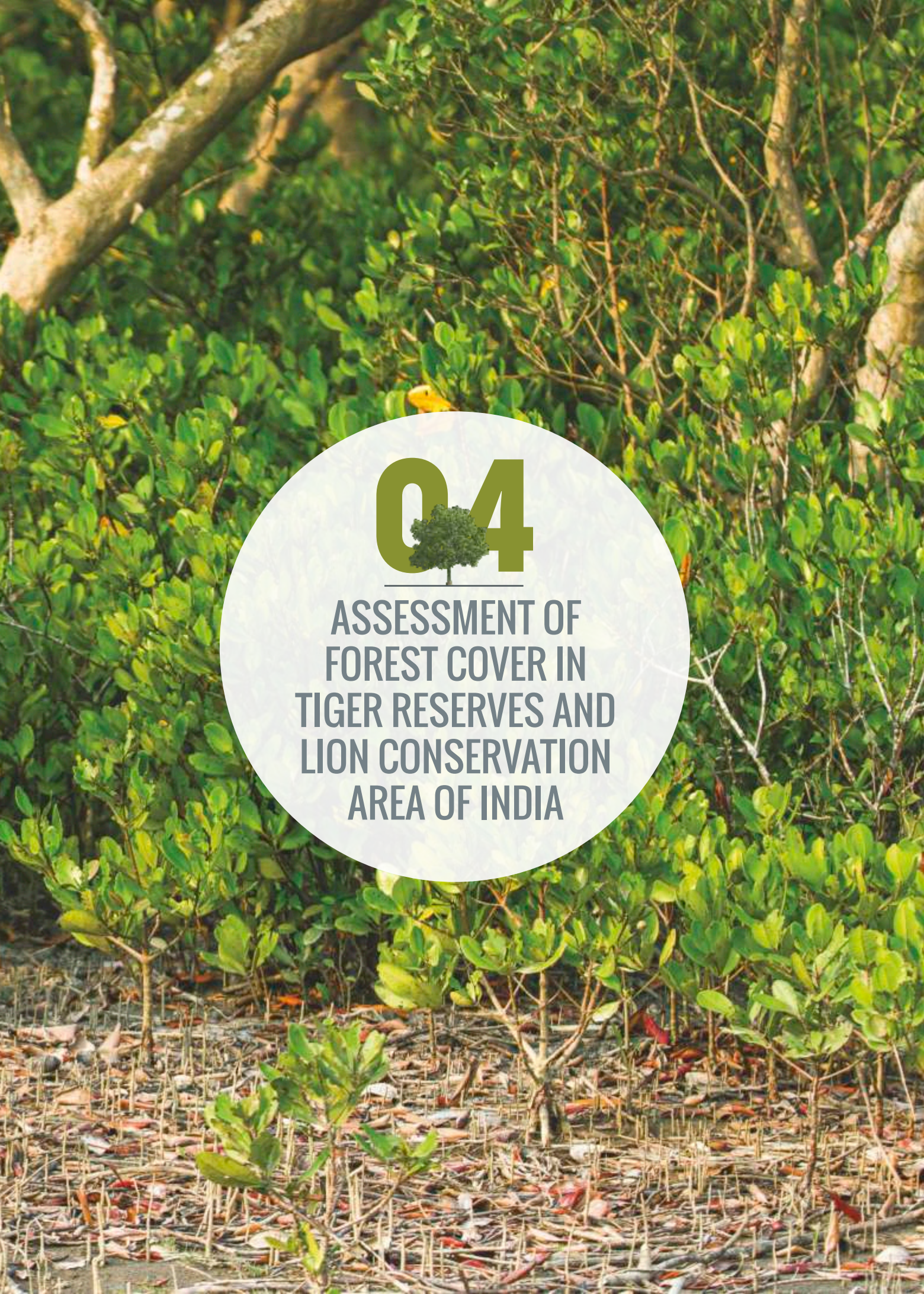


04

ASSESSMENT OF FOREST COVER IN TIGER RESERVES AND LION CONSERVATION AREA OF INDIA

Introduction 4.1

The Royal Bengal Tiger (*Panthera tigris*) is one of the most charismatic carnivores in the Indian subcontinent inhabiting a wide variety of ecosystems including high mountains, mangrove swamps, grasslands, dry and moist deciduous forests, evergreen forests etc. It is considered as an umbrella species whose conservation indirectly protects many other species at the ecosystem and landscape level. It is an "Endangered species" on the International Union for Conservation of Nature (IUCN) Red List. The Royal Bengal Tiger was declared the national animal of India in April, 1973. The Tigers in India account for 70% of the world's total Tiger population (3,890) followed by Russia and Indonesia[1]. India is party to the TX2 agreement of World Wildlife Fund (WWF) which is a global commitment to double the world's wild Tigers by 2022, in thirteen Tiger range countries (i.e. India, Nepal, Bhutan, Bangladesh, Myanmar, Russia, China, Malaysia, Thailand, Cambodia, Lao PDR, Vietnam and Indonesia).

The Asiatic Lion (*Panthera leo persica*) is an equally charismatic carnivore in India, with natural and cultural values attributed to it. The Lion was widely spread over India earlier but now its natural habitat is restricted only to Gir area of Gujarat. It is listed as "Endangered species" on the IUCN Red List because of its small population size and area of occupancy. Section 4.8 of this chapter covers the status of forest cover of this habitat.

Anthropogenic activities leading to loss of habitat, hunting of prey animals and poaching led to a decline in the Tiger population and by early 1970s, less than 2,000 Tigers were estimated to be left in the wild. Thereafter, a Tiger Task Force was set up by the Indian Board for Wildlife (IBWL) to suggest conservation measures for saving the Tiger from extinction. On the recommendation of this task force, the 'Tiger Protection Program', popularly known as Project Tiger, was launched on April 1, 1973 with the aim of restoring Tiger habitats and to ensure the maintenance of a viable population of Tigers. The Wildlife Protection Act (1972) was amended in December, 2006 to provide for the constitution of the National Tiger Conservation Authority (NTCA), with the task of laying down guidelines for Tiger conservation in the Tiger reserves, apart from National Parks and Sanctuaries and to steer the future path for Tiger conservation.

Periodic Tiger estimation or census exercises are carried out to assess the status of Tiger population, which reflects the conservation efforts of a country. In India, the first Tiger census was conducted in the year 2006 by NTCA in collaboration with the State Forest Departments, NGOs working on Tiger conservation and Wildlife Institute of India (WII). The results of the first census were presented in the report titled "Status of Tigers, Co-predators, Prey and their Habitat -2006" and since then Tiger census is carried out at four year interval. The latest and the fourth cycle of Tiger census was undertaken during 2018-2019. From the first assessment to the latest one, there has been an estimated increase in India's Tiger population from 1,411 to 2,967.

[1]Global Wild Tiger Status 2016, World Wildlife Fund and Global Tiger Forum

4.2 Tiger Reserves of India

The Wildlife Protection Act, 1972 (2006 amendment) provides for the declaration of an area as Tiger Reserve for the in-situ conservation of Tigers. A Tiger reserve comprises of a core area, which is kept as inviolate for the purpose of Tiger conservation and the peripheral area constitutes the buffer, which is a multiple-use area, with preference to conservation over other land uses, thereby maintaining an equilibrium between wildlife and human activities for the purpose of livelihood, developmental, social and cultural rights of the local people.

Tigers in India are found in different ecological landscapes, each having unique geographical characteristics. The Tiger Reserves fall in eighteen states of the country, categorized into five landscapes, covering an area of 73,972.50 sq km. Ramgarh Vishdhari Tiger Reserve (RVTR) situated in Bundi district of Rajasthan, is the latest and fifty-second Tiger Reserve in the country and was declared so on July 5, 2021. According to Tiger Census, 2018, currently Tiger population within Tiger Reserves is 1,923, which is 65% of the total Tiger population of India. The notified area of Tiger Reserves and their constituent core and buffer areas with estimated Tiger population, estimated Tiger density (per 100 sq km) as per Tiger Census 2018 are given in Table 4.1

Table 4.1 Estimated number of Tigers in Tiger Reserves in India as per Tiger Census, 2018

Sl. No	Ecological Landscape	Name of Tiger Reserve	State	Notified Area (sq km)*			No of Tigers**	Estimated Tiger Density** (per 100 sq km)
				Core Zone	Buffer Zone	Total		
1	Shivalik Hills and Gangetic Plains Landscape	Corbett	Uttarakhand and UP	821.99	546.92	1,368.91	231	14.00
		Dudhwa	Uttar Pradesh	1,093.79	1,107.98	2,201.77	82	3.70
		Pilibhit	Uttar Pradesh	602.79	127.45	730.24	57	6.60
		Rajaji	Uttarakhand	819.54	255.63	1,075.17	38	8.00
		Valmiki	Bihar	598.45	300.93	899.38	32	2.50
2	Central India and Eastern Ghats Landscape	Achanakmar	Chhattisgarh	626.19	287.82	914.01	5	0.46
		Amrabad	Telangana	2,166.37	445.02	2,611.39	7	0.19
		Bandhavgarh	Madhya Pradesh	716.90	820.03	1,536.93	104	5.83
		Bor	Maharashtra	138.12	678.15	816.27	6	0.60
		Indravati	Chhattisgarh	1,258.37	1,540.70	2,799.07	3	-
		Kanha	Madhya Pradesh	917.43	1,134.36	2,051.79	88	4.40
		Kawal	Telangana	892.23	1,123.21	2,015.44	1	-
		Melghat	Maharashtra	1,500.49	1,268.03	2,768.52	46	1.49
		Mukundara Hills	Rajasthan	417.17	342.82	759.99	1	-
		Nagarjunasagar Srisailam	Andhra Pradesh	2,595.72	700.59	3,296.31	38	0.91
		Nawegaon Nagzira	Maharashtra	653.67	1241.27	1,894.94	6	0.49
		Palamau	Jharkhand	414.08	715.85	1,129.93	0	-
		Panna	Madhya Pradesh	576.13	1,021.97	1,598.10	25	1.41
		Pench	Madhya Pradesh	411.33	768.30	1,179.63	61	5.50
		Pench - MH	Maharashtra	257.26	483.96	741.22	53	4.64
		Ramgarh Vishdhari***	Rajasthan		307.00		-	-
		Ranthambore	Rajasthan	1,113.36	297.92	1,411.28	53	9.60
		Sahyadri	Maharashtra	600.12	565.45	1,165.57	3	-
		Sanjay Dubri	Madhya Pradesh	812.57	861.93	1,674.50	5	0.23

Sl. No.	Ecological Landscape	Name of Tiger Reserve	State	Notified Area (sq km)*			No of Tigers**	Estimated Tiger Density** (per 100 sq km)
				Core Zone	Buffer Zone	Total		
		Sariska	Rajasthan	881.11	332.23	1,213.34	11	-
		Satkosia	Odisha	523.61	440.26	963.87	1	-
		Satpura	Madhya Pradesh	1,339.26	794.04	2,133.30	40	1.39
		Simlipal	Odisha	1,194.75	1,555.25	2,750.00	8	1.02
		Tadoba Andhari	Maharashtra	625.82	1,101.77	1,727.59	83	6.09
		Udanti Sitanadi	Chhattisgarh	851.09	991.45	1,842.54	1	-
3	The Western Ghats Landscape	Anamalai	Tamil Nadu	958.59	521.28	1,479.87	20	1.11
		Bandipur	Karnataka	872.24	584.06	1,456.30	126	7.70
		Bhadra	Karnataka	492.46	571.83	1,064.29	30	2.86
		Biligiri Ranganatha Temple	Karnataka	359.10	215.72	574.82	52	4.96
		Kalakad Mundanthurai	Tamil Nadu	895.00	706.54	1,601.54	7	0.43
		Kali	Karnataka	814.88	282.63	1097.51	4	-
		Mudumalai	Tamil Nadu	321.00	367.59	688.59	103	6.19
		Nagarhole	Karnataka	643.35	562.41	1,205.76	127	11.82
		Parambikulam	Kerala	390.89	252.77	643.66	26	1.95
		Periyar	Kerala	881.00	44.00	925.00	26	1.38
		Sathyamangalam	Tamil Nadu	793.49	614.91	1,408.40	83	3.75
		Srivilliputhur Megamalai***	Tamil Nadu	641.86	374.70	1,016.56	-	-
4	North Eastern Hills and Brahmaputra Flood Plains	Buxa	West Bengal	390.58	367.32	757.90	0	-
		Dampa	Mizoram	500.00	488.00	988.00	0	-
		Kamlang	Arunachal Pradesh	671.00	112.00	783.00	4	-
		Kaziranga	Assam	625.58	548.00	1,173.58	104	13.06
		Manas	Assam	526.22	2,310.88	2,837.10	31	3.30
		Namdapha	Arunachal Pradesh	1,807.82	245.00	2,052.82	11	-
		Nameri	Assam	320.00	44.00	364.00	3	-
		Orang	Assam	79.28	413.18	492.46	21	10.62
		Pakke	Arunachal Pradesh	683.45	515.00	1,198.45	3	-
5	Sundarbans	Sundarbans	West Bengal	1,699.62	885.27	2,584.89	88	3.60
		Total				**73,972.50**		

** NTCA website*
***Tiger Census 2018.*
****Tiger count is not available for the Tiger reserves formed after Tiger Census 2018*
Source: Status of Tigers, Co-predators, Prey and their Habitat 2018

The highest number of Tiger reserves are found in the states of Madhya Pradesh and Maharashtra having six Tiger reserves each. In terms of extent, the largest Tiger reserve is Nagarjunasagar Srisailam in Andhra Pradesh (3,296.31 sq km) followed by Manas in Assam (2,837.10 sq km) and Indravati in Chhattisgarh (2,799.07 sq km). The smallest Tiger reserve is Orang in Assam (492 sq km).

The highest number of Tigers are found in Corbett Tiger Reserve (231) followed by Nagarhole (127) and Bandipur (126), while no Tigers are found in Dampa, Buxa and Palamau Tiger reserves. The Tiger density per 100 sq km is highest in Corbett Tiger Reserve (14), followed by Kaziranga Tiger Reserve (13.06) and Nagarhole Tiger Reserve (11.82). The lowest Tiger density is found in Amrabad Tiger reserve (0.19), followed by Sanjay Dubri (0.23) and a Kalakad Mundanthurai (0.43).

