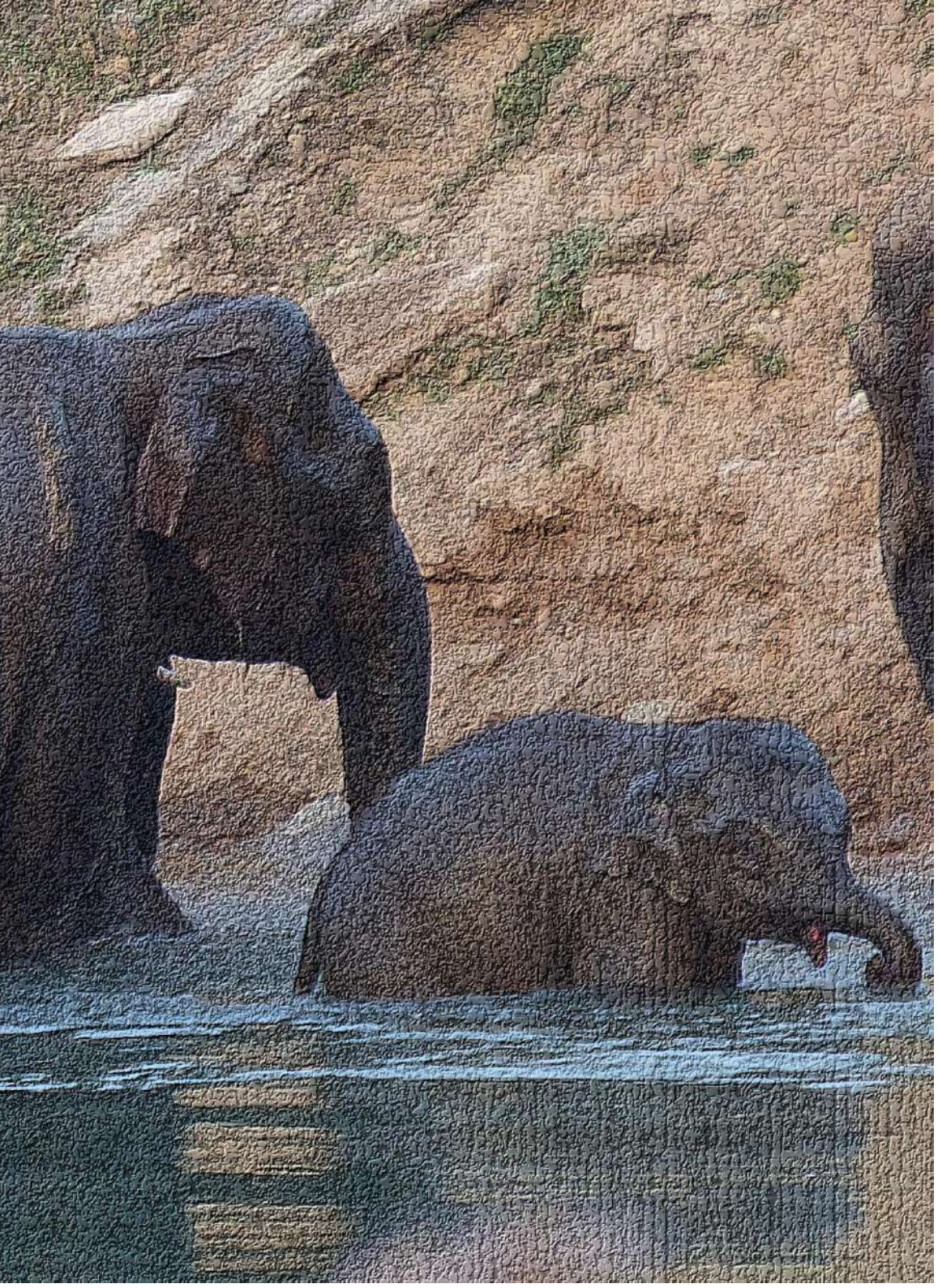
Elephant Reserves of India

LAND USE AND LAND COVER

Version - 2



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Version – 2

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Disclaimer:
Although geospatial data from reliable sources were used, Project Elephant cannot guarantee the accuracy of data and spatial maps presented in the report.

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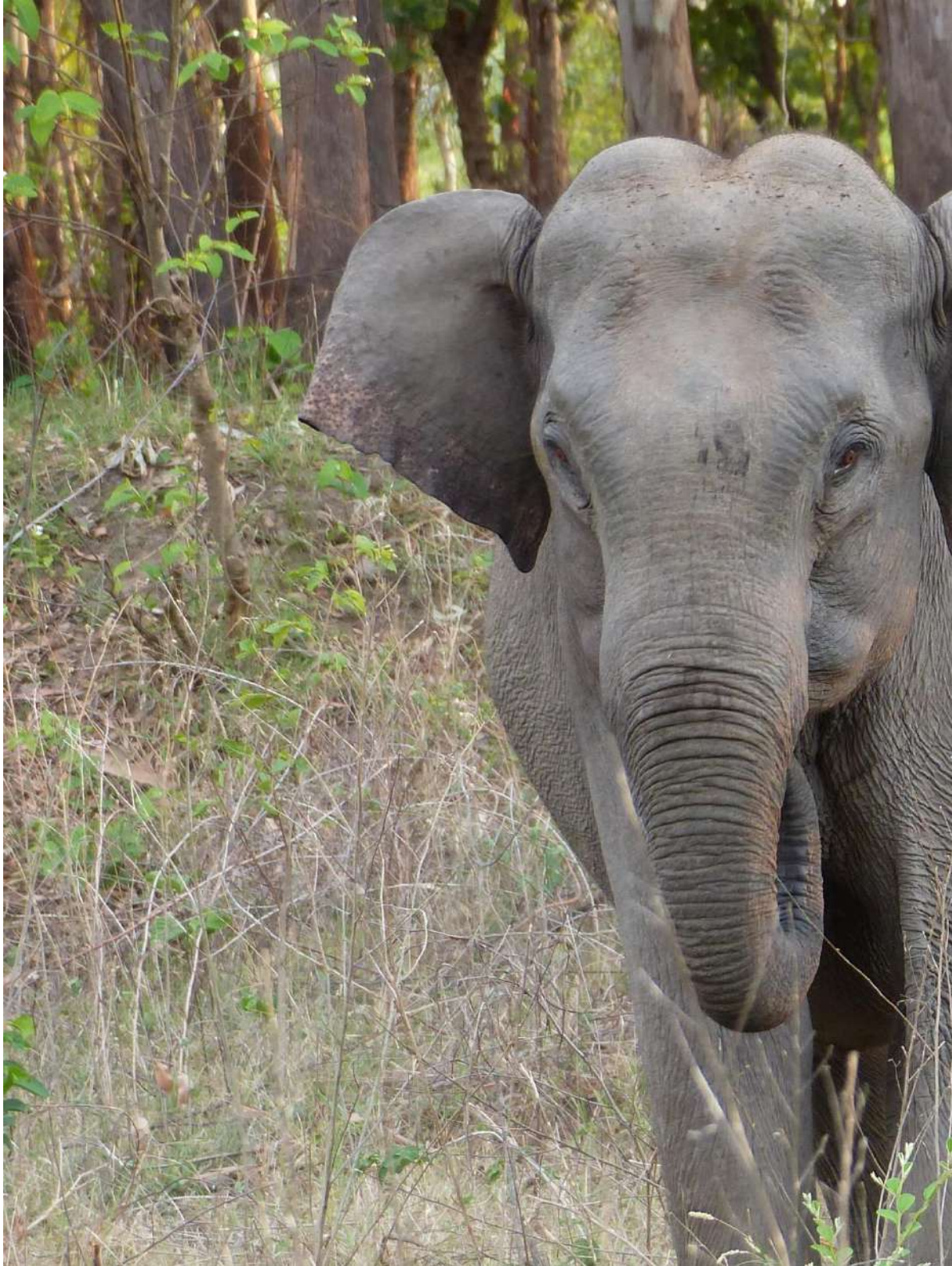

Elephant Reserves of India

LAND USE AND LAND COVER

Version – 2

Advisors

Dr. G.S. Bhardwaj, ADG (PE&PT) & MS (NTCA), MoEF&CC, GoI
Shri. Virendra R. Tiwari, Director, Wildlife Institute of India
Shri. Ramesh K Pandey, IGF (PT&E) & Director, Project Elephant, MoEF&CC, GoI

Team

Dr. Parag Nigam, Scientist G & Nodal Officer, Elephant Cell, WII
Dr. Bilal Habib, Scientist F & Asso. Nodal Officer, Elephant Cell, WII
Dr. Dheeraj Mittal, AIGF (PT&E), MoEF&CC, Govt. of India
Dr. Rajendra Kumar, Scientist C, (PT & PE), MoEF&CC
Dr. Dharmendra K. Gupta, Director (S), Project Elephant, MoEF&CC
Dr. K.M. Selvan, Asst, Director (S), Project Elephant, MoEF&CC
Dr. Lakshminarayanan, N., Consultant – C, Elephant Cell, WII
Shri. Udhayaraj AD, Project Scientist – II (GIS), Elephant Cell, WII

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State Forest Departments

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Forest & Climate Change Department, Government of Chhattisgarh

Department of Forest, Environment & Climate Change, Government of Jharkhand

Karnataka Forest Department, Government of Karnataka

Kerala Forests & Wildlife Department, Government of Kerala

Forests and Environment Department, Government of Meghalaya

Department of Environment, Forests & Climate Change, Government of Nagaland

Odisha State Forest Department, Government of Odisha

Forest Department, Government of Tamil Nadu

Environment, Forests and Climate Change Department, Government of Uttar Pradesh

Uttarakhand Forest Department, Government of Uttarakhand

West Bengal Forest Department, Government of West Bengal

Contents

Preface

Asian elephants occur in 13 range countries. Among them, India harbors the largest population of Asian elephants in the wild and thus, plays a pivotal role in their long-term conservation. To boost elephant conservation in India, the Government of India launched Project Elephant in 1992. Landscape units commensurate with elephants' large range needs were notified as Elephant Reserves (ER). Presently, the Elephant Reserves encompass 80,778 km^2 of heterogeneous habitats in 14 Indian states.

During the last few years, there is impetus to strengthen management focus to the Elephant Reserves so that elephant-centric prescriptions can be amalgamated into existing working plans and management plans. To bolster the Elephant Reserve management, creating thematic database in a readily available format assumes importance. Apropos, the Project Elephant collated basic information on all the Elephant Reserves of India and created an atlas during the year 2022, which was subsequently updated in 2023. During 2022, the Project Elephant also came up with a land use land cover classification of the Elephant Reserves. This report comprised land-cover maps for all the Elephant Reserves besides providing preliminary details on broad trends in land-use changes by comparing geospatial layers pertaining to four different periods.

Preparing theme-specific reports is one thing. Periodically updating the theme-specific reports with latest information is required and accordingly, the land use land cover report of 2022 is revised. In this revision, the following information is additionally provided:

1. Biogeographic provinces: Using Rodgers and Panwar (1988) biogeographic classification of India, the Elephant Reserves falling in major biogeographic provinces have been pictorially depicted.

2. Forest classification: To have a uniform approach in understanding forest types across Elephant Reserves, the Forest Survey of India's classification of Indian forests was used. The classification is based on the 'crown density' and comprises four major forest types viz. (i) scrub, (ii) open forest, (iii) moderately dense forest, and (iv) very dense forest.

3. Terrain: Within the Elephant Reserves, the terrain was classified into different gradients that have relevance for elephants. Information on the degrees of slope pertaining to three major categories is provided along with reserve-specific digital elevation maps that pictorially depict the elevation and gradient.

4. Drainage: Elephants are water-dependent species and thus, their habitat use is intricately linked with river systems. Therefore, the major rivers flowing through the Elephant Reserves have been provided.

While Pan-India land use land cover information can provide details useful for broad comparisons between the Elephant Reserves, it is desirable to carryout detailed land use land cover investigation for the individual Elephant Reserves to capture the finer details of changes potentially taking place. Such intensive assessments may be carried out in future by the Elephant Range States. We hope that this report will serve as reference document on land use and land classification in the Elephant Reserves and for better understanding of the managers in their efforts for conservation of elephants.

RAMESH KUMAR PANDEY, IFS
Inspector General of Forests (PT&E)
Director, Project Elephant

Data Source

In this report, 2018 Land Use & Land Cover (LULC) layer obtained from the BHUVAN Thematic Services website was used, which provides LULC data for the entire country. This layer was derived from Resourcesat-1 satellite's Linear Imaging Self-Scanning Sensor (LISS-III) data. The LULC layers adhere to the International Geosphere Biosphere Programme (IGBP) classification scheme (Loveland and Belward, 1997). Subsets of the LULC layer corresponding to the Elephant Reserves (ERs) extents were created. Raster subsets were vectorized to estimate the statistical areas of various feature classes.

Additionally, gradient within the ERs were estimated using the Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM). Further, Forest cover map of India (Forest Survey of India – 2017) data was used as a base layer for visualization. The resolution and source of the data used in the report have been provided in Table 1.

Table 1: Details of imagery used for LULC Elephant Reserves in India

Year	Source	Resolution (m)
2018	BHUVAN, NRSC, Government of India	30
2017	Forest cover map of India, Forest Survey of India	100
2000	NASA, Shuttle Radar Topography Mission, Digital Elevation Model	1 arc-second (~30 meters)

Classification System

The various LULC classes in the Bhuvan 2018 data were consolidated by merging different types of forest classes into a single forest class and different types of agricultural classes (Kharif and Rabi) into one agriculture class (Table – 2).

Table 2: LULC classification scheme adopted in the study

IGBP LULC Classes	LULC Classes used in study
Built-up (both urban and rural)	Built-up
Kharif	Agriculture
Rabi	Agriculture
Zaid	Agriculture
Double/triple	Agriculture
Currently Fallow land	Fallow land
Plantation/Orchards	Plantation/Orchards
Evergreen forest	Forest
Deciduous forest	Forest
Scrub/Degraded forest	Forest
Grassland	Forest
Other Wasteland	Fallow land
Scrubland	Forest
Water bodies	Water body
Littoral Swamp	Water body

Six major LULC classes were used in this report they are 1) Forest, 2) Agriculture, 3) Plantation/Orchard, 4) Water body, 5) Fallow land, and 6) Built-up areas.

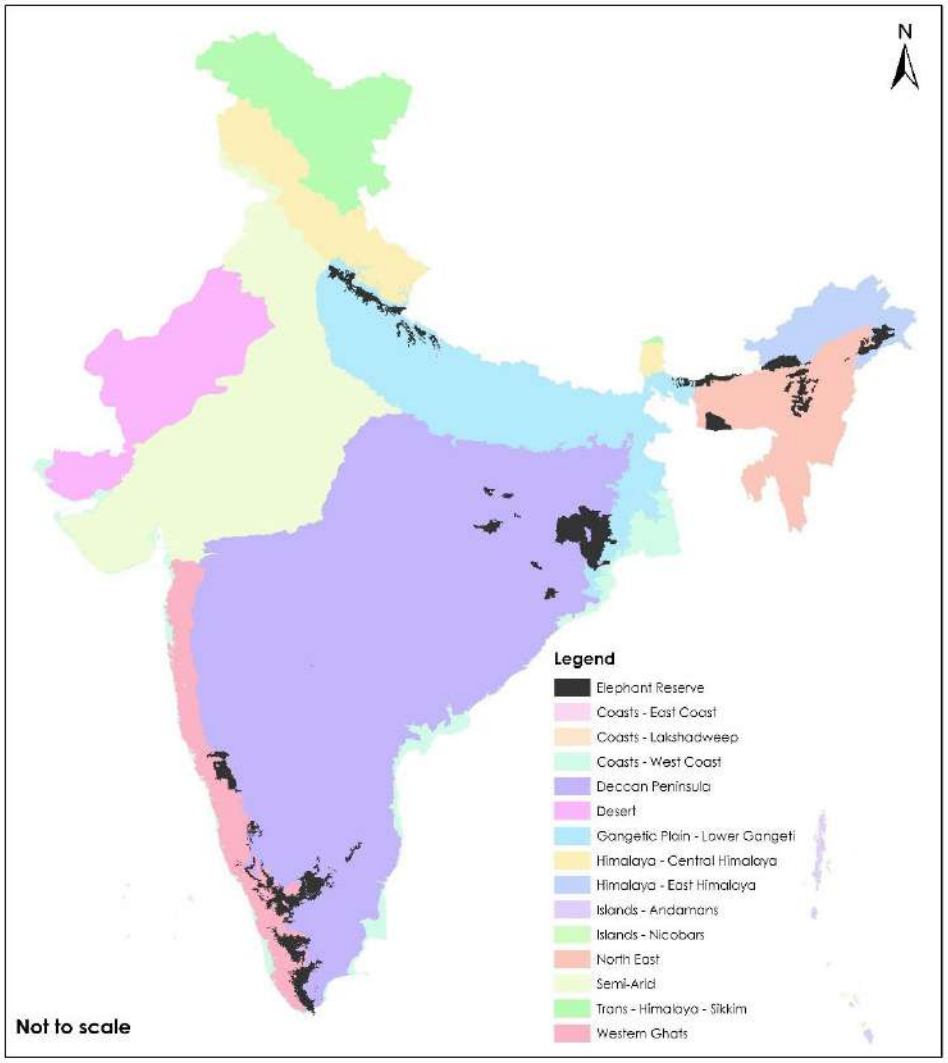
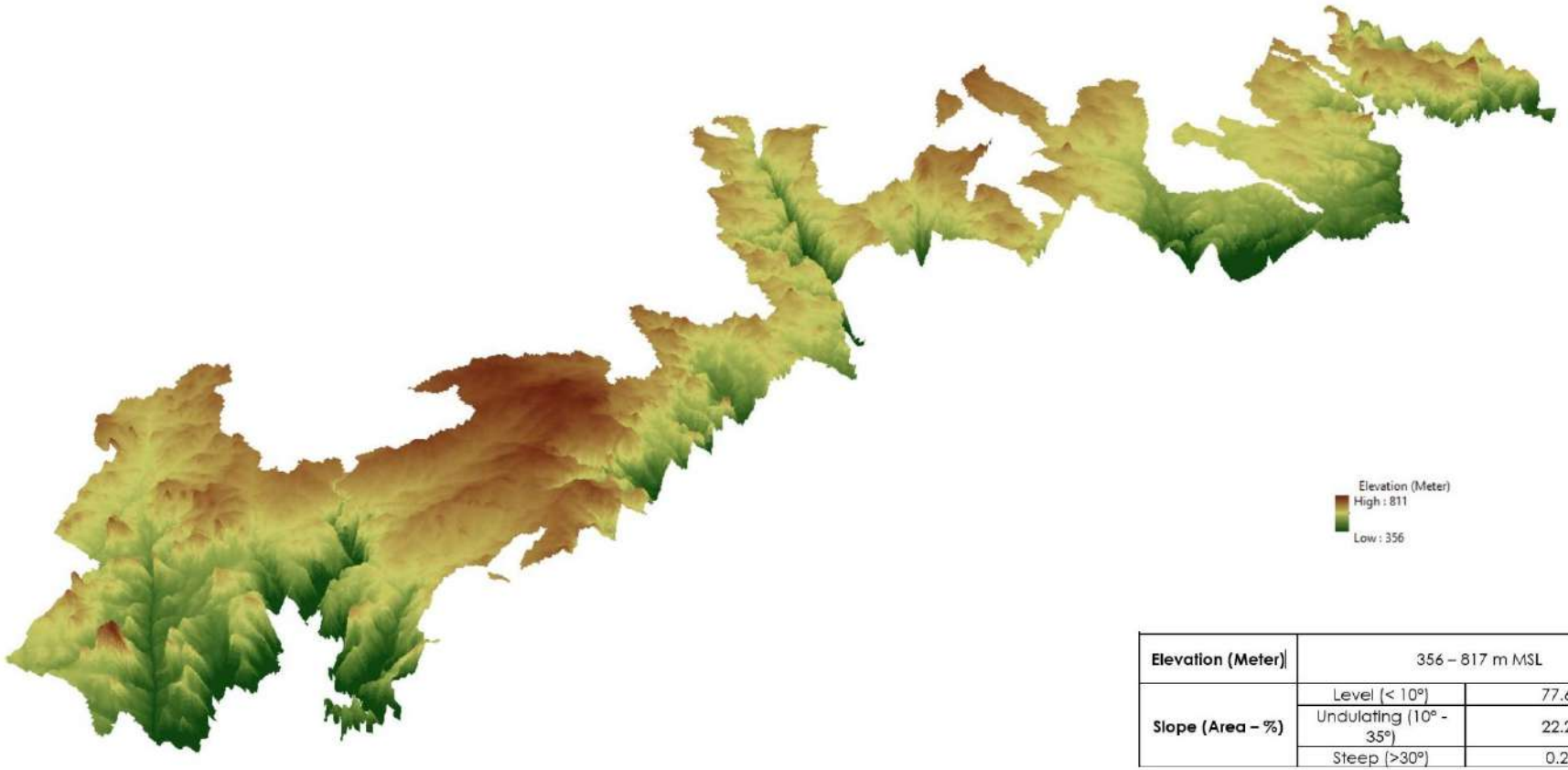


Figure 2: Elephant Reserves within Biogeographic provinces of India (Panwar & Rodgers, 1988)

ANDHRA PRADESH - RAYALA ELEPHANT RESERVE

Figure 2: Land use & Land cover Map of Rayala Elephant Reserve



Elevation (Meter)	356 – 817 m MSL	
Slope (Area – %)	Level (< 10°)	77.6%
	Undulating (10° - 35°)	22.2%
	Steep (>30°)	0.2%

Figure 3: 3-Dimensional view of Rayala Elephant Reserve

ARUNACHAL PRADESH - KAMENG ELEPHANT RESERVE

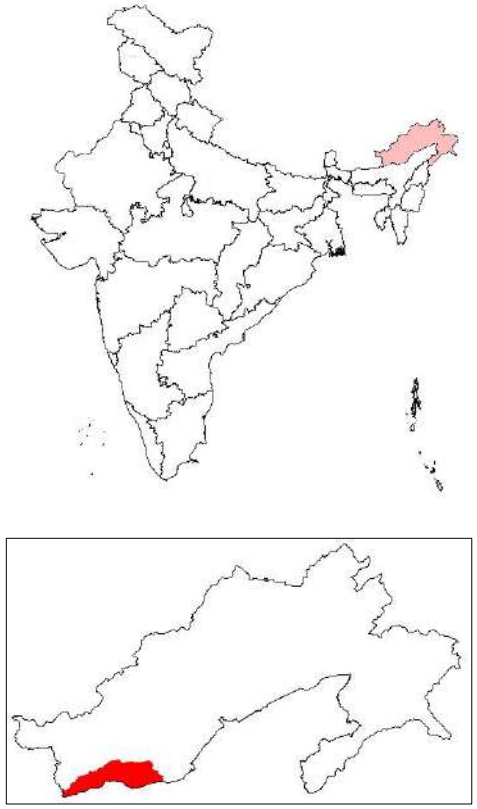
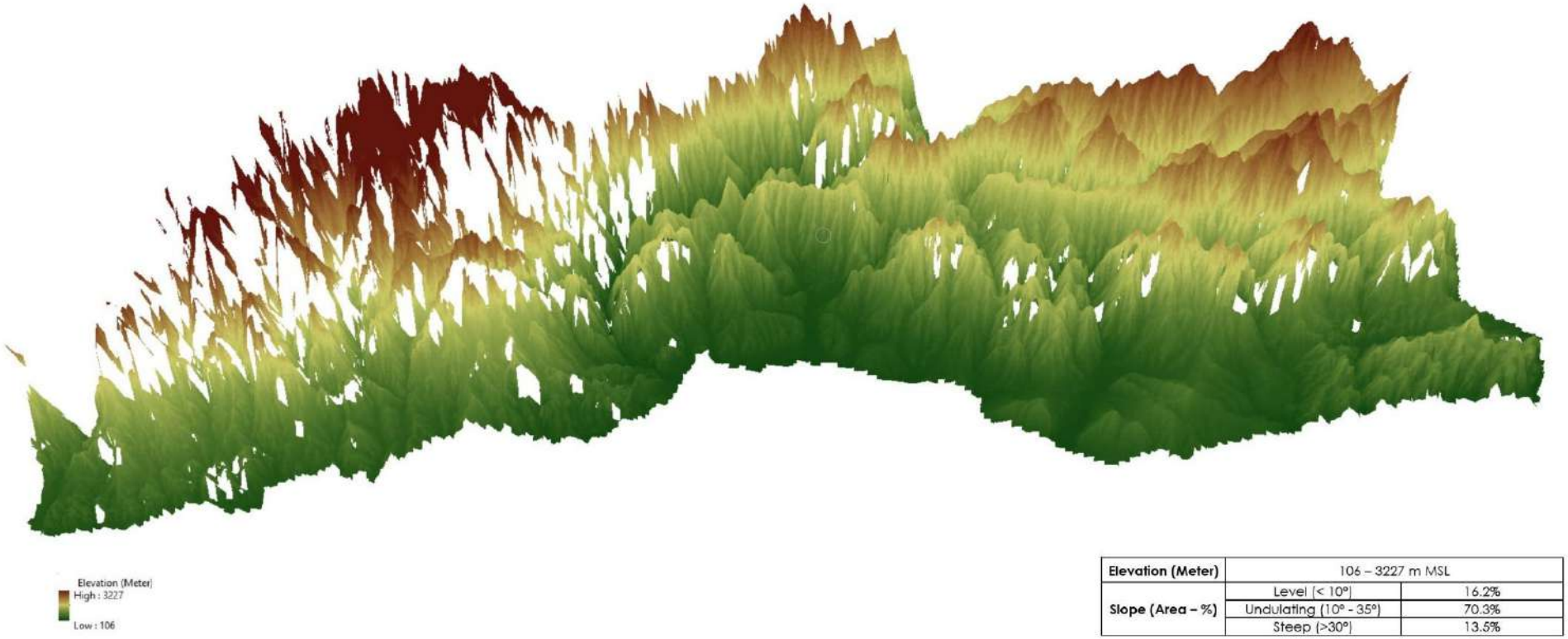


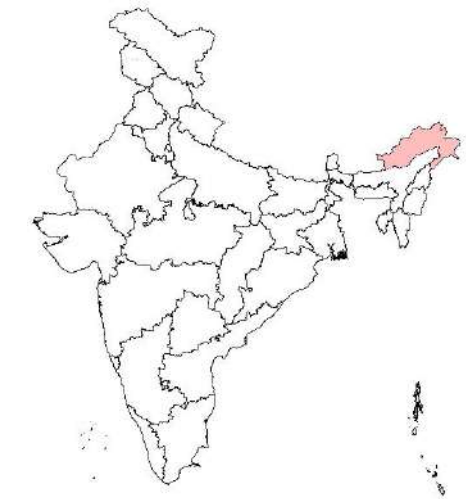
Figure 4: Land use & Land cover Map of Kameng Elephant Reserve

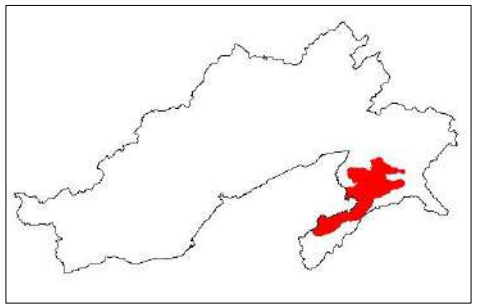


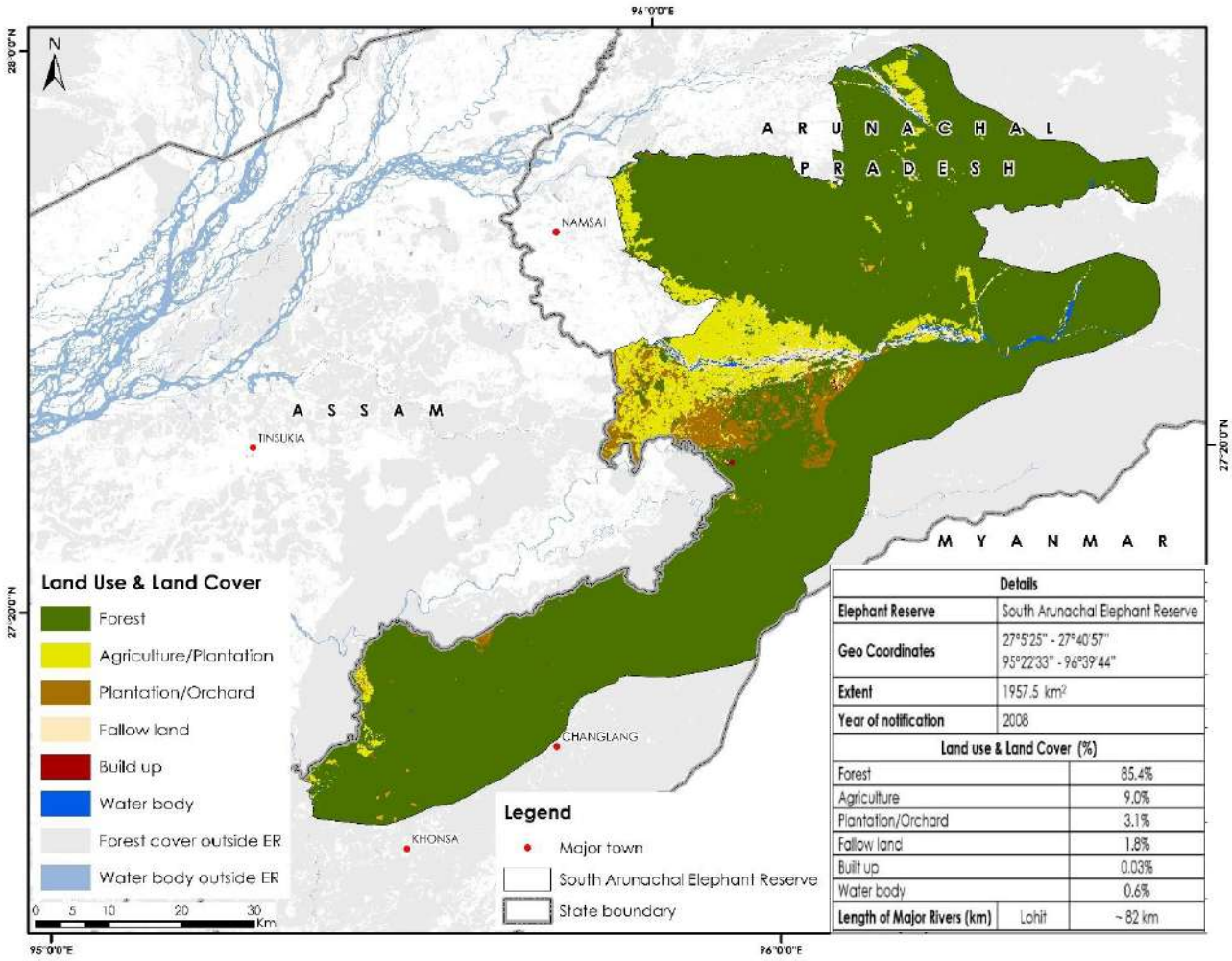
Elevation (Meter)	106 – 3227 m MSL	
Slope (Area – %)	Level (< 10°)	16.2%
	Undulating (10° - 35°)	70.3%
	Steep (>30°)	13.5%

Figure 5: 3-Dimensional view of Kameng Elephant Reserve

ARUNACHAL PRADESH – SOUTH ARUNACHAL ELEPHANT RESERVE

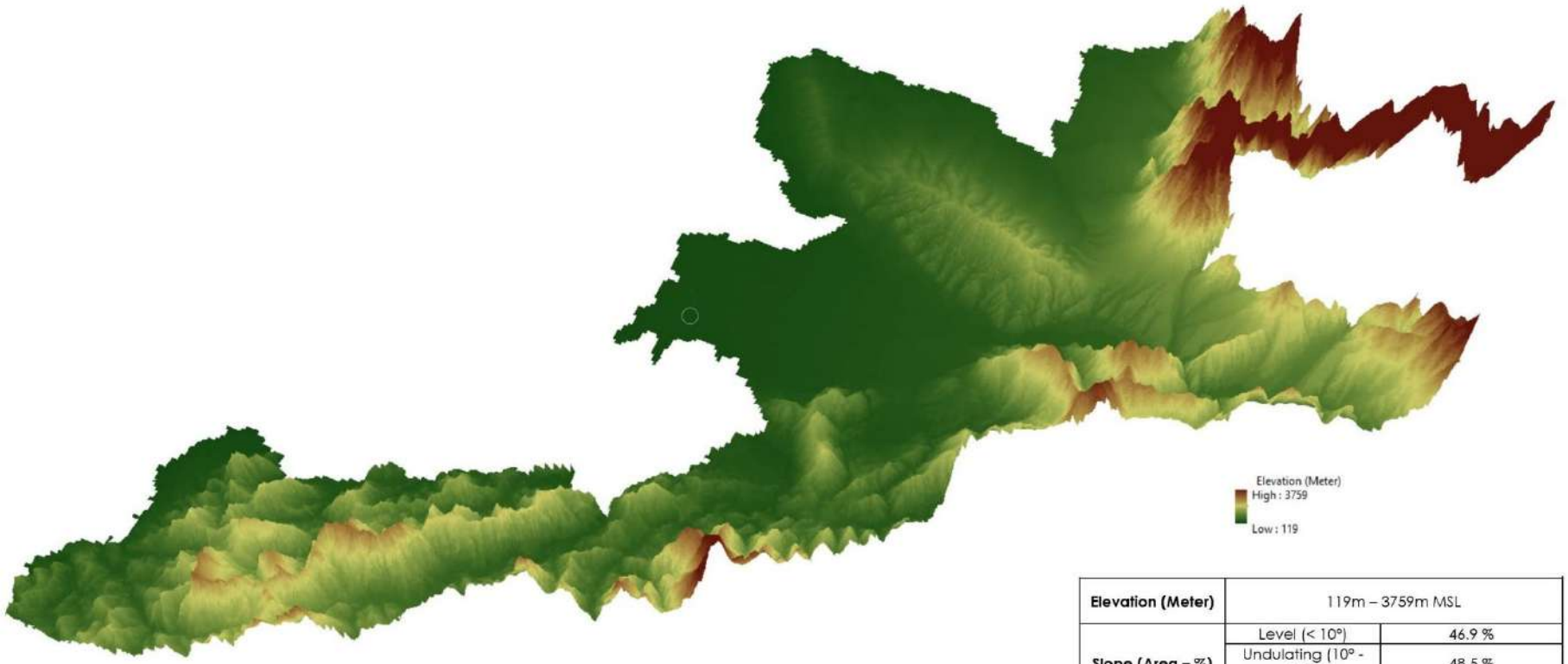






Details	
Elephant Reserve	South Arunachal Elephant Reserve
Geo Coordinates	27°5'25" - 27°40'57" 95°22'33" - 96°39'44"
Extent	1957.5 km²
Year of notification	2008
Land use & Land Cover (%)	
Forest	85.4%
Agriculture	9.0%
Plantation/Orchard	3.1%
Fallow land	1.8%
Built up	0.03%
Water body	0.6%
Length of Major Rivers (km) — Lohit	~ 82 km

