Introduction

Description of the Tiger Conservation Unit/Landscape and the significance of the area for tiger conservation.

a. Description of the Tiger Conservation Unit/Landscape:

- The Sahyadri tiger Reserve is located in Maharashtra state and takes its name due to the geographical position in the Sahyadri range of the Western Ghats. It is the first Tiger Reserve of Western Maharashtra and 4th Tiger Reserve of Maharashtra State It is constituted by combining Chandoli Wildlife Division (henceforth Chandoli). and Koyna Wildlife Division (henceforth Koyna). In terms of political administration boundary, it is situated at the juncture of four districts Satara (Mahabaleshwar, Jawali, Satara and Patan tehsils), Sangli (Shirala tehsil), Kolhapur (Shahuwadi tehsil) and Ratnagiri (Sangmeshwar and Khed tehsils).
- In the initial phase, the Maharashtra State Government, through notification No.WLP-1008/ Pra.Kra.232/ F-1, dated 5/1/2010, designated a total area of 741.22 sq.km., comprising Chandoli National Park (317.67 sq.km.) and Koyna Wildlife Sanctuary (423.55 sq.km.), as the Sahyadri Tiger Reserve. Subsequently, on 21st August 2012, the Government of Maharashtra, through Resolution no. WLP-2012/C.R. no.240/ F-1, officially declared and notified 600.12 sq.km. area as the Core or CTH and 565.45 sq.km. area as Buffer areas of the Sahyadri Tiger Reserve with its total area of 1165.57 sq.km. The reserve consists of two divisions, Chandoli and Koyna and eight ranges, including Kandat, Bamnoli, Koyna, Patan, Helwak, Dhebewadi, Chandoli and Amba.
- Introduction Table 1: following are the area details of core and buffer zone of Sahyadri Tiger Reserve:

Details of area of STR	Core Zone (Sq.km.)	Buffer Zone (Sq.km.)	Total area (Sq.km.)
Chandoli NP	313.84	3.83	317.67
Koyna WLS	286.28	123.23	423.55
Area outside Protected Area	-	424.34	424.34
Total Area	**600.12**	**564.44**	**1165.57**

- The reserve experiences distinct temperature variations throughout the year. Maximum summer temperatures, typically observed in April and May, range between 20°C to 24°C. Conversely, during the winter months, from December to February, minimum temperatures range from 18°C to 24°C. The area receives an average annual rainfall between 3000 to 5000 millimeters, contributing to its diverse ecosystems and water resources. In the year 2019, between June to September Patharpunj

village in Sahyadri Tiger Reserve has recorded highest rainfall (7359mm) in India. Sahyadri Tiger Reserve features a rugged and undulating terrain, characterized by an altitudinal gradient ranging from 343 meters to 1236 meters. This unique topography significantly influences the flow of small water bodies, runoffs, and stream lines, enhancing the reserve's stream network and water availability. The diverse landscape, including undulating terrain, high mountain peaks, steep valleys, ridges, laterite plateaus, grasslands, and dense forests, provides an ideal habitat for tigers and various wildlife species.

- Sahyadri boasts a long and glorious history of the reign of Emperor Shivaji and his successors. The history of empires also parallels with the history of wild tigers. Tigers were known to be common in the Sahyadri mountains; the hunting records of Emperor Shahu (1894–1922) of Kolhapur prove that tigers were fairly common in this area. With the onset of 21st century, tiger populations declined in the entire nation. The region is renowned for its water resources and holds historical importance. Sahyadri Tiger Reserve is intersected by the Koyna and Warana rivers, with major dams like Shivsagar situated in Koyna Wildlife Sanctuary and Vasantsagar in the Chandoli National Park.
- Stretching along the crest of the Sahyadri Range of the Northern Western Ghats, this area constitutes the catchment of the Warana and Koyna reservoirs. The Western Ghats region of India holds significance as an essential biodiversity hotspot, harbouring numerous endemics, rare, and endangered floral and faunal species within its bounds. The Sahyadri Tiger Reserve is located within Biogeographic Zone 5B of the Western Ghats, nestled in the heart of the Central Sahyadri Range. Characterized by its mountainous terrain, the reserve boasts steep, precipitous slopes, deep valleys, and extensive lateritic plateaus that stretch across its expanse.

b. The significance of the area for tiger conservation:

- This tiger reserve is renowned for its rich biodiversity, serving as a habitat for a wide array of flora and fauna typical of Northern Western Ghat. From iconic tiger populations to diverse plant species and other key wildlife, the Sahyadri Tiger Reserve stands as a vital stronghold for conservation efforts in the region. Its significance extends beyond local boundaries, contributing to the broader conservation goals of protecting India's natural heritage and maintaining the ecological balance of the Northern Western Ghat landscape.
- The Western Ghats is a world's biodiversity hotspot. Sahyadri Tiger Reserve plays crucial role for the conservation of endangered and endemic species in the northern Western Ghats. In 2012, UNESCO's World Heritage Committee recognized Koyna Wildlife Sanctuary and Chandoli National Park within Sahyadri Tiger Reserve as a World Natural Heritage Site.(Annexure No-43)

- The reserve highlights its significance as the northernmost tiger habitat in the Western Ghats. Koyna Wildlife Sanctuary and Chandoli National Park are Key Biodiversity Areas declared by KBA Partnership. Additionally, Birdlife International has declared Koyna Wildlife Sanctuary, an "Important Bird Area," and a portion near Navja village is designated as a "Medicinal Plant Conservation Area by Foundation for Revitalisation of Local Health Traditions (FRLHT).
- It is ecologically connected to Kali Tiger Reserve and Bhimgad WLS in Karnataka and Mhadei WLS in Goa through corridor area of Kolhapur Forest Division and Sawantwadi Forest Division. The diverse landscape, including undulating terrain, high mountain peaks, steep valleys, ridges, laterite plateaus, grasslands, and dense forests, provides an ideal habitat for tigers and various wildlife species.
- Sahyadri Tiger Reserve falls in Biogeographic Zone 5B of Western Ghats. The entire Sahyadri Tiger Reserve is mountainous, with very steep precipitous slopes, deep valleys and long stretching lateritic plateaus. The central portion of Sahyadri Tiger Reserve is occupied by "Shivsagar" reservoir of Koyana River and "Vasant Sagar" reservoir of Warana River. Floristic compositions of the Sahyadri Tiger Reserve represent the following Forest types.

  1) 2.A / C.2 – West coast Semi evergreen Forests

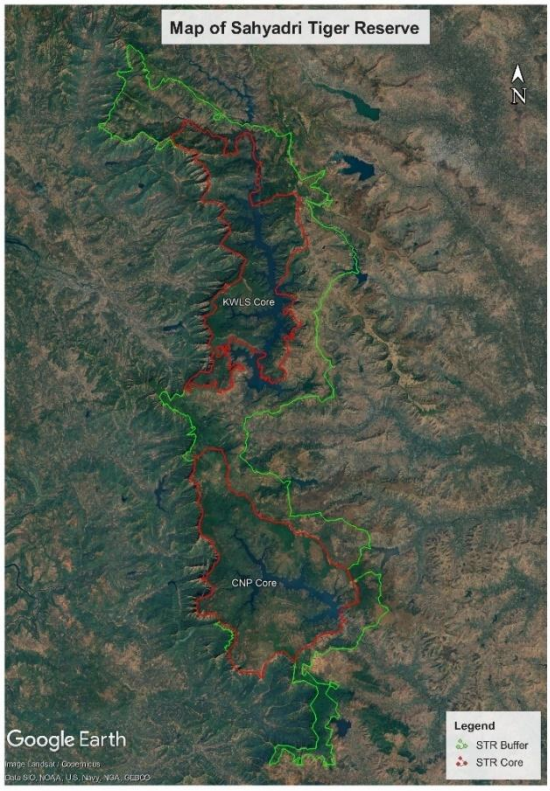
  2) 8.A. / C.2 – Western (Montane) Subtropical Hill Forests

  3) B / C.2 – Southern Moist Mixed Deciduous Forests.
- Most of the area prevails dense Semi-evergreen forests having remarkably wide range of flora and great variety of fauna. The most common floral species found here in this Protected Area are Anjani (Memecylon umbellatum), Jambhul (*Syzigium cumini*) Pisa (*Actinodaphaone angustifolia*) etc. The revenue wasteland and Malki lands included in the Tiger Reserve have scattered bushy tree growth in between and along nullah banks. The cultivated areas of rehabilitated villages turned to grassy meadows/Grasslands.
- The Lateritic plateaus are at an elevation of 1200 MSL. The rainfall received is between 2000 to 2500 mm annually. The plateau changes the colours after every 15-20 days as the monsoon progresses since June to October. The progress is in terms of yellow colours of Senecios and Smithias, blue colours of Utricularias, pink rosy colours of Impatiens, white colours of Eriocaulons and Habanerias and purple colours of Strobilanthes species. Many rare endemic endangered plants like Ceropegias, Seshagiria, Arisaemas, Decaschistia, Trithuria, Dipcadi etc., grow on these plateaus.
- The areas are home to the endangered species of top carnivores such as Tigers, Wild dogs, Leopards, Mega Herbivores: Gaur, Sambar, Barking Deer, Four Horned Antelope, Mouse Deer, Giant Squirrel, Porcupines and so on. Total 33 species of mammals have been recorded. In addition to this the Vasant Sagar reservoir is home to crocodiles, which are on the verge of extinction. It is home for

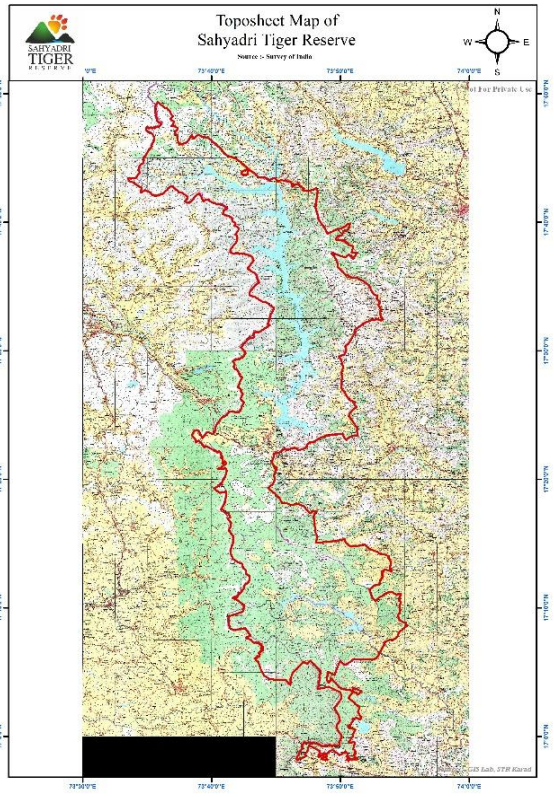
4 Hornbills and many other endemic Birds. The breeding grounds of Indian River Tern are found in Chandoli NP and Koyna WLS. Crocodile breeding is also noticed recently in Chandoli NP.

- From the previous research records on a various wildlife species, STR is having 244 Species of Birds, 120 Species of Butterflies, 22 Species of Amphibians, 44 Species of Reptiles, 50 Species of Fresh water fishes, 1452 Trees and 400 Medicinal Plants. It is also important to that several new species have been discovered from the landscape and includes Indotyphlus maharashtraenis, Cyrtodactylus deccanensis, Hemidactylus satarensis, Cnemaspis kolhapurensis, Indirana chiravasi, Cnemaspis girii, Sarada darwinin etc.
- 39 species of flowering plants find mention in the RED DATA book of the total 624, which make it approximately 6% of the Red data species. The orchids, lichens, ferns, mosses are indicators of purity of environment. The genus Ceropegia is represented in the region by about 24 species of, which about 10 are endemic to the sanctuaries. Vigna khandalensis, Atylosia lineata, A. scabrioides, Cucumis setosus and number of other such wild relatives of cultivated plants are endemic to the protected area.

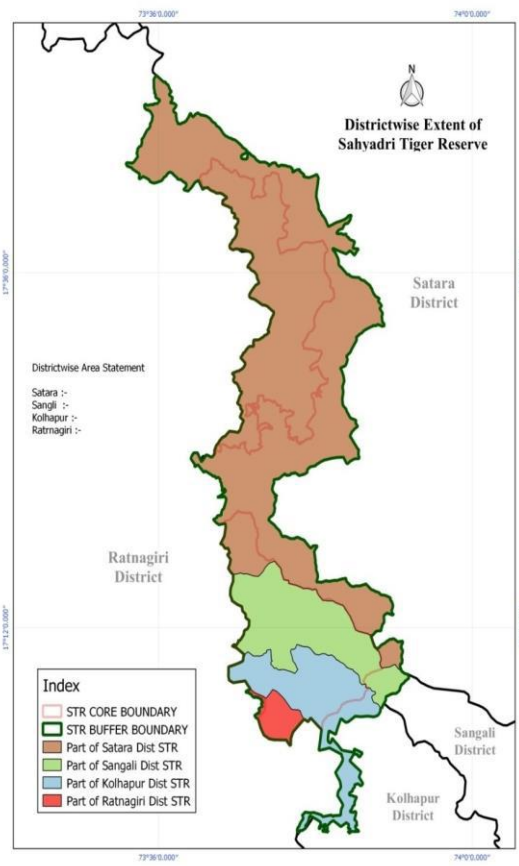
Map of Tiger Conservation Unit/Landscape:



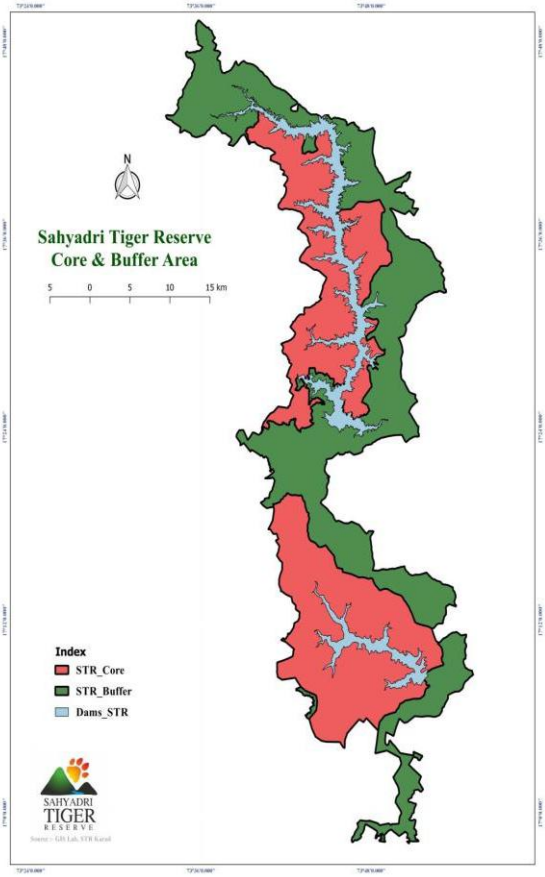
Map 1 Google Map of STR



Map 2 Toposheet Map of STR



Map.3. District wise Map of STR



Map.4. Core & Buffer Map of STR

Legal provisions contained in the Wildlife (Protection) Act regarding the Tiger Conservation Plan and a brief description of their relevance in the Tiger Conservation Unit/ Landscape.

- The Wildlife (Protection) Act, 1972 was amended in 2006, and a separate Chapter (IVB) has been added on the "National Tiger Conservation Authority", which has replaced Project Tiger. This Chapter, inter alia, has enabling provisions (Section 38V) for preparing a "Tiger Conservation Plan" for the proper management of a Tiger Reserve, which will also include staff development and deployment plan.
- The Core or Critical Tiger Habitat must remain inviolate to support tiger conservation efforts. Surrounding this habitat is the Buffer Zone, which serves to safeguard the integrity of the Critical Tiger Habitat while providing ample dispersal opportunities for tiger species. It also facilitates coexistence between wildlife and human activities, respecting the livelihoods, developmental needs, and cultural rights of local communities. Additionally, the adjoining landscape functions as a corridor, enabling the movement of wild animals between core areas.
- The guidelines of Project Tiger mandated that each Tiger Reserve adhere to a site-specific Management Plan, serving as the blueprint for reserve management. Consequently, Project Tiger emerged as a model for scientifically managing Protected Areas across India. It introduced the Core-

Buffer zonation concept and outlined interventions for protection, habitat enhancement, and field data collection concerning changes in flora and fauna composition due to protection measures, as well as animal estimation and other relevant aspects.

Delineation of Area into Core, Buffer and Adjoining Landscape:

A. Core Zone:

- In accordance with section 38 (V) (4) explanation (i) & (ii), the Principal Chief Conservator of Forests (Wildlife), M.S. Nagpur, via letter No. Desk 23(2) /Survey/pra.kra.50 (1)/4205 dated 12-03-2012, formed an expert committee to identify and establish the Critical Tiger Habitat area of the Sahyadri Tiger Reserve (STR). Subsequently, on 21st August 2012, the Government of Maharashtra, through Resolution no. WLP-2012/C.R. no.240/ F-1, officially declared and notified 600.12 sq.km. area as the Core Zone. (Atlas Map No. 12)
- There are many challenges before the STR administration since its creation. The core zone is divided into two parts and both parts are 7-8 km away from each other. Both units have a large edge to area ratio as the outer boundary is extremely irregular. More than 82 villages are adjoining to the core zone create enormous biotic pressure on the core area an no buffer zone on western side. Therefore, protection of this landscape is becoming challenging tasks for administration.
- The Core Zone, also known as the Core Tiger Habitat (CTH), within the Sahyadri Tiger Reserve spans across 62 villages. However, certain areas within both the Chandoli National Park (NP) and Koyna Wildlife Sanctuary (WLS) are excluded from the CTH, accounting for a total of 82 villages. Among these, 27 villages have been rehabilitated by the irrigation department through projects such as the Koyna and Warna Irrigation Project. Additionally, rights have been reserved for 18 villages within the Koyna WLS, as indicated by an enquiry report. Of the remaining 37 villages, the Forest Department has successfully relocated 29 villages, with ongoing efforts to address pending benefits for affected persons (PAPs). Rehabilitation processes for the remaining 8 villages are underway, with Forest Conservation Act (FCA) permissions secured for land in 2 villages, while proposals for the remaining villages are currently in progress.
- Introduction Table 2: following are the area details of core zone of Sahyadri Tiger Reserve:

Details of Core Zone of STR	Forest Area (Sq.km.)	Non-Forest Araea (Sq.km.)	Total area of Core Zone (Sq.km.)	No. of Villages yet to relocate
Chandoli Division	198.06	115.78	313.84	6
Koyna Division	196.42	89.86	286.28	2
Total Area	**394.48**	**205.64**	**600.12**	**8**

- **Note**: Of the 8 villages, *Amboli* Village in Kolhapur district is currently inhabited, with only land acquisition pending. However, the village's inquiry status is still pending with the Sub-Divisional Officer (SDO) and the inquiry officer in Shahuwadi. Notably, this village area was notified after Chandoli was declared a National Park in 2004.
- As per AITE 2022 report, Sahyadri Tiger Reserve has no tigers based on scat DNA analysis. However, the tiger population is transient and does not stay in tiger reserve for an entire duration of the year. A major finding came through in May, 2018 as a lone male tiger was recorded from four locations in Chandoli National Park, part of the tiger reserve. This was a confirmed record within the tiger reserve boundary after eight years. Later in early 2019 during Phase-I monitoring, a tiger scat was found in Waghane beat of Helwak range. Then again, after 4 years indirect evidence of tiger presence was found in Sonarli beat of Chandoli range on 12 December, 2023 and the same tiger captured in camera trap during Phase-IV, 2024. We named it as STR-T1 and he is still roaming in tiger reserve. We got recent CT photograph of STR-T1 on 30th May, 2024. STR-T1 so far covering 5 ranges out of 8 ranges of tiger reserve. This includes all four ranges of Chandoli Wildlife Divisions and One Koyna range of Koyna Wildlife Division. Recently, STR-T1 entered first time in Koyna range in Torane Beat after crossing heavy trafficked Karad- Chiplun National Highway at Ghatmatha. This is first photographic record of tiger in Koyna Wildlife Sanctuary.

- **B. Buffer Zone:**
- Buffer Zone of STR was declared to ensure that the CTH or core has adequate area for the dispersal of tigers and other species, and to promote co-existence between wildlife and humans. Buffer area serves as a 'shock-absorber' by meeting the demands of small timber, fuel wood, fodder and thatch grass of the local human and cattle populations. Hence, there is need of well-designed strategies for management of buffer zone. The Principal Chief Conservator of Forests (Wildlife), M.S. Nagpur, through letter No. D-22(8)/ TCP/ 1653/12-13, dated 26.7.2012, expert committee was constituted to identify and establish the Buffer area of the Sahyadri Tiger Reserve (STR). Subsequently, on 21st August, 2012, the Government of Maharashtra, through Resolution no. WLP-2012/C.R. no.240/ F-1, officially declared and notified 565.45 sq.km. area as Buffer Zone of the Sahyadri Tiger Reserve.
- The declaration of the Buffer Zone within the Sahyadri Tiger Reserve (STR) serves the purpose of providing ample space for the dispersal of tigers and other wildlife species from the Core Tiger Habitat (CTH). Additionally, it aims to foster harmonious coexistence between wildlife and human activities, while duly acknowledging the livelihoods, developmental needs, and social and cultural rights of the local communities. There are 82 habited villages included within this buffer zone having a human population of 52.3 thousand, 11.3 thousand households and Cattle Population of 23.5 thousand

approximately. The details of this area are given in the Buffer Zone Plan. The major communities in Buffer area are *Maratha, Nomadic tribe, Baudh Community and Muslim community.* Buffer villages are inhabited by *Maratha* community with highest percentage i.e.87.04%. People of these villages are mostly depending on agriculture and forest products etc. Locals used to enter in forest area for collection of fuelwood, livestock grazing, fruit collection etc. The largest village in buffer zone is *Rasati* with a population of 2050 in Koyna range and the smallest village is *Kemase* with a population of 15 people. (Atlas Map No. 167)

- Introduction Table 3: following are the area details of buffer zone of Sahyadri Tiger Reserve:

Details of buffer Zone of STR	Forest Area (Sq.km.)	Non-Forest Araea (Sq.km.)	Total area of Buffer Zone (Sq.km.)	No. of Villages
Chandoli Division	119.84	81.59	201.43	31
Koyna Division	102.44	261.57	364.02	54
Total Area	**222.28**	**343.17**	**565.45**	**85**

C.Corridor/ Adjoining Landscape:

- Sahyadri Tiger Reserve is ecologically connected to Kali Tiger Reserve and Bhimgad WLS in Karnataka and Mhadei WLS in Goa through corridor area of Kolhapur Forest Division and Sawantwadi Forest Division. In recent times, the declaration of new conservation reserves (CR) made the Sahyadri-Konkan corridor (Sahyadri Tiger reserve to Kali Tiger Reserve) a protected landscape of around 870 km2. This corridor or the landscape starts from Sahyadri Tiger Reserve (STR) and Jor-Jhambli Conservation Reserve further north and continues till Tillari Conservation Reserve-Mhadei Wildlife Sanctuary and further south. The importance of the southern corridor from Sahyadri to Radhanagri till Mhadei and Kali Tiger Reserve has been reaffirmed in the larger landscape context through the assessment of all habitat parameters. There are around seven Conservation Reserves situated in between the Sahyadri Tiger reserve-Radhanagri Wildlife Sanctuary-Mahdei Wildlife Sanctuary. North to the STR is Jor-Jhambli Conservation Reserve, in between STR and Radhanagri Wildlife Sanctuary, Vishalgad, Panhalgad, and Gaganbawda Conservation Reserve are situated. Further south to the Radhanagri, Ajara-Bhudargarh, Dondamarg-Amboli, Chandgad, and Tillari Conservation Reserve are situated and well connected further south to different protected areas in Goa and Karnataka. (Atlas Map No.180)
- The Sahyadri-Konkan corridor, which is part of the north-central Western Ghats, is a linear forested habitat that connects the Sahyadri Tiger Reserve (STR) in Maharashtra to the Kali Tiger Reserve (KTR) in Karnataka. The Western Ghats is one of the most biodiverse areas in India; this part of the

Western Ghats supports the northernmost limits of three of the four large carnivores that are found in Western Ghats – the tiger, dhole, and sloth bear.

- South of the Sahyadri Tiger Reserve, the corridor is viable with the adjacent PA; Radhanagri Wildlife Sanctuary, and with newly declared CRs it connects to the Mahadei Wildlife Sanctuary in Goa and the Kali Tiger Reserve in Karnataka, which works as a source population for tigers for Sahyadri-Konkan landscape. The viability of this corridor is crucial for the growth of the tiger population in this region and specially for STR. There are some points in the corridor where forested areas are small in size and fragmented as well, which serves as a bottleneck in the corridor. Crucial bottleneck points are situated in Gaganbawada, Vishalgarh CR and Tillari CR, focusing on these points can strengthen the corridor connectivity and can ensure a healthy tiger population and safe movement of tiger in the future.
- The southern corridor can still provide potential movement corridor for larger mammal species such as tigers, leopards and sloth bears. We found seven land use classes within Sahyadri. Of these, two dominant land-use types are dense forest and barren lands (which include rocky land or plateaus). A major component is water body, hence Sahyadri has a rich stream network. We further found that the western part of Sahyadri has good connectivity of dense forests. In the larger landscape context, the significance of the southern corridor from Sahyadri to Radhanagri till Dandeli and Mahdei has been again reiterated through the study of all habitat factors. Keeping this in view, a larger landscape level study is deemed important to understand the habitat status throughout the landscape.
- This corridor is fragmented at many sites which are human habitat and is also threatened at many places due to bauxite mining. Unless all these threats and impediments to habitat connectivity and recovery are identified, understood, and connected areas are secured, overall tiger recovery is challenging.
- The NTCA estimates that a tiger population of 80-100 tigers (with 20 females of breeding age) is required to be genetically viable on its own. It can be seen that not a single tiger population in the western ghat landscape is genetically viable in the long run by itself. Hence, the Adjoining Landscape/Corridor plan for each tiger reserve is a must to ensure the long-term viability of tiger populations in the Western Ghat Landscape. Sahyadri Tiger Reserve without any resident population of tigers is highly dependent on immigration and emigration of adult tigers from other sub-populations. Hence, the tiger conservation plan is very important to ensure connectivity of STR with other adjoining tiger reserves, protected areas and tiger bearing areas. Details of these areas are given in the adjoining landscape/Corridor plan.

D. Eco-sensitive Zone:

- On February 9, 2011, the Ministry of Environment, Forests, and Climate Change (MoEFCC) introduced new guidelines aimed at establishing eco-sensitive zones (ESZs) around Protected Areas. These zones are designed to mitigate the ecological damage caused by developmental activities in the vicinity of National Parks and Wildlife Sanctuaries. Acting as buffers, ESZs help regulate and manage activities surrounding these protected areas. The primary objective is to minimize adverse impacts on the delicate ecosystems encompassing these areas. While the width of the ESZ and the nature of regulations may vary depending on the specific protected area, a general principle suggests a width of up to 10 km around the perimeter of the protected area. (Atlas Map No. 6)
- It is necessary to conserve and protect the area the extent and boundaries of which is specified in proposal submitted to central government adjoining the Sahyadri Tiger Reserve (Koyna WLS and Chandoli NP) as Eco-sensitive Zone (ESZ) from ecological and environmental point of view and to prohibit industries or class of industries and their operations and processes in the Eco-sensitive zones. It is necessitating the requirement of proper safeguards and control over ongoing destructive activities in ESZ.
- The proposed Eco-sensitive Zone is spread over an area of 772.77 sq.km. and certain villages in Tahsil-Mahabaleshwar-8, Jawali- 7, Satara-6, Patan-44 in Satara district, Tahsil-Shirala-1 in Sangli district, Tahsil-Shahuwadi-9 in Kolhapur district, Tahsil-Sangameshwar-19, Khed-10, Chiplun-16 in Ratnagiri district, total-120 villages fall in the Eco-sensitive Zone of STR (Chandoli NP and Koyna WLS). The Eco-sensitive Zone of Sahyadri Tiger Reserve is the area to an extent of 1.23 km to 13.68 km from boundaries of Koyna WLS and Chandoli NP. The buffer zone of STR shall form part of the proposed Eco-sensitive Zone. All activities in the Eco-sensitive Zone shall be governed by the provisions of the Environment (Protection) Act, 1986 and rules made thereunder. The guidelines outline a comprehensive range of activities that may be permitted, regulated, or prohibited within the ESZs.

CHAPTER – 1

INTRODUCTION OF THE AREA

The Sahyadri Tiger Reserve (STR) is situated in the Sahyadri Ranges of the Western Ghats, encompassing parts of four districts in Maharashtra: Satara, Sangali, Kolhapur, and Ratnagiri. It was officially notified as a tiger reserve of India on February 5, 2010, making it the fourth tiger reserve in Maharashtra. The reserve spans two protected areas: the Koyna Wildlife Sanctuary and the Chandoli Wildlife Sanctuary.

The Koyna Wildlife Sanctuary was declared by the Government of Maharashtra on September 16, 1985, covering an area of 423.55 sq.km. Similarly, the Chandoli Wildlife Sanctuary was also declared on the same date, with an area of 308.97 sq.km. Later, the intention to establish the Chandoli Wildlife Sanctuary as the Chandoli National Park was declared on May 14, 2004, covering an area of 317.67 sq.km.

The proposal to designate the area as a tiger reserve was initiated in 2005 by the Conservator of Forests (Wildlife) in Kolhapur, who submitted it to the Chief Wildlife Warden of Maharashtra.

The process of establishing the Sahyadri Tiger Reserve occurred in two steps:

- On January 5, 2010, the Government of Maharashtra notified an area of 741.22 sq.km as the Sahyadri Tiger Reserve, comprising the Chandoli National Park and the Koyna Wildlife Sanctuary.
- Subsequently, on August 21, 2012, the Government of Maharashtra issued a notification designating 600.12 sq.km as the critical tiger habitat or core area and 565.45 sq.km as the buffer or peripheral area of the Sahyadri Tiger Reserve, bringing the total area to 1165.57 sq.km.

The Sahyadri Tiger Reserve is recognized as an important biodiversity hotspot, hosting a diverse range of flora and fauna, many of which are endemic to the Western Ghats. It also serves as a crucial catchment area for two dams in Western Maharashtra: the Koyna (Shivsagar) and Chandoli (Vasantsagar) reservoirs.

Moreover, on July 1, 2012, the Sahyadri Tiger Reserve was included as part of the UNESCO World Natural Heritage site. This designation highlights the area's significance in terms of biodiversity conservation and ecological importance.

Table.1.1 : Protected Area of Sahyadri Tiger Reserve

Sr No	Name of Protected area	Area (sq.km)	CTH Area (sq.km)
1	Chandoli National Park	317.67	313.84
2	Koyana Wildlife Sanctuary	423.55	286.28
Total Area		741.22	600.12
Total Buffer		**565.45**	
Total Tiger Reserve Area		**1165.57**	

The organization responsible for the management and development of the Sahyadri Tiger Reserve (STR) is the Forest Department of the Government of Maharashtra. This department oversees the conservation efforts, protection measures, and sustainable development initiatives within the tiger reserve.

In terms of administration and management, the core zone of the Sahyadri Tiger Reserve comprises eight villages, with two located within the Koyna Wildlife Sanctuary (WLS) and five within the Chandoli National Park (CNP).

The buffer zone of the Sahyadri Tiger Reserve was officially notified on August 21, 2012, covering an area of 565.45 square kilometers. This buffer zone encompasses 84 villages. Currently, the buffer zone is under unified control, likely implying centralized management and coordination for conservation and development activities.

Within the Sahyadri Tiger Reserve, there are eight ranges responsible for the management and protection of the wildlife and habitats.

Table.1.2 : Range,Round, & Beats of Sahyadri Tiger Reserve

Sr No	Name of Range	No of Round	No of Beat	Area in Sq Km	
				Core	Buffer
1	Kandat	3	8	2144.70	12172.01
2	Koyana	3	12	13127.60	4499.65
3	Bamnoli	3	9	5673.56	4945.00
4	Patan	3	9	2001.53	14785.71
5	Helwak	3	9	6676.08	7833.74
6	Dhebewadi	3	10	7984.64	5669.00
7	Chandoli	3	10	12990.24	1705.85
8	Amba	3	8	3733.34	4934.86
	Total	**24**	**75**	**54331.69**	**56545.82**

1.1. Name, Location, Constitution & Extent:

1.1.1. Name:

The Sahyadri Tiger Reserve, established by the Indian government in 2008, is located in the state of Maharashtra. It is situated within the Sahyadri Ranges of the Western Ghats, known for their rich biodiversity. The reserve spans across multiple districts, including Satara, Sangli, Kolhapur, and Ratnagiri. Notably, it falls within the eco regions of North Western Ghats moist deciduous forests and North Western Ghats montane rain forests.

1.1.2. Location:

The Sahyadri Tiger Reserve encompasses both core and buffer areas. The buffer area, as per the notification dated August 21, 2012, covers approximately 565.45 square kilometers. It extends across the geographic territories of the four aforementioned districts of Maharashtra. Specifically, it includes 1 village in Sangli district, 9 villages in Kolhapur district, 66 villages in Satara district, and 4 villages in Ratnagiri district. Within this buffer area, 424.34 square kilometers lie outside the protected area, while 141.11 square kilometers are part of the protected areas.

Geographical Coordinates:

The buffer area of the Sahyadri Tiger Reserve spans between 7°31'33" to 73°55'12" East Longitude and 16°58'05" to 17°49'14" North Latitude. The terrain ranges in elevation from 500 to 1200 meters above mean sea level (MSL), with the Western Ghats running north-south for approximately 100 kilometers and averaging a width of 20 kilometers. The pristine forests within the Kolhapur, Satara, Sangli, and Ratnagiri districts constitute the buffer area of the Sahyadri Tiger Reserve.

Location by Biogeographic Zonation:

The Sahyadri Tiger Reserve falls within the Oriental Biogeographic Region, specifically categorized under the Indo-Himalayan sub kingdom within the Paleotropical biogeographical kingdom. It is situated in Biogeographic Zone 5-B of the Western Ghats, within the Western Ghat Mountains biotic province. This classification is based on factors such as faunal assemblage, vegetation, altitude, latitude, and geographic location.

Table 1.3**:** The abstract of forest and non-forest area included in Buffer Zone of STR:

Sr No	Name of the PA	Name of District	Name of Tahsil	Core Ha	Buffer Ha	Total area Ha	Villages
1	Koyana WLS	Satara	Patan	12860.35	9148.1	22008.45	29
			Jaoli	15767.57	0	15767.57	17
			Mahabaleshwar	0	4578.98	4578.98	8
KOYANA NP				**28627.92**	**13727.08**	**42355**	**54**
2	Chandoli NP	Satara	Patan	3126.61	0	3126.61	18
		Sangli	Shirala	16131.75	383.51	16515.26	3
		Kolhapur	Shahuwadi	9802.74	0	9802.74	9
		Ratnagiri	Sangameshwar	2323.2	0	2323.2	1
CHANDOLI NP				**31384.3**	**383.51**	**31767.81**	**31**
SAHYADRI TIGER RESERVE				**60012.22**	**14110.59**	**74122.81**	**84**

1.1.3. Constitution:

The establishment of the Sahyadri Tiger Reserve (STR) follows the guidelines set forth in Section 38 (V) of the Wildlife (Protection) Act, 1972. This section mandates that the State Government, upon recommendation by the National Tiger Conservation Authority (NTCA), notifies an area as a Tiger Reserve. The Tiger Reserve comprises two essential parts: the Core or Critical Tiger Habitat (CTH) and the Buffer or peripheral area. These areas are identified and established based on scientific and objective criteria to ensure effective tiger conservation.

The Maharashtra State Government, through a notification dated January 5, 2010, designated an area of 741.22 sq.km., encompassing the Chandoli National Park (317.67 sq.km.) and the Koyna Wildlife Sanctuary (423.55 sq.km.), as the Sahyadri Tiger Reserve.

Expert committees were constituted by the Principal Chief Conservator of Forests (Wildlife) to identify and establish both the Critical Tiger Habitat and the Buffer area of the Sahyadri Tiger Reserve. The Core area is determined based on scientific criteria, ensuring the inviolability of habitat for tiger conservation. The Buffer area is delineated to promote coexistence between wildlife and human activities while safeguarding the integrity of the critical tiger habitat.

The Core area of the Sahyadri Tiger Reserve, identified through research data and expert analysis, spans 600.12 sq.km. It is crucial for sustaining tiger populations and ensuring long-term viability. However, the identified Core area is smaller than the recommended minimum of 800 sq.km. for inviolate space. Management practices within the proposed Buffer area aim to enhance tiger population and habitat connectivity, with the goal of achieving a sustainable tiger population of 15-20 individuals.

1.1.4. Extent:

The Core area of the Sahyadri Tiger Reserve covers 600.12 sq.km., while the Buffer area, as per the notification dated August 21, 2012, encompasses 565.45 sq.km. within the protected area. The historical forts and religious sites within the reserve area contribute to its uniqueness and attract visitors interested in trekking and experiencing the natural beauty of the region.

1.2. Approach and Access:

Access to the Sahyadri Tiger Reserve is facilitated through well-connected headquarters in Kolhapur and Karad, which are accessible via National Highway 4 (NH4). These headquarters serve as administrative centers for forest conservators, field directors, deputy directors, and sub-divisional officers, providing logistical support and coordination for conservation efforts within the reserve.(Map No.16)

Table 1.4: Distance of Tiger Reserve from nearest cities of our as well as neighboring states is as follows-

Sr. No.	State	Destination	Distance (kms)
Nearest Airports			
1	Maharashtra	Pune	210
		Kolhapur	140
		Mumbai	360
Nearest Railway Stations			
2	Maharashtra	Karad	65
		Chiplun to Koyana	52
State Transport Buses			
3	Maharashtra	Koyananagar	
		Kolhapur	140
		Satara	90
		Karad	60
		Patan	20
		Chiplun	40
		Satara Bamnoli	40
		Karad to Chandoli (Mandur)	50
		Islampur - Chandoli (Mandur)	65
		Kolhapur to Chandoli (Mandur)	90

1.3. Statement of Significance:

Despite being densely populated with numerous villages, the Sahyadri Tiger Reserve (STR) boasts exceptional biodiversity. Situated within the Western Ghats, one of India's ecologically richest regions, the reserve harbors a multitude of threatened species and unique ecosystems. The Western Ghats, second only to the Himalayas in terms of biological diversity, are home to a variety of flora and fauna, including endangered species like Garambi, Ranjaiphal, Dhup, and Rosewood (Shisham).

The climate and rainfall patterns in the region have fostered the evolution of diverse plant and animal species. The Western Ghats boast a significant forest cover, accounting for one-third of their total area. Within these forests thrive approximately 4000 species of flowering plants, with 1500 species being endemic. Additionally, the Western Ghats support 28 genera of mammals, 275 genera of birds, and 58 species of reptiles. Moreover, the region serves as the origin of several cultivated plants, including pepper, cardamom, ginger, turmeric, mangoes, jackfruit, ragi, and various millets. Orchids and medicinal plants also flourish in this biodiversity hotspot.

Furthermore, the Western Ghats are rich in mineral resources such as iron, manganese, and bauxite ores. The biological diversity of the region is crucial not only for its intrinsic value and the livelihoods of local communities but also for maintaining the ecological balance of the entire peninsular region.

The Sahyadri Tiger Reserve stands out as a sanctuary for climax and near-climax vegetation, with minimal risk of adverse human impact in the future. It holds several bio-geographical peculiarities and is of both global and national significance.

The reserve is inhabited by a diverse array of wildlife, including iconic species like tigers, leopards, sloth bears, Indian giant squirrels (Shekaru), Indian Gaurs, sambar deer, barking deer, wild boars, porcupines, wild dogs, mouse deer, and four-horned antelopes.

Biological Value:

The biodiversity of the Sahyadri Tiger Reserve is immense, encompassing a wide variety of vertebrates. Documented species include about 4000 species of Flowering Plant of which 1500 Species are endemic 28 Genera species of mammals, over 275 Genera species of birds, more than 275 species of butterflies, 58 species of reptiles, as well as numerous amphibians and fishes. The reserve serves as a haven for these animals, contributing significantly to regional and national conservation efforts.(Annexure No. 1 and 2)

Table.1.5 List of species found in STR as per WLPA-1972:

SCHEDULE-I		
Mammals		
SR.NO.	**COMMON NAME**	**SCIENTIFIC NAME**
1	Four-horned Antelope	*Tetracerus quadricornis*
2	Sloth Bear	*Melursus ursinus*
3	Asiatic Wild Dog	*Cuon alpines*
4	Indian Golden Jackal	*Canis aureus*
5	Jungle Cat	*Felis chaus*
6	Leopard	*Panthera pardus*
7	Leopard Cat	*Prionailurus bengalensis*
8	Rusty Spotted Cat	*Prionailurus rubiginosus*
9	Tiger	*Panthera tigris*
10	Asian Palm Civet	*Paradoxurus hermaphroditus*
11	Small Indian Civet	*Viverricula indica*
12	Brown Palm Civet	*Paradoxurus jerdoni*
13	Indian Chevrotain/Mouse Deer	*Moschiola indica*
14	Sambar	*Rusa unicolor*
15	Barking Deer	*Muntiacus muntjak*
16	Striped Hyaena	*Hyaena hyaena*
17	Indian Grey Mongoose	*Urva edwardsii*
18	Ruddy Mongoose	*Urva smithii*
19	Striped-necked Mongoose	*Urva vitticolla*
20	Asian Small-clawed Otter	*Aonyx cinerea*
21	Indian Pangolin	*Manis crassicaudata*

22	Indian Crested Porcupine	*Hystrix indica*
23	Bonnet Macaque	*Macaca radiata*
24	Indian Giant Squirrel	*Ratufa indica*
25	Indian gaur	*Bos gaurus*
Birds		
26	Barn Owl	*Tyto alba*
27	Amur Falcon	*Falco amurensis*
28	River Tern	*Sterna aurantia*
29	Great hornbill	*Buceros bicornis*
30	Malabar Grey Hornbill	*Ocyceros griseus*
31	Malabar Pied Hornbill	*Anthracoceros coronatus*
32	Black Eagle	*Ictinaetus malaiensis*
33	Bonelli's Eagle	*Aquila fasciata*
34	Booted Eagle	*Hieraaetus pennatus*
35	Brahminy Kite	*Hcdiastur indus*
36	Changeable Hawk-eagle	*Nisaetus cirrhatus*
37	Common Buzzard	*Buteo buteo*
38	Crested Serpent Eagle	*Spilornis cheela*
39	Griffon Vulture	*Gyps fulvus*
40	Pallid Harrier	*Circus macrourus*
41	Shikra	*Accipiter badius*
42	Short-toed Snake Eagle	*Circaetus gallicus*
43	Steppe Eagle	*Aquila nipalensis*
44	Tawny Eagle	*Aquila rapax*
45	Montagu's Harrier	*Circus pygargus*
46	White-eyed Buzzard	*Butastur teesa*
47	White bellied Sea eagle	*Haliaeetus leucogaster*
48	Small Minivet	*Pericrocotus cinnamomeus*
49	Western Osprey	*Pandion haliaetus*
50	Brown Fish-owl	*Ketupa zeylonensis*
51	Brown Wood-owl	*Strix leptogrammica*
52	Mottled Wood-owl	*Strix ocellata*
53	Short-eared Owl	*Asio flammeus*
54	Grey Jungle fowl	*Gallus sonneratii*
55	Indian Peafowl	*Pavo cristatus*
56	Nilgiri Wood pigeon	*Columba elphinstonii*
57	Heart-spotted Woodpecker	*Hemicircus canente*
58	Yellow crowned Woodpecker	*Leiopicus mahrattensis*
59	Rufous-fronted Prinia	*Prinia buchanani*
Reptiles		
60	Red Sand Boa	*Eryx johnii*

61	Whitaker's Boa	*Eryx whitakeri*
62	Marsh crocodile	*Crocodylus pcdustris*
63	Indian chameleon	*Chamaeleo zeylanicus*
64	Spectacled Cobra	*Naja naja*
65	Bengal Monitor	*Varanus bengalensis*
66	Checkered Keelback	*Fowlea piscator*
67	Indian Rat Snake	*Ptyas mucosa*
68	Russell's Viper	*Daboia russelii*
69	Indian rock Python	*Python molurus*
70	Indian Flap Shell Turtle	*Lissemys punctata*
71	Indian Star Tortoise	*Geochelone elegans*
SCHEDULE – II (See sections 9, 11, 12, 38-I, 39, 44, 45, 46, 47, 48, 48A, 49,50, 51, 54 and 57)		
Bats		
72	Indian Flying Fox	*Pteropus giganteus*
Deer		
73	Spotted Deer	*Axis axis*
Hares		
74	Indian Hare	*Lepus nigricollis*
	Other rodents	
75	Sahyadris Forest Rat	*Rattus satarae*
Pig		
76	Wild Pig	*Sus scrofa*
Primates		
77	Hanuman Langur	*Semnopithecus entellus*
Shrews		
78	Indian Treeshrew	*Anathana ellioti*
Squirrels		
79	Jungle Palm Squirrel/Three-striped Palm Squirrel	*Funambulus tristriatus*
Barbets		
80	Brown-headed Barbet	*Psilopogon zeylanicus*
81	White-cheeked Barbet	*Psilopogon viridis*
82	Coppersmith Barbet	*Psilopogon haemacephalus*
Bee-eaters		
83	Blue-bearded Bee-eater	*Nyctyornis athertoni*
84	Blue-cheeked Bee-eater	*Merops persicus*
85	Blue-tailed Bee-eater	*Merops philippinus*
86	Blue-throated Bee-eater	*Merops viridis*
87	Green Bee-eater	*Merops orientalis*
Bitterns, Herons, and Egrets		
88	Cattle Egret	*Bubulcus ibis*
89	Great Egret	*Ardea alba*
90	Grey Heron	*Ardea cinerea*

91	Indian Pond Heron	*Ardeola grayii*
92	Little Egret	*Egretta garzetta*
93	Striated Heron	*Butorides striata*
	Bulbuls	
94	Red-whiskered Bulbul	*Pycnonotus jocosus*
95	Red-vented Bulbul	*Pycnonotus cafer*
96	Yellow-browed Bulbul	*Acritillas indica*
97	Square-tailed Black Bulbul	*Hypsipetes ganeesa*
	Buntings	
98	Crested Bunting	*Emberiza lathami*
99	Grey-necked Bunting	*Emberiza buchanani*
100	Black-headed Bunting	*Emberiza melanocephala*
101	Red-headed Bunting	*Emberiza bruniceps*
	Quails	
102	Yellow-legged Buttonquail	*Turnis tanki*
	Canary Flycatchers	
103	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*
	Warblers	
104	Booted Warbler	*Iduna caligata*
105	Greenish Warbler	*Phylloscopus nitidus*
106	Sulphur-bellied Warbler	
	Cisticolas, Prinias	
107	Jungle Prinia	*Prinia sylvatica*
108	Ashy Prinia	*Prinia socialis*
109	Grey-breasted Prinia	*Prinia hodgsonii*
	Cormorants	
110	Little Cormorant	*Microcarbo niger*
111	Indian Cormorant	*Phalacrocorax fuscicollis*
	Crows	
112	Rufous Treepie	*Dendrocitta vagabunda*
	Cuckoos	
113	Asian Koel	*Eudynamys scolopaceus*
114	Banded Bay Cuckoo	*Cacomantis sonneratii*
115	Common Cuckoo	*Cuculus canorus*
116	Common Hawk Cuckoo	*Hierococcyx varius*
117	Greater Coucal	*Centropus sinensis*
118	Grey-bellied Cuckoo	*Cacomantis passerinus*
119	Indian Cuckoo	*Cuculus micropterus*
120	Large Hawk Cuckoo	*Hierococcyx sparverioides*
121	Jacobin/Pied Cuckoo	*Clamator jacobtnus*
122	Sirkeer Malkoha	*Taccocua leschenaultii*
	Drongos	
123	Ashy Drongo	*Dicrurus leucophaeus*

124	Black Drongo	*Dicrurus macrocercus*
125	Bronzed Drongo	*Dicrurus aeneus*
126	White-bellied Drongo	*Dicrurus caerulescens*
Ducks, Geese, and Swans		
127	Lesser Whistling Duck	*Dendrocygna javanica*
128	Indian Spot-billed Duck	*Anas poecilorhyncha*
Falcons		
129	Common Kestrel	*Falco tinnunculus*
130	Eurasian Hobby	*Falco subbuteo*
Fantails		
131	Spot breasted Fantail	*Rhipidura albogularis*
132	White-throated Fantail	*Rhipidura albicollis*
Finches		
133	Common Rosefinch	*Corpodacus erythrinus*
Flowerpeckers		
134	Thick-billed Flowerpecker	*Dicaeum agile*
135	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*
136	Nilgiri Flowerpecker	*Dicaeum concolor*
Flycatchers		
137	Asian Brown Flycatcher	*Muscicapa dauurica*
138	Blue Rock Thrush	*Monticola solitarius*
139	Blue Whistling Thrush	*Myophonus caeruleus*
140	Brown-breasted Flycatcher	*Muscicapa muttui*
141	Indian Robin	*Copsychus fulicatus*
142	Malabar Whistling Thrush	*Myophonus horsfieldii*
143	Oriental Magpie Robin	*Copsychus saularis*
144	Red-breasted Flycatcher	*Ficedula parva*
145	Rusty-tailed Flycatcher	*Ficedula ruficauda*
146	Tickell's Blue Flycatcher	*Cyomis tickelliae*
147	Verditer Flycatcher	*Eumyias thalassinus*
148	White-bellied Blue Flycatcher	*Cyornis pallidipes*
Grebes		
149	Little Grebe	*Tachybaptus ruficollis*
Hoopoes		
150	Common Hoopoe	*Upupa epops*
Hornbills		
151	Indian Grey Hornbill	*Ocyceros birostris*
Ioras		
152	Common Iora	*Aegithina tiphia*
Kingfishers		
153	Blue-eared Kingfisher	*Alcedo meninting*

154	Common Kingfisher	*Alcedo atthis*
155	Lesser Pied Kingfisher	*Ceryle rudis*
156	Stork-billed Kingfisher	*Pelargopsis capensis*
157	White-throated Kingfisher	*Halcyon smyrnensis*
Kites, Hawks, and Eagles		
158	Black-winged Kite	*Elanus caeruleus*
159	Black Kite	*Milvus migrans*
160	Oriental Honey Buzzard	*Pernis ptilorhynchus*
Larks		
161	Greater Short-toed Lark	*Calandrella brachydactyla*
162	Malabar Lark	*Galerida malabarica*
Laughing Thrushes and Large Babblers		
163	Common Babbler	*Argya caudata*
164	Jungle Babbler (Black-winged)	*Argya striata*
165	Large Grey Babbler	*Argya malcolmi*
166	Indian Rufous Babbler	*Argya subrufa*
167	Yellow-billed Babbler	*Argya affinis*
Leaf Warblers		
168	Blyth's Reed Warbler	*Phylloscopus reguloides*
169	Western Crowned Warbler	*Phylloscopus occipitalis*
Leaf birds		
170	Jerdon's Leafbird	*Chloropsis jerdoni*
171	Golden-fronted Leafbird	*Chloropsis aurifrons*
Minivets and Cuckoo shrikes		
172	White-bellied Minivet	*Pericrocotus erythropygius*
173	Orange Minivet	*Pericrocotus flammeus*
Monarchs		
174	Indian Paradise Flycatcher	*Terpsiphone paradisi*
Munias		
175	Black-throated Munia	*Lonchura kelaarti*
176	Indian Silverbill	*Euodis malabarica*
177	Scaly-breasted Munia	*Lonchura punctulata*
178	White-rumped Munia	*Lonchura striata*
Nightjars		
179	Indian Nightjar	*Caprimulgus asiaticus*
180	Jerdon's Nightjar	*Caprimulgus atripennis*
181	Indian Jungle Nightjar	*Caprimulgus indicus*
182	Savanna Nightjar	*Caprimulgus affinis*
Orioles		
183	Black-hooded Oriole	*Oriolus xanthornus*
184	Indian Golden Oriol	*Oriolus kundoo*

Owls		
185	Indian Scops-owl	*Otus bakkamoena*
186	Jungle Owlet	*Glaucidium radiatum*
187	Oriental Scops-owl	*Otus sunia*
188	Pallid Scops-owl	*Otus brucei*
189	Spotted Owlet	*Athene brama*
Parrots and Parakeets		
190	Vernal Hanging Parrot	*Loriculus vernalis*
191	Rose-ringed Parakeet	*Psittacula krameri*
192	Plum-headed Parakeet	*Psittacula cyanocephala*
193	Malabar Parakeet	*Psittacula columboides*
Partridges, Quails, and Pheasants		
194	Grey Francolin	*Francolinus pondicerianus*
195	Jungle Bush-quail	*Perdicula asiatica*
196	Painted Francolin	*Francolinus pictus*
197	Red Spurfowl	*Galloperdix spadicea*
Pigeons and Doves		
198	Asian Emerald Dove	*Chalcophaps indica*
199	Green Imperial Pigeon	*Ducula aenea*
200	Grey-fronted Green Pigeon	*Treron affinis*
201	Oriental Turtle Dove	*Streptopelia orientalis*
202	Spotted Dove	*Streptopelia chinensis*
203	Yellow-footed Green Pigeon	*Treron phoenicopterus*
Pipit and Wagtails		
204	Paddyfield Pipit	*Anthus rufulus*
205	Western Yellow Wagtail	*Motacilla flava*
206	White-browed Wagtail	*Motacilla maderaspatensis*
Pitta		
207	Indian Pitta	*Pitta brachyuran*
Plovers and Lapwings		
208	Little Ringed Plover	*Charadrius dubius*
209	Yellow-wattled Lapwing	*Vanellus malabaricus*
210	Red-wattled Lapwing	*Vanellus indicus*
Rails and Coots		
211	Common Moorhen	*Gallinula chloropus*
212	Slaty-legged Crake	*Rallina eurizonoides*
213	White-breasted Waterhen	*Amaurornis phoenicurus*
Reed Warblers and Allies		
214	Blyth's Reed Warbler	*Acrocephalus dumetorum*
215	Paddyfield Warbler	*Acrocephalus agricola*

Rollers		
216	European Roller	*Coracias garrulus*
217	Indian Roller	*Coracias benghalensis*
Sandpipers		
218	Common Sandpiper	*Actitis hypoleucos*
Shrikes		
219	Bay-backed Shrike	*Lanius vittatus*
220	Long-tailed Shrike	*Lanius schach*
Small Babblers		
221	Puff-throated Babbler	*Pellorneum ruficeps*
Sparrows		
222	House Sparrow	*Passer domesticus*
223	Yellow-throated Sparrow	*Gymnoris xanthocollis*
Starlings and Myna		
224	Brahminy Starling	*Sturnia pagodarum*
225	Chestnut-tailed Starling	*Sturnia malabarica*
226	Common Myna	*Acridotheres tristis*
227	Jungle Myna	*Acridotheres fuscus*
Storks		
228	Painted Stork	*Mycteria leucocephala*
229	Woolly-necked Stork	*Ciconia episcopus*
Sunbirds		
230	Crimson-backed Sunbird	*Leptocoma minima*
231	Purple Sunbird	*Cinnyris asiaticus*
232	Purple-rumped Sunbird	*Leptocoma zeylonica*
233	Vigor's Sunbird	*Aethopyga vigorsii*
Swallows and Martins		
234	Wire-tailed Swallow	*Hirundo smithi*
Swifts		
235	Little Swift / Indian House Swift	*Apus affinis*
236	Alpine Swift	*Tachymarptis melba*
Thick-knees		
237	Indian Thick-knee	*Burhinus indicus*
Thrushes		
238	Indian Blackbird	*Turdus simillimus*
239	Orange-headed Thrush	*Geokichla citrina*
240	Tickell's Thrush	*Turdus unicolor*
Weavers		
241	Baya Weaver	*Ploceus philippinus*
Warbler		

242	Indian White-eye Warbler	*Zosterops palpebrosus*
Woodpeckers		
243	Roufous woodpecker	*Micropternus brachyurus*
244	Lesser Yellownape	*Picus chlorolophus*
245	Black-rumped Flameback	*Dinopium benghalense*
	Geckos	
246	Deccan Banded Gecko	*Cyrtoddactylus albofasciatus*
247	BOAS	All species of the family Boidae except for those listed in Schedule I
Snakes		
248	Blind Snakes	All species of the Family *Typhlopidae*
249	Colubrid Snakes	All species of the Family *Colubridae* except those listed in Schedule I
250	Elapid Snakes	All species of the Family Elapidae except for those listed in Schedule I
251	Sand Snakes	All species of the Family *Psammophiidae*
252	Shield-Tailed Snakes	All species of the Family *Uropeltidae*
253	Sunbeam Snakes	All species of the Family *Xenopeltidae*
254	Thread Snakes	All species of the Family *Leptotyphlopidae*
255	Vipers	All species of the Family Viperidae except for those listed in Schedule I
Nymphalidae		
256	Blue Oakleaf	*Kallima horsfieldi*
257	Common Nawab	*Polyura athamas*
258	Danaid Egg fly	*Hypolimnas misippus*
259	Red-spot Duke	*Euthalia evelina*
260	Yellow Rajah	*Charaxes marmax*
261	Tamil Lacewing	*Zipotis saitis*
262	Tawny Rajah	*Charaxes bernardus*
Papilionidae		
263	Common Banded Peacock	*Papilio crino*
264	Crimson Rose	*Pachliopta hector*
265	Fourbar Swordtails	*Graphium agets*
266	Malabar Banded Peacock	*Papilio buddha*
Pieridae		
267	Common Albatross	*Appias albina*
268	Lesser Gull	*Cepora nadina*
269	One-spot Grass Yellow	*Eurema andersoni*

IMPORTANT-BIRD-AREA

Chandoli Dam and Koyana Dam is located in buffer and core area and It qualifies Al (Threatened Species). Az (Endemic Bird Area 123 Western Ghat criteria of Important Bird Area (IBA). IBA site code given to Koyana Sanctuary is : IN - MH -07 and Chandoli National Park is IN-MH-22 Respectively Local NGO's are demanding to notify this Dam as Conservation reserve and forest department with local NGO's has identified it as potential Bird Site.