The estimates of Tiger populations and prey populations help us in understanding the ecological relationship between Tigers and its prey population in different Tiger reserves. Tiger Census 2018 has estimated density of prey species in Tiger reserves based on results of line transect based sampling. The estimated individual density of prey species for Tiger reserves are given in Table 4.2.

Table 4.2 Estimated Individual Density of Prey species (per sq km)

Sl. No.	Tiger Reserve	Individual Density of Prey species (per sq km)						
		Barking Deer	Chinkara	Chital	Gaur	Nilgai	Sambar	Wild Pig
1	Achanakmar	1.34	-	12.60	5.53	-	0.64	10.55
2	Amrabad*	-	-	-	-	-	-	-
3	Anamalai	-	-	3.06	0.04	-	1.67	-
4	Bandhavgarh	0.48	1.28	41.36	-	1.91	3.85	5.94
5	Bandipur	8.70	-	51.72	0.84	-	7.27	2.04
6	Bhadra	2.04	-	14.35	3.71	-	8.53	4.67
7	Biligiri Ranganatha Swamy Temple	2.07	-	8.41	1.46	-	6.63	-
8	Bor*	-	-	-	-	-	-	-
9	Buxa	6.41	-	5.74	-	-	-	3.68
10	Corbett	6.33	-	71.31	-	-	11.38	8.50
11	Dampa*	-	-	-	-	-	-	-
12	Dudhwa*	-	-	-	-	-	-	-
13	Indravati*	-	-	-	-	-	-	-
14	Kalakad Mundanthurai	-	-	-	0.02	-	4.55	4.28
15	Kali	0.49	-	1.78	1.79	-	0.70	-
16	Kamlang*	-	-	-	-	-	-	-
17	Kanha	2.57	-	38.14	3.87	-	6.95	4.88
18	Kawal*	-	-	-	-	-	-	-
19	Kaziranga*	-	-	-	-	-	-	-
20	Manas*	-	-	-	-	-	-	-
21	Melghat	1.76	-	-	2.03	1.73	2.55	-
22	Mudumalai	-	-	46.49	2.61	-	3.21	-
23	Mukundara Hills	-	2.05	-		3.59	-	-
24	Nagarhole	4.93	-	24.13	1.86	-	4.77	3.46
25	Nagarjunasagar Srisailam*	-	-	-	-	-	-	-
26	Namdapha*	-	-	-	-	-	-	-
27	Nameri*	-	-	-	-	-	3.54	-
28	Nawegaon Nagzira	-	-	5.16	7.47	4.24	2.81	-
29	Orang*	-	-	-	-	-	-	-
30	Pakke*	-	-	-	-	-	-	-
31	Palamau	0.78	-	1.33	-	-	-	2.84
32	Panna	-	1.45	13.78	-	11.96	4.97	6.20
33	Parambikulam	-	-	-	0.04	-	6.56	-
34	Pench	0.59	-	65.75	4.35	4.19	7.68	12.34
35	Pench - MH	-	-	20.87	-	3.37	5.41	7.15
36	Periyar	-	-	-	0.10	-	5.07	-
37	Pilibhit	-	-	40.71	-	12.78	-	12.43
38	Rajaji	1.91	-	66.03	-	4.18	18.06	7.38
39	Ramgarh Vishdhari**	-	-	-	-	-	-	-
40	Ranthambore	-	2.04	21.62	-	9.37	13.95	-
41	Sahyadri	3.98	-	-	8.07	-	3.22	-
42	Sanjay Dubri	-	6.85	9.67	-	10.08	-	3.17
43	Sariska	-	-	14.35	-	25.54	18.95	18.11
44	Sathyamangalam	-	-	39.66	9.81	-	8.97	6.32
45	Satkosia	8.63	-	14.06	-	-	4.94	4.17

Sl. No.	Tiger Reserve	Individual Density of Prey species (per sq km)						
		Barking Deer	Chinkara	Chital	Gaur	Nilgai	Sambar	Wild Pig
46	Satpura	2.49	-	4.24	6.84	2.56	6.48	11.41
47	Simlipal	-	-	7.41	-	-	11.24	6.16
48	Srivilliputhur Megamalai**	-	-	-	-	-	-	-
49	Sundarbans	-	-	3.65	-	-	-	1.09
50	Tadoba Andhari	-	-	14.37	3.18	3.08	3.23	7.57
51	Udanti Sitanadi	0.62	-	-	-	-	-	-
52	Valmiki*	-	-	-	-	-	-	-

**Data not available in Tiger Census, 2018*
***Data not available for the Tiger reserves formed after Tiger Census 2018*
Source: Status of Tigers, Co-predators, Prey and their Habitat 2018

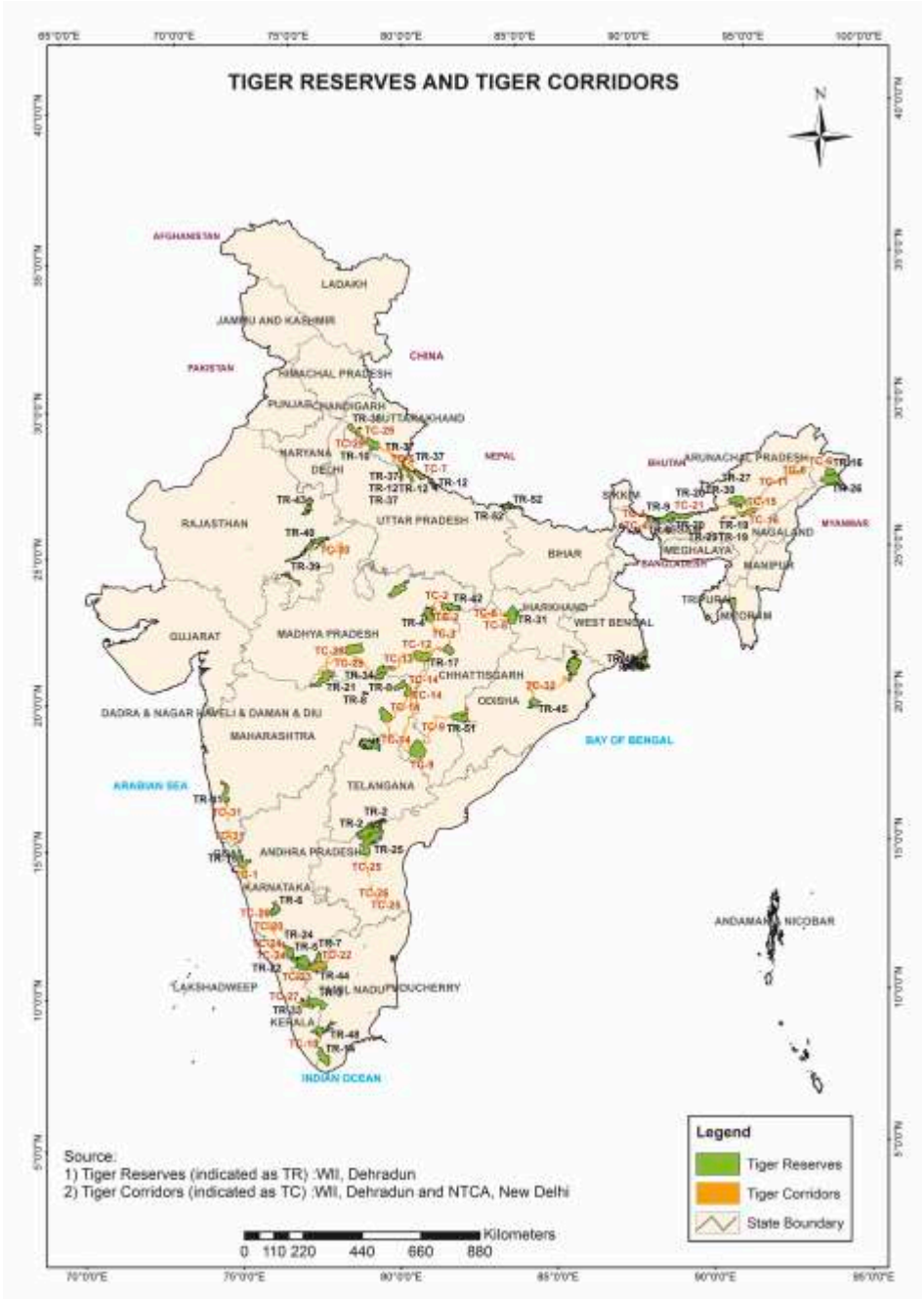


Figure 4.1
Tiger Reserves and Tiger Corridors of India

LIST OF TIGER RESERVES

TR-1	Achanakmar	TR-19	Kaziranga	TR-37	Pilibhit
TR-2	Amrabad	TR-20	Manas	TR-38	Rajaji
TR-3	Anamalai	TR-21	Melghat	TR-39	Ramgarh Vishdhari
TR-4	Bandhavgarh	TR-22	Mudumalai	TR-40	Ranthambore
TR-5	Bandipur	TR-23	Mukundara Hills	TR-41	Sahyadri
TR-6	Bhadra	TR-24	Nagarahole	TR-42	Sanjay-Dubri
TR-7	Biligiri Ranganatha Temple	TR-25	Nagarjunasagar Srisailam	TR-43	Sariska
TR-8	Bor	TR-26	Namdapha	TR-44	Sathyamangalam
TR-9	Buxa	TR-27	Nameri	TR-45	Satkosia
TR-10	Corbett (including Amangarh buffer)	TR-28	Nawegaon Nagzira	TR-46	Satpura
TR-11	Dampa	TR-29	Orang	TR-47	Similipal
TR-12	Dudhwa	TR-30	Pakke	TR-48	Srivilliputhur
TR-13	Indravati	TR-31	Palamau	TR-49	Sundarbans
TR-14	Kalakad-Mundanthurai	TR-32	Panna	TR-50	Tadoba-Andhari
TR-15	Kali Tiger Reserve	TR-33	Parambikulam	TR-51	Udanti-Sitanadi
TR-16	Kamlang_Boundary	TR-34	Pench-MH	TR-52	Valmiki
TR-17	Kanha Tiger Reserve	TR-35	Pench-MP		
TR-18	Kawal	TR-36	Periyar		

LIST OF TIGER CORRIDORS

TC-1	Anshi-Dandeli-Sharavathi Valley	TC-17	Kaziranga-Nameri
TC-2	Bandhavgarh-Sanjay-Dubri-Guru Ghasidas	TC-18	Kaziranga-Orang
TC-3	Bhandhavgarh-Achanakmar	TC-19	Kaziranga-Papumpare
TC-4	Buxa-Jaldapara	TC-20	Kudremukh -Bhadra
TC-5	Corbett-Dudhwa	TC-21	Manas
TC-6	Dibru Saikhowa-D'ering-Mehao	TC-22	Nagarahole-Bandipur-Mudumalai-Wayanad
TC-7	Durga-Kishanpur-Katarniaghat	TC-23	Nagarahole-Mudumalai-Wayanad
TC-8	Guru Ghasi Das- Palamau-Lawalong	TC-24	Nagarahole-Pushpagiri-Talakavery
TC-9	Indravati-Udanti-Sitanadi-Sunebeda	TC-25	Nagarjunsagar -Sri Venkateswara NP
TC-10	Kalakad_Mundanthurai-Periyar	TC-26	Paake-Nameri-Sonai-Rupai-Manas
TC-11	Kane WLS-Tale Valley WLS	TC-27	Parambikulam-Eranikulam-Indira_Gandhi
TC-12	Kanha-Achanakmar	TC-28	Pench-Satpura-Melghat
TC-13	Kanha-Pench	TC-29	Rajaji-Corbett
TC-14	Kanha to Navegoan-Nagzira-Tadoba-Indravati	TC-30	Ranthambore-Kuno-Shivpuri-Madhav
TC-15	Kaziranga-Itanagar WLS	TC-31	Sahyadri-Radhanagri- Goa
TC-16	Kaziranga-Karbi-Anlong	TC-32	Simlipal-Satkosia

Forest Cover Assessment in Tiger Reserves of India 4.3

The distribution of Tigers and their density in the forests vary because of several ecological factors such as forest cover, terrain and natural prey availability and also because of anthropogenic factors like presence of undisturbed habitat and management interventions. The extent of forest cover in Tiger Reserves is an important indicator of the health of the forest ecosystem. The forest cover determines the presence or absence of prey populations. Continuous, undisturbed and non-fragmented landscapes are essential for the survival of Tigers.

The Tiger generally requires habitat that includes forests, scrub, grasslands (part of non-forest in forest cover assessment) and water resources for their survival. An attempt has been made to assess the extent of forest cover in the Tiger reserves of the country. The latest digital boundaries of Tiger Reserves available with Wildlife Institute of India were used for the purpose of forest cover assessment within Tiger reserves. Numerous river streams either originate from the Tiger reserves or have their major catchments in Tiger reserves. Therefore, an assessment of the wetlands (both natural and man-made) within the Tiger reserves has also been made using the digitized boundary of wetlands of India from Space Application Center (SAC), Ahmedabad.

Methodology 4.3.1

The Forest Cover of 2021 assessment (data period 2018-2019), was analyzed within Tiger reserves in three canopy density classes namely, Open Forest (10-40%), Moderately Dense Forest (40-70%) and Very Dense Forest (>70%). Scrub, which is not a part of the forest cover, has also been recorded. The extent of Forest cover in the three density classes within the Tiger reserves for 2021 assessment is given in Table 4.3.

The Tiger reserves occupy an area of approximately 74,710.53 sq km, which is 2.27% of the country's geographical area. The current assessment shows that the forest cover in the Tiger reserves is 55,666.27 sq km, which is 7.80% of the country's total forest cover and 74.51% of the total area of Tiger reserves.

In terms of canopy density classes, the area covered by VDF is 16,444.51 sq km (22.01%), MDF is 26,856.71 sq km (35.95%) and OF is 12,365.05 sq km (16.55%). Scrub occupies a total area of 1,339.58 sq km (1.79%) (Table 4.3).