Figure 6: Land use & Land cover Map of South Arunachal Elephant Reserve



Elevation (Meter)	119m – 3759m MSL	
Slope (Area – %)	Level (< 10°)	46.9 %
	Undulating (10° - 35°)	48.5 %
	Steep (>30°)	4.6 %

Figure 7: 3-Dimensional view of South Arunachal Elephant Reserve

ASSAM – CHIRANG-RIPU ELEPHANT RESERVE

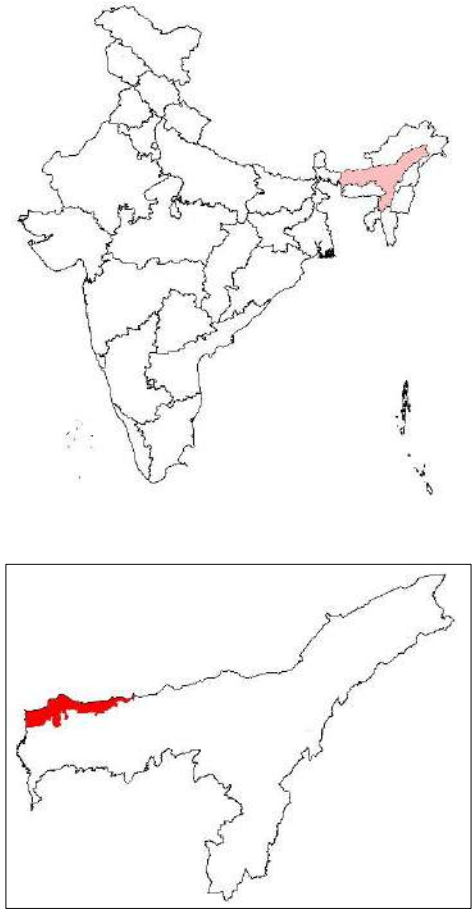
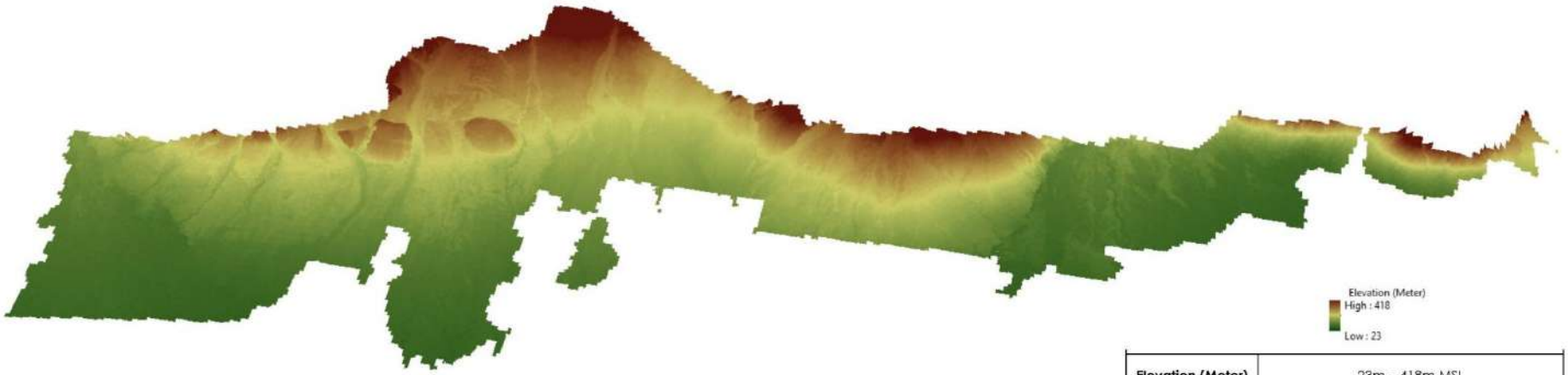


Figure 8: Land use & Land cover Map of Chirang - Ripu Elephant Reserve



Elevation (Meter)	23m – 418m MSL	
Slope (Area – %)	Level (< 10°)	99.2 %
	Undulating (10° - 35°)	0.8 %
	Steep (>35°)	0.0 %

Figure 9: 3-Dimensional view of Chirang - Ripu Elephant Reserve

ASSAM – DHANSIRI-LUNGDING ELEPHANT RESERVE

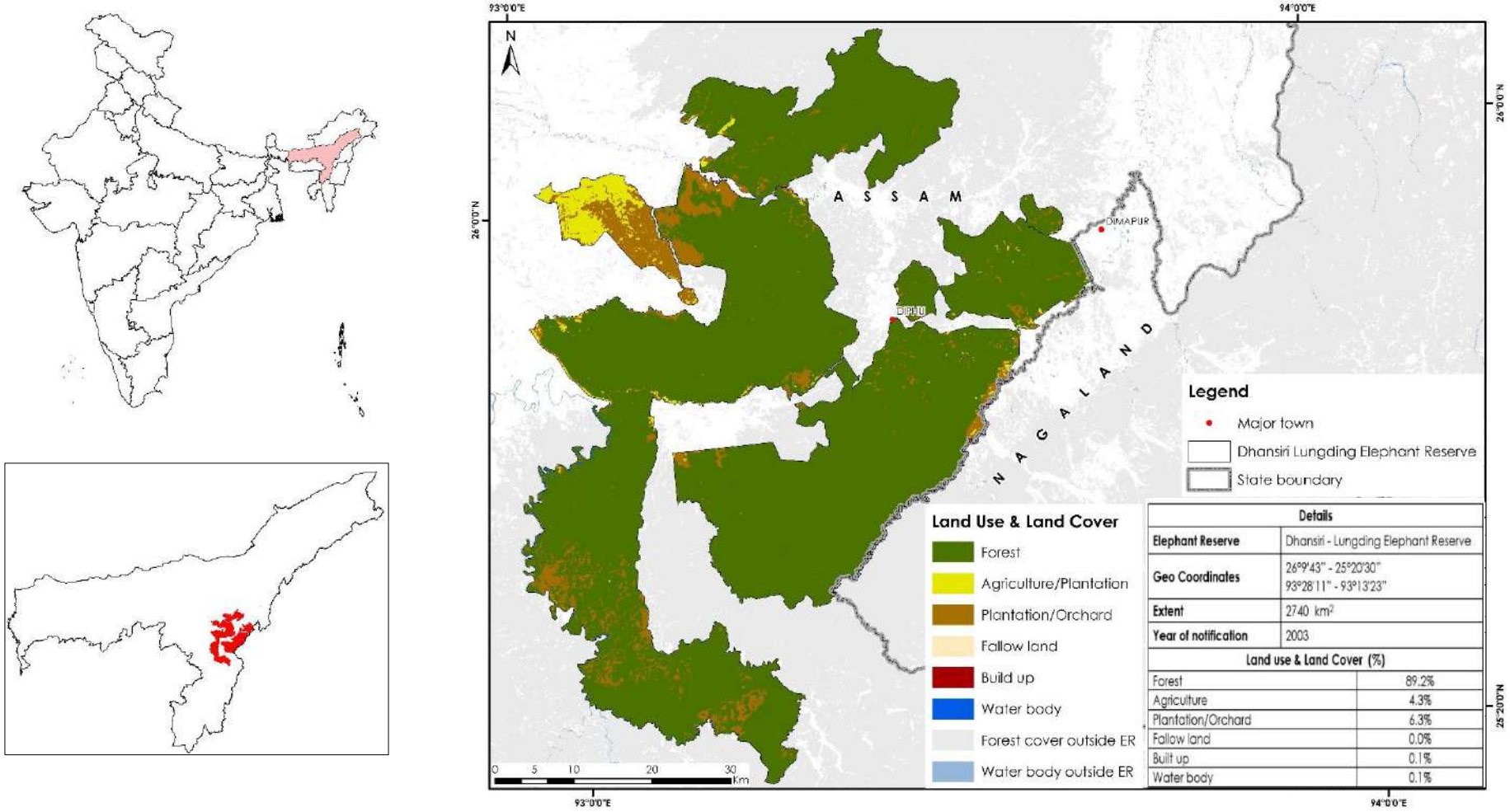
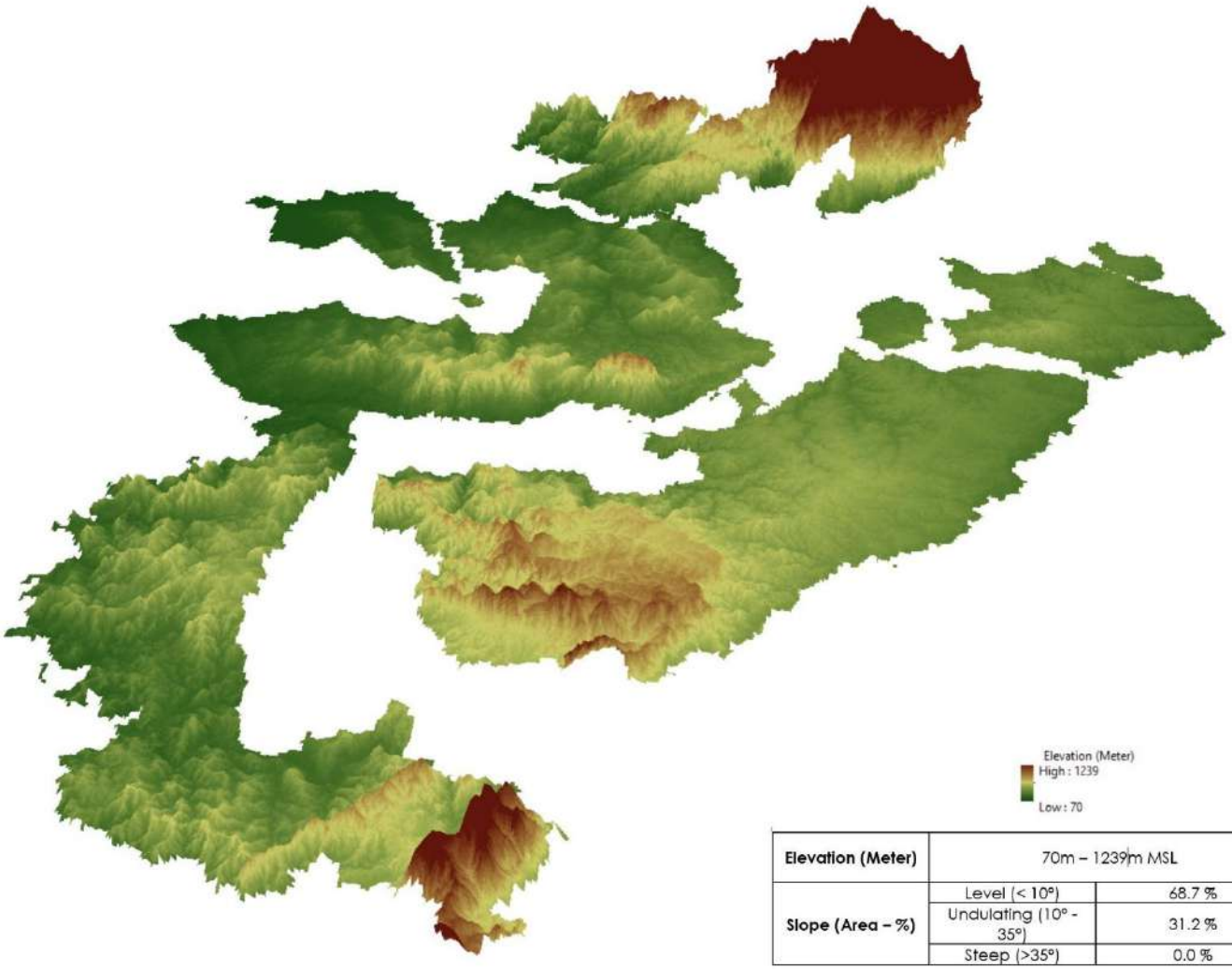


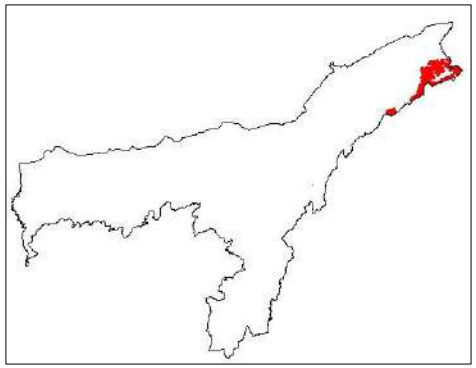
Figure 10: Land use & Land cover Map of Dhansiri - Lungding Elephant Reserve

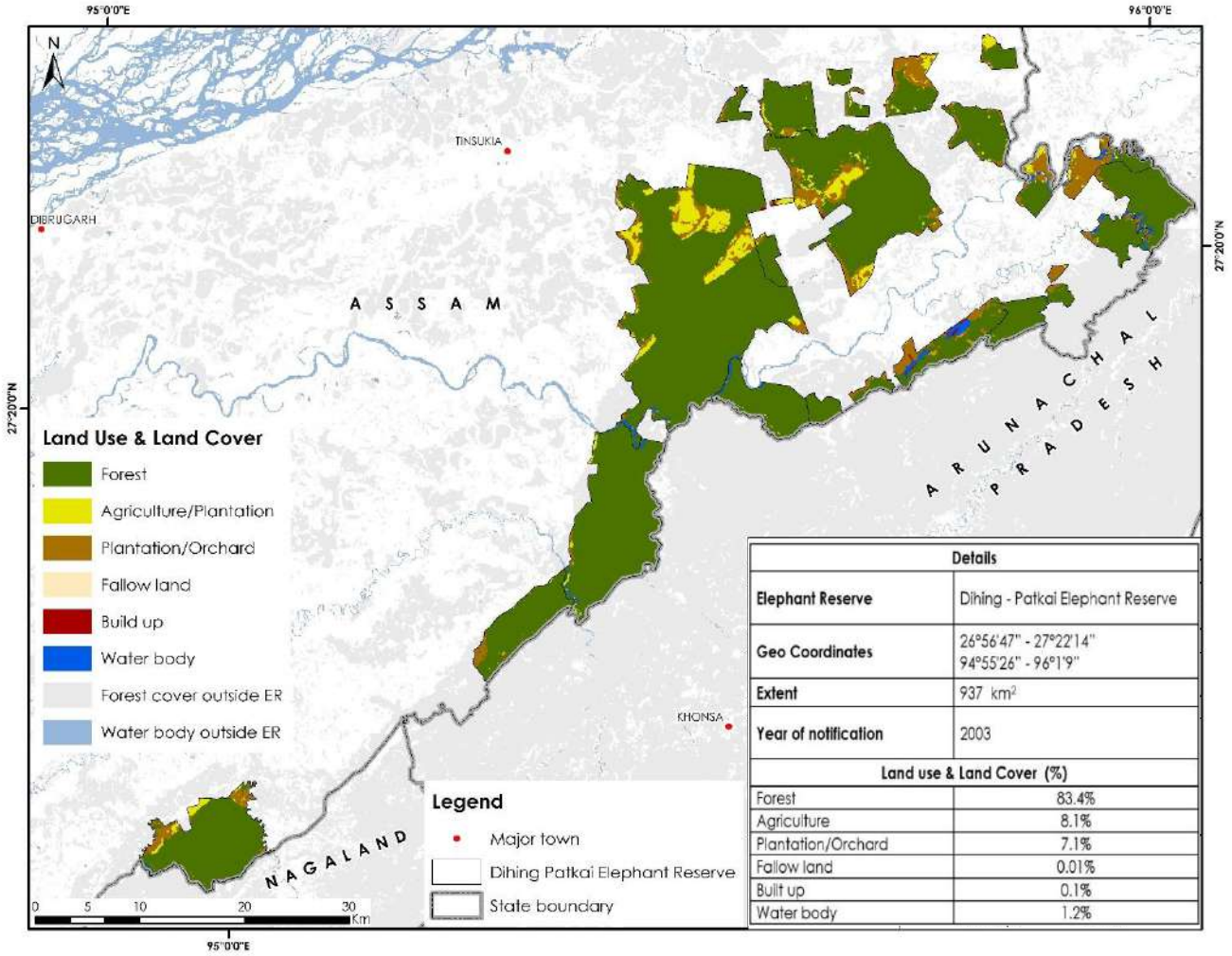


Elevation (Meter)	70m – 1239m MSL	
Slope (Area – %)	Level (< 10°)	68.7 %
	Undulating (10° - 35°)	31.2 %
	Steep (>35°)	0.0 %

Figure 11: 3-Dimensional view of Dhansiri - Lungding Elephant Reserve

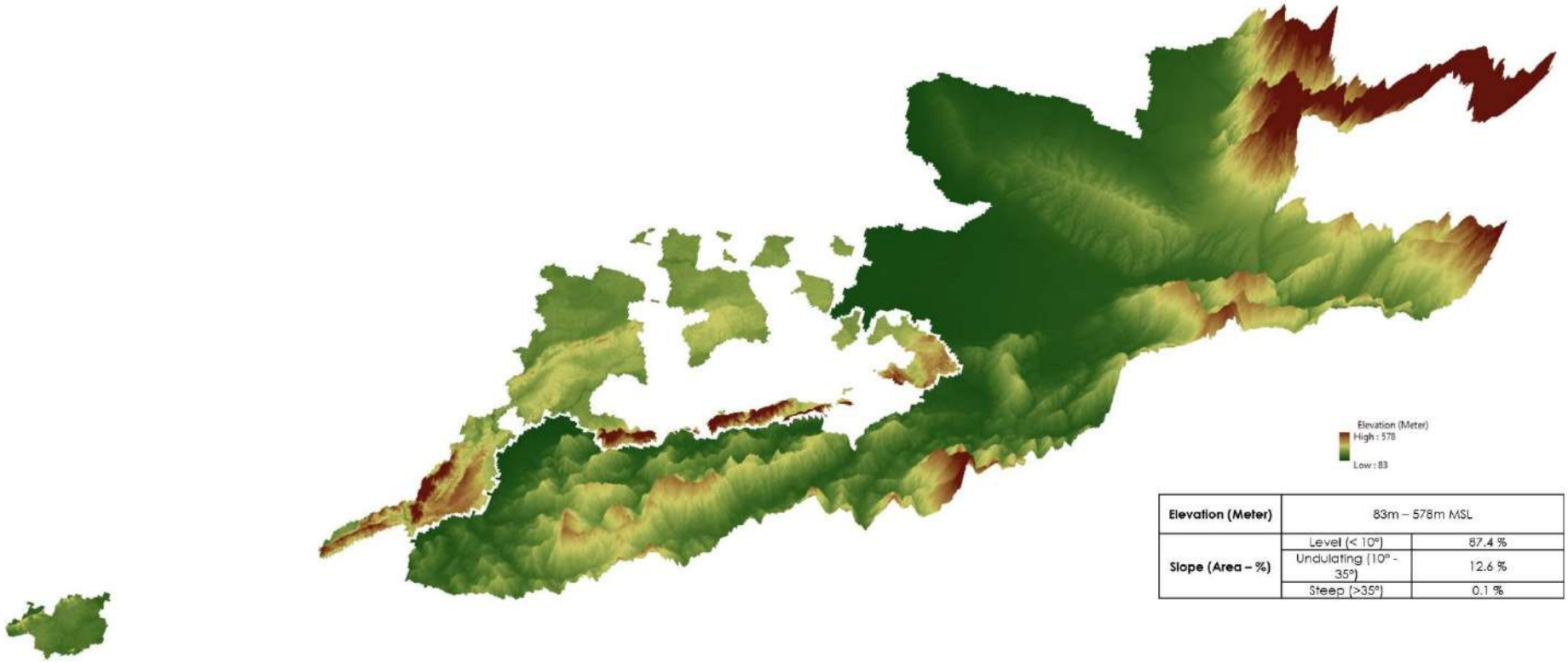
ASSAM – DIHING-PATKAI ELEPHANT RESERVE





Details	
Elephant Reserve	Dihing - Patkai Elephant Reserve
Geo Coordinates	26°56'47" - 27°22'14" 94°55'26" - 96°1'9"
Extent	937 km²
Year of notification	2003
Land use & Land Cover (%)	
Forest	83.4%
Agriculture	8.1%
Plantation/Orchard	7.1%
Fallow land	0.01%
Built up	0.1%
Water body	1.2%

Figure 12: Land use & Land cover Map of Dihing - Patkai Elephant Reserve



Elevation (Meter)	83m – 578m MSL	
Slope (Area – %)	Level (< 10°)	87.4 %
	Undulating (10° - 35°)	12.6 %
	Steep (>35°)	0.1 %

Figure 13: 3-Dimensional view of Dihing-Patkai Elephant Reserve

ASSAM – KAZIRANGA-KARBI-ANGLONG ELEPHANT RESERVE

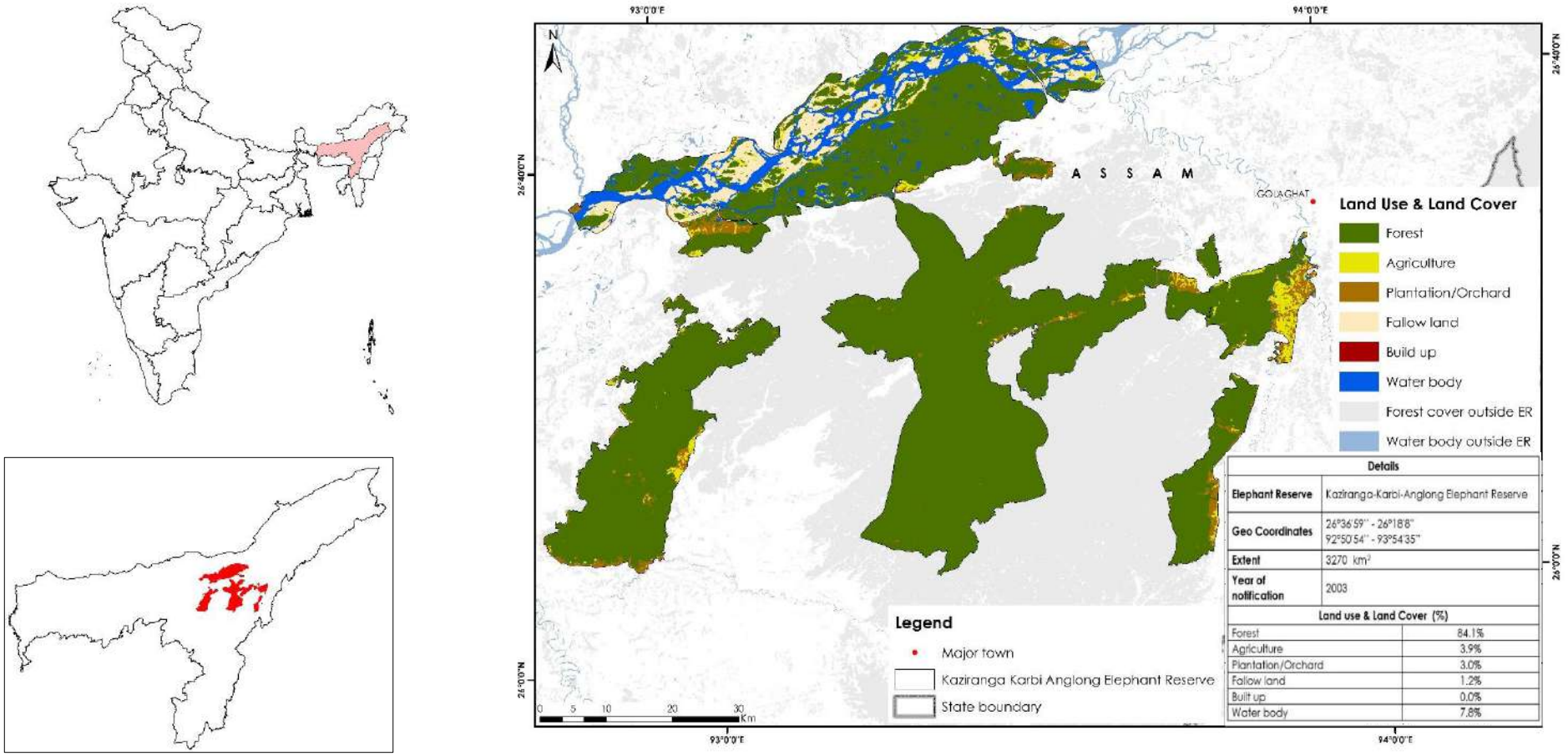
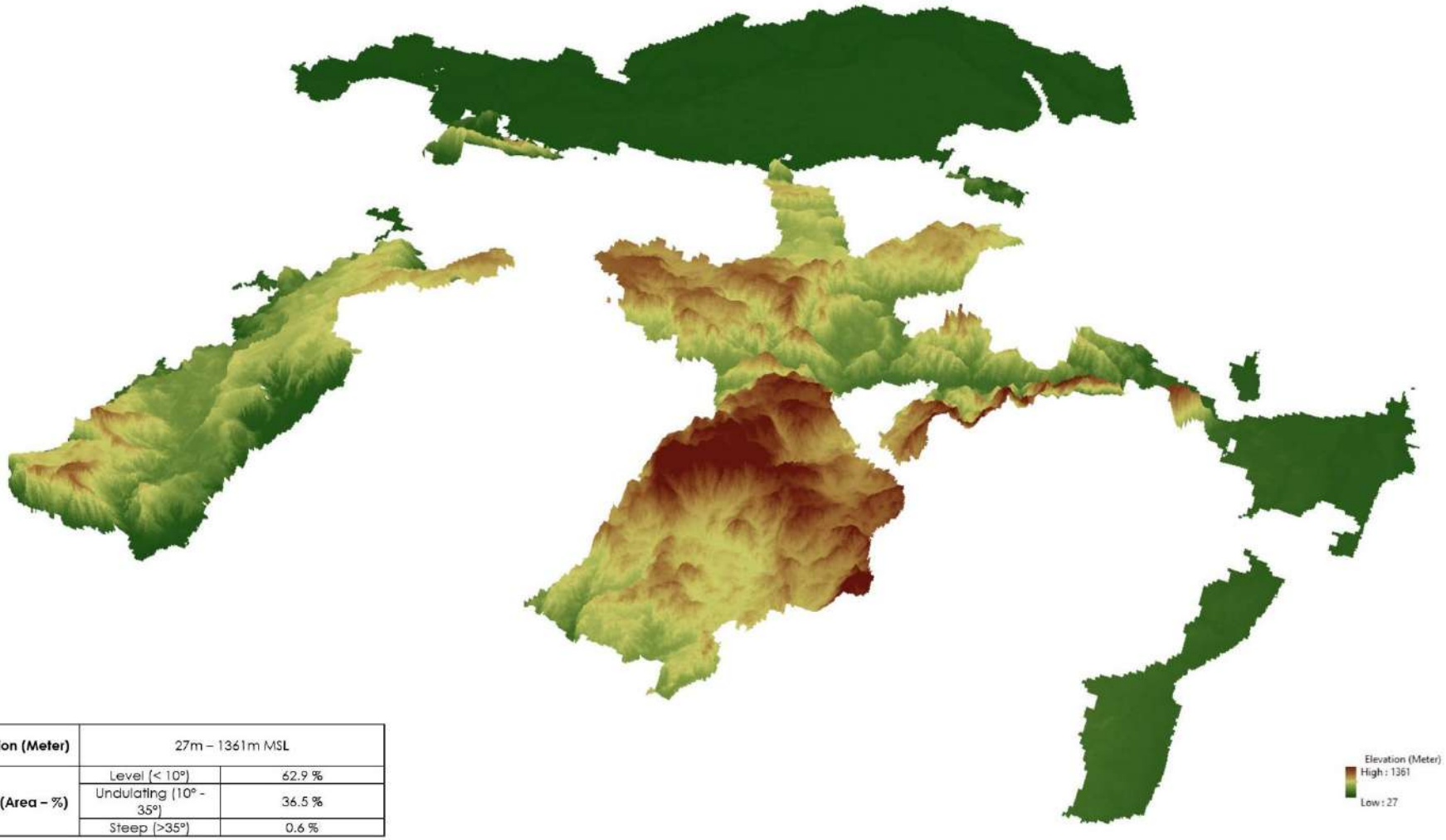


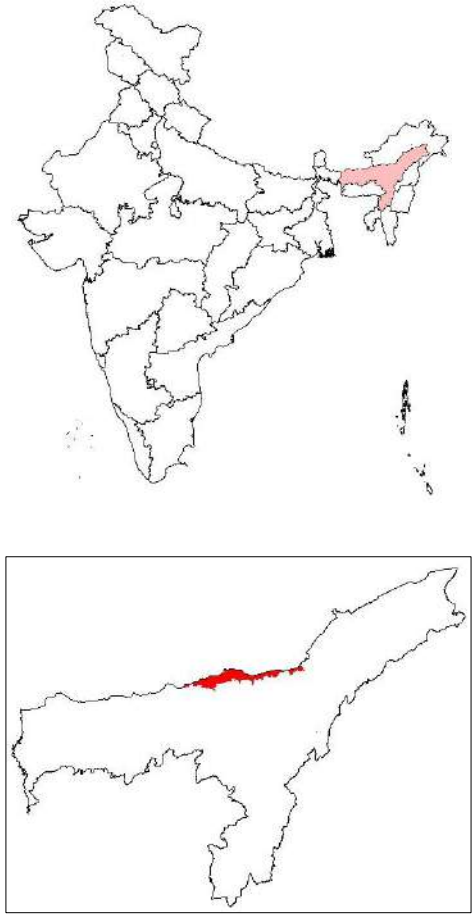
Figure 14: Land use & Land cover Map of Kaziranga-Karbi-Anglong Elephant Reserve



Elevation (Meter)	27m – 1361m MSL	
Slope (Area – %)	Level (< 10°)	62.9 %
	Undulating (10° - 35°)	36.5 %
	Steep (>35°)	0.6 %

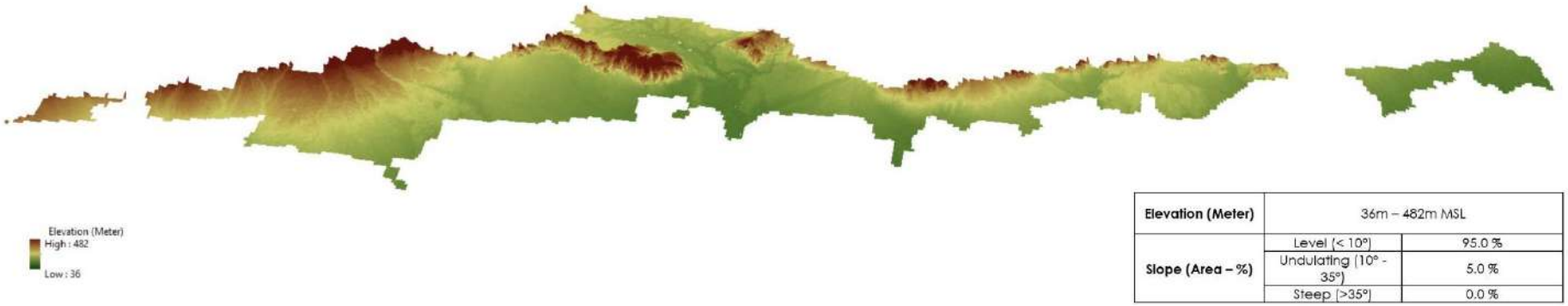
Figure 15: 3-Dimensional view of Kaziranga-Karbi-Anglong Elephant Reserve

ASSAM – SONITPUR ELEPHANT RESERVE



Details	
Elephant Reserve	Sonitpur Elephant Reserve
Geo Coordinates	26°50'44" - 26°18'8" 26°55'1" - 93°44'5"
Extent	1420 km²
Year of notification	2003
Land use & Land Cover (%)	
Forest	38.5%
Agriculture	47.7%
Plantation/Orchard	10.0%
Fallow land	0.7%
Built up	0.0%
Water body	3.1%

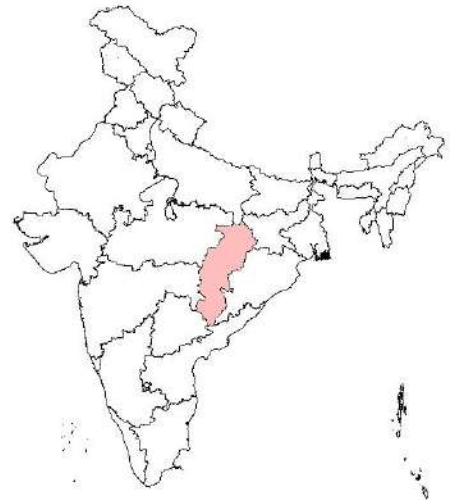
Figure 16: Land use & Land cover Map of Sonitpur Elephant Reserve

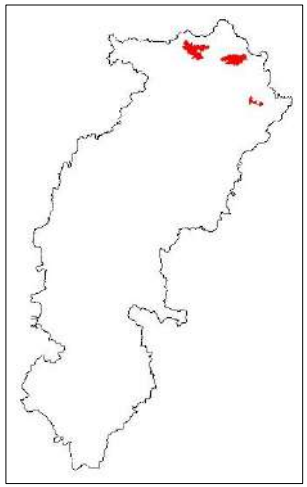


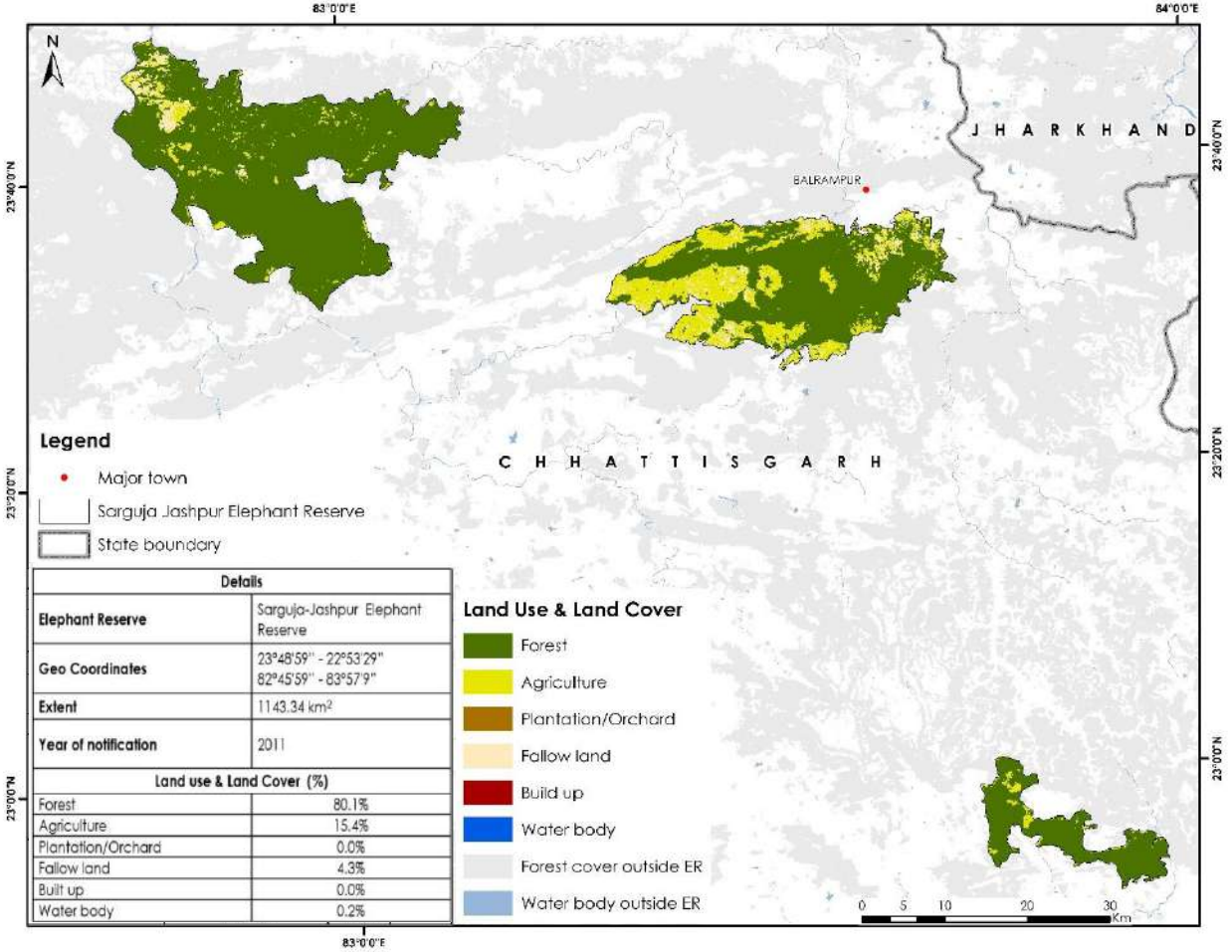
Elevation (Meter)	36m – 482m MSL	
Slope (Area – %)	Level (< 10°)	95.0 %
	Undulating (10° - 35°)	5.0 %
	Steep (>35°)	0.0 %