KOYNA WILDLIFE SANCTUARY

Category	Details
State	Maharashtra
IBA Site Code	IN-MH-07
District	Satara
Satars	[Not provided]
Coordinates	17 N
Ownership	[Not provided]
Area	42.355 hectares
Altitude	1,800 meters above sea level
Rainfall	1,500-3,000 mm
Temperature	Western Ghats
Biogeographic Zone	[Not provided]
Habitats	Tropical Dry Evergreen, Tropical Moist Deciduous Forest

PROTECTION STATUS :-

Wildlife Sanctuary, established Recently included in the Sahyadri Tiger Reserve (FT) along with Chandoli National Park vide government Notification dated 5 January 2010(Annexure No.6)

GENERAL DESCRIPTION

Koyna Wildlife Sanctuary is located in the tehsils of Jawali and Patan in Satara district, western Maharashtra, covering an area of 42,355 ha and extending westwards till Ratnagiri district. Koyna WLS includes the eastern and western catchments of Koyna Dam, a major hydroelectric project in western Maharashtra, currently generating 2.200 MW. The reservoir of the dam is known as Shivasagar. The sanctuary is well protected to a large extent by the Shivsagar reservoir and steep slopes. Chandoli corridor connect the sanctuary to Radhanagari Wildlife Sanctuary

At the center of the sanctuary has the historical Vasota fort, constructed during 1178-1193, which was taken over by the great Maratha warrior Chhatrapati Shivaji in 1655 and used as a prison. During the Peshwa regime in 1817. the fort was taken by the British after an intense battle. which resulted in its destruction. Now only ruins of the fort remain. The vegetation consists of Southern Tropical Evergreen Forest and Southern Moist Mixed Deciduous Forest according to the classification of Champion & Seth (1968), The sanctuary hosts the threatened tree species *Narkya Mappia foetida*. Euphorbia longana and *Klascarpus trcturins* are other uncommon species found bere Giant trees such as *Hoarpullia arbores* and *Turpinsa malabarien*, endemic to the Western Ghats, are commonly found in this IBA

AVIFAUNA

No Systematic study of the avifauna of Koyna WLS has been done, though the area is rich in avifauna and other biodiversity A decade ago. BNHS had undertaken an EIA project in the area and #1 bird species were reported from a small part of the sanctuary. Indian Blue Robin *Luscinia brunnea*, a Himalayan hird, was seen in this IBA site (A Akhtar, pera, comm. 2003). This is a Biame 7 (Stno Himalayan Temperate Forest) species. During winter, it is seen in Sri Lanka, hills of the Northeast and southern Western Ghats (Ali & Ripley 1987, Grimmett et al. 2011). This IBA once had undisturbed forests typical of Western Ghata (ERA 123), but now forest fires and encroachments have become common on the northern periphery, Especially Near tapola and Bamnoli Villages. Two Restricted-range species have been seen, but more research is needed to know the full extent of the avian diversity of this IBA

OTHER KEY FAUNA

Large mammals found in the Koyna Sanctuary are Tiger *Panthera tigris*, Leopard *P. pardus*, Gaur *Bos gaurus*, Indian Wild Dog *Cuon alpinus*, Sloth Bear *Melursus ursinus*, Sambar *Cervus unicolor*, Barking Deer *Muntiacus muntjak*, Mouse Deer *Moschiola meminna*, Indian Giant Squirrel *Ratufa indica*, Common Otter *Lutra lutra* (doubtful record), and Common Langur *Semnopithecus entellus*. Reptiles such as the Indian Python *Python molurus*, Beddome's Keelback *Amphiesma beddamei*, Indian Chamaeleon *Chamaeleon Zeylanicus*, Banded Gecko *Geckoella Deccanensis*, and Dwarf Gecko *Cnemaspis sp.* are also found.

A unique endemic species of amphibian, the Koyna Toad *Bufo koynensis*, is reported from the sanctuary, which is the type locality of this species, Other endemic amphibians, such as the caecilian *Indotyphlus sp*., Wrinkled Frog *Nyctibatrachus sp*., and the Bombay Bush Frog *Philautus bambavensis* are also reported (Varad Giri, pers, comm 2012).

Species	Scientific Name
Critically Endangered	
White-rumped Vulture	*Gyps bengalensis*
Long-billed Vulture	*Gyps indicus*
Vulnerable	
Asian Woollyneck	*Ciconia episcopus*
Indian Spotted Eagle	*Clanga clanga*
Nilgiri Wood-pigeon	*Columba elphinstonii*

Near Threatened	
River Tern	Sterna aurantia
Alexandrine Parakeet	*Psittacula eupatria*
Great Pied Hornbill	*Buceros bicornis*
Malabar Pied Hornbill	*Anthracoceros coronatus*
Endemic Bird Area 123: Western Ghats	
Nilgiri Wood-pigeon	*Columba elphinstonii*
Malabar Parakeet	*Psittacula columboides*
Malabar Grey Hornbill	*Ocyceros griseus*
Indian Rufous Babbler	*Turdoides subrufus*
Small Sunbird	*Leptocoma minima*
Biome 10: Indian Peninsula Tropical Moist Forest	
Malabar Pied Hornbill	*Psittacula columboids*
White-cheeked Barbet	*Megalaima viridis*
Malabar Whistling-thrush	*Myophonus horsfieldii*
Indian Scimitar-babbler	*Pomatorhinus horsfieldii*
Loten's Sunbird	*Cinnyris lotenius*
Biome 10: Indian Peninsula Tropical Moist Forest	
Jungle Bush-quail	*Perdicula asiatica*
Plum-headed Parakeet	*Psittacula cyanocephala*
Brown-headed Barbet	*Megalaima zeylanica*
Black-rumped Flameback	*Dinopium benghalense*
Malabar Lark	*Galerida malabarica*
Common Woodshrike	*Tephrodornis pondicerianus*
Small Minivet	*Pericrocotus cinnamomeus*
Indian Robin	*Saxicoloides fulicata*
Rufous-bellied Babbler	*Dumetia hyperythra*
Ashy Prinia	*Prinia socialis*
Jungle Prinia	*Prinia sylvatica*
White-bellied Drongo	*Dicrurus caerulescens*
Brahminy Starling	*Sturnus pagodarum*
Grey-headed Starling	*Sturnus malabaricus*

LAND USE

- Nature conservation
- Agriculture
- Hydroelectric project
- Windmill

THREATS AND CONSERVATION ISSUES

- Dam construction
- Hydroelectric project
- Poaching
- Overcollection of medicinal plants
- Tourism
- Encroachments
- Forest fires

The major threat to this IBA comes from the proposed Humbarli Pumped Storage Scheme (400 MW), as about 25 ha of pristine forest will be submerged by it. This IBA is a honeycomb of privately-owned forests and patches of agricultural land. The area at the periphery of the sanctuary is being actively promoted as a tourism zone by the Government of Maharashtra. This will create serious environmental problems in the form of increased tourist traffic, water pollution, littering of non-degradable waste. and general disturbance. Koyna is a well-known trekking location. Aggressive promotion of tourism in this area will increase garhage and noise pollution. The topography of the sanctuary is conduzive to high velocity wind, and therefore likely Oriental Dwarf Kingfisher *Ceyx enthaca* breeds in Koyna to be considered for exploitation of non-conventional energy. The windmills that dot the landscape are at present away from the boundary of the sanctuary, but are likely to come up inside also. The area is rich in medicinal plants that were sustainably used by the trihal community Dunge-dhangar. However, pharmaceutical companies are now increasingly exploiting this limited resource

CHANDOLI NATIONAL PARK

Category	Details
Altitude	[Not provided]
IBA Site Code	IN-MH-22
State	Maharashtra
District	[Not provided]
Coordinates	214500 N, OPE
Rainfall	55-0044 mm
Temperature	[Not provided]
Biogeographic Zone	Western Ghats
Ownership	Arva
Habitat	Tropical Dry Evergreen Forest
IBA Criteria	AL (Threatened), A2 End Hind Ass 123 Water Ghats
Protection Status	National Park (declared May 2001), included in Sahyadri Tiger Reserve (January 5, 2010)

Chandoli National Park lies in the catchment area of Warna Dam, straddling Vasant Sagar Reservoir. The backwaters of the dam stretch across 30 km in an east west direction. The dam and the water body have created a Boundary for the park on the eastern side, while the steep hills of the Western Ghats protect the western, northern, and southern sides, making it remote und fairly inaccessible. Chandoli Natural Park is located in Shirala and Shahuwadi tehsil of Sangli and Kolhapur districts respectively, in western Maharashtra, and extends westwards till Ratnagiri district. Chandoli NI lies between Koyna Wildlife Sanctuary and Radhanagari Wildlife Sanctuary, and is now part of the

Sahyadri Tiger Reserve, Sahyadri Tiger Reserve (STH) includes the northern and southern catchment areas of Warna Dam Historical sites in the Park include the 17th century Prachitgad and Bhairavgad forts of the Maratha kings Shivaji Maharaj and his son Sambhaji Maharaj.Flat topped mountains, rocky, lateritic plateaus called sades, with hardly any vegetation, and large boulders and caves are typical of the terrain of Chandoli NP

The forest types seen here are a mix of Western Tropical Hill Forest, West Coast Semi-evergreen Forest, and Southern Moist Mixed Deciduous Forest. In the dwarf evergreen foresta, tree species comimonly seen are Anjani or Ironwood *Memecylon umbellatum*, Jamun *Syzygium cumini*

Pisa *Actinodaphne angustifolia*. Fig *Firns glomerato*, Roar Sandalwood *Olea doira*. Spinmia Kine or Katak *Bridelin retuss*, Nana *Lagerstroemia lanceolata*, Kinjal *Terminalua paniculata*, Kokum *Garcinia indica*, and Freshwater Mangrove or *Phanasi Carallia bruchiata*. Other trees dominating the landscape include Indian Laurel or Ain *Terminalia tomentosa*, Indian Gooseberry Amla *Emblica officinalis*, Devil's Fig or Umbar *Ficus hispida*, and *Chetrulie Myrobalan* or Harra *Terminalia chebula*

The common Grasse of Chandoli NP include *Bangala Andropogon sp*., Golden Beard Grass or Dongari *Chrympoдoл fuleus*, Black Spear Grass Tanglehead Grass *Heteropopoв contortus* locally known as Kali Kuali, Buffel or Anjan Gruas *Cenchrus ciliaris*, Grader Grass or Kangiroo Grass or Karad *Themeda quadruahas*, and Saphet Kuali *Aristida fusculata*. Insectivorous plants like Drosers up, and *Utricularia sp.* are also found in this protected area

AVIFAUNA

This IBA site is one of the undisturbed forests of the Western Ghate Endemic Bird Arva (EBA 123). Almost 245 bird species have been reported here (Bhate 2011). Ramchandra (2013) reported the occurrence of 151 species of birds in Chandoli. Large nesting sites of Common Tern *Sterna hirundo* and

River Tern *Sterna aurantia* (Near Threatened), have been seen for past many yours in the Vajegann Valley, Pali Valley of Shivangar Reservoir in Koyna WLS and valley of Vasant Sagar Reservoir in Chandoli NP.

Species	Scientific Name
Critically Endangered	
White-rumped Vulture	*Gyps bengalensis*
Long-billed Vulture	*Gyps indicus*
Red-headed Vulture	*Aegypius Calvus*
Vulnerable	
Asian Woollyneck	*Ciconia episcopus*
Nilgiri Wood-pigeon	*Columba elphinstonii*
Near Threatened	
Painted Stork	*Mycteria leucocephala*
Black-Headed Ibis	*Threskiornis Melanocephalus*
Black-Tailed Godwit	*Limosa Limosa*
River Tern	*Sterna aurantia*
Alexandrine Parakeet	*Psittacula Eupatria*
Endemic Bird Area 123: Western Ghats	
Nilgiri Wood-pigeon	*Columba elphinstonii*
Malabar Parakeet	*Buceros bicornis*
Malabar Grey Hornbill	*Ocyceros griseus*
Malabar Lark	*Galerida Malabarica*
Grey-Headed Bulbul	*Pycnonotus Priocephalus*
White-bellied Blue Flycatcher	*Cyornis Pallipes*
Indian Rufous Babbler	*Turdoides subrufus*
Vigor,s Sunbird	*Aethopyga vigorsii*
Small Sunbird	*Leptocoma minima*

A single Red-headed Vulture *Argypius caluus* was recorded in 2007 (Rohan Bhate, pers comm. 2012)

OTHER KEY FAUNA

The mammals reported from this new IBA are Tiger *Panthera tigris*, Leopard *P. paridus*. Gaur *Bus qaurus* Indian Wild Dog *Cuon alpinas*, Slath Bear *Melursus ursinus*, Sambar *Rasa unicolor*, Barking Deer *Muntiacus munjuk*, Indian Mouse Deer *Moschiola indica*, Indian Giant Squirrel *Ratufa indica*, Common Otter *Lutra lutra*. Indian Pangolin *Manis croancaudata*, and Peninsular Grey Langur *Semnopithecus hector ochates*

Reptiles such as the Indian Rock Python *Python molurus*, Beddome's Keelback *Amphiesma beddomii*, Indian Chameleon *Chamaeleon acylanirus* Indian Monitor *Varanus bengalensis*, Deccan Banded Gecku *Gechuella decranenas* and Dwarf Gecko *Cremaspis spp* are also found. Even crocodiles seem to

have a healthy population in Chandali NP In a recent study, Koparde et al. (2014) found 53 spories of dragonflies, including 43 species in the buffer some and 33 species in the Core area.

Development

Work undertaken for habitat improvement and development in Chandoli NP includes removal of invasive species, auil and water conservation, vaccination of cattle, research, fire tracing, development of salt licks, demarcation of boundary, erection of watch towers. maintenance of nature trails, desalinating water holes, development of grasslands, and procurement of wireles equipment The Forest Eagle-Owl Ketupa nepatensis has been reported in Chandoli

LAND USE

- Education
- Conservation

Important as wildlife corridor in central ,Western and South India

1. Connectivity with Major Tiger Reserves and Wildlife Sanctuaries: The STR serves as a crucial wildlife corridor in central India, connecting various major tiger reserves and wildlife sanctuaries. It links to reserves such as Kali Tiger Reserve in Karnataka and Radhanagari Wildlife Sanctuary in Maharashtra. This connectivity enhances genetic diversity and promotes the movement of wildlife populations across a broader landscape.

2. Connection to Important Tiger Bearing Areas: In addition to linking major tiger reserves, the STR also connects to significant tiger-bearing areas such as Tadoba Andhari Tiger Reserve, Navegaon Nagzira Tiger Reserve, Pench Tiger Reserve, Melghat Tiger Reserve, and Bor Tiger Reserve in Maharashtra, as well as Kali Tiger Reserve in Karnataka and Parambikulaam Tiger Reserve in Kerala. These connections further enhance ecological connectivity and potential genetic exchange among tiger populations.

3. Proposed Conservation Reserve: Local non-governmental organizations (NGOs) have advocated for the Chandoli Dam and Koyana Dam area to be designated as a Conservation Reserve. This designation would provide additional protection and management measures to safeguard the biodiversity and ecological integrity of the area.

Overall, the STR plays a pivotal role as a wildlife corridor, facilitating the movement of wildlife populations across central and western India. The proposed designation of Nawegaon Bandh lake as a Conservation Reserve and its potential recognition as a Ramsar Site further emphasize the importance of conservation efforts in the region.

- **Catchment Values:**

In addition to its rich floral and faunal diversity, the Sahyadri Tiger Reserve (STR) area serves as a vital catchment for numerous dams and lakes. The core and buffer zones of the STR encompass the Chandoli and Koyana regions, depicted in the map showcasing the distribution of river basins within the landscape.

The forested areas within the STR act as catchments for several lakes scattered throughout the region. Major rivers flowing through the buffer area include Koyana, Kandat, Solashi, Urmodi, Tarli, Jagabudi, Vashiti, Morna, Wang Warna, Kandavan, Bav, Shashri, and Gad.

The extensive forest cover in the STR enhances the infiltration rate of rainfall and contributes to the maintenance and augmentation of groundwater levels in the area. Consequently, there are no water-scarce regions within the landscape of the STR. This favorable hydrological situation not only supports the diverse ecosystem within the reserve but also provides essential food and water security for the residents inhabiting the STR landscape.

Recreational Values:

The Sahyadri Tiger Reserve (STR) holds significant recreational value, offering diverse wildlife experiences despite infrequent sightings of its flagship species, the tiger. Certain areas within the buffer zone of the STR boast abundant populations of predators such as panthers and wild dogs, drawing in a large number of eco-tourists from across the country eager for sightings and photography opportunities. Sloth bears are commonly sighted within the buffer zone of the STR, adding to the attraction for wildlife enthusiasts. The presence of large groups of Indian gaurs, or Indian bison, also serves as a major draw for eco-tourists. Additionally, herbivores like sambar deer, wild pigs, and the iconic peacocks are regularly spotted, enhancing the overall wildlife viewing experience.

The diverse array of forest birds and water birds in the lakes within the buffer zone further adds to the appeal, attracting birdwatchers from all corners of the country. Overall, the STR offers a rich and varied wildlife experience, making it a popular destination for nature lovers and wildlife enthusiasts alike.

Aesthetic Values:

The Sahyadri Tiger Reserve (STR) is not only a sanctuary for wildlife but also a haven for natural beauty and artistic appreciation. The aesthetic values inherent in this landscape transcend mere quantification and contribute significantly to conservation efforts.

1. **Natural Beauty:** The STR is characterized by breathtaking landscapes, including lush forests, meandering rivers, cascading waterfalls, and serene lakes. These natural features captivate

visitors and evoke a sense of awe and wonder, fostering a deep appreciation for the beauty of the wilderness.

2. **Wildlife Encounters:** The reserve is home to a diverse array of wildlife, each possessing its own unique charm and aesthetic appeal. From the majestic tiger and elusive panther to the graceful sloth bear and elegant Indian gaur, encountering these magnificent creatures in their natural habitat is a truly awe-inspiring experience.
3. **Birdwatching:** The reserve boasts a rich avian diversity, with numerous species of forest birds and water birds inhabiting its forests and lakes. The sight of colorful birds flitting among the trees or gracefully gliding over the water surface adds to the aesthetic allure of the reserve.
4. **Sensory Experience:** The sights, sounds, and smells of the wilderness contribute to the aesthetic experience in the STR. The chorus of birdcalls, the rustle of leaves in the wind, and the earthy fragrance of the forest all combine to create a multisensory immersion in nature's beauty.
5. **Public Awareness:** The aesthetic appeal of the Sahyadri Tiger Reserve plays a vital role in generating public awareness about the importance of wildlife conservation. Visitors are moved by the beauty of the natural world and are inspired to become stewards of conservation, advocating for the protection of this invaluable treasure for future generations.

In essence, the aesthetic values inherent in the Sahyadri Tiger Reserve are priceless and serve as a powerful motivator for conservation efforts, reminding us of the intrinsic beauty and value of our natural heritage.

Scientific and Educational Values:

The Sahyadri Tiger Reserve (STR) holds immense scientific and educational value, serving as a living laboratory for research and a platform for learning about biodiversity and ecological processes.

1. **Diversity of Flora and Fauna:** The rich diversity of flora and fauna within the STR landscape provides an invaluable resource for scientific study and educational exploration. Students visiting from surrounding schools and colleges have the opportunity to observe and learn about a wide range of plant and animal species, enhancing their understanding of ecological principles and biodiversity conservation.
2. **Learning About Wildlife:** Students and members of the general public are attracted to the wild animals inhabiting the reserve, providing opportunities to learn about their habits, behavior, and other attributes. Observing wildlife in their natural habitat offers valuable insights into animal ecology and adaptation, fostering a deeper appreciation for the natural world.
3. **Scientific Principles:** The diverse array of large mammal species, reptiles, amphibians, insects, and birds found in the STR can serve as models for illustrating various basic scientific principles.

Studying the behavior, interactions, and ecological roles of these species contributes to our understanding of fundamental scientific concepts and ecological processes.

4. **Research Opportunities:** The Sahyadri Tiger Reserve offers a unique opportunity for students and researchers to engage in scientific research in wildlife biology, ecology, and conservation. There is immense scope for documenting the habits and behavior of various wildlife species, including invertebrates and flora, which remain poorly understood. Conducting research within the reserve contributes to the body of scientific knowledge and informs conservation management strategies. (Annexure No.40)
5. **Capacity Building:** By providing a platform for scientific research and educational experiences, the STR contributes to capacity building in the field of wildlife conservation. Students and researchers gain practical skills and knowledge that can be applied to conservation efforts both within the reserve and beyond.

   In conclusion, the Sahyadri Tiger Reserve serves as a valuable resource for scientific inquiry and educational exploration, offering opportunities for students, researchers, and the general public to learn about and contribute to the conservation of biodiversity in the Western Ghats region.

Economic Value:

In the context of a tiger reserve like the one mentioned in your excerpt, the economic value can be multifaceted:

1. **Tourism Revenue**: Tiger reserves attract a significant number of tourists interested in wildlife safaris and ecotourism activities. This influx of visitors generates revenue through entry fees, accommodation, guide services, and related expenditures on food and souvenirs. This revenue contributes directly to the local economy through job creation and business opportunities.
2. **Ecosystem Services**: Forests within tiger reserves provide essential ecosystem services such as clean air, clean water, and carbon sequestration. These services have economic value in terms of the costs avoided by not having to invest in alternative infrastructure or technologies to provide similar services.
3. **Biodiversity Conservation**: Tiger reserves are critical for preserving biodiversity, including not only the iconic tiger species but also numerous other flora and fauna. Preserving biodiversity has long-term economic benefits, including potential discoveries of new medicines, sustainable use of natural resources, and maintaining ecosystem resilience.
4. **Carbon Sequestration**: Forests within tiger reserves act as carbon sinks, absorbing carbon dioxide from the atmosphere and storing it in biomass and soil. This helps mitigate climate change by reducing greenhouse gas emissions. The economic value of carbon sequestration can be

significant, especially in the context of international efforts to combat climate change through mechanisms like carbon offsetting and trading.

5. **Water Resource Management**: Forests play a crucial role in regulating water cycles, including rainfall patterns, groundwater recharge, and flood control. Healthy forests in tiger reserves contribute to water security for local communities downstream, reducing the risk of droughts, floods, and associated economic losses.
6. **Research and Education**: Tiger reserves serve as living laboratories for scientific research and environmental education. Research conducted in these areas contributes to our understanding of ecosystems, biodiversity, and natural resource management. Additionally, environmental education programs conducted in tiger reserves help raise awareness about conservation issues and foster a sense of stewardship among local communities and visitors.
7. **Cultural and Spiritual Value**: Forests hold cultural and spiritual significance for many indigenous communities and local populations. Protecting these areas preserves traditional knowledge, cultural practices, and spiritual connections to the land, enriching the cultural heritage of society as a whole.
8. **Insurance against Risks**: Healthy ecosystems within tiger reserves provide a buffer against various risks and disasters, including natural hazards like storms, landslides, and wildfires. Maintaining these ecosystems reduces the vulnerability of nearby communities to such events, thus preventing economic losses associated with damage to infrastructure, property, and livelihoods.

Overall, the economic value of a tiger reserve extends far beyond direct monetary gains from tourism and resource extraction. It encompasses a wide range of ecosystem services, cultural benefits, and long-term sustainability considerations that contribute to the well-being of society as a whole

Other flow benefits:

In the context of the Sahyadri Tiger Reserve (STR), other flow benefits or intangible benefits could include:

1. **Ecological Services**: The forest ecosystem of the tiger reserve provides various ecological services such as pollination, pest control, and habitat provision for wildlife. These services contribute to the overall health and resilience of the ecosystem, indirectly benefiting human well-being by ensuring the sustainability of natural resources and supporting ecosystem functions.
2. **Cultural and Recreational Value**: The tiger reserve holds cultural significance for local communities and provides recreational opportunities for visitors. Activities such as hiking,

birdwatching, and nature photography offer opportunities for relaxation, inspiration, and spiritual rejuvenation, enhancing the quality of life for residents and tourists alike.

3. **Educational and Scientific Value**: The presence of diverse ecosystems within the tiger reserve offers valuable opportunities for environmental education and scientific research. Educational programs conducted in the reserve can raise awareness about conservation issues and foster a sense of stewardship among local communities and visitors. Scientific research conducted in the reserve contributes to our understanding of biodiversity, ecosystem dynamics, and natural resource management, with potential implications for sustainable development and environmental policy.

4. **Aesthetic and Psychological Benefits**: The scenic beauty and tranquility of the tiger reserve provide aesthetic and psychological benefits to visitors, offering respite from the stresses of urban life and promoting mental well-being. Access to natural landscapes has been linked to improved mood, reduced stress levels, and enhanced overall happiness and satisfaction with life.

5. **Water Regulation and Quality**: The forest ecosystem of the tiger reserve plays a critical role in regulating water flow, reducing soil erosion, and maintaining water quality in rivers and streams. These functions contribute to water security for downstream communities, ensuring access to clean water for drinking, agriculture, and other purposes.

6. **Climate Regulation**: Forests within the tiger reserve contribute to climate regulation by sequestering carbon dioxide from the atmosphere, mitigating the impacts of climate change. Carbon sequestration helps to reduce the risk of extreme weather events, such as droughts and floods, which can have significant economic and social consequences for local communities.
7. **Biodiversity Conservation**: The tiger reserve serves as a refuge for a wide range of plant and animal species, including many threatened and endangered species. Biodiversity conservation is essential for maintaining ecosystem resilience and ensuring the long-term viability of natural systems. Protecting biodiversity in the tiger reserve contributes to global efforts to preserve species diversity and genetic resources for future generations. These intangible benefits contribute to the overall value of the tiger reserve by enhancing human well- being, supporting sustainable development, and promoting the conservation of natural resources for future generations. While these benefits may not always be quantifiable in monetary terms, they are nonetheless essential for maintaining the ecological integrity and cultural significance of protected areas like the Sahyadri Tiger Reserve.

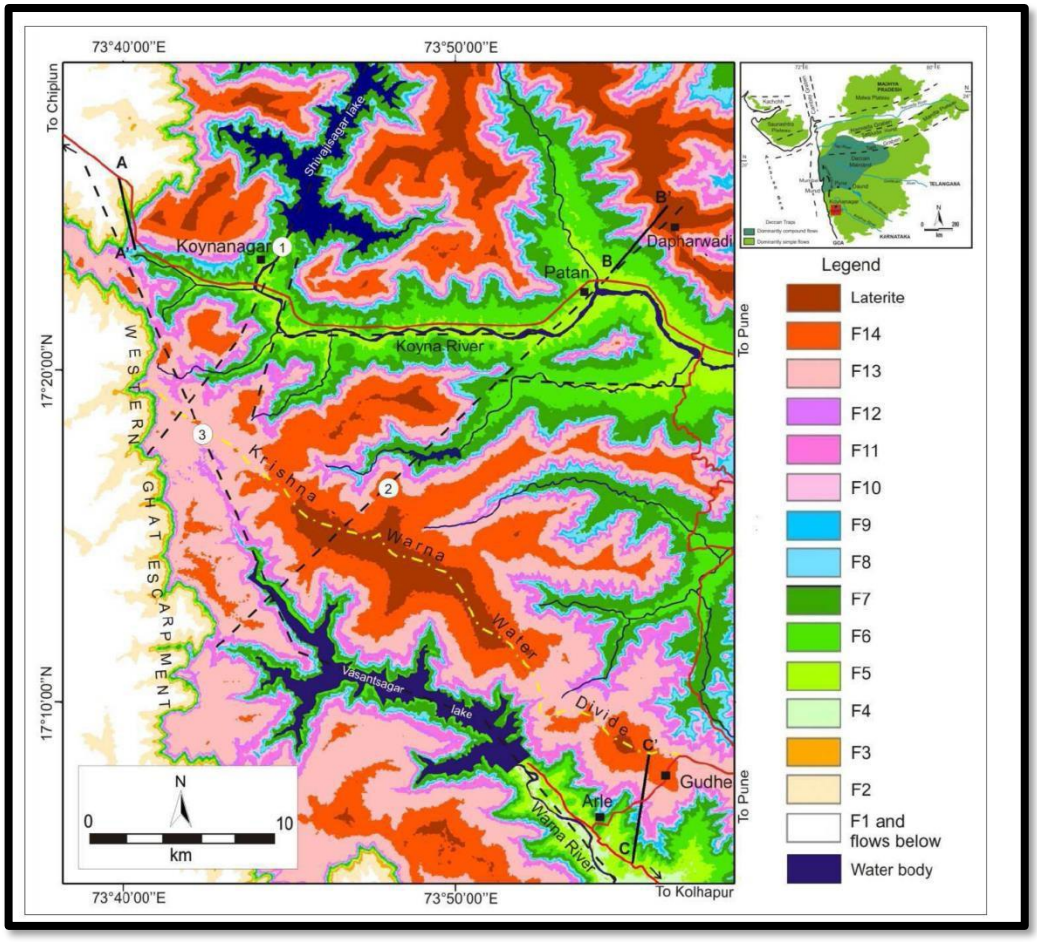
Chapter 2

Background Information and Attributes

2.1 Geology, Rock and Soil –

2.1.1 Geology:

The entire area is covered by basaltic lava, flows of upper cretaceous of lower Eocene age. The basalt is capped by lateritic of younger age which is bound in the plateau above 900 meters from mean sea level. Alluvium occurs in patches along banks of rivers Krishna, Venna, Kandati, Koyana and Warna with average thickness of 10 mtrs and contains pebbles, boulders of trap and beds of sand. The geology of the Sahyadri Tiger Reserve, situated in the Western Ghats of India, is characterized by a variety of rock formations and geological processes that have shaped its landscape over millions of years.



Map.2.1 Geological map of the Koyana-Warna Region (Duraiswami et al., JOURNAL GEOLOGICAL SOCIETY OF INDIA, Vol.90, December 2017). F1 to F14 are basaltic flows. The dashed lines 1, 2 and 3 indicate Koyana, Patan and Chiplun lineaments respectively.

Here are some key geological aspects of the region:.

1. **Ancient Mountain Range**: The Western Ghats, including the area of the Sahyadri Tiger Reserve, are one of the oldest mountain ranges in India. They are estimated to have formed around 150 to 200 million years ago, primarily as a result of tectonic plate movements.
2. **Basaltic Plateaus**: Basaltic plateaus are a prominent feature of the Western Ghats, including the Sahyadri Tiger Reserve. These plateaus are formed from solidified lava flows that occurred during volcanic activity millions of years ago.
3. **Lateritic Soils**: The weathering of basaltic rocks over time has led to the formation of lateritic soils in the region. These soils are rich in iron and aluminum oxides and are characteristic of tropical environments with high rainfall.
4. **Karst Topography**: Karst topography, characterized by limestone formations with caves, sinkholes, and underground drainage systems, is found in some parts of the Western Ghats. While not as extensive as in other regions, karst features may be present in the vicinity of the Sahyadri Tiger Reserve.
5. **Rivers and Valleys**: The Western Ghats are known for their numerous rivers and valleys, which have been carved out by the erosive action of water over millions of years. These river systems, including the Krishna, Godavari, and Tungabhadra rivers, play a crucial role in shaping the landscape and providing water to the region.
6. **Sedimentary Rocks**: While basaltic rocks dominate the geology of the Western Ghats, there are also pockets of sedimentary rocks in some areas. These sedimentary rocks may include sandstone, shale, and limestone, indicating past marine deposition and tectonic activity.
7. **Geomorphological Diversity**: The Sahyadri Tiger Reserve exhibits a diverse range of landforms and geomorphological features, including hills, valleys, ridges, and escarpments. These features provide a variety of habitats for the rich biodiversity found in the region.

Overall, the geology of the Sahyadri Tiger Reserve reflects the complex geological history of the Western Ghats, shaped by ancient tectonic events, volcanic activity, and erosional processes over millions of years.

2.1.2 Rocks:

The Deccan trap which belongs to the type called plateau basalt is extremely uniform in chemical composition over wide areas and is generally dark greenish-grey in colour but brownish to purple tints are also met within geological mapping. The physical volcanological studies of the lava flows in the area have brought to light, a succession of at least 15 lava flows. Most of the them are compound rubbly pahoehoe flows with a few being of pahoehoe and aa types (Duraiswami et al., 2017). These flows belong

to Wai Sub-group and the thickness of the individual flows vary from ~30-90 m. These flows generally contain alternating layers of amygdaloidal / vesicular and compact basalt units. The flow boundaries are most of the times associated with “reddened” horizons which is an oxidized part of the top of the lava flow unit. The flows cover wide areas and few of them have been traced over a distance of over 30 km. Being sub-horizontal in nature, the same flow often lie at the same altitude.

Laterite rests on the Deccan trap at an elevation of about 900 m capping the summits of the hills in the Western portion of the area. It has a thickness of about 30/40 m and is a coriaceous and variegated clayey rock with characteristic red and brown color. A fairly thick formation of lithomarge clays occur in between the laterite and Deccan trap in the Western parts of in the area.

Here are some of the rock types that are likely present:

1. **Basalt**: Basaltic rocks, formed from solidified lava flows, are likely to be found within the Sahyadri Tiger Reserve. Basalt is common in the Western Ghats and contributes to the rugged terrain and plateaus characteristic of the region.
2. **Granite**: Granite, an intrusive igneous rock, may also be present beneath the surface of the reserve. It forms through the slow crystallization of magma deep within the Earth's crust and can emerge through erosion, forming rocky outcrops and hill formations.
3. **Gneiss**: Gneiss, a metamorphic rock with alternating layers of different minerals, could be found in localized areas within the reserve. Gneiss forms through the metamorphism of pre-existing rocks and contributes to the geological diversity of the region.
4. **Lateritic**: Lateritic soils and rocks, rich in iron and aluminum oxides, are likely to be present in certain parts of the Sahyadri Tiger Reserve, particularly in areas with high rainfall. Literate formations often cover hillsides and plateaus, giving rise to distinctive red soils and landscapes.
5. **Schist**: Schist, another metamorphic rock characterized by its layered structure and visible mineral grains, may occur in localized areas within the reserve. It forms through the metamorphism of shale or other sedimentary rocks.
6. **Sedimentary Rocks**: Various sedimentary rocks, such as sandstone and limestone, could be present in the Sahyadri Tiger Reserve, particularly in areas where sedimentary basins and river valleys are present. These rocks may contain fossils and provide insights into the region's geological history.

These rock types collectively contribute to the geological diversity of the Sahyadri Tiger Reserve and play a crucial role in shaping its landscape, providing habitats for wildlife, and influencing ecological processes within the reserve.

2.1.3 : Soil:

The soil composition within the Sahyadri Tiger Reserve is influenced by various factors including parent rock material, climate, vegetation cover, and topography. While detailed soil surveys specific to the reserve may be limited, we can generally infer the soil types based on the broader soil characteristics of the Western Ghats region. The review of the literature on soil types in the regions suggest dominance of two types of soils: lateritic soil and black cotton soil developed on the basaltic rock. The patches of the alluvial soils are also found along the rivers flowing to Koyana reservoir.

The lateritic soil typically lies in the western part. The red clayey soil in the Sahyadri hill ranges is formed from the disintegration of laterite and is thin and poor on upper hill slopes and rich on lower gentle slopes. It is greatly neutralized by a mixture of humus which adds to its fertility in dense forest areas while in open areas it is extremely poor and forms hard strata. The typical laterite soil found on the higher ridges of Sahyadri indicate a tropical one, which being soft and porous, forms a well drained sub-soil. The laterite however when found in exposed conditions gets so hard after oxidation of the iron contained in it that it offers great resistance to further erosion.

Bauxite, copper, Manganese ore and building materials are the important minerals and rocks found in the area. The most important mineral is Bauxite. The bauxite occurrences are confined to the chains of plateau of the Western Ghats. The bauxite is associated with laterite capping and owes their origin to Deccan trap.

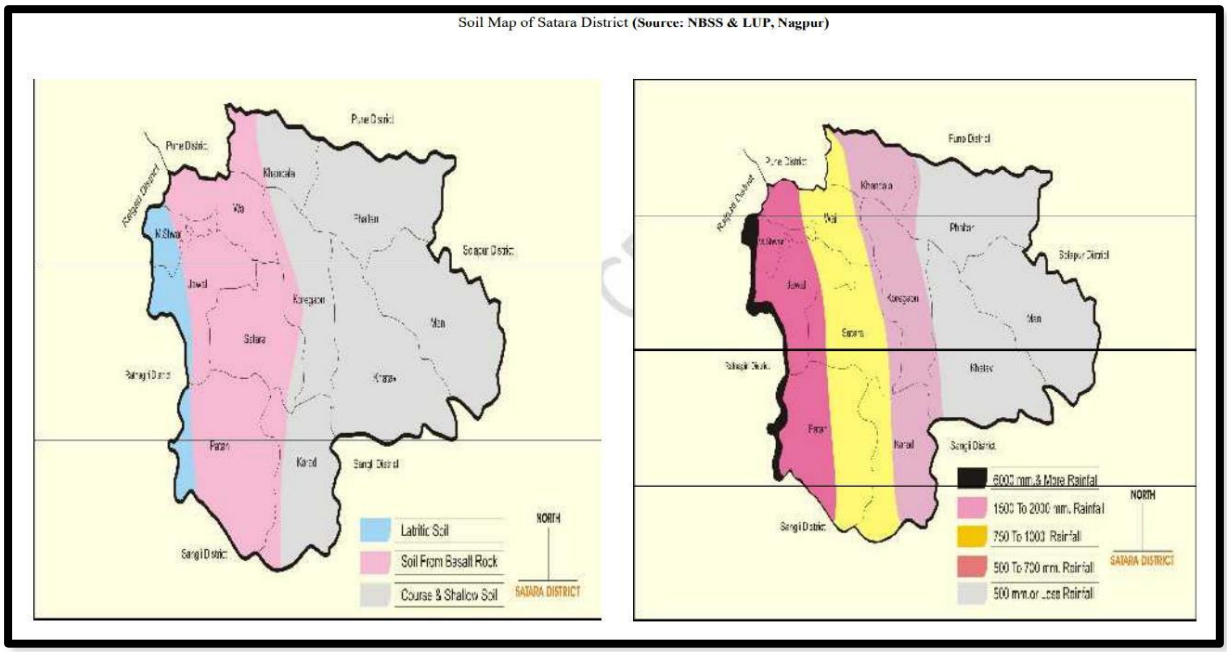
Here are some of the soil types that are likely to be found in the Sahyadri Tiger Reserve:

1. **Lateritic Soil**: The soils in the area belong to Reddish brown soil. The red clayey soil in the Sahyadri hill ranges is formed from the disintegration of lateritic and is thin and poor on upper hill slopes and rich on lower gentle slopes. It is greatly neutralized by a mixture of humus which adds to its fertility in dense forest areas while in open areas it is extremely poor and forms hard strata. The typical lateritic soil found on the higher ridges of Sahyadri indicate a tropical one, which being soft and porous, forms a well drained sub-soil. The lateritic however when found in exposed conditions gets so hard after oxidation of the iron contained in it that it offers great resistance to further erosion. Bauxite, copper, Manganese ore and building materials are the important minerals and rocks found in In the area. The most important mineral is Bauxite. The bauxite occurrences are confined to the chains of plateau of the Western Ghats. The bauxite is associated with lateritic capping and owes their origin to Deccan trap.
2. **Red and Yellow Soils**: Red and yellow soils, also known as ferruginous and ferro-alluvial soils, may be found in various parts of the reserve. These soils develop from weathering of various

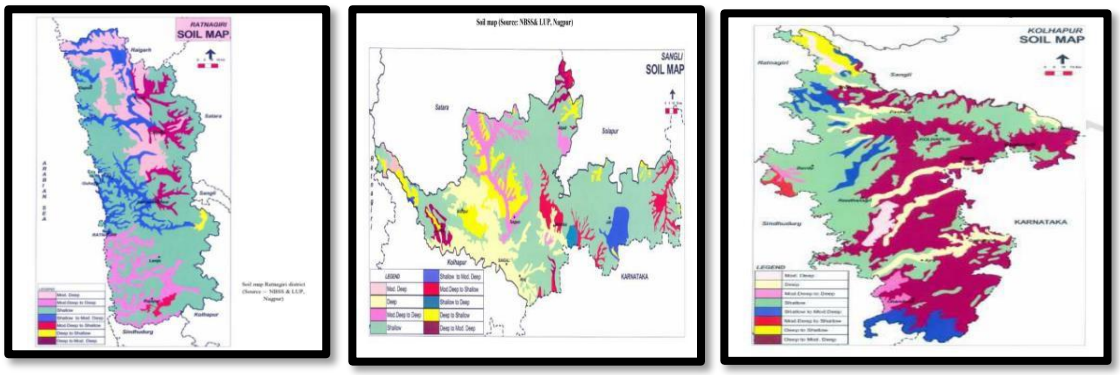
parent materials, including basalt, granite, and gneiss, and are characterized by their reddish or yellowish color due to iron oxide content.

3. **Alluvial Soils**: Alluvial soils are found in floodplains and river valleys within the Sahyadri Tiger Reserve, deposited by rivers and streams over time. These soils are generally fertile and well-drained, making them suitable for agriculture and supporting diverse vegetation.
4. **Mountain Soil**: Mountain soils, often referred to as mountain podzols or mountain humic soils, may occur in higher elevations within the reserve. These soils are characterized by their acidic nature, low fertility, and accumulation of organic matter in the surface layers.
5. **Clayey and Loamy Soils**: Clayey and loamy soils may be found in areas with gentle slopes and moderate drainage conditions. These soils have good water retention capacity and are conducive to supporting a variety of vegetation types, including dense forests.
6. **Lateritic Plateau Soils**: In areas with lateritic plateaus and hilltops, soils may consist of shallow lateritic layers overlaying weathered basaltic or granitic rocks. These soils are often well-drained but may have limited fertility due to nutrient leaching.

These soil types collectively contribute to the diverse ecosystems and vegetation communities within the Sahyadri Tiger Reserve, playing a crucial role in supporting the rich biodiversity of the region. Understanding soil characteristics is essential for conservation and land management efforts within the reserve.



Map.2.2.Soil Map of Satara District



Map.2.3.Soil Map and Soil Profile of Sahyadri Tiger Reserve

2.2 Hydrology and Water sources –

2.2.1 Hydrology:

The climate of the area on the whole is moderate. It does not show extremities. However, three distinct seasons are experienced. These are monsoons from June to September while October is the post-monsoon month with warmer climate, winters from November upto middle of February followed by a warm to hot summer from mid February upto first or second week of June. (Atlas Map No.26,27 and 28)

Rainfall:

The Sahyadri Tiger Reserve, located in the Western Ghats of India, typically receives significant rainfall due to its tropical climate and proximity to the monsoon winds. The exact amount of rainfall can vary depending on the specific location within the reserve and the time of year.The South-west monsoon, the main source of rainfall, begins about the middle of June and lasts till the end of September. Nearly 85% of the rainfall occurs during these months only. In the Sahyadri the rainfall is heaviest, it is 4000mm to 6200 mm in the tract.

Temperature:

The Sahyadri Tiger Reserve, located within the Western Ghats mountain range in India, encompasses a variety of elevations and habitats, each with its own temperature range. The reserve spans across parts of Maharashtra and Karnataka states.

In general, the temperature in the Sahyadri Tiger Reserve can vary depending on factors such as elevation, season, and proximity to water bodies. Here's a rough overview:

1. **Lowland Areas and Valleys**: These areas, especially those closer to the coast, tend to have higher temperatures. During the hottest months (March to May), temperatures can range from

25°C to 35°C (77°F to 95°F) or even higher. In the cooler months (December to February), temperatures may range from 20°C to 25°C (68°F to 77°F).

2. **Mid-Elevation Zones**: As you move to higher elevations within the reserve, temperatures generally become cooler. Average temperatures in mid-elevation zones might range from 20°C to 25°C (68°F to 77°F) during the warmer months and from 15°C to 20°C (59°F to 68°F) during the cooler months.
3. **Highland Areas**: The highest elevations within the reserve, such as the hill stations and mountain peaks, experience cooler temperatures. Average temperatures in these areas may range from 10°C to 20°C (50°F to 68°F) during the warmer months and can drop lower during the winter months, occasionally reaching near-freezing temperatures.
4. **Seasonal Variability**: Like the broader Western Ghats region, the Sahyadri Tiger Reserve experiences distinct seasons, including a hot and dry season (summer), a wet season (monsoon), and a cooler and drier season (winter). Temperature fluctuations throughout the year are influenced by these seasonal changes.

The winters start by November and continue till middle of February, December being the coldest month. In this season the mean daily temperature in the plains is 14° C. During the period between the middle of February to end of May there is continuous increase in the temperature. May being the hottest month of the year, the mean daily maximum temperature and the mean daily minimum temperature in the plains are 35.8° The heat is sometimes relieved by afternoon thunder showers. The onset of the South- West monsoons in the first or second week of June brings down the day temperature appreciably.

Humidity:

The humidity levels in the Sahyadri Tiger Reserve, situated in the Western Ghats of India, can vary depending on factors such as elevation, proximity to water bodies, and local weather patterns.

1. **Monsoon Season**: During the monsoon season, which typically occurs from June to September, humidity levels in the Sahyadri Tiger Reserve and surrounding areas tend to be high. This is due to the heavy rainfall and moisture-laden air associated with the southwest monsoon winds. Humidity levels during this period can often exceed 70% to 80% or even higher, especially in low-lying areas and dense forests where moisture is retained.
2. **Post-Monsoon and Winter Months**: After the monsoon season, humidity levels may gradually decrease as the region transitions to the post-monsoon and winter months (October to February). However, humidity remains relatively high compared to many other regions due to the area's tropical climate and dense vegetation. Humidity levels during this time may still range from 50% to 70% or more, particularly in forested areas and valleys.