Table 4.3 Forest Cover in Tiger Reserves (2021)

Class	Area (sq km)	% of Area of Digitized Tiger Reserve Boundary
Very Dense Forest	16,444.51	22.01
Moderately Dense Forest	26,856.71	35.95
Open Forest	12,365.05	16.55
Total Forest Cover	**55,666.27**	**74.51**
Scrub	1,339.58	1.79
Non-Forest	17,704.68	23.70
Total Area of Tiger Reserves	**74,710.53**	**100.00**

The Tiger Reserve wise details of forest cover are given in Table 4.4.

Table 4.4 Forest Cover of Tiger Reserves (2021 assessment) (in sq km)

			2021 Assessment						
Sl. No.	Name of Tiger Reserve	State	Area as per digitized Tiger Reserve Boundary*	VDF	MDF	OF	Total	% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub
1.	Achanakmar	Chhattisgarh	936.34	381.28	487.65	26.53	895.46	95.63	0.94
2.	Amrabad	Telangana	2,684.23	332.38	497.81	950.34	1,780.53	66.33	473.63
3.	Anamalai	Tamil Nadu	1,767.76	309.33	466.63	403.70	1,179.66	66.73	8.36
4.	Bandhavgarh	Madhya Pradesh	1,684.53	291.12	670.27	268.07	1,229.46	72.99	11.90
5.	Bandipur	Karnataka	1,784.47	62.95	459.50	432.78	955.23	53.53	19.76
6.	Bhadra	Karnataka	1,071.24	326.03	445.09	26.42	797.54	74.45	0.25
7.	Biligiri Ranganatha Temple	Karnataka	654.96	21.97	418.15	124.55	564.67	86.21	12.09
8.	Bor	Maharashtra	131.77	15.40	74.97	29.56	119.93	91.01	0.00
9.	Buxa	West Bengal	783.02	329.89	192.86	119.27	642.02	81.99	3.46
10.	Corbett	Uttarakhand & Uttar Pradesh	1,462.66	441.44	693.37	89.87	1,224.68	83.73	2.97
11.	Dampa	Mizoram	821.89	15.06	308.14	433.38	756.58	92.05	0.00
12.	Dudhwa	Uttar Pradesh	1,524.33	727.72	193.24	158.50	1,079.46	70.82	2.67
13.	Indravati	Chhattisgarh	2,922.39	1,167.39	809.78	400.11	2,377.28	81.35	0.50
14.	Kalakad Mundanthurai	Tamil Nadu	1,564.14	461.68	436.45	108.17	1,006.30	64.34	10.40
15.	Kali	Karnataka	1,411.75	273.74	962.33	69.15	1,305.22	92.45	0.12
16.	Kamlang	Arunachal Pradesh	792.03	307.84	302.31	102.86	713.01	90.02	1.26
17.	Kanha	Madhya Pradesh	2,070.63	598.72	714.04	152.72	1,465.48	70.77	1.06
18.	Kawal	Telangana	2,259.79	102.55	1,125.66	478.67	1,706.88	75.53	1.02
19.	Kaziranga	Assam	1,180.35	23.87	109.91	61.67	195.45	16.56	0.76
20.	Manas	Assam	3,030.24	1,086.36	296.27	244.09	1,626.72	53.68	13.56
21.	Melghat	Maharashtra	2,028.47	456.31	965.62	425.05	1,846.98	91.05	0.00
22.	Mudumalai	Tamil Nadu	750.81	143.29	260.98	285.61	689.88	91.88	3.18
23.	Mukundara Hills	Rajasthan	758.40	0.00	144.41	227.50	371.91	49.04	50.75
24.	Nagarhole	Karnataka	1,152.74	177.15	603.12	89.28	869.55	75.43	0.16
25.	Nagarjunasagar Srisailam	Andhra Pradesh	3,843.88	303.93	1,908.65	720.37	2,932.95	76.30	339.07
26.	Namdapha	Arunachal Pradesh	2,085.17	912.65	598.57	360.81	1,872.03	89.78	7.58
27.	Nameri	Assam	371.86	31.35	105.11	41.71	178.17	47.91	0.58
28.	Nawegaon Nagzira	Maharashtra	1,781.22	553.67	446.89	169.82	1,170.38	65.71	2.65

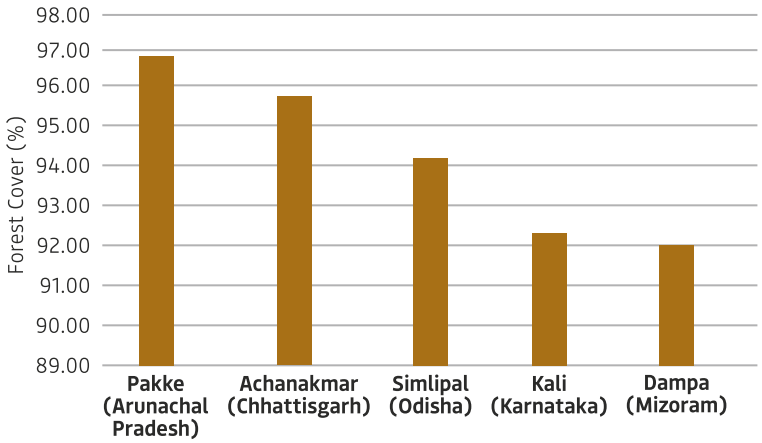
(in sq km)

Sl. No.	Name of Tiger Reserve	State	2021 Assessment: Area as per digitized Tiger Reserve Boundary*	VDF	MDF	OF	Total	% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub
29.	Orang	Assam	80.21	0.00	6.34	11.05	17.39	21.68	0.87
30.	Pakke	Arunachal Pradesh	1,507.71	487.25	751.92	220.82	1,459.99	96.83	2.67
31.	Palamau	Jharkhand	1,980.64	433.33	713.39	292.75	1,439.47	72.68	0.90
32.	Panna	Madhya Pradesh	1,783.48	154.32	643.08	461.75	1,259.15	70.60	66.81
33.	Parambikulam	Kerala	652.21	287.08	246.72	47.78	581.58	89.17	0.00
34.	Pench - MP	Madhya Pradesh	1,168.66	192.98	586.69	49.18	828.85	70.92	2.25
35.	Pench - MH	Maharashtra	738.28	223.87	320.32	65.09	609.28	82.53	0.00
36.	Periyar	Kerala	935.30	176.05	500.51	110.25	786.81	84.12	0.00
37.	Pilibhit	Uttar Pradesh	758.64	416.07	78.90	70.23	565.20	74.50	1.21
38.	Rajaji	Uttarakhand	1,102.41	253.38	563.49	164.22	981.09	89.00	2.36
39.	Ramgarh Vishdhari	Rajasthan	294.67	0.00	75.64	94.89	170.53	57.87	14.73
40.	Ranthambore	Rajasthan	1,765.57	0.00	229.14	572.21	801.35	45.39	169.28
41.	Sahyadri	Maharashtra	1,169.60	75.49	438.51	211.09	725.09	61.99	13.62
42.	Sanjay Dubri	Madhya Pradesh	1,490.33	286.34	630.48	263.34	1,180.16	79.19	0.99
43.	Sariska	Rajasthan	1,145.80	61.12	283.80	420.79	765.71	66.83	37.13
44.	Sathyamangalam	Tamil Nadu	1,581.77	161.23	658.09	540.98	1,360.30	86.00	26.50
45.	Satkosia	Odisha	981.97	184.41	507.82	113.59	805.82	82.06	11.31
46.	Satpura	Madhya Pradesh	2,033.79	254.34	982.79	501.69	1,738.82	85.50	1.28
47.	Simlipal	Odisha	2,721.62	1,205.52	1,138.78	218.56	2,562.86	94.17	0.05
48.	Srivilliputhur Megamalai	Tamil Nadu	501.12	57.32	206.89	118.70	382.91	76.41	8.94
49.	Sundarbans	West Bengal	2,634.74	739.72	468.49	304.95	1,513.16	57.43	0.00
50.	Tadobha Andhari	Maharashtra	1,647.22	655.47	444.18	162.00	1,261.65	76.59	0.17
51.	Udanti Sitanadi	Chhattisgarh	1,794.91	48.17	1,186.91	284.49	1,519.57	84.66	0.60
52.	Valmiki	Bihar	928.80	235.98	496.05	64.09	796.12	85.71	9.23
		Total	**74,710.53**	**16,444.51**	**26,856.71**	**12,365.05**	**55,666.27**	**74.51**	**1,339.58**

**Source: WII, Dehradun*

From the Table it is seen that Nagarjunasagar Srisailam Tiger Reserve in Andhra Pradesh (adjacent to the Amrabad Tiger Reserve in Telangana), has the largest forest cover (2,932.95 sq km) followed by Simlipal in Odisha (2,562.86 sq km) and Indravati in Chhattisgarh (2,377.28 sq km). In terms of forest cover as percentage of the area of Tiger reserves, the top five Tiger reserves are Pakke in Arunachal Pradesh (96.83%), Achanakmar in Madhya Pradesh (95.63%), Simlipal in Odisha (94.17%), Kali in Karnataka (92.45%) and Dampa in Mizoram (92.05%). Simlipal Tiger reserve has the highest area under VDF comprising 1,205.52 sq km, which is 47.04% of its total forest cover. Maximum area under MDF is in Nagarjunasagar Srisailam Tiger reserve comprising 1,908.65 sq km, which is 65.08% of its total forest cover. Open Forest is highest in Amrabad Tiger reserve comprising 950.34 sq km, which is 53.37% of its total forest cover.

Figure 4.2 Top five Tiger Reserves in terms of forest cover as % of the area of the Tiger Reserve.



4.3.2 Decadal Change in Forest Cover (ISFR 2011 to ISFR 2021)

The decadal assessment of change in forest cover within Tiger Reserves helps in assessing the impact of conservation measures and management interventions that have been implemented over the years. For decadal assessment, change in forest cover, during the period between ISFR 2011 (data period 2008 - 2009) and the current cycle (ISFR 2021, data period 2019-2020) within each Tiger Reserve has been analyzed.

Table 4.5 depicts decadal change in Forest Cover between 2011 and 2021 assessments. It is seen that between 2011 and 2021, the forest cover has decreased by 22.62 sq km (0.04%). Twenty Tiger reserves have recorded an overall gain in forest cover during the past decade whereas thirty-two Tiger reserves have recorded an overall loss of forest cover. The Tiger reserves showing significant gain in forest cover are Buxa (238.80 sq km) followed by Anamalai (120.78 sq km) and Indravati (64.48 sq km). The maximum losses in forest cover are recorded from Kawal (118.97 sq km.) followed by Bhadra (53.09 sq km) and Sundarbans (49.95 sq km).

Table 4.5 Change in Forest Cover of Tiger Reserves between 2011 and 2021 assessment

Sl. No.	Name of Tiger Reserve	State	Area as per digitized Tiger Reserve Boundary*	2011 Assessment			
				VDF	MDF	OF	Total
1	Achanakmar	Chhattisgarh	936.34	321.75	521.01	60.13	902.89
2	Amrabad	Telangana	2,684.23	337.55	480.85	918.74	1,737.14
3	Anamalai	Tamil Nadu	1,767.76	347.25	387.92	323.71	1,058.88
4	Bandhavgarh	Madhya Pradesh	1,684.53	295.33	674.01	263.26	1,232.60
5	Bandipur	Karnataka	1,784.47	10.25	461.10	491.27	962.62
6	Bhadra	Karnataka	1,071.24	292.20	507.70	50.73	850.63
7	Biligiri Ranganatha Temple	Karnataka	654.96	0.68	306.23	240.99	547.90
8	Bor	Maharashtra	131.77	15.42	77.83	27.28	120.53
9	Buxa	West Bengal	783.02	204.03	86.55	112.64	403.22
10	Corbett	Uttarakhand and Uttar Pradesh	1,462.66	330.58	825.40	91.61	1,247.59
11	Dampa	Mizoram	821.89	23.64	210.93	532.80	767.37
12	Dudhwa	Uttar Pradesh	1,524.33	401.39	436.18	246.45	1,084.02
13	Indravati	Chhattisgarh	2,922.39	896.69	764.05	652.06	2,312.80
14	Kalakad Mundanthurai	Tamil Nadu	1,564.14	258.44	660.30	121.65	1,040.39
15	Kali	Karnataka	1,411.75	68.20	1,098.89	151.27	1,318.36
16	Kamlang	Arunachal Pradesh	792.03	316.15	283.73	119.96	719.84
17	Kanha	Madhya Pradesh	2,070.63	598.88	702.22	175.09	1,476.19
18	Kawal	Telangana	2,259.79	91.88	1,260.19	473.78	1,825.85
19	Kaziranga	Assam	1,180.35	7.61	127.64	46.53	181.78
20	Manas	Assam	3,030.24	291.21	1,034.75	293.98	1,619.94
21	Melghat	Maharashtra	2,028.47	481.39	954.27	430.68	1,866.34
22	Mudumalai	Tamil Nadu	750.81	62.73	382.65	255.19	700.57
23	Mukundara Hills	Rajasthan	758.40	0.00	139.79	229.22	369.01
24	Nagarhole	Karnataka	1,152.74	1.15	729.27	181.51	911.93
25	Nagarjunasagar Srisailam	Andhra Pradesh	3,843.88	250.31	1,819.36	903.05	2,972.72
26	Namdapha	Arunachal Pradesh	2,085.17	891.01	634.78	381.22	1,907.01
27	Nameri	Assam	371.86	19.23	93.66	69.23	182.12
28	Nawegaon Nagzira	Maharashtra	1781.22	551.03	450.39	180.68	1,182.10
29	Orang	Assam	80.21	0.00	5.03	12.42	17.45
30	Pakke	Arunachal Pradesh	1507.71	425.94	814.40	218.37	1,458.71
31	Palamau	Jharkhand	1980.64	433.63	713.76	289.75	1,437.14
32	Panna	Madhya Pradesh	1783.48	156.15	653.98	394.10	1,204.23
33	Parambikulam	Kerala	652.21	196.51	330.53	49.74	576.78
34	Pench - MP	Madhya Pradesh	1168.66	194.30	590.89	52.23	837.42
35	Pench - MH	Maharashtra	738.28	224.15	319.10	71.84	615.09
36	Periyar	Kerala	935.30	161.31	488.54	158.33	808.18
37	Pilibhit	Uttar Pradesh	758.64	339.56	137.11	133.78	610.45
38	Rajaji	Uttarakhand	1102.41	188.65	631.20	191.44	1,011.29
39	Ramgarh Vishdhari	Rajasthan	294.67	0.00	78.51	75.88	154.39
40	Ranthambore	Rajasthan	1765.57	0.00	215.98	629.94	845.92

**Source: WII, Dehradun*
Light green color depicts loss and dark green color depicts gain in forest cover within Tiger reserves.