Figure 17: 3-Dimensional view of Sonitpur Elephant Reserve

CHHATTISGARH – SARGUJA-JASHPUR ELEPHANT RESERVE

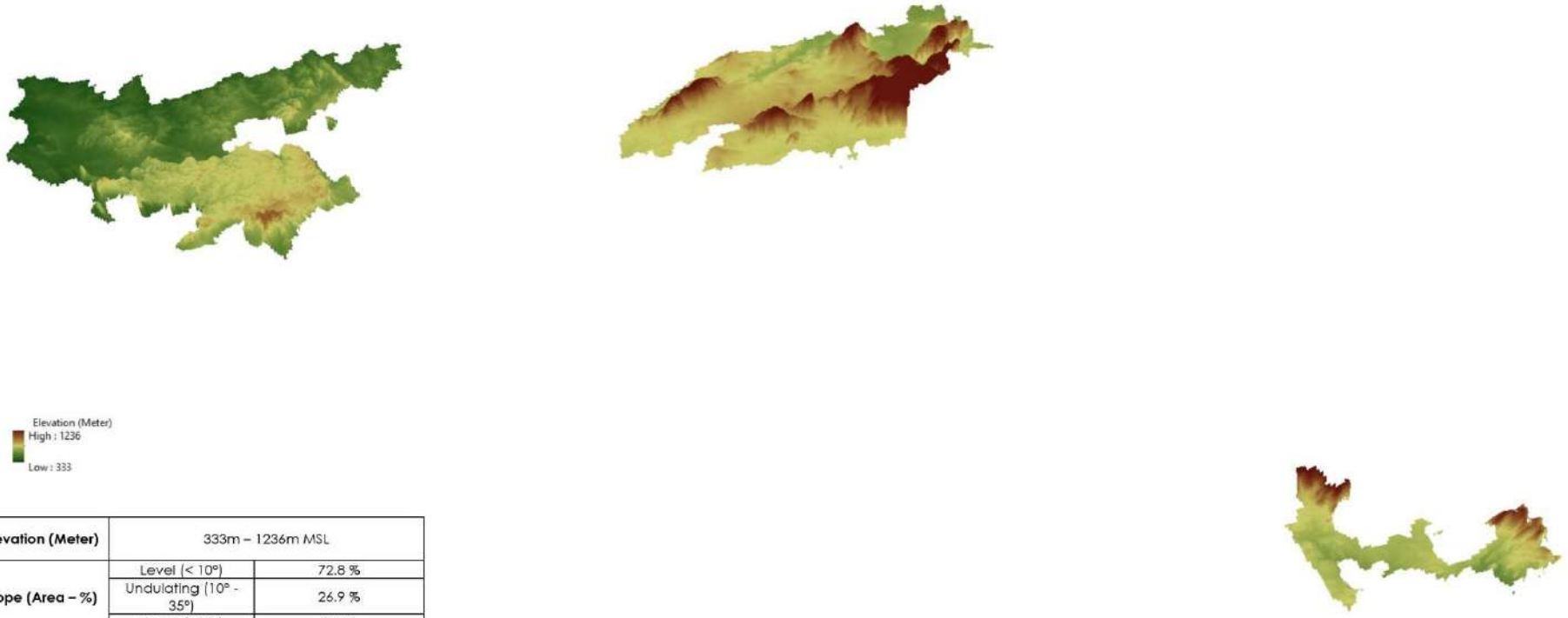






Details	
Elephant Reserve	Sarguja-Jashpur Elephant Reserve
Geo Coordinates	23°48'59" - 22°53'29" 82°45'59" - 83°57'9"
Extent	1143.34 km²
Year of notification	2011
Land use & Land Cover (%)	
Forest	80.1%
Agriculture	15.4%
Plantation/Orchard	0.0%
Fallow land	4.3%
Built up	0.0%
Water body	0.2%

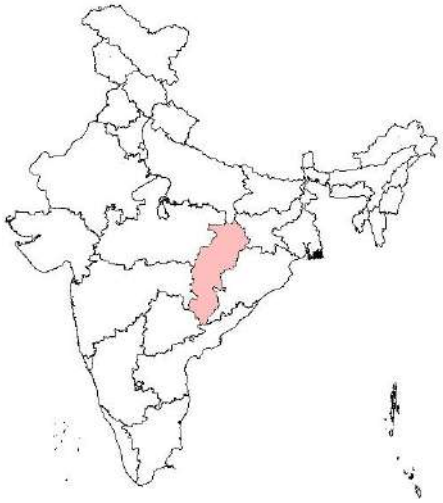
Figure 18: Land use & Land cover Map of Sarguja-Jashpur Elephant Reserve

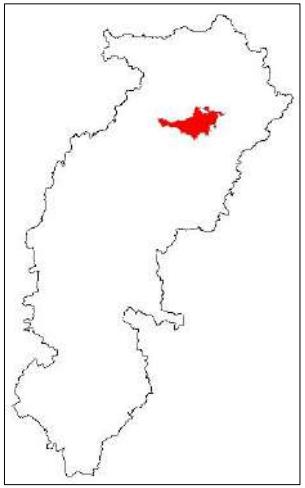


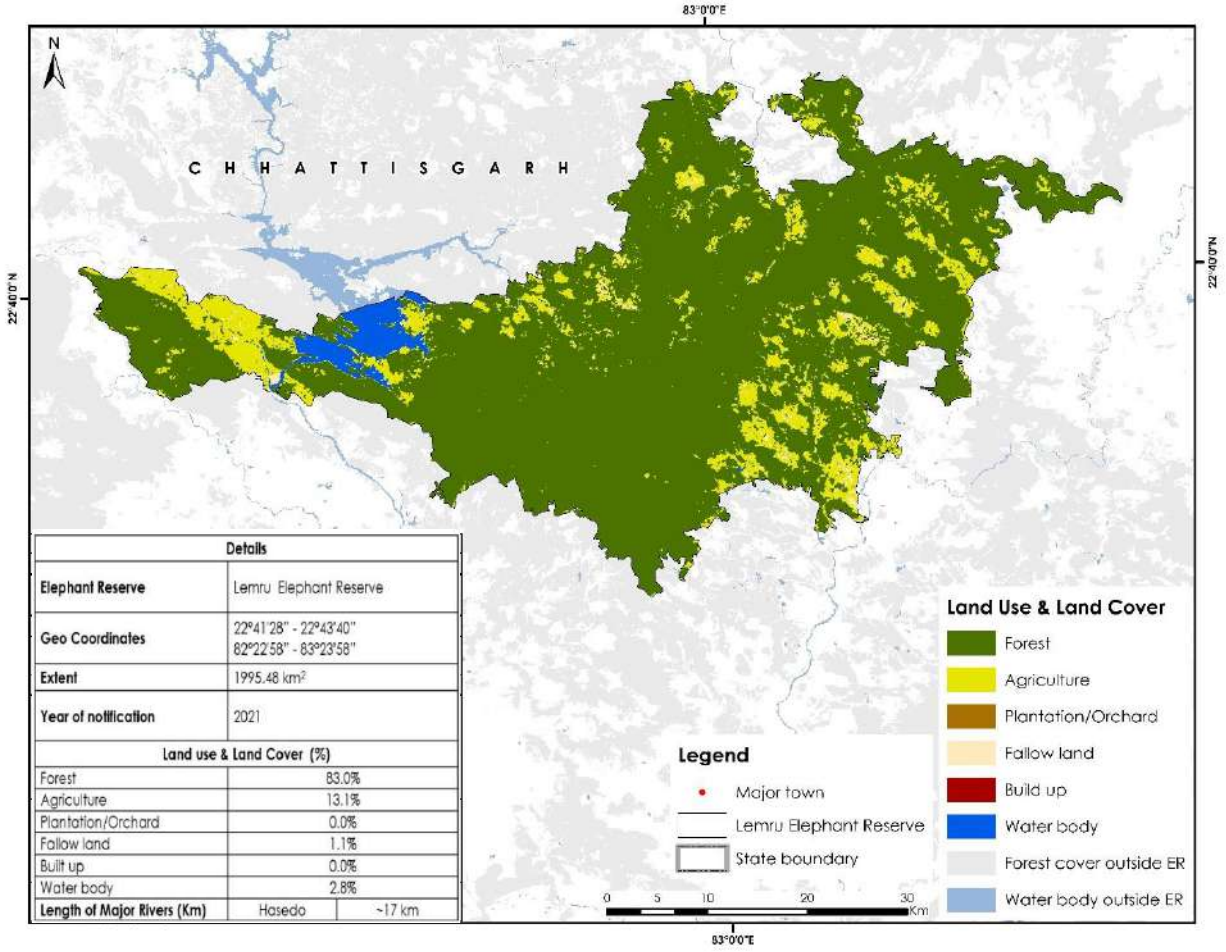
Elevation (Meter)	333m – 1236m MSL	
Slope (Area – %)	Level (< 10°)	72.8 %
	Undulating (10° - 35°)	26.9 %
	Steep (>35°)	0.3 %

Figure 19: 3-Dimensional view of Sarguja-Jashpur Elephant Reserve

CHHATTISGARH – LEMRU ELEPHANT RESERVE

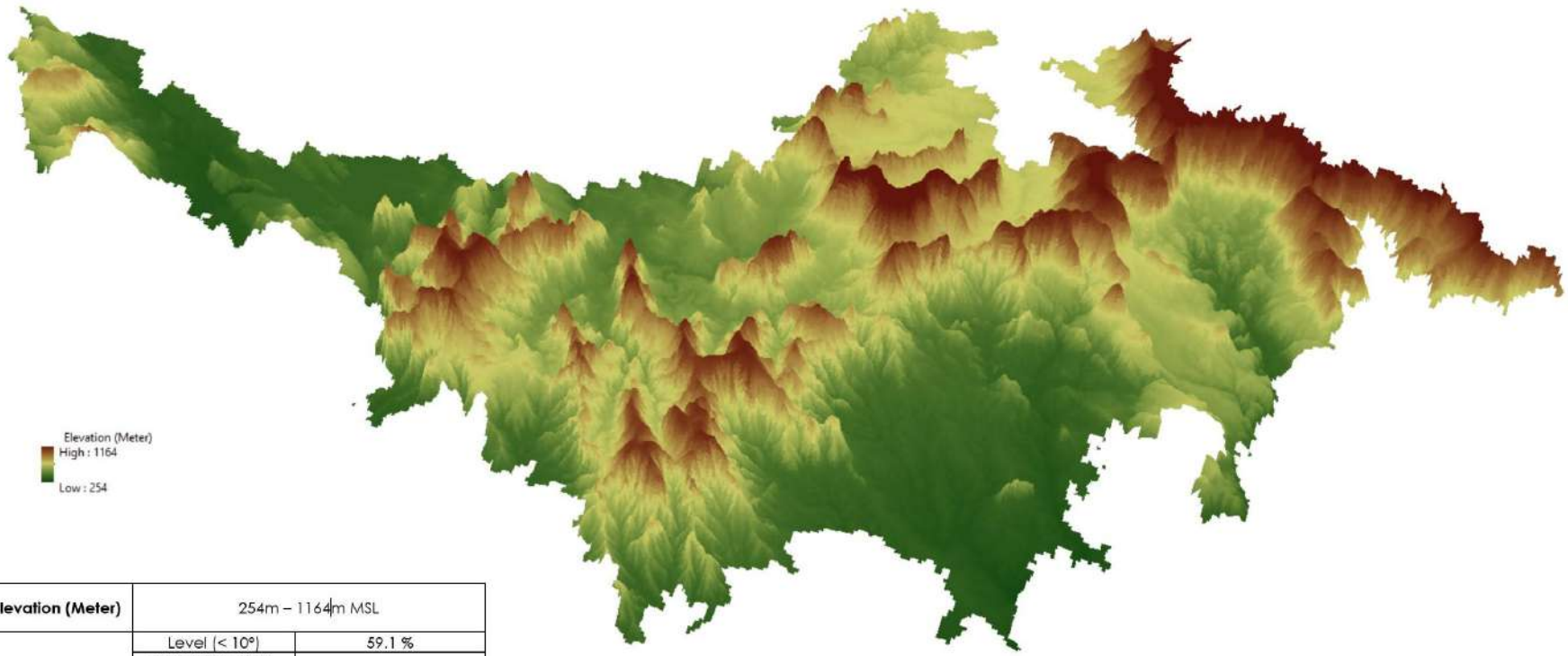






Details		
Elephant Reserve	Lemru Elephant Reserve	
Geo Coordinates	22°41'28" - 22°43'40" 82°22'58" - 83°23'58"	
Extent	1995.48 km²	
Year of notification	2021	
Land use & Land Cover (%)		
Forest	83.0%	
Agriculture	13.1%	
Plantation/Orchard	0.0%	
Fallow land	1.1%	
Built up	0.0%	
Water body	2.8%	
Length of Major Rivers (Km)	Hasedo	~17 km

Figure 20: Land use & Land cover Map of Lemru Elephant Reserve



Elevation (Meter)	254m – 1164m MSL	
Slope (Area – %)	Level (< 10°)	59.1 %
	Undulating (10° - 35°)	39.1 %
	Steep (>35°)	1.9 %

Figure 21: 3-Dimensional view of Lemru Elephant Reserve

JHARKHAND - SINGHBHUM ELEPHANT RESERVE

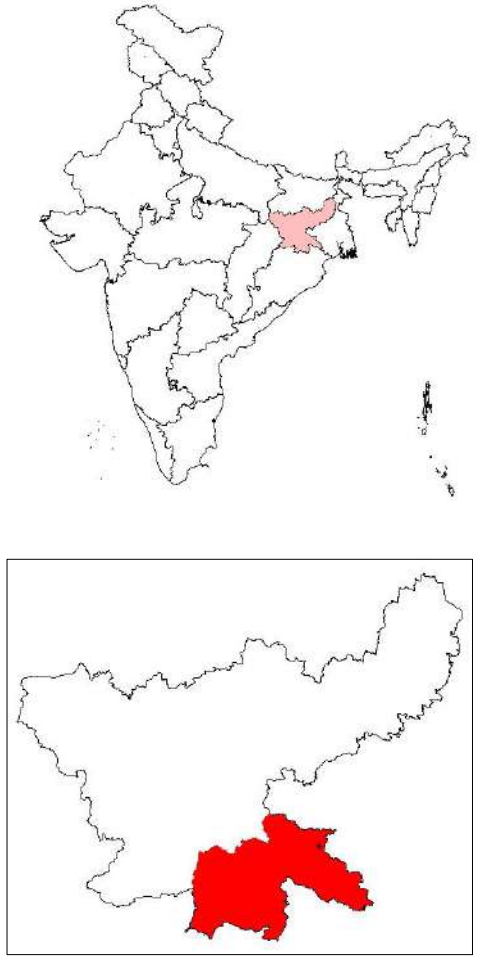
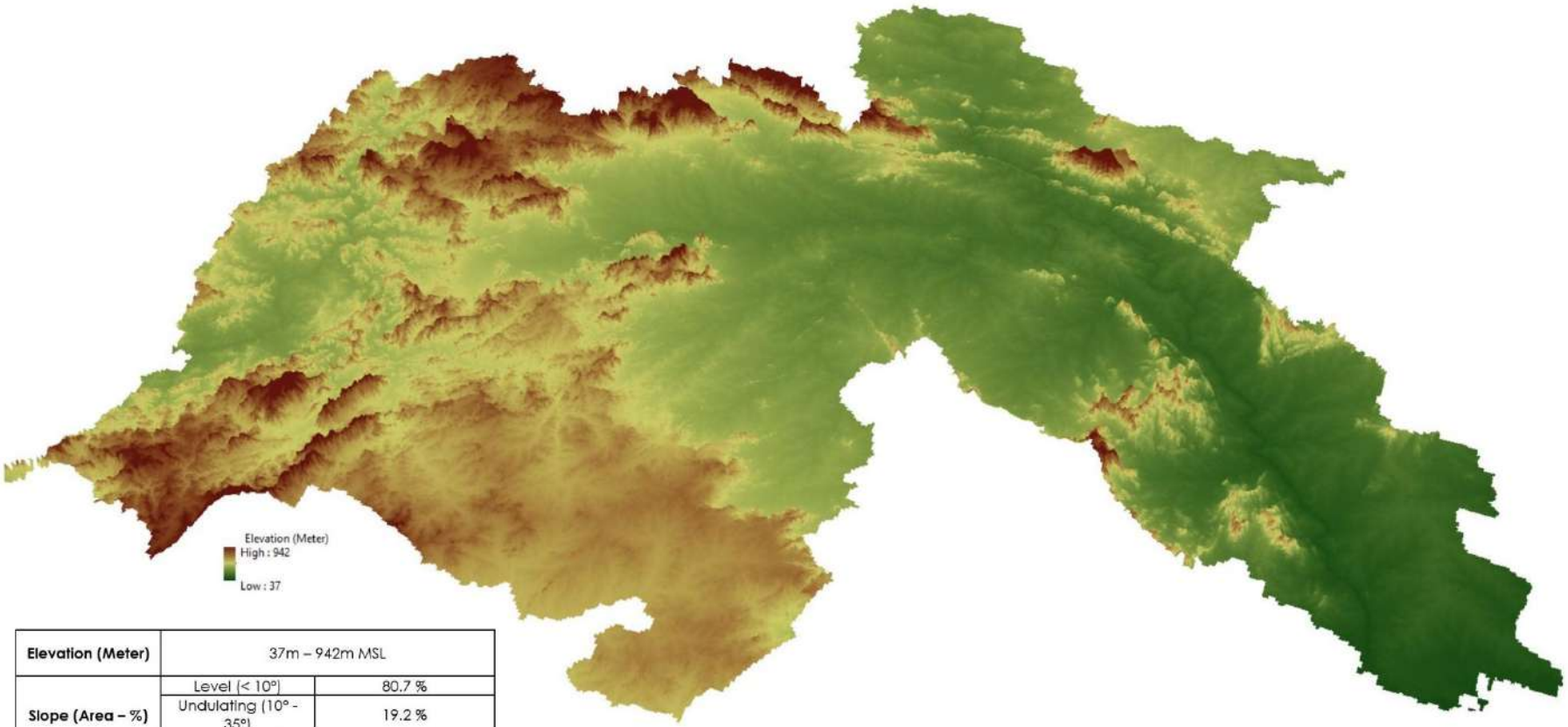


Figure 22: Land use & Land cover Map of Singhbhum Elephant Reserve



Elevation (Meter)	37m – 942m MSL	
Slope (Area – %)	Level (< 10°)	80.7 %
	Undulating (10° - 35°)	19.2 %
	Steep (>35°)	0.1 %

Figure 23: 3-Dimensional view of Singhbhum Elephant Reserve

KARNATAKA - DANDELI ELEPHANT RESERVE

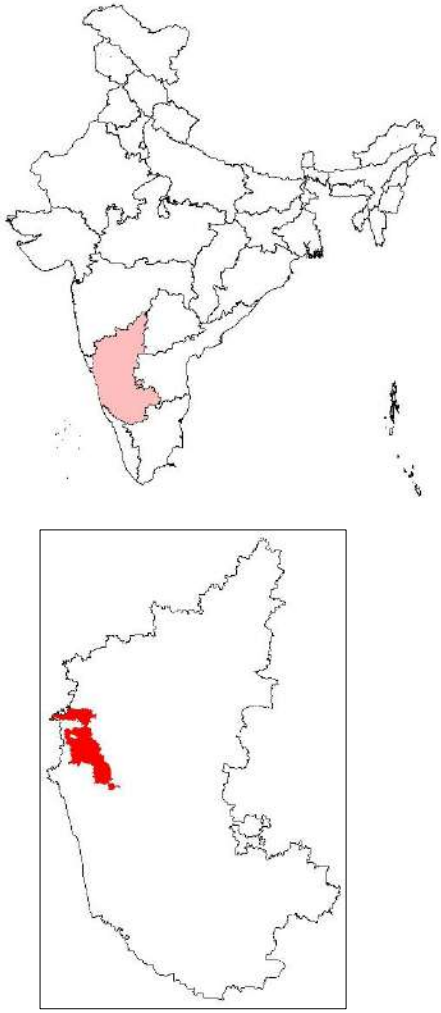
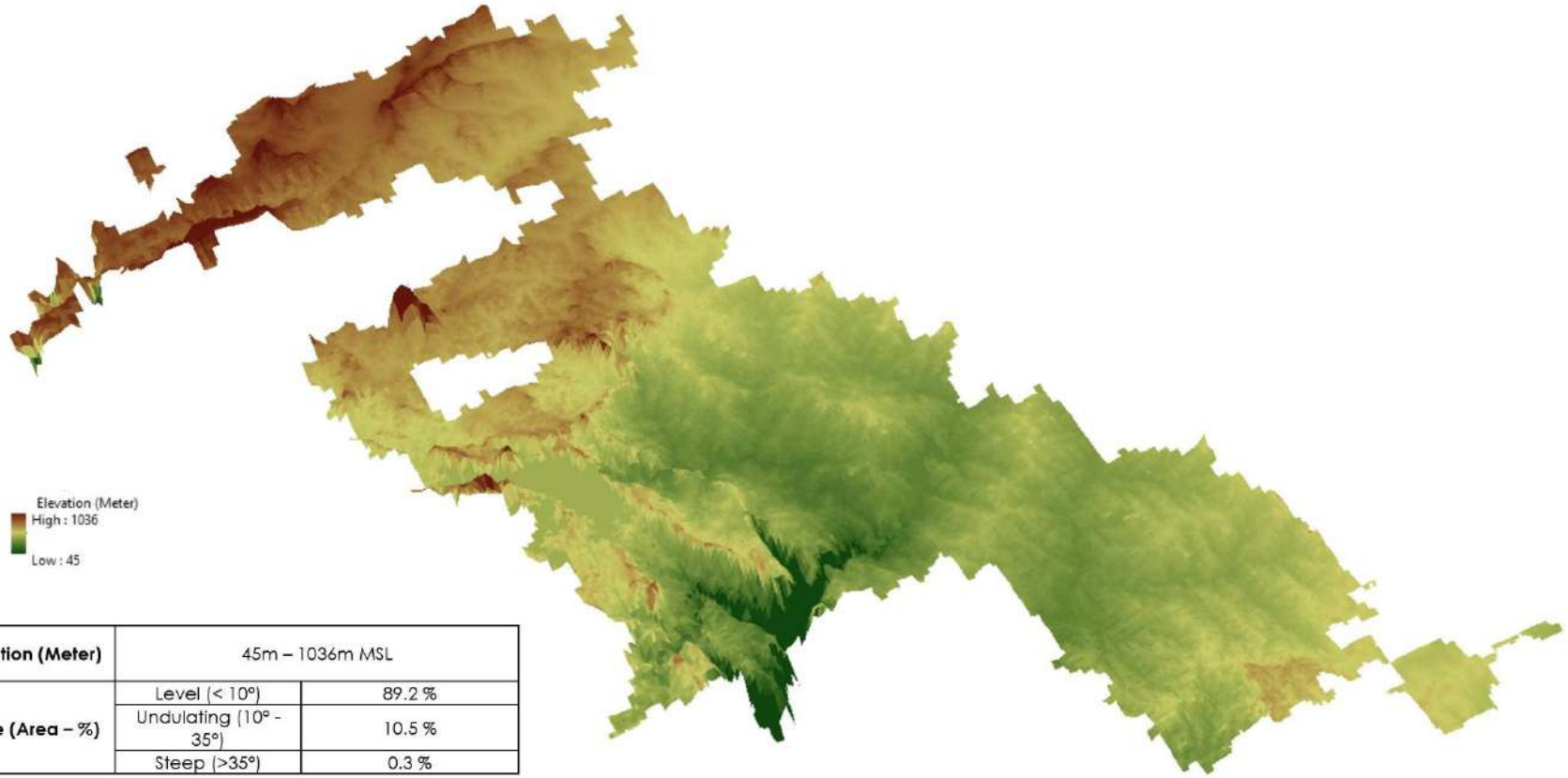


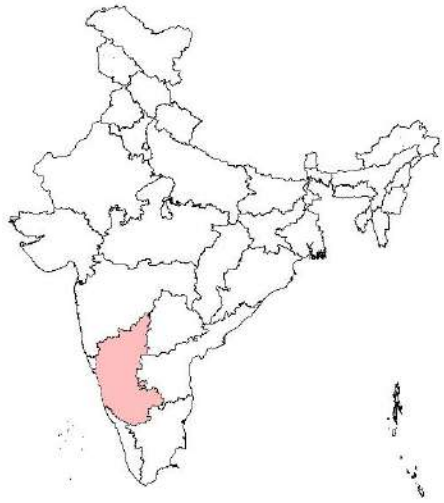
Figure 24: Land use & Land cover Map of Dandeli Elephant Reserve

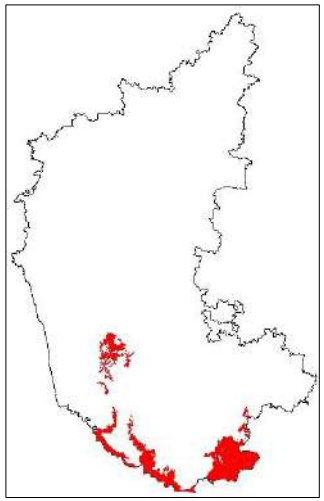


Elevation (Meter)	45m – 1036m MSL	
Slope (Area – %)	Level (< 10°)	89.2 %
	Undulating (10° - 35°)	10.5 %
	Steep (>35°)	0.3 %

Figure 25: 3-Dimensional view of Dandeli Elephant Reserve

KARNATAKA - MYSURU ELEPHANT RESERVE





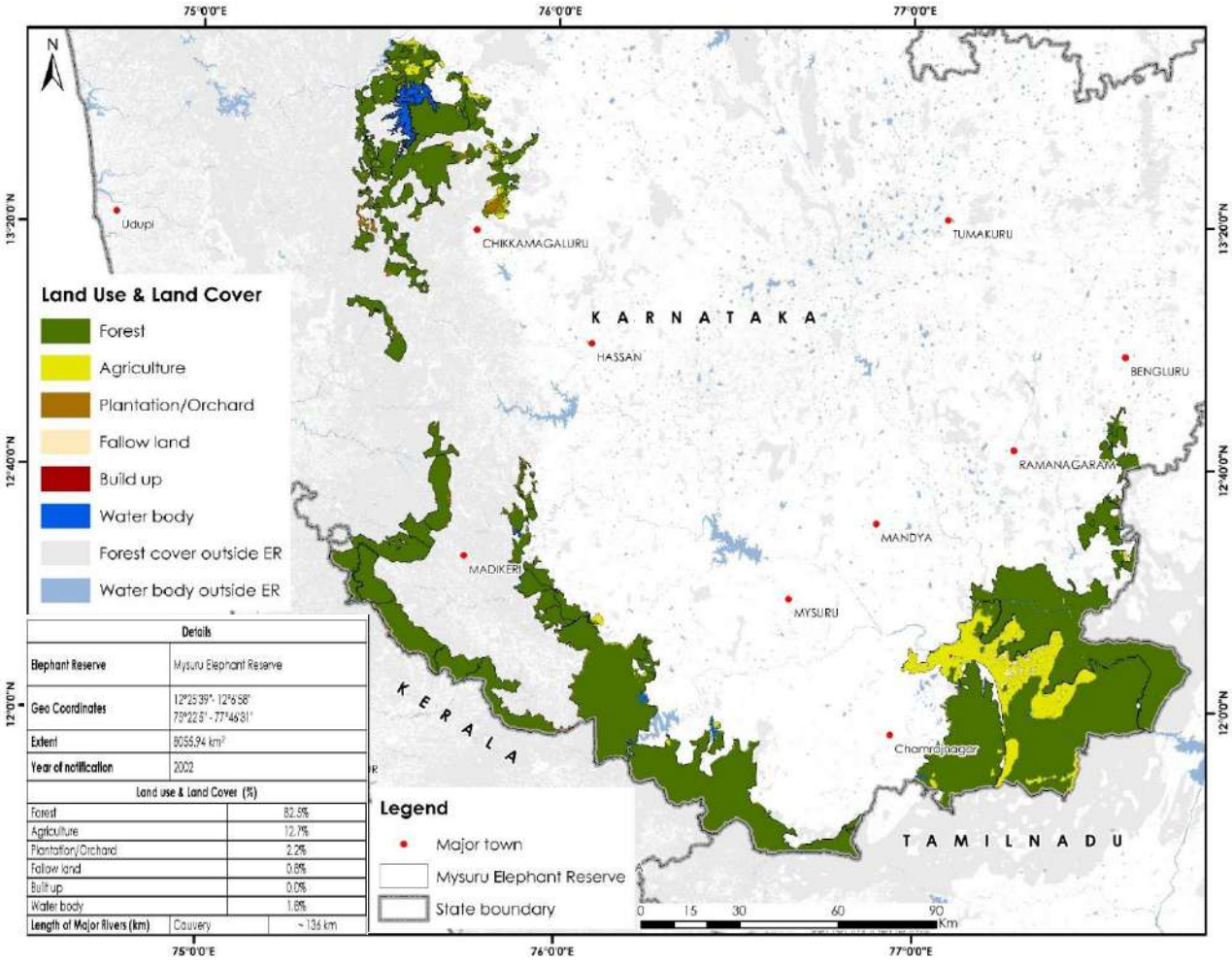
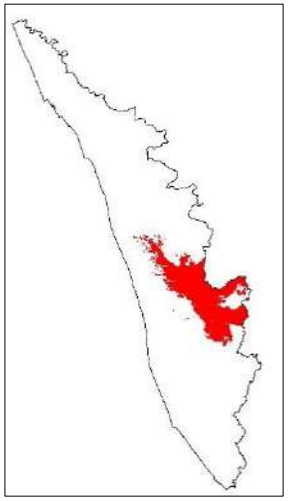


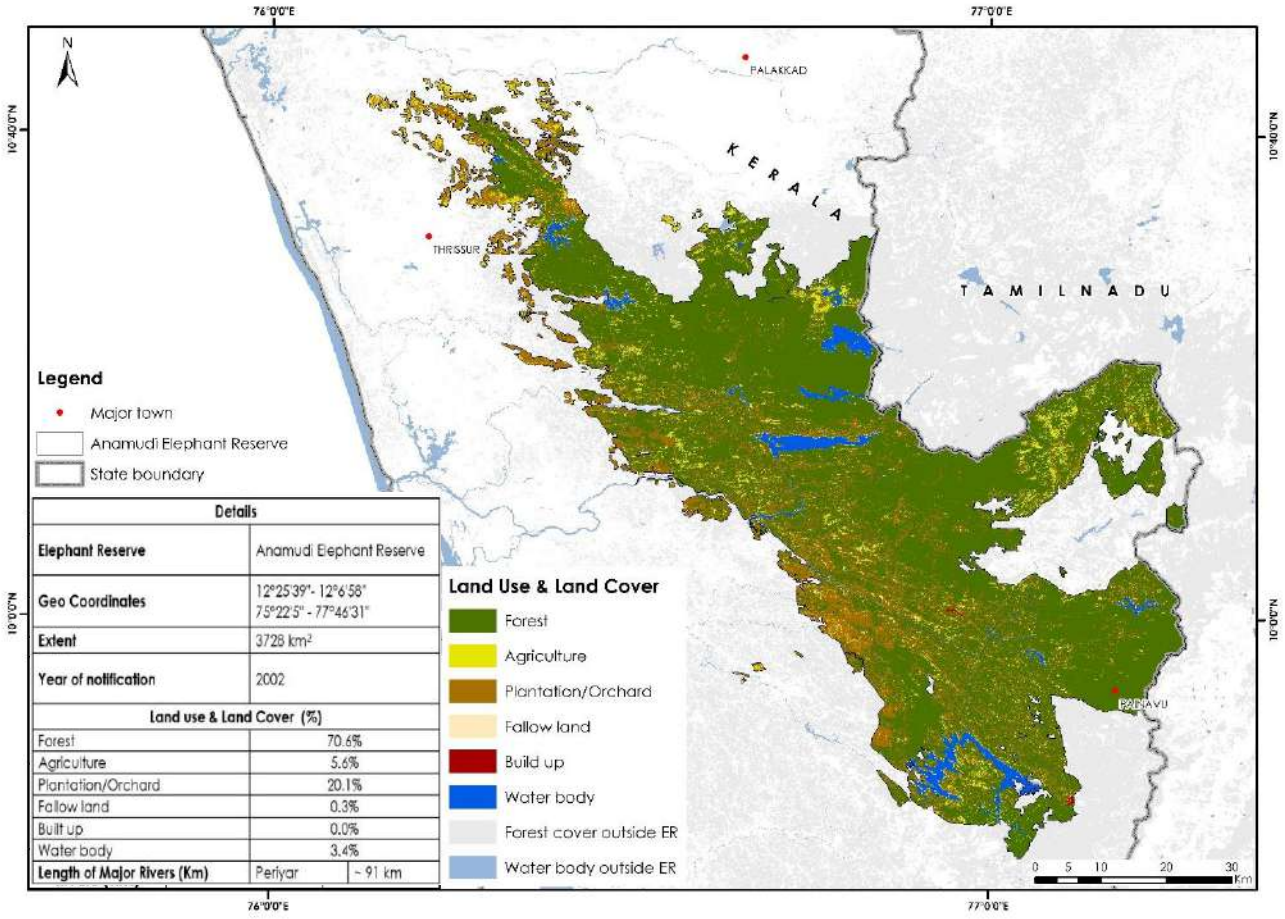
Figure 26: Land use & Land cover Map of Mysuru Elephant Reserve

