conservation.
- Dissemination of public opinion (pro-cheetah/conservation) developed by elected representatives as well as authorized government officials will be a regular process. There are no historically documented or known fatal attacks by cheetahs on humans, and this message along with the benefits of cheetah conservation through enhanced livelihood options has to be emphasized through outreach and awareness programs.
- Implementation of a modern smart patrol monitoring system such as MSTRIPES (Monitoring System for Tigers - Intensive Protection and Ecological Status) in the larger landscape. Monitoring prey populations, other carnivores, vegetation, anthropogenic disturbances, and understanding human-wildlife interactions in the landscape as well as capacity building of forest department staff.
 - Livelihood securities of the local communities need to be ensured at any cost. Measures such as compensation/ex-gratia payment schemes for wildlife-related damages to





property and life play a very important role in shaping successful conservation programs worldwide. Activities like timely and adequate payment for losses incurred due to wildlife would have to be considered as ecosystem maintenance costs that need to be paid to the local communities. Compensation can-not buy one's tolerance but is often perceived as an instant financial relief. Compensation rates for livestock predation for various livestock productivity classes would have to be decided after a thorough market survey and revised every couple of years. Options for provision of payment for crop losses due to wildlife as well as insurance schemes would have to be explored for losses against property and life.

- Veterinary initiatives in coordination with the animal husbandry department focusing on the vaccination of livestock including dogs and cats, and managing the dog population.
- Identification of potential wildlife corridors in the larger landscape on priority so that they can be safeguarded against conservation antagonistic land use patterns. This should be concomitant with the ecological restoration of the larger landscape.
- Vehicular traffic management in roads traversing forest areas in coordination with the transport department, particularly in wildlife-rich areas and potential wildlife corridors.
- During the summer season in this region, water can be a limiting resource and requires water management in drier parts of the PA and the landscape with at least one water hole within a radius of 4 km from each other, which would enhance the use of these areas by prey species and enhance the carrying capacity of the PA and the landscape.
- Grassland management by deterring the growth of woody species to promote natural prey base for cheetahs, leopards, and other endangered wildlife species of the region.
- Continuous efforts to eradicate weed species like Lantana camara, Prosopis juliflora, Cassia tora, Ageratum conyzoides, Eupatorium spp. etc from the grasslands. Another threat is the encroachment of grasslands by unpalatable species, which can reduce the area of productive grasslands (Rawat 2003). Woody tree growth would have to be regularly thinned to enable the existence of savannah-grasslands as an arrested successional stage, to promote a high density of wild ungulates.

- Measures to prevent fire are mostly in place as part of park management in Protected Areas and have to be implemented in the forest divisions of the landscape. Management of Non-timber Forest Produce (NTFP) collection and incidence of fire through increased surveillance and regulation.
- Restoration activity in the larger landscape that would involve the forest departments of M.P. and Rajasthan include managing grasslands, perennial water management, plantation of miscellaneous forage species like Ziziphus, Acacia, Carissa, Dichrostachys, Aegle, Terminalia, Diospyros, etc. to enhance the productivity and carrying capacity of the landscape.
- Eco-tourism which is sustainable and conservative, subservient to the conservation needs of the PA and of the project so that livelihood options for the local people can be created and the conservation agenda gets adequate public goodwill. Exploring options in complete consonance with the conservation objectives to generate revenues through brand building, marketing, sponsorships, merchandising, etc. would have to be carried out.
- Implementation of guidelines similar to the one provided by the NTCA's landscape management strategy in the Tiger Conservation Plan underlining the provision of incentives and enhancement of livelihood of resident communities, compensation for livestock kills, mitigation of human-wildlife negative interactions, and curtailment of high impact infrastructure as well as industrial developmental activities.

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BRINGING BACK THE

CHEETAH

TO INDIA



RESTORING NATION'S NATURAL HERITAGE
REVIVING OPEN NATURAL ECOSYSTEMS

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