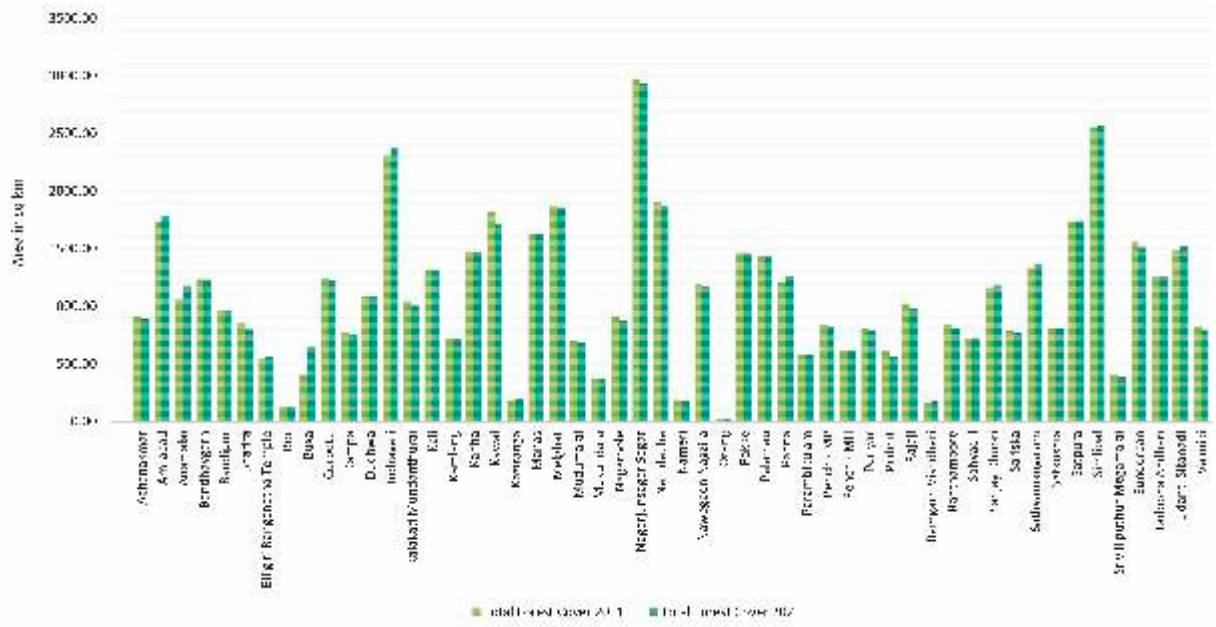
(in sq km)

		2021 Assessment						
% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub	VDF	MDF	OF	Total	% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub	Change in Forest Cover w.r.t ISFR 2011
96.43	0.00	381.28	487.65	26.53	895.46	95.63	0.94	-7.43
64.72	177.82	332.38	497.81	950.34	1,780.53	66.33	473.63	43.39
59.90	4.61	309.33	466.63	403.70	1,179.66	66.73	8.36	120.78
73.17	9.63	291.12	670.27	268.07	1,229.46	72.99	11.90	-3.14
53.94	19.04	62.95	459.50	432.78	955.23	53.53	19.76	-7.39
79.41	0.00	326.03	445.09	26.42	797.54	74.45	0.25	-53.09
83.65	26.69	21.97	418.15	124.55	564.67	86.21	12.09	16.77
91.47	0.00	15.40	74.97	29.56	119.93	91.01	0.00	-0.60
51.50	0.00	329.89	192.86	119.27	642.02	81.99	3.46	238.80
85.30	0.00	441.44	693.37	89.87	1,224.68	83.73	2.97	-22.91
93.37	0.00	15.06	308.14	433.38	756.58	92.05	0.00	-10.79
71.11	3.65	727.72	193.24	158.50	1,079.46	70.82	2.67	-4.56
79.14	0.00	1,167.39	809.78	400.11	2,377.28	81.35	0.50	64.48
66.52	8.56	461.68	436.45	108.17	1,006.30	64.34	10.40	-34.09
93.38	0.00	273.74	962.33	69.15	1,305.22	92.45	0.12	-13.14
90.89	0.00	307.84	302.31	102.86	713.01	90.02	1.26	-6.83
71.29	3.27	598.72	714.04	152.72	1,465.48	70.77	1.06	-10.71
80.80	0.64	102.55	1,125.66	478.67	1,706.88	75.53	1.02	-118.97
15.40	0.00	23.87	109.91	61.67	195.45	16.56	0.76	13.67
53.46	2.12	1,086.36	296.27	244.09	1,626.72	53.68	13.56	6.78
92.01	0.02	456.31	965.62	425.05	1,846.98	91.05	0.00	-19.36
93.31	0.09	143.29	260.98	285.61	689.88	91.88	3.18	-10.69
48.66	34.67	0.00	144.41	227.50	371.91	49.04	50.75	2.90
79.11	1.80	177.15	603.12	89.28	869.55	75.43	0.16	-42.38
77.34	175.20	303.93	1,908.65	720.37	2,932.95	76.30	339.07	-39.77
91.46	0.23	912.65	598.57	360.81	1,872.03	89.78	7.58	-34.98
48.98	0.00	31.35	105.11	41.71	178.17	47.91	0.58	-3.95
66.36	2.21	553.67	446.89	169.82	1,170.38	65.71	2.65	-11.72
21.75	0.00	0.00	6.34	11.05	17.39	21.68	0.87	-0.06
96.75	0.14	487.25	751.92	220.82	1,459.99	96.83	2.67	1.28
72.56	0.77	433.33	713.39	292.75	1,439.47	72.68	0.90	2.33
67.52	51.76	154.32	643.08	461.75	1,259.15	70.60	66.81	54.92
88.43	0.00	287.08	246.72	47.78	581.58	89.17	0.00	4.80
71.66	3.41	192.98	586.69	49.18	828.85	70.92	2.25	-8.57
83.31	0.00	223.87	320.32	65.09	609.28	82.53	0.00	-5.81
86.41	0.00	176.05	500.51	110.25	786.81	84.12	0.00	-21.37
80.47	0.00	416.07	78.90	70.23	565.20	74.50	1.21	-45.25
91.73	0.00	253.38	563.49	164.22	981.09	89.00	2.36	-30.20
52.39	31.48							
47.91	145.47	0.00	229.14	572.21	801.35	45.39	169.28	-44.57

Sl. No.	Name of Tiger Reserve	State	Area as per digitized Tiger Reserve Boundary*	2011 Assessment			
				VDF	MDF	OF	Total
41	Sahyadri	Maharashtra	1169.60	76.64	433.21	203.83	713.68
42	Sanjay Dubri	Madhya Pradesh	1490.33	287.49	631.63	243.03	1,162.15
43	Sariska	Rajasthan	1145.80	59.83	284.74	437.09	781.66
44	Sathyamangalam	Tamil Nadu	1581.77	198.34	853.69	278.57	1,330.60
45	Satkosia	Odisha	981.97	184.80	502.43	119.48	806.71
46	Satpura	Madhya Pradesh	2033.79	258.56	970.40	505.94	1,734.90
47	Simlipal	Odisha	2721.62	1205.90	1,137.99	212.93	2,556.82
48	Srivilliputhur Megamalai	Tamil Nadu	501.12	46.69	285.39	68.51	400.59
49	Sundarbans	West Bengal	2634.74	942.70	568.21	52.20	1,563.11
50	Tadobha Andhari	Maharashtra	1647.22	660.78	431.43	160.23	1,252.44
51	Udanti Sitanadi	Chhattisgarh	1794.91	47.95	1,182.27	257.46	1,487.68
52	Valmiki	Bihar	928.80	216.51	482.62	120.03	819.16
		Total	**74,710.53**	**13,872.37**	**28,854.69**	**12,961.83**	**55,688.89**

Source: WII, Dehradun
Gain in Forest Cover within Tiger Reserves
Loss in Forest Cover within Tiger Reserves

Figure 4.3
Forest Cover in Tiger Reserves of India in 2011 and 2021



(in sq km)

		2021 Assessment						
% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub	VDF	MDF	OF	Total	% of total forest cover w.r.t area of digitized Tiger Reserve Boundary	Scrub	Change in Forest Cover w.r.t ISFR 2011
61.02	9.22	75.49	438.51	211.09	725.09	61.99	13.62	11.41
77.98	0.05	286.34	630.48	263.34	1,180.16	79.19	0.99	18.01
68.22	17.89	61.12	283.80	420.79	765.71	66.83	37.13	-15.95
84.12	20.15	161.23	658.09	540.98	1,360.30	86.00	26.50	29.70
82.15	11.99	184.41	507.82	113.59	805.82	82.06	11.31	-0.89
85.30	0.50	254.34	982.79	501.69	1,738.82	85.50	1.28	3.92
93.94	1.83	1,205.52	1,138.78	218.56	2,562.86	94.17	0.05	6.04
79.94	29.50	57.32	206.89	118.70	382.91	76.41	8.94	-17.68
59.33	0.00	739.72	468.49	304.95	1,513.16	57.43	0.00	-49.95
76.03	0.45	655.47	444.18	162.00	1,261.65	76.59	0.17	9.21
82.88	0.08	48.17	1,186.91	284.49	1,519.57	84.66	0.60	31.89
88.20	0.07	235.98	496.05	64.09	796.12	85.71	9.23	-23.04
74.54	**795.01**	**16,444.51**	**26,856.71**	**12,365.05**	**55,666.27**	**74.51**	**1,339.58**	**-22.62**

4.4 Wetlands and their extent inside Tiger Reserves

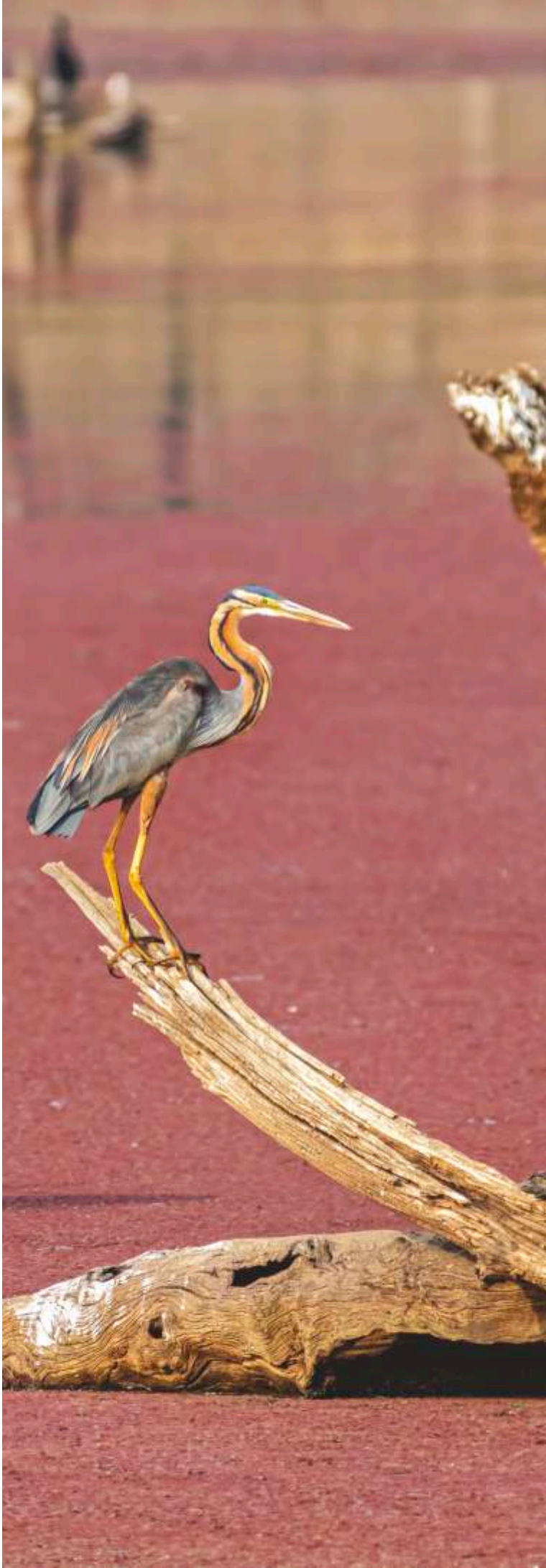
Wetlands support rich floral and faunal biodiversity. In view of their importance, wetlands within Tiger Reserves were inventoried and the information is being presented in Table 4.6. Space Application Center (SAC), Ahmedabad carried out mapping of wetlands from 2006 to 2010 and released an Atlas of Wetlands of India in the year 2011, which is the latest information showing spatial distribution of wetlands in India. An overlay analysis of the wetland layer over the Tiger Reserve layer has been carried out to know category-wise number and extent of wetlands.