Elevation (Meter)	48m – 1873m MSL	
Slope (Area – %)	Level (< 10°)	62.0 %
	Undulating (10° - 35°)	36.7 %
	Steep (>35°)	1.3 %

Figure 27: 3-Dimensional view of Mysuru Elephant Reserve

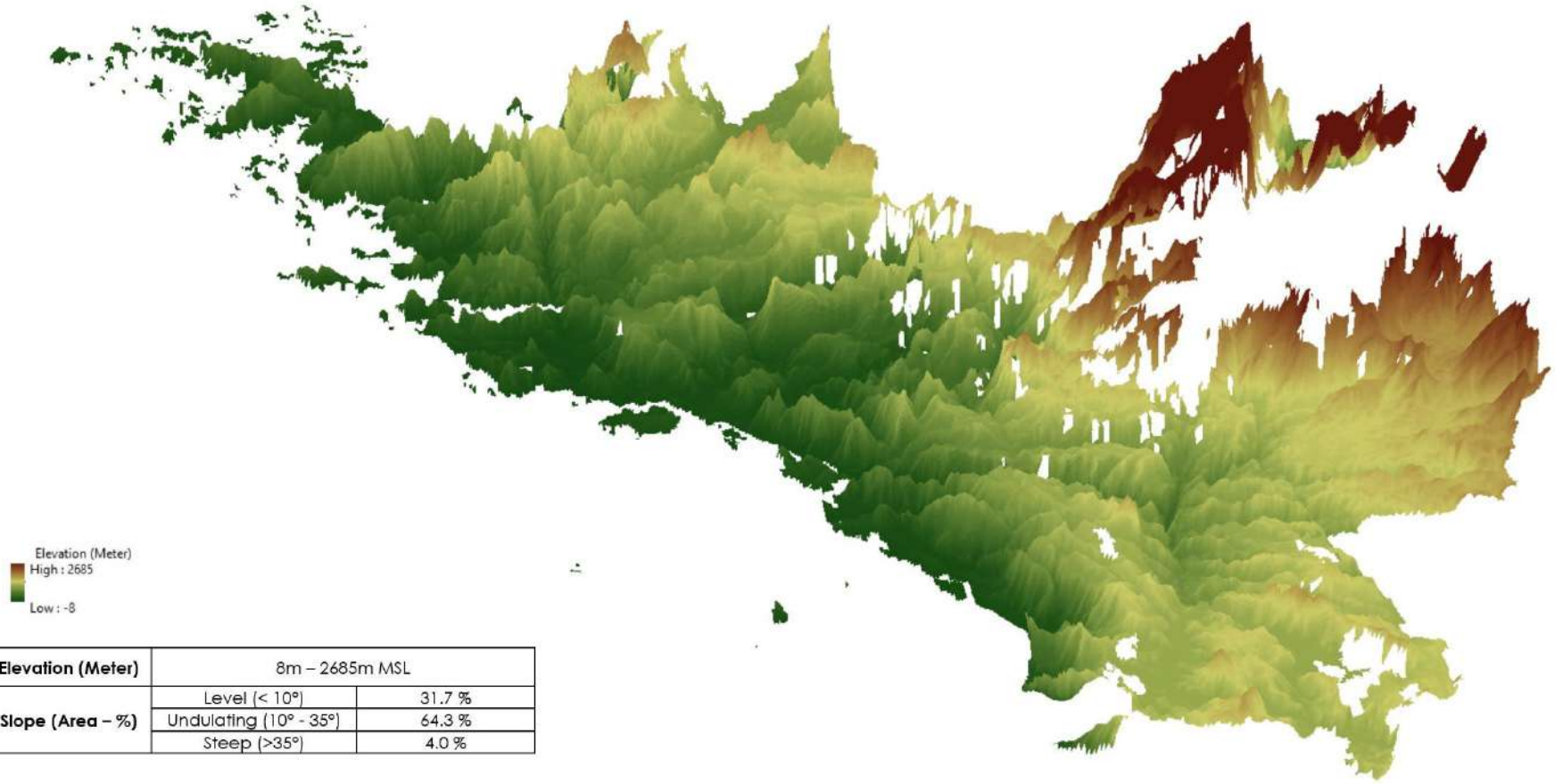
KERALA - ANAMUDI ELEPHANT RESERVE





Details	
Elephant Reserve	Anamudi Elephant Reserve
Geo Coordinates	12°25'39"- 12°6'58" 75°22'5" - 77°46'31"
Extent	3728 km²
Year of notification	2002
Land use & Land Cover (%)	
Forest	70.6%
Agriculture	5.6%
Plantation/Orchard	20.1%
Fallow land	0.3%
Built up	0.0%
Water body	3.4%
Length of Major Rivers (Km)	Periyar ~ 91 km

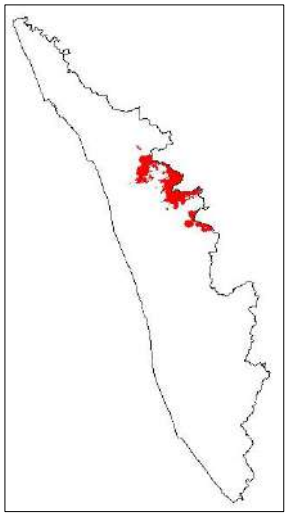
Figure 28: Land use & Land cover Map of Anamudi Elephant Reserve

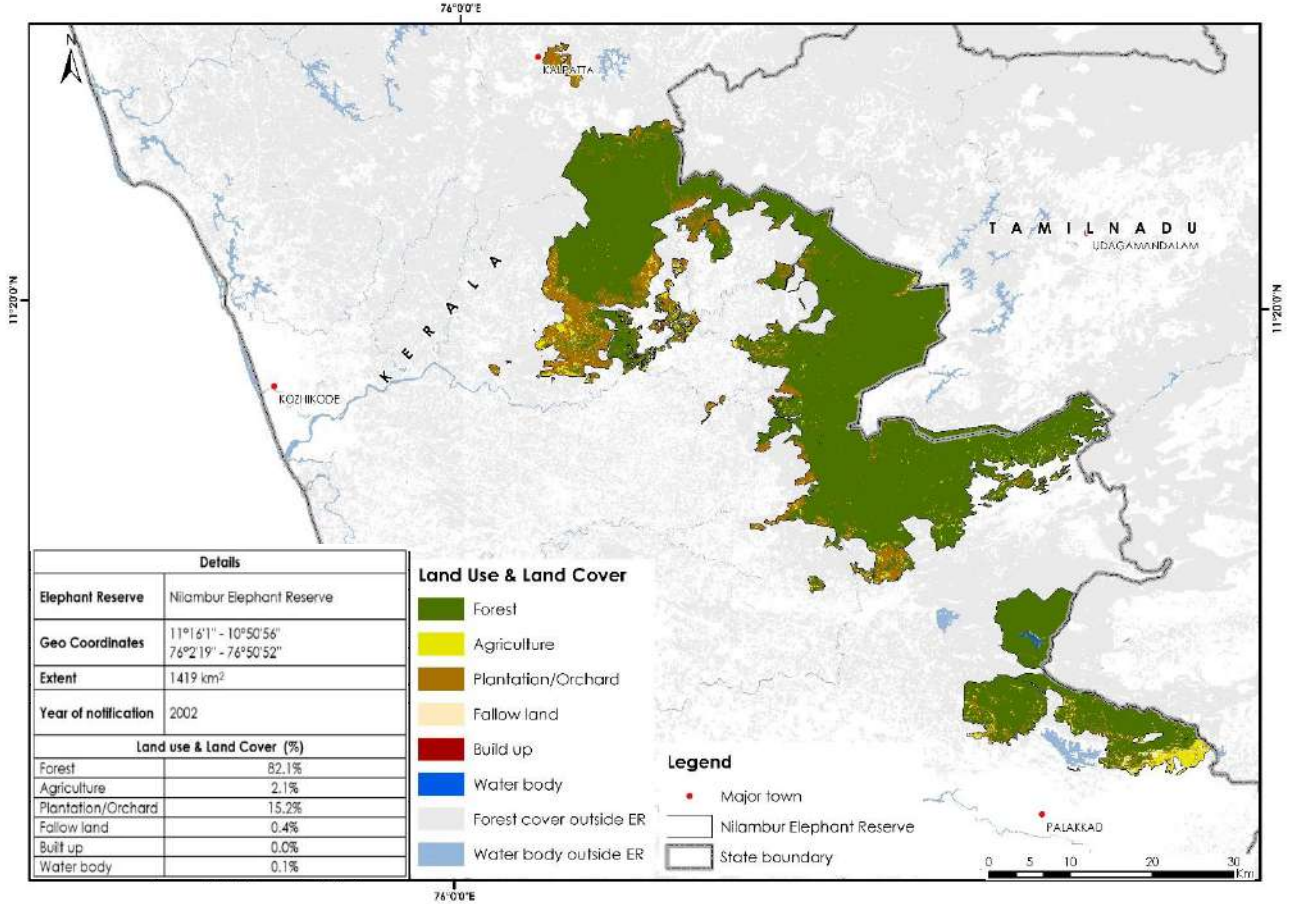


Elevation (Meter)	8m – 2685m MSL	
Slope (Area – %)	Level (< 10°)	31.7 %
	Undulating (10° - 35°)	64.3 %
	Steep (>35°)	4.0 %

Figure 29: 3-Dimensional view of Anamudi Elephant Reserve

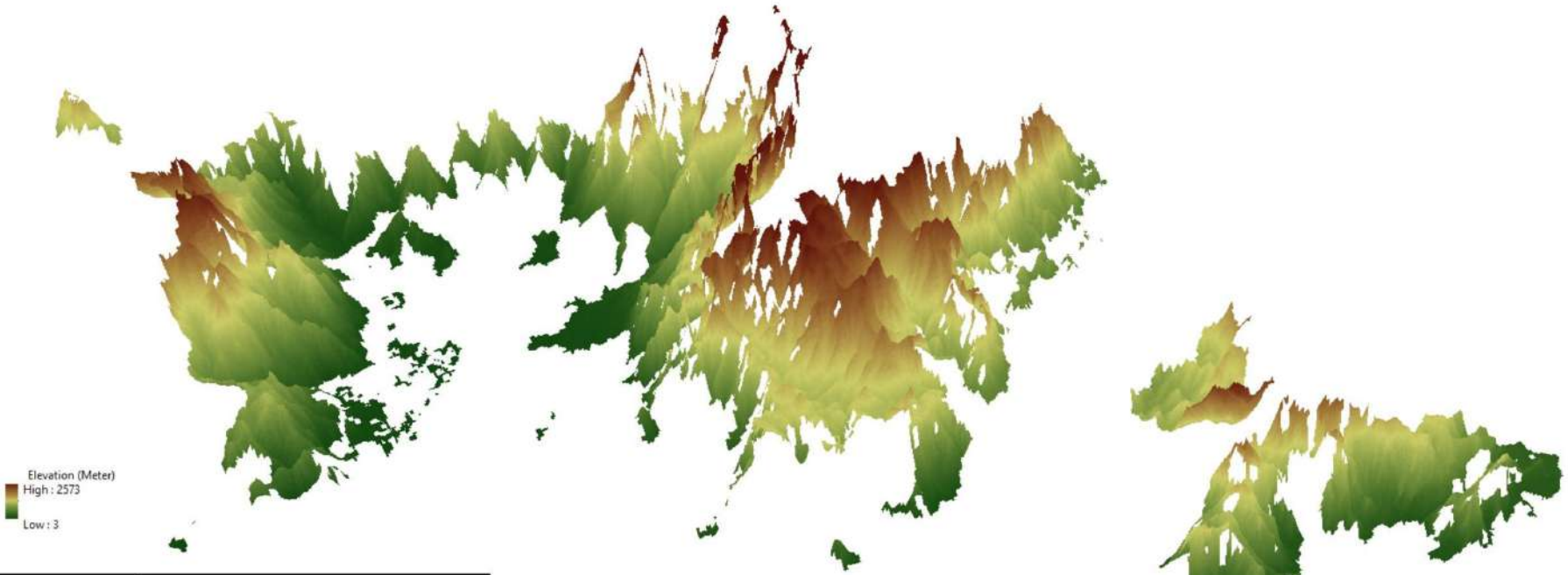
KERALA - NILAMBUR ELEPHANT RESERVE





Details	
Elephant Reserve	Nilambur Elephant Reserve
Geo Coordinates	11°16'1" - 10°50'56" 76°2'19" - 76°50'52"
Extent	1419 km²
Year of notification	2002
Land use & Land Cover (%)	
Forest	82.1%
Agriculture	2.1%
Plantation/Orchard	15.2%
Fallow land	0.4%
Built up	0.0%
Water body	0.1%

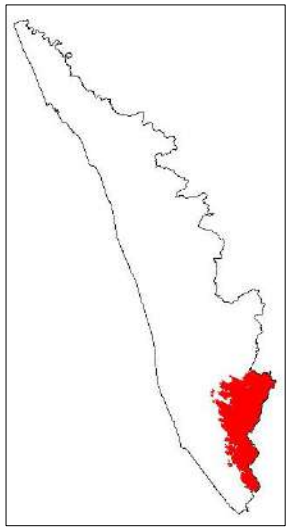
Figure 30: Land use & Land cover Map of Nilambur Elephant Reserve



Elevation (Meter)	3m – 2573m MSL	
Slope (Area – %)	Level (< 10°)	17.5 %
	Undulating (10° - 35°)	72.9 %
	Steep (>35°)	9.6 %

Figure 31: 3-Dimensional view of Nilambur Elephant Reserve

KERALA – PERIYAR ELEPHANT RESERVE



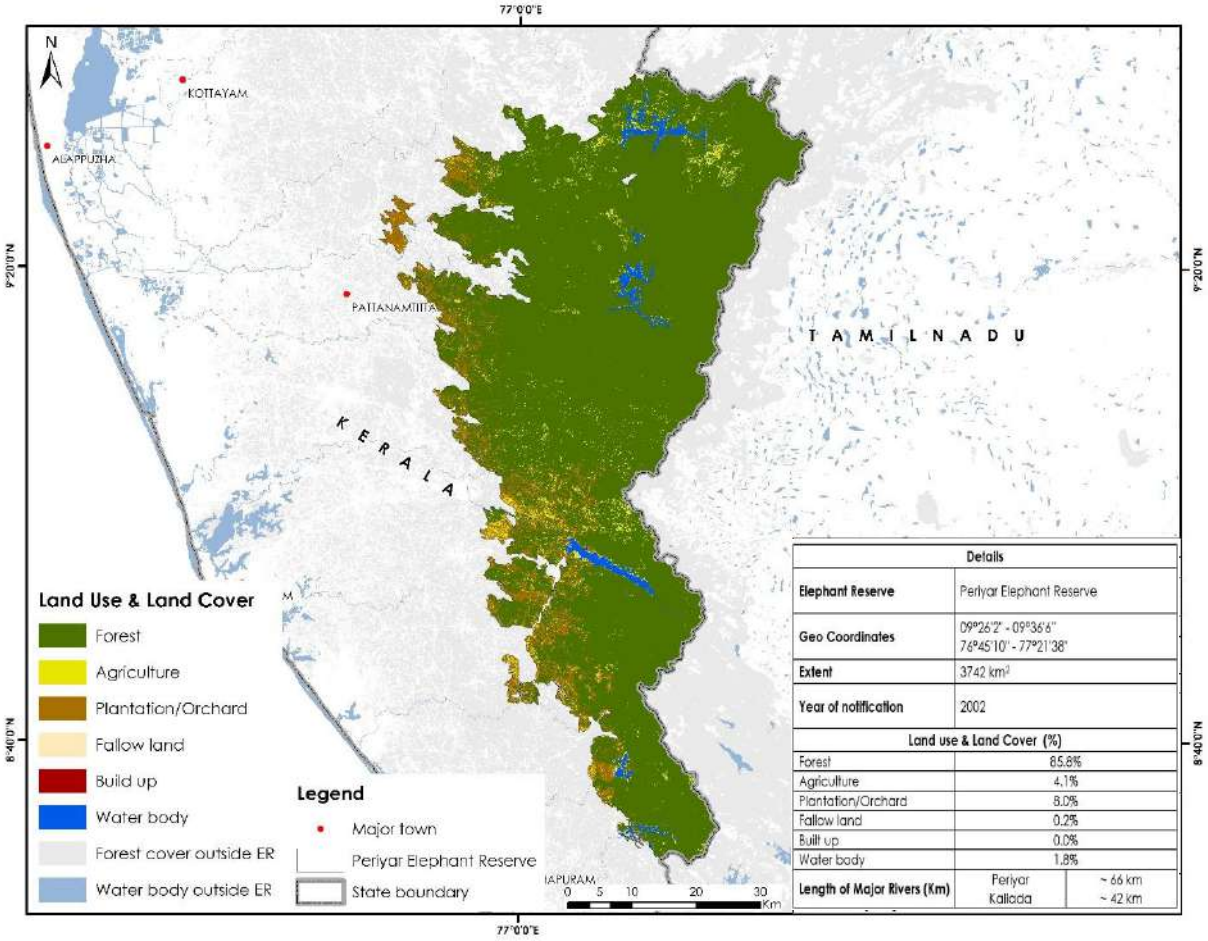
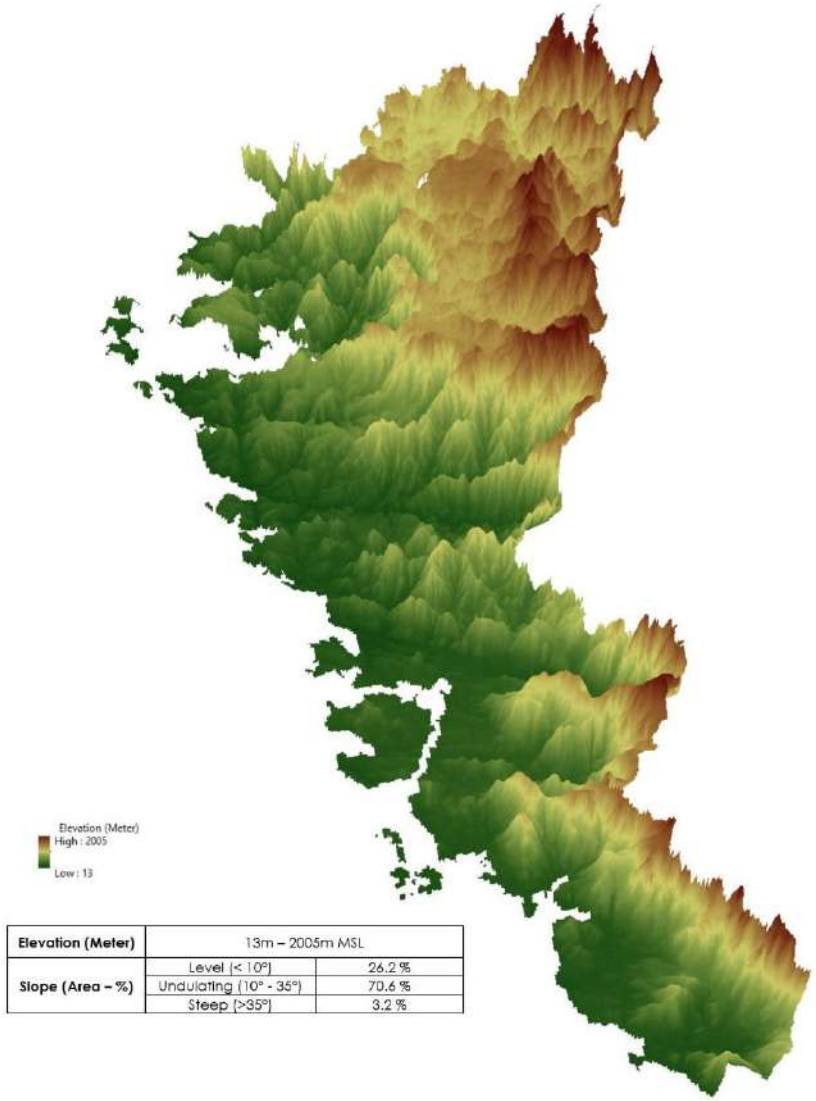


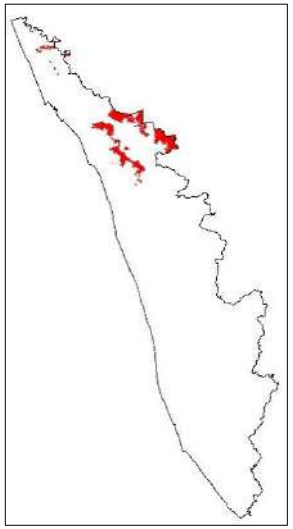
Figure 32: Land use & Land cover Map of Periyar Elephant Reserve

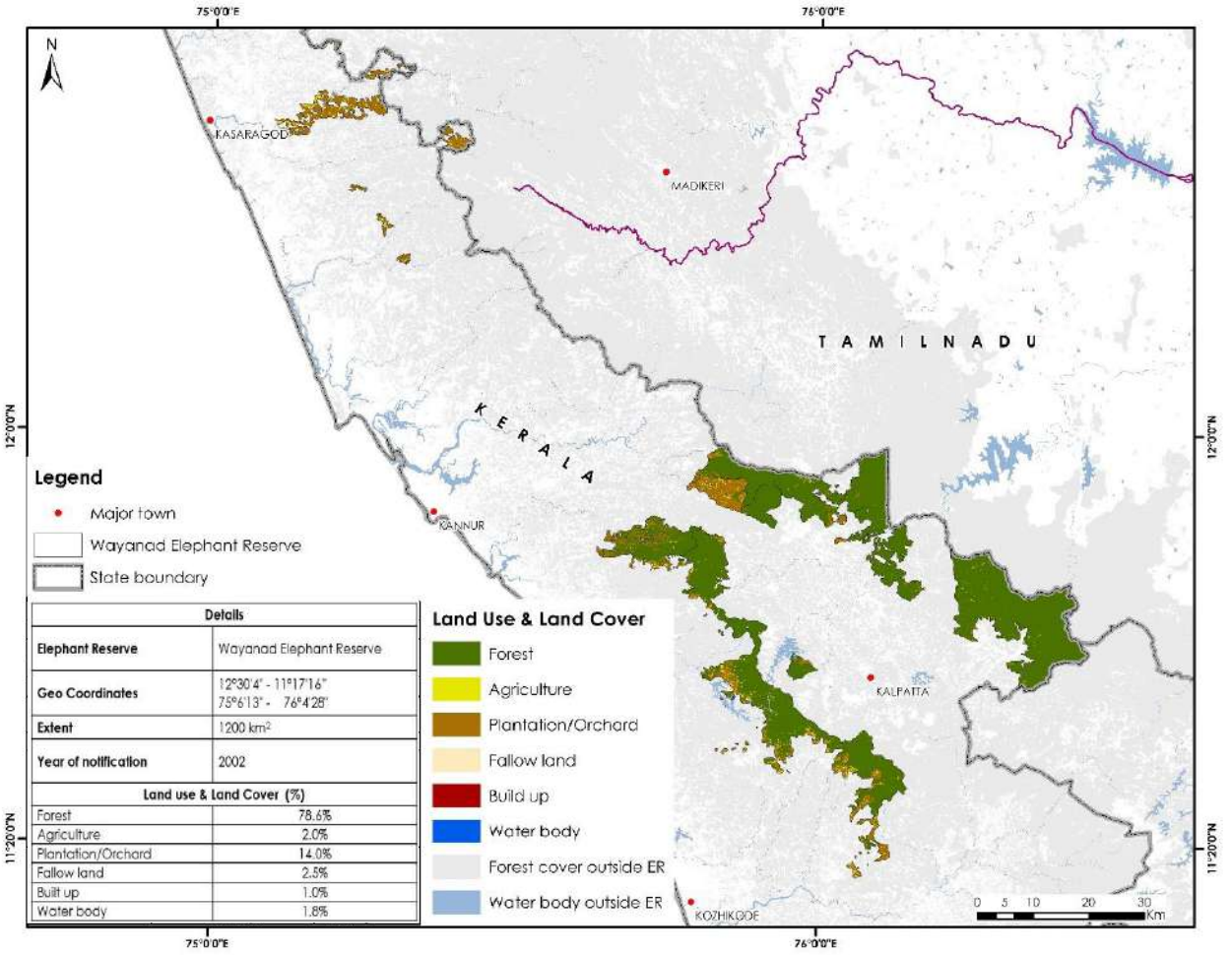


Elevation (Meter)	13m – 2005m MSL	
Slope (Area – %)	Level (< 10°)	26.2 %
	Undulating (10° - 35°)	70.6 %
	Steep (>35°)	3.2 %

Figure 33: 3-Dimensional view of Periyar Elephant Reserve

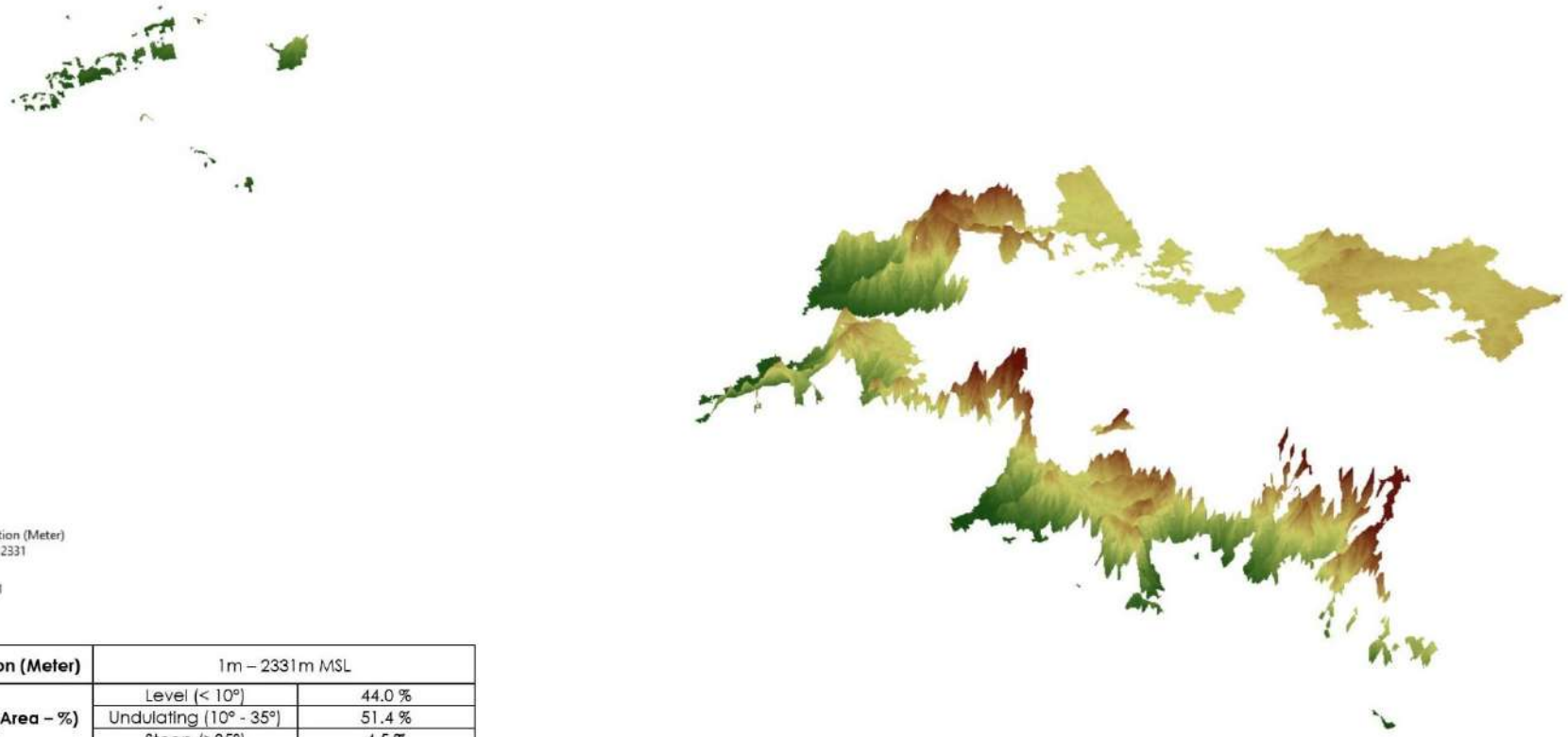
KERALA – WAYANAD ELEPHANT RESERVE





Details	
Elephant Reserve	Wayanad Elephant Reserve
Geo Coordinates	12°30'4" - 11°917'16" 75°613" - 76°4'28"
Extent	1200 km²
Year of notification	2002
Land use & Land Cover (%)	
Forest	78.6%
Agriculture	2.0%
Plantation/Orchard	14.0%
Fallow land	2.5%
Built up	1.0%
Water body	1.8%

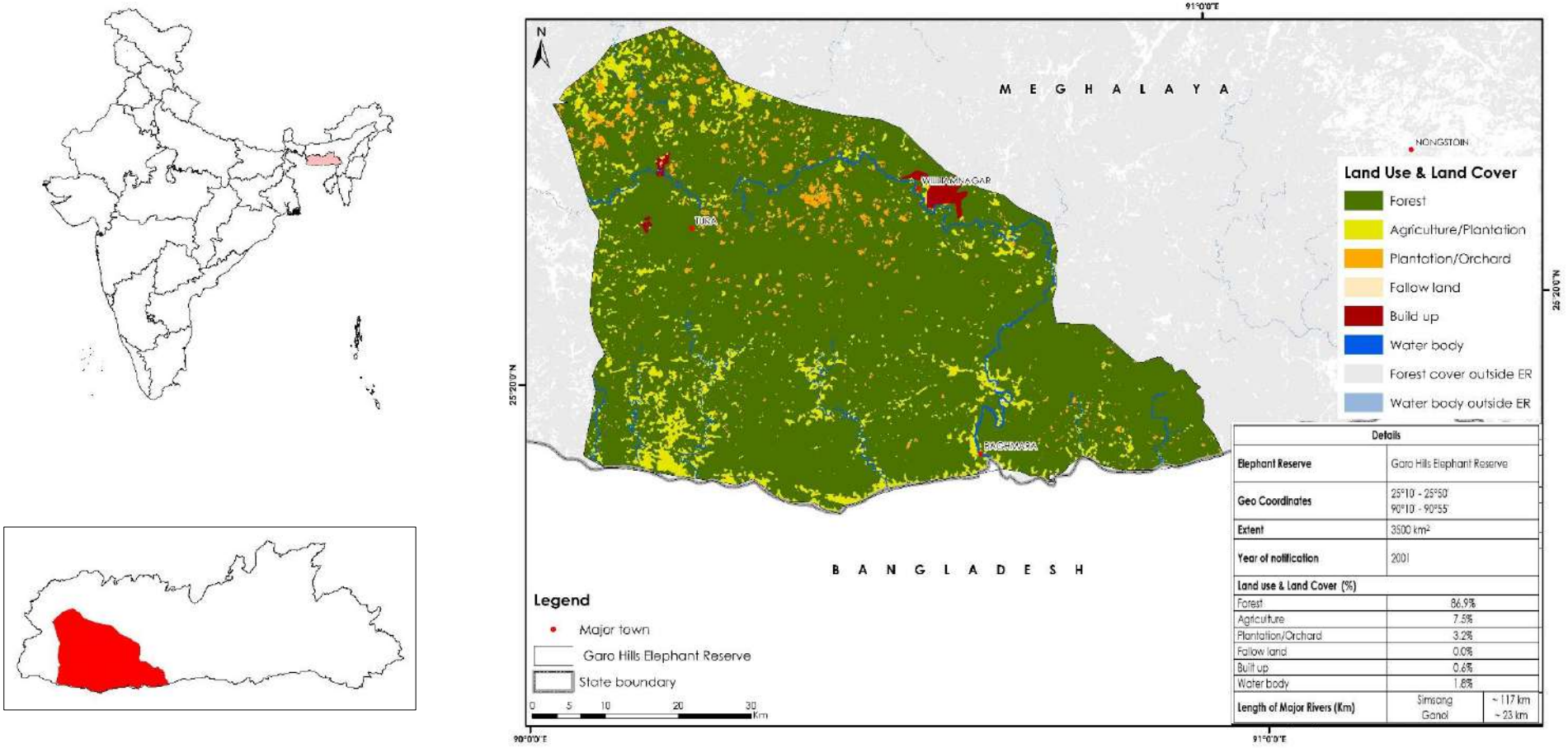
Figure 34: Land use & Land cover Map of Wayanad Elephant Reserve



Elevation (Meter)	1m – 2331m MSL	
Slope (Area – %)	Level (< 10°)	44.0 %
	Undulating (10° - 35°)	51.4 %
	Steep (>35°)	4.5 %