3. **Pre-Monsoon Season**: In the period leading up to the monsoon season (March to May), humidity levels can increase again as temperatures rise and moisture accumulates in the air. This period is often characterized by warm and humid conditions, with humidity levels typically ranging from 60% to 80% or higher.
4. **Spring and Early Summer**: During the spring and early summer months (March to May), humidity levels may vary depending on local weather patterns and vegetation cover. In areas with significant forest cover, humidity levels may remain relatively high, while open areas or higher elevations might experience slightly lower humidity levels.

Overall, the Sahyadri Tiger Reserve experiences a humid climate, especially during the monsoon season, due to its location in the Western Ghats and the presence of dense forests and abundant water sources. These humid conditions contribute to the region's rich biodiversity and lush vegetation.

Wind:

The wind patterns in the Sahyadri Tiger Reserve, located within the Western Ghats mountain range in India, are influenced by various factors such as local geography, elevation, and regional weather systems.

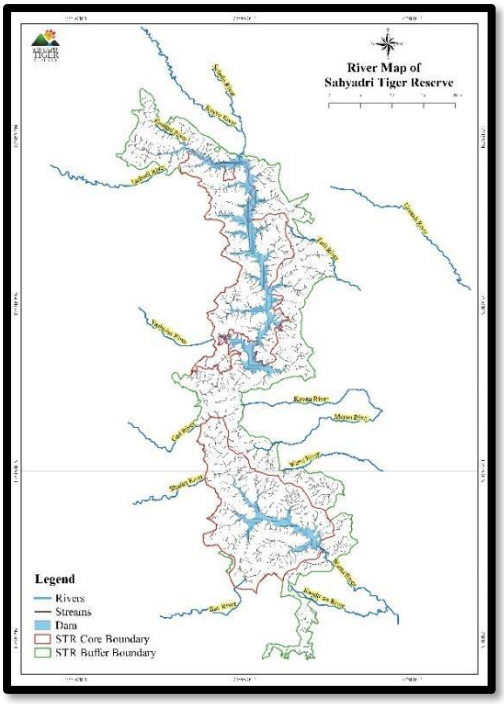
1. **Monsoon Winds**: During the southwest monsoon season (June to September), the prevailing wind direction in the Western Ghats is from the southwest. These monsoon winds bring heavy rainfall to the region, especially on the windward side of the mountains. The dense forests and steep slopes of the Western Ghats can enhance the effects of these winds, leading to intense rainfall and sometimes strong gusts.
2. **Seasonal Shifts**: As the seasons change, so do the prevailing wind patterns in the Western Ghats. During the post-monsoon and winter months (October to February), wind direction and intensity may vary. In general, winds from the northeast or east may become more prominent during this period, especially in the mornings and evenings.
3. **Local Topography**: The varied topography of the Sahyadri Tiger Reserve, including valleys, ridges, and slopes, can influence wind patterns within the reserve. Wind direction and speed may differ depending on the specific location and terrain features. For example, windward slopes facing the prevailing winds may experience stronger gusts and increased moisture, while leeward slopes may be drier and more sheltered.
4. **Microclimates**: Within the reserve, microclimates may develop due to differences in elevation, vegetation cover, and exposure to sunlight. These microclimates can influence local wind patterns and create pockets of calm or turbulent air. Valleys and ravines may experience

funneling effects that intensify winds, while dense forests can create sheltered areas with calmer conditions. Winds are strong particularly on the hills in the monsoon season. They are light to moderate during rest of the year. Thunderstorms occur in the hot season and in the pre-monsoon months. The hilly areas are generally covered with clouds and fog during the rainy season. Fog also occurs occasionally in the valleys in the cold season. Occurrence of frost is not recorded.

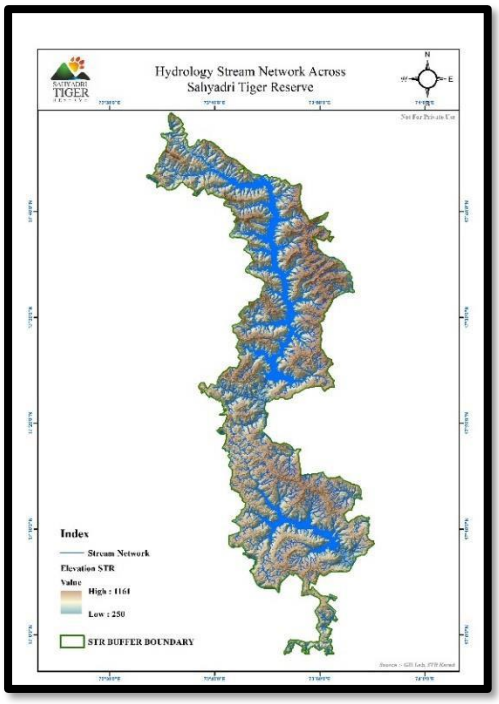
2.2.2 Water Source:-

On the whole water supply in the track is satisfactory. The drinking water is available from gravitation in most of the villages in higher ridges of Western Ghats. The rivers, nallas, Irrigation reservoirs and wells constitute the sources of water for agriculture and improve the moisture regime in their vicinity. The water table is quite high.

The drainage system of the Krishna includes, the drainage of four tributaries from north to south side, the Kandati, Koyana, Warna and Kadavi. The Krishna is one of the most important and sacred rivers of southern India. It rises on the northern part of STR at Mahabaleshwar. Today Koyana and Warna the chief feeder of Krishna has become an important rivers in Maharashtra due to its hydro-electric and irrigation projects.



Map.2.4 Hydrology and Water Source



Map.2.5.Stream Network

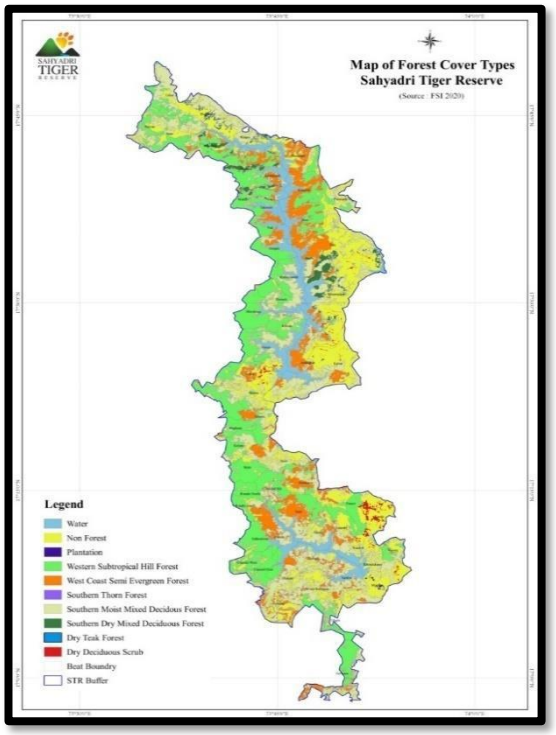
2.3. Vegetation Cover Types

Areas bearing evergreen and semi evergreen types of vegetation belonging to 'Western subtropical hill forest type i.e. A/C, and West coast semi evergreen forest type' i.e. $2A/C_2$ as per Champion and Seth's revised survey of the forest types of India. The site quality ranges between IVb to Iva. Occasional patches of site quality III are observed on gentle slopes or in valleys but such areas are negligible in extent. The areas occurring on very steep and precipitous slopes are almost blank with shrubby growth while it is better on lower slopes. There is hardly any tree-growth over vast stretches of exposed rocks, which have little or no soil cover while it is fairly dense in patches on gentle and moderate slopes. The quality in sheltered patches and valleys is better as compared to the areas exposed to high velocity winds, mist and foggy atmosphere during the monsoon where it is stunted and malformed. In general evergreen species show stunted growth with a height of 5-8 metres. The crop is middle aged to mature. The principle species are *Actinodaphne angustifolia, Terminalia chebula, Terminalia tomentosa, Catunaregam spinosa, Syzigium cumini, Mangifera indica, Phyllanthus emblica, Memecylon umbellatum* etc. (Atlas Map No. 30 to 36)

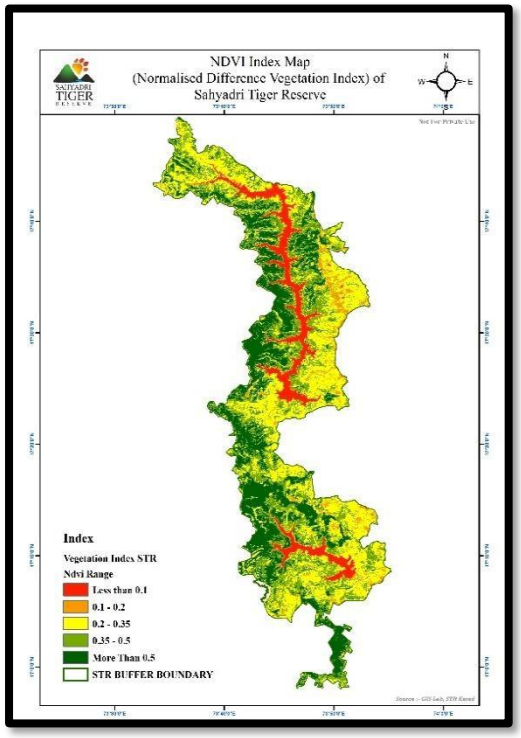
The areas are susceptible to soil erosion. The grazing is light to medium. Natural regeneration of these species is generally poor. Steep and precipitous slopes are practically blank and devoid of any tree growth due to absence of soil on the exposed rocks. There is however dense growth of evergreen species in the valleys comprising Amba (*Mangifera indica*), Jambhul, Hirda (*Terminalia chebula*). Kalamb (*Mitragyna parviflora*), Gela (*Randia dumatorum*), Anjani (*Memecylon edule*) etc. The crop is middle aged to mature. The upper hill slopes have poor density or blank areas while the density on the lower slopes and in valleys varies from 0.5 to 0.8. (Atlas Map No. 22 to 25))

Wild Fauna and Habitats The buffer area also has rich biodiversity Mega animals in the area are Tiger, Panther, Gaur, Sambar, Chausinga, Barking deer. Porcupine and majorly all that find in core. Habitat type is same. Eastern plateau areas have been invaded by wind mills.

Major Conspicuous Changes in the Habitat Since Inception – As it is the first time to bring the area under Wildlife management for co-existence, no such documentation is available. Eastern plateau areas invaded by wind mills are now found to be left by mega- animals as their monsoon shelter as per local observation.



Map.2.6. Map of Forest Cover Types STR



Map.2.7. NDVI Map of STR

2.4 . Wild fauna, Habitats and Tropic Niches

2.4.1 : Wild Fauna:

The wildlife habitat within the Sahyadri Tiger Reserve displays significant diversity, with various species distributed unevenly throughout its core area. The forests in the core zone primarily consist of dense forest types and lack extensive natural grasslands, which are essential for supporting the growth of herbivore populations. Despite this, the reserve is home to a variety of wild animal species, including Gaur, Wild Dog, Chausinga, Spotted Deer, Leopard, Wild Pig, Sambar, Barking Deer, and Sloth Bear.

The core area of the reserve boasts a rich diversity of wildlife and is particularly abundant in avifauna. Additionally, there are occasional visits by transient Tigers from neighboring tiger-bearing areas such as Kolhapur, Radhanagari, Sawantwadi and even from Karnataka State. Among the major predators in the reserve are Leopards and Wild Dogs.

Throughout the entire area of the tiger reserve, species like Wild Boar, Gaur, Sambar, and Barking Deer are distributed widely. However, the distribution of wildlife is not uniform, and some areas may have higher concentrations of certain species than others.

To effectively manage and conserve the wildlife within the Sahyadri Tiger Reserve, it is crucial to provide proper orientation and training to the territorial field staff in the field of wildlife management. This would enable them to carry out their responsibilities effectively and contribute to the protection and preservation of the reserve's biodiversity. (Annexure No 1 and 2)

2.4.2 : Habitat:

The basic principle will be to have interspersion of various habitat types rather than a uniform habitat to foster floral and faunal bio-diversity in Sahyadri Tiger Reserve. Herbivores are primary consumers and their food largely comprise of grass, leaves, flower, fruit and stem. The Cervids (deer family) are graminivores (grass eaters) or browsers or may adapt to both grazing as well as browsing. The quantity, quality and the spatial distribution of food are very important in a habitat.

The Core Zone supports a wide range of ungulate species of different food habits and niches. The survival of these species depends on different types of habitats protected and preserved in their original state. Needless to add, the populations of tiger and co-predator in turn depend on a good prey base in the Core Zone. Vegetation is a major component of wildlife habitat. It is made up of a number of plant communities, which can be distinct entities or more diffuse, merging slowly into each other. The value of habitat for wildlife species is directly linked to the type and variety of plant communities and their condition. It is evident that there is diversity in plant community. The communities have same distribution pattern which has resulted into distribution of edges, interspersion and juxtaposition of habitats. Vegetation as part of the habitat represents an ecosystem and forms the basis of food and cover for animals.

A wildlife habitat has four basic components, viz. food, cover, water and space, which are known as the 'welfare factors'. The presence and distribution of welfare factors govern the abundance of wild animals in an area. Majority of area of tiger reserve is under thick forests (woodlands), Natural and managed Grasslands are in small pockets, but they are very important for herbivores. Area vacated by rehabilitation of 56 villages from Sahyadri Tiger Reserve is also converted in large patch of grassland. The evergreen vegetation along the perennial water sources forms Riparian zones. Wetlands are water bodies in and around the tiger reserve that harbor the birds adapted predominately to an aquatic mode of life. Cliffs, sadas, caves and nallahs beds come under the category of unique habitats. Macroscopically, the habitat under consideration is a terrestrial habitat.

Though the actual delineation of the habitat on the map has not been possible the following different types of habitat are recognized for management purpose:

1. Woodlands
2. Grass lands
3. Riparian zones
4. Aquatic Habitat
5. Unique habitats
6. Species Specific Habitats

1. Woodlands:

Mixed Forest: A woodland habitat is a diverse ecosystem characterized by the presence of trees, shrubs, and a variety of plant and animal species. Woodlands can range from dense forests to open woodlands with scattered trees. They provide important habitats for wildlife and support a wide range of biodiversity. Good quality forests are found in pockets on deep moist soils in valleys and along nallah banks, lower hill slopes with deep alluvium deposits. The quality is poor on shallow and steep slopes. Grasses occur over all rock formations in the region.

Here are some key features of woodland habitats for wildlife:

1. **Tree Cover**: Woodlands are dominated by trees, which provide shelter, nesting sites, and food sources for many species of wildlife. Different types of trees, such as moist-deciduous or semi evergreen, support different kinds of wildlife.
2. **Understory and Shrubs**: Beneath the canopy of trees, there is often a layer of understory vegetation, including shrubs, bushes, and smaller plants. These provide additional habitat and food sources for a variety of wildlife species.
3. **Diverse Wildlife**: Woodlands support a diverse array of wildlife, including mammals, birds, reptiles, amphibians, insects, and more. Each species has its own niche within the ecosystem, depending on factors like diet, habitat preference, and behavior.
4. **Food Sources**: Woodland habitats offer a wide range of food sources for wildlife, including fruits, nuts, seeds, insects, small mammals, and birds. This abundance of food helps support healthy populations of wildlife within the ecosystem.
5. **Shelter and Nesting Sites**: Trees, shrubs, fallen logs, and other vegetation provide shelter, hiding places, and nesting sites for wildlife. These features are essential for breeding, raising young, and protection from predators.
6. **Water Sources**: Many woodland habitats contain streams, rivers, ponds, or other water bodies that provide essential drinking water and habitat for aquatic species as well as for terrestrial animals.
7. **Seasonal Changes**: Woodlands experience seasonal changes, including variations in temperature, precipitation, and vegetation. These changes influence the behavior and adaptations of wildlife throughout the year.

Conservation efforts to protect woodland habitats are crucial for maintaining biodiversity and ensuring the survival of wildlife species that depend on these ecosystems for their survival. This may include measures such as habitat restoration, sustainable land management practices, and the establishment of protected areas.

This is a habitat where forest trees occur. It is again subdivided into.

Natural Forest : *Callicarpa tomentosa, Butea monosperma, Erythrina suberosa, Terminalia belliriaca etc.*

Plantations : *Eculyptus spp., Acacia auriculiformis*

Most of the area in Chandoli National Park and Koyna Wildlife Sanctuary is natural forest. The major tree species are *Callicarpa tomentosa, Butea monosperma, Erythrina suberosa, Eculyptus spp., Acacia auriculiformis,Terminalia chebula, Terminalia elliptica, Ziziphus mauritiana, Wrightia tinctoria, Barlerai involucrate, Ardisia solanacea, Abutilon ranadei,Abutilon persicum,Canthium dicoccum, Dillenia pentagyna, etc.* Along the nullah *Terminalia , Syzyguim cumini, Terminalia bellirica* are found.

Main feature of the forest is presence of Anjani (*Callicarpa tomentosa*) in the middle storey in most of the parts. In most parts of the forest, all storeys are found. Ground flora includes mainly *Adenoon indicum, Alysicarpus pubescens, Amorphophallus bulbifer, Aponogeton satarensis, Ariopsis peltata, Arisaema neglectum, Arisaema sahyadricum etc*. Refer (Annexures No 1)

Shrubs and herbs like *Abutilon indicum*, *Abutilon persicum, Abutilopn ranadei, Ardisia solanacea*, *Barleria involucrate*, *Barleria parionitis etc.* are seen.

Many climbers are seen undisturbed forest of tiger reserve mainly in core area of Koyna and Chandoli as well as Riparian Patches of all the tiger reserves areas also. Common Climbers includes *Ipomoea pre-tigrides, Jasminum malabaricum, Merremia vitifolia, Moullava spicata, Mucuna monosperma, Pergularia daemia etc.*

Plantation: Plantations of following exotic species are observed in area of both Chandoli and Koyna which was previously done by territorial division after construction of Koyna reservoir.

Table.2.1. Plantation of Exotic Species in Sahyadri Tiger Reserve

Sr.No.	Scientific Name	English Name	Family	Type
1	*Acacia auriculiformis*	Australian babhul	Mimosaceae	Exotic plantations
2	*Casuarina equisetifolia*	Suru	Casuarinaceae	Exotic plantations
3	*Eucalyptus camaldulensis*	River red gum	Myrtaceae	Exotic plantations
4	*Eucalyptus grandis*	Rose gum/nilgiri	Myrtaceae	Exotic plantations
5	*Eucalyptus tereticornis*	Forest red gum	Myrtaceae	Exotic plantations
6	*Acacia mangium*	Australian teak	Mimosaceae	Exotic plantations
7	*Grevillea robusta*	Silver oak	Proteaceae	Exotic plantations

Plantation Information :

Exotic species include *Eucalyptus spp*., *A. auriculiformis*, and *C. equisetifolia*. **We needed help accessing forest department records to ascertain the age (year of planting) of the plantations.** According to old people, they give information about planted years from 1980 to 2000. (Personal observation in Koyna and Bamnoli plantations mostly done onwards 1965; Chandoli and Dhebewadi plantations mostly done onwards 1990 to 2000; because of variations in the DBH of exotic species.).

General information of exotic species.

Tree *Acacia auriculiformis* is a member of the **Mimosaceae family**. For over 60 years, *Acacia auriculiformis*, an exotic species native to Australia, Papua New Guinea, and some regions of eastern Indonesia, has been seeded throughout Asia. On deteriorated soils, the alien, quickly growing Acacia tree species was introduced to Southeast Asian nations. People have helped build acacia plantations to manufacture pulpwood in Bangladesh, China, India, Vietnam, and Indonesia. Approximately 2 million hectares are covered by acacia species planted in more than 70 countries (Turnbull et al. 1998). Acacia plants were brought to India to establish monoculture and mixed plantations quickly reforest damaged areas, and provide fuelwood and lumber.*Casuarina equisetifolia L.* is a fast-growing exotic tree, one of the 96 species of trees and shrubs in the **Casuarinaceae family**, and has garnered significant interest because of its various uses (Turnbull, 1990). In India, *C. equisetifolia* was introduced from Australia in the second half of the nineteenth century, mainly to fuel steam engines. Approximately in Karwar, it was first planted in 1868–1869. Later, it was also introduced to Kerala, Maharashtra, and Karnataka's coastal regions. With an estimated 800,000 hectares of plantations, India is the world's largest producer of casuarina. In India, its primary application is in coastal afforestation programs.

The genus Eucalyptus comprises a variety of flowering trees and shrubs, belongs to **Myrtaceae family** of angiosperms. Over 700 species make up the genus, the majority of which are native to Australia. One of the first forest species widely grown around the globe is eucalyptus. The majority of India's eucalyptus plantations were grown over the two decades between 1960 and 1980. In India, some 170 eucalypt species, variations, and provenances were tested (Bhatia, 1984). The policy's purpose in turning low-value natural forests into plantations was to boost output and generate revenue for the government. Some state governments planted eucalyptus plantations by clear-cutting even moist deciduous woodlands, taking advantage of a federally funded program to cultivate fast-growing species that began in the 1960s. Pulpwood became sometimes scarce, necessitating the use of fast-growing species. This prompted a strong urge to plant eucalyptus on large plantations to meet the industry's demand for wood fiber.

2. Grasslands: On the lands of 29 villages Rehabilitated villages and plateaus good quality grass land habitat are developed. Grassland habitats are diverse ecosystems characterized by vast expanses of

grasses with few trees or shrubs. They are found on every part of tiger reserve and play a crucial role in supporting a wide variety of wildlife species. Here are some key features of grassland habitats in wildlife areas:

1. **Grasses**: Grasslands are dominated by grass species, which can vary depending on factors such as climate, soil type, and precipitation. Grasses in these habitats are typically adapted to drought and fire, with deep root systems and the ability to re-grow quickly after disturbances.
2. **Herbivores**: Grasslands support a variety of herbivorous wildlife species, including grazing mammals such as bison, antelope, deer. These animals feed on the abundance of grasses and other vegetation in the habitat.
3. **Predators**: Grasslands are also home to a diverse array of predators that prey on herbivores. This includes carnivores such as leopard, wild dog, tiger as well as birds of prey like eagles and hawks.
4. **Birds**: Grassland habitats provide important nesting and foraging grounds for many bird species. Grassland birds include species like meadowlarks, sparrows, plovers, and grouse, which rely on the open landscape and grass cover for their survival.
5. **Insects and Invertebrates**: Grasslands support a rich diversity of insects and invertebrates, which play essential roles in pollination, decomposition, and nutrient cycling. Grassland habitats provide important habitat for butterflies, grasshoppers, beetles, and many other insect species.
6. **Seasonal Changes**: Grassland ecosystems experience seasonal changes in temperature, precipitation, and vegetation growth. These changes influence the behavior and adaptations of wildlife species throughout the year, including migration, breeding, and foraging patterns.

Conservation efforts to protect grassland habitats are crucial for maintaining biodiversity and ensuring the survival of wildlife species that depend on these ecosystems for their survival. This may include measures such as habitat restoration, sustainable land management practices, and the establishment of protected areas. (Atlas map no. 114)

A wide variety of grasses from the ground cover in most of the area .Grasses like *Themeda quadrivalvis, Ischima laxum, Apluda mutica, Ergostis tennella and Cynodon dactylon, Imperata cylindrica* , Dicanthium annulatum, Dicanthium caricosum, Dimeria blatteri etc. are seen over the area. Detail list of grasses is given in Annexure No. - 1

3. Riparian Habitats: This habitat occurs along water courses (Big Nullah) and moist places. They are important and very essential for some species. There is a distinct micro-climate and it is associated with distinct vegetation. Riparian vegetation along stream banks harbor many animals and also serves as 'corridors' for animal movement. Core area of STR has part of 2 major and 15 small watersheds divided

for preparation of this TCP purpose. Many of watersheds having 3 th and 6th order of nallahs and this nallah from 3rd orders are demarcated as riparian habitat. In summer season, most of the wildlife is concentrate in and around these types of habitat. 4th, 5th and 6th orders nallah are providing good riparian habitat for wildlife (Atlas Map No 28)

4. Aquatic Habitat: In STR core zone, 2 big reservoir namely Koyna (Shivsagar) and Warna (Vasantsagar) inside and on the boundary of core zone, acts as good aquatic habitat for aquatic fauna mainly for indigenous fishes, water birds, amphibians. The Koyna Dam is located on the Koyna River in Maharashtra, India. While the primary purpose of the dam is hydroelectric power generation and water supply, it also creates an aquatic habitat within its reservoir. Warana dam is located on Warana river .Here are some characteristics of the aquatic habitat formed by the Koyna Dam and Warana dam. (Atlas Map .26)

1. **Reservoir**: The Dams forms a large reservoir behind it, which provides a habitat for various aquatic species. The reservoir can support a diverse range of aquatic life, including fish, invertebrates, and aquatic plants.
2. **Fish Species**: The reservoir created by the Dams is home to several fish species. Common species found in such reservoirs in Maharashtra include mahashir, Mola Carplet, Kalabans, Baril, Reba Carp, Giant Danio, Tunga Garra, Stone Sucker, Nilgiri Stone Sucker, Jerdoni Carp, Shooting Barb, Calbas as well as other fish like Tilapia, Common carp, and Catfish. .(Annex.2)
3. **Birds and Mammals**: Aquatic habitats like the both the Dam reservoir also attract birds and mammals that depend on water for drinking and foraging. Waterfowl, wading birds, and other aquatic bird species may be seen around the reservoir, along with mammals such as otters and occasionally larger predators like crocodiles or gharials particularly in Warana dam.(Annex.2)
4. **Aquatic Plants**: The presence of water in the reservoir allows for the growth of aquatic plants such as submerged plants, floating plants, and emergent plants. These plants provide habitat, shelter, and food for various aquatic organisms.

   Overall, while the both the Dams primarily serves as a source of hydroelectric power and water supply, it also creates an aquatic habitat that supports a variety of plant and animal life. Conservation efforts are important to maintain the health and sustainability of this aquatic ecosystem amidst human activities and potential environmental changes.

5. **Unique habitats:**

Sahyadri tiger Reserve has some unique habitats which are constituted by certain geomorphic features, apart from plant communities. The presence of such geomorphic features

undoubtedly imparts diversity to a wildlife habitat and consequently, they also affect animal richness in an area. Cliff, Sadas, Caves, Overhangs, Outcrops, Cavities, Burrows and Rocky areas are important habitats for many species of wildlife. While managing these areas for wildlife, their importance is to be understood properly. These are unique habitats and are formed due to geomorphic features. Cliff, Sadas, Caves, Rocky areas etc. are important habitats for wildlife but they are seldom given importance in forestry.

While managing these areas for wildlife their importance is to be understood properly. These are unique habitats and are formed due to geomorphic features. In other habitats, plant community is always associated whereas in this case such association is not prominent. In this tiger reserve, two types of unique habitats are of great importance from the wildlife species point of view, the cliffs and caves or dens. As stated earlier these unique habitats are different from special habitats (like snags, dead wood). In nearly all the cases they cannot be artificially created or if once destroyed cannot be replaced. Caves are natural structures having a chamber inside, but they can be formed due to rocky boulders also. They provide shelter from enemies, breeding place, darkness and undisturbed environments. They are seen in many localities but their number is low.

Unique habitats are very less as compared to the total area but they are important as wildlife habitats. The adjacent plant community provides feeding ground to the animals of this habitat. Based on available information and personal observation following recommendations are made for management of these habitats.

Method of Execution:

- These unique habitats would be identified and mapped correctly.
- Area where they occur would be given protection from all disturbances.
- Recreational activity in this area will not be allowed.

6. Species Specific Habitats:

Some special and unique habitats like tree hollows, fallen logs, Sadas, Small pounds, snags, burrows, cliffs, overhangs, cavities and caves in the rocks are very important for different animals and birds as well as other wildlife also. Species that use these habitats are many times very sensitive to the changes brought about in these habitats. So, any sort of disturbance is very harmful. These habitats, their importance, use and also recommendations are discussed below.

i. Snags: Snag is a standing dead tree from which the leaves and most of the limbs have fallen. If the dead tree is broken off at more than 5 m. in height it will still be called a snag. This dead tree should have minimum 10 cm dia. at breast height.

Table.2.2 Showing snags helping different Life Forms**:**

Sr. No.	Form of Life	Use of Snag	Examples
1	Fungi	Dead wood support	Agariucus
2	Lichens, Orchids	Substrate	Vanda
3	Invertebrates	Space under bark serves as cover & feeding place	Spiders, ants, beetles.
4	Birds	Tree hollows & cavities are used for shelter & for nesting. Also as perches.	Woodpeckers, barbets, tits, owls, parakeet etc.
5	Reptiles	Under barks, cavities & snag itself serves as feeding place, escape & breeding cover	Snake, lizard, gecko & monitor lizard
6	Mammals	Cavities serve as dens or as resting & escape cover. Areas under bark used as resting-place.	Bats, rats, palm civet, flying squirrel, mouse deer.

Snag provides a portion of life support system for many species of plants, invertebrates, birds and mammals. About more than 25 birds species use snags for nesting, shelter or perching site. Some species can create their own cavities and some use readymade cavities or enlarge them to suit to their demand for nesting. The size of the species dictates the minimum diameter of the snag that can provide a large enough nesting site. For example, common grey-hornbill will require large diameter snag whereas pigmy woodpecker will occupy smaller diameter snag.

At present, we have very little knowledge about the territorial requirement of each species, potential maximum population of each species using snags & such other important information. One thing is definite that large snags can be substituted for smaller ones but reverse is not true. We have to provide snags of sufficient size to ensure long term welfare of dependent species. Snags are developed naturally and over the time they get converted into “Dead and Down Woody Material”.

ii. Dead and Down Woody Material: Dead and down woody material is usually viewed as unwanted in the forests which are managed for commercial timber production. This material is considered as home for many organisms like fungi, insects and some other invertebrates and small vertebrates which are supposed to be pests and disease causing organisms. Sometimes, it is also considered as a fire hazard. To some extent these are valid considerations. But this dead and down woody material in various stages of decay serves many important functions including the habitat for number of wildlife species. Long and other woody debris like stumps, bark slush occur on the ground in most parts of the area. These features provide diversity in the environment and habitat for many animals and birds. They also help in mineral cycling, nitrogen fixation and such other ecological processes. The natural accumulation and decay of logs vary with the type of forest and plant species. In the areas near villages where people illegally collect such material as firewood special attention should be paid.

Method of Execution:

- More study about the requirement of each species of conservation unit for dead wood and down woody material is necessary, Also studies on accumulation rate, decomposition rate, effect of fire on that, occurrence of fire due to such material should be undertaken.
- All the logs should be retained. They can be removed if they cause obstacle to wildlife in trails, entrance of cave or den or access to water.

Components of Wildlife Habitat:

A wildlife habitat has four basic components, viz. cover, water, food and space, which is known as 'welfare factors' or 'limiting factors'. Limiting factors acts through habitat and results in keeping check on animal population, their distribution and such other factors. The habitat factors affect the spatial occupancy and abundance of animals. There is range of tolerance in all wildlife to its environmental factors. If an environmental factor exceeds the maximum or comes down below the minimum tolerance limits in any given area, it becomes a limiting factor, thereby preventing the distribution of the particular animals or group of animals in that area. Any factor which tries to bring down the growth potential in an ecosystem becomes a limiting factor. The period during which the 'limiting factors' are most active called as 'pinch period'. The usual pinch period in STR is 'dry' or 'lean' summer season, during which food and water are scarce in the habitat.

Cover: Cover is something which provides the wild animal with shelter. It means variation seen in a habitat, which affords protection to animals from weather, predators and enemies by offering a better vantage point. It can be dense growth, forest land, burrow, hallow, grassland, crevices etc. e.g. Porcupine needs cover in the shape of a burrow whereas Malabar pied hornbill or woodpecker prefers a hollow in a tree trunk. More so, animals are in need of different types of cover at different times of their life. Such covers can be refuge cover, loafing cover, escape cover, ambush cover, breeding cover, roosting cover, thermal cover etc. e.g. Large low lying leaves of *Bauhinia vahli* act as good thermal and also breeding cover for Grey Jungle Fowl whereas flat stretches of forest floor acts as escape cover for deer family. Ground cover of Karvi provides good cover for escape, breeding cover and for roosting for many small nocturnal mammals and birds. The cover in a habitat affects the hunting behavior of carnivores as well as the anti-predator strategies of prey animals.

From the diversity of the animals and birds that are seen in this area, it can be said on broad lines that cover requirement of life forms is adequately met with by the area and it does not act as a limiting factor. Though, the habitat is quantitatively richer in the form of woodland providing shelter, grasslands are few. Biotic pressure of grazing and fire is a major factor destroying fodder and cover of wild animals. The hilly terrain makes it difficult to control especially in peak heat season

Water: The presence of abundant food in a habitat is rendered useless, if water is not available in close proximity. A habitat becomes poor from the wildlife point of view if it is devoid of a water source. Excepting the fringe areas, water sources are well distributed within the tiger reserve in the form of natural springs and seepages, lakes and artificial waterholes. Therefore, water is not a limiting factor for tiger reserve except few hilly areas of Koyna and some part of Chandoli. Otherwise, every part of tiger reserve has at least one perennial water source in every 2 sq.km. (Atlas Map 115).

Food: Food is essential pre-requisite for any wildlife. The animals require energy for day-to-day maintenance, reproduction and growth. Animals are categorized as herbivores, carnivores, omnivores, piscivores and insectivores depending on the food they consume. The availability of food in a habitat changes seasonally. The range of food material upon which an animal usually feeds is called its 'food spectrum'. The quality, quantity and spatial distribution of food are very important in a habitat. Generally, the availability is adequate to all wild animals. The approaching summer season brings in the scarcity period when animals exhibit a gradual shift to less preferred food items to meet their requirement. They are seen feeding on leaves of Kanchan, Ktesavar, Vaghati , Kumbha and Butea flowers, fruits of Behda, Hirda, Jambhul, Mango etc. Also barks of some species show signs of being eaten by animals. Fires also play a major role in creating scarcity conditions for herbivores as grass and herbaceous forage gets burnt. Hence rigid fire protection has to be ensured.

Space: Animals require physical space to live; its day to day requirements like procurement of food, water, cover and mates are met from this space. The space available for animal use is also affected by various other habitat related concepts, like the presence of eco-tones, edges, interspersion, juxtaposition, territory and home ranges of animals and availability of mates. The amount of space required depends on the population size, which in turn is dependent on the habits and body size of the animal species, and the diversity available in the habitat to meet the various requirements.

2.4.3 Tropic Niches:

Wildlife manager should have clear idea about the base concepts of habitat and their components as well as niche of wild animal. It will give better understanding of habitat and requirement of various wild animals found in his area. It is very much useful to wildlife area manager while planning and effective implementation of wildlife management activities.

All the species of wildlife have the special capacity to survive under a given set of environmental conditions within its tolerance limit. Every single species of plants or animals has evolved to its present form after successful competition. The fittest survive in nature and the less fit, perish. Niche means the role played by a species in its natural habitat or functional role of species in an ecosystem. A niche is a 'role', rather than a 'place' and can be understood in the context of interaction between the species and

the environment. According to the Odum (1971), the 'habitat' of an organism is analogous to its 'address', whereas the 'niche' corresponds to its 'profession' in an ecosystem. Thus, several species may occupy one habitat at any point in time, but their niches may vary.

This ecological separation of among the species is essential to prevent conflicts and escape from continues competition. Niche essentially pertains to food; other important parameters that determine a niche are cover, water and space. Niche is also pertains to various types of resources, two species seldom show identical requirements. Different animals occupy different niches, due to which their feeding habits, prey size, spatial-temporal utilization of habitat, vary.

Shyadri Tiger Reserve as a part of UNESCO World Heritage Site and one of the eight "hottest hotspots" of biological diversity in the world, harbor a remarkable array of flora and fauna. Understanding the tropic niches within this habitat provides insight into the complex ecological interactions that sustain its biodiversity. Here are some examples of tropic niches in the Western Ghats:

1. **Canopy Dwellers**: The dense canopy of the tiger reserve is home to numerous species of trees, epiphytes, and climbers. Within this niche, various species of birds, such as Malabar Grey Hornbill inhabit the upper layers of the forest, feeding on fruits and insects. Arboreal mammals like the Langur also reside in the canopy, utilizing it for shelter and foraging.
2. **Understory and Shrub Layer**: Beneath the canopy lies the understory, where smaller trees, shrubs, and ferns thrive. This layer provides habitat for many species of birds, reptiles, and amphibians, including various frog species and endemic reptiles such as the Malabar Pit Viper.
3. **Forest Floor**: The forest floor of the Western Ghats supports a diverse array of species adapted to the shaded, moist environment. This niche is inhabited by ground-dwelling birds like jungle fowl and ground-dwelling mammals such as the Malabar Giant Squirrel. Various species of insects, including beetles, ants, and termites, play crucial roles in nutrient cycling and decomposition processes.
4. **Streams and Rivers**: The tiger reserve are crisscrossed by numerous streams and rivers, creating aquatic habitats that support a wealth of biodiversity. Aquatic species like the endangered Mahseer fish and endemic freshwater crabs inhabit these water bodies, while birds like the White-bellied Blue Flycatcher and Malabar Pied Hornbill depend on them for food and water.
5. **Grasslands and Plateaus** : Grasslands and plateaus, found in the higher elevations of the Western Ghats, harbor unique species adapted to mountain environments. Sambar, Barking deer, Mouse deer grazes in these grasslands. The Plateaus are home to many endemic species, including the fan throated lizards, Caecilian and crabs.

Understanding these tropic niches is essential for conserving the biodiversity of the Western Ghats. Protecting these habitats and the species that inhabit them requires comprehensive conservation strategies that consider the complex interactions between organisms and their environment.

2.5 Major Conspicuous Changes in the Habitat since inception:

As on March 2024 Total 29 villages from tiger reserve i.e. 19 from Chandoli National Park and 10 from Koyna Wildlife Sanctuary have been rehabilitated and 8 villages yet to be rehabilitated. Before it 27 villages rehabilitated by Irrigation department during construction of Koyna and Chandoli reservoir. This vacated area due to relocation of 56 villages from Koyna and Chandoli is now converted and well managed as grassland. The following influences have been noticed in Chandoli National Park & Koyna Wild life Sanctuary is as follows.

Wildlife habitat rehabilitation efforts can bring about several significant changes in the ecosystem. Some of the major conspicuous changes include:

1. **Increased Biodiversity**: Effective rehabilitation efforts often lead to the restoration of habitat diversity, which can attract a greater variety of wildlife species. This can include the reintroduction of native plant species, which in turn support various animal species.
2. **Population Recovery**: Endangered or threatened species may experience population recovery as their habitat is restored. This can have cascading effects on the entire ecosystem, as the presence of these key species often influences the abundance and behavior of other species.
3. **Improved Habitat Connectivity**: Habitat rehabilitation projects sometimes focus on creating or restoring wildlife corridors, which facilitate the movement of animals between fragmented habitats. This can help mitigate the negative effects of habitat fragmentation and increase gene flow between populations.
4. **Enhanced Ecosystem Services**: Rehabilitated habitats often provide a wider range of ecosystem services, such as water purification, carbon sequestration, and soil stabilization. These services benefit both wildlife and human communities living in or near the rehabilitated areas.
5. **Mitigation of Human-Wildlife Conflict**: By restoring natural habitats and providing suitable resources for wildlife, rehabilitation efforts can help reduce conflicts between humans and wildlife. This can lead to better coexistence between local communities and wildlife populations.
6. **Improved Ecotourism Opportunities**: Successful habitat rehabilitation projects can create new opportunities for ecotourism, as restored habitats become attractive destinations for nature

enthusiasts. This can contribute to local economies while also raising awareness about the importance of conservation.

7. **Natural Regeneration Processes**: In some cases, habitat rehabilitation efforts may rely on natural regeneration processes, such as allowing forests to regenerate naturally after disturbances like logging or wildfires. This approach can lead to resilient, self-sustaining ecosystems over time.

These changes highlight the potential benefits of habitat rehabilitation for both wildlife and human well-being. However, the success of such efforts depends on careful planning, monitoring, and ongoing management to ensure that the restored habitats remain healthy and functional in the long term.

CHAPTER 3

STATUS OF TIGER AND CO-PREDATOR

Sahyadri Tiger Reserve (1166 km2) and comprising of Chandoli National Park and Koyna Wildlife Sanctuary, is a unique landscape situated in the northern Western Ghats of India. The region is well-known for water security and holds substantial historical significance. Tigers were common in the region in the last century, however poaching and large-scale habitat alteration has caused drastic impact on tiger numbers, and other wildlife in general. Sahyadri was notified as a tiger reserve on January 5, 2010, however tigers have been sparsely recorded from the reserve limits. Hence, the status of Sahyadri as a tiger reserve has been often questioned due to low tiger density, and thus restoring its tiger population is imperative. With this background, a tiger recovery project was initiated by the Sahyadri Tiger Reserve Conservation Foundation collaboratively with the Wildlife Institute of India (WII) and National Tiger Conservation Authority (NTCA). The overall goal of the project is to enable ecological integrity by establishing an optimal, free-ranging tiger population in Sahyadri Tiger Reserve by 2025.

The WII field team reached Sahyadri in January 2017 and after initial reconnaissance survey in all fiver ranges of the reserve till March 2017, concerted efforts to record the present status of wildlife were undertaken. Surveys were in the form of camera trapping, line transect surveys, sign surveys and vegetation sampling as part of the feasibility study for potential tiger recovery in the reserve. A major finding came through in May 2018 as a lone male tiger was recorded from four locations in Chandoli National Park part of the tiger reserve. This was a confirmed tiger record within the reserve boundary after eight years i.e. 2011. Tiger was captured in camera trap in year 2011 in Chandoli National Park at Sidheshwar Beat. Later in early 2019 during Phase I monitoring, a tiger scat was found in Waghane beat of Helwak range. Using camera traps nested in a random encounter modelling (REM) framework, we estimated overall prey density (per km2 at 95% CI) to be 23.25 (17.10–32.07), 26.65 (23.30–30.06), 29.55 (24.59–35.05) and 25.35 (18.55–35.78) in 2017, 2018, 2019 and 2020 respectively. Simultaneously our predictive habitat suitability for tiger in Sahyadri revealed that 451 km2 totaling 38% of the total tiger reserve area. Considering both these aspects (suitable habitat area and prey density), we estimated tiger carrying capacity within the park to be ~ 27 tigers using the Karanth et al (2014) equation. However, this estimate should be viewed with caution as the maximum carrying capacity for tigers in the area given that tigers are translocated successfully, in case natural colonization is deemed highly impossible, and that the factors that could potentially hamper tiger recovery are strictly controlled and eradicated completely.

Phase III activities, i.e., camera trapping and sign survey for tiger and other carnivores, line transect for prey abundance was carried out in the year 2022. The Phase III monitoring in Sahyadri Tiger Reserve was carried out both core and buffer areas. Sahyadri is a unique landscape owing to the remoteness and

configuration and hence if face challenges in terms of animal monitoring. Some parts of the landscape are difficult to access, although efforts have been increased and in this Phase III session, both core and buffer areas were covered.

Over the past 15 years, there have been only a few records of Tigers in the Sahyadri Tiger Reserve (STR), indicating that they are not the major predators in this area. Instead, Leopards (*Panthera pardus*) and Wild Dogs (Dholes, *Cuon alpinus*) act as co-predators alongside Tigers. These three species—Tigers, Leopards, and Dholes—form a sympatric guild that extends across a large region of the Indian subcontinent. The segregation of these species along various niche dimensions, such as space, time, and food, helps avoid competition and facilitates resource partitioning, leading to their ecological separation.

The coexistence of these large carnivores is studied by examining their spatial use, activity patterns, and diet, which are strongly influenced by competition and predation (Brown 1965, Hutchinson 1959). Subordinate species typically employ a combination of spatial segregation, temporal segregation, and diet partitioning to reduce direct competition with dominant predators (Cozzi et al. 2013, Crooks et al. 1995, Hayward and Slotow 2009, Périquet et al. 2014). Research from various parts of India has shown that dominant carnivores not only regulate herbivore populations but also shape carnivore community structures through intra-guild competition.

Generally, in sympatric guilds, larger predators suppress the abundance of smaller ones (Berger 2007, Letnic 2011). However, when the influence of a dominant predator is reduced, intraspecific competition becomes a significant evolutionary force, leading to rapid diversification (Simpson 1955). Consequently, the demographics, abundance, distribution, social interactions, ranging patterns, habitat preferences, and behavioral mechanisms of temporal and diet partitioning among subordinate co-predators may shift (Groom 2016, Mondal 2012).

Ecologists have long posited that niche segregation reduces exploitative competition, facilitating the coexistence of intra-guild species. Both extant and extinct large predators tend to compete for similar prey but differ in their behavioral adaptations to trophic, temporal, and spatial aspects of their environments to coexist. When competition from a dominant predator decrease, subordinate co-predators experience shifts in demographics, abundance, distribution, interactions, ranging patterns, habitat preferences, and behavioral mechanisms related to temporal and dietary preferences.

Tigers, Dholes, and Leopards coexist across their distribution range in Indian jungles. In the central Indian landscape, the average Dhole pack size is 5 to 6 individuals, and Tiger density is 5-7 per 100 km². However, the Nawegaon-Nagzira Tiger Reserve has a larger average Dhole pack size (mean

pack size 14.7) and a lower density of Tigers (0.95 per 100 km²). This study aims to understand the behavioral patterns of Dholes with higher pack sizes and their interactions with sympatric carnivores.

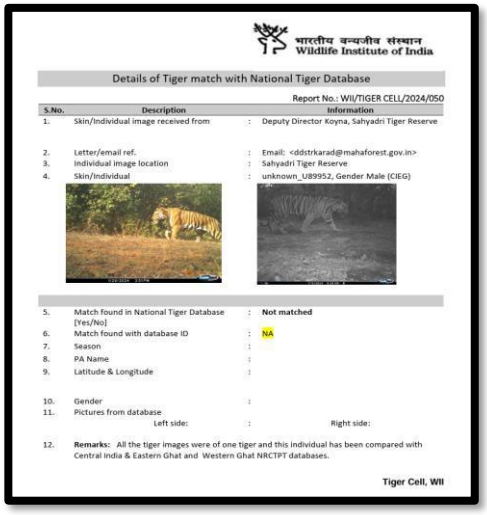
3.1 Distribution:

3.1.1 Current Status of Tiger:

Pugmark of Tiger trail recorded at Sonarli Back water of Chandoli on 12th Dec 2023, and a camera trap photo of young Male recorded on 17th Dec 2023 (refer to fig.3.1) at Kolhapur Nivale, Amba range of STR after five years. Tiger was not captured during the AITE Phase III sampling session (2022). The last photographic tiger record was in 2018 and before that in 2011. (Atlas Map No.48)

The male Tiger detected in Dec 2023 stayed back in Sahyadri Tiger Reserve for the first time. Tiger activities monitored continuously in STR by field staff and Tiger Cell from 12th Dec 2023 to 30th May 2024, (6 months). The tiger was captured on camera trap on 56 locations and indirect signs (pugmarks, scat, kill, scrape) recorded on 61 locations in five ranges of Sahyadri Tiger Reserve during this six-month monitoring period. The male tiger camera trap images were shared with Tiger Cell of Wildlife Institute of India (WII) for the identification of individual and comparing with other landscape. WII reverted that the individual does not match with tigers from Tiger Cell database and with the southern Western Ghats, Central India landscape and Eastern Ghats landscape tiger data. WII reported it is as a new individual recorded for the first time in Sahyadri Tiger Reserve (refer to Fig.3.2). It has given a unique Tiger code as STR-T1 by the authority of tiger reserve for further monitoring and management of this big cats.

Fig.3.1: First camera trap capture of STR-T1 at Kolhapur Nivale, Amba range, Sahyadri Tiger Reserve.



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

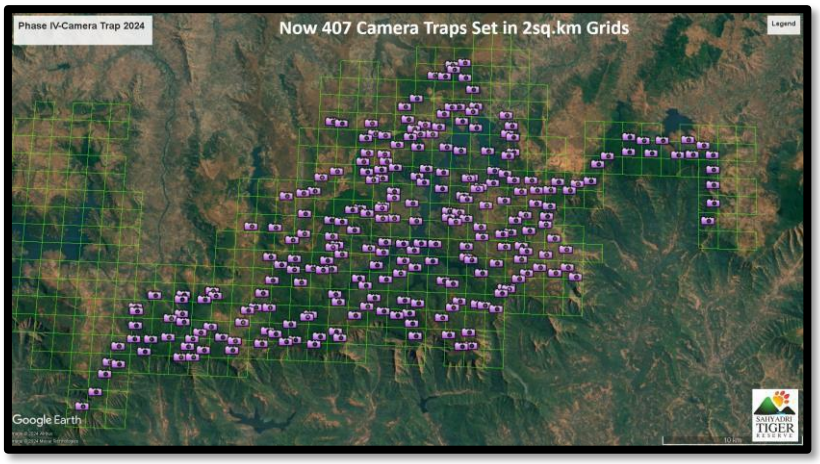
Details of Tiger match with National Tiger Database

Report No.: WII/TIGER CELL/2024/050

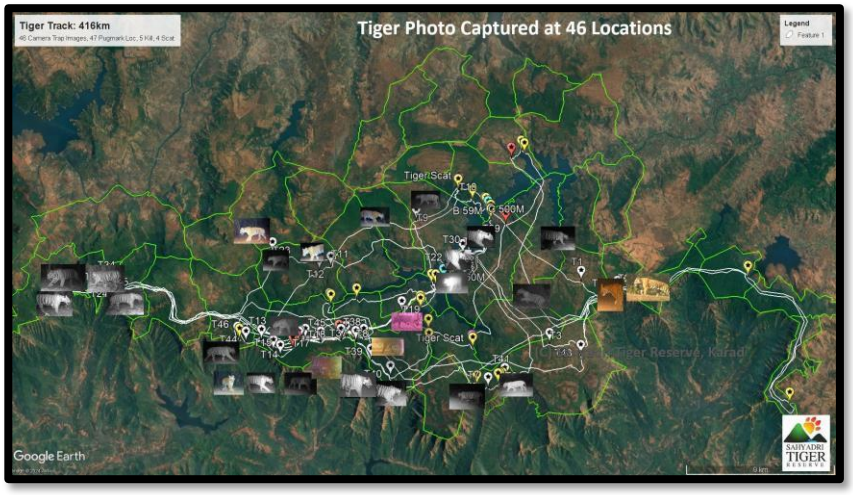
S.No.	Description		Information
1.	Skin/Individual image received from	:	Deputy Director Koyna, Sahyadri Tiger Reserve
2.	Letter/email ref.	:	Email: <ddstrkarad@mahaforest.gov.in>
3.	Individual image location	:	Sahyadri Tiger Reserve
4.	Skin/Individual	:	unknown_U89952, Gender Male (CIEG)
5.	Match found in National Tiger Database [Yes/No]	:	Not matched
6.	Match found with database ID	:	NA
7.	Season	:	
8.	PA Name	:	
9.	Latitude & Longitude	:	
10.	Gender	:	
11.	Pictures from database		
	Left side:	:	Right side:
12.	**Remarks:** All the tiger images were of one tiger and this individual has been compared with Central India & Eastern Ghat and Western Ghat NRCTPT databases.		

Tiger Cell, WII

Fig.3.2: Tiger Cell, WII report on STR-T1 male tiger



Map.3.1 : Phase IV camera trap distribution at Chandoli division for tiger monitoring.