Table 4.6 Wetlands within Tiger Reserves

Sl. No.	Name of Tiger Reserve	Area as per digitized Tiger Reserve Boundary*	Inland Wetlands Man Made		Inland Wetlands Natural		Coastal Wetlands Natural	
			No.	Area	No.	Area	No.	Area
1	Achanakmar	93,634.00	14	114.89	2	770.96	0	0
2	Amrabad	2,68,423.00	10	6,624.32	6	1,890.94	0	0
3	Anamalai	1,76,776.00	23	2,665.14	12	1,113.72	0	0
4	Bandhavgarh	1,68,453.00	80	389.03	7	930.06	0	0
5	Bandipur	1,78,447.00	72	1,405.19	3	141.20	0	0
6	Bhadra	1,07,124.00	15	8,179.02	4	496.36	0	0
7	Biligiri Ranganatha Temple	65,496.00	8	370.21	3	172.65	0	0
8	Bor	13,177.00	1	224.89	0	0.00	0	0
9	Buxa	78,302.10	0	0.00	14	4,897.81	0	0
10	Corbett	1,46,266.00	7	7,909.20	29	4,795.70	0	0
11	Dampa	82,189.00	0	0.00	7	360.48	0	0
12	Dudhwa	1,52,433.00	3	2,044.14	128	9,918.91	0	0
13	Indravati	2,92,239.00	81	693.87	2	5,004.00	0	0
14	Kalakad Mundanthurai	1,56,414.00	170	3,853.01	34	1,973.56	0	0
15	Kali	1,41,175.00	5	2,752.47	6	873.52	0	0
16	Kamlang	79,203.00	0	0.00	4	316.58	0	0
17	Kanha	2,07,063.00	70	232.30	4	905.47	0	0
18	Kawal	2,25,979.00	38	1,571.48	10	3,093.12	0	0
19	Kaziranga	1,18,035.00	1	22.59	246	50,508.30	0	0
20	Manas	3,03,024.00	1	2.33	118	21,391.10	0	0
21	Melghat	2,02,847.00	11	435.22	13	2,543.45	0	0
22	Mudumalai	75,081.00	7	62.94	2	272.70	0	0
23	Mukundara Hills	75,840.00	24	373.95	8	1,645.92	0	0
24	Nagarhole	1,15,274.00	34	1,829.20	3	221.35	0	0
25	Nagarjunasagar Srisailam	3,84,388.00	18	10,044.60	5	1,458.12	0	0
26	Namdapha	2,08,517.00	0	0.00	22	5,365.17	0	0
27	Nameri	37,186.10	6	4,092.61	0	0.00	0	0
28	Nawegaon Nagzira	1,78,122.00	312	6,969.23	4	114.74	0	0
29	Orang	8,021.20	0	0.00	3	1,295.70	0	0
30	Pakke	1,50,771.00	0	0.00	1	2,722.67	0	0
31	Palamau	1,98,064.00	23	187.39	21	3,358.40	0	0
32	Panna	1,78,348.00	42	404.22	6	2,549.66	0	0
33	Parambikulam	65,220.90	6	3,248.66	10	499.16	0	0
34	Pench	1,16,866.00	95	5,406.82	3	475.65	0	0
35	Pench - MH	73,828.40	51	4,423.02	3	178.29	0	0
36	Periyar	93,530.00	4	26.20	10	2,607.87	0	0
37	Pilibhit	75,864.00	8	469.70	25	4,016.45	0	0
38	Rajaji	1,10,241.00	3	82.50	14	6,624.83	0	0

(in ha)

Wetlands (<2.25 ha)**		Total Wetlands		Wetland Area as % of TR Area
No.	Area	No.	Area	
62	62	78	947.85	1.01
3	3	19	8,518.26	3.17
47	47	82	3,825.86	2.16
137	137	224	1,456.09	0.86
179	179	254	1,725.39	0.97
86	86	105	8,761.38	8.18
38	38	49	580.86	0.89
0	0	1	224.89	1.71
0	0	14	4,897.81	6.26
16	16	52	12,720.90	8.70
12	12	19	372.48	0.45
101	101	232	12,064.10	7.91
104	104	187	5,801.87	1.99
85	85	289	5,911.57	3.78
18	18	29	3,643.99	2.58
9	9	13	325.58	0.41
387	387	461	1,524.77	0.74
25	25	73	4,689.60	2.08
74	74	321	50,604.9	42.87
25	25	144	21,418.4	7.07
9	9	33	2,987.67	1.47
10	10	19	345.64	0.46
59	59	91	2,078.87	2.74
136	136	173	2,186.55	1.9
5	5	28	11,507.7	2.99
30	30	52	5,395.17	2.59
11	11	17	4,103.61	11.04
3	3	319	7,086.97	3.98
2	2	5	1,297.70	16.18
2	2	3	2,724.67	1.81
282	282	326	3,827.79	1.93
126	126	174	3,079.88	1.73
0	0	16	3,747.82	5.75
197	197	295	6,079.47	5.20
24	24	78	4,625.31	6.26
3	3	17	2,637.07	2.82
12	12	45	4,498.15	5.93
16	16	33	6,723.33	6.10



Sl. No.	Name of Tiger Reserve	Area as per digitized Tiger Reserve Boundary*	Inland Wetlands Man Made		Inland Wetlands Natural		Coastal Wetlands Natural	
			No.	Area	No.	Area	No.	Area
39	Ramgarh Vishdhari	29,467.00	7	286.36	3	203.00	0	0
40	Ranthambore	1,76,557.00	43	428.10	12	1,388.53	0	0
41	Sahyadri	1,16,960.00	12	13,258.70	7	227.99	0	0
42	Sanjay Dubri	1,49,033.00	18	452.96	1	2,134.90	0	0
43	Sariska	1,14,580.00	36	638.58	4	543.04	0	0
44	Sathyamangalam	1,58,177.00	17	1,832.43	4	211.76	0	0
45	Satkosia	98,197.00	6	121.35	12	3,884.92	0	0
46	Satpura	2,03,379.00	36	16,821.50	8	2,292.09	0	0
47	Simlipal	2,72,162.00	4	411.21	13	815.90	0	0
48	Srivilliputhur Megamalai	50,112.00	2	14.66	2	55.48	0	0
49	Sundarbans	2,63,474.00	1	13.25	3	1,03,080.00	131	1,51,850
50	Tadobha Andhari	1,64,722.00	128	6,160.24	10	481.64	0	0
51	Udanti Sitanadi	1,79,491.00	22	1,753.71	7	1,558.80	0	0
52	Valmiki	92,880.00	0	0.00	14	1,529.41	0	0
	Total	**74,71,052.70**	**1,575**	**1,19,303.34**	**892**	**2,63,912.20**	**131**	**1,51,850.19**

**Source: WII, Dehradun*
***Wetlands <2.25 ha are calculated from point feature layer of wetlands, where each point has an area of 1 ha*

From Table 4.6 it is seen that the 5,821 wetlands cover a total area of 5,38,288.73 ha (5,382.89 sq km) which is 7.20% of the total area of the Tiger reserves. The Sundarban Tiger reserve has the largest area under wetlands 2,54,943.63 ha (2,549.44 sq km) accounting for 96.76% of its total area. These wetlands are mostly coastal and inland in nature. Kanha Tiger reserve has the highest number of wetlands, 461 wetlands, most of which are less than 2.25 ha in size.

4.5 Forest Types in Tiger Reserves

Information about Forest Types in Tiger Reserves provides a scientific basis for analyzing its biophysical attributes. This may serve as a basis for working plan preparation, silvicultural management, habitat management, biodiversity studies and other wildlife management practices.

FSI carried out the first ever mapping of Forest Types of India as per the classification of forests by Champion & Seth, 1968 and the results were presented in the Atlas of Forest Types of India published in the year 2011. Champion & Seth divided forest types of India into 6 Major Groups, further classified into 16 Forest Types Groups and 200 different Forest Types. Out of 200 Forest Types, FSI mapped 178 Forest Types. The work has been further updated in the revised Atlas of Forest Types of India, 2020, and 188 forest types out of the 200 described by Champion & Seth have been mapped.

Forest Types within Tiger Reserves have been mapped, based on the updated Atlas of Forest Types, 2020. It is seen that within Tiger Reserves, 103 different forest types belonging to 13 Type Groups occur. These comprise a varied spectrum of vegetation types indicative of rich biodiversity. The Forest Types include Moist Siwalik Sal forest in the North, Southern Dry Mixed deciduous forest and

(in ha)

Wetlands (<2.25 ha)**		Total Wetlands		Wetland Area as % of TR Area
No.	Area	No.	Area	
20	20	30	509.36	1.73
171	171	226	1,987.63	1.13
4	4	23	13,490.70	11.53
124	124	143	2,711.86	1.82
140	140	180	1,321.62	1.15
19	19	40	2,063.19	1.30
50	50	68	4,056.27	4.13
127	127	171	19,240.60	9.46
55	55	72	1,282.11	0.47
5	5	9	75.14	0.15
0	0	135	2,54,944	96.76
47	47	185	6,688.88	4.06
114	114	143	3,426.51	1.91
12	12	26	1,541.41	1.66
3,223	**3,223.00**	**5,821**	**5,38,288.73**	**7.20**

West Coast Tropical Evergreen forests and Semi Evergreen forests in the South, Northern Dry Mixed Deciduous forests and *Anogeissus pendula* forests in the west, to East Himalayan mixed coniferous forests and Mangrove forests in the east. The area of Forest Type Groups within Tiger Reserves is given in Table 4.7.

Figure 4.4 Photograph showing *Anogeissus pendula* forest in Ranthambore Tiger Reserve, Rajasthan

Table 4.7 Forest Type Groups in Tiger Reserves

Sl. No.	Tiger Reserve	Forest Type Group					
		Group 1: Tropical Wet Evergreen Forests	Group 2: Tropical Semi-Evergreen Forests	Group 3: Tropical Moist Deciduous Forests	Group 4: Littoral and Swamp Forests	Group 5: Tropical Dry Deciduous Forests	Group 6: Tropical Thorn Forests
1	Achanakmar	-	-	793.79		104.61	-
2	Amrabad	-	-	-	-	2,082.63	223.92
3	Anamalai	135.13	21.34	299.48	7.25	323.83	11.76
4	Bandhavgarh	-	-		0.06	1,251.63	-
5	Bandipur	0.01	5.56	152.46	-	811.11	-
6	Bhadra	14.32	43.90	478.93	-	141.26	-
7	Biligiri Ranganatha Temple	44.51	90.64	125.02	-	303.99	10.78
8	Bor	-	-	-	-	121.14	-
9	Buxa	-	191.54	274.58	-	75.91	-
10	Corbett (including Amangarh Buffer)	-	-	994.43	-	223.67	-
11	Dampa	-	687.32	59.90	-		-
12	Dudhwa	-	-	821.95	122.70	189.56	-
13	Indravati	-	-	1,839.82	-	511.07	-
14	Kalakad Mundanthurai	381.72	147.59	318.10	-	141.71	63.66
15	Kali	386.10	465.43	445.58	-	-	-
16	Kamlang	-	21.42	5.99	-	-	-
17	Kanha	-	-	1,391.76	-	117.13	-
18	Kawal	-	-	-	-	1,718.79	-
19	Kaziranga	-	19.75	174.44	127.30	-	-
20	Manas	-	172.34	1,363.70	-	22.97	-
21	Melghat	-	-	-	0.52	1,849.24	-
22	Mudumalai	-	24.54	143.51	25.59	491.01	4.93
23	Mukundara Hills	-	-	-	-	422.22	-
24	Nagarhole	4.33	0.08	324.01	-	508.78	0.04
25	Nagarjunsagar Srisailam	-	-	-	-	3,263.82	23.53
26	Namdapha	486.47	178.82	16.09	-	-	-
27	Nameri	4.77	171.45	-	-	-	-
28	Nawegaon Nagzira	-	-	-	-	1,172.98	-
29	Orang	-	-	20.00	26.12	-	-
30	Pakke	263.01	624.03	-	-	-	-
31	Palamau	-	-	22.91	-	1,394.73	-
32	Panna	-	-	-	0.14	1,328.57	-
33	Parambikulam	299.22	117.06	147.15	-	13.82	-
34	Pench - MH	-	-	-	-	599.89	-
35	Pench - MP	-	-	164.40	-	669.38	-
36	Periyar	600.97	139.16	40.81	-	-	-
37	Pilibhit	-	-	469.24	0.01	89.78	-

(in sq km)

Forest Type Group							TOF/ Plantation	Total
Group 8: Subtropical Broadleaved Hill Forests	Group 9: Subtropical Pine Forests	Group 11: Montane Wet Temperate Forests	Group 12: Himalayan Moist Temperate Forests	Group 14: Sub-Alpine Forests	Group 15: Moist Alpine Scrub	Group 16: Dry Alpine Scrub		
-	-	-	-	-	-	-	-	898.40
-	-	-	-	-	-	-	-	2,306.55
44.92	-	85.19	-	-	-	-	321.79	1,250.69
-	-	-	-	-	-	-	0.96	1,252.65
-	-	-	-	-	-	-		969.14
4.52	-	-	-	-	-	-	173.72	856.65
1.62	-	-	-	-	-	-	0.61	577.17
-	-	-	-	-	-	-		121.14
69.93	-	-	-	-	-	-	33.35	645.31
-	3.65	-	0.01	-	-	-	19.64	1,241.40
-	-	-	-	-	-	-	-	747.22
-	-	-	-	-	-	-	35.10	1,169.31
-	-	-	-	-	-	-	6.05	2,356.94
4.22	-	19.61	-	-	-	-	37.75	1,114.36
-	-	-	-	-	-	-	1.23	1,298.34
192.48		328.72	156.42	1.94	80.95	-	-	787.92
-	-	-	-	-	-	-	1.31	1,510.20
-	-	-	-	-	-	-	0.91	1,719.70
-	-	-	-	-	-	-	4.53	326.02
-	-	-	-	-	-	-	70.56	1,629.57
-	-	-	-	-	-	-	-	1,849.76
0.19	-	-	-	-	-	-	3.82	693.59
-	-	-	-	-	-	-	0.11	422.33
-	-	-	-	-	-	-	35.61	872.85
-	-	-	-	-	-	-	0.51	3,287.86
692.13	-	400.24	100.07	0.03	92.58	0.17	7.53	1,974.13
-	-	-	-	-	-	-	3.09	179.31
-	-	-	-	-	-	-	0.42	1,173.40
-	-	-	-	-	-	-	0.01	46.13
575.23	-	-	-	-	-	-	-	1,462.27
-	-	-	-	-	-	-	21.47	1,439.11
-	-	-	-	-	-	-	1.59	1,330.30
-	-	-	-	-	-	-	9.28	586.53
-	-	-	-	-	-	-	-	599.89
-	-	-	-	-	-	-	1.50	835.28
-	-	0.72	-	-	-	-	4.95	786.61
-	-	-	-	-	-	-	10.40	569.43