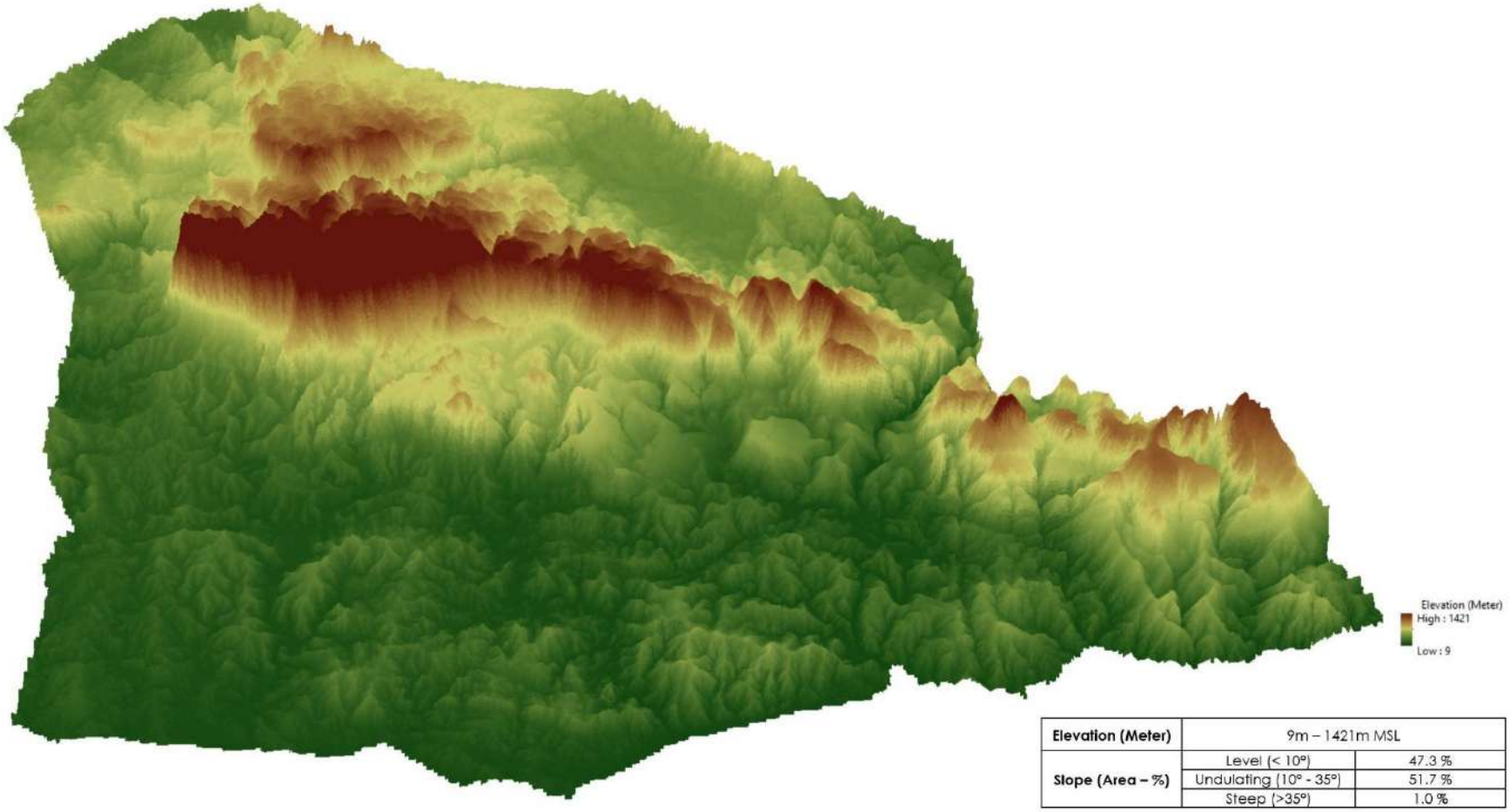
Figure 35: 3-Dimensional view of Wayanad Elephant Reserve

MEGHALAYA – GARO HILLS ELEPHANT RESERVE



Details		
Elephant Reserve	Garo Hills Elephant Reserve	
Geo Coordinates	25°10' - 25°50' 90°10' - 90°55'	
Extent	3500 km²	
Year of notification	2001	
Land use & Land Cover (%)		
Forest	86.9%	
Agriculture	7.5%	
Plantation/Orchard	3.2%	
Fallow land	0.0%	
Built up	0.6%	
Water body	1.8%	
Length of Major Rivers (Km)	Simsang Ganol	~ 117 km ~ 23 km

Figure 36: Land use & Land cover Map of Garo Hills Elephant Reserve



Elevation (Meter)	9m – 1421m MSL	
Slope (Area – %)	Level (< 10°)	47.3 %
	Undulating (10° - 35°)	51.7 %
	Steep (>35°)	1.0 %

Figure 37: 3-Dimensional view of Garo Hills Elephant Reserve

NAGALAND - INTANKI ELEPHANT RESERVE

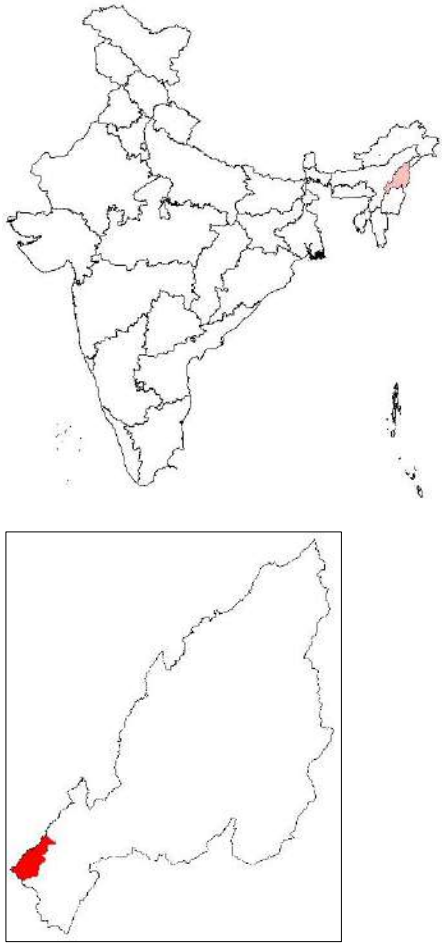
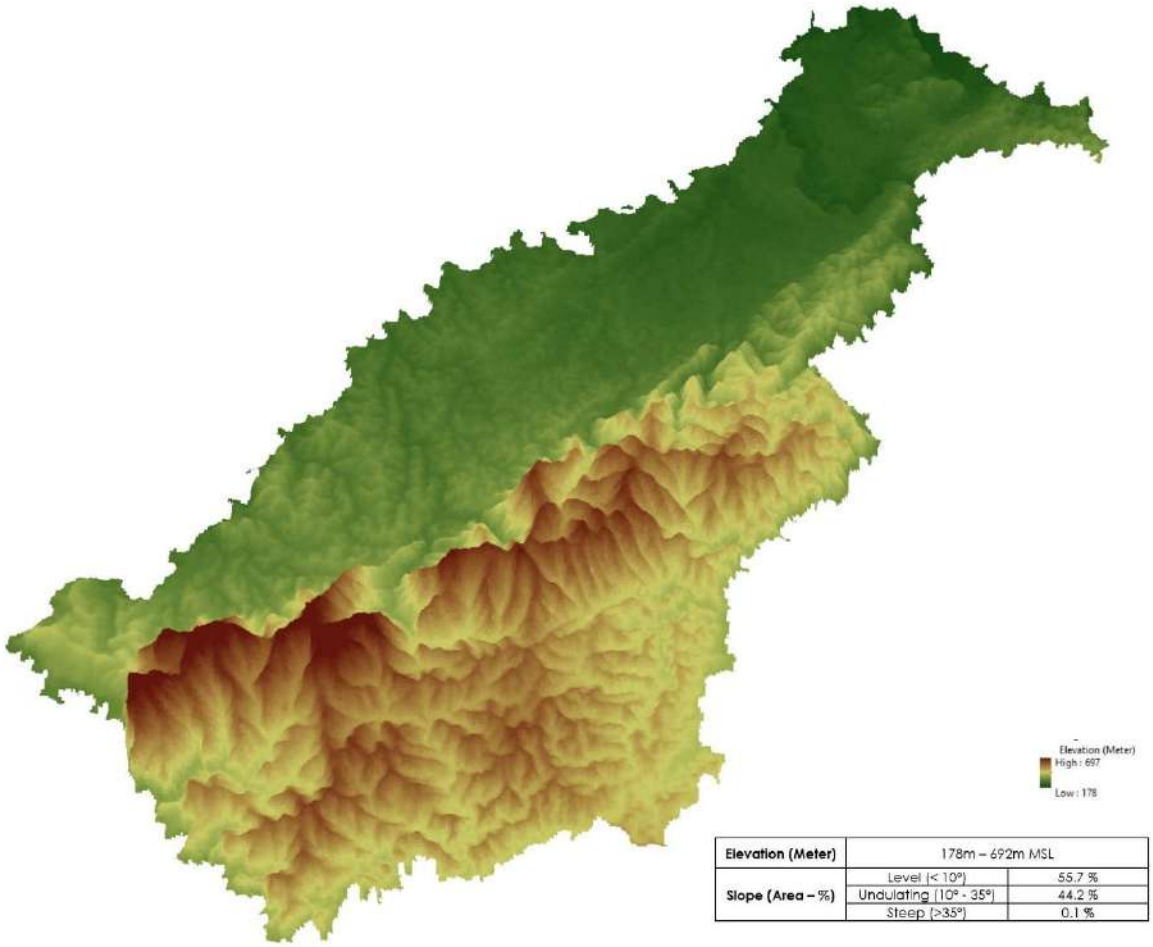


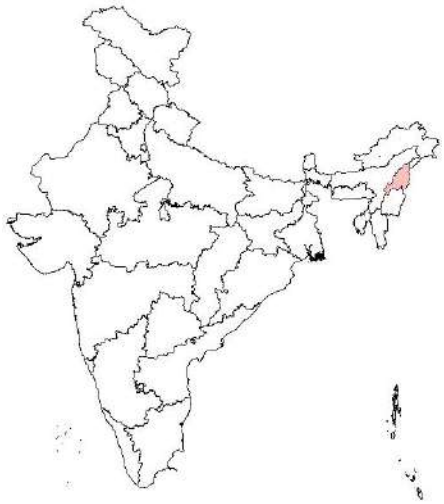
Figure 38: Land use & Land cover Map of Intanki Elephant Reserve

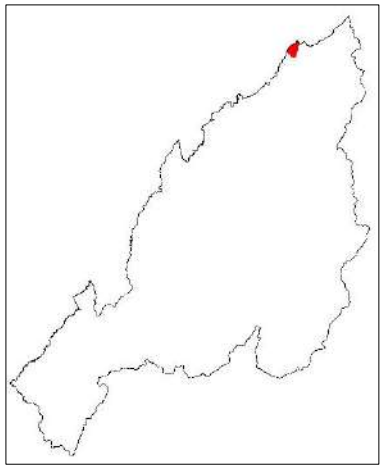


Elevation (Meter)	178m – 692m MSL	
Slope (Area – %)	Level (< 10°)	55.7 %
	Undulating (10° - 35°)	44.2 %
	Steep (>35°)	0.1 %

Figure 39: 3-Dimensional view of Intanki Elephant Reserve

NAGALAND - SINGPHAN ELEPHANT RESERVE





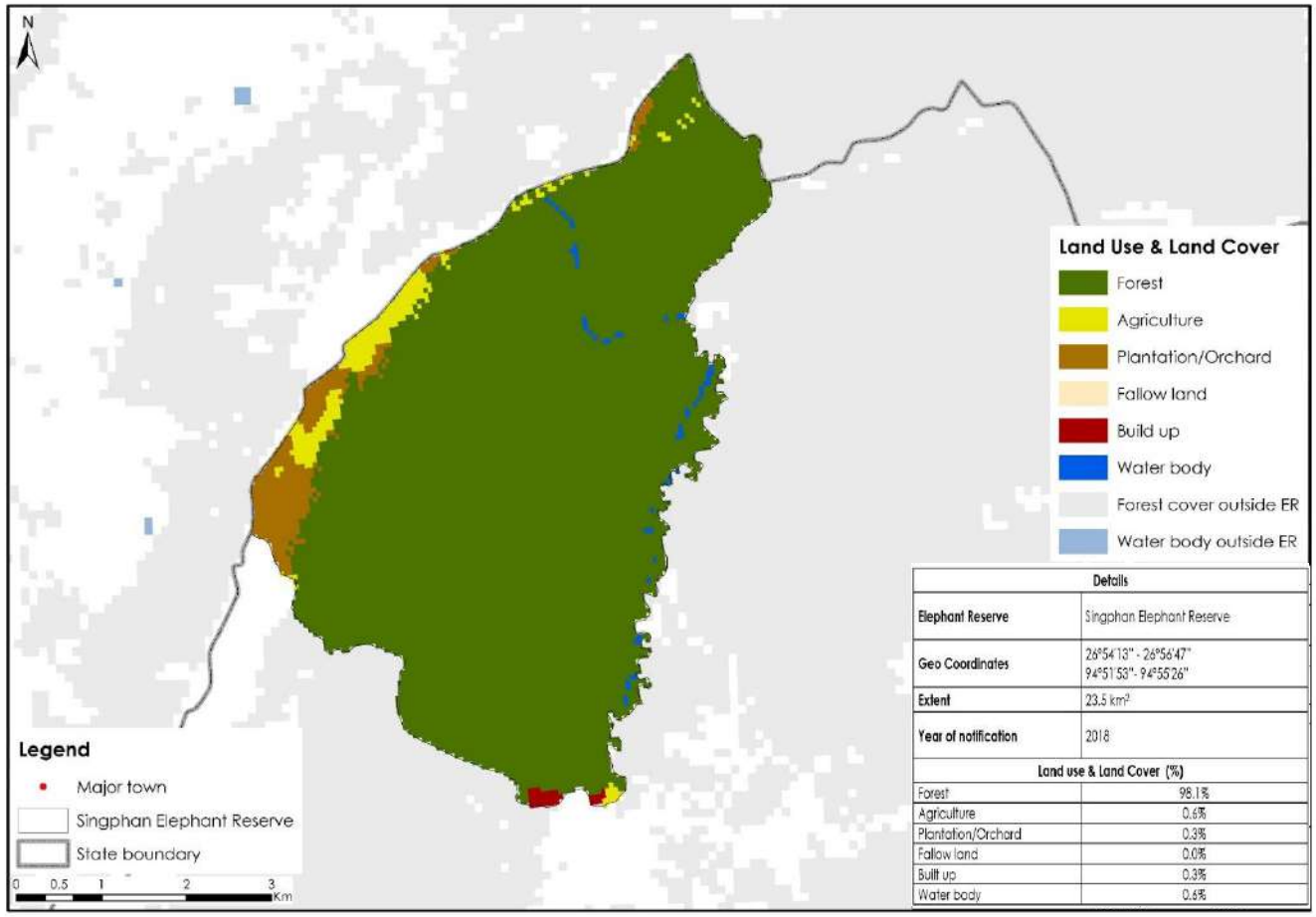
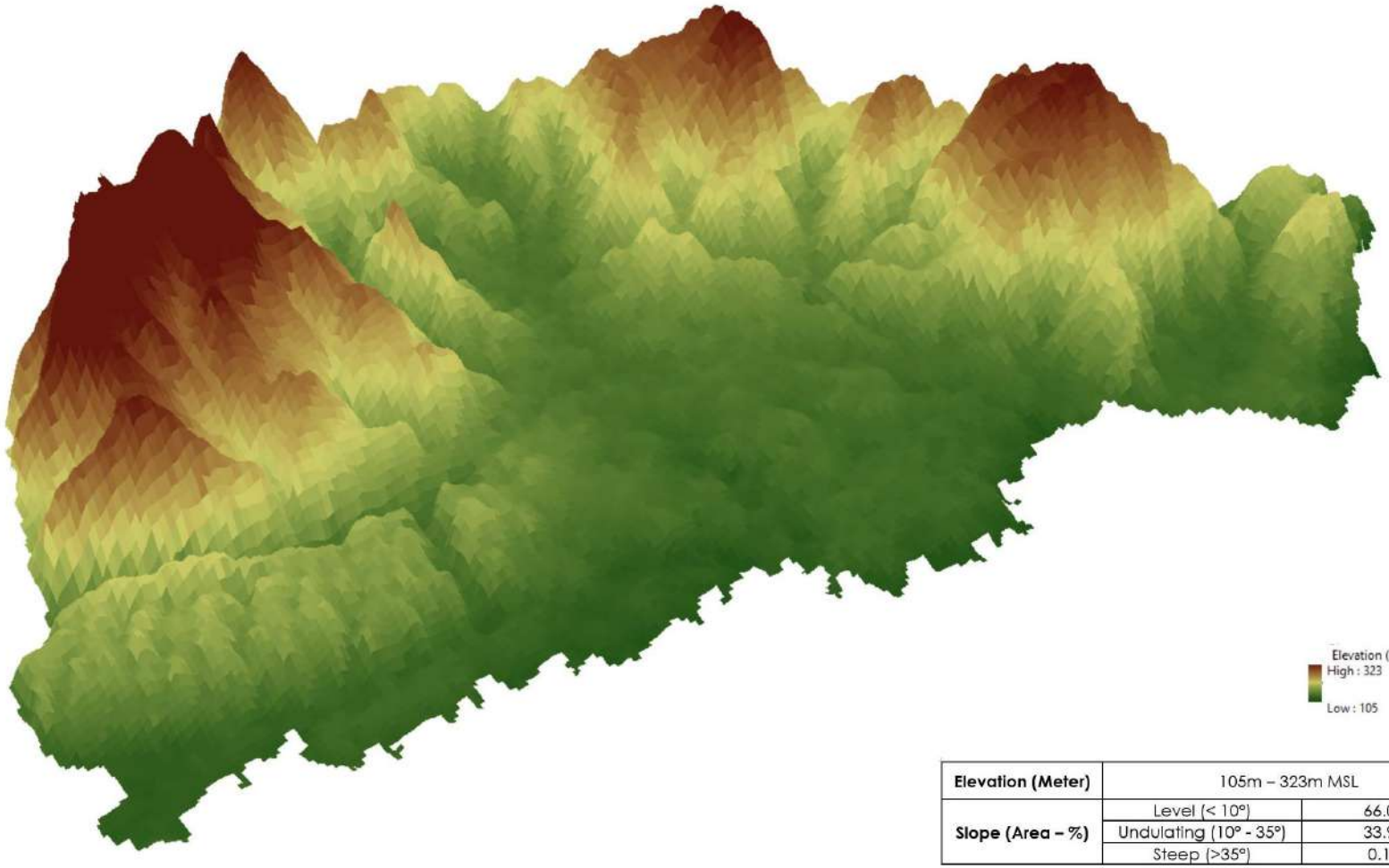


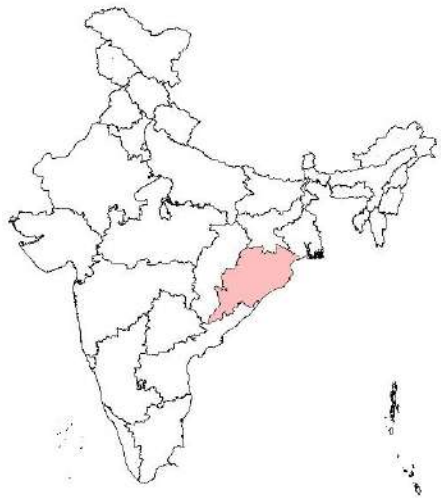
Figure 40 Land use & Land cover Map of Singphan Elephant Reserve

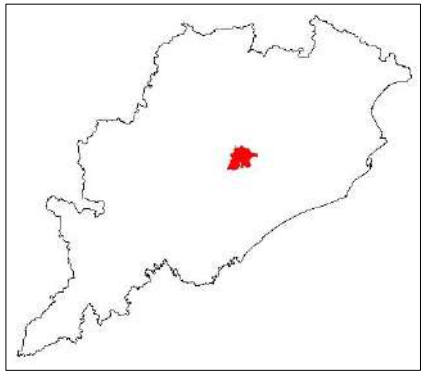


Elevation (Meter)	105m – 323m MSL	
Slope (Area – %)	Level (< 10°)	66.0 %
	Undulating (10° - 35°)	33.9 %
	Steep (>35°)	0.1 %

Figure 41: 3-Dimensional view of Singphan Elephant Reserve

ODISHA - MAHANADI ELEPHANT RESERVE





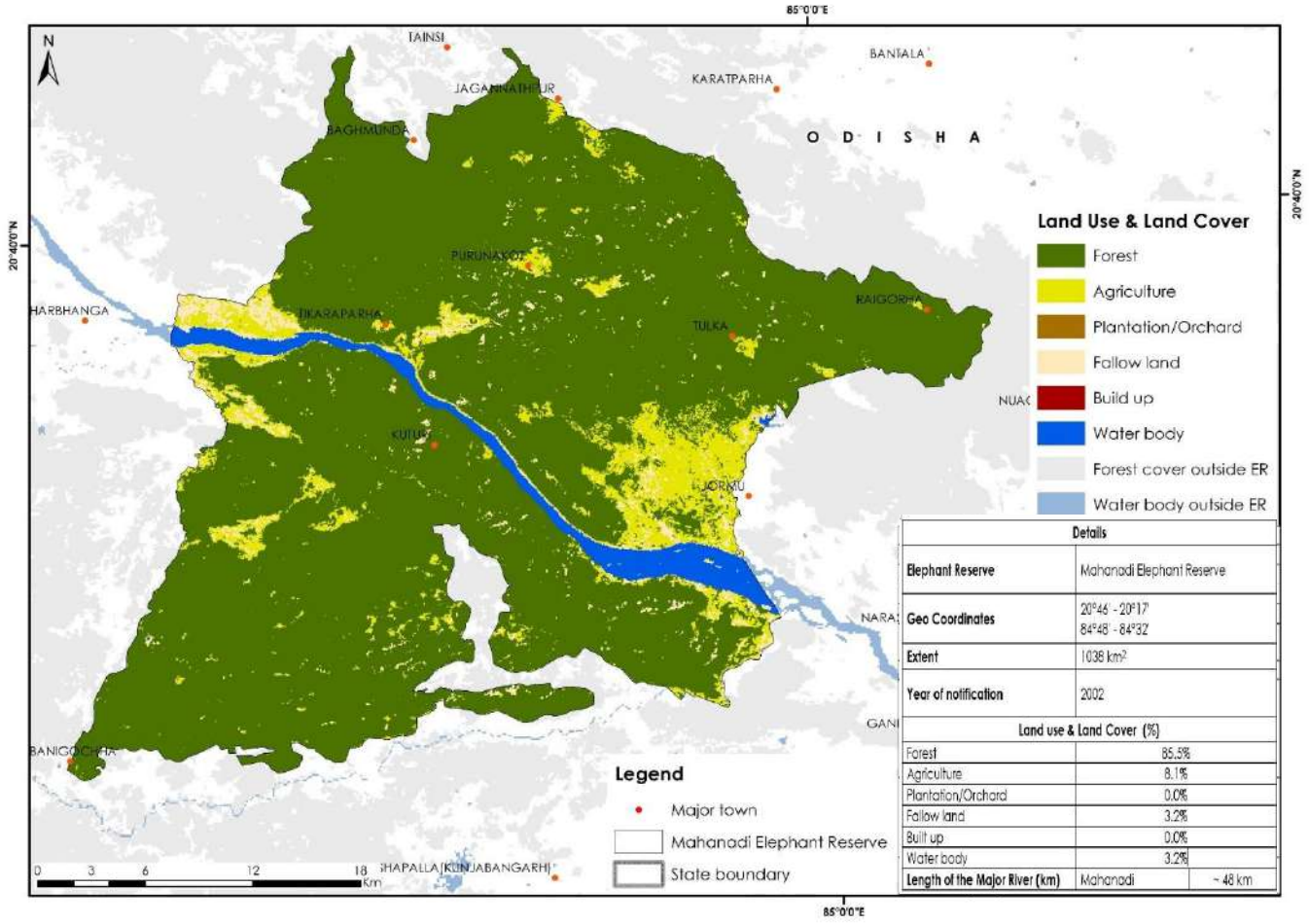
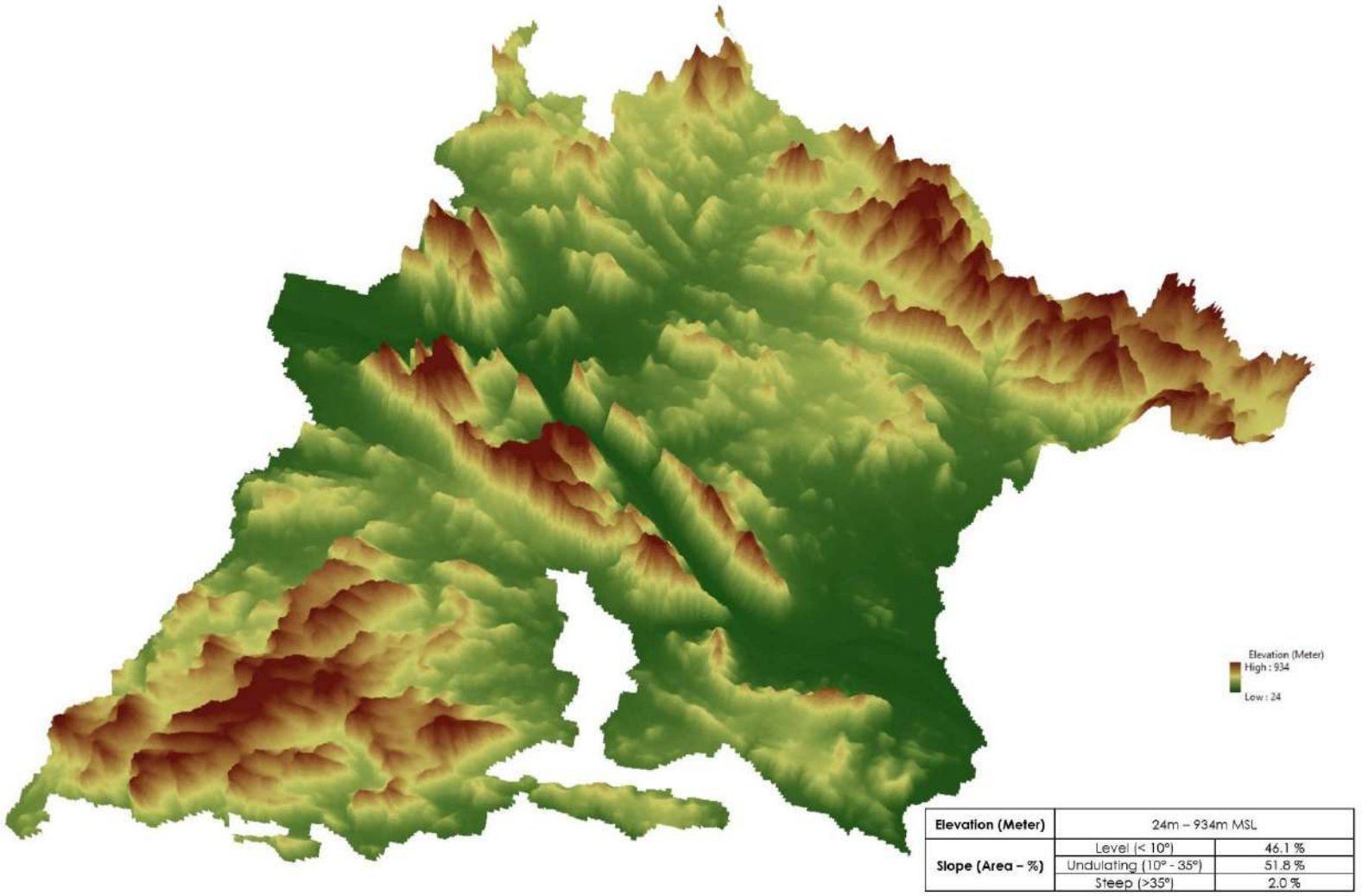


Figure 42: Land use & Land cover Map of Mahanadi Elephant Reserve



Elevation (Meter)	24m – 934m MSL	
Slope (Area – %)	Level (< 10°)	46.1 %
	Undulating (10° - 35°)	51.8 %
	Steep (>35°)	2.0 %

Figure 43: 3-Dimensional view of Mahanadi Elephant Reserve

ODISHA - MAYURBHANJ ELEPHANT RESERVE

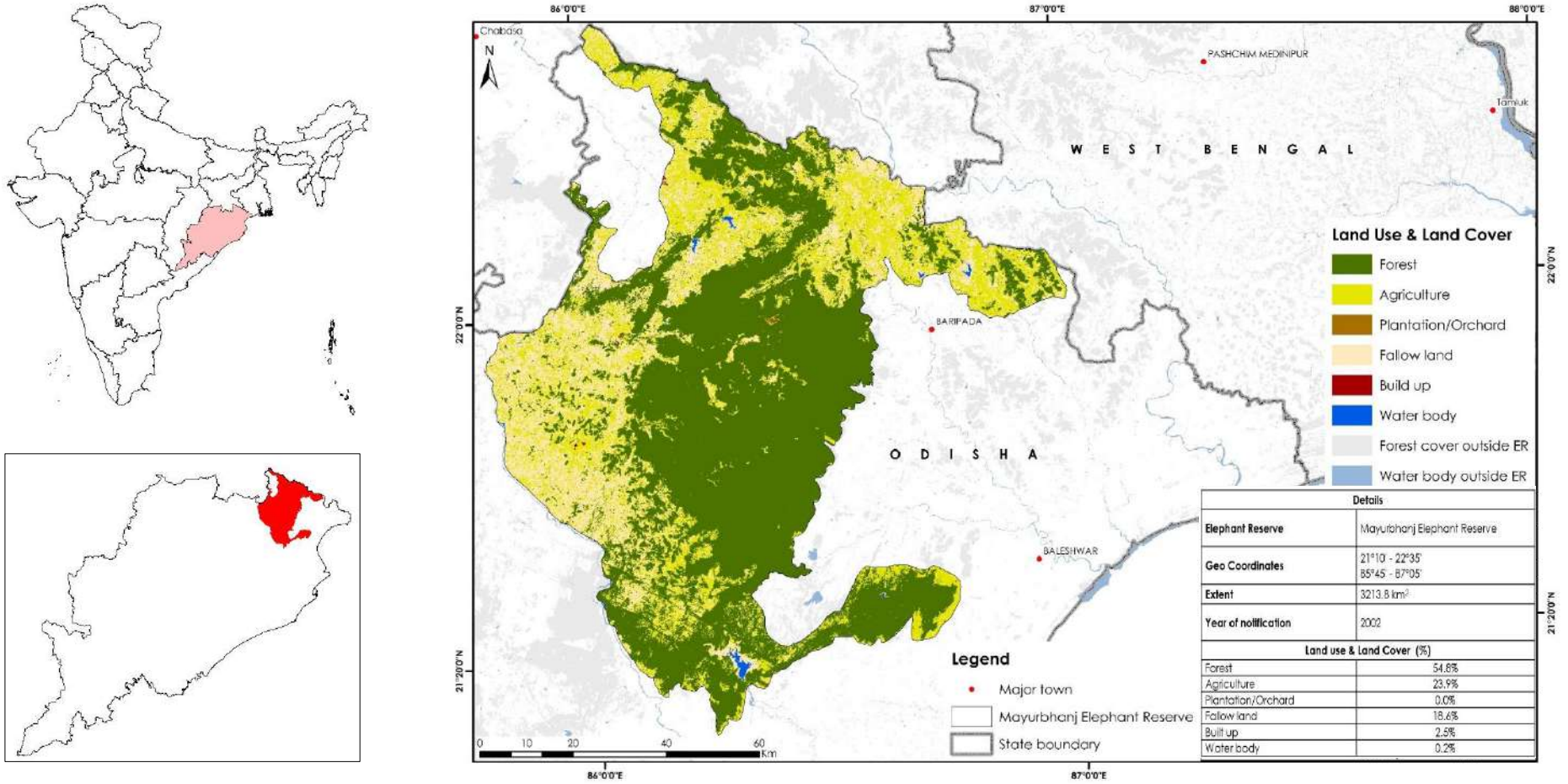
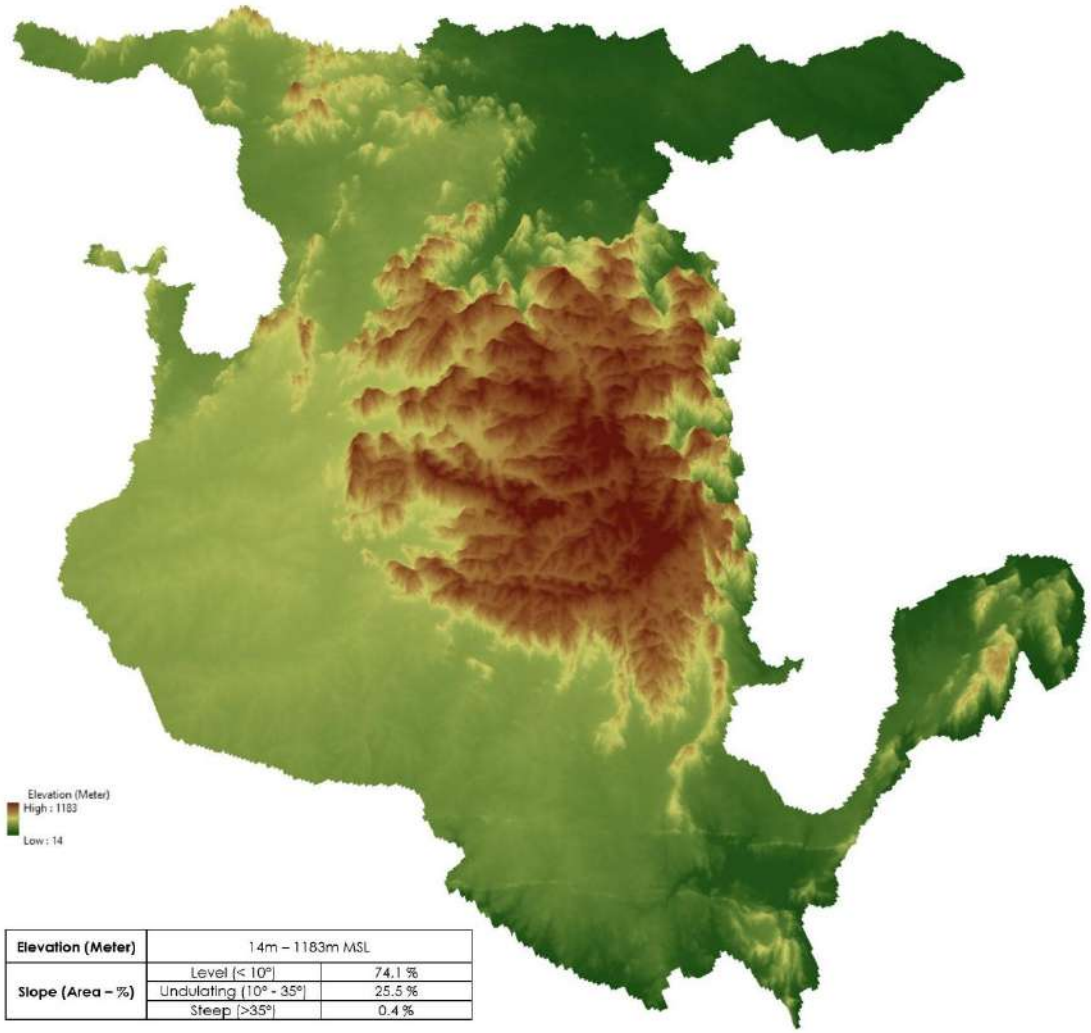


Figure 44: Land use & Land cover Map of Mayurbhanj Elephant Reserve



Elevation (Meter)	14m – 1183m MSL	
Slope (Area – %)	Level (< 10°)	74.1 %
	Undulating (10° - 35°)	25.5 %
	Steep (>35°)	0.4 %