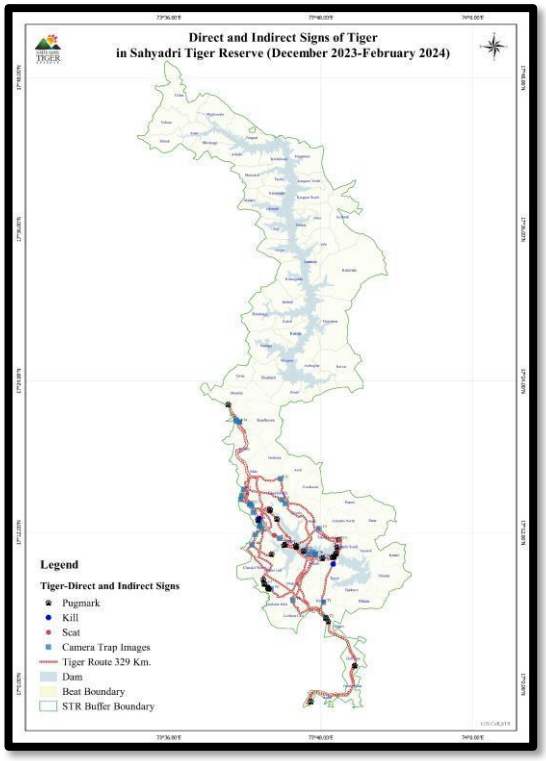
Map.3.2: Tiger camera trap captures in STR (***Annexure 3.1***).

Map.3.3: Tiger indirect signs and estimated track in STR.

Tiger Signs: An adult male Tiger photographed on 17th Dec 2023, at Kolhapur Nivale beat of Amba range. The same individual has stayed back in Sahyadri Tiger Reserve for more than 6 months. Tiger Cell and field staff continuously monitored the movement pattern, tracks, and signs of the Tiger by implementing 407 camera traps, developing PIPs and collecting data related to scat, pugmark, kill, etc. The individual has recorded at 59 camera trap locations and found its indirect signs on 61 locations in past 6 months as follows.

Sr. No.	Tiger Sign	No of Signs
1	Camera Trap Capture	59
2	Pugmark	52
3	Scat	5
4	Prey Kill	5
5	**Total**	**120**

Table:3.1 Total tiger signs recorded between Dec 2023 to May 2024



Map.3.4: Tiger pugmarks, kill, scat and camera trap images recorded map of past 6 months.

- **Activity Pattern:** An activity pattern has been developed based on the 59 camera trap records using date, time and locations as follows:

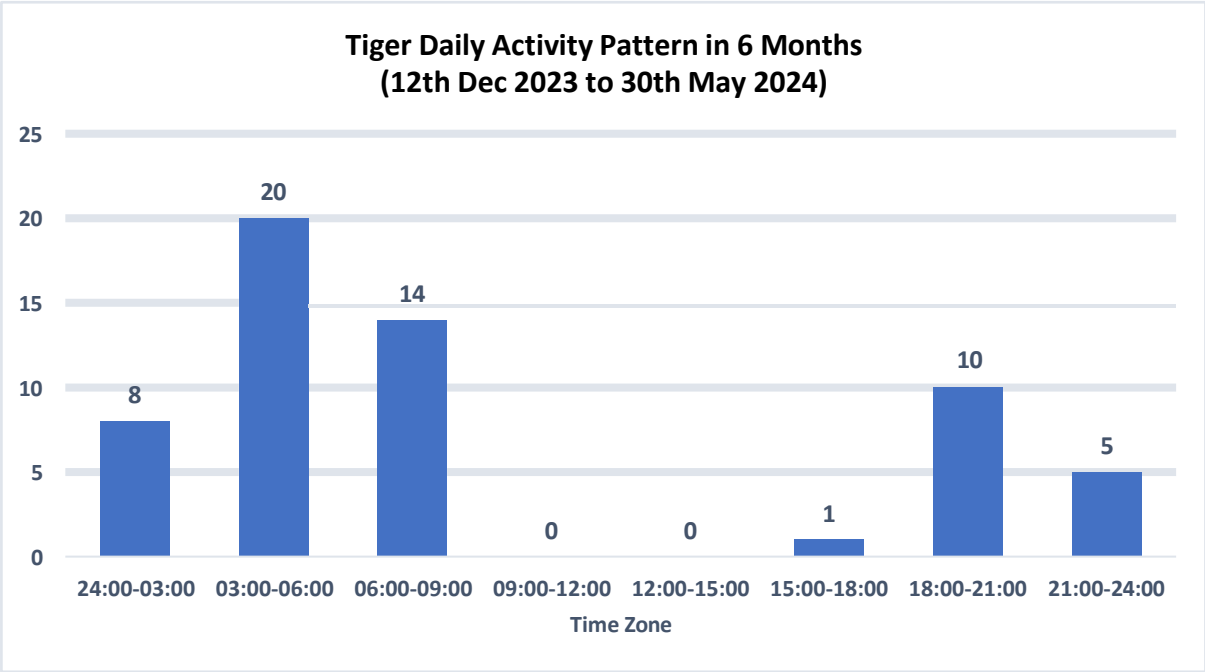
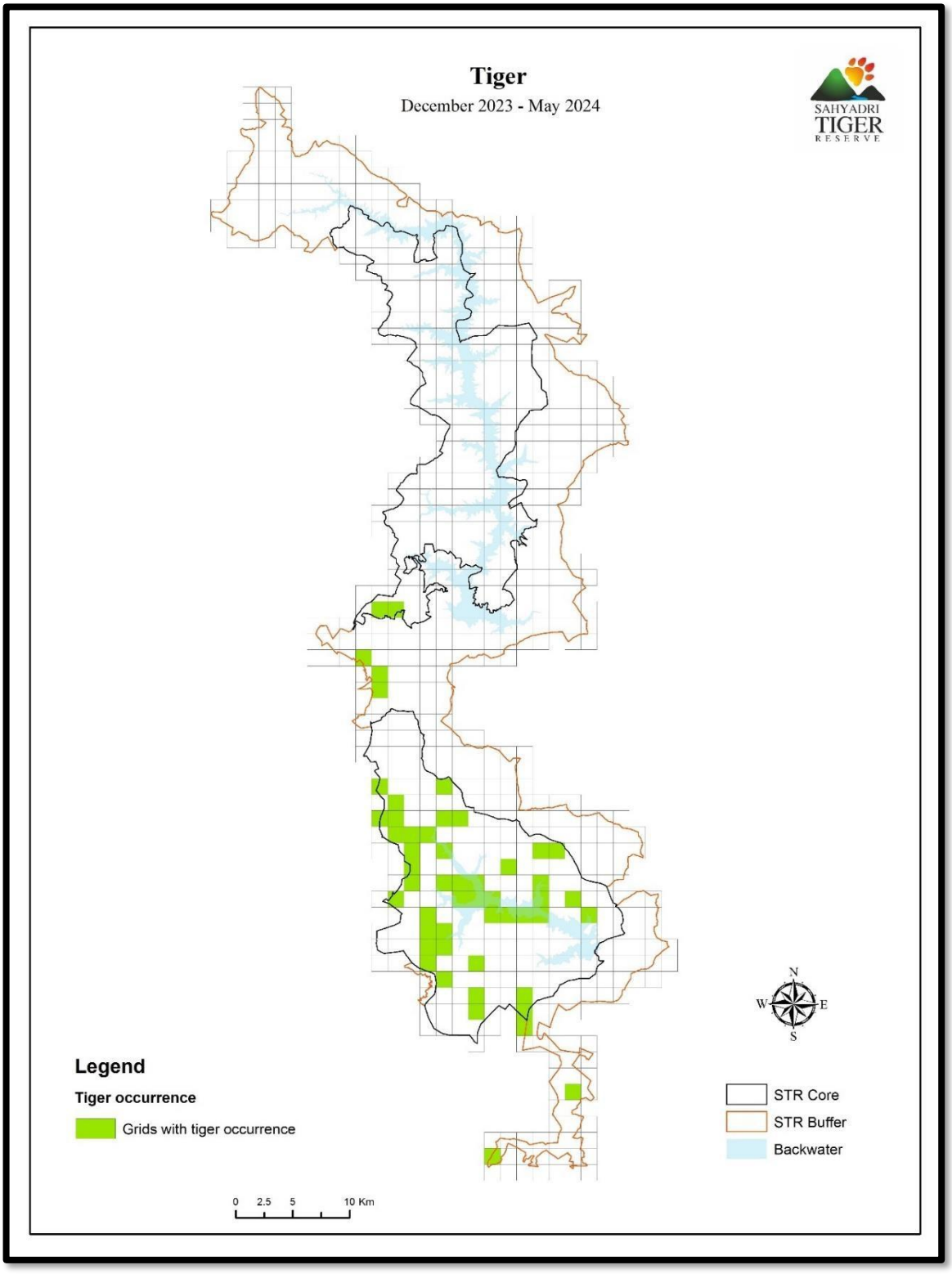


Fig.3.3: Number of camera trap images of tiger captured during different period of the day

- 72.41% of the tiger images (42) captured between 2400 hrs to 0900 hrs. 27.11% of tiger images (16) captured between 1800 hrs to 2400 hrs. It shows that Tiger activity is high between 1800 hrs to 0900 hrs night time. Highest activity peak observed between 0300 hrs to 0600 hrs. Tiger is less active during the day time between 0900 hrs to 1800 hrs. Only one tiger images captured in day time between 0900 hrs to 1800 hrs.

Fig.3.4: Tiger STR-T1 photo captured on camera trap at Dhakale, Chandoli (15/03/2024-04:58)

1) **Tiger Distribution Map:** Tiger has been recorded in 52 grids based on camera trap captures and indirect signs (scat, pugmark, and kill). Occupancy of tiger in STR is 6.8% out of total 763 grids based on camera trap photos (***Annexure 3.1***).



Map.3.5**:** Tiger distribution based on camera trap captures in STR 2023-24.

2) Beat wise Tiger Distribution:

- Tiger has been recorded in 15 beats of Sahyadri Tiger Reserve. Rundiv beat has recorded highest tiger activity and Nivale, Waghane and Takle beat has recorded low tiger captures. The beat wise tiger distribution has been shown in following graph:

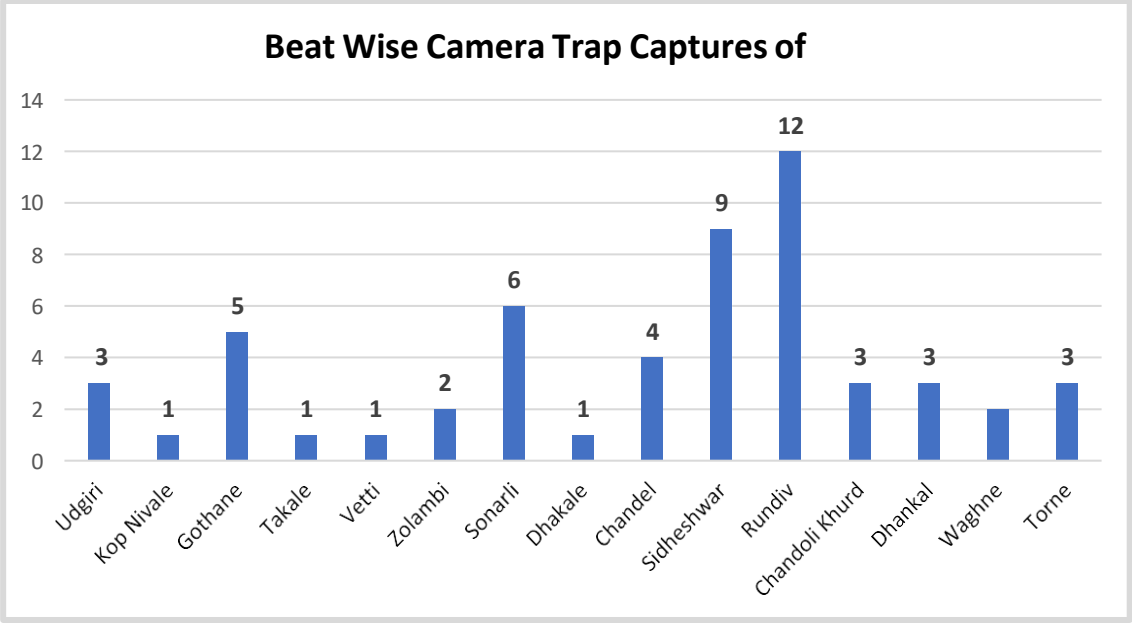


Fig.3.5: Number of camera trap images of tiger captured in various beats of STR.

3) Range wise tiger distribution:

- Tiger has been recorded on 59 locations in four different ranges of Chandoli division of STR. Tiger has recorded highest in Helwak with 22 records and Chandoli range with 20 records. Tiger has recorded for 9 times in Amba, 4 times in Dhebewadi and 3 times in Koyna range as follows.

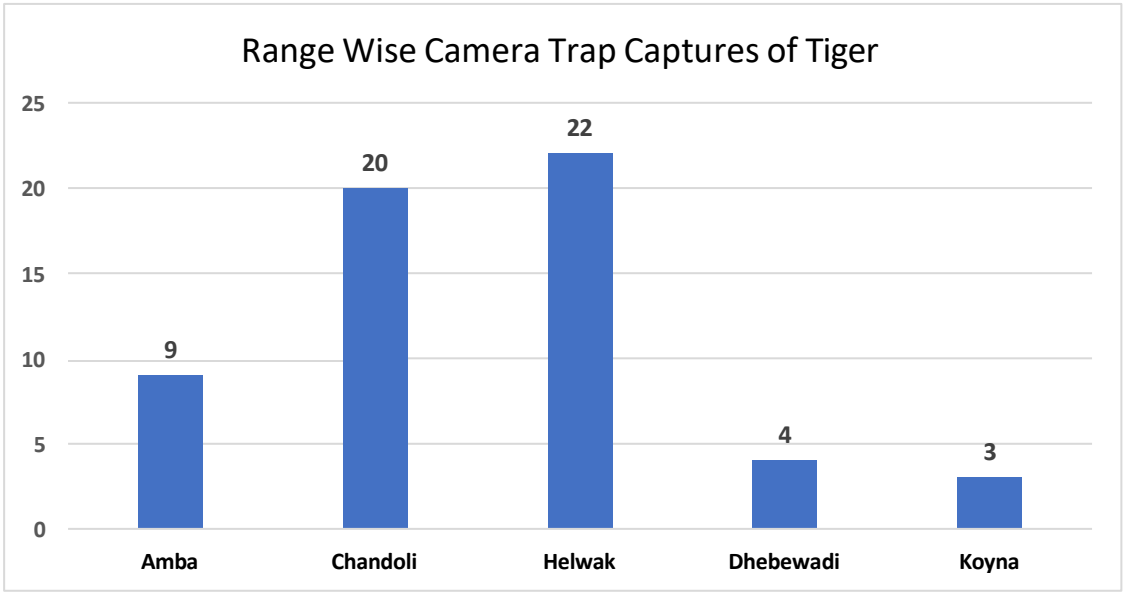


Fig.3.6: Number of camera trap images of tiger captured in various ranges of STR.

3.1.2 Previous Record of Tigers in Sahyadri Tiger Reserve:

Tiger Recorded in 2011: After the Sahyadri Tiger Reserve was established in 2010, the first confirmed sighting of a tiger occurred in 2011 at Chandoli National Park. This adult male tiger was initially recorded at Kalavantini Well and Kokan Kada Point on the main patrolling road in the Sidheshwar Beat of Chandoli National Park. The tiger moved from Rundiv to Chandel within the Sidheshwar Beat and was captured by two camera traps (refer to Map.3.6).

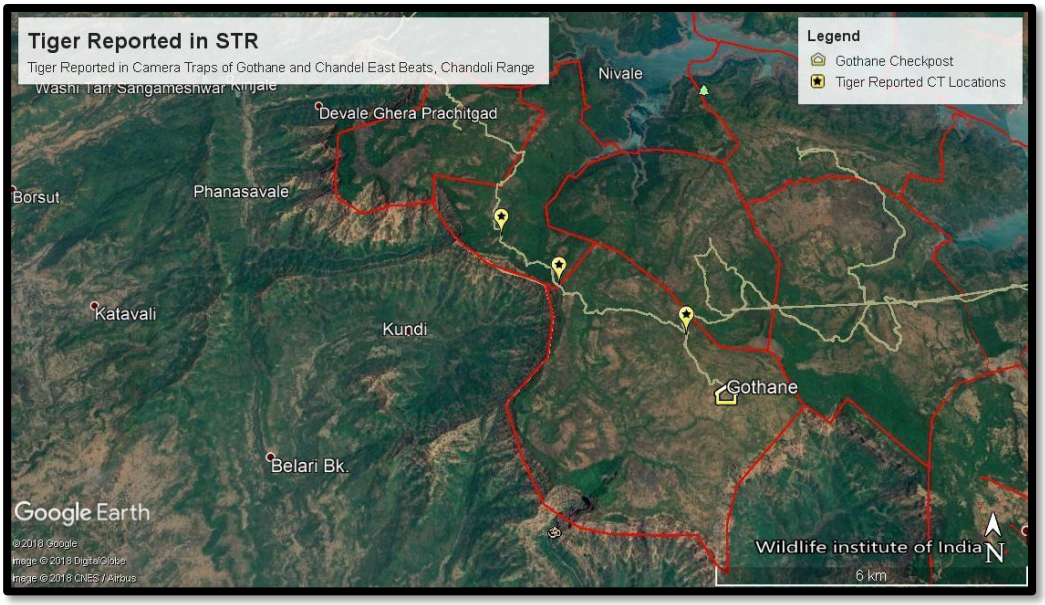
Map.3.6: Tiger recorded (yellow pointer) at Sidheshwar Beat, Chandoli, STR in 2011

Fig. 3.7: Tiger recorded at Sidheshwar Beat, Chandoli, STR in 2011

Tiger Recorded in 2018: The second recorded sighting occurred in May 2018, with camera trap photos taken at four nearby locations within Chandoli National Park. Six images of the tiger were captured by cameras positioned in these locations: two images from the Chandel (East) beat, one from the Gothane beat in the Chandoli range, and one from the Rundiv (South) beat in the Helwak range (refer to Table 3.2, Map. 3.7, and Fig. 3.8).

Table 3.2: Details of camera trap locations from where tigers were photo-captured

Date	Time	Beat	Latitude	Longitude
22/05/18	19:29	Rundiv (S)	17.22996	73.6977
23/05/18	17:49	Chandel (E)	17.13190	73.72572
23/05/18	18:36	Chandel (E)	17.12114	73.73774
24/05/18	00:52	Gothane	17.11057	73.76320



Map.3.7: Presence locations of tiger in May 2018

Fig.3.8: Camera trapped images of tiger in May 2018 at Chandel and Gothane beat of STR.

- **Tiger Scat and Genetic Analyses Results:**

In 2019, fresh scats were recorded during regular field surveys in the Helwak range. The field team conducted sign surveys, and upon noticing potential tiger scats, collected samples and sent them to the Wildlife Institute of India (WII) for genetic confirmation. In January 2019, sign surveys revealed two potential tiger scats in the Helwak range of the tiger reserve (see Table 3.3 and Fig. 3.9). After screening both samples, one scat was confirmed to be from a tiger.

Table 3.3: Details of potential tiger scat samples collected in January 2019

Date	Latitude	Longitude	Elevation (m)	Range	Beat	Forest type	Scat condition
22/01/2019	17.33373	73.71082	651	Helwak	Waghne	Riverine	Very fresh
09/01/2019	17.33892	73.74384	660	Helwak	Govare	Plateau	Very old

Fig. 3.9: Tiger scat found in Waghne beat, Helwak range

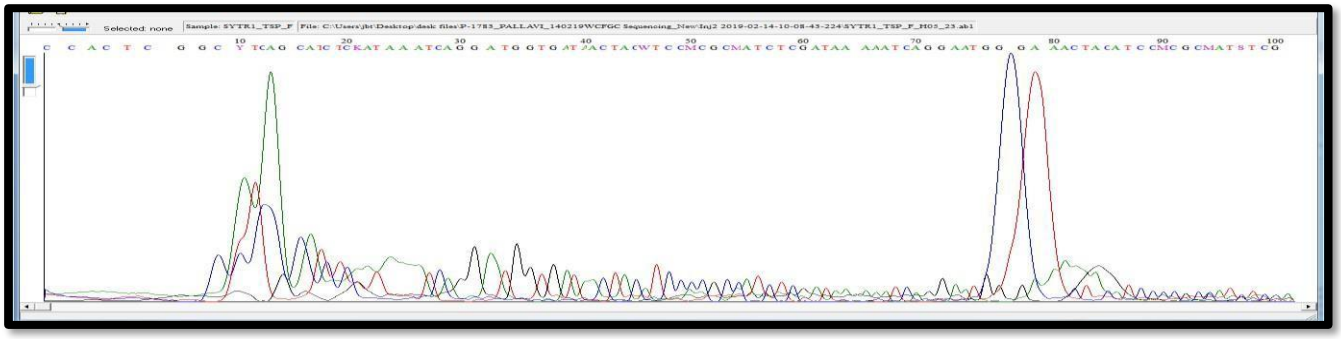


Fig 3.10: A preview of Electrophorogram generated after sequencing of PCR products.

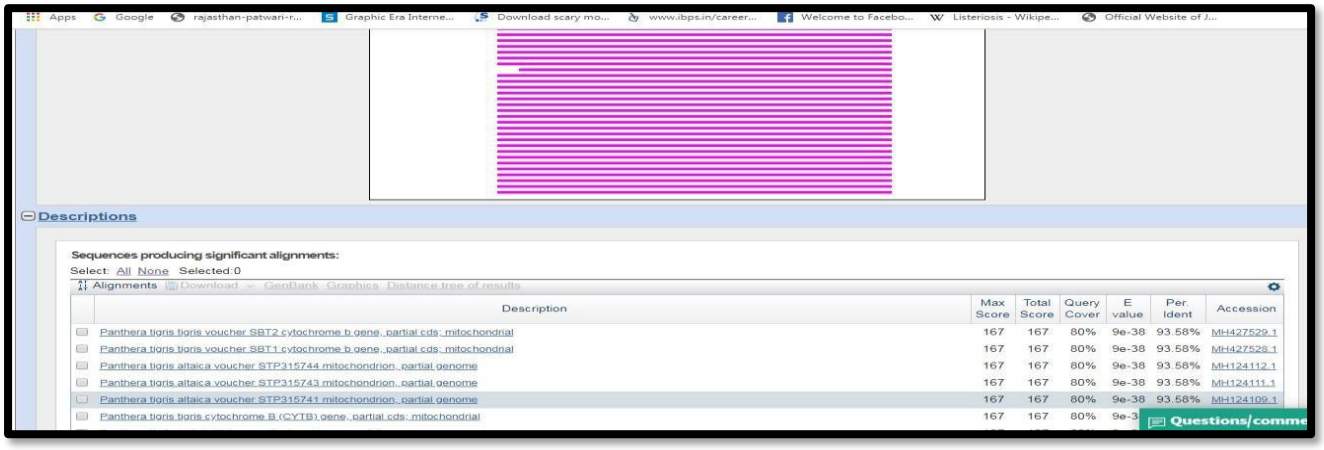


Fig.3.11: Preview of the species identification similarity matrix using sequence in NCBI

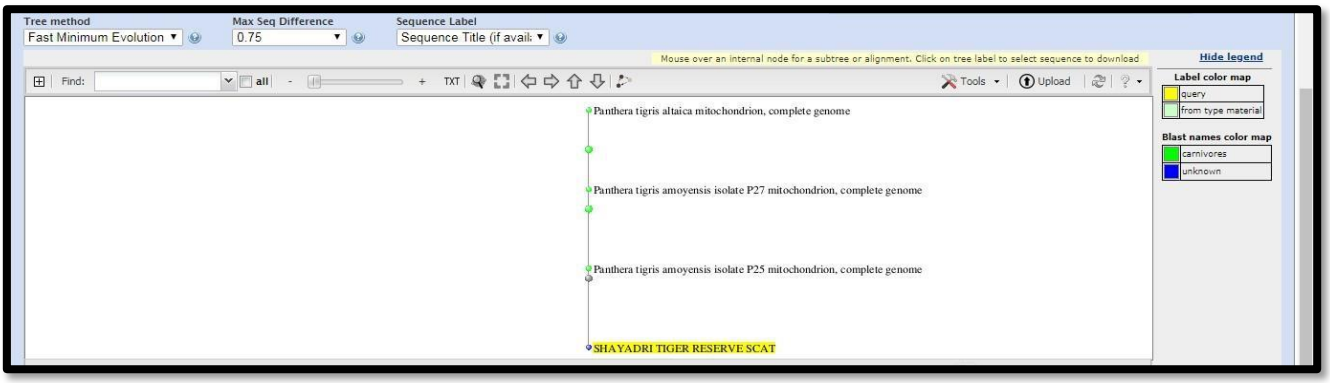


Fig.3.12: Phylogenetic tree showing the confirmation of Tiger

- **Tiger Scat DNA Sequencing:** We sequenced the scat samples in both directions for the initial confirmation of its origin. We used Qiagen Stool Kit (Qiagen). This method yielded better quality and quantity of DNA. All sequences were visually inspected and matched against Genebank database for species confirmation. Based on blast program of the NCBI database, all sequences clustered with *Panthera tigris* showing that these samples are of tiger. The species-specific cytochrome *b* fragment is useful for the species identification. We present previews of some of the important steps in the process in Fig.3.10, 3.11, 3.12.
- **Historical status of tigers in the landscape:** All past records of tiger occurrence in the Sahyadri landscape were searched from forest department records ***(Annexture 3.2).*** Tiger records found in the old documents were similarly scarce and only occasionally recorded. This further proves that tigers although have been frequenting this landscape, have not settled within Sahyadri Tiger Reserve.

3.2. Abundance:

3.2.1 Co-Predator Status:

Large carnivores and co-predators of Tiger recorded within Sahyadri Tiger Reserve are leopard, sloth bear and dhole (Wild dog). Leopards, sloth bears, and dholes play significant roles as co-predators in ecosystems where tigers are present. Their interactions with tigers and their contributions to biodiversity and ecosystem stability are vital. Here is an overview of the importance of each species as co-predators: Among large carnivores reported in Phase IV 2023 survey, sloth bear had the highest camera trap captures 669, followed by leopard 508 and dhole 171. (Atlas Map No.88)

Sr.No	Common Name	Phase IV 2022 Independent Captures	Phase IV 2023 Independent Captures
1	Leopard	430	508
2	Sloth bear	330	669
3	Dhole	104	171

Table. 3.4: Camera trap independent captures of co-predators' leopard, sloth bear and dhole in phase IV survey of 2022(sampled grids 395) and 2023(sampled grids 466).

3.2.1.1 Photographic capture rates of co-predators: Among the large carnivores present in the landscape, leopards have the highest capture rates from 2017 to 2020 Phase IV survey data (Table 3.5; Fig. 3.13).

Table 3.5: Mean photo-capture rates (SE in parentheses) of carnivore species by year and range

Species	Year	Mean	Bamnoli	Koyna	Helwak	Chandoli
Leopard	2017	2.02 (0.41)	3.10 (0.7)	0.10 (0.09)	2.84 (0.82)	2.11 (0.85)
	2018	4.97 (0.62)	7.31 (2.25)	3.81 (0.73)	2.28 (0.8)	7.51 (1.48)
	2019	7.38 (1.23)	9.56 (1.91)	3.26 (0.73)	2.27 (0.75)	14.14 (3.86)
	2020	3.68 (1.84)	9.37 (6.82)	3.49 (0.62)	0.03 (0.01)	0.05 (0.01)
Sloth bear	2017	3.05 (0.65)	5.92 (1.53)	0.64 (0.35)	1.76 (0.61)	1.94 (1.1)
	2018	4.27 (0.69)	4.58 (2.35)	3.85 (0.76)	4.41 (1.75)	4.72 (1.61)
	2019	6.21 (1.24)	4.45 (2.65)	4.05 (1.28)	4.34 (1.00)	11.36 (3.36)
	2020	2.41 (0.61)	1.27 (0.39)	2.33 (0.47)	3.96 (2.19)	1.65 (0.51)
Dhole	2017	0.39 (0.14)	0.08 (0.07)	0.10 (0.09)	2.62 (0.82)	0
	2018	0.65 (0.18)	0.26 (0.2)	0.35 (0.21)	0.43 (0.41)	1.66 (0.57)
	2019	0.7 (0.16)	0	0.23 (0.11)	1.14 (0.44)	1.43 (0.45)
	2020	0.82 (0.58)	0.01 (0.01)	0.35 (0.09)	2.64 (2.14)	0.01 (0.01)

Carnivore capture rates by range and year

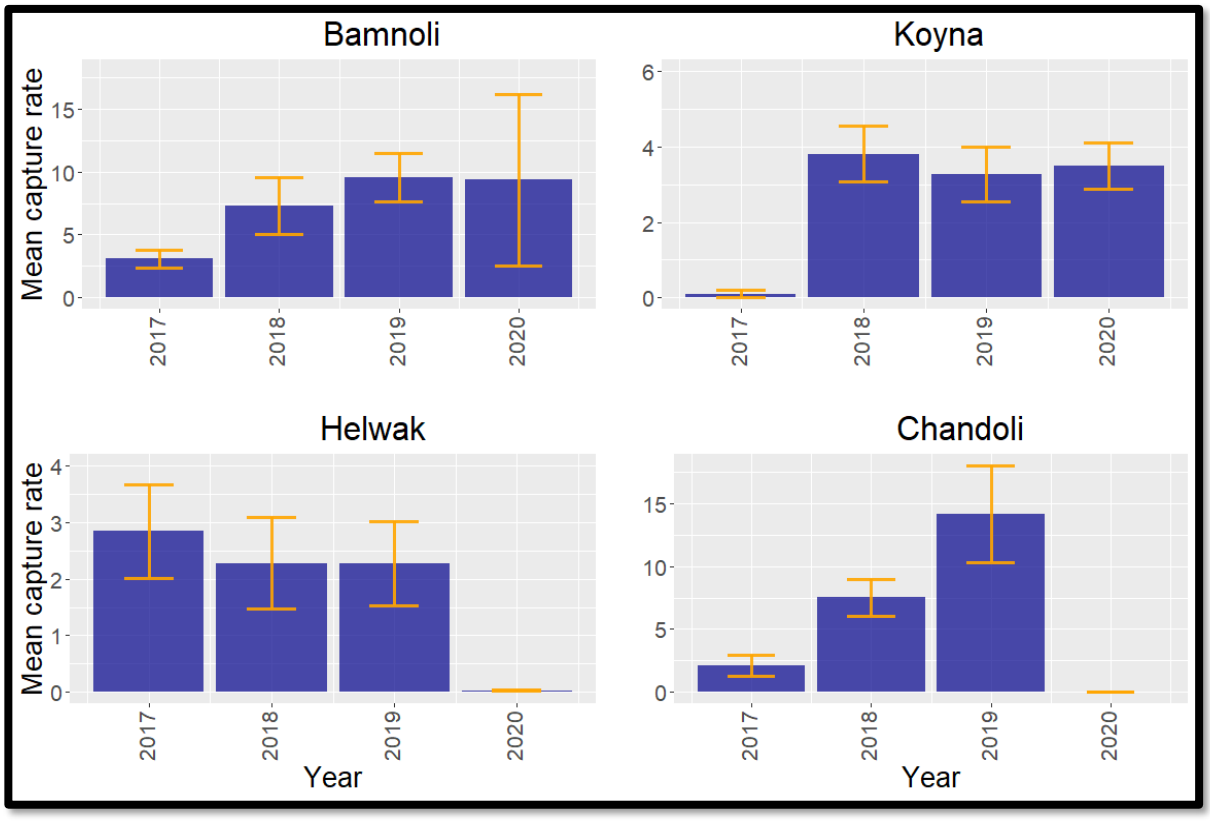


Fig.3.14: Sloth bear capture rates by range and year 2017-2020.

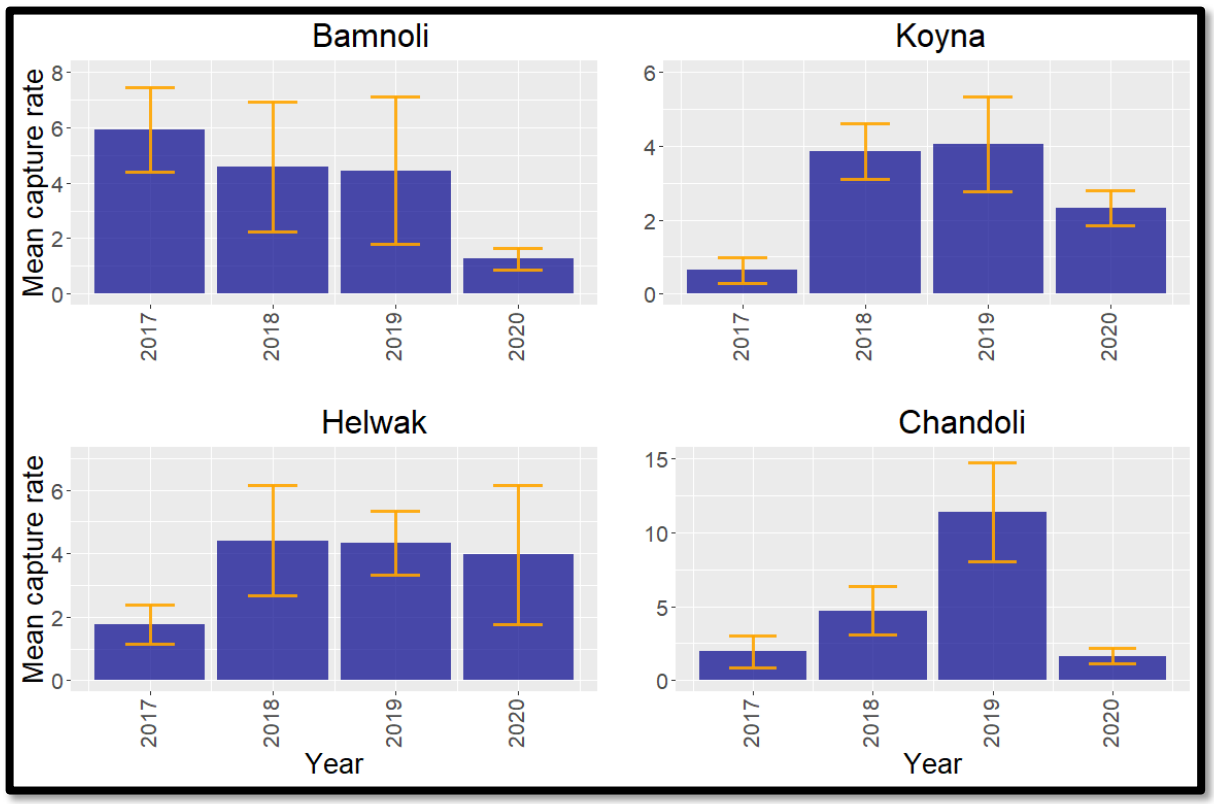


Fig.3.13: Leopard capture rates by range and year 2017-2020.

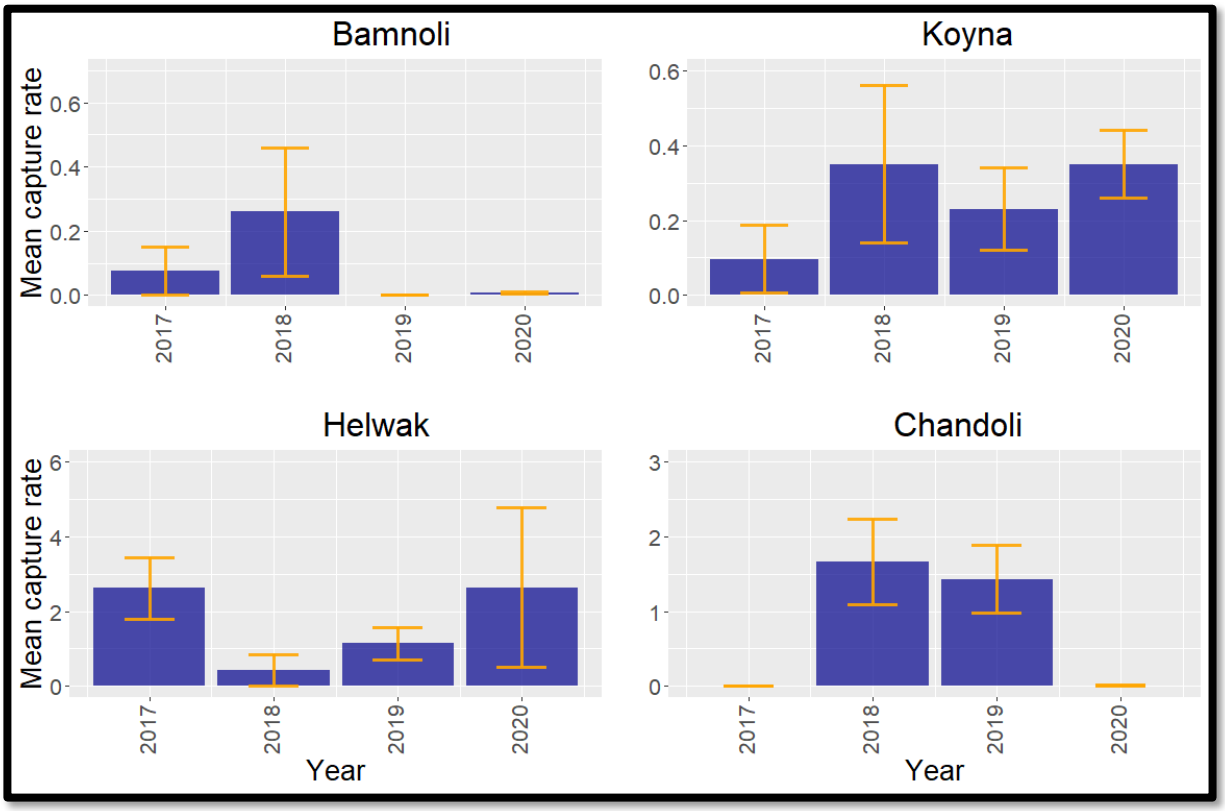
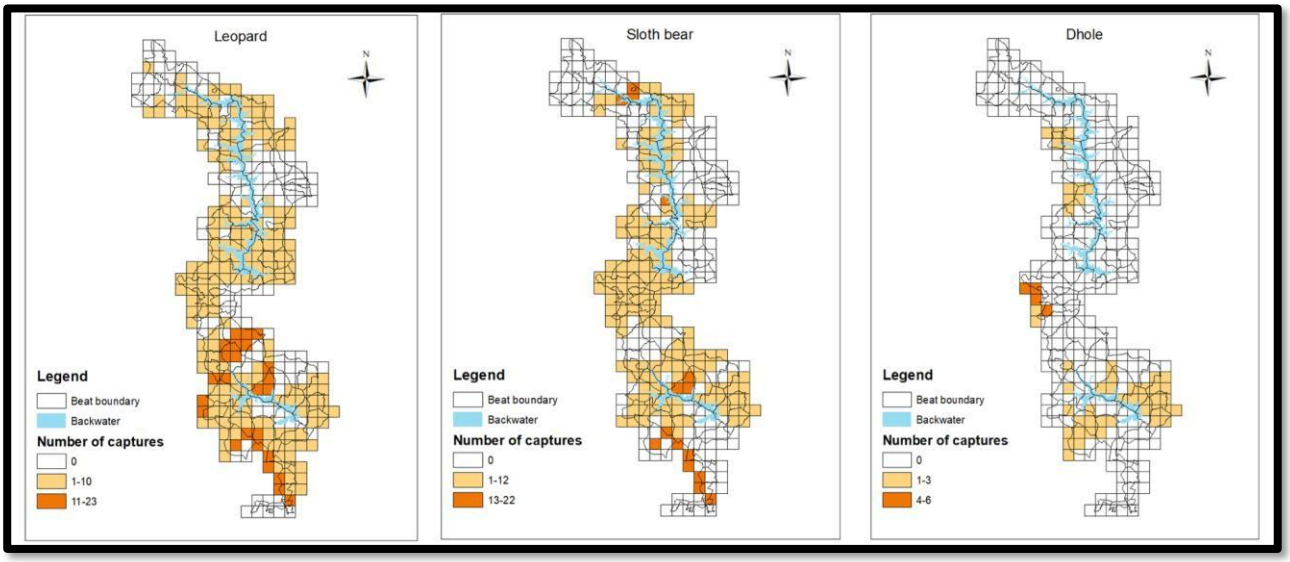


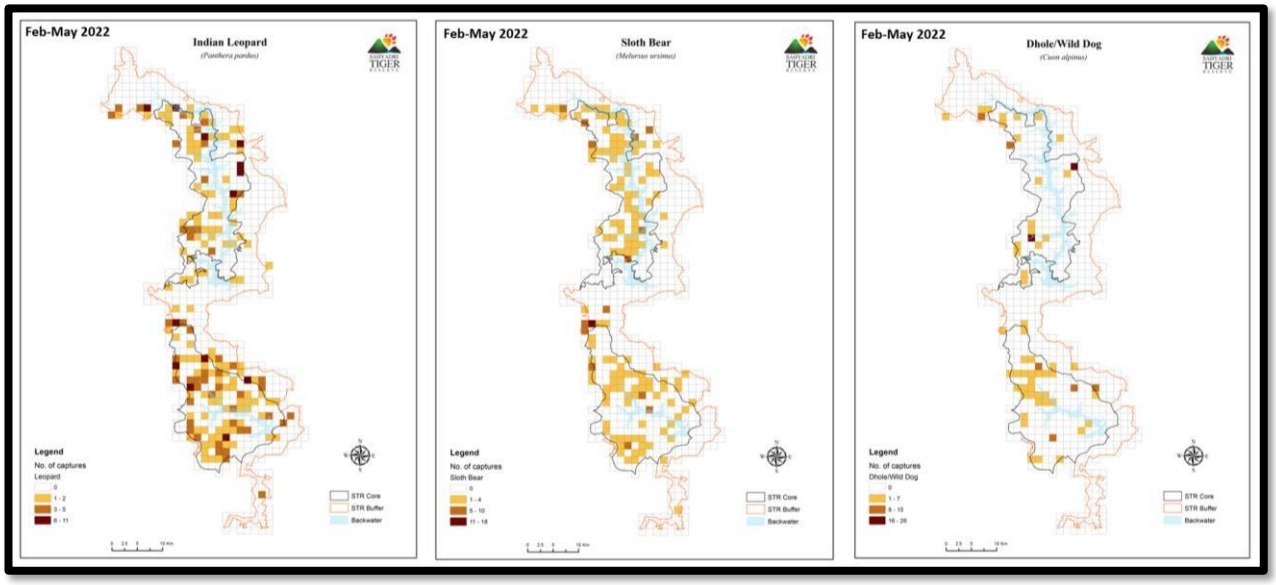
Fig.3.15: Dhole capture rates by range and year 2017-2020.

Map. 3.8: Distribution and Abundance of Co-predators in Sahyadri Tiger Reserve 2020,2022 & 2023

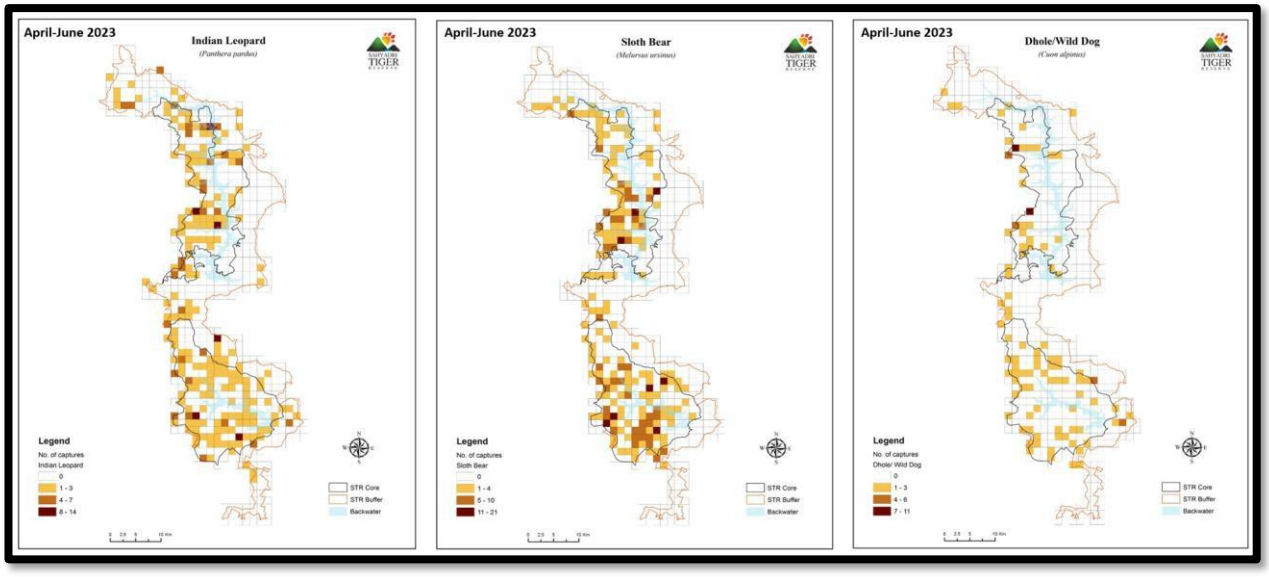
Phase IV-2020



Phase IV-2022



Phase IV-2023



3.2.2 Abundance of Leopard Dhole, and Sloth bear:

Relative abundance index of leopard in Phase-IV 2022 was 34.10 and increased up to 43.60 in Phase-IV 2023 survey (refer to Table3.6).

Sr.No	Species	Year of Phase IV Assessment	Independent Captures	Relative Abundance Index (1000 TN)
1	Leopard	2022	430	34.10
		2023	508	43.60
2	Dhole	2022	104	8.24
		2023	171	14.67
3	Sloth Bear	2022	330	26.17
		2023	669	57.42

Table 3.6.: Relative abundance index of Leopard (RAI = ((independent photographs / trap nights) × 1000). Total camera trap nights in 2023 was 11650 & in 2022 was 12609).

(The Relative Abundance Index (RAI) is a metric used to estimate the population size or density of a species within a specific area, based on indirect signs of presence such as tracks, scat, camera trap photos, or vocalizations. It provides a relative measure of species abundance, useful in ecological and wildlife studies.)

Phase I 2022 Sign Survey Results: Co-predators were recorded during the Phase I sign survey of 2022, Sloth bear recorded for 357 times, Leopard for 242 and Wild Dogs for 82 times.

Table 3.7: Co-predators recorded during the sign survey of Phase I sampling 2022.

Sr. No.	Species	No. of Observations	Encounter Rate
1	Sloth Bear	357	0.5179
2	Indian Leopard	242	0.3511
3	Wild Dog	82	0.1189

3.2.3 Leopard (*Panthera pardus*):

The presence of leopards in the Sahyadri Tiger Reserve is integral to the biodiversity and ecological health of the area. The Sahyadri Tiger Reserve, located in the Western Ghats of Maharashtra, India, encompasses several protected areas and serves as a critical habitat for a diverse array of wildlife. Here is an overview of the importance and role of leopards in this specific reserve:

Ecological Role of Leopards in Sahyadri Tiger Reserve

1. Biodiversity and Ecosystem Balance:

- **Prey Population Control:** Leopards help maintain the balance of prey species, such as deer, wild boar, and smaller mammals. By controlling these populations, leopards prevent overgrazing and the subsequent degradation of vegetation, which is crucial for maintaining the overall health of the ecosystem.
- **Trophic Cascade Effects:** As apex predators, leopards exert a top-down control on the food web, influencing the abundance and behavior of herbivores and meso-predators. This trophic cascade effect helps sustain the ecological equilibrium.

2. Adaptability and Habitat Utilization:

- **Versatile Habitat Use:** Leopards are highly adaptable and can thrive in various habitats, from dense forests to rocky outcrops. In the Sahyadri Tiger Reserve, their ability to use diverse habitats reduces direct competition with tigers, which prefer larger, contiguous forested areas.
- **Nocturnal and Diurnal Activity:** Leopards exhibit flexibility in their activity patterns, often being more nocturnal compared to tigers. This temporal separation in activity helps minimize conflicts and allows both predators to coexist.

3. Inter-Species Dynamics:

- **Competition and Coexistence:** While leopards and tigers may compete for similar prey, their spatial and temporal niche differentiation generally allows for coexistence. Leopards often inhabit areas on the periphery of tiger territories or regions with more rugged terrain.
- **Scavenging Role:** Leopards sometimes scavenge on kills made by tigers or other predators. This scavenging behavior aids in the nutrient recycling process within the ecosystem, ensuring that no part of a carcass is wasted.
- **Indicator Species:** The presence of leopards is an indicator of a healthy ecosystem. Conservation efforts aimed at protecting leopards also benefit other species and the overall biodiversity of the Sahyadri Tiger Reserve.

- **Human-Wildlife Conflict Mitigation:** Leopards often come into conflict with humans, particularly in fringe areas of the reserve. Effective management strategies, including community engagement and conflict mitigation programs, are essential for the coexistence of leopards and local communities.

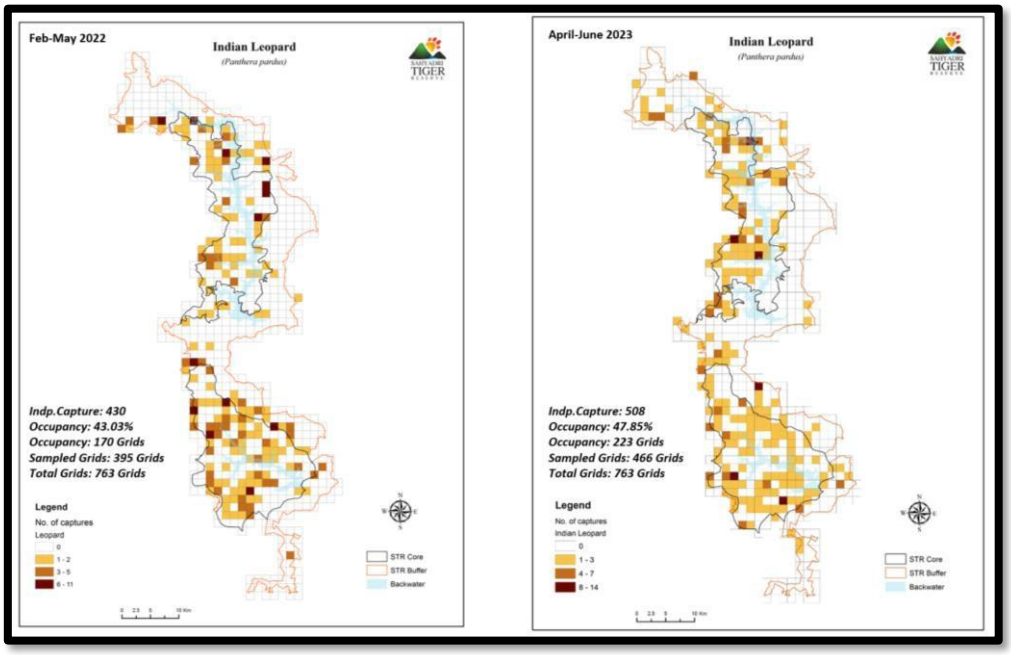
Leopards in the Sahyadri Tiger Reserve play a crucial role in maintaining ecological balance and biodiversity. Their adaptability and interactions with other species, including tigers, highlight the complexity of predator-prey dynamics and the importance of conserving these apex predators. Effective conservation strategies that address habitat protection, human-wildlife conflict, and community involvement are essential to ensure the survival of leopards and the overall health of the Sahyadri Tiger Reserve ecosystem.

3.2.3.1 Distribution and Abundance of leopard in Sahyadri Tiger Reserve:

Phase IV 2022: The independent captures of leopard in Phase IV 2022 survey were 430 with 43.03% occupancy of sampled 395 total sampled grids out of 763 total grids (refer to table 3.8, fig.3.17).
Phase IV 2023: The independent captures of leopard in Phase IV 2023 survey were 508 with 47.85% occupancy of sampled 466 total sampled grids out of 763 total grids (refer to table 3.8, fig.3.17).

Sr.No	Year of Phase IV Assessment	Independent Captures	Sampled Grids	Occupied Grids	Occupancy out of sampled grids	Relative Abundance Index (1000 TN)
1	Phase IV 2022	430	395	170	43.03%	34.10
2	Phase IV 2023	508	466	223	47.85%	43.60

Table 3.8: Leopard captures recorded in Phase IV 2022 and 2023 survey.