Sl. No.	Tiger Reserve	Forest Type Group					
		Group 1: Tropical Wet Evergreen Forests	Group 2: Tropical Semi-Evergreen Forests	Group 3: Tropical Moist Deciduous Forests	Group 4: Littoral and Swamp Forests	Group 5: Tropical Dry Deciduous Forests	Group 6: Tropical Thorn Forests
38	Rajaji	-	-	507.45	0.76	444.10	-
39	Ramgarh Vishdhari	-	-	-	-	184.76	-
40	Ranthambore	-	-	-	-	944.63	6.49
41	Sahyadri	-	142.85	253.84	-	41.10	0.07
42	Sanjay Dhubri	-	-	-	-	1,185.00	-
43	Sariska	-	-	-	-	805.92	1.84
44	Sathyamangalam	-	226.31	0.12	0.12	980.30	176.31
45	Satkoshia	-	4.61	520.08	-	292.29	-
46	Satpura	-	-	-	10.53	1,738.37	-
47	Simlipal	-	-	2,082.89	-	495.42	-
48	Srivilliputhur Megamalai	11.60	27.05	64.75	-	306.44	64.42
49	Sunderban	-	-	-	1,507.14	-	-
50	Tadoba Andhari	-	-	-	-	1,264.70	-
51	Udanti Sitanadi	-	-	981.03	-	538.21	-
52	Valmiki	-	1.65	421.34	15.92	367.84	-
	Total	**2,632.16**	**3,524.44**	**15,719.55**	**1,844.16**	**29,534.31**	**587.75**

(in sq km)

Forest Type Group							TOF/ Plantation	Total
Group 8: Subtropical Broadleaved Hill Forests	Group 9: Subtropical Pine Forests	Group 11: Montane Wet Temperate Forests	Group 12: Himalayan Moist Temperate Forests	Group 14: Sub-Alpine Forests	Group 15: Moist Alpine Scrub	Group 16: Dry Alpine Scrub		
-	1.76	-	-	-	-	-	31.01	985.08
-	-	-	-	-	-	-	-	184.76
-	-	-	-	-	-	-	0.17	951.29
303.92	-	-	-	-	-	-	0.75	742.53
-	-	-	-	-	-	-	0.24	1,185.24
-	-	-	-	-	-	-	0.61	808.37
-	-	-	-	-	-	-	1.11	1,384.27
-	-	-	-	-	-	-	2.55	819.53
1.35	-	-	-	-	-	-	3.34	1,753.59
-	-	-	-	-	-	-	3.04	2,581.35
-	-	-	-	-	-	-	0.66	474.92
-	-	-	-	-	-	-	0.62	1,507.76
-	-	-	-	-	-	-	0.45	1,265.15
-	-	-	-	-	-	-	1.16	1,520.40
-	-	-	-	-	-	-	0.29	807.04
1,890.51	**5.41**	**834.48**	**256.50**	**1.97**	**173.53**	**0.17**	**853.80**	**57,858.74**

4.6 Forest Cover in Tiger Corridors

Tiger Corridors constitute areas linking one Tiger Reserve with another Tiger Reserve, allowing movement of Tigers, prey and other wildlife. They provide connectivity between Tiger source populations. In the absence of corridors, the Tiger habitats may become isolated, making the Tigers vulnerable to inbreeding and local extinction. These areas may not be diverted for anthropological uses, except in public interest and with approval of the National Board for Wildlife and on advice of the NTCA. The map showing location of Tiger corridors in the country is given in Figure 4.1.

The extent of forest cover in the Tiger corridors of the country as per the latest assessment has been derived. The latest digital boundaries of Tiger corridors available from NTCA and Wildlife Institute of India were used. The Tiger corridors occupy an area of approximately 14,289.37 sq km, which is 0.43 % of the country's geographical area. The current assessment shows that the forest cover in the Tiger corridors is 11,575.12 sq km, which is 1.62 % of the country's total forest cover.

In terms of canopy density classes, the area covered by VDF is 2,908.54 sq km (20.36%), MDF is 6,074.19 sq km (42.51%) and OF is 2,592.39 sq km (18.14%). Scrub occupies a total area of 52.99 sq km (0.37%) (Table 4.8).

Table 4.8 Forest Cover in Tiger Corridors

Class	Area (sq km)	Percentage of Area of Digitized Tiger Corridor Boundary
Very Dense Forest	2,908.54	20.36
Moderately Dense Forest	6,074.19	42.51
Open Forest	2,592.39	18.14
Total Forest Cover	**11,575.12**	**81.01**
Scrub	52.99	0.37
Non-Forest	2,661.26	18.62
Total Area of Tiger Corridors	**14,289.37**	**100.00**

Table 4.9 depicts forest cover in Tiger corridors as per the latest assessment. From the table it is seen that Kanha to Navegoan-Nagzira-Tadoba-Indravati Tiger corridor passing through MP, Chhattisgarh & Maharashtra, has the largest forest cover (2,012.26 sq km), which is 86.50 % of the area of Tiger corridor, followed by Pench-Satpura-Melghat in MP and Maharashtra (1,195.79 sq km), which is 83.21% of the area of Tiger corridor and Simlipal-Satkosia in Odisha (810.23 sq km), which is 83.05% of the area of Tiger corridor. In terms of forest cover as percentage of the area of Tiger corridors, the top five Tiger corridors are Kane WLS-Tale Valley WLS Corridor in Arunachal Pradesh and Assam (97.03%), Nagarahole-Bandipur-Mudumalai-Wayanad in Karnataka and Tamil Nadu (94.87%), Kudremukh NP-Bhadra WLS Corridor (93.86%) in Karnataka, Anshi-Dandeli-Sharavathi Valley Corridor in Karnataka (93.67%) and Nagarahole-Pushpagiri-Talakavery Corridor (92.60%) in Karnataka and Kerala. Kanha to Navegoan-Nagzira-Tadoba-Indravati Tiger corridor has the highest area under VDF comprising 857.65 sq km, which is 42.62% of its total forest cover. It also has the maximum area under MDF comprising 882.87 sq km, which is 43.87% of its total forest cover. The highest area under Open Forest is found in Pench-Satpura-Melghat Tiger corridor comprising 392.25 sq km, which is 32.80 % of its total forest cover. The highest area under scrub is found in Ranthambore-Kuno-Shivpuri-Madhav Tiger corridor in Rajasthan and MP, covering an area of 15.68 sq km.

Decadal Change in Forest Cover (ISFR 2011 to ISFR 2021) 4.6.1

For decadal assessment, change in forest cover, during the period between ISFR 2011 (data period 2008 - 2009) and the current cycle (ISFR 2021, data period 2019-2020) within each Tiger corridor has been analyzed. Table 4.10 depicts decadal change in Forest Cover between 2011 and 2021 assessments. Between 2011 and 2021, the forest cover has increased by 37.15 sq km (0.32%).

Table 4.9 Forest Cover in Tiger Corridors (ISFR, 2021)

Sl.No.	Name of Tiger Corridor	State	Area as per digitized Tiger Corridor Boundary**	
1	Anshi-Dandeli-Sharavathi Valley	Karnataka	432.85	
2	Bandhavgarh-Sanjay-Dubri-Guru Ghasidas	MP & Chhattisgarh	598.99	
3	Bhandhavgarh-Achanakmar #	MP & Chhattisgarh	405.72	
4	Buxa-Jaldapara	West Bengal	45.50	
5	Corbett-Dudhwa*	Uttarakhand & UP	872.90	
6	Dibru Saikhowa-D'ering-Mehao Corridor	Arunachal Pradesh & Assam	860.90	
7	Durga-Kishanpur-Katarniaghat*	Uttar Pradesh	30.63	
8	Guru Ghasi Das- Palamau-Lawalong	Jharkhand & Chhattisgarh	517.63	
9	Indravati-Udanti-Sitanadi-Sunebeda	Odisha & Chhattisgarh	862.52	
10	Kalakad-Mundanthurai-Periyar	Kerala and Tamil Nadu	137.48	
11	Kane WLS-Tale Valley WLS	Arunachal Pradesh & Assam	139.29	
12	Kanha to Navegoan-Nagzira-Tadoba-Indravati#	MP, Chhattisgarh & Maharashtra	2,326.38	
13	Kanha-Achanakmar	MP & Chhattisgarh	264.46	
14	Kanha-Pench	Madhya Pradesh	538.47	
15	Kaziranga-Itanagar WLS Corridor	Arunachal Pradesh & Assam	236.39	
16	Kaziranga-Karbi-Anglong	Assam	32.35	
17	Kaziranga-Nameri	Arunachal Pradesh & Assam	171.77	
18	Kaziranga-Orang	Assam	129.30	
19	Kaziranga-Papumpare	Arunachal Pradesh & Assam	72.74	
20	Kudremukh NP-Bhadra WLS	Karnataka	417.19	
21	Manas*	Assam	5.50	
22	Nagarahole-Mudumalai-Wayanad	Kerala & Tamil Nadu	180.18	
23	Nagarahole-Bandipur-Mudumalai-Wayanad	Karnataka & Tamil Nadu	132.03	
24	Nagarahole-Pushpagiri-Talakavery	Karnataka & Kerala	306.82	
25	Nagarjunsagar -Sri Venkateswara NP	Andhra Pradesh	625.75	
26	Paake-Nameri-Sonai-Rupai-Manas*	Arunachal Pradesh & Assam	132.92	
27	Pench-Satpura-Melghat	MP & Maharashtra	1,437.03	
28	Parambikulum-Ernakulum-Indira Gandhi	Kerala	56.70	
29	Rajaji-Corbett	Uttarakhand & UP	170.66	
30	Ranthambore-Kuno-Shivpuri-Madhav	Rajasthan & MP	535.47	
31	Sahyadri-Radhanagri	Maharashtra & Karnataka	637.23	
32	Simlipal-Satkosia #	Odisha	975.62	
	TOTAL		**14,289.37**	

* Part of Corridor falls outside India. Therefore the area of Forest Cover and the part of shapefile falling in India only are given.

** The area of Tiger corridor falling inside Tiger reserve has been excluded from the area of Tiger corridor to avoid duplicity in forest cover.

Tiger corridor boundary from NTCA website has been used. The rest of the boundaries are received from WII.

(in sq km)

ISFR 2021					
Very Dense Forest	Mod. Dense Forest	Open Forest	Total Forest Cover	% of total forest cover wrt area of digitized Tiger Corridor Boundary	Scrub
165.72	212.04	27.68	405.44	93.67	0.00
32.09	247.21	155.1	434.40	72.52	0.44
37.74	164.66	61.36	263.76	65.01	1.97
8.97	2.03	14.77	25.77	56.64	0.00
311.35	288.48	52.55	652.38	74.74	0.95
182.54	327.37	144.99	654.90	76.07	6.48
0.09	0.58	2.97	3.64	11.88	0.00
138.46	227.75	84.37	450.58	87.05	0.40
145.80	491.50	137.76	775.06	89.86	1.05
27.50	66.02	32.01	125.53	91.31	0.58
54.61	48.00	32.54	135.15	97.03	0.00
857.65	882.87	271.74	2,012.26	86.50	2.97
121.41	84.59	17.00	223.00	84.32	0.13
110.10	293.87	90.04	494.01	91.74	0.00
1.62	9.06	16.61	27.29	11.54	0.03
3.25	15.79	7.45	26.49	81.89	0.00
2.78	15.07	12.82	30.67	17.86	0.63
2.09	1.58	4.81	8.48	6.56	0.00
2.78	8.25	10.09	21.12	29.03	0.36
158.35	203.38	29.83	391.56	93.86	0.26
1.36	2.07	1.42	4.85	88.18	0.00
64.20	71.82	26.47	162.49	90.18	0.03
23.94	73.97	27.35	125.26	94.87	0.34
126.76	129.98	27.37	284.11	92.60	0.02
11.07	422.85	140.66	574.58	91.82	7.94
34.27	64.74	16.96	115.97	87.25	4.39
130.03	673.51	392.25	1,195.79	83.21	2.37
9.01	31.12	11.53	51.66	91.11	0.00
16.93	86.42	18.84	122.19	71.60	1.31
0.51	123.34	315.86	439.71	82.12	15.68
29.11	358.07	139.61	526.79	82.67	1.47
96.45	446.20	267.58	810.23	83.05	3.19
2,908.54	**6,074.19**	**2,592.39**	**11,575.12**	**81.01**	**52.99**

Table 4.10 Change in Forest Cover of Tiger Corridors of India between 2011 and 2021 Assessment

Sl.No.	Name of Tiger Corridor	State	Area as per digitized Tiger Corridor Boundary**	
1	Anshi-Dandeli-Sharavathi Valley	Karnataka	432.85	
2	Bandhavgarh-Sanjay-Dubri-Guru Ghasidas	MP & Chhattisgarh	598.99	
3	Bhandhavgarh-Achanakmar #	MP & Chhattisgarh	405.72	
4	Buxa-Jaldapara	West Bengal	45.50	
5	Corbett-Dudhwa*	Uttarakhand & UP	872.90	
6	Dibru Saikhowa-D'ering-Mehao Corridor	Arunachal Pradesh & Assam	860.90	
7	Durga-Kishanpur-Katarniaghat*	Uttar Pradesh	30.63	
8	Guru Ghasi Das- Palamau-Lawalong	Jharkhand & Chhattisgarh	517.63	
9	Indravati-Udanti-Sitanadi-Sunebeda	Odisha & Chhattisgarh	862.52	
10	Kalakad-Mundanthurai-Periyar	Kerala and Tamil Nadu	137.48	
11	Kane WLS-Tale Valley WLS	Arunachal Pradesh & Assam	139.29	
12	Kanha to Navegoan-Nagzira-Tadoba-Indravati#	MP, Chhattisgarh & Maharashtra	2,326.38	
13	Kanha-Achanakmar	MP & Chhattisgarh	264.46	
14	Kanha-Pench	Madhya Pradesh	538.47	
15	Kaziranga-Itanagar WLS Corridor	Arunachal Pradesh & Assam	236.39	
16	Kaziranga-Karbi-Anglong	Assam	32.35	
17	Kaziranga-Nameri	Arunachal Pradesh & Assam	171.77	
18	Kaziranga-Orang	Assam	129.30	
19	Kaziranga-Papumpare	Arunachal Pradesh & Assam	72.74	
20	Kudremukh NP-Bhadra WLS	Karnataka	417.19	
21	Manas*	Assam	5.50	
22	Nagarahole-Mudumalai-Wayanad	Kerala & Tamil Nadu	180.18	
23	Nagarahole-Bandipur-Mudumalai-Wayanad	Karnataka & Tamil Nadu	132.03	
24	Nagarahole-Pushpagiri-Talakavery	Karnataka & Kerala	306.82	
25	Nagarjunsagar -Sri Venkateswara NP	Andhra Pradesh	625.75	
26	Paake-Nameri-Sonai-Rupai-Manas*	Arunachal Pradesh & Assam	132.92	
27	Pench-Satpura-Melghat	MP & Maharashtra	1,437.03	
28	Parambikulum-Ernakulum-Indira Gandhi	Kerala	56.70	
29	Rajaji-Corbett	Uttarakhand & UP	170.66	
30	Ranthambore-Kuno-Shivpuri-Madhav	Rajasthan & MP	535.47	
31	Sahyadri-Radhanagri	Maharashtra & Karnataka	637.23	
32	Simlipal-Satkosia #	Odisha	975.62	
		TOTAL	**1,4289.37**	