Figure 45: 3-Dimensional view of Mayurbhanj Elephant Reserve

ODISHA - SAMBALPUR ELEPHANT RESERVE

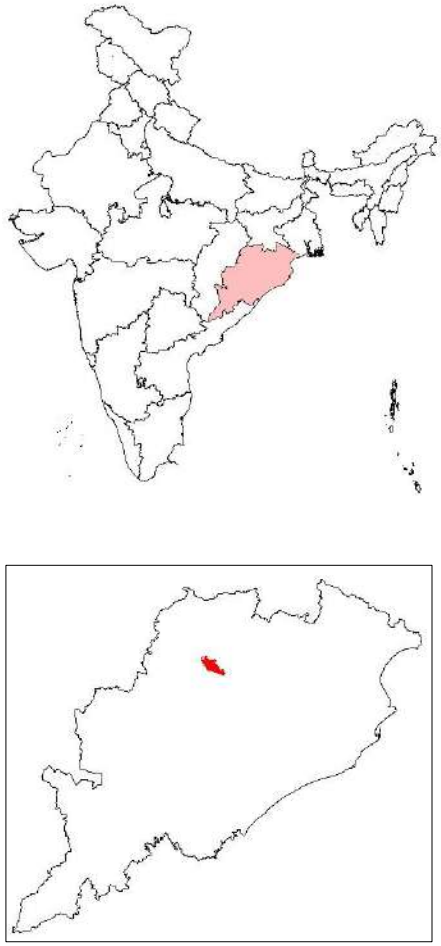
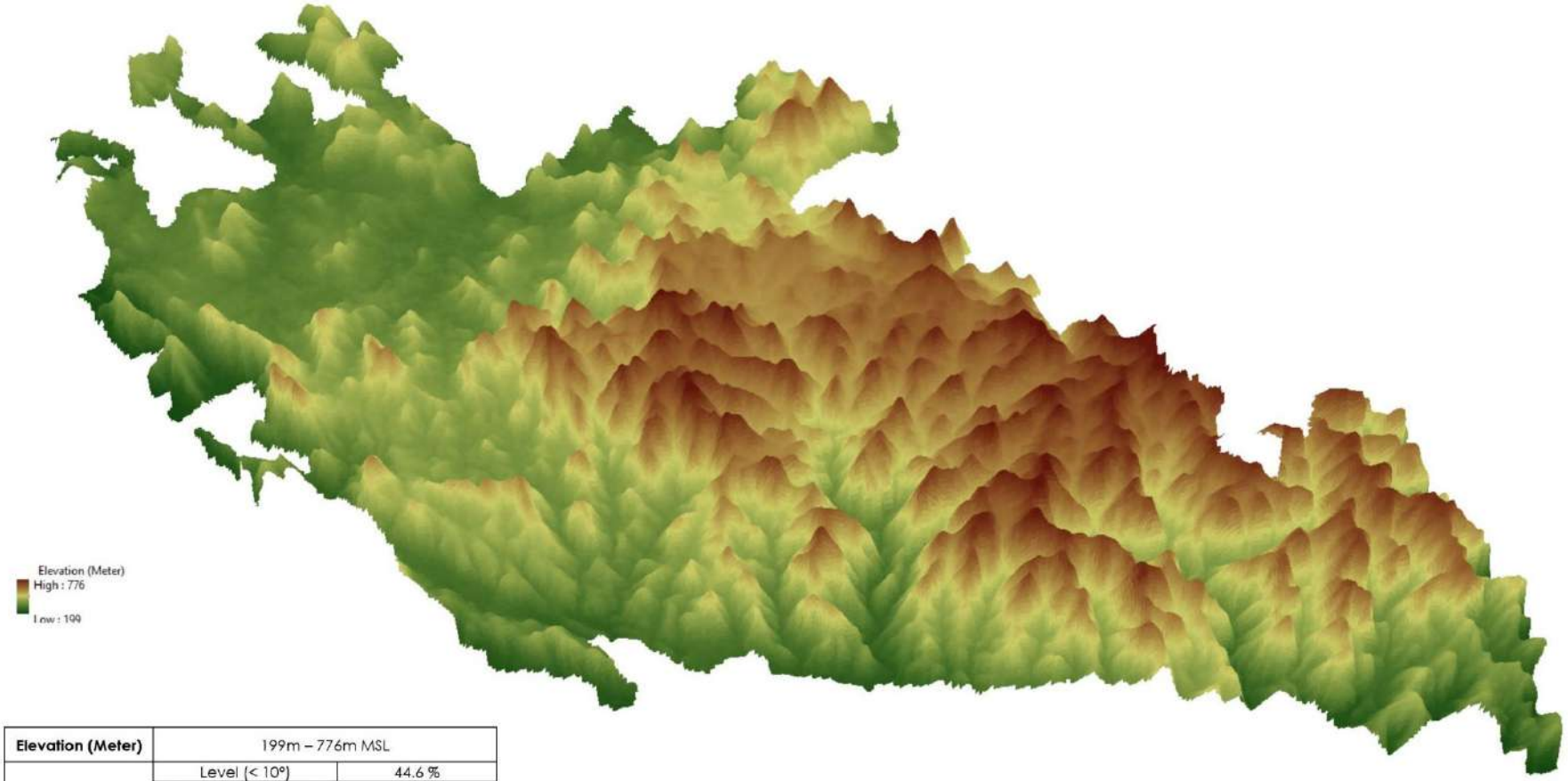


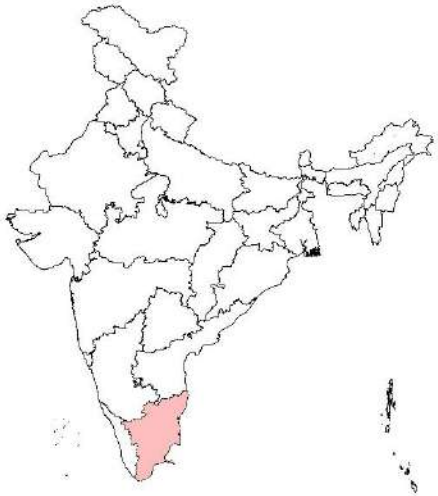
Figure 46: Land use & Land cover Map of Sambalpur Elephant Reserve

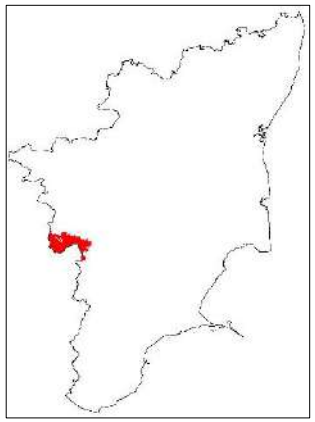


Elevation (Meter)	199m – 776m MSL	
Slope (Area – %)	Level (< 10°)	44.6 %
	Undulating (10° - 35°)	55.2 %
	Steep (>35°)	0.2 %

Figure 47: 3-Dimensional view of Sambalpur Elephant Reserve

TAMILNADU - ANAMALAI ELEPHANT RESERVE





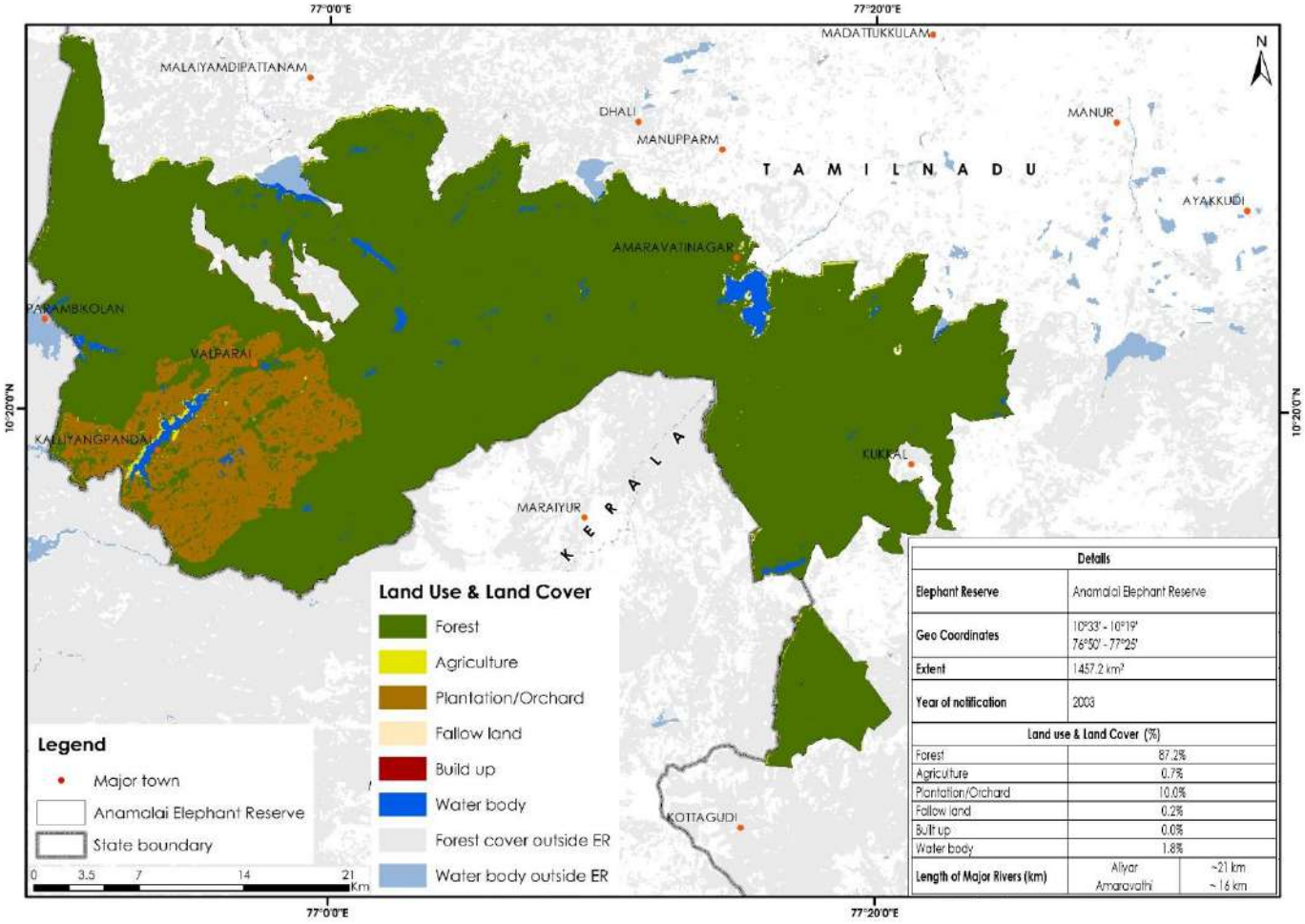
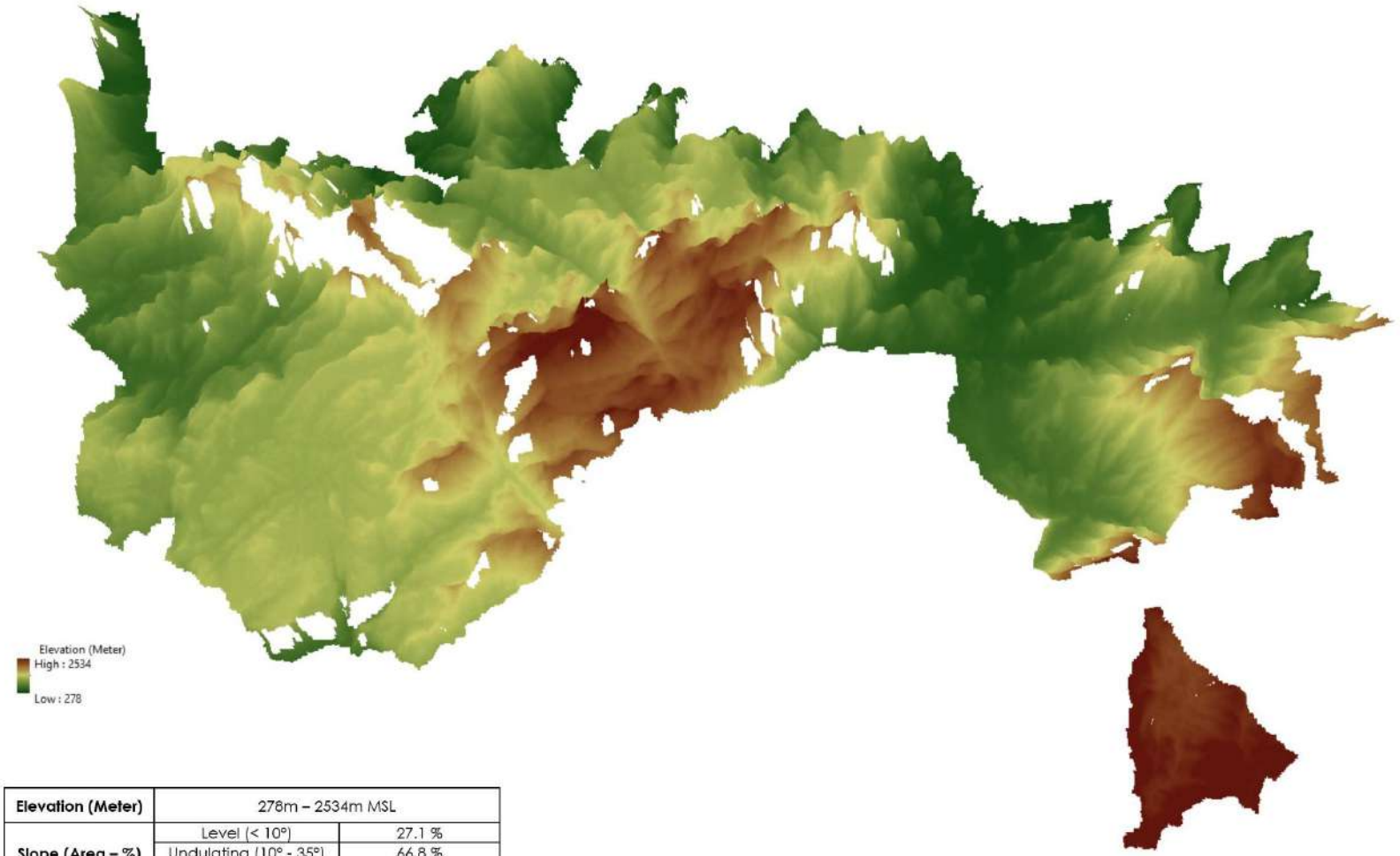


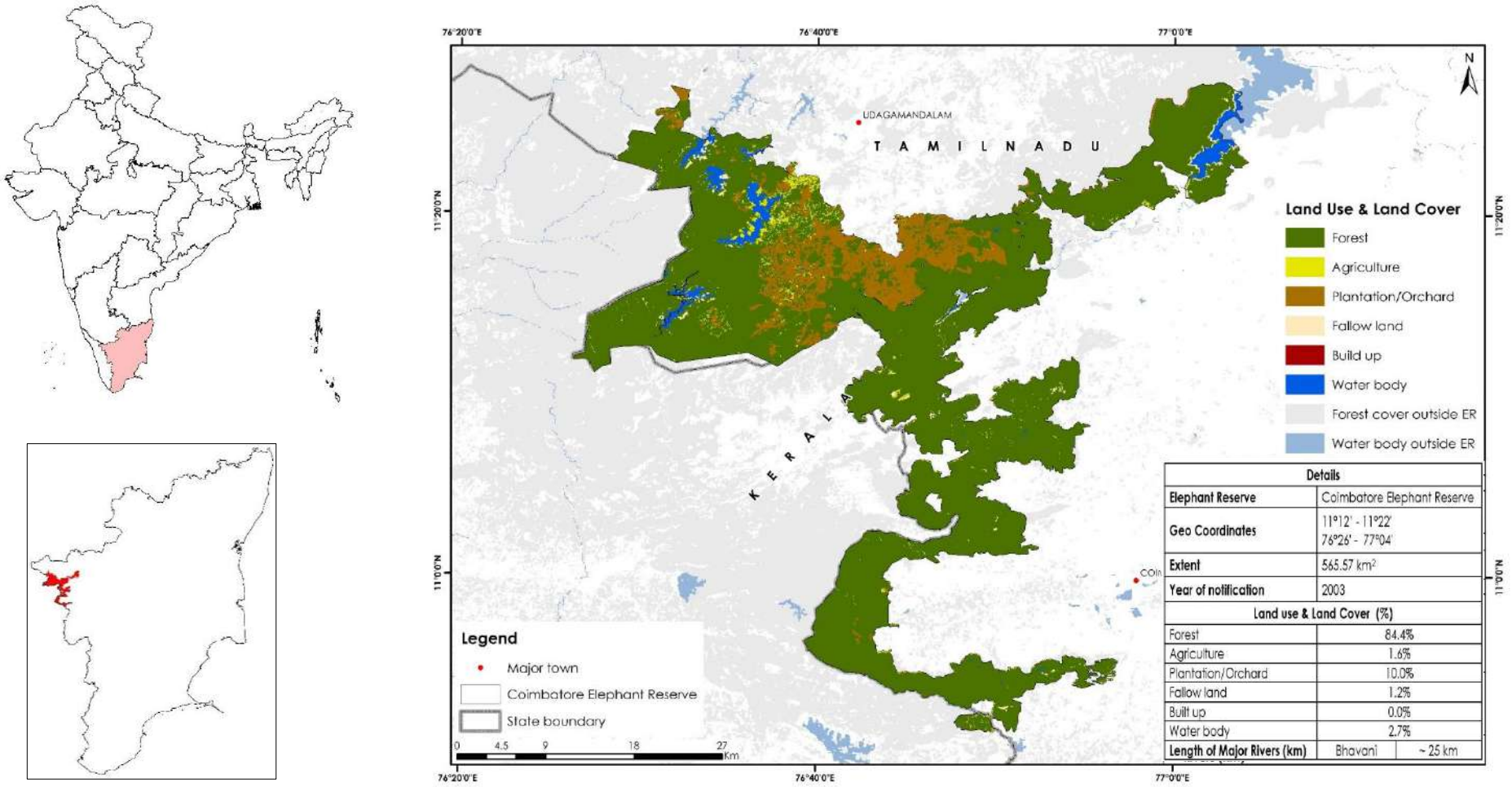
Figure 48: Land use & Land cover Map of Anamalai Elephant Reserve



Elevation (Meter)	278m – 2534m MSL	
Slope (Area – %)	Level (< 10°)	27.1 %
	Undulating (10° - 35°)	66.8 %
	Steep (>35°)	6.1 %

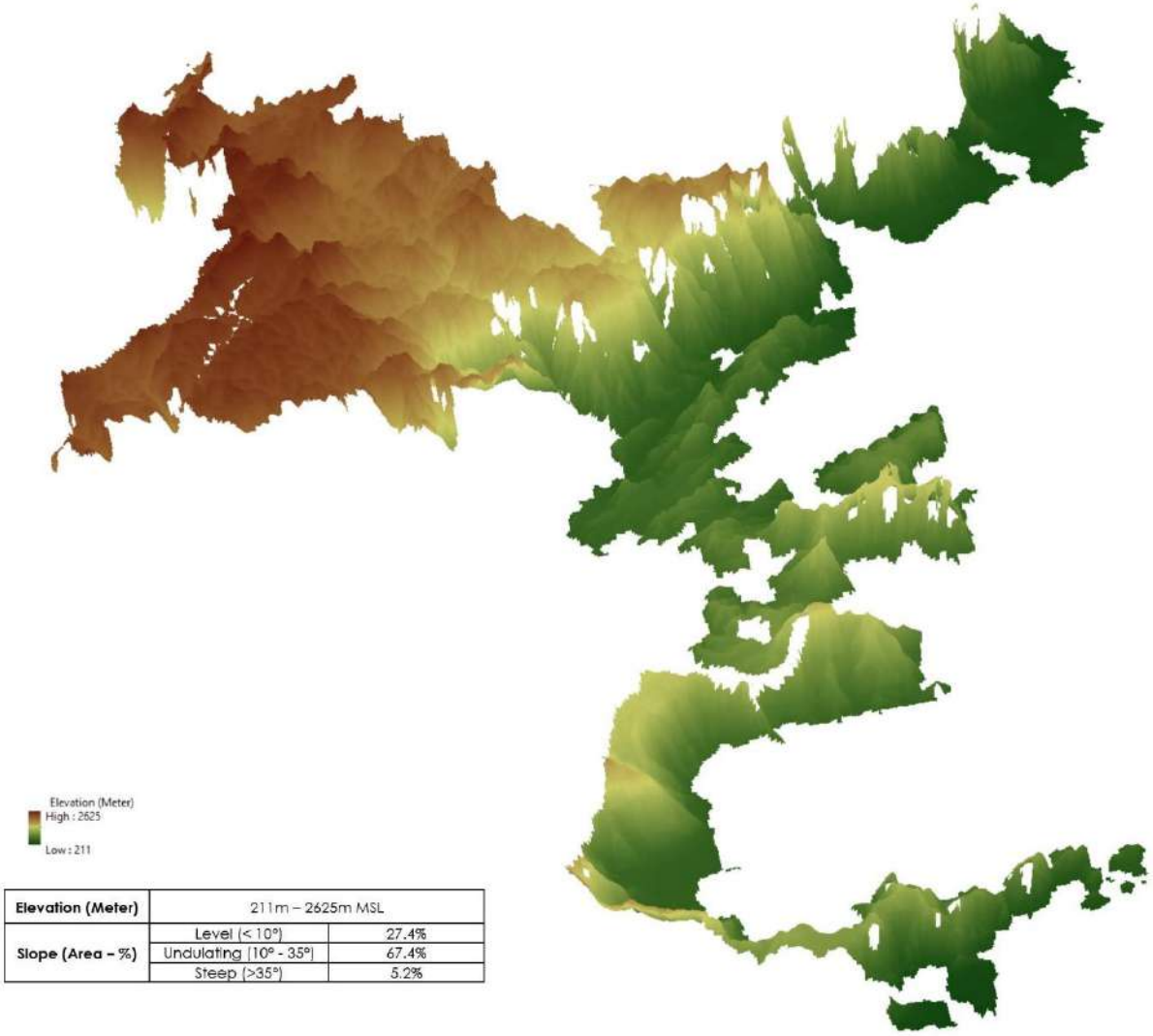
Figure 49: 3-Dimensional view of Anamalai Elephant Reserve

TAMILNADU - COIMBATORE ELEPHANT RESERVE



Details	
Elephant Reserve	Coimbatore Elephant Reserve
Geo Coordinates	11°12' - 11°22' 76°26' - 77°04'
Extent	565.57 km²
Year of notification	2003
Land use & Land Cover (%)	
Forest	84.4%
Agriculture	1.6%
Plantation/Orchard	10.0%
Fallow land	1.2%
Built up	0.0%
Water body	2.7%
Length of Major Rivers (km)	Bhavani ~ 25 km

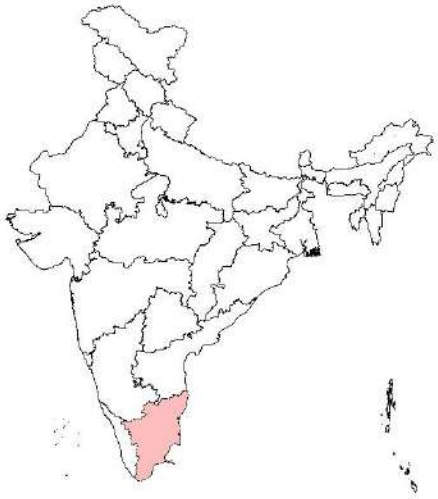
Figure 50: Land use & Land cover Map of Coimbatore Elephant Reserve

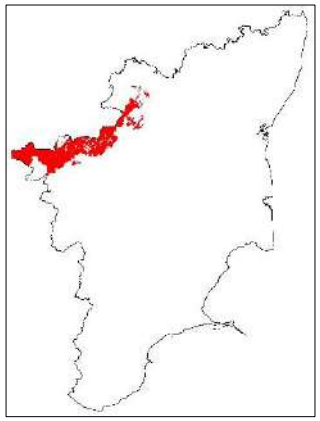


Elevation (Meter)	211m – 2625m MSL	
Slope (Area – %)	Level (< 10°)	27.4%
	Undulating (10° - 35°)	67.4%
	Steep (>35°)	5.2%

Figure 51: 3-Dimensional view of Coimbatore Elephant Reserve

TAMILNADU - NILGIRI ELEPHANT RESERVE





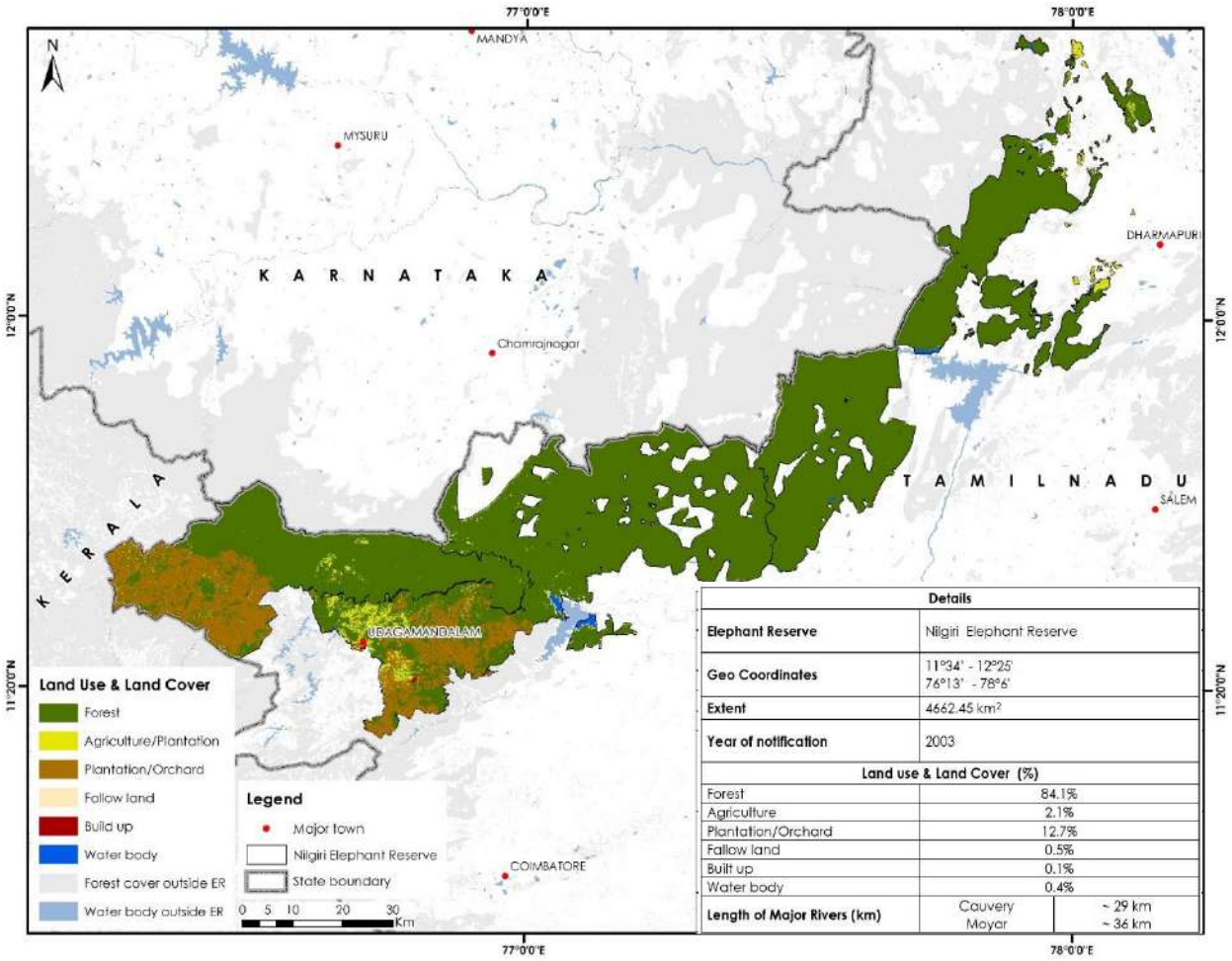
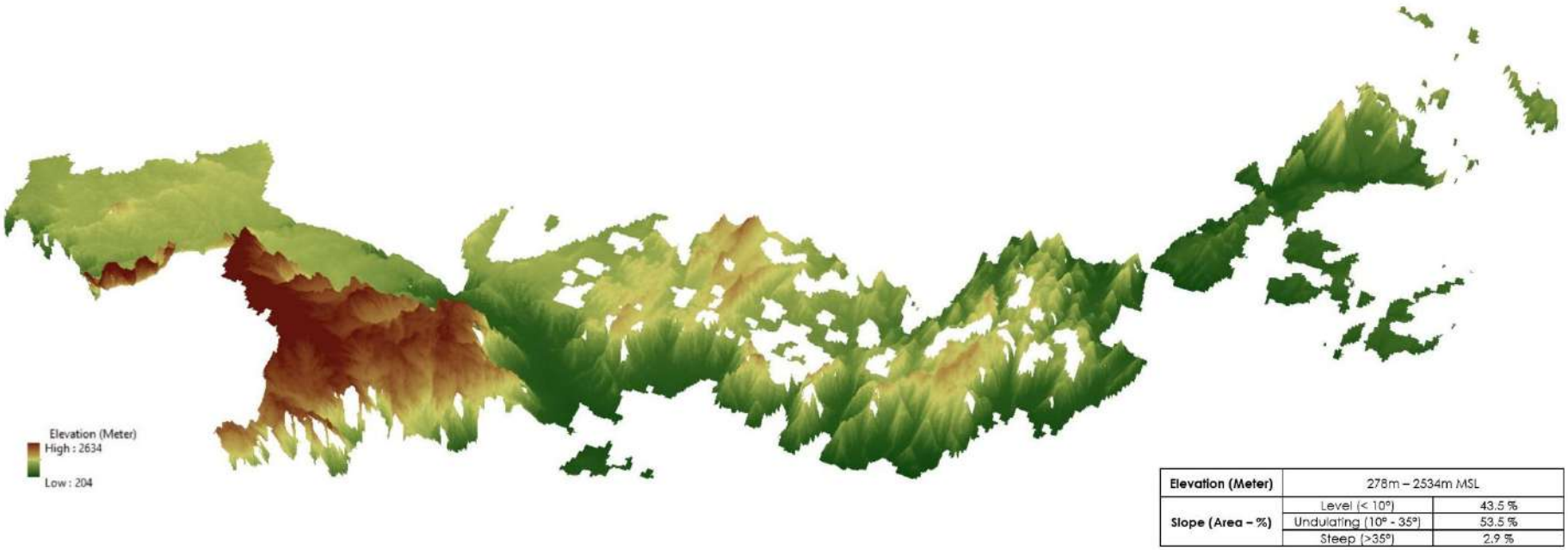


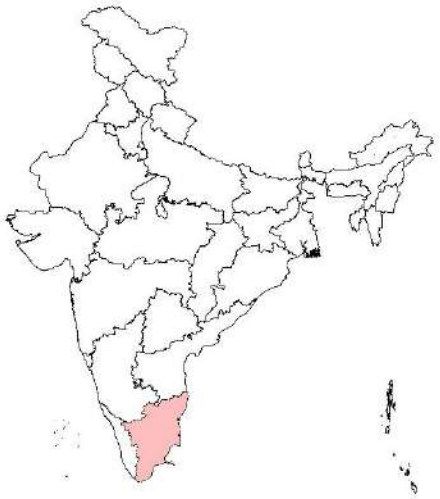
Figure 52: Land use & Land cover Map of Nilgiri Elephant Reserve

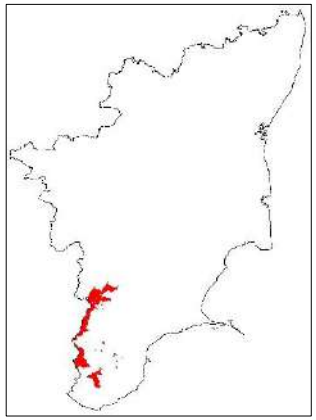


Elevation (Meter)	278m – 2534m MSL	
Slope (Area – %)	Level (< 10°)	43.5 %
	Undulating (10° - 35°)	53.5 %
	Steep (>35°)	2.9 %