Map.3.9: Leopard distribution & abundance Phase IV 2022 & Phase IV 2023

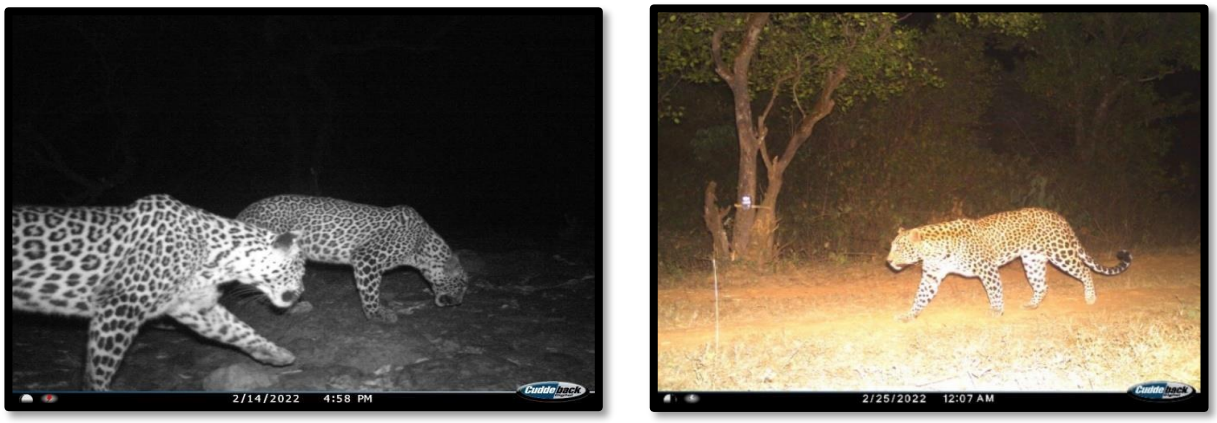


Fig. 3.17: Camera trap captures of leopard.

- **Leopard individual identification:**

Research team counted minimum number of leopards in STR by using Phase IV 2020 Camera Trap data. It is counted by comparing camera trap images manually with each other. (This is rough estimate to get idea of minimum number of leopards in STR) Total 43 individual leopards (25 females and 18 males) were identified using the rosette patterns (Fig. 3.18). However, many images remain unidentified due to poor lighting conditions as well as blurry images. A complete catalogue of individual male and female leopards with maps has been prepared.

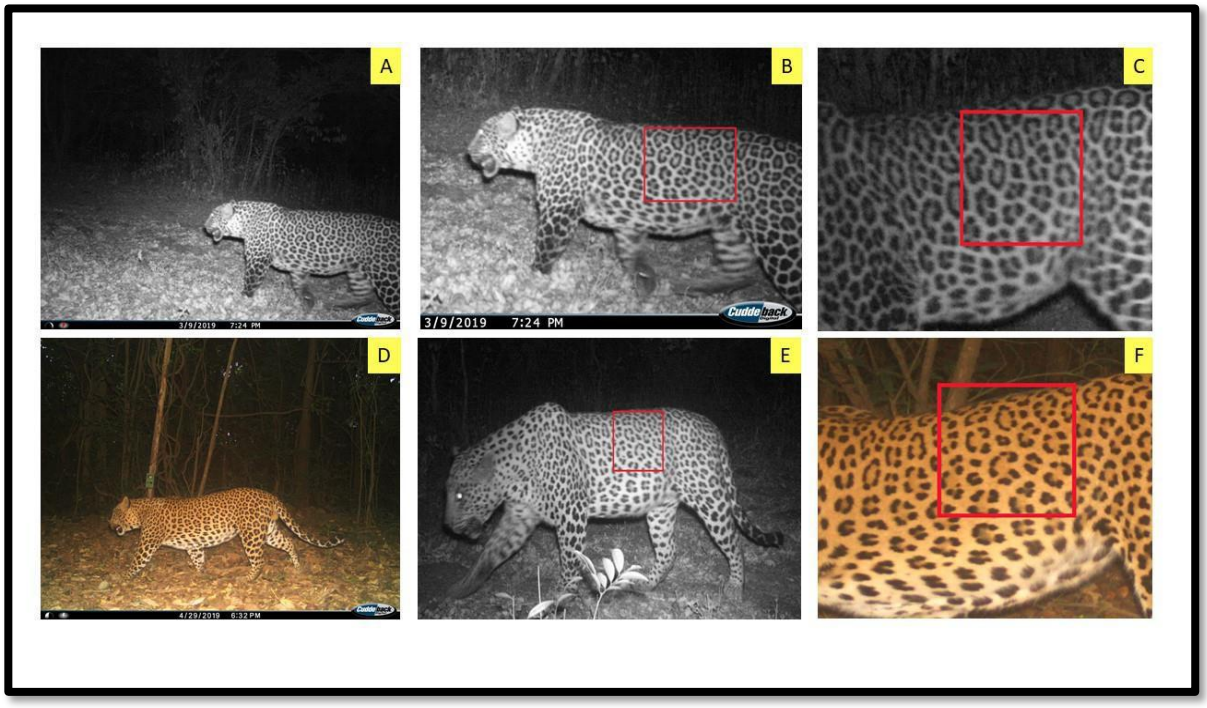
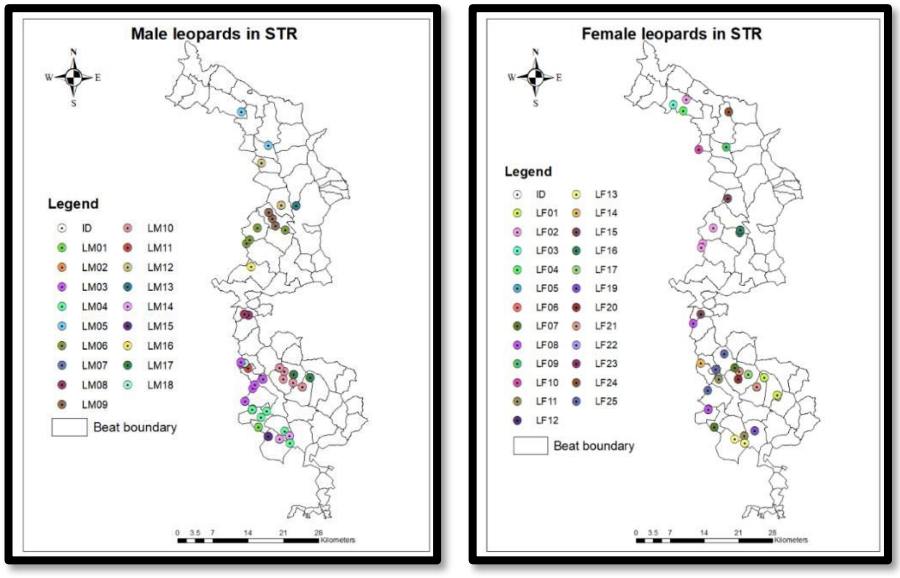


Fig. 3.18: Example of how leopards were identified. (Left panel (A and D) shows two individual adult male leopards. Middle panel (B and E) shows up-close of each individual with red square highlighting a portion of the left plank to distinguish the rosette pattern. Right panel (C and F) shows zoomed in images of the highlighted portion with clearly visible distinct rosette patterns).

3.2.3.2 Spatial mapping of individual leopards: We also mapped the locations from where these individual leopards were captured (Fig.3.8). It is noteworthy that a high number of leopards occur and cluster within Chandoli National Park area. Only a few identified leopards seem to be having territory in Koyna Wildlife Sanctuary.



Map.3.10: Occurrence locations of individual male and female leopards in the tiger reserve

3.2.4 Dhole (*Cuon alpinus*):

Also known as Asiatic wild dog, dhole (*Cuon alpinus*) and locally called as Kolsundha, plays a crucial role in the Sahyadri Tiger Reserve for several reasons:

- **Ecosystem Balance:** As apex predators, dholes help maintain the balance of the ecosystem by regulating prey populations, which in turn influences the structure and composition of the vegetation and the overall health of the environment.
- **Scavenging and recycling nutrients:** Dholes often scavenge, and their feeding behavior helps in nutrient recycling. By consuming carcasses, they help decompose organic matter and return nutrients to the soil, promoting plant growth.
- **Biodiversity Indicator:** The presence of dholes is an indicator of a healthy, biodiverse ecosystem. Their survival depends on a robust prey base and intact habitats, signaling a well-functioning ecosystem.
- **Predator Interactions:** Dholes contribute to the dynamics of predator interactions within the reserve. Their presence can affect the behavior and distribution of other predators, such as tigers and leopards, leading to a more balanced predator-prey relationship.
- **Conservation Significance:** Protecting dholes helps safeguard broader biodiversity. Conservation efforts aimed at dholes also benefit other species sharing their habitat, promoting overall ecological integrity.
- **Cultural and Ecotourism Value:** Dholes add to the wildlife diversity of the Sahyadri Tiger Reserve, enhancing its appeal for ecotourism, which can generate revenue for local communities and support conservation initiatives.

In summary, the Asiatic wild dog is essential for maintaining ecological balance, indicating ecosystem health, influencing predator-prey dynamics, facilitating nutrient cycling, promoting healthy prey demographics, and indicating ecosystem health and supporting conservation and ecotourism efforts in the Sahyadri Tiger Reserve.

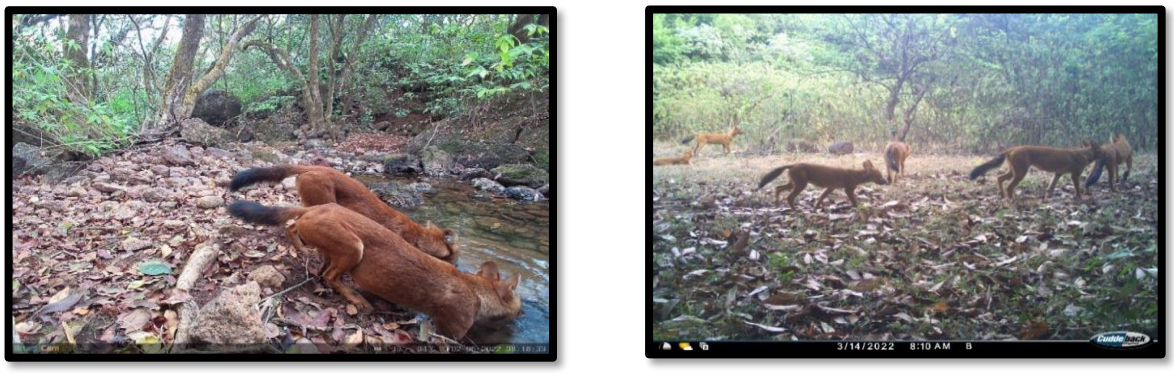


Fig.3.19: Camera trap captures of dholes.

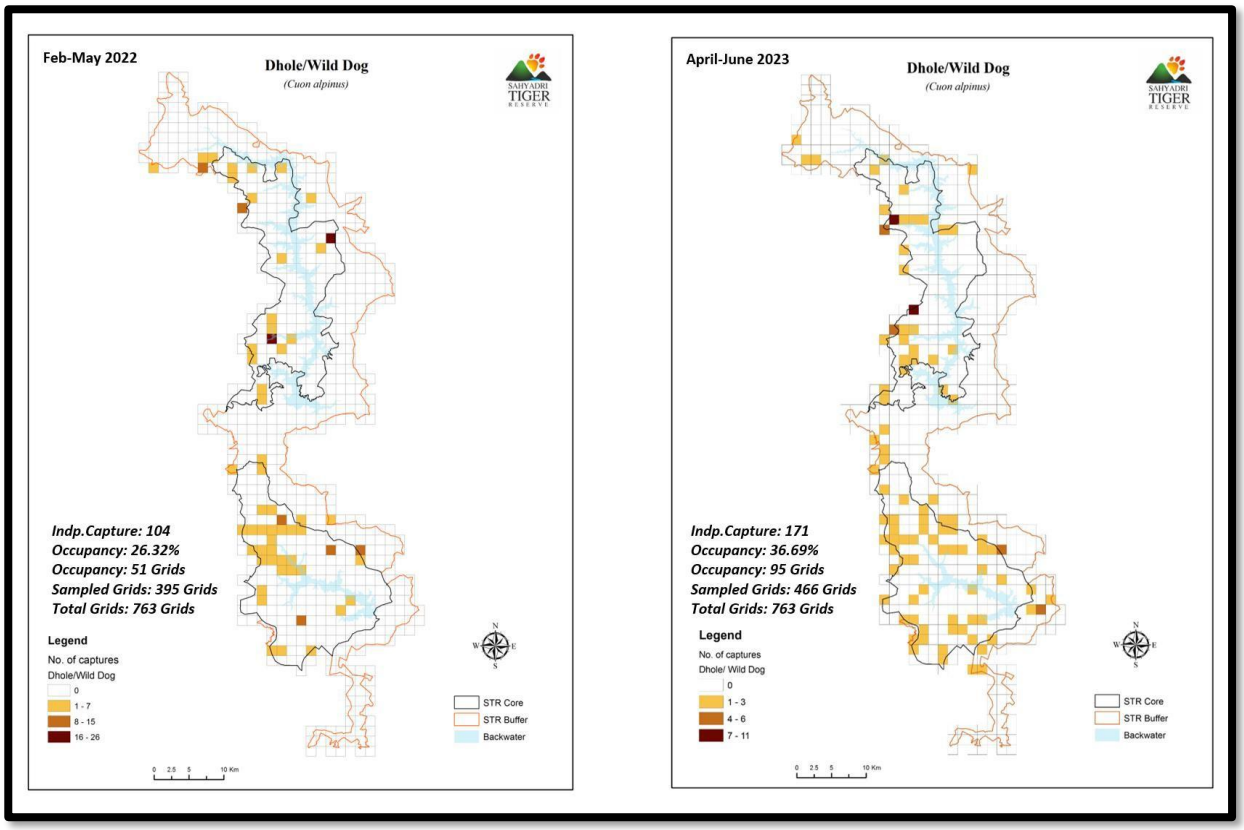
3.2.4.1 Distribution and Abundance of Dhole in Sahyadri Tiger Reserve:

Phase IV 2022: The independent captures of Dhole in Phase IV 2022 survey were 104 with 12.91% occupancy of sampled 395 total sampled grids out of 763 total grids (refer to table 3.9, fig.6).

Phase IV 2023: The independent captures of Dhole in Phase IV 2023 survey were 171 with 20.38% occupancy of sampled 466 total sampled grids out of 763 total grids (refer to table 6, fig.5).

Sr.No	Year of Phase IV Assessment	Independent Captures	Sampled Grids	Occupied Grids	Occupancy out of sampled grids	Relative Abundance Index (1000 CI)
1	Phase IV 2022	104	395	51	12.91%	8.24
2	Phase IV 2023	171	466	95	20.38%	14.67

Table 3.9: Leopard captures recorded in Phase IV 2022 and 2023 survey.



Map.3.11: Dhole distribution & abundance Phase IV 2022 & Phase IV 2023

3.2.5 Sloth Bear (*Melursus ursinus*):

The Sloth Bear (Melursus ursinus) holds a unique position as a co-predator alongside the tiger in the Sahyadri Tiger Reserve, contributing to the ecosystem in various important ways:

- **Complementary Predation:** While tigers primarily hunt large herbivores such as deer and wild boar, sloth bears focus on insects, fruits, and small animals. This complementary predation helps maintain a balance across different trophic levels, reducing competition for food resources and promoting a diverse prey base.
- **Habitat Structuring:** Sloth bears' foraging behavior, such as digging for insects and breaking open termite mounds, alters the physical structure of the habitat. These modifications can create microhabitats that benefit other species, including those that tigers prey upon, thereby supporting overall biodiversity.
- **Prey Population Regulation:** By feeding on insects and small animals, sloth bears help regulate these populations, which indirectly affects the vegetation structure. Healthy vegetation supports a robust herbivore population, which in turn sustains the tiger population.
- **Nutrient Cycling:** The feeding activities of sloth bears contribute to nutrient cycling in the ecosystem. For example, their consumption and excretion of fruits aid in seed dispersal and plant growth, which is essential for maintaining the forest structure that provides habitat for tigers and their prey.
- **Reducing Intraspecific Competition:** As sloth bears and tigers have different dietary preferences and hunting methods, their coexistence reduces direct competition for the same food resources. This allows for a more stable predator community and helps in the efficient utilization of available resources.
- **Scavenging Benefits:** Sloth bears occasionally scavenge on carcasses left by tigers, ensuring that no part of the kill goes to waste. This scavenging behavior helps in nutrient recycling and reduces the spread of disease by quickly breaking down animal remains.
- **Indicator of Ecosystem Health:** The presence of both sloth bears and tigers in the same habitat indicates a well-functioning, biodiverse ecosystem. Their coexistence suggests a healthy prey base and sufficient habitat complexity to support multiple large predators.

In summary, as a co-predator with the tiger, the sloth bear plays a crucial role in maintaining ecological balance, structuring habitats, regulating prey populations, contributing to nutrient cycling, and reducing competition for food resources in the Sahyadri Tiger Reserve. Their combined presence underscores the health and complexity of the ecosystem.

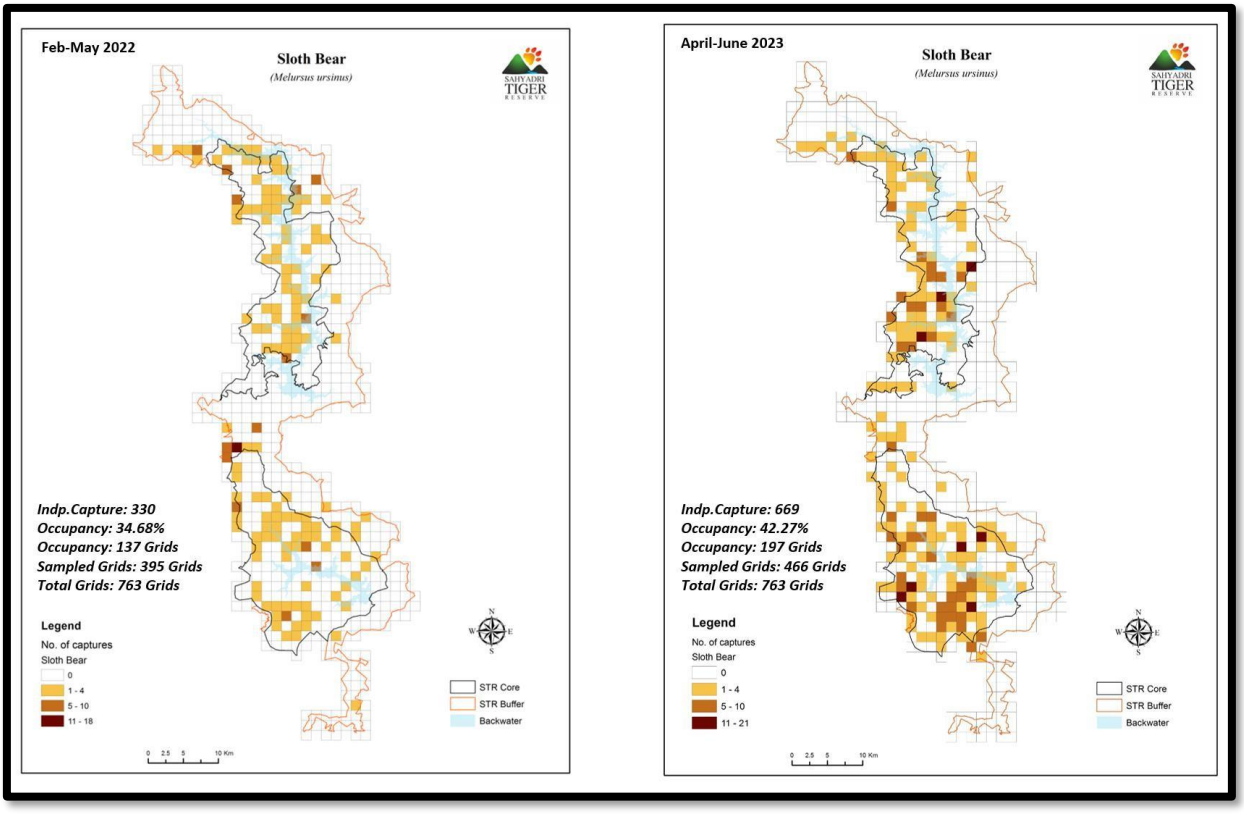
3.2.5.1 Distribution and Abundance of Sloth bear in Sahyadri Tiger Reserve:

Phase IV 2022: The independent captures of Sloth bear in Phase IV 2022 survey were 137 with 34.68% occupancy of sampled 395 total sampled grids out of 763 total grids (refer to table 6, fig.6).

Phase IV 2023: The independent captures of Sloth bear in Phase IV 2023 survey were 197 with 42.27% occupancy of sampled 466 total sampled grids out of 763 total grids (refer to table 6, fig.5).

Sr.No	Year of Phase IV Assessment	Independent Captures	Sampled Grids	Occupied Grids	Occupancy out of sampled grids	Relative Abundance Index (1000 CI)
1	Phase IV 2022	330	395	137	34.68%	26.17
2	Phase IV 2023	669	466	197	42.27%	57.42

Table 3.10: Sloth bear captures recorded in Phase IV 2022 and 2023 survey.



Map 3.12: Sloth bear distribution & abundance Phase IV 2022 & Phase IV 2023

Fig. 3.20: Camera trap captures of sloth bear.

Discussion: After the completion of four years, we have confirmed tiger presence within Sahyadri Tiger Reserve twice. It is now clear that tigers have been frequenting the reserve, although have not settled within the reserve boundary. Furthermore, Sahyadri hosts a rich assemblage of large and small carnivores. We identified 43 individual leopards; this is however the lowest density estimate as large number of camera trap images remain unidentified. We expect that actual density estimate will be much higher than 43. Other than leopard, dhole and sloth bears are seen as large carnivores in this landscape. Sloth bears are quite common, but dhole detections are low. Dholes are constrained to pockets especially in Chandoli part of the tiger reserve.

3.3 Prey-Predator Relationship:

Fig. 3.21: Camera trap captures of leopard with mouse deer kill.

3.3.1.1 Introduction: The ecological niche of an animal encompasses patterns of activity on both spatial and temporal scales (Halle and Stenseth, 2000). Temporal activity patterns are strongly influenced by the

24-hour oscillation between day and night. Temporal partitioning of activity facilitates the coexistence of competing species (Schoener 1974). Camera traps offer a unique advantage to assess activity patterns through photographic captures, as all images are time stamped. Researchers have recently focused attention on the finer scaled temporal data provided by time-stamped camera trap images (e. g. Ridout and Linkie 2009; Rowcliffe et al. 2014) which detail the timing of wildlife occurrences across points in space. Further, temporal camera trap data offer the opportunity to address unresolved questions regarding species ecology and community interactions, such as variation in activity patterns and partitioning along the temporal axis. Within Sahyadri as well, it is important to understand how species partition or overlap in time to coexist. Activity patterns also offer insights into predator-prey interactions in time, and how prey can avoid predator by partitioning time.

3.3.1.2 Methods: Using the camera trap dataset of 2019, we assessed the temporal niche overlap to understand predator-prey relationship and other species-pairs.

3.3.1.3 Dial activity patterns: We estimated kernel density estimates (Ridout and Linkie 2009) to assess activity patterns. We converted the time of photographic event to radians and then used the overlap package (Meredith and Ridout, 2014) in R (R Core Team 2020) to fit the data to a circular kernel density and estimated the activity level of each species. We then used the overlap Est function to test for the degree of overlap (Δ) in activity patterns among species pairs. We then calculated 95 % confidence intervals by bootstrapping 9999 estimates of activity for each species, and then estimated overlap between each species pair using the boot Est and boot CI functions. In addition to testing for species overlap, we also visualized species activity pattern by administrative ranges within Sahyadri. This has direct management implication as this shows the activity pattern of species in different ranges and also which are the peak hours in which species are most active. Activity and overlap for species which had fewer captures was not done, as this leads to either null or erroneous results.

3.3.1.4 Results: Among predator-prey pairs, we found high overlap between leopard and gaur (0.85), leopard and wild pig (0.85) and leopard and sambar (0.74). Dhole had low activity overlap with ungulates. Sloth bear had high overlap with gaur (0.86), wild pig (0.86) and sambar (0.78) (Table 1). Leopard also had high overlap with sloth bear (0.76). Dhole had low overlap with the other two large carnivores (Table 2). Among ungulates, gaur had high overlap with wild pig (0.83), and sambar (0.76). Wild pig also had high overlap with sambar (0.82) (Table 3.11). Other species pairs had moderate to low activity overlap.

Table 3.11: Temporal overlap estimates among predators and prey

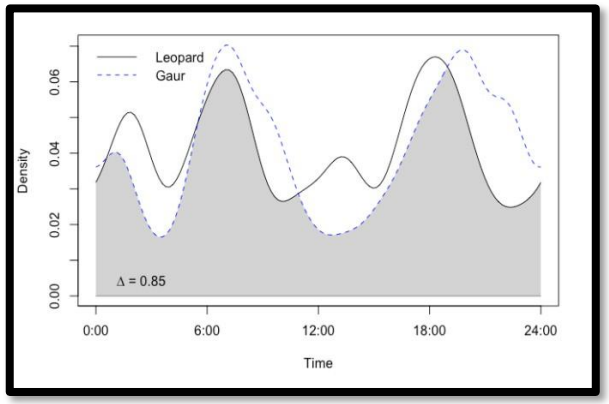
Species	Gaur	Wild pig	Sambar	Barking deer	Mouse deer
Leopard	0.85 (0.79–0.89)	0.85 (0.76–0.86)	0.74 (0.65–0.77)	0.57 (0.49–0.61)	0.51 (0.37–0.52)
Dhole	0.60 (0.46–0.63)	0.50 (0.37–0.54)	0.43 (0.28–0.44)	0.57 (0.46–0.64)	0.23 (0.11–0.25)
Sloth bear	0.86 (0.76–0.87)	0.86 (0.75–0.86)	0.78 (0.69–0.83)	0.54 (0.44–0.57)	0.57 (0.47–0.62)

Table 3.12: Matrix of temporal overlap estimate among large carnivores

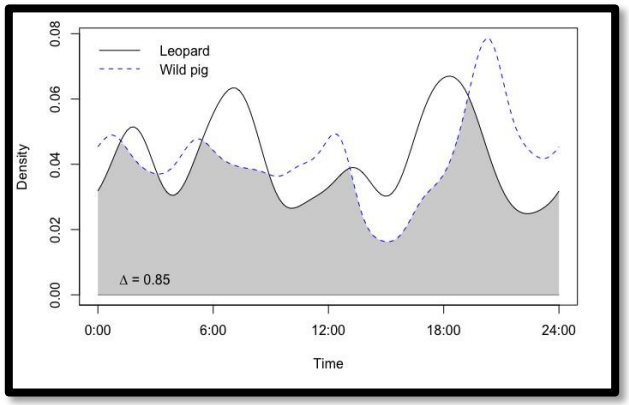
Species	Leopard	Dhole	Sloth bear
Leopard	—	0.54 (0.41–0.59)	0.76 (0.70–0.82)
Dhole		—	0.49 (0.41–0.59)
Sloth bear			—

Table 3.13: Matrix of temporal overlap estimate among ungulates

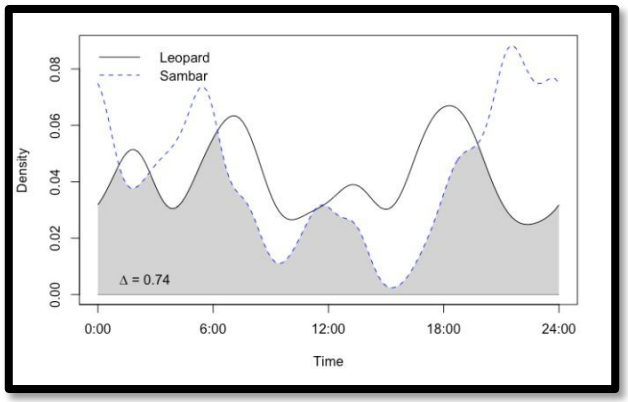
Species	Gaur	Wild pig	Sambar	Barking deer	Mouse deer
Gaur	—	0.83 (0.80–0.87)	0.76 (0.67–0.77)	0.56 (0.49–0.58)	0.52 (0.42–0.54)
Wild pig		—	0.82 (0.76–0.86)	0.52 (0.45–0.54)	0.59 (0.49–0.62)
Sambar			—	0.38 (0.30–0.40)	0.73 (0.63–0.76)
Barking deer				—	0.17 (0.08–0.17)
Mouse deer					—



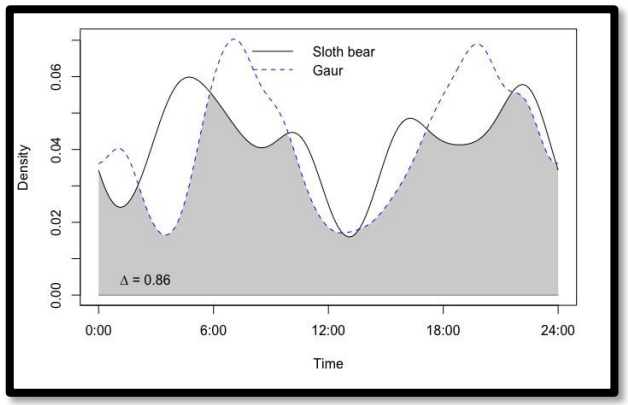
Leopard + Gaur



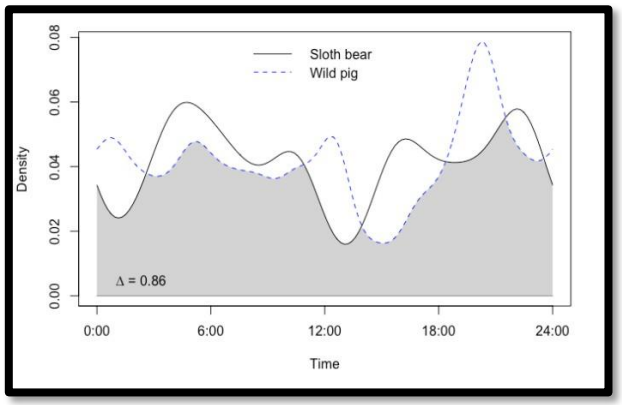
Leopard + Wild pig



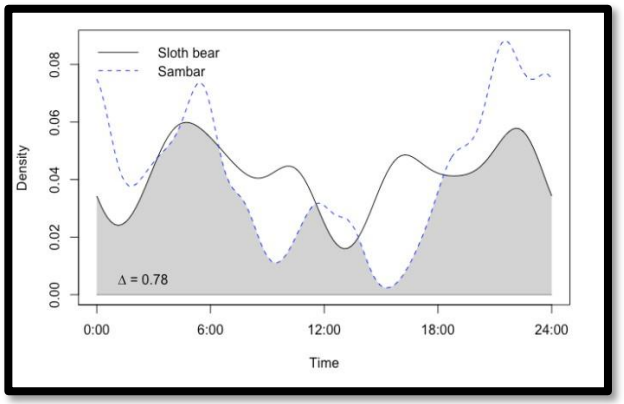
Leopard + Sambar



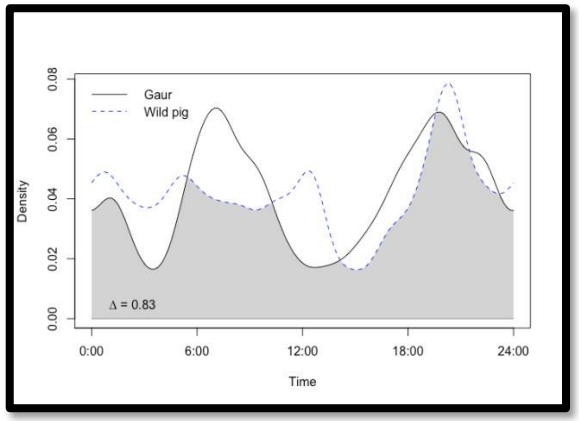
Sloth bear + Gaur



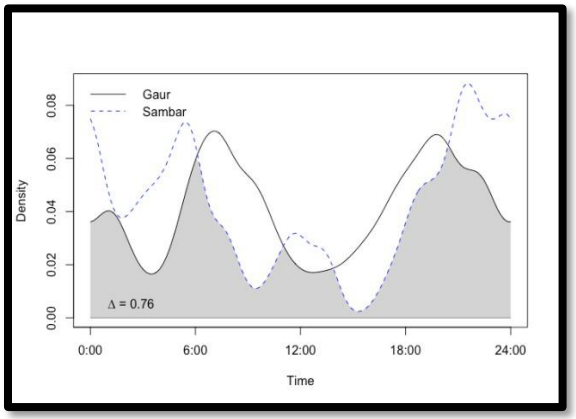
Sloth bear + Wild pig



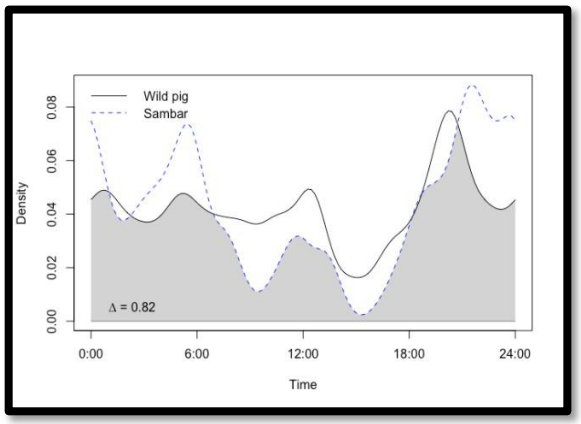
Sloth bear + Sambar



Gaur + Wild pig

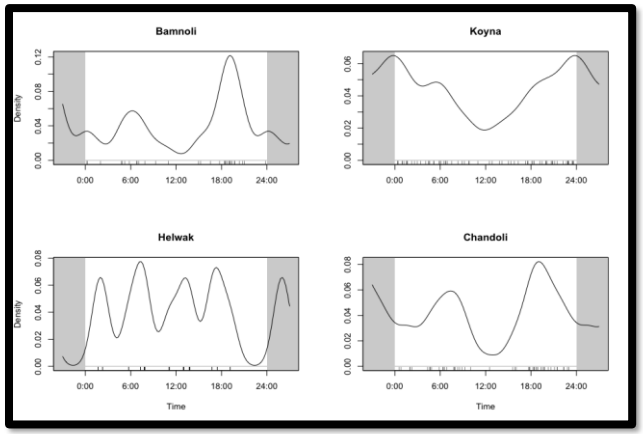


Gaur + Sambar

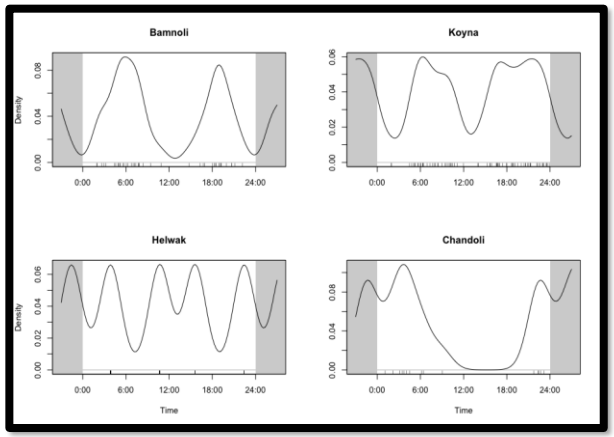


Wild pig + Sambar

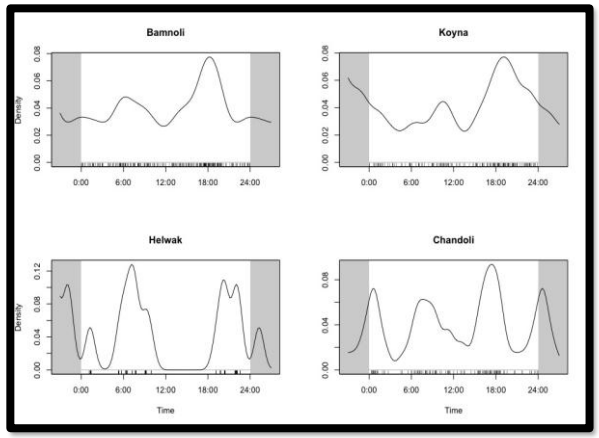
3.3.1.5 Species activity patterns by range: Disentangling species activity patterns by administrative ranges in Sahyadri is important to understand peak activity hours in different ranges. All ranges vary in human pressure and temporal activity patterns are helpful in understanding how species are using time in varied human pressure regimes (Frey et al. 2017). We found that in Koyna and Chandoli ranges, the primary core areas in the reserve, most mammals show a uniform activity pattern throughout the day (24-hour period). Leopard, gaur, sambar, common palm civet and small Indian civet all show nocturnal peaks in Bamnoli range, as this range includes much of the buffer area. Wild pig uses this range similar to other core ranges given that it is a common species and less vulnerable to human pressure.



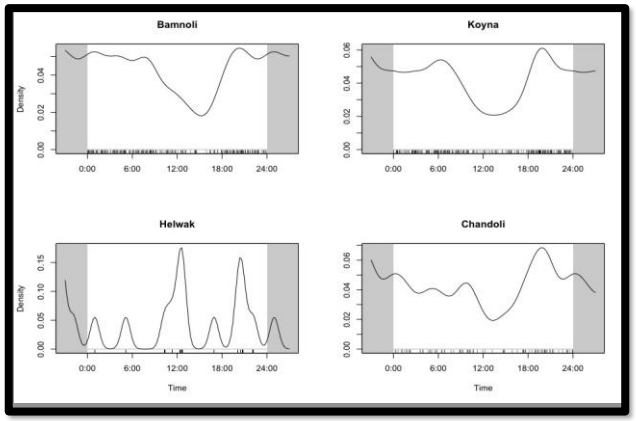
Leopard



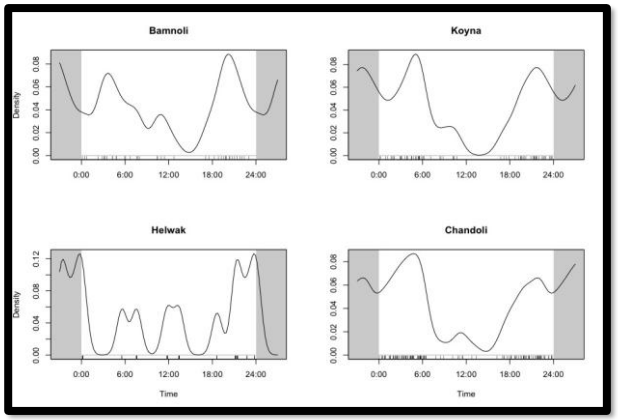
Sloth Bear



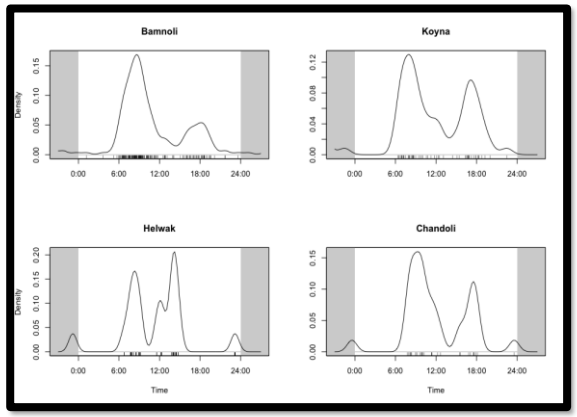
Gaur



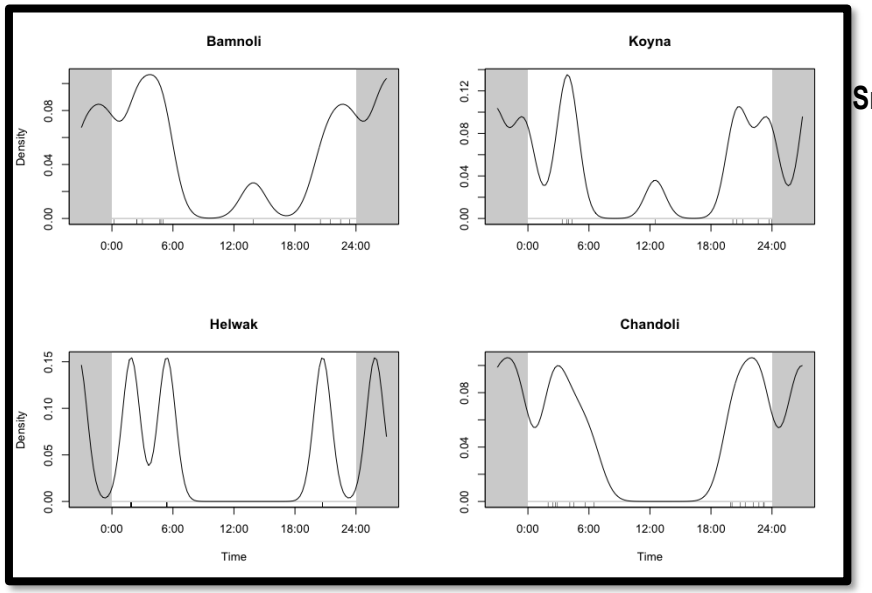
Wild pig



Sambar

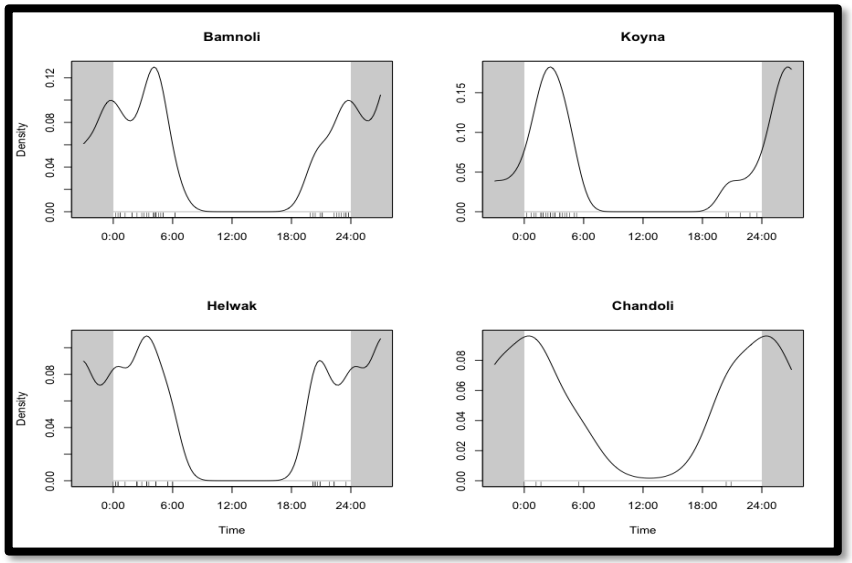


Barking deer

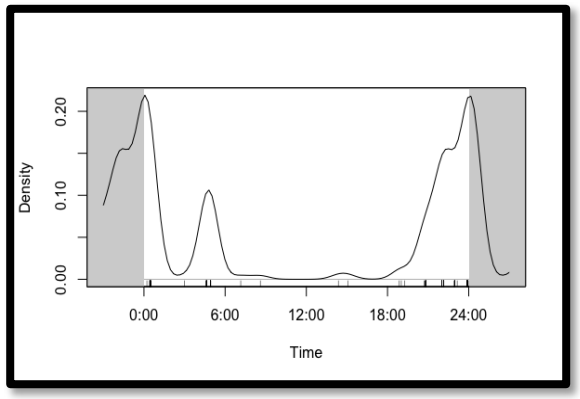


Small Indian civet

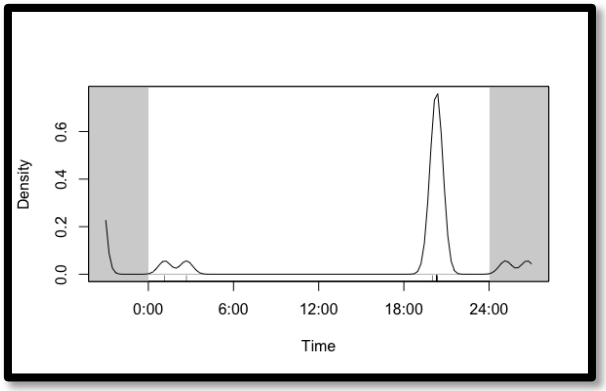
Common palm civet



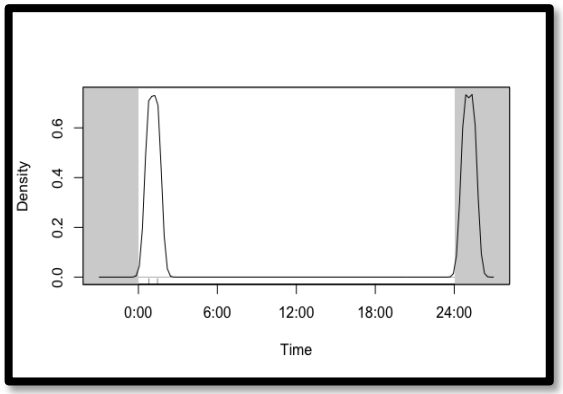
Small India civet



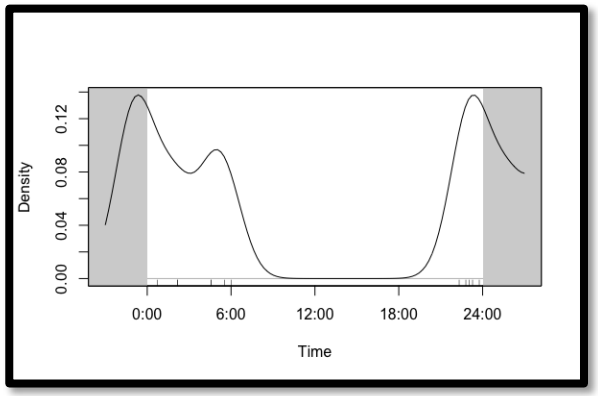
Jungle cat



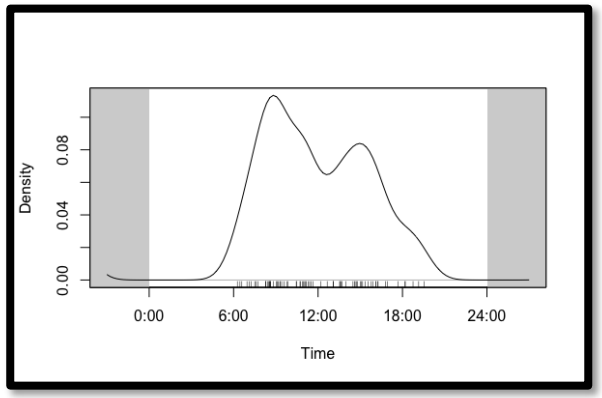
Leopard cat



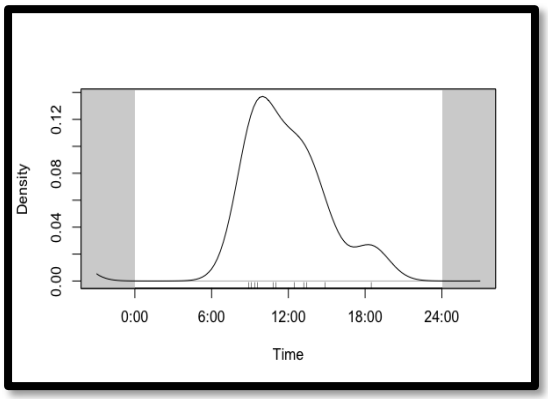
Rusty spotted cat



Brown palm civet



Ruddy mongoose



Stripe-necked mongoos

3.3.6 Discussion:

Temporal camera-trap data offer the opportunity to address unresolved questions regarding species ecology and community interactions, such as variation in activity patterns and partitioning along the temporal axis. These temporal insights are not only valuable from an ecological perspective, but they also provide insight into human-driven changes to species behaviors and interactions, and the resulting impacts on niche partitioning and community structure. There is mounting evidence that human-driven landscape and community impacts including land-use change (Ramesh and Downs 2013), human activity (Wang et al. 2015), hunting (Di Bitetti et al. 2008) may alter species' activity patterns and competitive or predatory interactions through altered temporal niche partitioning. To understand this affect, we visualized species diel activity by different ranges in Sahyadri. Koyna, Helwak and Chandoli form the bulk of core area of the reserve. Bamnoli comprises a substantial buffer area where human activity is high. This was clearly visible in the activity graphs which showed peak activity in night hours (1800–0600 hours).

Further, the activity overlap showed high correlation between activity of predators and prey. This information is valuable to understand prey-predator dynamics in a temporal axis. Leopard and sloth bears had high overlap with gaur, wild pig and sambar. Looking at activity overlap among carnivores, it was found that leopard and sloth bear had high activity overlap. This is perhaps that both these are widely spread species in the landscape, and hence activity overlap is high. Among ungulates, gaur, sambar and wild pig had high overlap. This is also because of similar reason that these species are common in this landscape and have adapted well to the landscape and are active throughout the day.

3.3.7 Tiger Prey Preference:

From Dec 2023, Tiger activities had been continuously monitored through camera trap and daily patrolling and PIPs. In five months, field observations by staff, tiger had been recorded hunting 2 Indian Gaur, 2 Feral Cattle and 1 wild pig as follows.

Sr.No	Prey Species	Age	Status	Observation Date	Observation by	Beat	Range
1	Indian Gaur	Male	Hunt	18/12/2023	Field Staff	Rundiv	Helwak
2	Wild Pig	Male	Hunt	14/01/2024	Field Staff	Chandoli Khurd	Helwak
3	Feral Cattle	Female	Hunt	29/01/2024	Field Staff	Sonarli	Chandoli
4	Indian gaur	Female	Hunt	02/03/2024	Field Staff	Rundiv	Helwak
5	Feral Cattle	Female	Hunt	14/03/2024	Field Staff	Nandoli	Dhebewadi

Table 3.14: Tiger hunting behavior observed in field staff patrolling from Dec 2023 to May, 2024.

Fig.3.22.Full grown male Gaur Kill, Rundiv, Helwak

Fig.3.23.Full grown male Wild Pig Kill, Chandoli Khurd, Helwak

Fig.3.24 Full grown female Ferral Cattle Kill, Sonarli, Chandoli

Fig.3.25.Full grown female Guar Kill,

3.3.8 Leopard Prey Preference:

Leopard has been recorded on camera trap while hunting and feeding on various prey species as shown in following table. Total 9 camera trap images observed that leopard hunting prey capture were recorded. Leopard has been found hunting mouse deer 3 times, giant squirrel 3 times, and langur, wild pig and Indian hare once.

Sr. No	Prey Species	Camera Trap Date	Time	Observation By
1	Mouse Deer	02/02/2018	2:38pm	Camera Trap
2	Giant squirrel	12/02/2019	12:30pm	Camera Trap
3	Wild Pig	17/02/2022	10:02pm	Camera Trap
4	Giant squirrel	14/03/2022	05:32am	Camera Trap
5	Langur	26/04/2022	07:56am	Camera Trap
6	Giant squirrel	16/05/2022	16:10pm	Camera Trap
7	Mouse Deer	23/05/2023	13:58pm	Camera Trap
8	Mouse Deer	29/08/2023	18:01pm	Camera Trap
9	Indian Hare	12/02/2024	11:23pm	Camera Trap

Table 3.15: Leopard hunting and feeding on various prey species captured in camera traps from 2018 to 2024.