**Part of Corridor falls outside India. Therefore the area of Forest Cover and the part of shapefile falling in India only are given.*

(in sq km)

ISFR 2011					
Very Dense Forest	Mod.Dense Forest	Open Forest	Total Forest Cover	% of total forest Cover wrt area of digitized Tiger Corridor Boundary	Scrub
17.36	315.82	72.64	405.82	93.76	0.00
32.46	246.21	149.08	427.75	71.41	1.19
37.95	165.60	57.93	261.48	64.45	3.37
0.00	5.21	6.15	11.36	24.97	0.00
218.72	375.77	79.31	673.80	77.19	0.00
201.73	322.73	133.27	657.73	76.40	0.28
0.00	0.64	2.48	3.12	10.19	0.00
67.47	332.07	54.71	454.25	87.76	0.16
79.48	515.42	177.31	772.21	89.53	1.05
23.44	58.51	41.64	123.59	89.90	0.12
37.47	63.31	34.63	135.41	97.21	0.00
836.18	917.96	270.85	2,024.99	87.04	0.13
119.79	85.36	18.32	223.47	84.50	0.00
110.25	296.16	90.08	496.49	92.20	0.00
1.84	12.32	12.50	26.66	11.28	0.00
2.26	17.34	6.45	26.05	80.53	0.00
2.96	16.56	9.72	29.24	17.02	0.00
0.79	3.30	6.85	10.94	8.46	0.00
3.31	7.50	7.59	18.40	25.30	0.00
111.30	191.11	7.59	310.00	74.31	0.00
2.84	1.56	0.95	5.35	97.27	0.33
46.14	79.75	40.53	166.42	92.36	0.24
19.14	72.55	29.69	121.38	91.93	0.36
41.11	151.01	96.04	288.16	93.92	0.00
10.08	389.54	151.08	550.70	88.01	22.80
37.68	71.26	12.17	121.11	91.11	0.04
135.29	687.24	392.43	1,214.96	84.55	2.80
10.78	21.32	22.70	54.80	96.65	0.00
39.85	80.26	19.45	139.56	81.78	0.00
0.59	123.72	326.20	450.51	84.13	10.83
26.75	355.84	145.08	527.67	82.81	2.40
83.46	437.73	283.40	804.59	82.47	3.00
2,358.47	**6,420.68**	**2,758.82**	**11,537.97**	**80.75**	**49.10**

***The area of Tiger Corridor falling within Tiger Reserves has been excluded from the area of the shapefile.*
 # The shapefile of NTCA has been used for analysis in accordance with NTCA report "Connecting Tiger Corridors" (2015)

ISFR 2021				
Very Dense Forest	Mod.Dense Forest	Open Forest	Total Forest Cover	
165.72	212.04	27.68	405.44	
32.09	247.21	155.1	434.40	
37.74	164.66	61.36	263.76	
8.97	2.03	14.77	25.77	
311.35	288.48	52.55	652.38	
182.54	327.37	144.99	654.90	
0.09	0.58	2.97	3.64	
138.46	227.75	84.37	450.58	
145.80	491.50	137.76	775.06	
27.50	66.02	32.01	125.53	
54.61	48.00	32.54	135.15	
857.65	882.87	271.74	2,012.26	
121.41	84.59	17.00	223.00	
110.10	293.87	90.04	494.01	
1.62	9.06	16.61	27.29	
3.25	15.79	7.45	26.49	
2.78	15.07	12.82	30.67	
2.09	1.58	4.81	8.48	
2.78	8.25	10.09	21.12	
158.35	203.38	29.83	391.56	
1.36	2.07	1.42	4.85	
64.20	71.82	26.47	162.49	
23.94	73.97	27.35	125.26	
126.76	129.98	27.37	284.11	
11.07	422.85	140.66	574.58	
34.27	64.74	16.96	115.97	
130.03	673.51	392.25	1,195.79	
9.01	31.12	11.53	51.66	
16.93	86.42	18.84	122.19	
0.51	123.34	315.86	439.71	
29.11	358.07	139.61	526.79	
96.45	446.20	267.58	810.23	
2,908.54	**6,074.19**	**2,592.39**	**11,575.12**	

(in sq km)

% of total forest cover w.r.t area of digitized Tiger Corridor Boundary	Scrub	Forest Cover Change between ISFR 2011 to 2021	Forest Cover Change % w.r.t 2011 Assessment
93.67	0.00	-0.38	-0.09
72.52	0.44	6.65	1.55
65.01	1.97	2.28	0.87
56.64	0.00	14.41	126.85
74.74	0.95	-21.42	-3.18
76.07	6.48	-2.83	-0.43
11.88	0.00	0.52	16.67
87.05	0.40	-3.67	-0.81
89.86	1.05	2.85	0.37
91.31	0.58	1.94	1.57
97.03	0.00	-0.26	-0.19
86.50	2.97	-12.73	-0.63
84.32	0.13	-0.47	-0.21
91.74	0.00	-2.48	-0.50
11.54	0.03	0.63	2.36
81.89	0.00	0.44	1.69
17.86	0.63	1.43	4.89
6.56	0.00	-2.46	-22.49
29.03	0.36	2.72	14.78
93.86	0.26	81.56	26.31
88.18	0.00	-0.50	-9.35
90.18	0.03	-3.93	-2.36
94.87	0.34	3.88	3.20
92.60	0.02	-4.05	-1.41
91.82	7.94	23.88	4.34
87.25	4.39	-5.14	-4.24
83.21	2.37	-19.17	-1.58
91.11	0.00	-3.14	-5.73
71.60	1.31	-17.37	-12.45
82.12	15.68	-10.80	-2.40
82.67	1.47	-0.88	-0.17
83.05	3.19	5.64	0.70
81.01	**52.99**	**37.15**	**0.32**

Box-4.1 Forest Cover Analysis in Nagarjunasagar-Sri Venkateswara NP Tiger Corridor, Andhra Pradesh

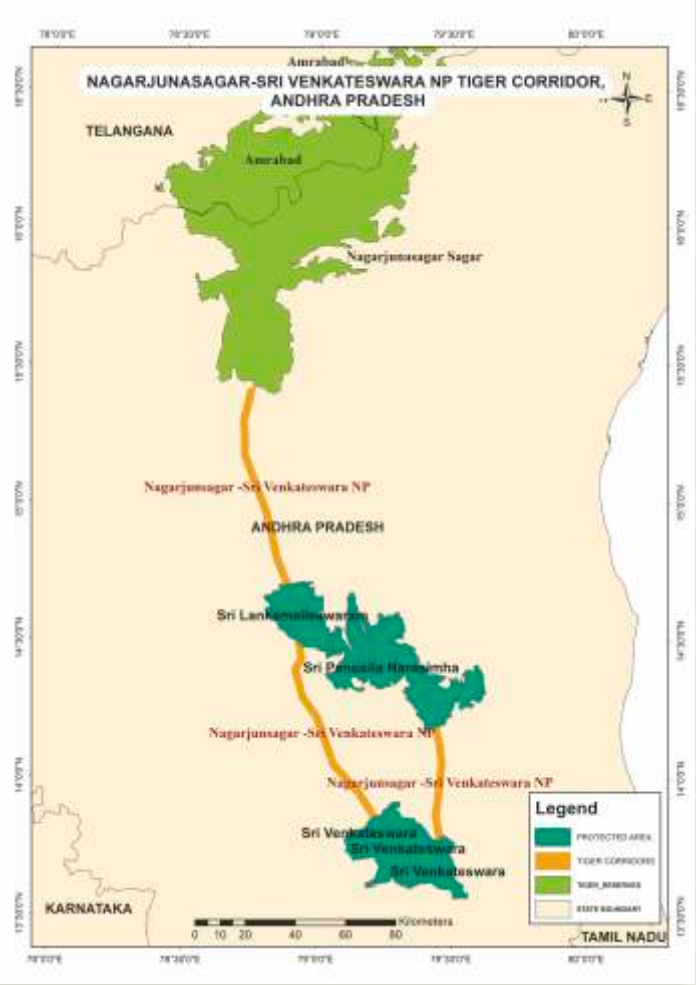
Forest Cover Analysis in Nagarjunasagar-Sri Venkateswara NP Tiger Corridor, Andhra Pradesh

Nagarjunasagar-Sri Venkateswara NP tiger corridor connects Nagarjun Sagar Sri Sailam Tiger Reserve (NSTR) and Sri Venkestwara National Park and passes through Sri Lankamalleswaram and Sri Penusila Narasimha wildlife sanctuaries. However, there are several national and state highways cutting across the corridor.

Figure represents map of the Nagarjunasagar-Sri Venkateswara NP Tiger Corridor.

The forest cover assessment for 2021 was carried out and thereafter compared with the 2011 assessment for decadal change analysis. As per the latest assessment, forest cover in the tiger corridor is 574.58 sq km, out of which VDF is 11.07 sq km, MDF is 422.85 sq km and OF is 140.66 sq km.

The decadal forest cover analysis done between ISFR 2021 and 2011 assessment shows that the forest cover has increased from a total of 550.70 sq km in 2011 assessment to 574.58 sq km in 2021 assessment, showing a net increase of 23.88 sq km (4.34%) wrt 2011 assessment.



Decadal Forest cover assessment between ISFR 2011 and ISFR 2021

Tiger Corridor	Digitized Area	Forest Cover 2011	% of total forest wrt digitized area	Forest Cover 2021	% of total forest wrt digitized area	Forest Cover Change between 2011 to 2021	Forest Cover Change %
Nagarjunasagar Sri Venkateswara	625.75	550.70	88.01	574.58	91.82	23.88	4.34

Box-4.2 Economic Evaluation of Tiger Reserves in India

Economic Evaluation of Tiger Reserves in India

Tiger reserves are effective tools of conservation of natural forests as well as support ecosystem services such as food, water, water, air and soil quality and other important human needs. A study on "Economic valuation of tiger reserves in India: A value + approach" was conducted by the Centre for Ecological Services Management (CESM) of the Indian Institute of Forest Management (IIFM) in collaboration with the National Tiger Conservation Authority (NTCA). The major objective of the study was to enhance tiger conservation by highlighting the economic benefits of Tiger reserves. The approach followed was a VALUE+ approach, where the 'value' indicates all benefits for which monetary economic valuation is possible, while the '+' represents all such benefits for which such valuation is currently not possible either on account of lack of accepted methodologies, knowledge and/or understanding and derived data. The study analyzed the economic valuation of selected tiger reserves in two phases:

		Stock and Flow Benefits (million USD per yr)		
Tiger Reserve	**State**	**Stock**	**Flow**	**Investment Multiplier**
Corbet	Uttarakhand	4026.90	226.50	401
Kanha	Madhya Pradesh	2973.50	253.10	273
Kaziranga	Assam	344.50	150.10	200
Periyar	Kerala	4869.20	271.10	459
Ranthambore	Rajasthan	756.90	127.90	273
Sunderbans	West Bengal	10088.80	197.00	530

Phase-I (2014) was carried out in 6 Tiger reserves namely Corbett Tiger Reserve, Kanha Tiger Reserve, Kaziranga Tiger Reserve, Periyar Tiger Reserve, Ranthambore Tiger Reserve and Sundarban Tiger Reserve

Phase-II (2019) was conducted in ten selected tiger reserves namely. Anamalai, Bandipur, Dudhwa, Melghat, Nagarjunasagar-Srisailam , Pakke, Palamau, Panna , Similipal and Valmiki Tiger Reserve

		Total Economic Value			Stock and Flow Benefits (million USD per yr)		
Tiger Reserve	**State**	**Direct**	**Indirect**	**Option**	**Stock**	**Flow**	**Investment Multiplier**
Anamalai	Tamil Nadu	22.71	8174.62	1579.19	46150.09	9776.50	3750.10
Bandipur	Karnataka	56.35	5085.57	1263.74	31476.15	6405.70	716.34
Dudhwa	Uttar Pradesh	8.97	4221.34	864.61	56106.31	5094.90	573.83
Melghat	Maharashtra	51.41	10312.99	1984.95	75043.33	12349.30	346.73
Nagarjunasagar Srisailam	Andhra Pradesh	101.87	12883.35	3216.19	50129.74	16202.10	7488.59
Pakke	Arunachal Pradesh	20.36	7214.75	1487.09	8722.20	32201.19	1946.49
Palamu	Jharkhand	46.03	11123.39	1785.01	96744.71	12954.40	3450.55
Panna	Madhya Pradesh	78.80	5310.76	1565.00	13745.53	6954.60	1939.36
Simlipal	Odisha	89.53	13317.50	623.08	49832.80	16030.10	3038.31
Valmiki	Bihar	39.70	5987.39	873.20	43682.86	6900.30	1235.60

PARAMETERS OF ECONOMIC EVALUATION

Total Economic Value is comprised of Direct, Indirect and Option Values -

1. **Direct Values**: These can be associated with goods having market value like timber, fuel, fish, etc.
2. **Indirect Values**: Ecological services that provide life support like watershed protection, nutrient cycling
3. **Option Values**: Placed on the potential future ability to use a resource even though it is not currently used and the likelihood of future use is very low, e.g.: future recreation and ecotourism options

Investment Multiplier: It is an indicative value of the quantum benefits retuned by the tiger reserve and their natural systems into the human well-being. The aggregate flow benefit from forests is compared with its management costs to obtain the 'Investment multiplier'.