Figure 53: 3-Dimensional view of Nilgiri Elephant Reserve

TAMILNADU – PERIYAR SRIVILLIPUTHUR ELEPHANT RESERVE





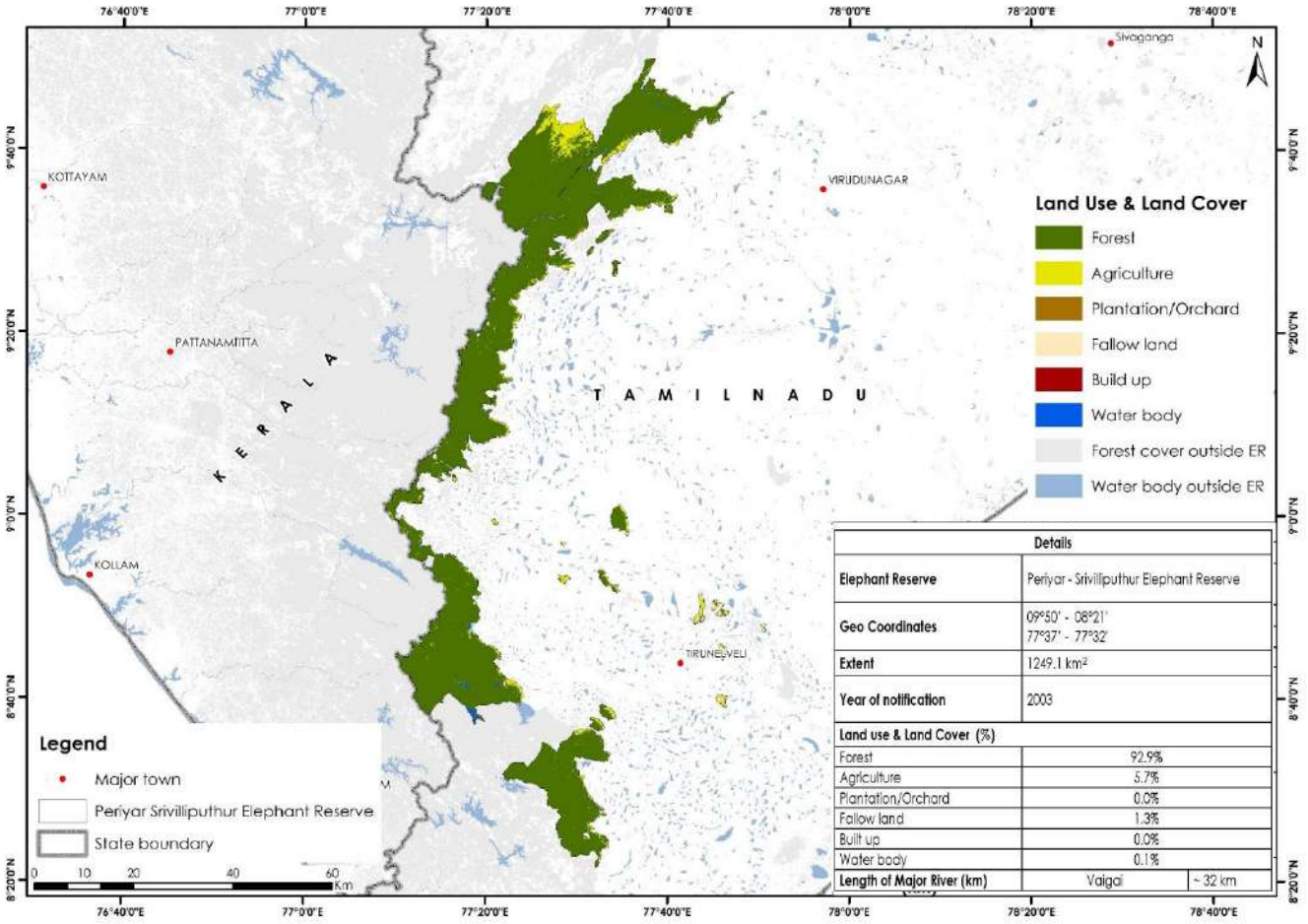


Figure 54: Land use & Land cover Map of Periyar Srivilliputhur Elephant Reserve

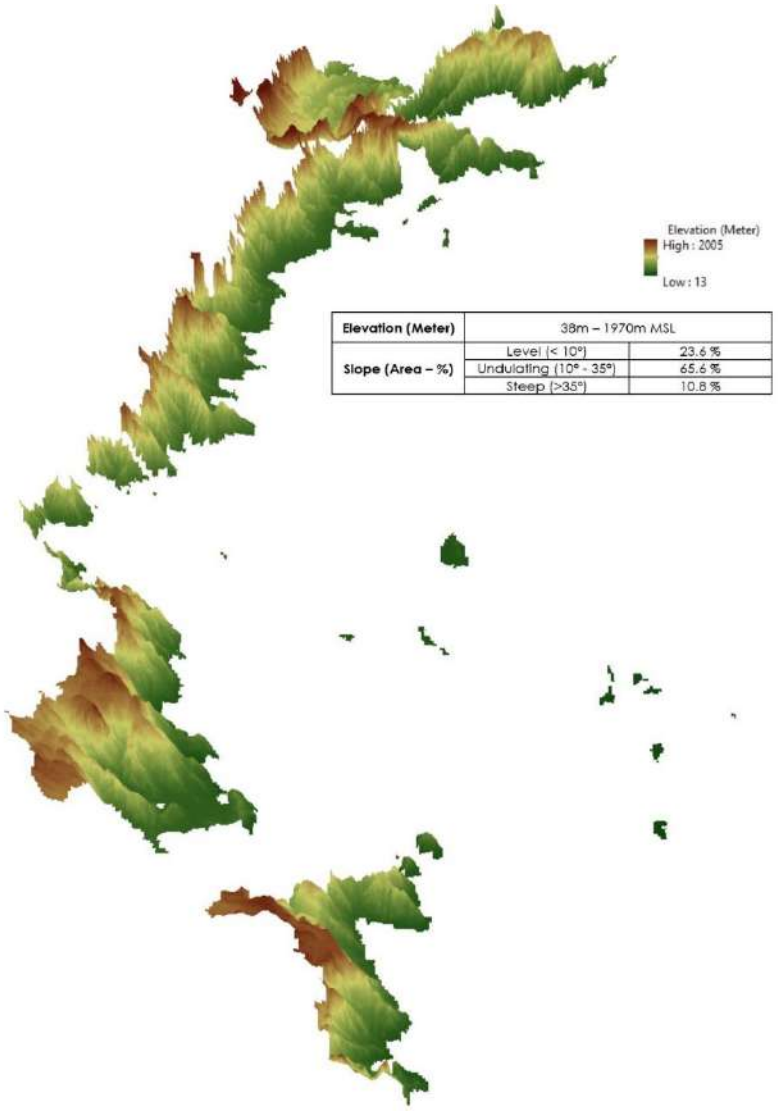
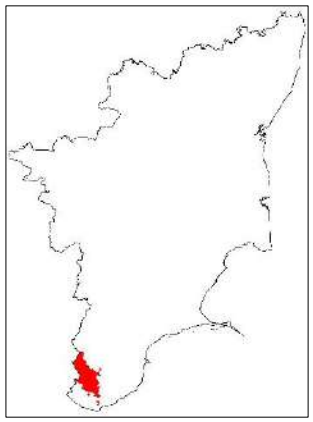
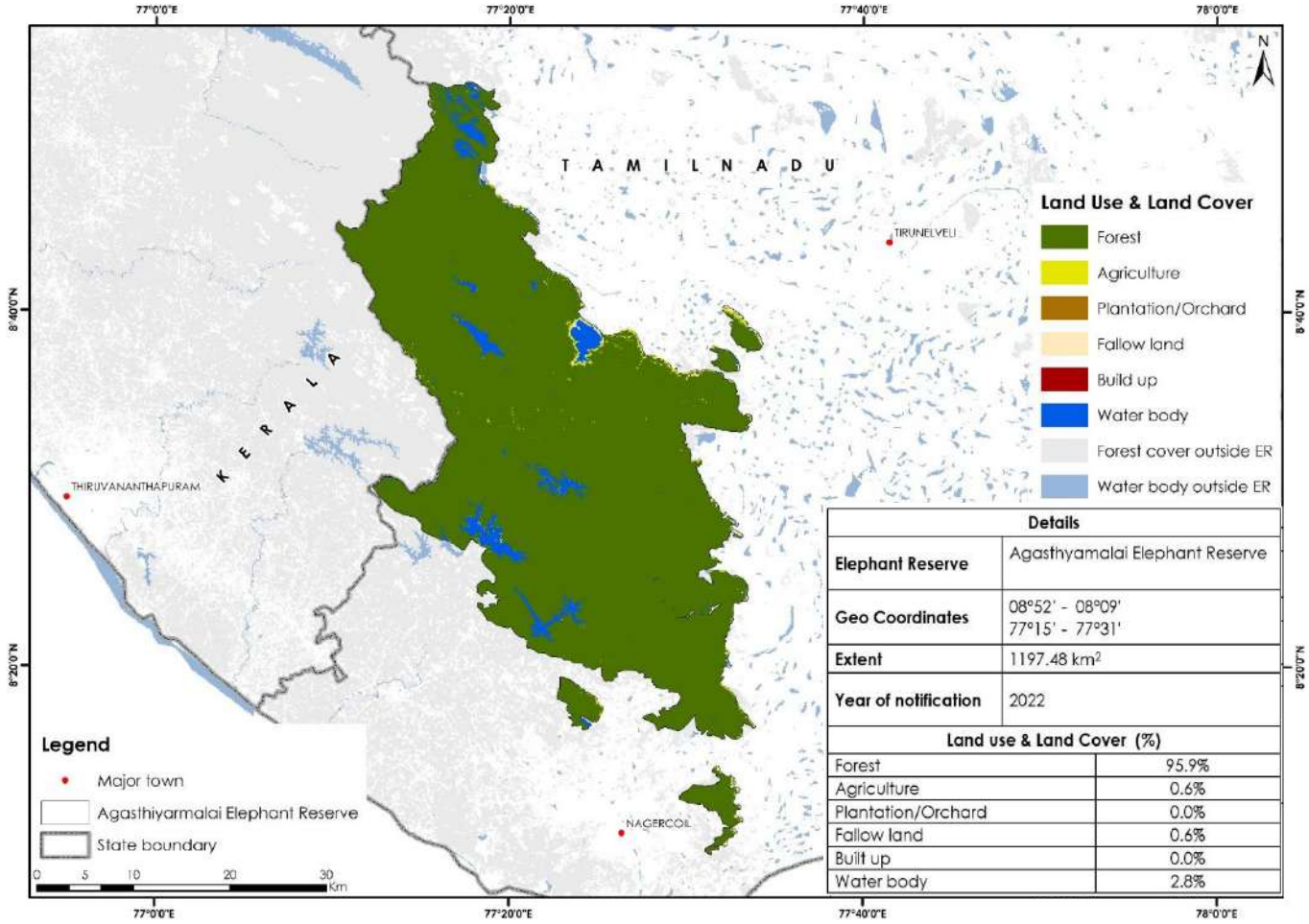


Figure 55: 3-Dimensional view of Periyar Srivilliputhur Elephant Reserve

TAMILNADU – AGASTHYAMALAI ELEPHANT RESERVE



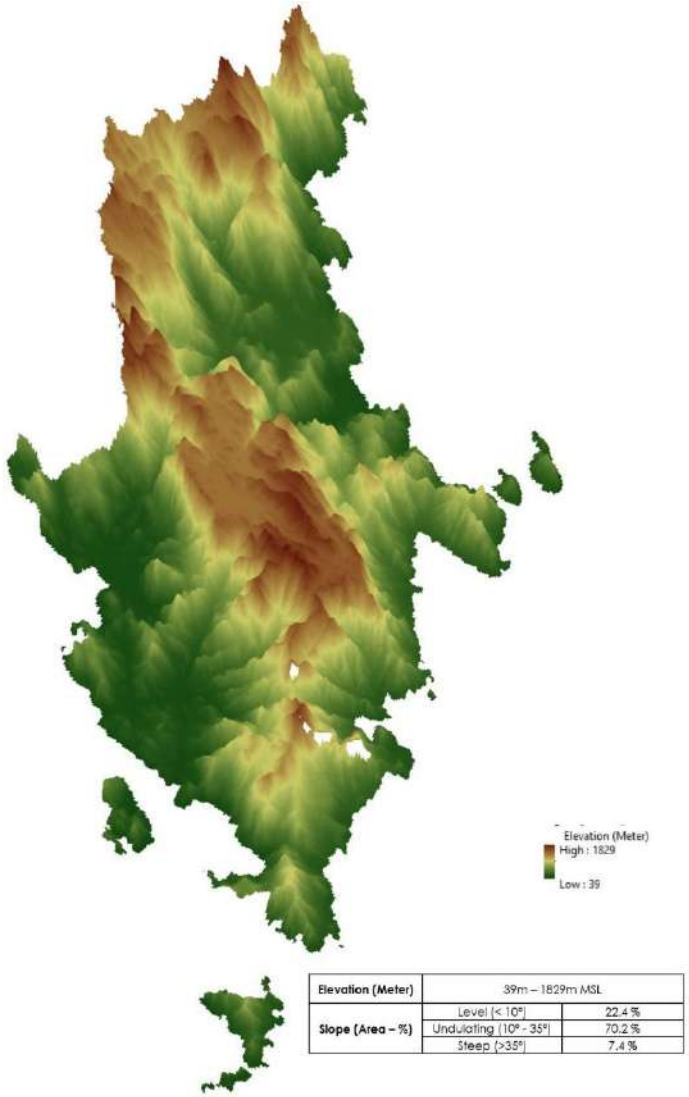


Details	
Elephant Reserve	Agasthyamalai Elephant Reserve
Geo Coordinates	08°52' - 08°09' 77°15' - 77°31'
Extent	1197.48 km²
Year of notification	2022

Land use & Land Cover (%)	
Forest	95.9%
Agriculture	0.6%
Plantation/Orchard	0.0%
Fallow land	0.6%
Built up	0.0%
Water body	2.8%

Disclaimer: The geospatial layer of Agasthyamalai Elephant Reserve was generated using gazette notification

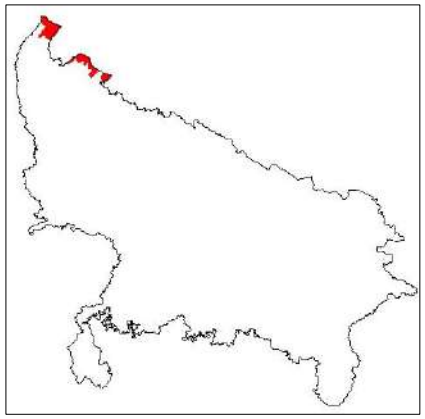
Figure 56: Land use & Land cover Map of Agasthyamalai Elephant Reserve

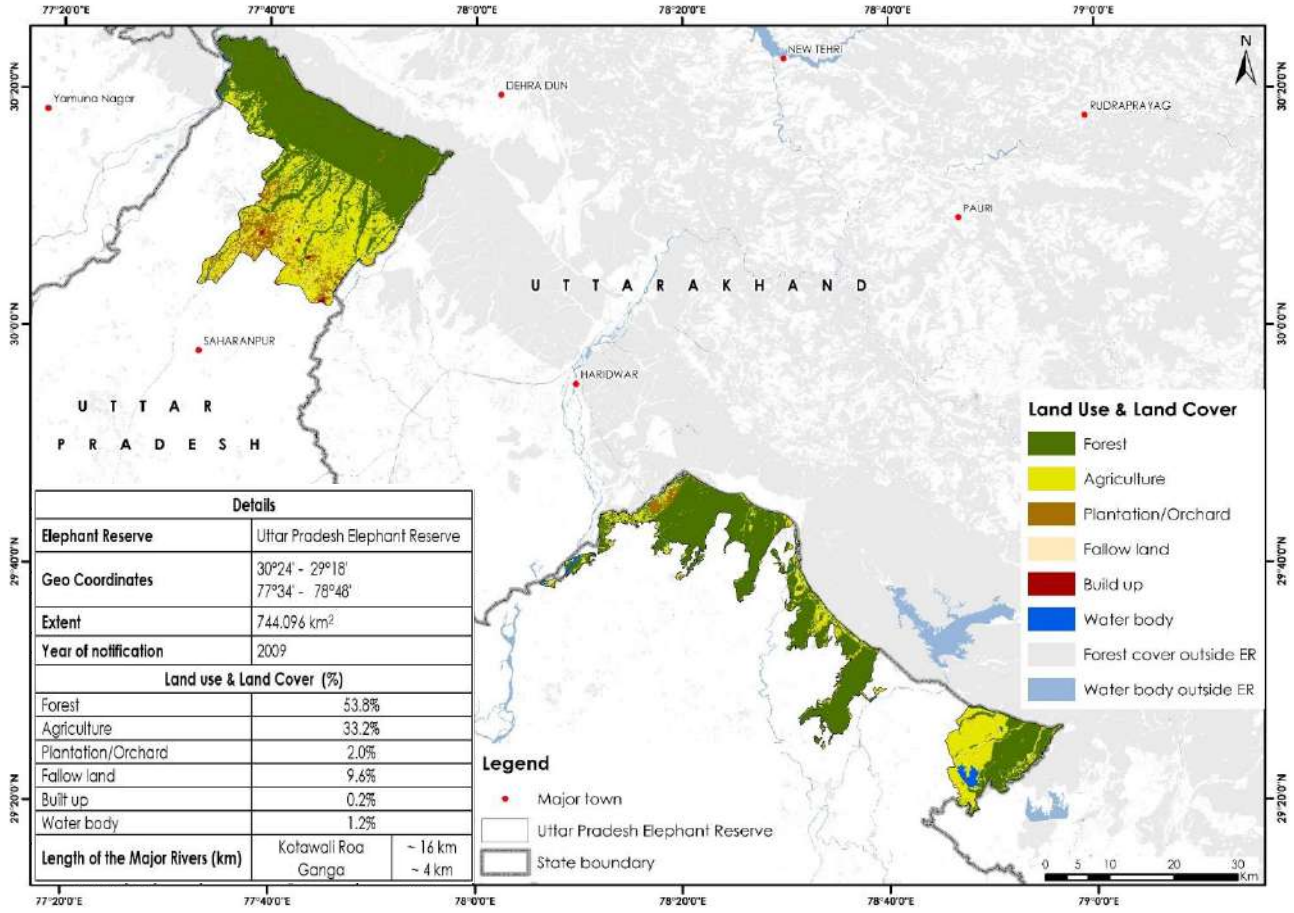


Elevation (Meter)	39m – 1829m MSL	
Slope (Area – %)	Level (< 10°)	22.4 %
	Undulating (10° - 35°)	70.2 %
	Steep (>35°)	7.4 %

Figure 57: 3-Dimensional view of Agasthyamalai Elephant Reserve

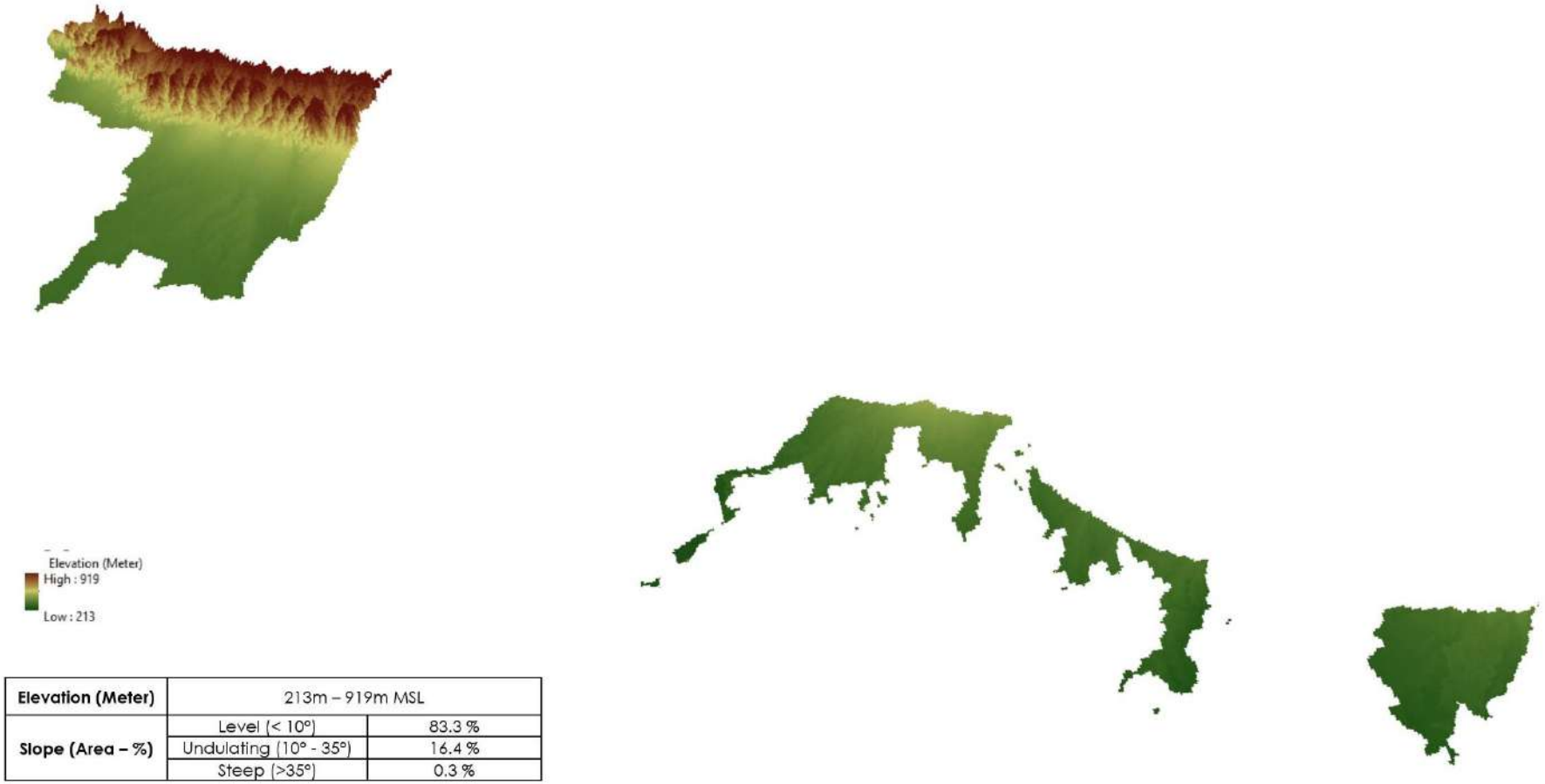
UTTAR PRADESH – UTTAR PRADESH ELEPHANT RESERVE





Details		
Elephant Reserve	Uttar Pradesh Elephant Reserve	
Geo Coordinates	30°24' - 29°18' 77°34' - 78°48'	
Extent	744.096 km²	
Year of notification	2009	
Land use & Land Cover (%)		
Forest	53.8%	
Agriculture	33.2%	
Plantation/Orchard	2.0%	
Fallow land	9.6%	
Built up	0.2%	
Water body	1.2%	
Length of the Major Rivers (km)	Kotawali Roa Ganga	~ 16 km ~ 4 km

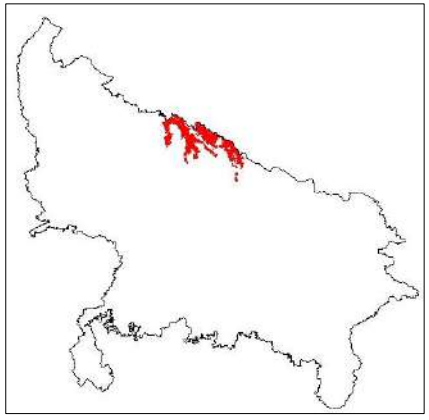
Figure 58: Land use & Land cover Map of Uttar Pradesh Elephant Reserve

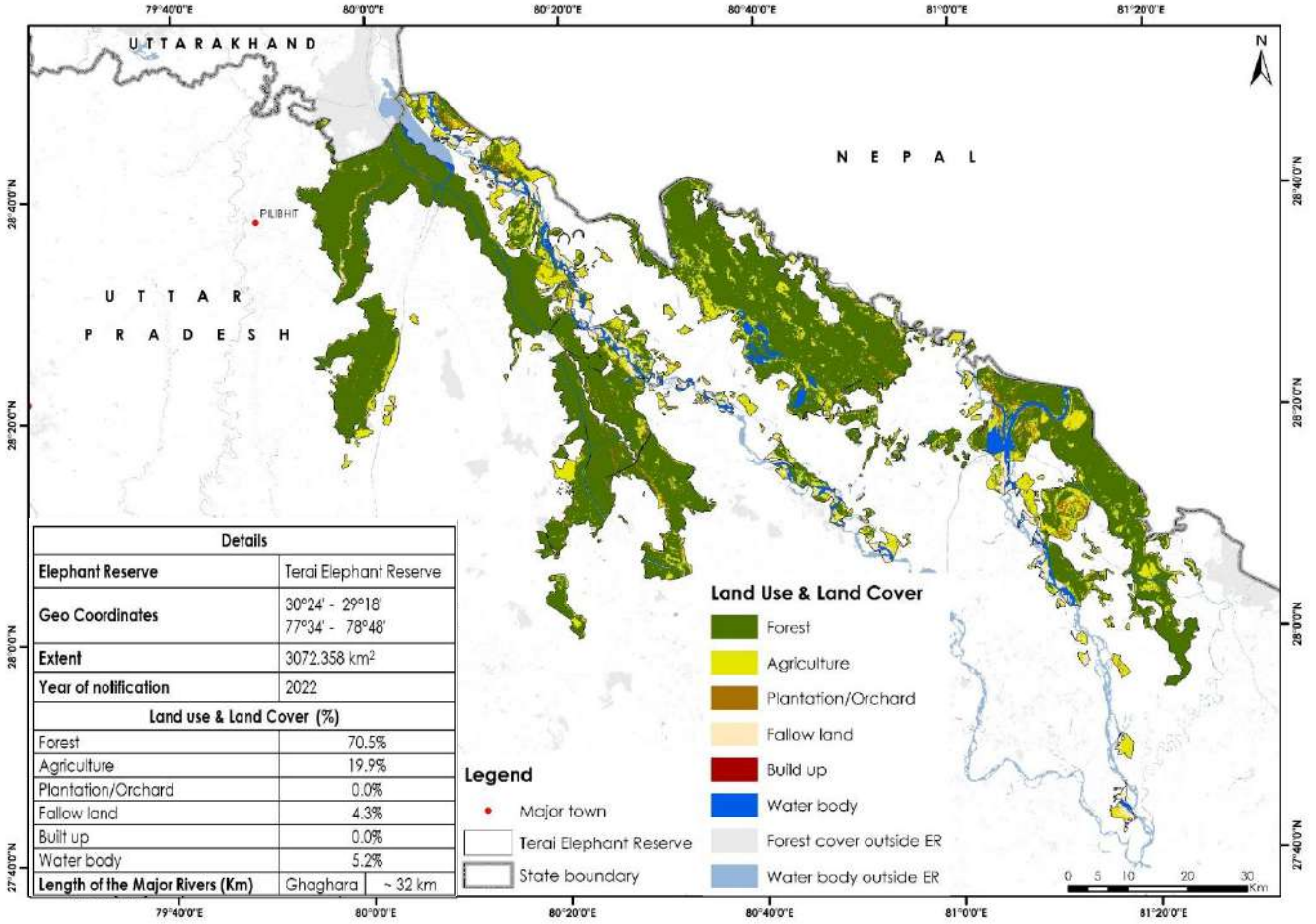


Elevation (Meter)	213m – 919m MSL	
Slope (Area – %)	Level (< 10°)	83.3 %
	Undulating (10° - 35°)	16.4 %
	Steep (>35°)	0.3 %

Figure 59: 3-Dimensional view of Uttar Pradesh Elephant Reserve

UTTAR PRADESH – TERAI ELEPHANT RESERVE

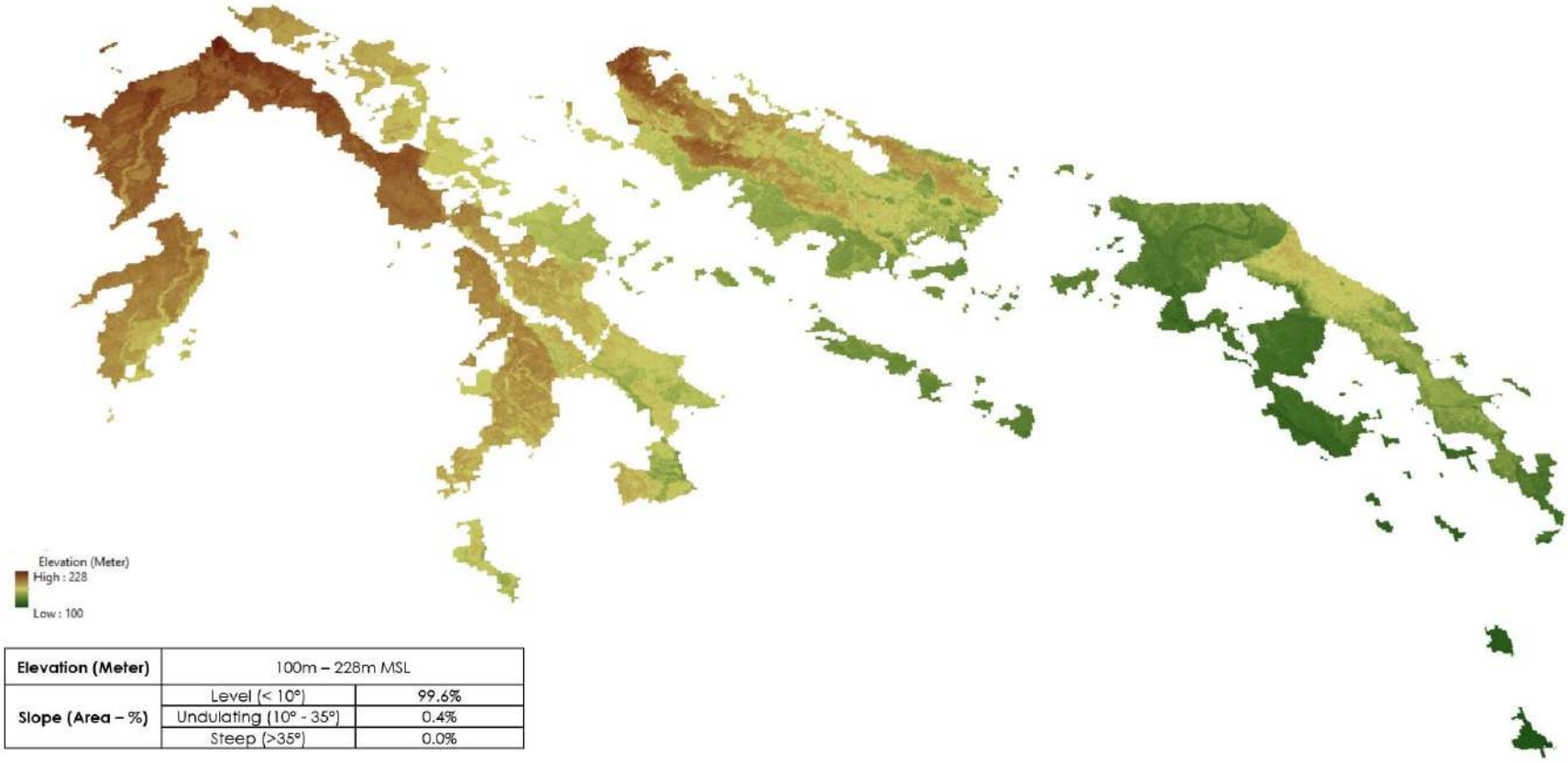




Details	
Elephant Reserve	Terai Elephant Reserve
Geo Coordinates	30°24' - 29°18' 77°34' - 78°48'
Extent	3072.358 km^2
Year of notification	2022
Land use & Land Cover (%)	
Forest	70.5%
Agriculture	19.9%
Plantation/Orchard	0.0%
Fallow land	4.3%
Built up	0.0%
Water body	5.2%
Length of the Major Rivers (Km)	Ghaghara ~ 32 km

Disclaimer: The geospatial layer of Terai Elephant Reserve was generated using gazette notification

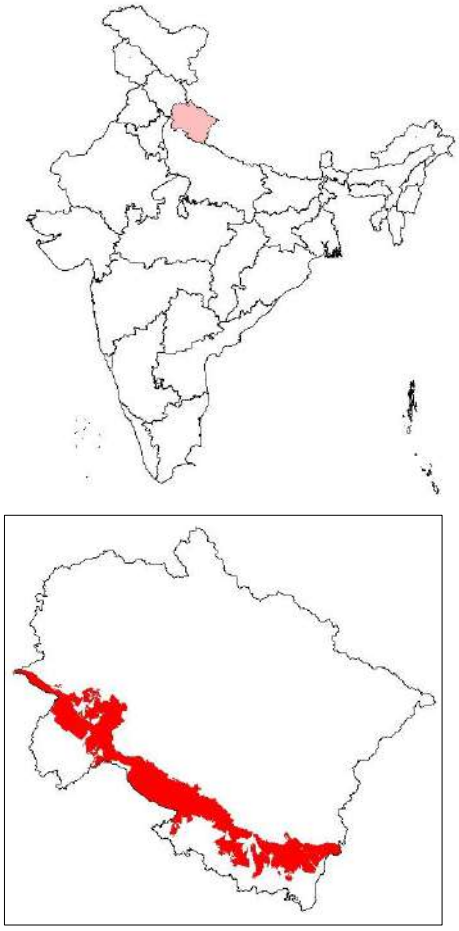
Figure 60: Land use & Land cover Map of Terai Elephant Reserve

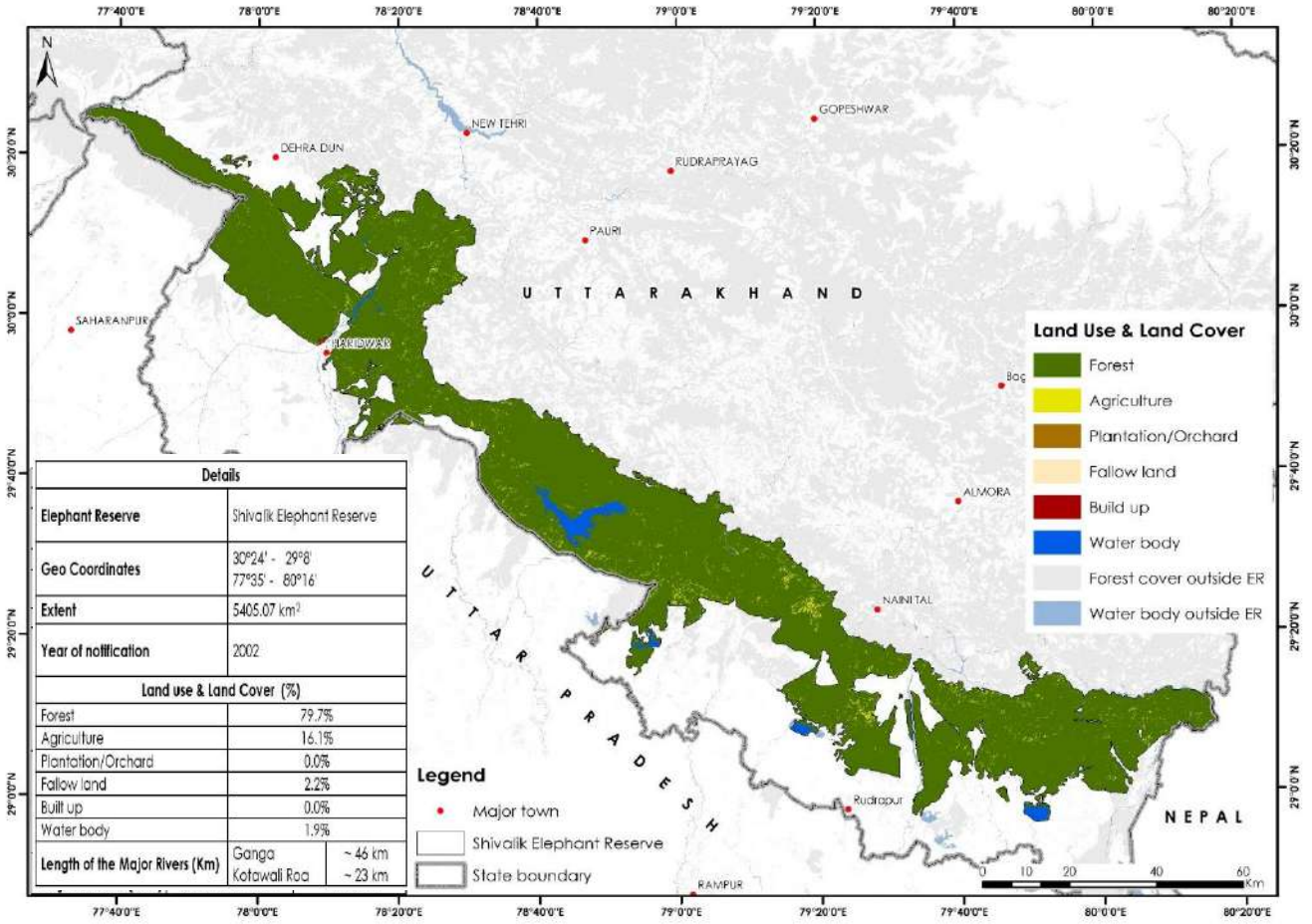


Elevation (Meter)	100m – 228m MSL	
Slope (Area – %)	Level (< 10°)	99.6%
	Undulating (10° - 35°)	0.4%
	Steep (>35°)	0.0%