Fig.3.26.Leopard with Mouse Deer Kill, Mandur, Dhebewadi

Fig.3.27. Leopard with Langur Kill

Fig.3.28. Leopard with Wild pig Kill, Humbarne, Dhebewadi

Fig.3.29. Leopard with Giant squirrel Kill

3.3.9 Wild Dog Prey Preference:

Wild Dogs has been recorded on camera trap while hunting, feeding, and scavenging on various prey species as shown in following table. Total 15 observations were recorded through camera trap and field surveys where wild dogs hunting, feeding, and scavenging on various prey species. Through analysis Wild Dogs has been found hunting and feeding on feral cattle 5 times and twice on livestock, 3 times hunting sambar, and four times cornering and scavenging on dead gaurs, and only once scavenging on dead wild pig. Details as follows:

Sr.No	Prey Species	Age	Status	Observation Date	Time	Observed By	Beat	Range
1	Feral Cattle	Calf	Hunt	/ /2021	-	Field Staff	Takle	Dhebewadi
2	Feral Cattle	Calf	Hunt	12/08/2021	08;02am	Camera Trap	Dhakale	Chandoli
3	Feral Cattle	Male	Corner	03/03/2022	7:18am	Camera Trap	Dhakale	Chandoli
4	Sambar	Male	Hunt	11/04/2022	-	Field Staff	Kasni	Dhebewadi
5	Sambar	Female	Hunt	15/05/2023	06:52am	Camera Trap	Sidheshwar	Chandoli
6	Indian Gaur	Females	Corner	12/06/2023	09:13am	Camera Trap	Chandel	Chandoli
7	Livestock	Calf	Hunt	22/08/2023	-	Field Staff		Dhebewadi
8	Indian Gaur	Male	Scavenging	18/12/2023	-	Camera Trap	Rundiv	Helwak
9	Indian Gaur	Females	Corner	28/12/2023	22:47pm	Camera Trap	Gothane	Amba
10	Wild Pig	Male	Scavenging	14/01/2024	-	Camera Trap	Chandoli Khurd	Helwak

11	Sambar	Male	Hunt	16/01/2024	07:15pm	Camera Trap	Kolhapur Nivale	Amba
12	Feral Cattle	Female	Scavenging	29/01/2024	-	Camera Trap	Sonarli	Chandoli
13	Indian gaur	Female	Scavenging	02/03/2024	-	Camera Trap	Rundiv	Helwak
14	Feral Cattle	Female	Scavenging	14/03/2024	-	Camera Trap	Nandoli	Dhebewadi
15	Livestock	Calf	Hunt	24/05/2024	-	Field Staff	Nandoli	Dhebewadi

Table 3.16: Wild Pig hunting, feeding, and scavenging on various prey species, captured in camera traps and field observation by staff on patrolling from 2018 to 2024.

Fig.3.30. Dhole pack cornering Full grown male feral buffalo, Takle, Dhebewadi

Fig.3.31. Dhole pack cornering Guar female group, Chandel, Chandoli

Fig.3.32 Dholes hunting male sambar, Kolhapur Nivale, Amba

Fig.3.33. Dholes feeding on male sambar, Kolhapur Nivale, Amba

Fig.3.34 Dholes pack hunting feral cattle calf, Dhakale, Chandoli

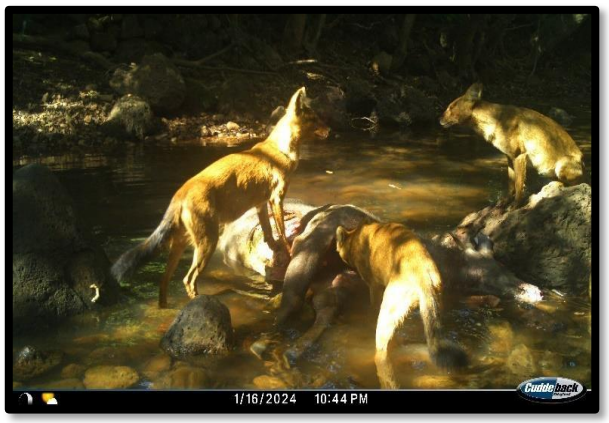


Fig 3.35. Dholes pack hunting sambar, Sidheshwar, Chandoli

3.3.5 Conclusion: Photographic evidence from camera traps and daily observations by field staff reveal distinct prey preferences among the predators of the Sahyadri Tiger Reserve. Tigers predominantly hunt larger prey such as gaur, feral cattle, and wild pigs. In contrast, leopards favor smaller prey species, including mouse deer, langur, giant squirrel, Indian hare, and occasionally wild pigs. Wild dogs, known for their pack hunting, target large prey like feral cattle and sambar, and are often seen scavenging on tiger kills such as Indian gaur and wild pig, which they struggle to hunt independently.

The gaur, being the largest and a favored prey species, plays a crucial role in the diet of tigers, the apex predators of the reserve. Together, tigers, leopards, and wild dogs (dhole) maintain the population dynamics of herbivores, from small to large, while each predator maintains its ecological niche within the ecosystem.

3.4 Assessment Of Threats:

The Sahyadri Tiger Reserve, nestled in the Western Ghats of India, faces a range of threats that jeopardize its biodiversity and the survival of its iconic tiger, co-predators and prey species population. These threats arise from both natural and anthropogenic factors, posing significant challenges to conservation efforts. Threats to the Sahyadri Tiger Reserve encompass a spectrum of human-induced pressures that endanger its ecological integrity and biodiversity. These threats include:

- **Habitat Fragmentation and Degradation:** The fragmentation of habitat due to human activities such as agricultural expansion, dams, hydro-electric projects, highways, windmills infrastructure development, human settlement and mining disrupts the continuity of compact wildlife habitat and

corridors, limiting the movement of tigers and other wildlife species. Deforestation in private area in buffer and corridor and habitat degradation further exacerbate this issue, reducing suitable habitats for tigers and prey species.

- **Human-Wildlife Conflict**: Increasing human interference into tiger habitats leads to conflicts between local communities and wildlife, particularly when tigers or other predators' prey on livestock or pose a threat to human safety. Retaliatory killings, habitat destruction, and depletion of prey base are common consequences of such conflicts, posing a serious threat to tiger and other predators' populations. Crop raiding due to wild pig and gaur is increased. Gaur and sloth bear attack also increased.
- **Illegal Grazing -** STR has over 80 villages within its buffer zone, with 7 villages containing human habitation and 1 village uninhabited within the core zone. Additionally, 29 villages have been relocated by the forest department. There are more than 500 feral cattle inside the core zone (though a systematic study has not yet been conducted), and there is significant pressure from domestic cattle in the buffer zone villages on the buffer zone forest, as well as on the adjoining forest area of the core zone. Moreover, there is also considerable pressure from domestic cattle in core villages on the surrounding core zone forest.
- **Poaching and Illegal Wildlife Trade**: Though the incidences are very less, the poaching on smaller scale can take place at anytime and anywhere. Most of villages has been relocated but yet 07 villages with human habitation and 01 village without any habitation still are inside the core zone. There are always a possibility of poaching from villagers of these villages. Illegal hunting activities such as trapping, snaring, and the use of licensed or unlicensed guns pose a significant threat to wildlife populations, particularly prey and endangered species. Poaching for local consumption and for illegal wildlife trade remain persistent threats to tiger populations in the Sahyadri Tiger Reserve. Lack of effective law enforcement and inadequate monitoring exacerbate the problem.
- **Illegal Resource Collection:** Gathering resources such as fuelwood and medicinal plants (e.g., Narkya, Hirda, Tamalpatra, Shikakai) without proper authorization can lead to habitat degradation and loss of biodiversity.
- **Forest Fire**: Deliberate or accidental fires set for various purposes, such as clearing land for agriculture or hunting, can result in habitat destruction and loss of vegetation cover, affecting wildlife populations. (Atlas Map No. 130)
- **Human Disturbance and Infrastructure Development**: Rapid urbanization, tourism, and infrastructure development in and around the reserve lead to habitat disturbance, noise pollution, and habitat

fragmentation. Roads, canals, and other linear infrastructure pose barriers to wildlife movement and increase the risk of accident.(Atlas Map No- 134)

- **Threat to Grasslands:** There are threat to grasslands due to encroachment of woody vegetation and ferns, results in shrinkage of grasslands area. This reduces the availability of open grassland habitats for herbivores.
- **Unregulated tourism/tourism structures/pilgrimage tourism**: this poses a significant threat to the wildlife habitat and on wildlife as they can lead to habitat destruction, disturbance of wildlife, and degradation of natural resources. Unplanned construction of tourism infrastructure such as resorts, lodges, and roads can fragment habitats, disrupt wildlife corridors, and degrade sensitive ecosystems. Unregulated tourism activities such as loud noise, bright lights, and excessive human presence can disturb wildlife, disrupt breeding and feeding patterns, and increase stress levels among animals. Uncontrolled tourism can lead to overuse of natural resources such as water, fuelwood, and wildlife products, resulting in habitat degradation and loss of biodiversity. Unregulated tourism can inadvertently introduce invasive species through the transportation of goods, vehicles, and visitors from outside the reserve.
- **Threats to Unique Habitat like Sadas/Lateritic plateau:** Ecological assessment of representative sites shows high species richness and diversity on this lateritic plateau. Removal of boulders, filling of shallow ponds, or altering the drainage pattern can have severe impacts on biodiversity of lateritic plateau (Sada) which may be visible only after some years. Tourism, wind farms, infrastructure development and mining are serious threats to the rocky lateritic plateaus.

Addressing these multifaceted threats requires comprehensive conservation strategies, collaborative efforts among stakeholders, and sustainable management practices to safeguard the Sahyadri Tiger Reserve's biodiversity and ensure its ecological resilience for future generations. Collaboration between government agencies, local communities, NGOs, and other stakeholders is crucial for the effective conservation of the Sahyadri Tiger Reserve and the protection of its biodiversity.

3.4.1 Major developments in the adjoining areas, that have bearing on STR:

Bauxite mining in the corridor/ proposed buffer area and windmills in the neighboring/adjoining plateaus are the major causes of concern.

Table. 3.17 The following developments occurred in some places CNP and KWLS affecting as under:

Name of the Area	Type of development	How does it affect the PA
Nivale (Kolhapur) beat area	Bauxite mining at Udgiri.	A large number of vehicles are moving throughout the day. The mining area is adjoining the park boundary. The blasting at mining site has been disturbing the wild animals in the Nivale (Kolhapur) beat.
Vele, Kusavade beats of Koyana WLS	Wind mills at Chalkevadi, Gojegaon, Aral and Kusavade.	The large no. of windmills erected on Chalakevadi plateau has adversely affected free movement of wild animals during monsoon and winter.
Northern part of PA	Outside the northern part of the PA, the villagers have cut trees in private areas up to the boundary of NP.	No hiding place, tree shelter on the northern part of the P.A. for the wild animals, particularly big mammals.
Koyana Wildlife Sanctuary	Windmills,resorts,construction of road, Minor irrigation Tank, activities of Koyana Hydro Electric Project	Destruction of habitat due to construction of Road, Resorts, Minor irrigation tank, Wind mills and various activities of Koyana Hydro Electric Project. These disturbances are mainly in eastern part of KWLS .

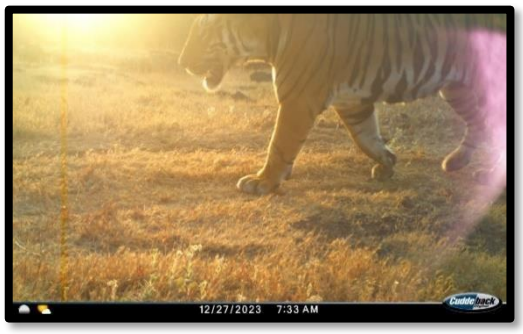
TIGER CAPTURED IN CAMERA TRAP

(From Dec 2024 to May 2024)

17/12/2023- Kolhapur Nivale, Amba

26/12/2023- Plantation Chauk, Chandel, Chandoli

26/12/2023- Kundi Wat, Chandel, Chandoli



27/12/2023- Rundiv Sada, Sidheshwar, Chandoli

28/12/2023- Vetti Tower,Takle, Dhebewadi

29/12/2023- Karambal Nala, Zolambi, Dhebewadi

31/12/2023- Gave Tower, Chandoli Khurd, Helwak

31/12/2023- Chandoli Khurd, Helwak

31/12/2023- Tiribhatti, Rundiv, Helwak

31/12/2023- Tiribhatti, Rundiv, Helwak

01/01/2024- Prachitgad Fata, Rundiv, Helwak

01/01/2024- Ambole Road, Sidheshwar, Chandoli

09/01/2024- Chandoli Khurd, Helwak

11/01/2024- Dhankal, Helwak

11/01/2024- Dhankal, Helwak

12/01/2024- Sidheshwar, Chandoli

22/01/2024- Sonarli Back Water, Chandoli

29/01/2024- Sonarli Back Water, Chandoli

07/02/2024- Waghane, Helwak

10/02/2024- Dhankal, Helwak

12/02/2024 – Aswal Dhond, Sidheshwar, Chandoli

12/02/2024- Bail Pani, Sidheshwar, Chandoli

21/02/2024- Gothane, Amba

23/02/2024- Gothne, Amba

26/04/2024 - Udgiri, Amba

15/05/204 – Sidheshwar,Chandoli

05/05/204 – Gothane, Amba

02/03/2024 – Rundiv , Helwak

06/03/2024 – Zolambi, Dhebewadi

27/03/2024 – Takle Dhebewadi

Table.3.18: OLD RECORDS OF TIGER FROM SAHYADRI LANDSCAPE

Report date/Survey date/year	Place/beat	Range	Latitude	Longitude	Sighting/sign	Source	Remarks/details
2007/08	Maldev/ Dicholi/ Karanjawade	Koyana	—	—	Roaring sound	Per. comm. (R. R. Patil)	
2008	Maldev	Koyana	—	—	Sighted by a local (Shamrao)	Pers. comm. (Shamrao/R. R. Patil)	
11/05/11	Siddheshwar	Helwak	—	—	Captured in camera trap	Official record	
Feb-12	Male	Helwak	—	—	scat	Official record	During 2012 Tiger Census
06/02/14	Chandel	Chandoli	—	—	Tiger sighted at night	Official record	
12/06/14	Hasne west	Radhanagri	16.31025	73.84875	Scat	Official record	
12/06/14	Ninawale	Radhanagri	16.32856	73.91631	Scat	Official record	
12/06/14	Olwan	Radhanagri	16.40742	73.84072	Scat	Official record	
12/06/14	Manbet	Radhanagri	16.45425	73.894	Scat	Official record	
14/12/14	Fejiwada	Radhanagri	16.33753	73.91764	Scat	Official record	
09/12/14	Male (Dobyachasada)	Helwak	17.28214	73.72911	Scat	Official record	
7/5/2014 to 9/5/2014	Pali	Koyana	17.60358	73.72739	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Zolambi	Chandoli	17.18628	73.84172	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Rundiv	Helwak	17.25161	73.70631	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Rundiv	Helwak	17.21728	73.717	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Karajawade	Koyana	17.5385	73.76464	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Karajawade	Koyana	17.53231	73.76544	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
7/5/2014 to 9/5/2014	Chandel East	Chandoli	17.11928	73.73169	Scat	Official record	Confirmed with genetic analysis from WII, results received in 2016
30/11/14 to	Konoli	Radhanagri	16.29878	73.98569	Scat	Official record	

30/11/14 to 18/2/2015	Fejiwada	Radhanagri	16.33753	73.91764	Scat	Official record	
30/11/14 to 18/2/2015	Bambarde	Radhanagri	16.25581	73.93989	Scat	Official record	
30/11/14 to 18/2/2015	Konoli	Radhanagri	16.29872	73.98581	Scat	Official record	
30/11/14 to 18/2/2015	Naniwale	Radhanagri	16.32031	73.90628	Scat	Official record	
30/11/14 to 18/2/2015	Naniwale	Radhanagri	16.30364	73.90494	Scat	Official record	

Chapter – 4:

THE HISTORY OF PAST MANAGEMENT & PRACTICES

4.1: Conservation History:

Chronological sequence of events in the history of STR:

Sahyadri Tiger Reserve (STR) was notified as 39 th tiger reserve of India on 05/01/2010. Its 4th Tiger reserve of Maharashtra. It is situated in Satara, Sangli, Kolhapur and Ratnagiri Districts in the western Maharashtra. Present Koyna division forest was part of Satara division whereas Present Chandoli division forest was part of Satara, Sangli, Kolhapur & Ratnagiri divisions. STR comprised of the notified area of Chandoli National Park and Koyna Wildlife Sanctuary. Landmark events and chronological sequence of events in the history of the tiger reserve is as under:

Year	Events
1985	Area of Koyna was declared as Wildlife Sanctuary vide Government Notification No.WLP 1085/CR-588/ (II) F-5, dated 16/09/1985.(Annexure No 3)
1985	Area of Chandoli was declared as Wildlife Sanctuary vide Government Notification No.WLP 1085/CR-588/ (II) F-5, dated 16/09/1985.(Annexure No.40
1993	DCF WL Kolhapur office constituted for management of Koyna WLS, Chandoli WLS, Radhanagari WLS and Sagareshwar WLS.
2002	Management plan of Chandoli Wildlife Sanctuary for period 2001-02 to 2010-11 was approved on 23/5/2002
2004	Area of Chandoli was declared as National Park vide Government Notification No. WLP 1099/CR-117/F-1, dated 14/05/2004 (Annexure No. 5)
2010	STR constituted as per Government Notification No. WLP 1008/CR-232/F-1, dated 05/01/2010 (Annexure No.6)
2010	Second cycle of MEE evaluation was carried out in which STR secure in **Fair** category. (59.00%)
2011	First Management plan of Koyna WLS in operation for the period of 2003-04 to 2013-14 was approved on 29.11.2003.
2011	Sahyadri Tiger Reserve Conservation Foundation constituted as per section 38 (X) of WLPA,1972 as per government resolution dated 8.11.20211

2012	Core and Buffer zones of STR notified as per Government Notification No. WLP-2012/CR-240/F-1, dated 21/08/2012 (Annexure No.7)
2012	GR for rehabilitation of villages in Core area of STR promulgated on 03/11/12 (Annex.16)
2013	Tiger Conservation Plan for management of STR for period 2013-2023 sanctioned on 25.10.2013.
2014	Third cycle of MEE evaluation of STR carried out, in which STR Secure in **Good** category. (67.19%)
2014	Office of DFO, Sahyadri Tiger Reserve, Karad created at Karad.
2018	Fourth cycle of MEE evaluation of STR carried out, in which STR Secure **Good** category. (60.16%)
2018	Inaguration of new Office of Deputy Director, Sahyadri Tiger Reserve at Karad i.e. Sahyadri Bhavan at Aagashivnagar, Karad on 22.12.2018.
2019	Separate division for CNP carved out under DFO WL Chandoli as per government resolution dated 1.3.2019, While KWLS is under control of DD, STR, at Karad.(Annex.9)
2019	Final notification of Koyna WLS on 29 may 2019
2021	Internal MEE i.e. third-party evaluation of STR carried out before fifth cycle of MEE in which STR secure Fair category (56.25 %)
2022	Fifth cycle of MEE evaluation of STR carried out, in which STR Secure "**Very Good** "category for first time. (78.79%). It is first time, STR secure Very Good category in his last four MEE.
2023	Reorganization of Ranges, Rounds and beats done for effective management, new ranges created viz Kandat, Patan in KWLS whereas Amba in CNP. (3/5/2023)
2024	Period of TCP for period 2013-14 to 2022-23 is completed.

4.1.2 History of Management and Administration of Area which is under STR:

The present area of Sahyadri Tiger Reserve (STR) which is spread in Satara, Sangli, Kolhapur and Ratnagiri Districts was previously the part of territorial divisions (Satara, Sangli, Kolhapur and Chiplun) under Kolhapur territorial Circle. Hence, it has long history of management before it comes under wildlife management. Present forest composition and wildlife status is the cumulative result of various management works performed in these areas and various events happened time to time in the past with this forest. All

these historical events are important to mention in this tiger conservation plan for better understanding of ecological changes done over the period in the management history of this area and its impact on present forest and wildlife condition prevailed today in this landscape.

Brief History of Area:

Forests of the Ex-Bombay State: The present forest area of the Sahyadri Tiger Reserve was originally a part of the forests of the former Bombay States, managed under the Satara and Kolhapur forests division. The present STR is part of forests of Western Ghat in the western part of Satara, Sangali and Kolhapur districts. This forest was then part of Mahabaleshwar, Satara, Patan, Dhebewadi, Shirala and Malkapur range. A brief overview of the historical background of these forests is given below:

Prior to 1818 the Satara territory was ruled by the Marathas. During their rule the forests were specially preserved in the west of the district to make the approach to hill forts more difficult and, in some cases, to protect villages from the full force of the monsoon, elsewhere the system was to reserve all teak, sandal and blackwood. i.e., the only species which had a market value as "royal" trees. These trees could be cut only on payment of fees. In addition, there fairly extensive tracts reserved as sheri or crown lands. These were principally grass lands to produce hay and to provide grazing for the state cavalry and elephants. There were patches of teak forests which were preserved to exercise the 'royalty' right. The right to graze cattle in these forests was either sold yearly or given on contract. In most villages an area was set apart as common land known as 'gairan' where free grazing was allowed for tenants who held their lands on hereditary tenure, a privilege which casual tenants did not possess.

The acquisition of the territory by the British started in 1818 with the overthrow of Bajirav Peshva-II it and continued till 1848 when the whole of the Satara State lapsed to the British on the death of Shahaji, *Raja* of Satara. After acquisition of the territory some Sheri lands were let out for cultivation and some were retained as forest or grazing lands. Fixed tax known as *Gavat katai* or grass cess was levied from certain villages in lieu of the supply of grass free of charge to the Raja. There was a grazing tax on sheep, at rates varying for almost every village, and ranging from Rs. 5.25 to Rs. 6.62 per 100 sheep belonging to resident villagers and Rs. 7.25 per 100 sheep belonging to wandering *Khillaris*.

Dr. Gibson, Superintendent of the Botanical Gardens, was appointed as the first Conservator of Forests under the Bombay Presidency from 19th December, 1846 and Satara was added to his charge in 1848. In his reports, he remarked that the previous destruction of the forests especially on the Ghats was so

great that same it would take many years to build up anything like wood-preserves. In 1859 /60 he suggested levying a tax on *hirda* from the forests around Mahabaleshwar but it was not until 1879 that the system of purchasing *hirda* at Government depots was introduced. Forest reserves were set apart in the evergreen forests along the Ghats at the time of the revenue survey settlements during 1860-62. As these settlements presupposed permanent occupation of lands given for cultivation the rates of assessment were fixed at only Rs. 0.31 to 0.46 per hectare, in order to allow for the long fallow periods without which cultivation on the steep hillsides in the high rainfall tract was impossible.

This however was not in accordance with the ideas of the inhabitants who expected to be allowed to continue their old-time practice of shifting cultivation, and to be able to move into the forest reserves as soon as they had exhausted the lands they already had. After a few years, therefore, when they had improvidently exhausted the lands given for cultivation and they found that all the forest reserves were not to be made available for a similar purpose, there was considerable distress, to mitigate which some lands from the reserves were given out in 1868 by Mr. Spence and in 1872 by Mr. Wilson. In the latter year Satara was separated from Poona and formed into a separate forest charge. In 1875, a joint demarcation was carried out by Messrs. Shuttleworth and Winter to fix the minimum essential forest reserves. In 1879, after the introduction of the Indian Forest Act of 1878, a total area of 594,606 acres was proclaimed to be reserved forest. Even this, however, was by no means final and it was not until 1883 that the final settlement was fixed for Wai, Satara and Javli talukas. The rights acknowledged were limited to those of way and of access to temples, springs and water courses. Privileges sanctioned were grazing and gathering dead wood, thorns, and certain minor forest produce.

During these years exploitation was gradually extended boundaries were demarcated, survey and mapping work was completed and the staff was gradually organized. The trade was principally in some teak rafters at an average price of 10-40 rupees per hundred except at Mahabaleshwar where a fuel depot was maintained and *raival* (species other than teak) rafters were sold for house building. The price of fuel at the depot was Rs. 1.25 per *khandi* of 784 lbs. The sales of teak rafters had risen from 13,119 to 32,619 in 1882-83. It was not until 1892- 93 that organized exploitation was introduced. In that year the first working plan written by Fagan was introduced.

The Past systems of Management and their results: The past management of the forests in Satara Forest division was a part of the erstwhile Ex-Bombay state and which is now part of STR is discussed in following Table:

Sr. No.	Working Plan	Working Plan Period	Provisions of forests management
1	Fagan's Provisional Working Plan	1892-93 to 1933-34	In 1892-93, Fagan wrote and brought into force a provisional WP for 47,579 acres of teak forest, 518 acres of babul (Acacia arabica) forest and 1,484 acres of evergreen forest at Mahabaleshwar. For the teak forests coppice with standards on 40 years rotation was prescribed, for babul clear felling on a 40 years rotation with artificial regeneration and for the evergreen forest, light improvement fellings on 30 years cycle was prescribed. The Plan remained in force till 1932-33 for most of the eastern half of the Satara division.
2	Bourke's Working Plan	1909 to 1917	In 1909 D.R.S. Bourke revised the portion of Fagan's Plan which dealt with Mahabaleshwar and adding additional areas on the plateau. The system prescribed remained the same viz. light improvement fellings on 30 years cycle. Forests brought under Fagan's Plan were included in Block I and the remaining forests on the plateau in Block II and III. Coupes were closed to grazing for 10 years.
3	Master's Working Plan	1917-18 to 1922-23	Bourke's Plan was revised by A.N. Master in 1917-18. More forests on the lower slopes were brought into the Plan. The system prescribed remained the same viz. light improvement fellings on 30 years cycle. Old blocks I to III were retained and new areas were included in blocks IV to IX. Climber cutting was prescribed. Coupes were close to grazing for 10 years.
4	Hodgson's Working Plan	1922-23 to 1933-34	Master's Plan was revised by E.M. Hodgson in 1922-23. Owing to the increased demand for fuel at Mahabaleshwar and Pachgani, it was felt necessary to work larger areas of the forest. Areas under Master's Plan were included in block I to IX and new areas in blocks X to XVI. He prescribed light improvement fellings on 30 years cycle. Coupes of Blocks I to VI and XV were to be worked annually while the other blocks were kept reserved to meet the future increased demand. Exploited coups were closed to grazing for 10 years.
5	Maintland-Kirwan's Working Plan	1907-08 to 1933-34	In the South-Western portion of the Satara division, where the best teak forests (Karad, Patan and Shirala teak forests) were located, Fagan's Plan was revised by J.D. Maitland- Kirwan in 1907-08. Here also the main prescriptions were retained unaltered but some additional areas were brought under regular management and the allocation to felling series and coupes was modified in some cases. The past system of management was coppice with standards in all organised deciduous forests and light improvement felling in the organized evergreen forests on and around Mahabaleshwar plateau. The evergreen forests on Mahabaleshwar plateau and other exploitable areas surrounding it were worked under light improvement felling on a 30 years cycle, and the area of each annual coupe in a felling series was equal or

			approximately equal to 1/30th of the area of that felling series.
6	Singh's Working Plan	1934-35 to 1972-73	In 1934-35, J.A. Singh revised all existing Plans for different parts combining them into one Plan. He divided the forest into evergreen zone and deciduous zone. Current STR forests is part of evergreen zone.In evergreen zone, Fuel Working Circle (18,316.1ha.), Experimental Working Circle (552.40 ha.), Hirda and Shikekai Working Circle (5,20,966 ha) and the In-exploitable Working Circle. (93,353 ha.) were constituted. In Fuel Working Circle, all exploitable evergreen forests in and around Mahabaleshwar Plateau and evergreen forests of Thoseghar, Jalkewadi and Navli-Dhavli were included. The silviculture system adopted was selection fellings with 30 years felling cycle and 21 felling series corresponding to 21 blocks. Felling Series VIII to XVIII were situated on difficult ground and so were not worked. Decaying, overmature, unsound and suppressed trees etc were to be removed. The Experimental Working Circle was divided into three felling series viz. (1) The exotic felling series prescribing introduction of exotics at Mahabaleshwar (2) The teak conversion felling series prescribing introduction of teak in wet mixed deciduous forests in Satara and Patan ranges and (3) Anjani felling series prescribing cultural operations and felling of useless growth impeding the development of Anjani trees in Patan range. Hirda and Shikekai Working Circle comprised of all the inexploitable evergreen forest which were not economical to be worked. Only Hirda and Shikekai were to be collected. The prescribed operations to be carried out were mature and fruit bearing trees to be freed to stimulate fruiting, planting of one year old Hirda seedlings on selected sites to be carried out, Shikekai climbers to be trained on useless species and propagation of Shikekai to be done by sowing seeds or planting cuttings. In the In-exploitable Working Circle the evergreen forests which were inaccessible or were of extremely poor growth were clubbed together.In Fuel Working Circle, out of 21 FS only 5 FS (I to V) were situated on Mahabaleshwar plateau and remaining along steep slopes. FS II, IV and V were fully worked while others were either partly worked or not worked at all due to inaccessible terrain. The silvicultural system prescribed was in fact 'Improvement fillings'. The prescriptions of marking rules were not clear. The terms like overmature and unsound trees, decaying trees, advance growth etc were not defined. This resulted in over felling for revenue to a certain extent. As maturity was not defined, thinning which were prescribed in the 11th and 21st year amounted to main felling for revenue. The prescription of artificial regeneration in felled coupes was not attended properly. In the Experimental Working Circle, no work seems

			to have been carried out. In Hirda and Shikekai Working Circle, except extraction of Hirda and Shikekai fruits, no other operations were carried out for encouragement of Hirda trees and Shikekai climbers.
7	B. P. Desai's Working Plan	1975-76 to 1989-90	B.P. Desai revised the Singh's Plan (1934-35 to 1972-73) and S.M. Wagle's scheme (1958-59 to 1972-73) and consolidated the whole forest area of Satara Forest division except area transferred from other department to this forest division from 1973 onwards. B.P. Desai constituted seven Working Circles for the forests of this division. Allocation of areas, treatment prescribed and the results for each Working Circle is summarised as below. **1. The Protection Working Circle (36,362.911 ha):** This Working Circle included all forests occurring on very steep slopes forming the catchment of the hydro-electric project at Koyana nagar and irrigation project at Dhom. It also included areas of Hirda and Shikekai Working Circle, inaccessible areas of Fuel Working Circle and all areas of In-exploitable Working Circle of Singh's Plan. No working and silviculture systems were prescribed except the collection of Minor Forest Produce on lease to avoid erosion and laterization due to opening of the canopy of the existing vegetal cover. The area was proposed to be fire protected and completely closed to grazing. The forests under this WC were not worked under any silvicultural system. Only Planting of blanks and afforesting the open lands were done. In regular Plantations, only weeding's were done. All these operations resulted in improving the stock and site conditions by soil and water conservation. The improvement was very conspicuous in Koyana catchment forests mainly due to protection from grazing, Fires and illicit-cutting. Area had regenerated naturally. **2.The Selection cum Improvement Working Circle (32,764.205 ha)**: This WC included all the evergreen and semi-evergreen forests found in Mahabaleshwar, Satara, Dhebewadi and Patan ranges of the Western region, other than those included in Protection Working Circle. It also included all accessible and workable areas excluding the areas under the Silviculturist plots of the Experimental Working Circle of Singh's Plan. The prescriptions laid down in the Working Plan were good and suited to improvement of the growing stock. As the operations were not carried out as per the prescriptions, no beneficial effect to achieve the objectives could be seen. **3. The Improvement Working Circle (4,435.294 ha):** This Working Circle included all such areas where teak was found and which were capable of producing medium sized timber of

			teak and valuable miscellaneous species. Treatments prescribed were not followed strictly and carried out timely resulting in adverse impact on soil and moisture condition. Even the crop is further deteriorated. STR forest was not included in this working circle. **4. The Afforestation Working Circle (27,857.485 ha) :** All areas which were unfit for working on account of sparse growth and low percentage of economically valuable species and which were incapable of producing small sized timber or firewood were included in this Working Circle. To cover whole area quickly, an Afforestation period of 20 years was adopted. The area was divided into 19 afforestation series with 20 coupes in each afforestation series. Removal of bushy and undesirable growth if interfering with afforestation operations and planting the area with suitable species like Neem, Shiras, Babul, Khair, Anjan, Karanj, Eucalyptus, Hirda, Bibla, Tendu, Teak, Sissoo, Shikekai in the afforestation area. Gully plugging and nalla bunding was also advised in afforestation areas. **5. The Pasture Working Circle (55,547.333 ha): This** Working Circle included all the areas of the Pasture Working Circle of Singh's Plan and Wagle's scheme and also the area other than those included in Afforestation Working Circle which were not under any management before. These areas were devoid of any tree growth except thorny bushes seen sparsely. The areas were distributed all over the division. In this Working Circle no treatment was given which had affected adversely on soil and moisture. The forest area available for grazing was much less than was necessary to meet the grazing demands. The pressure of grazing on forest areas was heavy due to excessive cattle population and excessive grazing had upset the biological balance. At places rocky out crops had emerged out due to heavy soil erosion. All this resulted in increased proportion of coarse and unpalatable grasses. **6. The Kuran Working Circle (3,042.559):** This Working Circle comprised the areas similar to those which had been allotted to Pasture Working Circle and where there was keen demand for fodder grasses near towns and large villages. Treatment as per the prescriptions was not completely given so no beneficial effect was noticed. **7. The Minor Forest Produce (Overlapping) Working Circle:** This Working Circle included all the areas covered by the Working Plan. Apart from Hirda and Shikekai and grass, various minor forest products sold annually from area dealt with were Apta, Tendu and Kadi nimb leaves, Chillar and Tarvad bark, Pisa fruit, Arrow root tubers, sticks of Medshing,

<table>
<tr><td></td><td></td><td></td><td>Rohtal, Pandhari, Atki and Gela and Agave leaves. Objects of management of this Working Circle were to increase the yield to the maximum extent to ensure and proper collection of Minor Forest products. Treatment prescribed were (1) Removal of congestion by removing inferior species to avoid suppression of Hirda, Kadi nimb trees and Shikekai climbers (2) Planting of Apta, Tembhurni, Agave in suitable localities.</td></tr>
<tr><td>8</td><td>L. G. Kulkarni and Pethkar's Plan</td><td>1996-97 to 2005-06</td><td>Kulkarni and Pethkar revised Desai's WP (75-76 to 89-90) with the basic objectives of governing the National Forest Policy of 1988. The whole forest area of Satara Forest division i.e. 1,28,935.75 ha has been divided into 4 main and 2 overlapping Working Circles. Allocation of areas, treatment prescribed and Results for each WC is given below:
<table>
<tr><th>Sr.no.</th><th>Working Circle (WC)</th><th>Area (ha)</th></tr>
<tr><td>1</td><td>The Protection and Reservoir Catchment WC</td><td>43682.75</td></tr>
<tr><td>2</td><td>Mahabaleshwar Plateau WC</td><td>5567.97</td></tr>
<tr><td>3</td><td>Enrichment WC</td><td>22352.65</td></tr>
<tr><td>4</td><td>Afforestation WC</td><td>57332.59</td></tr>
<tr><td>5</td><td>Non-Timber Forest Produce (Overlapping) WC</td><td>128935.76</td></tr>
<tr><td>7</td><td>Wild life (Over lapping) WC</td><td>128935.76</td></tr>
</table>
1.Protection and Reservoir Catchment Working Circle: This WC included all forest areas which were on very steep to precipitous slopes, areas which came under catchments of hydroelectric project of Koyana nagar, Dhom dam and also the areas that had been depleted through maltreatment, illicit cutting, illicit grazing and fires and exploitation of which accelerate soil erosion. It included very steep to precipitous and inaccessible areas of Mahabaleshwar, Patan, Satara and Dhebewadi Ranges. The objects of management were to maintain existing vegetal cover, to prevent soil erosion for avoiding silting of Koyana nagar and Dhom dams, to improve the forest cover by gap Planting and under Planting wherever possible and to improve subsoil water regime.</td></tr>
</table>

- Koyna WLS and Chandoli WLS is transferred to Kolhapur Wildlife Division in the year 1993. For the purpose of management of Koyna WLS and Chandoli NP, Wildlife Management Plans prepared as per the guidelines of the Wildlife Institute of India, Deharadun, duly approved by the Chief Wildlife Warden, after deliberations by a state level committee specially constituted for the same. The details are represented as under:

Protected Area	Plan	Approval date & period
Chandoli National Park	Management plan	23/5/2002 & 2001-02 to 2010-11.
Koyna Wildlife Sanctuary	Management plan	29/11/2003 & 2003-04 to 2013-14

- In 2010, area of both Koyna WLS and Chandoli NP declared as Sahyadri Tiger Reserve and in 2012, area of notified STR in 2010 and its surrounding area declared as Core zone or CTH and Buffer Zone of STR. The TCP is mandatory as per Chapter IV-B section 38 V of WLPA, 1972. Hence, first TCP of STR is approved on 25.10.2013. for the period of 2013-14 to 2022-23.

Cultural history: This area had been full of virgin forests, high cliffs, wildlife and sites suitable for forts, which served to monitor and control important trade routes between Konkan and Deccan plateau region, namely Mahimandangad, Vasota, Pali, Jungli jaigad, Bhairavgad and Prachitgad. Though these forts constructed mainly by Shilahar kings, and had reigned by More of Jaoli, (Prominent of them was Chandrarao More.) They come into main focus during Chh. Shivaji Maharaj reign, as their Swarajya constituted in western parts of Maharashtra, making full use of hilly and treacherous terrain, dense forests and nearly inaccessible forts to control and monitor the region, to have a retreating place during war as well as prison also, i.e. Vasota. And to have a natural protection or barrier to forts, they intentionally preserve and protect forests around them. Later, during late seventeenth and early eighteen century period, these forts taken over and destroyed by British, this area remain difficult to access.

Local practices: From historical times, this area is inhabited by *Maratha/Kunbi*, *Dhangar*, *Gavali* population among which Maratha/Kunbi primarily doing agriculture, in forms of shifting cultivation i.e. *kumri* growing Rice, *Nachani*, *Vari*, *Rajgira* by clearing tracts of forests. *Dhangar* & *Gavali* community being cattle herder community, had sizeable population of cattle, sell milk and its products in nearby markets, also collect various N.T.F. Ps from forests like honey, shikekai, vavding and many other medicinal and edible plants also. Later, after construction of dams viz. Koyna and Chandoli, villages rehabilitated outside, but many villagers returned and settled above HFL of dam backwater, in this period practice of coal making by burning of wood in these forests is in vogue, and large forest is cut and burnt down for making coal and for construction of roads for transport of coal by lorries. Hence, much forest near villages as seen today is stunted whereas tall, natural forest is there in deep, inaccessible valleys.

Dam history: Two protected areas i.e. Chandoli and Koyna are naturally protected by Sahyadri range on West and Chandoli & Koyna dam on East respectively. Chandoli dam is constructed on Warana River in 1985 and has 35 TMC capacity, while Koyna dam is constructed on Koyna River in 1962 (work stared in 1957) and has 105 TMC capacity. Backwater of these 2 dams proved to be vital water source for flora and fauna of STR as well as creating a peculiar habitat one of its kind. Of these 2 dams, history of Koyna dam is particularly interesting, as preliminary survey was done back in 1905. First Prime Minister of India

Jawarharlal Nehru had a special affection for this mammoth project. Major earthquake of 6.6 Richter scale happened at Koynanagar on 11 december 1967 in which about 177 people died and over 2200 injured.

In 2021, Major landslides occur due to heavy downpour all over area in and surrounding STR and villages viz. Navja, Mirgaon, Lamaj was specially affected. Many water courses changed, hill slopes ravaged and add much silt on river bed.

Plantation history: Eucalyptus plantations: Eucalyptus plantations were raised in then Koyna sub-division under the schemes of raising plantations of fast-growing species and plantations of pulpwood species. These plantations were raised over 1600 hectares at a total cost of Rs. 7, 07,000 during the years from 1963/64 to 1968/69. The results of the plantations are not promising. Eucalyptus was planted over 72 hectares during the years 1966/67 and 1967/68 under the Scheme of raising fuel wood species at a total cost of Rs. 30,369.

Bamboo plantations: In view of keen commercial demand for bamboos, bamboo plantations were raised over 241.8 hectares in Koyna Sub division at a total cost of Rs. 85,591 during the years from 1962/63 to 1968/69. The plantations are not successful.

Prey augmentation attempts: Chital introduction: In order to augment and enrich the prey for tigers, attempts made to introduce spotted deers in CNP, one such attempt as carried out in 2014 in enclosure at Zolambi, 20 spotted deers i.e. *Chital* brought from Sagareshwar WLS. Another attempt made in 2021

Facts about forests of Satara District from *Satara District Gazetteer*: In 1872, the Satara forests were separated from Poona forests and made distinct charge. The evergreen forests of the Sahyadri range from a belt along the west of the district 6-14 miles broad. They stretch almost without a break through the whole of this distance and were not much broken by tillage. They contain many trees valuable for both for a timber and as a firewood. On the account of difficulty to transport, the Sahyadri forests yield little revenue. The chief species of these were *Jambhul (Eugenia jambolanum), Anjan (Memecylon tinctorium), Ain (Terminalia glabra), Umbar (Ficus glomerta), Kenjal (Terminalia paniculata), Hirda (Terminalia chebula), Phanas (Artocarpu integrifolia), Nana (Lagerstromia parviflora)*, and bamboos.

Since 1877-88 much tree seed had been sown broadcast in all the ranges, the result in the west is fair. Shortly before the annexation of Satara (1847) it was brought to the notice of government that the Satara Mountain ranges were particularly bare of trees. The conservator Dr. Gibson remarked that this

barrenness was in measure particular to Satara territory, and that it was due to carelessness of Satara chiefs. The peshwas had been strict in preserving trees and in British districts the Peshwa's policy had, to some extent, been followed. In the Sahyadris certain parts were reserved for thick forests by order of Maratha government, occasionally near forts apparently to make them less accessible and sometimes for the shelter of villages from the storms of southwest monsoon. Almost every Sahyadri village had its sacred grove and often thick bits of forest reserved by the villagers themselves usually in inaccessible situations where wood ash tillage was unprofitable.

In 1878 a change was made in the forest policy of government. It was decided that the need for increased forest conservancy was urgent to protect soil from being washed away; for the storage of water at the sources of rivers; and on general considerations of climate and rainfall. After the introduction of Forest act all waste land in the Sahyadris was proclaimed reserved forest. In parts of Sahyadris the hardships caused by the stricter policy proved unbearable, while everywhere the enforcement of the new Forest act was impossible as the people had hitherto been allowed to take many kinds of forest produce without interference. Result was that in 1880 an assistant collector was appointed to determine the rights existing in proclaimed forest lands and to recommend how claims not amounting to rights should be dealt with. Besides settling forest rights assistant collector was directed to make a final demarcation of the forest lands, where necessary to recommend the exclusion of lands already proclaimed forests, and to consolidate forest blocks by exchange, or, by purchase.

Regard was to be had both to the interests of cultivation and of forest conservancy. In the parts of Sahyadris where distress was found to prevail, land was to be allotted for wood-ash tillage regulated on a fixed system of most troublesome rotation. Government at the same time sanctioned the settlement of rights in proclaimed reserves and decided what privileges should be continued and under what restrictions. The rights admitted included rights of way and access to springs, temples and watercourses. The privileges allowed were grazing and gathering dead wood, thorns and other minor forest produces. Three important passes fall within STR viz. Ambavali pass, Male pass and Tivra pass served as important trade routes between Konkan and Plateau region.

Wild-Life: In the west near the Sahyadris chiefly in the Koyna Valley and the Hills of the Mala pass are found the *Tiger, Leopard, Bear, Sambar, spotted deer, Barking deer, Hog deer, Gaur, Indian hare, Porcupine, Wild cat*. Neither *Tigers* nor *leopards* are so numerous as to do much damage, though occasionally man-eating tigers appear and owing to their exceeding cunning and the large forests of the

Koyna valley, are very difficult to destroy. Of late years' *gaur* have increased in the forests on Mala pass hills, but they seldom come north of Helwak though they formerly found in the neighborhood of Mahabaleshwar. *Sambar* have also increased in the Mala pass forests as the forest area is so large that it is nearly impossible to drive them out. They have almost ceased in the woodlands to the north of Helwak as that tract have killed large numbers by netting.

Though the people kill does and fawns, spread of reserved forests has been yearly increasing the number of *Sambars. Bears* are not numerous, they do no harm except when they have young ones or are suddenly surprised, were never known to attack man. Wild dogs kill many spotted and small deer, and the people say that they'll hunt down and kill Tigers. But no case of a Tiger being killed by wild dogs is known to have occurred in Satara. During 1874 to 1882, 294 persons killed by wild animals, of whom, 23 were killed by tigers, 28 by other animals and 243 by snakes. Out of 661 cattle killed, 589 were killed by tigers and leopards. During the same 8 years, of the wild animals killed for government rewards, 34 tigers were killed for Rs. 736, and 93 leopards for Rs. 825. As per Satara Working plan 1975-76 records, The Gaur or Indian Bison or gawa (*Bos gaurus)* is rarely found in south of Helwak near Mala-Kolna and at Kirsule in the forests of Koyna valley.

4.1.2.1 General History of Management of Forest Area of STR when it was part of Territorial Forest Divisions in Kolhapur Circle:

Earlier both Satara & Sangli Forest areas were part of Satara Division right upto 1970. Sangli sub division was carved out in 1970 for the forests in Sangli district. Initially Koyna wildlife Sanctuary area falls within Koyna Forest Sub-Division comprising 1683.860 Sq. kms. All the forest area gone through the various stages of management interventions as per working plans (in case of territorial divisions) and management plans (WLS and NP). This forest area was also gone through the different types and amount of biotic pressures as different time in this long history of these area. Hence, in present scenario, it is important to know about historical changes made in the composition of forest due management intervention by forest department done time to time and impact and quantum of biotic pressure.

Initially, the area was brought under systematic management as per working plan by J.A. Singh (1934-35 to 1973-74). He put most of the area in Evergreen Zone. Only Hirada and Shikekai collection was allowed. Then since 1975-76 to 1989-90 the area was worked as per the working plan by B.P. Desai. The P.A. area was put under Protection Working Circle and Afforestation Working Circle. Some of the area remained unexploited due to remoteness.

No emphasis was given to wildlife management. But since the declaration of Koyna and Chandoli Wildlife sanctuaries in 1985, the protected areas were excluded from working plan and felling of trees were stopped. N.T.F.P. collection was continued till the year 1990. Thereafter exploitation of any forest produce has been stopped and the emphasis was given to wildlife conservation. Since 1993, after creation of Kolhapur (Wildlife) Division, the management of Koyana and Chandoli Sanctuaries were brought under this division. Since then, the various habitat developmental and conservation works were taken up and it resulted in improved condition of habitat of wild animals in both Sanctuaries.

4.1.2.3 Past management of Game and its Results:

I. Before Notification:

Before the enactment of the Wildlife (Protection) Act 1972, there was no uniform legislation to control and regulate wildlife activities.

II. after Notification:

8

The State Government declared 423.55 sq.km and 308.97 sq.km areas as Koyna Wildlife Sanctuary and Chandoli Wildlife Sanctuary respectively vide notification no. WLP 1085/CR-588/ (II) F-5, dated 16/09/1985. After the notification the area has been getting strict protection. All kinds of extraction, grazing, exploitation and removal of wildlife and any damage to the wildlife habitat are strictly prohibited. The recent amendments of 2006 to the Wildlife (Protection) Act 1972 have also strengthened the wildlife protection activities. After the notification the basic and the main aim of the management is to improve, maintain and preserve the environment of the sanctuary so that the flora and fauna occupy their natural habitat and live and grow in the optimum living conditions.

Past systems of Management: - In general, the indiscriminate destruction of wildlife since the end of 19th century has disturbed the balance of nature. During the British rule, steps although sporadic were initiated to preserve the wildlife. In 1887, the first Act for preservation of wild animals and wild birds came into force followed by the Wild Birds and Animals Protection Act in 1912. The Provisions under section 26 (I) (i), 32 (j) and 76 (d) of the Indian Forest Act in 1927 afforded protection to wild life in reserved and protected forests. In 1953, the Bombay Wild Animals and Wild Birds Protection Act, 1951 came into force. The provisions of the Act are applicable to forest as well as non-forest areas in the state and provides regulation on shooting in reserved forests and other areas outside it, issue of licenses for shooting, trapping etc. It classifies game

into various categories, prescribing closed seasons etc. There is a provision in the Act for constituting selected areas as sanctuaries and for their administration. The act also seeks to control dealing in trophies and other wildlife produce and also pets. The State has protected the rare and vanishing species of wildlife by declaring them as "Protected". Satara Working plan 1975 prescribed development of roads viz. Zolambi to Nandoli, Petlond to Siddheshwar, Petlond to Rundiv, Valvan to Bamnoli, Mala to Goware, Navja to Shirshinge.

Timber operations including Bamboo and Firewood Harvest: -

Bamboo working system was not practiced in the past. Even today no bamboo is removed from the PA. Timber working system was practiced in the old plantations raised especially of Eucalyptus species under the clear-felling system. Fuel wood from the submerged area was collected in the past and was sold in the depots at Mahabaleshwar. Collection of fuel wood was totally stopped in the PA from 1996.

Silvicultural systems and tending operations: -

No silvicultural systems and tending operations are practiced in PA presently. In the past, selection-cum-improvement system was being practiced…….

4.1.2.4 Collection of Non timber Forest Produce: -

Hirda, Shikekai, Pisa fruits, Kadipatta, Apta leaves, Tamalpatra, Rameta bark, Spagnum mosses, Honey, Vavding, Chiva, cane etc. are some of the important non timber forests produce available in PA. Of these Hirda, Shikekai, Tamalpatra, Kadipatta were auctioned every year prior to the notification of the PA. Chiva and Cane (Vet) were being auctioned occasionally. From 1985, no non timber forest produce is auctioned. At present the collection of NTFP has been totally stopped.

4.1.2.5 Leases: -

No forest area of the PA is given on lease base for any purposes like mining, quarrying, fishing etc.

4.1.2.6 Other programs and activities: -

Most of the Tiger Reserve area is a reserved forest. No grazing settlements were situated in this area. But, the large population of livestock (mostly unproductive) in and around the PA leads to a challenge for the management of PA owing to the competition for the fodder & water. Three Wind mill projects are there on

eastern side of STR viz. Sahyadrinagar, Chalakewadi in Jaoli taluka of Satara district and Gudhe panchgani in Shirala taluka of Sangli district,

The various important measures undertaken to safeguard and protect the existing wildlife are briefly discussed below.

- All the required enquiry proceedings were completed and final notification has been issued.
- Effective forest protection measures to check illicit cutting, encroachment, poaching, fishing, N.T.F.P. collection etc. are adopted.
- Effective habitat improvement works are undertaken.
- Wireless network has been established and is in the process of up gradation.
- All types of felling have been suspended.
- Entry timings are fixed depending upon the season. Rainy season is observed as closed period. Night movement inside the sanctuary is prohibited.
- The staff and vehicle is exempted from being requisitioned for election duties as per the directives from the Chief Election Commissioner of India.
- Vaccination of cattle from surrounding villages is carried out every year.
- Regular census operation is carried out.
- Villages Eco-development Project was implemented in peripheral villages to reduce their dependency on the PA's resources.
- Various research activities are undertaken.
- Local People are involved in wildlife conservation activities.

The net result of this is that the PA's area has received strict protection and the population of the wildlife has increased. Today, this area constitutes the prime habitat for many endangered animals and birds.

4.2: Habitat Management:

There were 2 separate management plans for Koyna wildlife Sanctuary & Chandoli National Park before the declaration of the tiger reserve. The period of Management Plan of Koyna wildlife Sanctuary is for 2001 to 2011 and for Chandoli National Park was for 2003 to 2013. Then, after notification of Sahyadri Tiger Reserve, habitat management work has done as per approved Tiger Conservation Plan for the period of 2013-14 to 2022-23. Habitat management works like grassland management, weed eradication, waterhole creation and management, soil and water conservation works has been taken as per approved

management plan in both protected area before declaration of STR. After notification of tiger reserve, habitat management works has been carried out as per approved tiger conservation plan.

4.2.1 Management Plan of Chandoli National Park:

Objectives of approved Management plan: Based on the National Forest Policy 1988 and the National Wildlife Action Plan 1983, the objectives of wildlife management of Koyna Wildlife Sanctuary are as under: -

1. To Protect and develop wildlife habitats and catchment of the Koyna water reservoir for biodiversity conservation.
2. To consolidate the areas of the sanctuary.
3. To promote Eco-tourism and provide awareness about wildlife conservation.