Stock and Flow Benefits: The stock refers to natural resource stock serving as the base for generating benefits. Flow Benefits refer to the actual flow of benefits. In this study, standing timber and carbon storage are taken as Stock benefit and Carbon sequestration are taken as flow benefit

GROSS ECONOMIC BENEFITS FROM 10 TIGER RESERVES (PHASE-II)

Resources for Humans
Rs. 1643 to 7042 crore

Protection from Diseases, Insects, Parasites
Rs. 7.7 to 24.15 Cr

Ecosystem Services
Rs. 2567 to 8260 Cr

Sociocultural Benefits
Rs.0.3 to 62.144 Cr

Natural Assets
Rs. 15,310-98,530Cr

4.7 Assessment of Forest Cover in Lion Habitat area of Gir Wildlife Sanctuary (WLS) and National Park (NP), Gujarat

The Asiatic lion (*Panthera leo persica*) is listed as "Endangered species" on the IUCN Red List because of its small population size and area of occupancy. Gir forest of Gujarat (India) is the only natural habitat of the lion in India. Gir National Park and Wildlife Sanctuary comprising a total area of 1,412.13 sq km is located in the Junagadh district of Gujarat. Gir has the largest compact tract of dry deciduous forests in the country with a topography composed of successive rugged ridges, isolated hills, plateaus and valleys. It is part of the Indo-Malayan Ecoregion Kathiarbar-Gir Dry Deciduous Forests[2]. The Lion Census is conducted every five years by the Gujarat Forest Department for estimation of lion population. The latest Lion Census, 2020, reports the presence of 674 lions in the country.

4.7.1 Forest Cover Assessment and Decadal Assessment of Changes in Forest Cover

Analysis of forest cover, within Gir NP and WLS was carried out. The total forest cover was observed to be 1,295.34 sq km, accounting for 85.20% of the total area of the Gir NP and WLS.

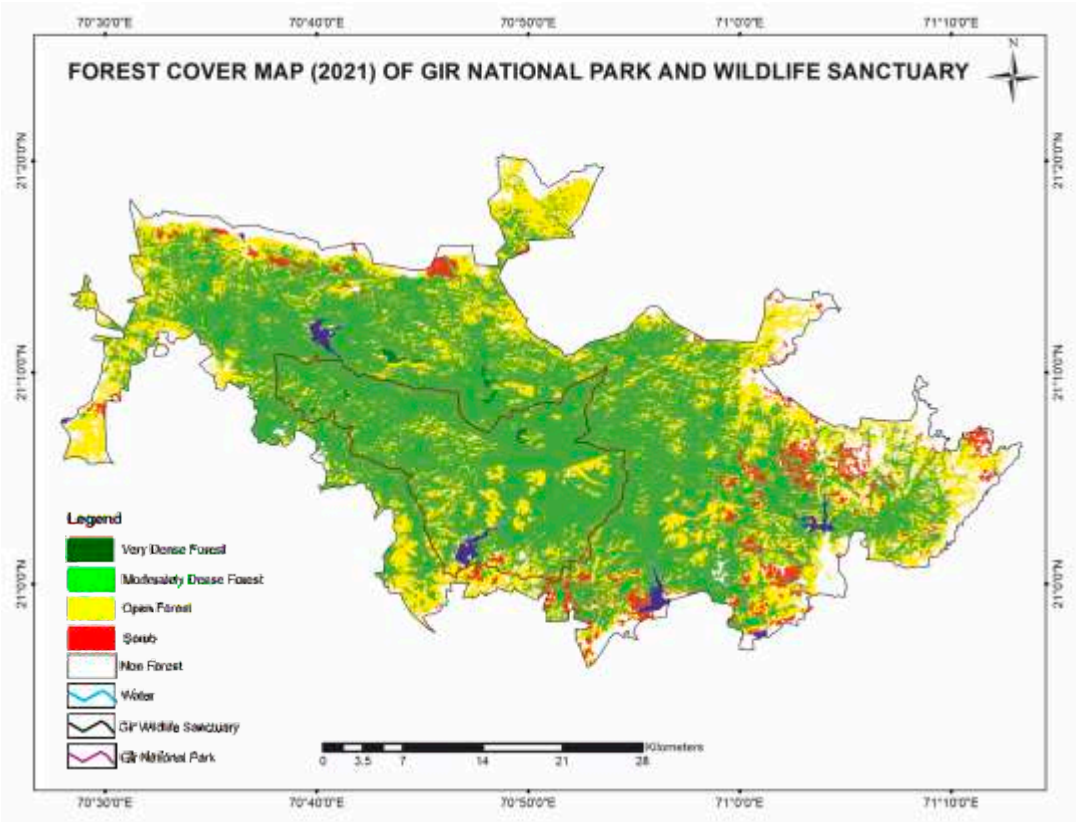


Figure 4.5 Forest Cover Map (2021) of Gir National Park and Wildlife Sanctuary

[2] *"Kathiarbar -Gir dry deciduous forests". Terrestrial Ecoregions. World Wildlife Fund. Retrieved 16 September 2021.*

(in sq km)

Table 4.11 Forest Cover in Gir Wildlife Sanctuary and National Park as per ISFR 2011

		2011 Assessment							
Sl. No.	Name	Notified Area*	Area as per digitized boundary**	Very Dense Forest	Mod. Dense	Open Forest	Total Forest Cover	% of total forest cover w.r.t area of digitized boundary	Scrub
1	Gir National Park	258.71	288.67	1.73	239.06	43.20	283.99	98.38	0.00
2	Gir Wildlife Sanctuary	1,153.42	1,231.65	2.54	636.80	405.44	1,044.78	84.83	7.06
	Total	**1,412.13**	**1,520.32**	**4.27**	**875.86**	**448.64**	**1,328.77**	**87.40**	**7.06**

** Source: Gujarat SFD Website*
*** Source: WII, Dehradun*

(in sq km)

Table 4.12 Forest Cover in Gir Wildlife Sanctuary and National Park as per ISFR 2021

		2021 Assessment							
Sl. No.	Name	Very Dense Forest	Mod. Dense Forest	Open Forest	Total Forest Cover	% of total forest cover wrt area of digitized boundary	Change in Forest Cover w.r.t ISFR 2011	Change % w.r.t ISFR 2011	Scrub
1	Gir National Park	1.47	227.95	52.37	281.79	97.62	-2.20	-0.77	1.12
2	Gir Wildlife Sanctuary	2.55	625.57	385.43	1,013.55	82.29	-31.23	-2.99	52.26
	Total	**4.02**	**853.52**	**437.80**	**1,295.34**	**85.20**	**-33.43**	**-2.52**	**53.38**

** Source: Gujarat SFD Website*
*** Source: WII, Dehradun*

Table 4.11 and 4.12 depict the status of Forest cover in Gir National Pak and wildlife sanctuary in 2011 and 2021 assessment, respectively. Between the two assessments, there is a decrease of 33.43 sq km (2.52%) in forest cover.

The decrease in Forest cover is attributed to habitat improvement measures taken in the last decade like, removal of Prosopis juliflora from grassland areas and canopy manipulation for creating openings in the MDF and VDF areas.

4.8 Forest Types within Gir National Park and Wildlife Sanctuary

The prime habitat for Asiatic Lions is open woodlands, thick grassland and brush habitat, where there is sufficient cover for hunting and denning. These grasslands also provide food for the herbivorous animals that lions prey upon. According to the latest Atlas of Forest Types of India (2020), Gir wildlife sanctuary (excluding National Park), has 177.60 sq km of grassland whereas Gir National Park has 33.58 sq km of grassland, summing upto 211.18 sq km , which is 26.11% of the area of Gir National Park and WLS (Table 4.13). This grassland belongs to 5/DS4 Dry grassland Forest Type. Fig 4.5 depicts the forest type map of Gir WLS and NP.

Table 4.13 Forest Types in Gir National Park and WLS

(in sq km)

Sl. No.	Forest Type	Gir WLS	Gir NP	TotalArea	% wrt digitized boundary
1	5A/C1a Very dry teak forest	126.44	44.32	170.76	11.23
2	5A/C3 Southern dry mixed deciduous forest	436.64	144.25	580.89	38.21
3	5/DS1 Dry deciduous scrub	93.73	16.52	110.25	7.25
4	5/DS4 Dry grass land	177.60	33.58	211.18	13.89
5	5/E2 *Boswellia* forest	1.30	0.00	1.30	0.09
6	5/E5 *Butea* forest	30.44	9.82	40.26	2.65
7	5/E9 Dry bamboo brakes	1.98	0.00	1.98	0.13
8	5/1S1 Dry tropical riverain forest	0.04	0.00	0.04	0.00
9	6/E2 *Acacia senegal* forest	39.00	18.10	57.10	3.76
10	6B/C1 Desert thorn forest	156.23	17.27	173.5	11.41
	Sub- Total	**1,063.40**	**283.86**	**1,347.26**	**88.62**
11	TOF/Plantation	0.93	2.06	2.99	0.20
	Total	**1,064.33**	**285.92**	**1,350.25**	**88.82**

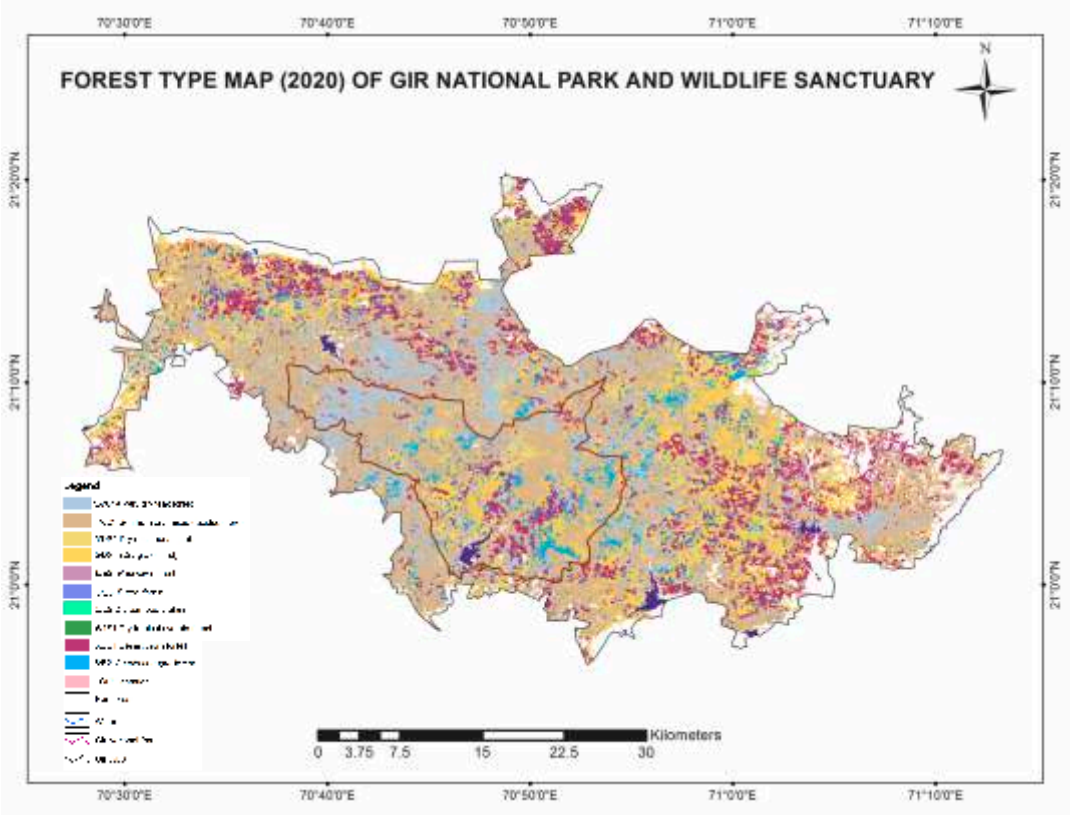


Figure 4.6 Forest Type Map (2020) of Gir National Park and Wildlife Sanctuary

Wetlands in Gir Wildlife Sanctuary and National Park 4.9.

The Gir NP and WLS forms the catchment area of several major rivers, thereby providing ecological security to the surrounding drought prone region[3]. As per analysis of wetlands (National Wetlands Atlas, SAC, Ahmedabad), Gir National Park and Wildlife sanctuary have 31 wetlands occupying an area of 2,518 ha (25.81 sq km) which is 1.66% of their total area (Table 4.14).

(in ha)

Sl. No.	Name	Area as per digitized Boundary*	Inland Wetlands Man Made		Inland Wetlands Natural		Coastal Wetlands Natural		Wetlands (<2.25 ha)**		Total Wetlands		Wetland Area as % of Total Area
			No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	
1	Gir National Park	28,867.00	2	345.00	3	341.00	0	0.00	0	0.00	5	686.00	2.38
2	Gir Wildlife Sanctuary	1,23,165.00	10	1,084.00	16	744.00	0	0.00	4	4.00	26	1,832.00	1.49
	Total	**1,52,032.00**	**12**	**1,429.00**	**19**	**1,085.00**	**0**	**0.00**	**4**	**4.00**	**31**	**2,518.00**	**1.66**

Table 4.14 Wetlands in Gir Wildlife Sanctuary and National Park

Conclusion 4.10

There is an overall decrease in forest cover of 22.62 sq km (0.04%) in 52 Tiger reserves in the last decade. Out of 52 Tiger reserves, 20 have shown an increasing trend, ranging from 1.28 sq km (Pakke) to 238.80 sq km (Buxa) whereas 32 have registered a decline in the forest cover, ranging from 0.06 sq km (Orang) to 118.97 sq km (Kawal). In case of the Lion habitat, a decrease of 33.43 sq km (2.52%) of forest cover has been observed in the last ten years.

The information may be utilized for further analysis and devising appropriate conservation strategies to maintain the biodiversity, robustness and the ecosystem services flowing out of these pristine areas.

[3] *Estimation of the Status of Asiatic Lion (Panthera leo persica) Population in Gir Lion Landscape, Gujarat, India. A. P. Singh, Ram Ratan Nala. Volume 144, Issue 10, October 2018.*