Figure 61: 3-Dimensional view of Terai Elephant Reserve

UTTARAKHAND – SHIVALIK ELEPHANT RESERVE

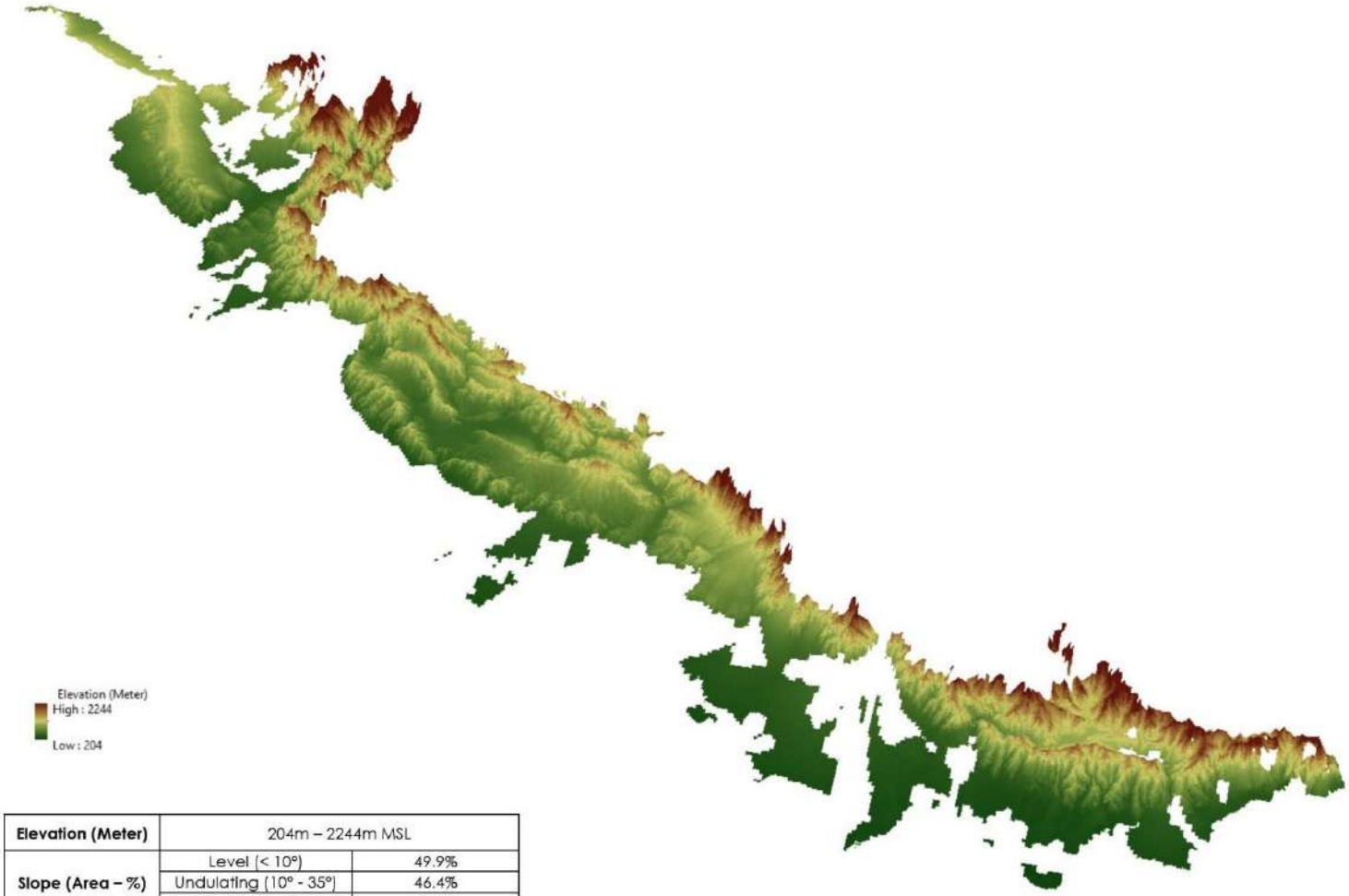




Details		
Elephant Reserve	Shivalik Elephant Reserve	
Geo Coordinates	30°24' - 29°8' 77°35' - 80°16'	
Extent	5405.07 km²	
Year of notification	2002	
Land use & Land Cover (%)		
Forest	79.7%	
Agriculture	16.1%	
Plantation/Orchard	0.0%	
Fallow land	2.2%	
Built up	0.0%	
Water body	1.9%	
Length of the Major Rivers (Km)	Ganga	~ 46 km
	Kotawali Roa	~ 23 km

Disclaimer: The geospatial layer of Shivalik Elephant Reserve was generated using gazette notification

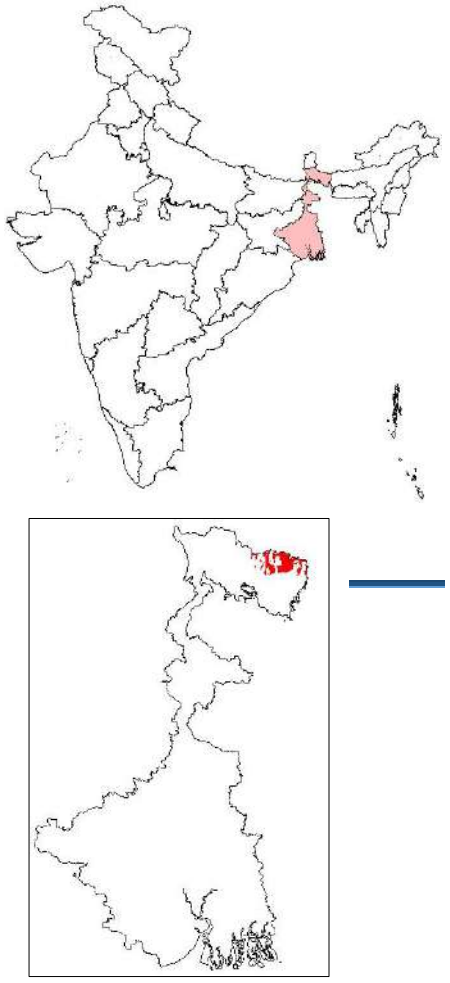
Figure 62: Land use & Land cover Map of Shivalik Elephant Reserve

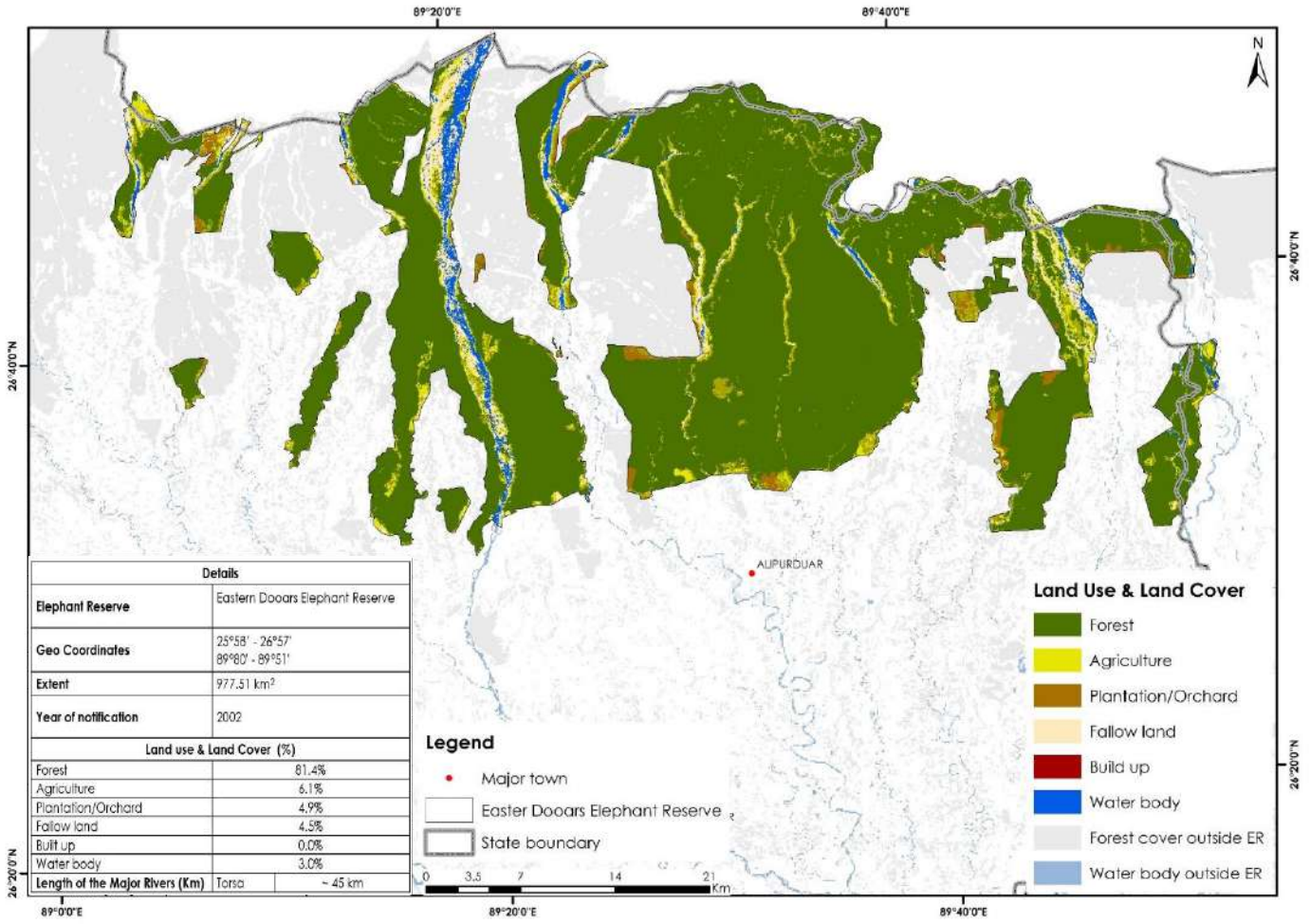


Elevation (Meter)	204m – 2244m MSL	
Slope (Area – %)	Level (< 10°)	49.9%
	Undulating (10° - 35°)	46.4%
	Steep (>35°)	3.7%

Figure 63: 3-Dimensional view of Shivalik Elephant Reserve

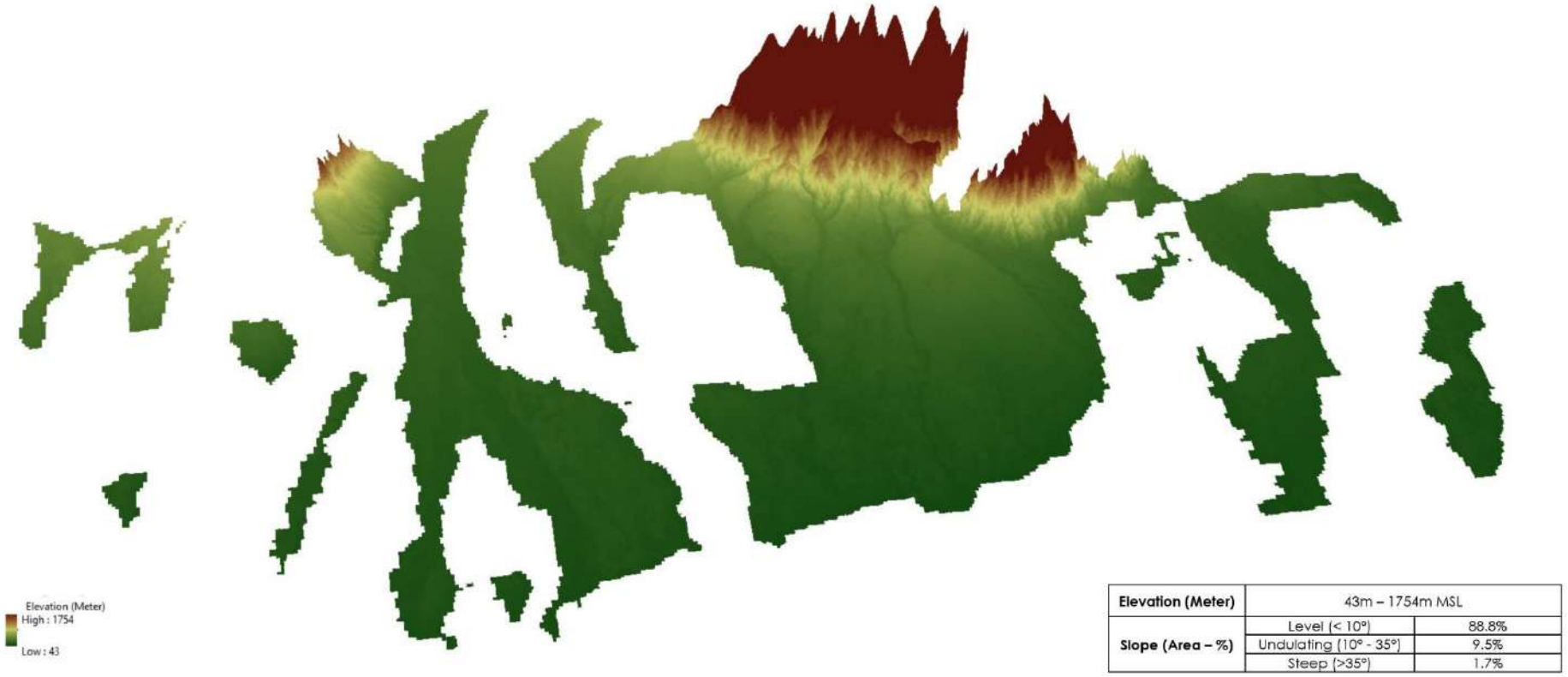
WEST BENGAL – EASTERN DOOARS ELEPHANT RESERVE





Details		
Elephant Reserve	Eastern Dooars Elephant Reserve	
Geo Coordinates	25°58' - 26°57' 89°80' - 89°51'	
Extent	977.51 km²	
Year of notification	2002	
Land use & Land Cover (%)		
Forest	81.4%	
Agriculture	6.1%	
Plantation/Orchard	4.9%	
Fallow land	4.5%	
Built up	0.0%	
Water body	3.0%	
Length of the Major Rivers (Km)	Torsa	~ 45 km

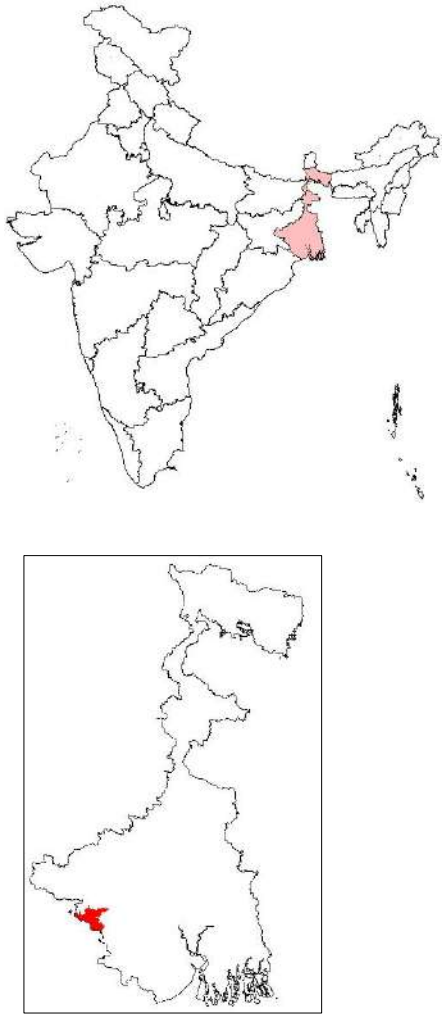
Figure 64: Land use & Land cover Map of Eastern Dooars Elephant Reserve



Elevation (Meter)	43m – 1754m MSL	
Slope (Area – %)	Level (< 10°)	88.8%
	Undulating (10° - 35°)	9.5%
	Steep (>35°)	1.7%

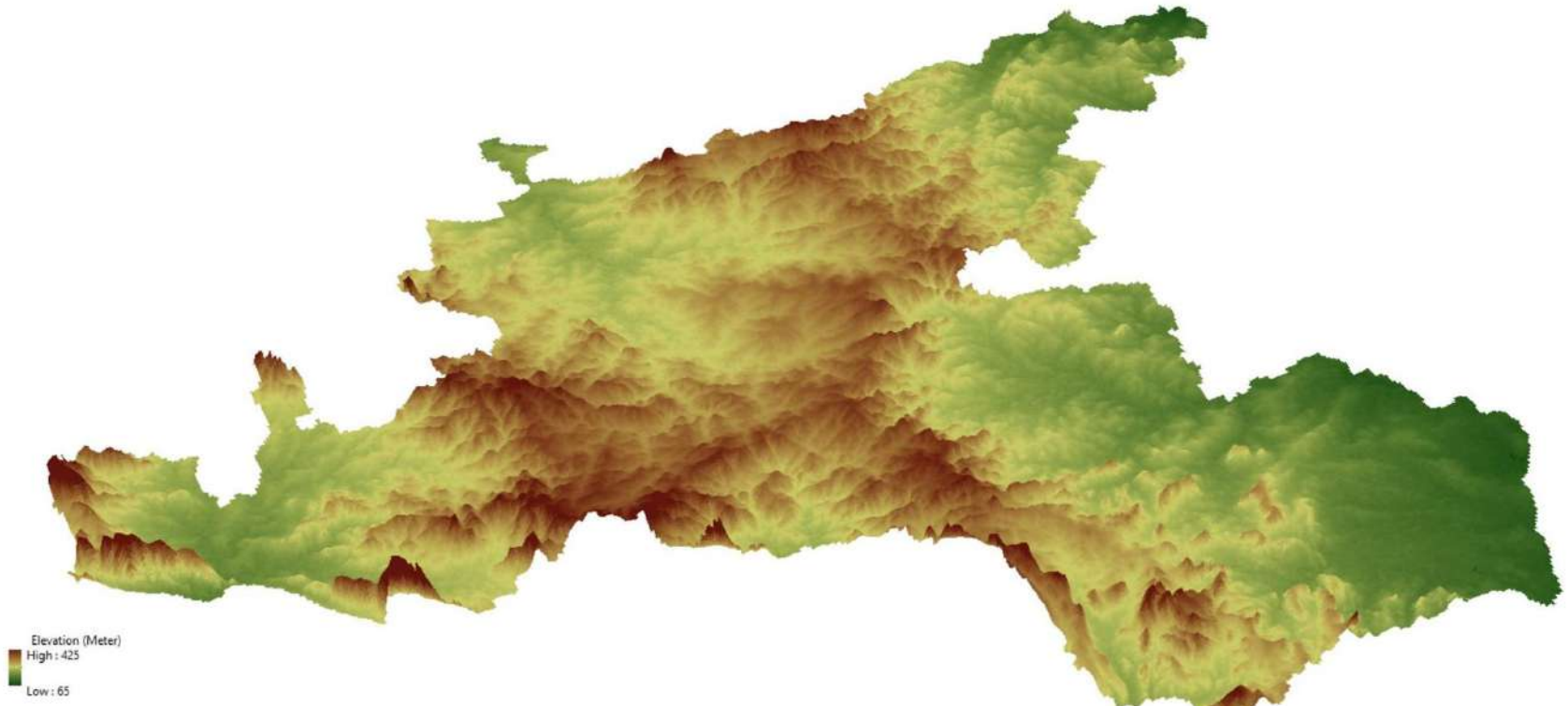
Figure 65: 3-Dimensional view of Eastern Dooars Elephant Reserve

WEST BENGAL – MAYURJHARNA ELEPHANT RESERVE



Details	
Elephant Reserve	Mayurjharna Elephant Reserve
Geo Coordinates	23°27' - 22°23' 86°27' - 87°32'
Extent	414 km^2
Year of notification	2002
Land use & Land Cover (%)	
Forest	51.9%
Agriculture	43.5%
Plantation/Orchard	0.0%
Fallow land	4.1%
Built up	0.4%
Water body	0.1%

Figure 66: Land use & Land cover Map of Mayurjharna Elephant Reserve



Elevation (Meter)	65m – 425m MSL	
Slope (Area – %)	Level (< 10°)	92.5%
	Undulating (10° - 35°)	7.5%
	Steep (>35°)	0.0%

Figure 67: 3-Dimensional view of Mayurjharna Elephant Reserve

SUMMARY

Information on land cover is fundamental for any management plan. With rapid advancement in remote sensing, high-resolution spatial information is readily available for making useful land use classifications. During the last few years, the Project Elephant has placed renewed impetus towards harmonizing Elephant Reserve management in the country. Plans are afoot to prepare Elephant Conservation Plan (ECP) for effective management of the Elephant Reserves. Thus, it is pertinent to periodically carry out periodic land cover and land use classification of the Elephant Reserves so that information remains up-to-date. The objective of the report was to provide a broad picture on the existing land use and land cover information within the Elephant Reserves using readily available thematic maps. Some of the salient features of the land cover assessment carried for ERs have been detailed below:

1. Biogeographic Regions

The 33 Elephant Reserves occurring in 14 Indian states represent 6 major biogeographic regions of India (Figure-1). The Western Ghats region has the highest number of Elephant Reserves (n=11) followed by the North-East region (n=8) and the Deccan Peninsula (n=8) (Figure - 68).

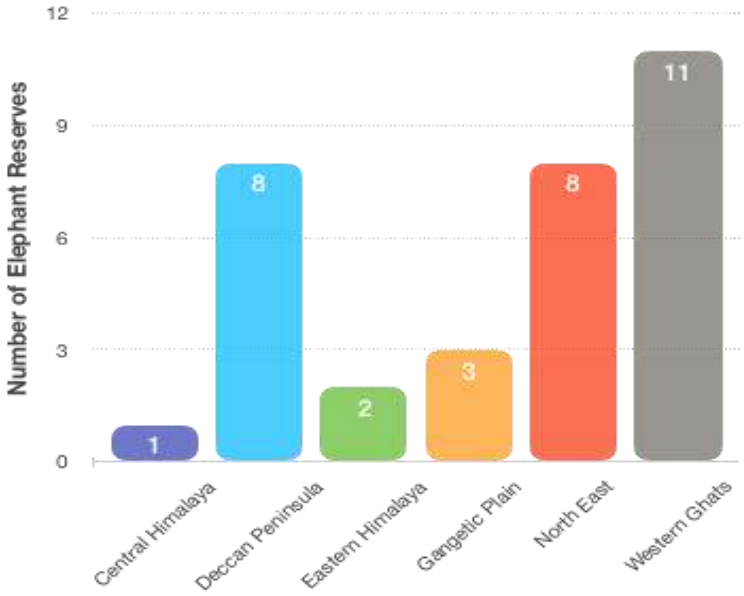


Figure 68: Elephant Reserves occurring in the major biogeographic regions of India

2. Land cover within ER

Across all ERs, the forest cover was around 82% and the rest were non-forests with predominance of agriculture. Among the four elephant-bearing regions, the ERs occurring in the east-central region have 62.6% of the ER area under forest cover, which is substantially less than the other regions (Table-3).

The Singhbhum ER in Jharkhand spanning 13,440 km^2 has only 39.4% under forest cover, while rest of the area comprise other land-uses.

The Sonitpur ER in Assam also has a low 41.6% of ER area under forest cover.

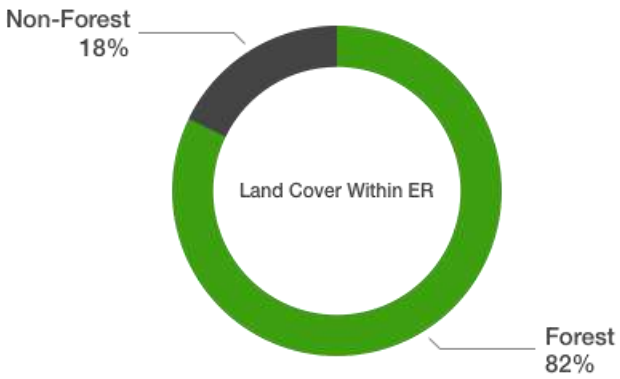


Figure 69: Percentage of forest cover within the Elephant Reserves

Table-3 Region-specific forest cover within ERs in India

S.No	Region	Elephant Reserves	ER Area	Forest Cover	Percent Forest Cover
1	North-west	6	12622.3	11727.3	92.9
2	North-east	8	16119.0	14085.4	87.3
3	East-central	7	21671.1	13566.3	62.6
4	Southern	12	30364.4	27899.3	91.8

3. Forest Types within ER

The Forest Survey of India (FSI) classifies Indian forests into four major types based on the crown density namely 1) very dense forests (crown density > 70%), moderately dense forests (crown density 40 to 70%), open forests (crown density 10 to 40%) and scrub (crown density < 10%). Within ERs, more than 50% of the forest cover pertains to the moderately dense forests. Very dense forests, which may correspond to evergreen vegetation constitutes 23.2% of the forest cover within ER, while the open forests constitute 25.8% of the total forest cover

occurring in the ER (Fig-70). Scrub vegetation within the ERs is relatively negligible.

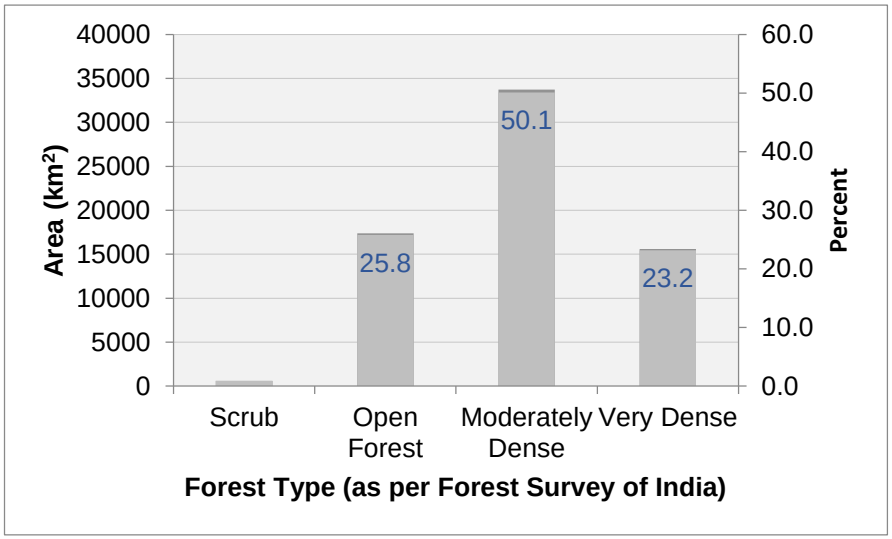


Figure 70: Forest type as per the Forest Survey of India classification

4. Gradient within ERs

Gradient within the ERs were classified into three types namely (i) <10° slope (ii) >10 and less than 35° slope, and (iii) > 35° slopes. From elephants' point of view, areas with <10° slope constitutes a relatively flat terrain and thus, would be wholly available for them. Areas occurring in the gradient above 10°, but below 35° would be hilly and rugged, which elephants may use except select steep sections. Elephant use of such habitats in this gradient would be conditional on surface water availability and its effect on vegetation. Areas of ER having a steep gradient of 35° and above may not be available for elephants at all. Some of these steep gradients may even serve as tacit barriers for elephants within the ER precluding use of considerable habitats.

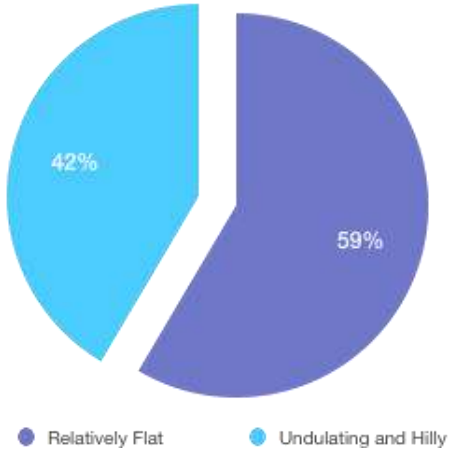


Figure 71: Percentage of gradient within the Elephant Reserves

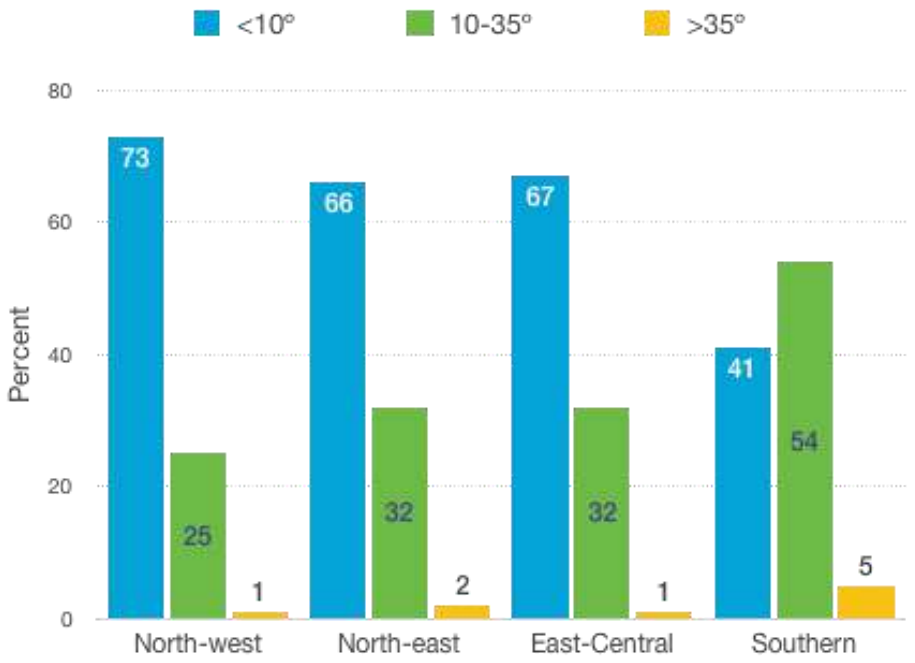


Figure 72: Gradient (measured in the degree of slope) occurring within ERs across four elephant-bearing regions

Overall, about 42% of the terrain within ERs is undulating and hilly. In this, about 2.6% of the areas have a steep gradient with slopes exceeding 35°. Almost 5% of the areas occurring in the Western Ghats and 3% of the areas in the North-East Hills have steep slopes. Among the ER, Kameng and South Arunachal ERs in Arunachal Pradesh; Srivilliputtur, Agasthiyamalai, Anamalai, and Coimbatore ERs in Tamil Nadu; Nilambur, Wayanad and Anamudi ERs in Kerala, and Shivalik ER in Uttarakhand are relatively mountainous with steep slopes.

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Sources (Gazette notification)

1. Government of Andhra Pradesh gazette notification, vide G.O.Ms.No.106 dated 09/02/2003 "Declaration of Rayala Elephant Reserve"
2. Government of Arunachal Pradesh gazette notification, vide No. CWL/D/7/2001/2868-2943 dated 19/06/2006 "Declaration of Kameng Elephant Reserve"
3. Government of Arunachal Pradesh gazette notification, vide No. CWL/D/21(14)06/07/517-67 dated 29/02/2008 "Declaration of South Arunachal Elephant Reserve"
4. Government of Assam gazette notification, vide No. FRW - 44/2002/47 dated 06/03/2003 "Declaration of Chirang-Ripu Elephant Reserve"
5. Government of Assam gazette notification, vide No. FRW - 44/2002/70 dated 19/04/2003 "Declaration of Dhansiri-Lungding Elephant Reserve"
6. Government of Assam gazette notification, vide No. FRW - 44/2002/67 dated 17/04/2003 "Declaration of Dihing-Patkai Elephant Reserve"
7. Government of Assam gazette notification, vide No. FRW - 44/2002/64 dated 17/04/2003 "Declaration of Kaziranga-Karbi Anglong Elephant Reserve"
8. Government of Assam gazette notification, vide No. FRW - 44/2002/46 dated 07/03/2003 "Declaration of Sonitpur Elephant Reserve"
9. Government of Chhattisgarh gazette notification, vide No. F 8-6/2007/10-2 dated 15/09/2011 "Declaration of Sarguja-Jashpur Elephant Reserve"
10. Government of Chhattisgarh gazette notification, vide No. F 8-6/2007/10-2 dated 07/10/2021 "Declaration of Lemru Elephant Reserve"
11. Government of Jharkhand gazette notification, vide No. 33/200-3640 dated 26/09/2001 "Declaration of Singhbhum Elephant Reserve"
12. Government of Karnataka gazette notification, vide No. FEE 362 FWL 2014 dated 26/03/2015 "Declaration of Dandeli Elephant Reserve"
13. Government of Karnataka gazette notification, vide No. FEE 231 FWL 2000 dated 25/11/2002 "Declaration of Mysuru Elephant Reserve"
14. Government of Karnataka gazette notification, vide No. FEE 202 FWL 2014 dated 26/03/2015 "Extension of Mysuru Elephant Reserve"
15. Government of Kerala gazette notification, vide G.O(P) No: 19/2002/F&WLD dated 02/04/2002

"Declaration of Wayanad, Nilambur, Anamudi and Periyar Elephant Reserve"

16. Government of Meghalaya gazette notification, vide No. FOR.132/2000/97 dated 31/10/2001 "Declaration of Garo Hills Elephant Reserve"
17. Government of Nagaland gazette notification, vide No. FOR/GEN-5/2001 dated 28/02/2005 "Declaration of Intanki Elephant Reserve"
18. Government of Nagaland gazette notification, vide No. FOR/GEN-16/2016 dated 16/08/2018 "Declaration of Singphan Elephant Reserve"
19. Government of Odisha gazette notification, vide No.8F(W) 17/02.10162/F&E dated 19/06/2002 "Declaration of Mahanadi Elephant Reserve"
20. Government of Odisha gazette notification, vide No.8F(W)-42/2001 15806/F&E dated 29/07/2001 "Declaration of Mayurbhanj Elephant Reserve"
21. Government of Odisha gazette notification, vide No.8F(W)10/2002.5840/F&E dated 27/03/2002 "Declaration of Sambalpur Elephant Reserve"
22. Government of Tamil Nadu gazette notification, vide G.O.(Ms) No.151 dated 19/09/2003 Notification – I "Declaration of Nilgiri Elephant Reserve", Notification – II "Declaration of Nilambur Elephant Reserve", Notification – III "Declaration of
23. Periyar Srivilliputhur Elephant Reserve", Notification – IV "Declaration of Anamalai Elephant Reserve".
24. Government of Tamil Nadu gazette notification, vide G.O.(Ms) No.135 dated 10/08/2023 "Declaration of Agasthyamalai Elephant Reserve",
25. Government of Uttar Pradesh gazette notification, vide No.1496(1)/14-4-2009-802/2004 dated 09/09/2009 "Declaration of Uttar Pradesh Elephant Reserve"
26. Government of Uttar Pradesh gazette notification, vide No.823/81-4-2022 dated 29/12/2022 "Declaration of Terai Elephant Reserve"
27. Government of Uttarakhand gazette notification, vide No. 1777/1(2)/V.A. P/2002-19(2)/2002 dated 20/10/2002 "Declaration of Shivalik Elephant Reserve"
28. Government of West Bengal gazette notification, vide No.3293-For.11B-19/2000 dated 28/08/2002 "Declaration of Eastern Dooars Elephant Reserve"
29. Government of West Bengal gazette notification, vide No.8F(W)10/2002.5840/F&E dated 27/03/2002 "Declaration of Mayurjharna Elephant Reserve.

Project Elephant,
Ministry of Environment, Forest & Climate Change
6th Floor, Jal Block,
Indira Paryavaran Bhawan, Jor Bagh Road,
New Delhi 110003.

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Director
Wildlife Institute of India
Post Box No# 18, Chandrabani
Dehradun, 248001, Uttarakhand,
Email: wii@wii.gov.in