Zonation: The whole area of Koyna Wildlife Sanctuary has been divided into four management zones as given below:

Table.4.1: Statement Showing Management zones

Sr. No.	Management Zones	Details of management zone	Area (in ha.)
1.	Core Zone	Management of the habitat of important species of the area.	16730.45
2.	Eco-Restoration Zone	Non-forest area included in PA prone to encroachment and disputed forest area etc.	5750.58
3.	Development Zone	Area which requires certain treatment for development of wildlife and the habitat	6682.87
4.	Tourism Zone	Areas suitable for tourism development	2514.00
		Total Area	**31677.9**

4.2.2 Management Plan of Koyna Wildlife Sanctuary:

Objectives of approved Management plan: Based on the National Forest Policy 1988 and the National Wildlife Action Plan 1983, the objectives of wildlife management of Koyna wildlife Sanctuary are as under: -

- To Protect and develop wildlife habitats and catchment of the Koyna water reservoir for biodiversity conservation.
- To consolidate the areas of the sanctuary.
- To promote Eco-tourism and provide awareness about wildlife conservation.

Zonation: The whole area of Koyna Wildlife Sanctuary has been divided into four management zones as given below:

Table.4.2: Statement Showing Management Zones

Sr. No.	Management Zones	Details of management zone	Area (in ha.)
1.	Core Zone	Management of the habitat of important species of the area.	8306.63
2.	Eco-Restoration Zone	Non-forest area included in PA prone to encroachment and disputed forest area etc.	14198.15
3.	Development Zone	Area which requires certain treatment for development of wildlife and the habitat	17142.93
4.	Tourism Zone	Areas suitable for tourism development	2544.31
		Total Area	**42192.02**

4.2.3 Tiger Conservation Plan of STR for Period of 2013-14 to 2022-23: This plan was first TCP for STR and its period is completed on 31.3.2024. This plan has been adopted different zone and theme approaches for management strategies for STR. Following major four zones have been considered for core zone of STR in this TCP.

Table.4.3: Statement Showing Management Zones:

Sr.No.	Name of the Zone	Area Ha.	Percentage to the core area
1.	Eco-restoration Zone	4000.00	6.67%
	A. Meadow Maintenance zone	3000.00	5.0%
	B. Meadow Development Zone	1000.00	1.67%
2	Eco – Tourism Zone	3613.62	6.02 %
3	Administrative Zone	12.00	0.02 %
4	Protected Core Zone	50896.74	84.81 %
5	Village relocation Zone	1489.86	2.48
	Total	**60012.22**	**100 %**

Habitat development works has been carried out mainly in eco-restoration zone. These areas are the ones excluding the Eco-tourism zone and the administrative zone but include all such inviolate areas of

the current notified area. Major zone suggested for habitat development in the TCP was eco-restoration zone in which zone is divided into meadow maintenance and meadow development sub-zone. Prescription given for this zone is reiterating below:

A. Meadow Maintenance zone: The operations suggested to carry out in these meadows are -

- Eradication of weeds and cleaning for edible species,
- Strengthening of existing water holes by deepening and desiltation,
- Creation of new water holes at the suitable sites,
- Removal of feral and unproductive cattle,
- Nala bunding and other Soil moisture conservation activities,
- Controlled fire burning and lopping of palatable species.

B. Meadow Development Zone: Following prescriptions are suggested for agriculture areas of the recently shifted and yet to be shifted villages

- Eradication of weeds and cleaning for edible species,
- Ploughing can be done wherever possible.
- Suitable grass tussocks plantation, by fencing the areas in early rains
- Strengthening of existing water holes by deepening and desiltation,
- Creation of new water holes at the suitable sites,
- Removal of feral and unproductive cattle,
- Nala bunding and other Soil moisture conservation activities,
- Controlled fire burning and lopping of palatable species.

During the period of this TCP, many grassland development works, eradication of weed and new regeneration are done as well as cleaning of natural waterhole and creation of new waterhole has done. SMC works has mainly done in Chandoli Wildlife Division. New meadows are created on the agriculture land of newly relocated villages from Koyna Wildlife Division. We have tried for removal of feral cattle from core zone but they have been coming to core zone again, even by crossing such a big reservoir. MEE-TR report suggested that feral cattle is potential prey for tiger hence don't remove them but monitor their number. Tiger recovery project-phase-I was started in 2017 to completed in July, 2022. Final report suggested that prey density of principal prey in STR is increased since 2017 and habitat development is one of the reasons for increase in prey base in STR.

4.2.4 Major Conspicuous Changes in the Habitat observed:

The current habitat within the Sahyadri Tiger Reserve (STR) reflects a series of changes and interventions spanning back to the 19th century. Historically, the forest underwent various treatments outlined in different working plans of the Satara Forest Division and Koyna Sub-division. Despite these interventions, the area remained remote and largely inaccessible, minimizing significant impacts on vegetation.

However, the landscape underwent significant transformations following the construction of major dams on the Koyna River in 1957 and the Chandoli Dam on the Warna River in 1985. These infrastructural developments led to substantial alterations in habitat, vegetation composition, and wildlife occupancy. Tree felling activities associated with dam construction, disturbances during the construction phase, and the relocation of affected villages due to dam projects have collectively reshaped the ecological dynamics of the region.

Following the completion of dam construction and subsequent reservoir formation, the western parts of both the Koyna and Warna dams became inaccessible due to the creation of expansive reservoirs hence core area of PA's became inaccessible to human and livestock. Consequently, much of the protected areas surrounding these reservoirs benefited from natural protection. However, the extended water bodies resulting from the reservoirs have fragmented contiguous habitat into numerous patches.

This fragmentation has had a profound impact on the distribution and occupancy of wild animals. Many species have adapted to this new landscape by swimming across the reservoirs, particularly during the summer months when water sources become scarce. In summer, wildlife tends to congregate around the reservoirs for access to drinking water, leading to instances where large animals like Gaurs may become mired in mud due to siltation within the reservoirs.

Furthermore, the relocation of villages necessitated by dam construction has resulted in the creation of grasslands on previously cultivated land. This further alters the habitat dynamics in the vicinity of the reservoirs, impacting wildlife behavior and ecosystem functioning.

As a result of reduced human presence, both protected areas have seen improvements in wildlife habitat. The departure of villagers has led to the emergence of feral cattle, which now exhibit aggressive behavior when encountered in the jungle. Previously, the habitat in both protected areas faced significant

biotic pressure from villagers, who relied on the forests for fuelwood, Non-Timber Forest Products (NTFPs), and engaged in poaching activities. Additionally, domestic dogs and livestock from remaining villages continue to exert biotic pressure on the habitat.

To mitigate these pressures and conserve vegetation in the watershed of both reservoirs while reducing siltation, both protected areas were designated as wildlife sanctuaries on September 16, 1985. However, the relocation of the remaining 37 villages from these sanctuaries had not addressed, as there was no established policy for rehabilitation in the forest department. Addressing this issue was crucial for ensuring the long-term conservation and ecological health of these protected areas.

With the growing demand from people for relocation due to repeated earthquake tremors and increased inaccessibility of villages, compounded by the loss of road connectivity following the creation of reservoirs, the Maharashtra government made the decision to relocate 24 villages from Chandoli Wildlife Sanctuary (WLS) through a resolution dated 1995. The Executive Engineer of the Warna canal was appointed as the project officer for this relocation initiative. By the year 2000, 12 villages from Sangli district, 6 villages from Kolhapur district, and one village from Ratnagiri district had been successfully rehabilitated, leaving five villages pending relocation. Similarly, out of the 12 villages within Koyna Wildlife Sanctuary (WLS), 10 had been relocated while 2 remained pending.

The vacated areas resulting from the relocation of 21 villages in Chandoli WLS and 10 villages in Koyna WLS have now transformed into large inviolate areas, characterized by grasslands and thriving wildlife habitat. This transformation has proven to be a significant boost for increasing wildlife populations in the region. With only 7 inhabited villages and one partially inhabited village remaining to be relocated, the core zones of both sanctuaries are on the verge of becoming entirely inviolate. This transition will undoubtedly create ideal wildlife habitats and further bolster the increase in wild animal populations.

The relocation of 29 forest villages from the Sahyadri Tiger Reserve (STR) has led to a remarkable improvement in wildlife habitats, creating larger inviolate zones conducive to wildlife conservation. The sites of the relocated villages have transformed into diverse and thriving grasslands, leading to an increase in sightings, particularly of gaur. Over the years, consistent protection measures have supported the growth of indigenous species such as Rametha (Lasiosiphon eriocephalus), Gela (Randia dumetorum), Awala (Phyllanthus niruri), and Umbar (Ficus glomerata), which have expanded into the grasslands. However, the

area of bamboo has significantly decreased due to poor regeneration following drying and dying back in 2007 and 2008, potentially due to heavy rains and steep terrain washing away seeds.

Water development initiatives have played a crucial role in ensuring the availability and equitable distribution of water for wildlife across the Chandoli National Park (CNP) and Koyna Wildlife Sanctuary (KWLS). Nevertheless, recent years have seen challenges emerge, particularly in the Sada areas (top plateaus), where invasive species like Eulalia trispicata (Tambit grass), ferns, and Strobilanthus spp. (Karvi) are encroaching upon the prominent grasslands. Furthermore, repeated surface fires originating from adjacent villages have contributed to the general degradation of grasslands, resulting in poor soil cover and moisture levels, and an increase in the infestation of weed/unpalatable species. Addressing these challenges will be crucial for maintaining the integrity of the tiger reserve's habitat.

4.2.5 Insect attack and pathological problems: No large-scale insect attacks like leaf defoliators, root borers, stem borers are recorded in the PA. No pathological problems are recorded in wild animals of PA, but very few incidences of foot and mouth disease to the domestic cattle on the outskirts of PA are recorded. Immunization has been carried out regularly for cattle inside and on the fringes of PA.

4.2.6 Wildlife Health: Wild animals found in the PA are of good health. No diseases to the wild animals were recorded in the past. No diseases have been noticed to have spread in the PA from the domestic cattle. When there is any incidence of disease to the livestock, people are taking the medical expertise of Livestock Development Officer. Vaccination program is being carried out to prevent any major outbreak of contagious diseases. There are no facilities available in the PA for the treatment of wild animals.

4.3: Protection and Intelligence Gathering:

4.3.1 Protection/ Illegal Activities:

4.3.1.1 Poaching:

From 2010 to 2023, Sahyadri Tiger Reserve (STR) has a documented history of poaching incidents targeting various wildlife species. Historically, poaching went unchecked due to insufficient control measures. However, recent efforts have been made to curb this illicit activity. Night patrols conducted regularly by field staff aim to deter poachers and prevent illegal fishing. Villagers are encouraged to report any suspicious activities to facilitate prompt intervention. Special focus is placed on sensitive locations and buffer zone areas of the tiger reserve. In the Sahyadri region, where certain villages have long-standing

traditions of hunting wild animals for festivals like Holi and Makarsankranti, heightened vigilance is maintained, coupled with local awareness campaigns on wildlife conservation. Presently, poaching is not a prevalent issue, thanks to the proactive patrols by protected area (PA) staff and strict monitoring of water bodies. However, there remains a need to equip field staff with firearms for self-defense, enhancing the overall protection infrastructure against poaching threats.

4.3.1.2 Encroachment:

Encroachment incidents within the Sahyadri Tiger Reserve have been observed, particularly in Vajegaon village located within the Koyana Wildlife Sanctuary. Approximately 2.14 hectares of land have been encroached upon for agricultural and residential purposes. Legal action has been initiated against the offenders, although the matter is currently under litigation as the encroachers have taken the matter to court. Additionally, following the Kyana earthquake of 1967, several local villages and settlements were established within forest areas. Moreover, with the declaration of the tiger reserve area's expansion into Satara district as a buffer zone, some older settlements remain within these buffer reserve forests. It is imperative to identify and map such areas, addressing the issue to ensure the preservation and integrity of the Sahyadri Tiger Reserve.

4.3.1.3 Illegal cutting of trees:

The history of illicit felling within the Sahyadri Tiger Reserve (STR) indicates no large-scale incidents, yet there has been a total of 26 offenses recorded from 2010 to 2023. These illegal activities primarily involve cutting trees for agricultural purposes or shifting cultivation. Typically, the illicit felling is targeted at obtaining small timber or crafting agricultural implements. These activities tend to concentrate in the fringe areas neighboring human habitation, particularly in the densely populated northern and southern parts of the reserve. Notably, there is no evidence of illicit felling for commercial timber or firewood trading with neighboring communities. Offenders face strict penalties under the Indian Forest Act, including fines and compensatory measures. Regular field patrols and cross-verification by forest officials aim to detect and address any instances of illegal tree cutting promptly.

4.3.1.4 Illegal removal of MFP

The Sahyadri Tiger Reserve (STR) has a relatively unremarkable history regarding the illegal removal of Minor Forest Produce (MFP). There have been no significant incidents recorded in this regard. It's suspected that small quantities of MFP have been traditionally utilized by local villagers for medicinal purposes over the years. However, there were a few notable instances of illegal removal of medicinal plants

like Narkya and Saptrangi reported in the protected area from 2005 to 2008. Since then, due to the stringent actions taken by the department against offenders, no new major incidents of MFP removal have been reported.

4.3.1.5 Grazing by the domestic livestock

The Sahyadri Tiger Reserve (STR) has a history of illegal grazing incidents, primarily due to a high dependency of domestic livestock on the protected area (PA). The practice of stall feeding is not prevalent, leading to domestic cattle developing feral tendencies, posing challenges for PA management. As villages undergo rehabilitation and locals release cattle to graze freely, competition for water, fodder, and habitat intensifies, impacting wild herbivores. Moreover, feral cattle may act as carriers of diseases like Rinderpest and Foot and Mouth Disease, necessitating urgent action to prevent potential outbreaks among wild bovines.

The Dangar community, known for their livestock rearing, primarily resides in the buffer zone, exerting significant grazing pressure in forest areas. Additionally, settlements near the core area of the tiger reserve contribute to this pressure. Up to 27 offenses of illegal grazing have been reported in STR from 2010 to 2023.

Efforts to provide alternative livelihoods for locals and raise awareness about forest laws and wildlife importance are crucial in curbing illegal grazing. Regular vaccination programs for domestic cattle, conducted by field officers in coordination with the Animal Husbandry Department over the past five years, contribute to wildlife safety and must continue uninterrupted.

4.3.1.6 Wild fires

Forest fires pose a significant threat to the Sahyadri Tiger Reserve (STR), with a total of 210 recorded fire incidents since 2010. Particularly in the Candoli National Park (CNP) area, a higher frequency of fire incidents is observed, notably affecting the major grasslands within the CNP division of the protected area.

These fires primarily manifest as ground or surface fires, often attributed to human activities. Most fires in the PA are of anthropogenic origin, often sparked by the negligence of villagers during activities such as slash-and-burn agriculture.

In the buffer zone of STR, traditional practices among villagers, such as the belief that fires lead to the growth of better grass, exacerbate the fire threat. Therefore, there is a pressing need for awareness and publicity campaigns aimed at neighbouring villagers. Such initiatives can foster an eco-friendly mindset, creating a social fence around the protected area and mitigating the risk of forest fires.

4.3.1.7 No. of Forest/ Wildlife offences in last three years and stages:

The data of offences is given below. No major cases are reported. However, one major Narkya (*Nothopodytes nimmoniana*) illicit felling case was registered in Chandoli in 2005 wherein 490 people have been prosecuted. Given, a strict prosecution and publicity thereon, no such serious offences have taken place in and around the PA.

Table.4.4: Offence Registered in CNP (2014-2015 to 2024-25)

Sr. No.	Period	No. of offences	Illicit	Fire	Encroachment	Poaching	Misc.	Compensation received (Rs.)	Cases disposed off
1.	2014-15	00	00	00	00	00	00	00	00
2.	2015-16	00	00	00	00	00	00	00	00
3.	2016-17	00	00	00	00	00	00	00	00
4.	2017-18	00	00	00	00	00	00	00	00
5.	2018-19	00	00	00	00	00	00	00	00
6.	2019-20	21	01	17	00	00	03	32000	20
7.	2020-21	23	02	19	00	01	01	8000	21
8.	2021-22	12	02	06	00	00	04	00	21
9.	2022-23	13	00	11	00	00	02	00	11
10.	2023-24	08	01	05	00	01	01	3000	08
11.	2024-25	31	2	18	1	00	11	00	24
Total		108	8	76	1	2	22	43000	105

Table.4.5: Offence Registered in Koyna WLS (2014-2015 to 2024-25)

Sr. No.	Period	No. of offences	Illicit	Fire	Encroachment	Poaching	Misc.	Compensation received (Rs.)	Cases disposed off
1.	2014-15	01	01	00	00	00	00	00	01
2.	2015-16	02	00	02	00	00	00	00	02
3.	2016-17	08	00	04	00	00	04	00	06
4.	2017-18	05	00	02	00	00	03	6000	05

5.	2018-19	09	00	00	00	06	03	00	07
6.	2019-20	09	00	04	00	03	02	60000	02
7.	2020-21	21	00	12	00	07	02	15500	19
8.	2021-22	10	00	05	01	04	00	00	09
9.	2022-23	04	00	00	01	03	00	00	03
10.	2023-24	04	00	02	01	01	00	00	02
11.	2024-25	04	00	00	00	04	00	00	04
Total		77	1	31	3	28	14	81500	60

4.3.2 Intelligence Gathering:

The Sahyadri Tiger Reserve (STR) has a well-established history of intelligence gathering, involving various personnel ranging from daily wage laborers to forest guards and officers. In some beats, villagers from adjacent areas provide information via phone or in person, which is promptly verified and acted upon.

To enhance intelligence gathering, field staff members have undergone training at the Maharashtra Intelligence Academy in Pune, focusing on techniques for establishing informant networks and gathering valuable information. Additionally, regular communication with other village departments has been initiated through various programs, facilitating interactions between officers working in the field to obtain information from diverse sources.

Recognizing the crucial role of Police Patils as key informers, they are honored during wildlife day programs with certificates and cash rewards. Furthermore, joint meetings between local police stations and forest officers occur regularly, as recommended by tiger cell meetings. These initiatives contribute to the development of a robust intelligence network, essential for effective conservation efforts, and must be sustained for the foreseeable future.

4.4: Tourism and Interpretation:

Before the notifying STR, there were very few tourist facilities available in both Koyna WLS and Chandoli NP. Tourists were also visiting in very small numbers. After notification of tiger reserve, slowly STR started to attract more tourist. Tourist number is increased from 12000 in 2007-08 to 58000 in 2023-24.

The PA is having many attractions for facilitating the informed wildlife tourism. Tourists are very much

fascinated by the scenic beauty of the region apart from the historical forts like Vasota, Mahimagad, Bhairavgadh, Jangli Jayagad etc. Tourists are also attracted for trekking these places and for visiting the temples located at Nageshwar, Parvat, Chakdev etc. Tourists are also fascinated by the famous Koyna dam and its hydroelectricity projects and the water sports in the Shivasagar lake at Tapola. They also like to visit the Ozarde waterfalls especially in rainy season and Nehru Garden and research station at the outskirts of PA.

Private motor launches are also available at Tapola, Bamnoli and previously from Koyna for the movement of tourists. The number of tourists visiting the Chandoli NP are comparatively less as no boating is being allowed in Vasanthsagar. But animal sighting is more in the existing tourism zone of CNP. Though most of the tourists are especially interested in wildlife observation they are unable to do so due to the undulating terrain, low visibility as vegetation is very dense and lack of basic tourism infrastructure facilities. Nature lovers, wildlife observers and institutional groups also visit the PA for the study of wild flora and fauna. No camping facilities are available to the tourists from the wildlife division, previously it was a dormitory in Chandoli NP at Mandur. Sahyadri Tiger Reserve has great potential as eco-tourism destination in the state of Maharashtra. In 2023-24 more than fifty-eight thousand tourists were explored the area. After establishment the STR visitors from various region are continuously exploring the area. At present the tourist accommodation needs are fulfilled by private Homestay, hotels & resorts. The Tourism complex is planned to develop at each Gate. Presently tourist resorts at Amba, Mandur-Chandoli, Kathi-Awasari and Koynanagar are well furnished with all the amenities for the tourists and good numbers of homestays and tents are available at Bamnoli. Government PWD rest house available only in Koynanagar and Mandur, besides this, government stay is not available at other places. Available Govt. rest house, private resorts, home stays from buffer & adjoining region are given in Annexure.No.52 of Ecotourism Plan. Presently local community is mainly benefited in eco-tourism activities through engagement as eco-guides, safari vehicle/boat drivers, homestay & by catering; doing works as unskilled laborers in the resorts and some are also deployed for protection work in core zone of STR.

4.4.1 Facilities available to the visitors in CNP:

- Interpretation Centre **–** One small interpretation center established at Mandur, the headquarters of the Range Forest Officer, Chandoli National Park provides basic information to the visitors regarding the local mammals, avifauna, flora, map, sight-seeing places etc. At many occasions presentations are also arranged in the interpretation center for the visiting school children, students and tourist groups.

- Dormitory – There is one dormitory at Mandur of 10 - beds capacity. Rs. 20 per person is being charged for a day stay. After providing the dormitory facility and improvement of the roads inside the PA, it was observed that the number of visitors to CNP has almost doubled in numbers in a span of two years. But now dormitory is not available to tourist, as it is converted into ticket counter.
- Informative signages have been provided along the road in the tourism zone. Nature trails are also being maintained for providing informed and interactive wildlife tourism. Good and durable quality boards have been used keeping in view of the high rainfall conditions. Though there is no separate staff is earmarked for tourism, but the bigger groups of visitors are provided with the staff members/ daily wage laborers facilitating as guides.
- Drinking water and Toilet facilities have been made available.
- Watch towers at three places in tourism zone are the attraction points for the tourists.
- Facility of state transport buses up to Khundlapur, twice a day up to Mandur at an interval of one hour has been made available by discussing with the local State Transport authorities.

4.4.2 Facilities available to the visitors in Koyna WLS:

- Interpretation Centre**:** Small but a quality interpretation centre, created at Metindoli near the foothills of Vasota fort accessible from Bamnoli, provides information to the visitors regarding the local mammals, birds, butterflies, insects, flora, maps, sightseeing places etc. There is no electricity hence there are limitation to show presentations and films at interpretation. Now, there is one tourist facility at Bamnoli which is gate way to Vasota and Kandat for those tourists coming from Satara city. In this facility, one meeting hall for lectures, presentations and screening wildlife films. Poster on biodiversity of STR are displayed in the same hall for educate tourist. One souvenier shop, reception and toilet facility for both gents and ladies available in same building.
- Informative signages have been provided along the nature trails in the tourism zone. Nature trails are maintained properly for the visiting tourists.
- Though, there is no separate staff earmarked for tourism, the big tourist groups are provided with staff members / daily wager laborers as eco - guides.
- Drinking water and Toilet facilities have been made available.
- Old temples at historic Vasota Fort and Nageshwar Temple and Chakdev and Parvat are the attraction points for the tourists.

4.4.3 Visitation data of last five years:

The following data shows the numbers visitors to the protected areas. The tourist zone needs to be developed near the Koyna dam site; the entire tourist inflow is yet to be tapped in the KWLS. Around 10,000 tourists visit Ozarde waterfall in the monsoon season which is yet to be tapped for informed wildlife tourism. The tourist inflow considered for the data includes only the visitors entering from Bamnoli side of the Koyna WLS.

Table.4.6: Details of visitation and revenue from year 2007-08 to 2022-12 is given in following table:

Year	Name of PA, s	Vehicles	Amount (Rs)	Youth Dormitory	Amount (Rs)	Tourists	Amount (Rs)	Total Amount	Grand Total
2007-08	CNP	204	7315	0	0	1197	22260	29575	422490
	KWLS	985	73875	91	67200	11307	251840	392915	
2008-09	CNP	248	8690	0	0	1219	24020	32710	503850
	KWLS	1050	78750	131	116400	11392	276990	471140	
2009-10	CNP	534	18630	85	1700	2183	41250	61580	403770
	KWLS	1082	81150	48	30400	11654	230640	342190	
2010-11	CNP	739	26665	403	8060	3569	69300	104025	241955
	KWLS	502	37650	04	1600	5108	98680	137930	
2011-12	CNP	808	29540	391	7820	4234	81310	118670	285755
	KWLS	595	44625	0	0	6255	122460	167085	

Table.4.7: The following data shows the numbers visitors and revenue generated in STR in past 10 years.

Sr.No.	Year	Tourists Visited	Revenue Generated
1	2014-15	-	₹ 13,90,235
2	2015-16	37358	₹ 15,23,045
3	2016-17	45011	₹ 16,94,055
4	2017-18	65200	₹ 26,09,140
5	2018-19	62866	₹ 23,59,165
6	2019-20	74360	₹ 32,21,410

7	2020-21	48511	₹ 25,53,155
8	2021-22	38590	₹ 19,21,505
9	2022-23	37621	₹ 51,77,255
10	2023-24	58012	₹ 70,13,910

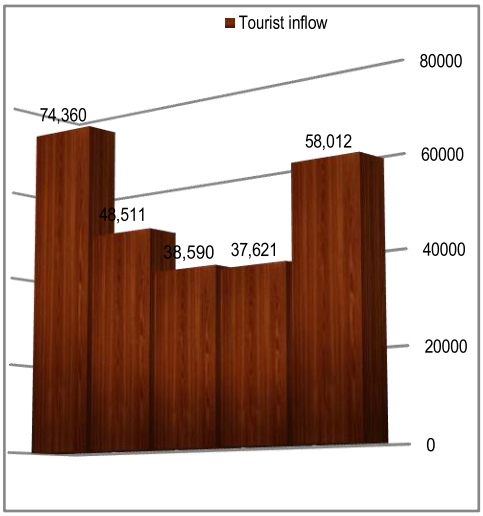


Fig.4.1: Tourist Inflow in STR

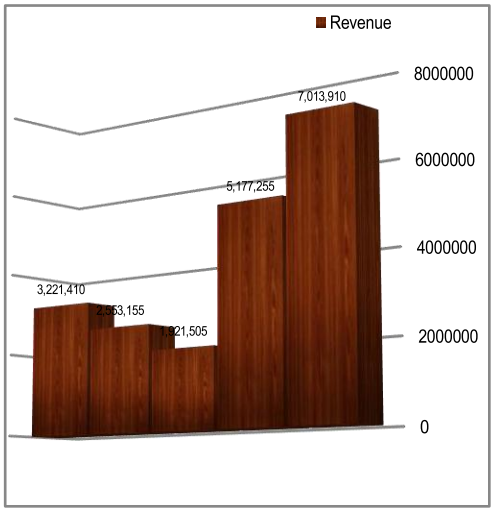


Fig.4.2: Revenue generated from Tourism

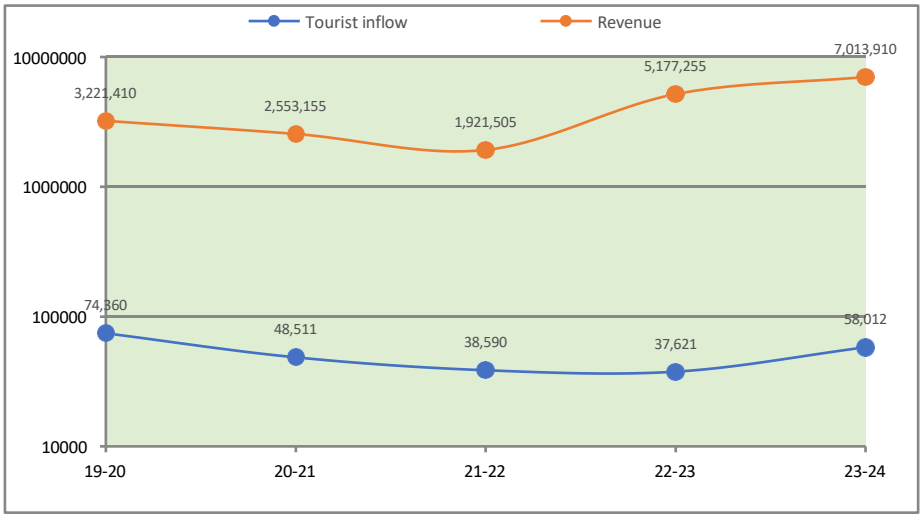


Fig.4.3: Graphical Presentation Tourist Inflow & Revenue Generated

4.5: Research and Monitoring:

4.5.1 Research

Research plays a pivotal role in wildlife management, serving as a cornerstone for informed decision-making and effective conservation efforts. Wildlife management stands at the forefront of our efforts to preserve western ghats biodiversity and ensure the continued existence of countless species. However, this noble pursuit is fraught with challenges, ranging from habitat loss and fragmentation to climate change and poaching. In the face of such complexities, the need for robust research in wildlife management cannot be overstated. Research serves as our guiding light, illuminating the intricate dynamics of ecosystems and the behavior of wildlife within them. Through rigorous scientific inquiry, we gain crucial insights into species' population dynamics, habitat requirements, migration patterns, and interactions with their environment.

Armed with this knowledge, we can devise targeted conservation strategies that address specific threats and safeguard vulnerable species. Furthermore, research fuels innovation in wildlife management, enabling the development of cutting-edge technologies and methodologies for monitoring and protection of wildlife. From advanced tracking devices and remote sensing techniques to genetic analysis and ecological modeling, research empowers us to track wildlife populations, identify critical habitats, and predict future trends with unprecedented accuracy. Moreover, research fosters collaboration and knowledge-sharing among scientists, conservationists, policymakers, and local communities.

By fostering interdisciplinary dialogue and partnerships, research enables us to harness collective wisdom and leverage diverse perspectives in the pursuit of common conservation goals. As stewards of thisplanet, it is incumbent upon us to invest in research and prioritize science-based approaches in wildlife management. Only through a concerted effort to expand our understanding and embrace evidence-based practices can we hope to safeguard western ghat's rich biodiversity for generations to come. In the Sahyadri Tiger Reserve (STR), a total of 25 research topics (Annexure No 51)) have been permitted, resulting in numerous research papers covering various aspects of biodiversity and the landscape within the reserve. However, the final reports of many of these research works have not been submitted to the STR office. Historically, the reserve authorities did not conduct any research programs. However, since 2016, several research projects have been initiated by the STR in collaboration with organizations such as the Wildlife Institute of India (WII), Wildlife Conservation Trust (WCT), and other

research institutes and universities. To streamline research efforts, the STR has established its own Tiger Cell within the DD Koyna office since 2020, conducting regular Phase-I and Phase-IV exercises.

Since 2022, the STR Conservation Foundation has introduced the 'Natural History Fellowship,' offering Rs. 50,000 annually to students willing to conduct research on topics identified by the STR authority. More than 50 research topics (see Annexure no 40) have been identified by the authorities, primarily focusing on issues and challenges related to STR management. This fellowship aims to encourage local students to engage in research, providing valuable data for wildlife management decision-making. Additionally, the foundation supports students through a hands-on 'Internship Program' initiated since 2023, with a maximum duration of 3 months. Initially, an honorarium of Rs. 3000 was provided, which has now been increased to Rs. 10,000 per month. The Internship Program aids the tiger cell and management by facilitating the collection and analysis of field and research data, assisting in research work, and contributing as an additional workforce during large-scale exercises like Phase-IV and Phase-I.

The STR extends support to all researchers and surveyors conducting studies within its premises. Recently, the establishment of the Sahyadri Wildlife Research Facility (SWRF) was approved during the Governing Body meeting in January 2024. This facility will serve as a resource hub for young wildlife researchers, offering basic amenities such as laboratory facilities, a natural history library, presentation facilities, access to basic data, training, essential research equipment, accommodation, expert guidance, and more.

The Research Wing of the Maharashtra Forest Department, known as Silva, operates a research center located in Koynanagar. The Research Forest Officer (RFO) oversees activities at this headquarters. Their responsibilities include maintaining various research plots and ensuring the collection of mandatory observations from these plots. Some of these plots are situated within the core zone, while others are located in the buffer zone. Further details regarding the research plots managed by the Research Wing are provided in the table below:

Table.4.8: Details of research plots under Koynanagar Research Centre, Research Wing (Silva), MFD in STR which are as follows:

Sr. No.	Location of plot	Establishment	Area (ha)	Survey no.	Compt. No./zone	Remarks
1	Koynanagar (Research Center)	1965	45.00	95, 96, 97, 112, 113	434 (Buffer)	-
2	Chirambe (Research sub-enter)	1984-85	44.00	3 to 5 & 8, 9, 17, 19, 20, 21	- (Core)	-

3	Mirgaon (Conservation Plot)	1993-94	5.00	-	431 (Buffer)	Mixed Species
4	Mirgaon (Seed Plot)	1993-94	5.00	-	431 (Buffer)	-
5	Karanjawade (Conservation Plot)	1994-95	5.00	-	395 (Core)	Mixed Species
6	Navja (Conservation Plot)	2001-02	5.00	-	418 (Core)	Mixed Species
7	Nechal (Biodiversity Plot)	2007-08	5.00	28, 33	478 (Buffer)	-
8	Koynanagar (Research Center)	1965	45.00	95, 96, 97, 112, 113	434 (Buffer)	-

Numerous research papers found online lacked formal permission records from our office, with some utilizing the names of protected areas or tiger reserves without authorization. Despite this, there has granted permission for more than 40 research projects. While some projects cover intriguing and management-relevant topics, a significant portion of researchers have failed to submit their final reports, which are not on record at our office. Detailed lists of research projects and research papers are provided in Annexures 8.1 and 8.2, respectively.

4.5.2 Monitoring:

Monitoring of research projects is crucial for ensuring their progress, adherence to guidelines, and timely completion. Here's a structured approach to monitoring such projects:

- Establish Clear Objectives: Clearly define the objectives and expected outcomes of the research project at its outset. These objectives should align with the goals of wildlife management and conservation.
- 2. Regular Progress Updates: Require researchers to provide regular updates on their progress, including milestones achieved, challenges faced, and any deviations from the initial plan.
- Scheduled Meetings: Conduct periodic meetings or reviews with researchers to discuss their progress, address any issues or concerns, and provide guidance or support as needed.
- Compliance Check: Ensure that researchers are complying with all relevant regulations, permissions, and ethical guidelines throughout the duration of the project.
- Data Collection and Analysis: Monitor the collection, analysis, and interpretation of data to ensure accuracy, reliability, and relevance to the research objectives.
- Field Visits: Conduct field visits to observe research activities firsthand, verify data collection methods, and assess the condition of research sites.
- Final Report Submission: Set clear deadlines for the submission of final research reports and require researchers to adhere to these deadlines. Review the reports for completeness,

accuracy, and compliance with project objectives.

- Feedback and Evaluation: Provide constructive feedback to researchers based on the quality and completeness of their work. Evaluate the overall effectiveness and impact of the research project in meeting its objectives.
- Dissemination of Findings: Facilitate the dissemination of research findings through publications, presentations, or other appropriate channels to ensure that the knowledge generated contributes to wildlife management and conservation efforts.
- Documentation and Records: Maintain comprehensive documentation and records of all aspects of the research project, including permissions, correspondence, data, reports, and evaluations.

By implementing these monitoring measures, wildlife management authorities can ensure that research projects are conducted effectively, ethically, and in accordance with established guidelines, ultimately contributing to informed decision-making and conservation outcomes.

4.6: Present Status of Rehabilitation:

According to inquiry reports, a total of 82 villages were involved in the creation of both protected areas, Chandoli National Park and Koyna Wildlife Sanctuary. The Water Resource Department of Maharashtra state relocated 27 villages for the Koyna and Warna Hydroelectric projects, while rights are reserved for 18 villages within Koyna Wildlife Sanctuary. The Forest Department is responsible for relocating the remaining 37 villages, of which 29 villages have been relocated in Kolhapur, Sangli, Satara, and Thane districts. However, some relocation dues of Project Affected Persons (PAPs) from these villages are still pending with the government. Furthermore, one village from Ratnagiri district, six villages from Kolhapur district, and twelve villages from Sangli district within Chandoli National Park were relocated through a special GR of 1995 (Annexure no.53 and 54). The Executive Engineer (Warna Canal) served as the Project Officer for this endeavor until the relocation process was transferred to the Forest Department in 2016.

Table.4.09: Status of Rehabilitation of Villages in STR given in following table:

Sr. No	District	Villages in Tiger Reserves as per Notification			Villages relocated by Water Resources Dept.	Villages To be Relocated by Forest Dept.	Villages relocated by Forest Dept.	Villages to be Relocated by Forest Dept.
		Total villages	Rights Reserved	Villages To be Relocated	Total	Total	Total	Total
1	Satara	52	18	34	19	15	10	5

2	Sangli	19	0	19	5	14	12	2
3	Kolhapur	10	0	10	3	7	6	1
4	Ratnagiri	1	0	1	0	1	1	0
Total		**82**	**18**	**64**	**27**	**37**	**29**	**8**

Among the ten relocated villages from Satara District that underwent rehabilitation, five villages (Dicholi, Zadoli, Punavali, Kisrule, and Nahimbe) from Patan Tahsil were relocated to Palus in Sangali and three colonies in Satara district. The other five villages (Ravandi, Adoshi, Modoshi, Kusapur, and Khirkhindi) situated in Jawali Tahsil were relocated to Thane District at Eksal Sagaon, Bhiwandi.

The relocation process is pending for 8 villages is currently underway, out of this, five villages: Janaichiwadi, Khundalapur, Male, Kolane, and Patharpunj are from Chandoli National Park, and two villages: Vele and Deur are from Koyna Wildlife Sanctuary. As there is no human habitation in Amboli village, only land acquisition is pending for this village: Amboli, from Kolhapur in Chandoli NP because of enquiry report is still pending with SDO, Shahuwadi. We got Stage-II approval for FCA proposal for both Vele and Male Villages. FCA proposal of forest land for remaining villages is in process.

Table.4.10: Land Acquisition Details by Rehabilitation from Core Zone given in following table:

Sr. No.	District	Total Relocated Villages	Land Acquired by Forest Department (Ha.)	Villages to be Rehabilitated	Land to be Acquired (Ha.)
1	Satara	10	1544.52	5	3444.47
2	Sangli	12	1957.08	2	275.00
3	Kolhapur	6	716.74	1 (Amboli)	Enquiry report is pending
4	Ratnagiri	1	873.85	0	0
Total		**29**	**5092.19**	**8**	**3719.05**

The government and forest department are actively working towards the successful relocation of the

Chandoli National ParK: The P.A. had originally 32 villages located within which human population of 7894 occurring 8428.92 hact. Of Malki land. Cattle population was much higher. Therefore, the area was facing high biotic pressure. 8 villages (4500 people) were rehabilitated out of sanctuary area by the Irrigation Department when Chandoli dam was built. Then for remaining 24 villages, the detailed inquiry under Sec. 19 to 25 of wildlife (Protection) Act 1972 was made for settlement of rights and privileges of people residing in it, and detailed inquiry

report was submitted to Govt. As this area falls in seismic prone zone and partly affected by sanctuary area, the government took decision to shift all the villages out of sanctuary area. Thus during 1997-99 out of remaining 24 villages 20 villages have been rehabilitated out of sanctuary and interestingly in 2004 decision made to elevate status of Chandoli WLS to Chandoli National Park. *Dhangar wada part of Khundlapur, Janaiwadi* part of *Chandoli budruk, Male, Kolane and Patharpunj* in core zone are in the process of rehabilitation and will be shifted out of the national park in next coming years.

Koyna Wildlife Sanctuary: Out of total 50 villages (25 in Jaoli, 25 in patan) in KWLS, 19 villages already rehabilitated by Irrigation Department when Koyna dam was built. Rights of 18 villages maintained. 10 villages (5 In Patan, 5 in Jaoli) are rehabilitated outside sanctuary area. Vele and Deur village in core zone are in the process of rehabilitation and will be shifted out of the Sanctuary in next 1-2 years.

Table.4.11: **District wise and Project Officer wise details of Village Rehabilitation in STR**

District	Project Officer	Total Villages To be Rehabilitated by Forest Department	Villages Rehabilitated by Forest Department (Till Date)	Villages Remaining to be Rehabilitated by Forest Department	Total villages relocated in respective districts	Number of Resettled Colonies
Satara	DCF Satara	15	10	5	1	3
Sangli	DCF Sangli	14	12	2	16	21
Kolhapur	DCF Kolhapur	7	6	1	6	14
Ratnagiri	DCF Kolhapur	1	1	0	1	1
Thane	DCF Thane	0	0	0	5	1
Total		**37**	**29**	**8**	**29**	**40**

Issues of Rehabilitation: There are many issues related to already relocated villages and its PAP's and villages and PAP's, those are under process of rehabilitation. Important and common issues are given below:

- Cut off date for valuation of assets
- Half acre

4.7: Administration and Organization:

4.7.1 Staff Status -The administration and management of this reserve is directly under the control of Conservator of Forests (Wildlife), Kolhapur based at Kolhapur. This post was upgraded in past to CCF an FD, STR for few years. This division is under the supervision of Additional Principal Chief Conservator of Forests (Wildlife), West, Mumbai. There are 2 posts of Asstt. Conservator of Forests one for CNP & another for KWLS. There are three territorial ranges i.e.one at Chandoli for CNP and other 2 are Koyna and Bamnoli at KWLS. The ranges are divided into 4 rounds and 38 beats. The details of range, round and beat is given in (Annexure: No. 36 to 39 and 48 to 50) Average area per beat is 19.51 sq.km. which thrice to the norm of 750 ha. Per beat and too heavy considering the steep valleys and remoteness of the area.

Table.4.12: Following table showing how administrative structure of STR changed over the period:

Period	Divisions	DD/DFO	Sub divisions	ACF	Ranges	RFOs	ROs	FGs
2010 to 2015	1	1	2	2	3	3		36
2015 to 2019	1	1	2	2	5	5		
2019 to 2023	2	2	4	4	5	7	17	56
2023 to till date	2	2	4	4	8	9	30	75

Following the reorganization of STR in 2023, three new ranges were established: Amba in the Chandoli Wildlife Division, and Kandat and Patan in the Koyna Wildlife Division. Additionally, 19 new beats were designated, 7 in the Chandoli Wildlife Division, and 12 in the Koyna Wildlife Division.

This reorganization was prompted by administrative inconveniences and challenges stemming from large areas per beat and range, especially when compared to other tiger reserves in the state to managers for their field for purpose of convenience of field management. As a result of this proposal, which was subsequently approved, the STR has gained additional posts, alleviating some of the workload pressure on the administration.

Table.4.13: The current officers and staff position is given in following table:

Sr. No.	Post	Total Post		Grand Total	CF & FD Office	Koyna WL Division	Chandoli WL Division
		Permanent	Temporary				
1.	CF and FD	1	-	1	1	-	-
2.	Deputy Director	1	-	1	0	1	

3.	Divisional Forest Officer	1	-	1	0	-	1
4.	Asstt. Conservator of Forests	5	-	5	1	2	2
5.	Range Forests Officer	9	-	9	0	5	4
6.	Range Surveyor	1	-	1	1	-	-
7.	Surveyor	4	-	4	2	1	1 (1 Add)
8.	Chief Account	-	-	-	-	-	-
9.	Head Clerk	1	-	1	1	-	-
10.	Accountant	6	-	6	3	1	2
11.	Stenographer	1	-	1	1	-	-
12.	Forester	-	-	-	0	15	15
13.	Clerk	16	-	16	2	7	7
14.	Forest Guard	-	-	-	1	48	45
15.	Driver	3	-	3	1	1	1
16.	Peon	2	-	2	2	-	-
17.	Khansama cum Chaukidar	-	-	-	-	-	-
18.	Minibus Driver	-	-	-	-	-	-
19.	Cleaner	-	-	-	-	-	-
20.	Luanch Tandel	1	-	1	-	1	-
21.	Luanch Driver	1	-	1		1	-
22.	Mali	-	-	-	-	-	-
23.	Khalashi	-	-	-	-	-	-
24.	Khansama	-	-	-	-	-	-
25.	Forest Labour	10	-	10	2	-	8
26.	Section Engineer	-	-	-	1	-	-
27.	Naik	1	-	1	1	-	-
Total		**189**		**189**	**20**	**83**	**86**

A detailed list of sanction post under various heads in STR is given in Annexure- 48 to 50)

Trainings to the staff: Regular training programs are organized for staff members, particularly forest guards and foresters. These sessions, overseen by the Range Forest Officer (RFO) and Sub-Divisional Forest Officer (Sub-DFO), cover a range of topics including information on wild animals, relevant activities, legal acts, and guidelines for behavior.

While some forest guards may have missed out on in-service compulsory Field General Duty training in the past, efforts have been made to ensure that training is now regularly arranged, with nearly all staff having completed mandatory courses. Newly recruited forest guards are the only exception, but they are slated to undergo training within one year of recruitment, subject to availability of seats at the training school. Currently, the RFO, though directly recruited and trained, except one RFO, lacks specialized training in wildlife management.

Training for field staff of tiger reserves is essential for ensuring the successful protection and management of these critical habitats and the iconic species they support. It not only enhances the effectiveness of conservation efforts but also fosters a culture of professionalism, dedication, and

stewardship among those entrusted with the responsibility of safeguarding our natural heritage. Many them-based trainings for field staff and officers are regularly arranged to enhance their capacity and effective deliveries of their duties.

For carrying out the wild life monitoring exercises like phase-iv camera trapping, phase-I, Law enforcement, NTCA SoP, overall beat management, stress management, MSTrIPES, PIP preparation, Protection issues, grassland management and grass identification, use of drone etc. trainings were arranged periodically by the senior officers and by inviting the outside resource persons. Though the field staff is not trained in wildlife management, but short duration training courses have been conducted at PA level by the division by Tiger Reserve officers and inviting the outside resource persons for capacity building of the front-line staff. List of various trainings arranged for field staff in last three years is attached in Annexure. Every year, training program on the techniques of monitoring the wild animals is repeated before the annual monitoring operation for all field staff members and training on waterhole census as '*Nisarganubhav'* is given to volunteers.

Organization – Besides the departmental control over the area, other organizations are supporting the management objective of STR

- **The Tiger Cells** in each district under chairmanship of each S.P. (Satara, Sangli, Kolhapur and Ratnagiri) are functioning regularly.(Annexure No.27)
- **The Sahyadri Tiger Reserve Conservation Foundation, (STRCF) Kolhapur**: STRCF is formed in March 2012 and headed by CF and FD as Executive Director and both Deputy Directors are Member Secretory. In accordance with Section 38X of the Wildlife (Protection) Act, 1972, the state government is mandated to establish a Tiger Conservation Foundation for each tiger reserve. This foundation aims to facilitate and support the management of tiger reserves for the conservation of tigers and biodiversity, and to promote eco-development initiatives by involving local communities in the development process. (Annexure No 20)
  - Governing Body of STRCF:
  - Executive committee of STRCF:
  - District Rehabilitation Committee (DRC):
  - District committee of EDC:
  - Eco-Development Committee (EDC): (Annexure No. 24 to 26)
  - Local Advisory Committee (LAC); (Annexure No. 42)
  - Transfer committee:

- Sahyadri Wildlife Research Facility (SWRF):
- State-level Steering Committee
- Some NGOs and NGIs are pro-active in arranging awareness programs, livelihood activities, restoration works, man-animal conflict etc. to locals in buffer zone and helps locally as per need and availability to the local staff and officers.

Chapter – 5

Land use Patterns and Conservation-Management issues

The STR landscape represents a typical rural setting interspersed with forest patches. The common land use is marginal agriculture of paddy crop cultivation and the villagers own considerable livestock. In the context of conservation, forestry happens to be an important land use.

5.1 Land use Classification:

The broad categorization of land in STR is as shown below:

Sr. No.	Land use class	Area (Km^2)
1	Dense forest	408.72
2	Open forest	220.94
3	Scrub land	134.29
4	Barren land	305.64
5	Agricultural land	20.76
6	Water body	75.86
7	Reservoir bed	11.79

(Table..5.1 Source: Tiger Recovery Strategy and Long-term Monitoring in Sahyadri Tiger Reserve, Maharashtra: Feasibility Assessment and Strategic Action Plan, STR with WII 2018)

5.1 Land Use Classification of buffer – (As per 2001 census) (in Ha)

Buffer outside P.A.	Forest	Irrigated	Un irrigated	Cultivable Waste	Non cultivable	Other Uses Gaonthan, roads, submergence etc.
42434.43	19316.99	433.61	13410.52	3762.31	5327.73	183.27
14110.60	2911.32	47	1025.06	2134.71	2756.23	5236.28

5.2 Socio-economic Profile of villages:

As stated in earlier chapters, the overall socio-economic status of the people is comparatively low, mostly falling below the poverty line. The major source of income is marginal agriculture. Major crop is paddy, Nachani and wari. They also earn income from livestock rearing and wages earned through ongoing forestry and other department related works. Following table shows the socio-economic profile of tahsils in the buffer zone of STR (Annexure No 12 and 13):

Table.5.3 Human Population of Sahyadri Tiger Reserve (Source: CENSUS OF INDIA, 2011)

Table.5.3 Human Population of Sahyadri Tiger Reserve (Source: CENSUS OF INDIA, 2011)

Sl. No.	Name of Tahsil	Total Population	SC %	ST %	Main workers %	Marginal worker %	Literacy %	Cultivators %	Agriculture labors %	Household industry workers %
1	2	3	5	6	7	8	9	10	11	12
1	Satara	502049	11.08	0.97	34.86	5.43	88.72	29.17	11.90	4.27
2	Mahabaleshwar	72830	11.28	5.06	34.67	6.23	83.91	37.49	9.39	3.04
3	Jawali	106506	7.06	1.90	36.38	11.75	81.96	56.61	15.43	3.06
4	Patan	299509	8.69	0.73	39.61	8.37	77.40	54.26	24.65	2.36
5	Shirala	162911	10.53	0.32	39.89	9.27	78.88	51.66	22.23	4.13
6	Shahuwadi	185661	11.35	0.27	43.15	8.51	72.68	61.53	16.83	2.37
7	Sangameshwar	198343	4.90	0.21	39.01	11.23	79.26	54.52	20.55	2.53
8	Khed	181615	5.41	1.38	34.27	6.33	82.19	42.00	23.23	2.42

84 villages in buffer zone spread over 8 tahsils in Satara, Sangli, Kolhapur and Ratnagiri districts.

As most of the inhabitants are marginal cultivators, agriculture labors and household industrial labors, economic condition of the people is very low as compared to the national level.

The major sources of income are marginal agriculture (paddy), income from livestock rearing, collection of NTFP and wages earned through ongoing forestry and other department related works. Major area of the buffer area of STR is situated in Satara District and that too in Patan Tehsil.

As per scenario available out of 424.34 Sq.Km. Out of this, 193.17 Sq.Km. comprises of the forest area in the possession of the forest department. So, it forms 45.52% of the total geographic area of Sahyadri Tiger Reserve buffer area outside the PA. The total human population in 20 buffer villages inside protected areas is **7914**. The total human population in 48 buffer villages (out of 60) outside protected areas is **28203**. Rest 8 villages only Forests area is included in Buffer of STR. Majority of the people are young or old . Middle aged people generally leave the area for occupation and reside at Mumbai. No industries are developing here. KOYANA and WARNA irrigation projects have provided employment to the local people. On the Eastern side of Buffer, from 2001 onwards, at Chalakevadi, Kusavade, Aral and Gojegaon windmills have also provided employment to the local villagers. At Gokul, Humbarli, Deshmukhwadi, Helvak, Paneri, Manadur and Udagiri tourism is a supplementary source to the people. At Deshmukhvadi- Humbarali 9 resorts and 2 Rest Houses exists which cares to tourism needs at present. In Manadur 2 Rest Houses exists for night halt.

5.3 : Resource Dependency of Villages:

The villages within the Buffer zone heavily rely on forest resources for their daily needs, and the livelihoods of many households are directly linked to these resources, including firewood, non-timber forest products (NTFPs), and grass. This dependency on forests is significant, encompassing fuel, fodder, grazing areas, water sources, and small timber. There is considerable potential for providing ecologically sustainable livelihood options to reduce this dependency.

The reliance on forests for firewood is particularly high, with wood being essential for heating and lighting during the winter months. Domestic wood consumption doubles in winter compared to summer. Fodder is another critical resource, with almost complete dependence on forests, vital for rural livelihoods. Income from minor forest products is seasonal, and in private areas, tree cutting becomes a prominent activity during lean periods, especially in Patan Tahasil.

NTFP collection, such as Hirda, Shikekai, and Tamalpatra, is carried out seasonally in all villages within these areas, highlighting the continued dependence of local communities on forests for grazing and firewood.

5.4 Human-Wildlife Conflicts:

Human-wildlife conflicts have reached critical levels in the buffer zone. Crop raids by wild pigs, nilgai, and sambar are widespread in numerous villages. Additionally, leopard attacks on cattle are common due to unrestricted grazing across the forest area. Although instances of human fatalities caused by tigers and leopards are not frequent in the buffer zone, the threat remains present.

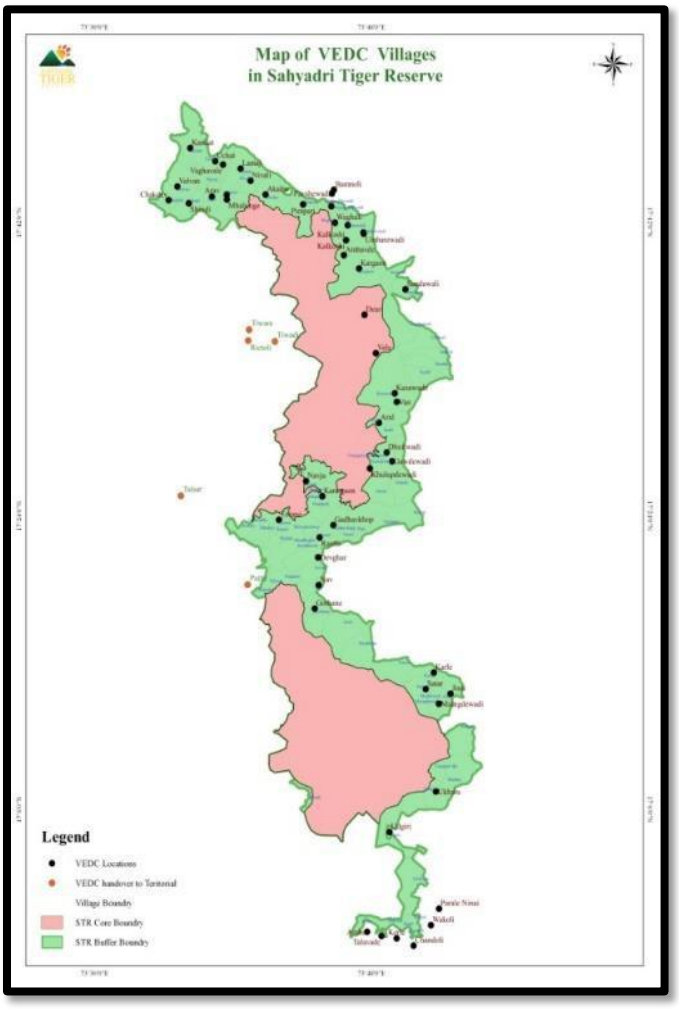
In cases of human-wildlife conflicts, strict adherence to NTCA guidelines and standard operating protocols is ensured. However, frustrations arise among the people when state government compensation fails to reach them promptly. The human-wildlife interface in the buffer zone is highly sensitive due to the presence and movement of wild animals. These interactions often involve crop and livestock depredation, as well as injuries or loss of life to both wildlife and humans.

Cattle and goat rearing for sustenance are the supplementary activity adopted along with the agriculture. Heavy grazing and other resources used by livestock created competition among wild animal and livestock for their survival.

People who are residing close to wild animal habitat face following problems.

1. Crop raiding
2. Cattle depredation
3. Attack on human being

Also wild life is adversely affected by activities of villagers in different ways- loss of habitat due to non forest activities, disturbance due to grazing and fuelwood, MFP collection, loss of prey species due to hunting, etc.



Map 5.1: Village Distribution in Buffer Zone of STR:

Human Wildlife Conflict – Occasional issues of conflict are seen in this area.

- Attacks on human beings: Attacks on human beings by Indian Gaur and Leopard during last three years have been noticed.
- Attacks on the cattle/ crop raiding cases: The details of the attacks on cattle and cases of crop raiding by wild animals during last three years are as follows.

Table No.5.4 Compensation cases for Year 2017-18 to 2023-24 in Buffer area and outside Pas

Sr.No	Range	Crop Depredation		Livestock Depredation		Human Attack		Total	
		No. of Incidents	Compensation	No. of Incidents	Compensation	No. of Incidents	Compensation	No. of Incidents	Compensation
2017-2018									
1	Koyna	3	18711	2	6763	1	100000	6	125474
2	Bamnoli	26	79122	4	58500	2	113580	32	251202
3	Chandoli	3	2110	0	0	0	0	3	2110
4	Helwak	26	132806	7	56250	0	0	33	189056
5	Dhebewadi	29	87994	9	46500	0	0	38	134494
Total		**87**	**320743**	**22**	**168013**	**3**	**213580**	**112**	**702336**
2018-19									
1	Koyna	7	54110	5	43645	0	0	12	97755
2	Bamnoli	27	40311	0	0	0	0	27	40311
3	Chandoli	9	19105	7	104150	0	0	16	123255
4	Helwak	17	109296	6	75750	0	0	23	185046
5	Dhebewadi	33	134432	15	112750	1	1500000	49	1747182
Total		**93**	**357254**	**33**	**336295**	**1**	**1500000**	**127**	**2193549**
2019-20									
1	Koyna	22	78194	8	78750	1	20000	31	176944
2	Bamnoli	31	43632	9	63000	1	125000	41	231632
3	Chandoli	16	53036	3	30750	0	0	19	83786
4	Helwak	27	139327	5	49500	1	11023	33	199850
5	Dhebewadi	4	7675	15	129000	0	0	19	136675
Total		**100**	**321864**	**40**	**351000**	**3**	**156023**	**143**	**828887**
2020-21									
1	Koyna	37	78263	2	41625	0	0	39	119888
2	Bamnoli	31	49762	12	103000	1	1784	44	154546
3	Chandoli	11	33653	8	88125	2	125000	21	246778

4	Helwak	41	159721	7	85750	1	18934	49	264405
5	Dhebewadi	14	21961	8	87000	0	0	22	108961
Total		**134**	**343360**	**37**	**405500**	**4**	**145718**	**175**	**894578**

Sr.No	Range	Crop Depredation		Livestock Depredation		Human Attack		Total	
		No. of Incidents	Compensation	No. of Incidents	Compensation	No. of Incidents	Compensation	No. of Incidents	Compensation
2021-22									
1	Koyna	17	48103	15	294600	0	0	32	342703
2	Bamnoli	104	198733	22	267000	2	13881	128	479614
3	Chandoli	49	129335	6	60875	0	0	55	190210
4	Helwak	40	122994	18	341925	0	0	58	464919
5	Dhebewadi	17	53914	20	125625	0	0	37	179539
Total		**227**	**553079**	**81**	**1090025**	**2**	**13881**	**310**	**1656985**
2022-23									
1	Koyna	12	33251	28	567000	1	17115	41	617366
2	Bamnoli	9	39234	19	303000	3	625000	31	967234
3	Chandoli	88	148459	12	112875	0	0	100	261334
4	Helwak	85	321425	15	156278	0	0	100	477703
5	Dhebewadi	79	298052	20	247250	1	125000	100	670302
Total		**273**	**840421**	**94**	**1386403**	**5**	**767115**	**372**	**2993939**
2023-24									
1	Koyna	82	417593	81	1443900	1	125000	164	1986493
2	Bamnoli	89	523293	39	682875	1	12638	129	1218806
3	Chandoli	15	20944	10	89250	2	625000	27	735194
4	Helwak	113	414650	32	509562	2	625000	147	1549212
5	Dhebewadi	91	187897	36	409500	2	3000000	129	3597397
Total		**390**	**1564377**	**198**	**3135087**	**8**	**4387638**	**596**	**9087102**

Table.5.5: Human injury and death in STR from year 2017-18 to 2023-24

Sr. No.	Range	Human Attack	
		Injury	Death
1.	Koyna	4	0
2	Bamnoli	10	0
3.	Chandoli	4	0
4.	Helwak	4	0
5.	Dhebewadi	2	2
6.	**Total**	**24**	**2**

Forest and Wildlife offences:-

Due to effective protection, no poaching of tiger was noticed in the area during the last three years. There is no large scale illicit felling in the area. However, the local people indulge in poaching of small animals like hare, deer etc. and illicit felling in the forest area adjoining to village to meet their domestic needs of fuel, fodder and other forest produce. Offences are registered against such offenders. The details of offence cases registered during last three years are as follows.

Table No.5.6: Offence Details in Sahyadri Tiger Reserve (2011-12 to 2023-24)

Offence Details									
Sr. No.	Year	Illegal Felling	Encroachment	Illegal grazing	Poaching	Forest Fire	Trespass	Misc.	Total
1	2011-12	4	0	0	1	8	5	6	24
2	2012-13	13	0	1	1	20	0	6	41
3	2013-14	1	9	0	1	17	0	0	28
4	2014-15	1	0	2	1	11	0	1	16
5	2015-16	1	0	0	1	11	0	6	19
6	2016-17	0	0	0	2	20	4	1	27
7	2017-18	0	0	0	0	13	5	0	18
8	2018-19	0	0	0	8	17	4	0	29
9	2019-20	1	0	0	2	21	2	3	29

10	2020-21	2	0	1	6	30	5	2	46
11	2021-22	2	1	0	9	11	0	1	24
12	2022-23	0	1	0	4	11	0	1	17
13	2023-24	1	1	0	2	7	0	1	12
Total		**26**	**12**	**4**	**38**	**197**	**25**	**28**	**330**

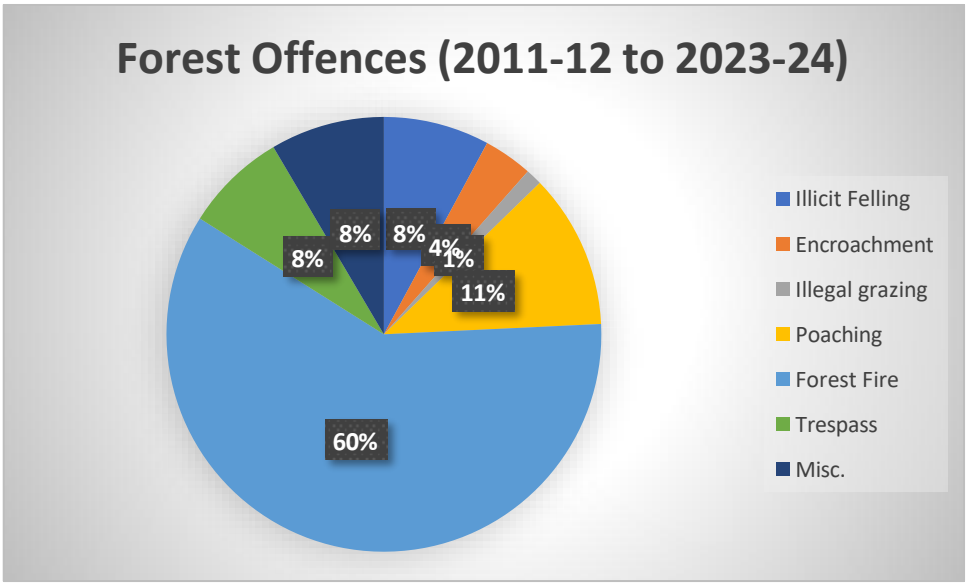


Fig.5.1: Percentage of Forest Offences (2011-12 to 2023-24)

Chapter – 6

Vision, Goals, Objectives and Problems

6.1 Vision

Long term, ecologically sustainable management of the STR landscape beyond the core or critical tiger habitat, for ensuring gene porosity of tiger, co-predators and prey through conservation of habitat supplement, with the active support of local people.

6.2 Management Goals

- To provide habitat supplement to the spillover population of Tiger and its prey from the Core area, conserve with the active cooperation of stakeholder communities.
- Long term viable conservation of STR as a northern most tiger habitat in Western Ghat.
- To ensure ecosystem services from the area for the welfare of society by mainstreaming concerns of biodiversity/tiger in various land uses
- To provide site specific, need based, participatory eco-development inputs to local stakeholders for rationalizing their resource dependency on the Tiger Reserve and strengthen their livelihoods, so as to elicit their support for conservation of the area.
- To create conservation awareness among the people by sensitizing and educating them towards nature in general and tiger in particular.
- Active management for addressing Wildlife-human interface conflicts.
- Mainstreaming wildlife concerns in various production sectors in the area.

6.3 Management Objectives

In tune with the vision and the goals stated above, the managerial objectives are given below:

- To strengthen the infrastructure for protection and management of core zone in order to provide maximum protection to the tiger reserve.
- Providing special incentives to local people through the EDCs of core villages for tiger/wildlife protection, while maintaining village level wildlife monitoring registers

- Fine tuning ongoing traditional forestry operations with twin objectives of conserving/protecting habitat supplement (forest patches), while institutionalizing a process for accessing carbon funds to incentivize the people
- Taking special initiatives for addressing the forest resource dependency of local people with special treatment for zudupi jungle
- Evolving an ecologically viable ecotourism strategy to benefit the local community
- Ensuring retrofitting measures for heavily used infrastructures like roads, railways, canals etc.
- Ensuring proactive measures for addressing human-wildlife interface, disease transmission, staff development
- Protection of unique habitats in buffer zone.
- To maintain the essential ecological processes & the life support systems to preserve the natural environment of STR landscape in its pristine form.
- To promote and encourage eco-tourism, wildlife research and involvement stakeholders in wildlife conservation activities.
- To protect key watershed areas of the various lakes, reservoirs & streams in & around the STR.
- To improve the technical abilities & motivation levels of the field staff by training, tours, interactions & dissemination of knowledge & information.
- To initiate the involvement of local people in the conservation, nature interpretation & eco-development activities.

6.4 Problems in Achieving Objectives:

- Comparatively productive core critical habitat, with a good turnover of wild animals moving across the landscape with high possibility of human-wildlife conflict
- Low socio-economic status of local people, with high dependency on forest resources for their day to day needs with few livelihoods' options
- Water becomes limiting factor during dry season in buffer area, with water points/tanks/dam being shared by livestock as well as wild animals
- Vulnerability to targeted/revenge killing due to frequent movement of wild animals in human dominated areas
- Huge number of villages in buffer area leading to unavoidable man-animal conflicts.
- Buffer / Core area is fragmented by networks of Road and human habitation, which create unhealthy wild habitat interventions leading to wild animal accidents e.g. Both block of core zone is 7-8 km away and only connected through few forest patches. But buffer area is cut across many places by Canals,

National Highway, State highways, District roads and Village roads which causes major disturbance to smooth movement of wild animals from one block to another block of core zone and among forest patches of buffer zone.

- Biotic pressure on the core zone due to 07 human habitation and land acquisition of one village still inside the core zone.
- Poaching of prey animals and sometimes electrocution of wild animals is the major problem on the boundary of the core zone and in the buffer area.

6.5 Strengths-Weaknesses-Opportunities-Limitations (SWOT) Analyses:

SWOT analysis provides a structured framework for understanding the internal and external factors that influence tiger conservation efforts. By systematically evaluating strengths, weaknesses, opportunities, and threats, conservationists can develop evidence-based conservation plans that prioritize actions, allocate resources effectively, and maximize the likelihood of success in conserving tigers and their habitats. Management Strengths and Management weaknesses of STR observed in MEE of the year 2010, 2014, 2018, 2022 and Internal MEE-2021 is attached in Annexure No.14.1.

Strength:

- **Rich Biodiversity**: The STR is part of the Western Ghats Tiger Landscape and a UNESCO World Heritage Site, boasting rich biodiversity, including rare and endemic species. The reserve boasts high biodiversity and is home to many endemic species, contributing to its ecological significance and conservation value.
- **Rainfall Distribution**: The temporal spread of rainfall reduces forest fire incidents, helping maintain ecosystem health and biodiversity,
- **Natural Geographical Barrier:** The reserve benefits from natural geographical barriers i.e. Konkan cliff, which can help protect wildlife habitats and maintain ecosystem integrity. The interior parts of the STR are well-protected due to terrain complexity.
- **Relocation of Villages:** Relocation efforts have successfully reduced human-wildlife conflict by moving villages out of core areas, enhancing conservation outcomes. Plans for relocating villages within the reserve are underway, with a few remaining villages awaiting relocation pending state government support.
- **Increasing Prey Base:** The prey base has been increasing steadily over the past few years, supporting predator populations and overall ecosystem health.

- **Youth Outmigration:** Outmigration of youths can reduce human pressures on the reserve and minimize negative impacts on wildlife and habitats.
- **Low Offences:** Fewer reported offences indicate effective law enforcement and community engagement in conservation efforts.
- **Good Meadows:** The presence of good meadows provides vital habitat for a variety of wildlife species especially herbivores and grassland birds.
- **Diverse Habitat:** The reserve encompasses diverse habitats, supporting a wide range of flora and fauna and enhancing ecosystem resilience.
- **Financially Strong Conservation Foundation**: The Tiger Conservation Foundation's financial strength enables effective conservation management and implementation of conservation initiatives.
- **Water Availability:** Adequate water availability, except in certain areas, supports diverse ecosystems and sustains wildlife populations.
- **Increasing Source Tiger Population:** This is indeed a positive indicator for conservation efforts in the region. The presence of tigers in the corridor and the nearest source area indicates the potential for these populations to establish themselves as resident populations within the Sahyadri Tiger Reserve in the future.
- **Protection Infrastructure:** Adequate protection infrastructure ensures effective monitoring and enforcement of conservation regulations.
- **Protected Corridors**: Corridors are well-protected, with conservation reserves declared over most reserve forests, facilitating wildlife movement and genetic exchange.
- **Unified Control with STR:** Unified control with the STR streamlines management and coordination efforts, enhancing conservation outcomes.
- **Eco-Development Committees (EDC):** The presence of EDCs in most villages promotes community participation in conservation and sustainable development initiatives.
- **Conservation Efforts**: Management efforts over the past few years have resulted in an increase in the prey base and the source population of tigers in adjoining areas. Additionally, conservation reserves are established to protect corridors.
- **Eco-Sensitive Area Notification**: Draft notification of the corridor area as an Eco-Sensitive Area provides additional protection, safeguarding vital wildlife habitats and corridors.

These strengths provide a strong foundation for effective conservation management and highlight the potential for further successes in biodiversity conservation within the Sahyadri Tiger Reserve.

Weaknesses:

- **Tiger Population:** There are indications of tiger presence through genetic analysis and sporadic camera trap captures, but no resident tiger population is confirmed.
- **Accessibility and Infrastructure:** The terrain and water bodies make the reserve inaccessible, with few internal roads. Efforts are underway to improve access, but progress is slow.
- **Staff Awareness**: Frontline staff may not be adequately aware of the Outstanding Universal Values (OUVs) of Sahyadri's World Heritage Site status.
- **Connectivity and Corridors:** Forested buffers and corridors connecting critical tiger habitats are at risk due to incompatible land use, such as highway expansion and mining activities.
- **Habitat Improvement:** Measures for habitat improvement and eco-development interventions are being implemented, but their impact is not yet visible.
- **Leopard Release and Monitoring**: Leopards rescued from various places have been released into the reserve without a proper monitoring mechanism, raising concerns about their impact on the ecosystem.
- **Plantation Practices:** Large-scale plantation of exotic species like Eucalyptus has occurred in edge habitats, potentially affecting biodiversity.
- **Human-Wildlife Conflict:** Measures to mitigate human-wildlife conflict primarily focus on compensation, which may not effectively reduce conflicts.
- **Distance from Source Population:** The source population of tigers is far from the reserve, with only transient male tigers visiting, indicating a lack of a settled population.
- **Funding and Administration:** Insufficient and irregular funding, along with administrative challenges across multiple districts, hinder effective conservation efforts.
- **Human Habitation and Commercial Development:** Human habitation within critical tiger habitat, commercial development in sensitive areas, and the presence of windmills on ecologically unique plateaus further threaten the reserve's integrity.
- **Terrain Inaccessibility:** The rugged terrain makes it challenging to patrol and cover all areas effectively, leaving parts of the reserve vulnerable to illegal activities.
- **Staff Shortage:** Insufficient field staff exacerbates the challenges of monitoring and protecting the reserve's wildlife and habitats.
- **Linear Shape and High Edge Ratio**: The reserve's linear shape and division of core zone/CTH into two parts with a high edge-to-area ratio increase vulnerability to external biotic pressures and habitat fragmentation.
- **Transient Tiger Visits**: Lack of a settled tiger population and distant source populations indicate challenges in maintaining settled population, genetic diversity and long-term viability.

- **Outmigration from Buffer Villages**: Low livelihood opportunities lead to outmigration, impacting local involvement and support for conservation efforts.
- **Ecological Concerns:** reservoirs, steep slopes, and exotic plantations in Koyna affects habitat expansion and management activities which limits the carrying capacity of herbivores,
- **Low Prey Base:** Compared to other tiger reserves, Sahyadri has a lower prey base, potentially impacting predator populations.
- **Limited Field Presence of Management:** Managers' engagement in meetings detracts from field visits, reducing oversight and management effectiveness.
- **Human Habitation in CTH**: Human habitation within critical tiger habitat poses threats to wildlife and increases human-wildlife conflict.
- **Buffer Zone Sensitivity:** Buffer zones experience high biotic pressure, exacerbating conflicts and habitat degradation.
- **Fragmentation due to Reservoirs:** The presence of large reservoirs fragments wildlife habitat, impacting connectivity and species movement.
- **Commercial Development in Corridors**: Corridor bottlenecks face pressure from commercial development, further limiting wildlife movement.
- **Unemployment in Buffer Zones**: high unemployment in buffer zones can lead to various socio-economic challenges, including increased engagement in illegal activities. When people lack viable livelihood options, they may resort to activities such as poaching, illegal logging, or encroachment on protected areas for resources. Moreover, unemployment can also reduce local support for conservation efforts. When communities feel economically marginalized and disconnected from conservation initiatives, they may not see the value in protecting wildlife and habitats. Instead, they may view conservation regulations as barriers to their economic well-being.
- **Lack of STPF Sanction**: Non-sanctioning of Special Tiger Protection Force (STPF) hampers anti-poaching efforts and wildlife protection.
- **Administrative Challenges**: The reserve spanning four districts complicates coordination with line departments.
- **Windmills in Sensitive Areas**: Windmills on ecologically unique plateaus threaten sensitive habitats and wildlife in the region.
- **Remoteness of Area**: Remoteness of area creates psychological boredom and lonely feeling among the staff, who reside inside for many days. Any basic requirements and essential material needed cannot be easily get it to them, if anything needs, he must to go out 30-40 km for nearest village. It therefore hampers their motivation and efficiency to work. Hence, most of the staff avoid transfer in wildlife area.

Addressing these issues will require coordinated efforts from various stakeholders, including government agencies, local communities, and conservation organizations, to ensure the long-term survival of the Sahyadri Tiger Reserve and its wildlife.

Opportunities:

In the Sahyadri Tiger Reserve (STR), situated within the Western Ghats and renowned for its rich habitat diversity, varied flora and fauna, and high levels of endemism, numerous opportunities exist for enhancing the management of both the tiger reserve and its surrounding landscape. Here are the opportunities, we should plan in order to enhance management effectiveness:

- Considering the positive outcomes observed from incentivized voluntary relocations, it may be advisable to continue such initiatives to further reduce human impact and enhance conservation efforts in the region. Voluntary relocation results in expansion of grassland area and continuity to habitat, ultimately it creates inviolate space for wildlife in core zone.
- Exploring the possibility of implementing voluntary relocation programs for villages within the Tiger Reserve could minimize human-wildlife conflicts and habitat disturbance while ensuring the safety and well-being of local communities.
- Exploring the possibility of repopulating habitats with ungulate species to support ecosystem balance and enhance prey availability for carnivores could be a valuable conservation strategy to consider.
- Projects aimed at augmenting the cheetal population could be expedited to provide a more robust prey base, supporting carnivore populations and overall ecosystem health.
- It might be worthwhile to focus on strategic locations and explore the possibility of expanding efforts to encourage transiting tigers to establish residency in suitable habitats.
- Enhancing the sampling scale of camera trap deployments could significantly improve monitoring capabilities and provide more comprehensive coverage of wildlife populations.
- Emphasizing the importance of habitat preservation and connectivity with neighboring reserves could help maintain ecological integrity and facilitate wildlife movement across landscapes.
- Developing a comprehensive management plan focusing on reducing human impacts, enforcing strict anti-poaching measures, and exploring alternative livelihoods for local communities could lead to more sustainable conservation outcomes.
- Initiating population recovery plans for tigers in collaboration with source populations like Kali Tiger Reserve and corridor forests through Goa could enhance genetic diversity and contribute to the long-term viability of tiger populations.

- Prioritizing actions aimed at reducing human impacts, controlling poaching, and restoring a robust prey base before considering tiger augmentation measures could ensure a more holistic approach to conservation planning.
- Implementing systematic management plans to address the invasion of various invasive species, with a focus on areas where invasion is at an early stage, could help prevent further spread and protect native habitats.
- Prioritizing removal efforts in areas where invasion is potentially in the initial stage could be advisable to minimize the impact of invasive species on native ecosystems.
- Strengthening collaborations with forest departments of neighboring states, law enforcement agencies, and relevant authorities could enhance wildlife protection efforts through joint operations and knowledge sharing.
- Focusing on joint operations, anti-poaching measures, and overall wildlife safety could contribute to the effective protection of wildlife within the Tiger Reserve.
- Investing in continuous monitoring and research initiatives to assess the impact of existing threats and track the effectiveness of implemented mitigation measures would provide valuable insights for adaptive management.
- Tracking the effectiveness of implemented mitigation measures and adapting strategies accordingly based on ongoing monitoring and evaluation could lead to more efficient conservation outcomes.
- Encouraging the active involvement of local communities in conservation efforts could foster a sense of ownership and stewardship towards wildlife and their habitats, leading to more sustainable conservation practices.
- It is crucial to implement sustainable development initiatives in buffer zones that provide alternative livelihood opportunities for local communities. These initiatives could include ecotourism, sustainable agriculture, handicraft production, or skill development programs. By engaging local residents in conservation-compatible livelihoods, we can reduce dependence on illegal activities, alleviate poverty, and foster a sense of ownership and support for conservation efforts. Additionally, involving communities in decision-making processes and ensuring equitable sharing of benefits from conservation initiatives can further strengthen their commitment to protecting biodiversity.
- Raising awareness about the importance of tiger reserves and exploring community-based conservation models could help garner support and participation from local communities in conservation initiatives.
- Enhancing infrastructure for the protection network, staff housing, monitoring, and communication could improve operational efficiency and effectiveness in wildlife conservation efforts.

- Addressing challenges related to inaccessible terrain, lack of tracks, and loss of local terrain knowledge through strategic planning and capacity building initiatives could improve conservation outcomes in challenging environments.
- Recognizing the potential for ecotourism in the UNESCO-recognized Western Ghats complex and exploring avenues for sustainable ecotourism development could provide alternative livelihood options for local communities while promoting conservation.
- Considering the development of community-based ecotourism initiatives as a means to generate revenue and support conservation efforts could provide economic incentives for local communities to engage in conservation activities.
- Providing incentives for staff, such as one-step higher pay and allowances, could recognize and reward their dedication and contribution to wildlife protection efforts, fostering morale and commitment.
- Deploying additional staff, increasing their strength, and establishing a robust communication network could enhance surveillance and response capabilities within the Tiger Reserve, contributing to improved wildlife protection.
- Eco-tourism-based livelihood opportunities: Leveraging eco-tourism can not only provide sustainable livelihoods for local communities but also contribute to conservation efforts. By promoting responsible tourism practices, communities can benefit economically while fostering a sense of stewardship for their natural surroundings.
- Natural tiger migration by Corridor strengthening and Tiger re-introduction: Facilitating natural tiger migration by Implementing effective mitigation policies and conservation measures to strengthen wildlife corridors can enhance connectivity between fragmented habitats, facilitating the movement of wildlife and promoting genetic exchange among populations and considering tiger re-introduction programs can help in maintaining genetic diversity and population viability of tigers within the reserve.
- Increasing carrying capacity: By managing habitat effectively and ensuring an adequate prey base, the carrying capacity of the reserve for both tigers, co-predators and their prey species can be increased, supporting larger populations of wildlife.
- Research and biodiversity documentation: Investing in research initiatives and biodiversity documentation can provide valuable insights into the ecological dynamics of the reserve, aiding in informed decision-making and conservation planning.
- Exploration of new species: Conducting surveys and research to discover and document new species can contribute to biodiversity conservation efforts and raise awareness about the importance of preserving ecosystems.

- Payment for Ecosystem Services (PES): Implementing PES schemes for forests like Malki Forest can incentivize conservation efforts by compensating communities for preserving ecosystem services such as carbon sequestration, water regulation, and biodiversity conservation.
- Capacity building and institutionalization: Strengthening the capacity of reserve staff, institutions, and local stakeholders through training and institutionalization of participatory management approaches can improve the effectiveness of conservation efforts.
- Reduction of resource dependency: Implementing sustainable resource management practices and alternative livelihood options can reduce dependency on buffer forest resources, alleviating pressure on natural habitats.
- Use of technology: Embracing innovative technologies such as remote sensing, GPS tracking, and camera traps can enhance monitoring and protection efforts, improving efficiency in conservation management.
- Restoration of mining sites: restoring degraded areas, including former mining sites, can help in creating habitat expansion for wildlife and restoring habitat connectivity.

By capitalizing on these opportunities and implementing integrated conservation strategies, the Sahyadri tiger reserve can strengthen its protection and management efforts, ensuring the long-term survival of its biodiversity and the ecological integrity of the region.

Threats:

The Sahyadri Tiger Reserve, nestled in the Western Ghats of India, faces a range of threats that jeopardize its biodiversity and the survival of its iconic tiger population. These threats arise from both natural and anthropogenic factors, posing significant challenges to conservation efforts. Some of the key threats include:

- **Habitat Fragmentation and Degradation:** The fragmentation of habitat due to human activities such as agricultural expansion, dams, hydro-electric projects, highways, windmills infrastructure development, human settlement and mining disrupts the continuity of compact wildlife habitat and corridors, limiting the movement of tigers and other wildlife species. Deforestation in private area in buffer and corridor and habitat degradation further exacerbate this issue, reducing suitable habitats for tigers and prey species.
- **Human-Wildlife Conflict**: Increasing human interference into tiger habitats leads to conflicts between local communities and wildlife, particularly when tigers prey on livestock or pose a threat to human safety. Retaliatory killings, habitat destruction, and depletion of prey base are common consequences of such conflicts, posing a serious threat to tiger populations. Crop raiding due to wild pig and gaur is increased. Gaur and sloth bear attack also increased.

- **Poaching and Illegal Wildlife Trade**: Illegal hunting activities such as trapping, snaring, and the use of licensed or unlicensed guns pose a significant threat to wildlife populations, particularly prey and endangered species. Poaching for local consumption and for illegal wildlife trade remain persistent threats to tiger populations in the Sahyadri Tiger Reserve. Lack of effective law enforcement and inadequate monitoring exacerbate the problem.
- **Illegal Resource Collection:** Gathering resources such as fuelwood and medicinal plants (e.g., Narkya, Hirda, Tamalpatra, Shikakai) without proper authorization can lead to habitat degradation and loss of biodiversity.
- **Grazing Pressure:** Uncontrolled grazing by feral cattle or illegal grazing of domesticated livestock can degrade habitats, compete with native herbivores for resources, and spread diseases.
- **Forest Fire**: Deliberate or accidental fires set for various purposes, such as clearing land for agriculture or hunting, can result in habitat destruction and loss of vegetation cover, affecting wildlife populations.
- **Human Disturbance and Infrastructure Development**: Rapid urbanization, tourism, and infrastructure development in and around the reserve lead to habitat disturbance, noise pollution, and habitat fragmentation. Roads, canals, and other linear infrastructure pose barriers to wildlife movement and increase the risk of roadkill and human-tiger conflicts.
- **Climate Change:** Climate change poses a long-term threat to the Sahyadri Tiger Reserve, altering habitats, disrupting ecosystems, and affecting prey populations. Changes in temperature and precipitation patterns, increased frequency of extreme weather events, and habitat loss are among the climate-related challenges faced by the reserve.
- **Inadequate Management and Enforcement:** Insufficient funding, staffing, and resources, as well as weak governance and lack of political will, undermine effective management and law enforcement in tiger reserves.
- **Threat to Grasslands:** There are threat to grasslands due to encroachment of woody vegetation and ferns, results in shrinkage of grasslands area. This reduces the availability of open grassland habitats for herbivores. Grasslands in the Sahyadri Tiger Reserve may harbour endemic plant species adapted to this unique habitat. The loss of grasslands due to woody encroachment threatens these specialized species, increasing the risk of local extinctions.
- **Unregulated tourism/tourism structures/pilgrimage tourism**: pose a significant threat to the wildlife habitat as they can lead to habitat destruction, disturbance of wildlife, and degradation of natural resources. Unplanned construction of tourism infrastructure such as resorts, lodges, and roads can fragment habitats, disrupt wildlife corridors, and degrade sensitive ecosystems. Unregulated tourism activities such as loud noise, bright lights, and excessive human presence can disturb wildlife, disrupt breeding and feeding patterns, and increase stress levels among animals. Uncontrolled tourism can lead

to overuse of natural resources such as water, fuelwood, and wildlife products, resulting in habitat degradation and loss of biodiversity. Unregulated tourism can have negative effects on local communities, including cultural erosion, social conflict, and economic inequality. Unregulated tourism can inadvertently introduce invasive species through the transportation of goods, vehicles, and visitors from outside the reserve.

- **Threats to Unique Habitat like Sadas/Lateritic plateau:** Rocky plateaus in the northern Western Ghats are specialized habitats belonging to the general habitat category of lateritic plateau and rock outcrops. Ecological assessment of representative sites shows high species richness and diversity. Removal of boulders, filling of shallow ponds, or altering the drainage pattern can have severe impacts on biodiversity of lateritic plateau (Sada) which may be visible only after some years. Tourism, wind farms, infrastructure development and mining are serious threats to the rocky lateritic plateaus.
- **Proposed additional structures in and around Koyna dams i.e. Phase 5 & 6 project**: any proposed structures undergo rigorous ecological assessments is needed to minimize their impact on the tiger reserve and surrounding environment.

Addressing these threats requires a multifaceted approach, including habitat restoration, community-based conservation initiatives, strengthened law enforcement, and sustainable land-use planning. Collaboration between government agencies, local communities, NGOs, and other stakeholders is crucial for the effective conservation of the Sahyadri Tiger Reserve and the protection of its biodiversity.

CHAPTER 7

MANAGEMENT STRATEGIES

7.1 Delineation of Critical Tiger Habitat and Inviolate Areas:

As per the provision of the Wildlife (Protection) Amendment Act, 2006 No. 39 of 2006 dated 3rd September 2006, Section 38V (4) (i) the expression Tiger Reserve includes Core or Critical Tiger Habitat areas of National Parks and Sanctuaries, where it has been established, based on scientific and objective criteria that such areas are required to be kept as inviolate for Tiger conservation, without affecting the rights of the Scheduled Tribes or such Other Forest Dwellers, and notified as such by the State Government in consultation with an Expert Committee constituted for the purpose.

As required under the provisions of the section 38 (V) (4) explanation (i) & (ii), the Principal Chief Conservator of Forests (Wildlife), M.S. Nagpur vide letter No. Desk 23(2)/Survey/pra.kra.50 (1)/4205 dated 12-03-2012 had constituted the expert committee for identification and establishment of the Critical Tiger Habitat area of the Sahyadri Tiger Reserve (STR) and also vide letter No. D-22(8)/ TCP/ 1653/12-13, dated 26.7.2012 had constituted the expert committee for identification and establishment of the Buffer area of the Sahyadri Tiger Reserve (STR). (Annexure No -7)

The Areas for Core and Buffer part of Sahyadri Tiger Reserve were notified on 21st August, 2012 as per the Resolution of Government of Maharashtra no. WLP-2012/C.R. no.240/ F-1. As per this notification, following areas of STR have been declared as Core or Critical Tiger Habitats.

Table No.7.1: Details of division wise area of core zone or CTH are as given below:

Details of Core Zone of STR	Forest Area (Sq.km.)	Non-Forest Araea (Sq.km.)	Total area of Core Zone (Sq.km.)	No. of Villages yet to relocate
Chandoli Wildlife Division	198.06	115.78	313.84	6
Koyna Wildlife Division	196.42	89.86	286.28	2
Total Area	**394.48**	**205.64**	**600.12**	**8**

To establish inviolate areas, six villages from Chandoli Wildlife Division (Amboli, Janaiwadi, Khundalapur, Kolane, Male, and Patharpunj) and two villages from Koyna Wildlife Division (Vele and Deur) require relocation. The details of relocated villages and villages to be relocated and additional details are provided in (Annexure No. 53 and 54 and Atlas Map No.109 and 110). The rehabilitation process is being carried out in accordance with Maharashtra Government Resolution No. WLP1012/C.R. No.122/F-1 dated November 3, 2012, 2015, and 2018.

7.2 Zone and Theme Approaches to Management Strategies –

The implementation strategy would involve delineating zones, as outlined in Para 7.2.1, to ensure targeted managerial focus, complemented by overlapping thematic interventions as outlined in the theme plans. The management strategies for tiger reserves often incorporate zone-based and theme-based approaches to ensure the effective conservation of tiger populations and their habitats.

7.2.1 Zone Plan:

A "zone" denotes a delineated area with distinct management objectives. The creation of separate zones is imperative due to potential incompatibilities between these objectives within specific areas. For instance, the aim of preserving catchment capability may conflict with allowing grazing of domestic livestock in a Protected Area (PA). Similarly, the activity of livestock grazing may contradict the goal of offering nature experiences to visitors.

The establishment of a zone necessitates a systematic approach based on clearly defined objectives. It involves crafting a self-contained sub-plan focused on the identified objective(s), which entails identifying pertinent issues, devising strategies, and implementing a robust monitoring and evaluation framework. Management interventions aligned with these objectives are imperative Considerable importance is placed on the maintenance of 'wilderness' conditions especially since large wilderness areas in the past were able to absorb impacts of natural random events and much lower levels of manmade perturbations that existed then are no longer in existence.

As natural habitats continue to diminish significantly, remaining areas necessitate intensive management practices. However, this approach occasionally conflicts with the "leave it to nature" ethos, rooted in the extensive wilderness areas of centuries past characterized by sparse human populations and limited human needs. Within the landscape of the STR, the natural succession process in meadows would naturally progress from grassland to woodland if left unchecked. It is imperative to intervene to maintain the grassland state, despite these grasslands having anthropogenic origins and being situated within the core zone. Leveraging generic management principles, data analysis, and field expertise, it is proposed to delineate appropriate management zones through Zone Plans, supplemented by overlapping Theme Plans.

The following Zone Plans are proposed in the Core Area or CTH of Sahyadri Tiger Reserve.

7.2.1.1 Zone plan for the creation of inviolate space

7.2.1.2 Zone plan for unique/ Special habitat management

7.2.1.3 Zone Plan Grassland/ Meadow Management

7.2.1.4 Zone Plan for Weed Eradication and Eco-Restoration

7.2.1.5 Zone plan for Relocation of Sambar and Chital

7.2.1.6 Zone Plan for Re-introduction of locally extinct species like tiger etc.

7.2.1.7 Zone Plan for Eco-tourism.

7.2.1.8 Zone plan for Administration

7.2.1.9 Zone Plan for Removal of Exotic Plantation

7.2.1.1 Zone plan for the creation of inviolate space:

i. General:

The establishment of the Sahyadri Tiger Reserve was formalized through Government Notification No. WLP 1008 / P.No. 232/F-1 dated January 05, 2010, which merged the Chandoli National Park and Koyna Wildlife Sanctuary. Furthermore, in accordance with Section 38 (V) of the Wildlife Protection Act 1972, Government Notification No. WLP- 2012 / P.No. 240/FA dated August 21, 2012, delineated the core and buffer zones for the reserve. The core area spans 600.12 sq. km and was designated to create an inviolate zone aimed at safeguarding wildlife and their habitats.

According to various inquiry reports, a total of 82 villages were involved in the creation of both protected areas, Chandoli National Park and Koyna Wildlife Sanctuary. The Water Resource Department of Maharashtra state relocated 27 villages for the Koyna and Warna Hydroelectric projects, while rights are reserved for 18 villages within Koyna Wildlife Sanctuary. The Forest Department is responsible for relocating the remaining 37 villages, of which 29 villages have been relocated in Kolhapur, Sangli, Satara, and Thane districts. However, some relocation dues of Project Affected Persons (PAPs) from these villages are still pending with the government.

Furthermore, one village from Ratnagiri district, six villages from Kolhapur district, and twelve villages from Sangli district within Chandoli National Park were relocated through a special GR of 1995. The Executive Engineer (Warna Canal) served as the Project Officer for this endeavor until the relocation process was transferred to the Forest Department in 2016. Details of rehabilitation are provided in table no 7.2

Sr. No	District	Villages in Tiger Reserves as per Notification			Villages relocated by Water Resources Dept.	Villages To be Relocated by Forest Dept.	Villages relocated by Forest Dept.	Villages to be Relocated by Forest Dept.
		Total villages	Rights Reserved	Villages To be Relocated	Total	Total	Total	Total
1	Satara	52	18	34	19	15	10	5

2	Sangli	19	0	19	5	14	12	2
3	Kolhapur	10	0	10	3	7	6	1
4	Ratnagiri	1	0	1	0	1	1	0
Total		**82**	**18**	**64**	**27**	**37**	**29**	**8**

Table No.7.2: Status of Rehabilitation of Villages in STR given in following table:

Among the ten relocated villages from Satara District that underwent rehabilitation, five villages (Dicholi, Zadoli, Punavali, Kisrule, and Nahimbe) located in Patan Tahsil were relocated to Palus in Sangali and three colonies in Satara district. The other five villages (Ravandi, Adoshi, Modoshi, Kusapur, and Khirkhindi) situated in Jawali Tahsil were relocated to Thane District at Eksal Sagaon, Bhiwandi.

The relocation process is pending for 8 villages is currently underway, out of this, five villages: Janaichiwadi, Khundalapur, Male, Kolane, and Patharpunj are from Chandoli National Park, and two villages: Vele and Deur are from Koyna Wildlife Sanctuary. As there is no human habitation in Amboli village, only land acquisition is pending for this village: Amboli, from Kolhapur in Chandoli NP because of enquiry report is still pending with SDO, Shahuwadi. We got Stage-II approval for FCA proposal for both Vele and Male Villages. FCA proposal of forest land for remaining villages is in process.

Table.7.3: Land Acquisition Details by Rehabilitation from Core Zone given in following table:

Sr. No.	District	Total Relocated Villages	Land Acquired by Forest Department (Ha.)	Villages to be Rehabilitated	Land to be Acquired (Ha.)
1	Satara	10	1544.52	5	3444.47
2	Sangli	12	1957.08	2	275.00
3	Kolhapur	6	716.74	1 (Amboli)	Enquiry report is pending
4	Ratnagiri	1	873.85	0	0
Total		**29**	**5092.19**	**8**	**3719.05**

The government and forest department are actively working towards the successful relocation of the remaining villages to create inviolate spaces for wildlife. These efforts involve voluntary rehabilitation of the villages to suitable locations, ensuring the preservation of both wildlife habitats and the well-being of local communities.

ii. Objectives:

- **Conservation Priority**: The primary objective of relocating villages from core zones of tiger reserves is to prioritize the conservation of critically endangered species, such as tigers, by creating inviolate spaces where wildlife can thrive without human disturbance.
- **Habitat Restoration**: By relocating human settlements from core tiger habitats, the objective is to restore and maintain the natural habitat integrity crucial for the survival and breeding of tigers and other wildlife species.

- **Mitigating Human-Wildlife Conflict**: Relocating villages from core zones reduces the likelihood of human-wildlife conflicts, which often arise due to competition for resources or encounters between people and wildlife, thereby ensuring the safety and well-being of both humans and animals.
- **Population Management:** The relocation of villages from core tiger habitats contributes to population management efforts by preventing human encroachment and associated negative impacts on wildlife populations, such as habitat fragmentation, poaching, and depletion of prey species.
- **Sustainable Development**: Simultaneously, the objective is to provide affected communities with opportunities for sustainable development by offering alternative livelihood options, improved infrastructure, access to education and healthcare facilities, and other socio-economic benefits.
- **Cultural Preservation**: Efforts will be made to respect and preserve the cultural heritage and traditional lifestyles of relocated communities, ensuring that their cultural identity and social cohesion are maintained despite the resettlement process.
- **Adaptive Management and Stakeholder Engagement**: The objective involves implementing a participatory and adaptive management approach, engaging relevant stakeholders, including local communities, government agencies, conservation organizations, and experts, to ensure the success and sustainability of the relocation process while addressing potential challenges and incorporating feedback from affected parties.
- **Long-term Conservation Impact**: Ultimately, the objective of relocating villages from core zones of tiger reserves is to achieve long-term conservation impact by establishing resilient and ecologically functional habitats capable of supporting viable populations of tigers and other wildlife species for future generations.

iii. Issues and Problems:

- **Socio-Economic Displacement**: Relocating communities from their ancestral lands can lead to socio-economic displacement, disrupting livelihoods and traditional ways of life. This can cause resentment, social unrest, and challenges in adapting to new environments and livelihood opportunities.
- **Resistance and Opposition**: Some villagers may resist relocation efforts due to attachment to their land, cultural ties, or skepticism about the benefits of relocation. Opposition from local leaders, community members, or vested interests can hinder the relocation process and prolong negotiations.
- **Inadequate Compensation and Rehabilitation**: Inadequate compensation packages and rehabilitation measures for displaced communities can exacerbate grievances and hinder the resettlement process. Lack of access to basic amenities, healthcare, education, and livelihood support in resettlement areas can further compound challenges.

- **Land Tenure and Legal Issues:** Resolving land tenure and legal issues, including land ownership, title deeds, and property rights, can be complex and time-consuming, particularly in cases of overlapping claims or disputed land ownership. Legal battles and bureaucratic delays can stall the relocation process.
- **Environmental Impact:** Relocating villages from core zones may have unintended environmental consequences, such as deforestation, soil erosion, or changes in land use patterns, if not accompanied by appropriate environmental safeguards and land management practices.
- **Infrastructure Development and Service Provision:** Ensuring adequate infrastructure development, including roads, water supply, sanitation, and electricity, in resettlement areas is essential for meeting the basic needs of relocated communities. Delays or deficiencies in infrastructure provision can hamper community acceptance and integration.
- **Livelihood Alternatives and Economic Empowerment:** Providing viable livelihood alternatives and economic opportunities to displaced communities is crucial for their long-term socio-economic well-being and successful resettlement. Limited access to employment opportunities, training programs, and income-generating activities can undermine the sustainability of relocation efforts.
- **Cultural Preservation and Social Cohesion:** Safeguarding the cultural heritage and social cohesion of relocated communities is essential for maintaining community identity and resilience. Integrating cultural considerations and community participation in decision-making processes can help mitigate cultural erosion and social fragmentation.

Addressing these issues and challenges requires a multi-dimensional approach that integrates socio-economic development, environmental sustainability, cultural preservation, and community empowerment to ensure the successful and sustainable relocation of villages from core zones of tiger reserves while providing opportunities for development and conservation.

iv. Strategies:

1. Community Participation and Consultation:

- Foster open dialogue and consultation with affected communities throughout the relocation process.
- Establish committees and arrange regular meetings with Project Affected Persons (PAPs) to facilitate participation in decision-making and ensure transparency.

2. Comprehensive Socio-Economic Rehabilitation:

- Explain all rehabilitation packages to every member of community or all PAP's.
- For handholding of PAP's, provide skill development, vocational training, and entrepreneurship opportunities to enhance the economic resilience and self-reliance of relocated individuals and families.

- Ensure access to essential services such as healthcare, education, clean water, sanitation, and electricity in resettlement areas to improve quality of life and well-being.

3. Fair and Transparent Compensation:

- Conduct fair and transparent valuation of land and assets to determine compensation packages for displaced households, adhering to legal frameworks and international standards.
- Establish grievance redress mechanisms to address complaints and disputes related to compensation, ensuring prompt resolution and recourse for affected individuals.
- Solve all grievances of PAP's of already rehabilitated villages.

4. Habitat Restoration:

- Implement wildlife management practices like dismantle all the structures, habitat restoration, grassland management, waterhole creation, fire management and fruit tree and bamboo plantation etc after preparing judicious plan prepared by experts.

5. Co-ordination Meetings of Government agencies and PAP's:

- As member secretory, Project officer should arrange meeting of 'District Rehabilitation Committee' (DRC) regularly in every month to coordinate with relevant government agencies and development partners to mobilize resources and expertise for infrastructure development, ensuring equitable access and distribution of benefits.

6. Cultural Preservation and Social Cohesion:

- Respect and preserve the cultural heritage, traditions, and social fabric of relocated communities through culturally sensitive planning and programming.
- Facilitate community-led initiatives to preserve cultural practices, language, and intangible heritage, fostering a sense of identity and belonging in resettlement areas.

7. Capacity Building and Empowerment:

- Strengthen the capacity of local institutions, community-based organizations, and government agencies involved in relocation planning and implementation through training, technical assistance, and knowledge exchange.
- Empower displaced communities to actively participate in decision-making processes, advocacy, and collective action to address their needs and interests.

8. Conflict Resolution and Stakeholder Engagement:

- Promote constructive dialogue and conflict resolution mechanisms to address grievances, resolve disputes, and build trust among stakeholders.
- Foster partnerships and collaboration between government agencies, civil society organizations, local communities, and conservationists to jointly address challenges and achieve shared goals.

v. Monitoring and evaluation:

- Effective monitoring and evaluation mechanisms are needed to assess the socio-economic, environmental, and cultural impacts of relocation initiatives and ensure accountability and transparency in the resettlement process. Lack of monitoring can lead to unintended consequences and missed opportunities for improvement.
- Regularly review and adapt relocation strategies based on monitoring data, stakeholder feedback, and lessons learned, fostering continuous improvement and adaptive management.

7.2.1.2 Zone plan for unique/ Special habitat management

i. General:

This zone includes practically the entire area of core/ critical tiger habitat covering lateritic plateaus, cliffs, caves, rocky areas, burrows dens, waterfalls, wetlands and riparian zones and other unique features. This zone requires only stepped-up protection and monitoring. Drastic interventions for habitat are not required. Activities aimed to maintain the habitat in its present status need to be continued. Special focus should be ensured to safeguard unique habitats. No intervention of any kind is required in such areas and the purpose of putting them under a zone plan is to ensure complete tranquility.

Some Unique habitats are a function of plant communities and succession stages, which are primarily biological and they can be created and/or altered by the management interventions. The main unique habitats found in the STR areas are, namely, Lateritic plateaus, cliffs, caves, rocky areas, burrows, dens, waterfalls, wetlands and riparian zones etc. The special habitat such as the aquatic habitats is dynamic and productive areas which are often subjected to influence from natural and human factors. The aquatic habitats are located as eco-tones between dry terrestrial systems and permanently flooded aquatic systems such as lakes, etc. The major wetlands inside the Core zone are Koyna Reservoir i.e. Shivsagar formed by the Koyna Dam, which serve as vital habitats for various aquatic species within the sanctuary. Additionally, the Chandoli Dam Reservoir (Vasant Sagar) provides essential wetland habitat within Chandoli National Park.

In the beats having such unique habitat patrolling squad team should monitor during there patrolling of

the area and must record it on patrolling register. Forester and Range Forest Officers of the concerned area should visit such unique habitat whenever they visit the concerned beat.

ii. Objectives:

The prominent objectives of the management of Unique/special habitats are given, as follows.

- Implement appropriate protective measures and management interventions to safeguard, conserve, and maintain the pristine condition of special habitats.
- Direct efforts towards comprehending and identifying the ecological roles of these special habitats within the ecosystem of the STR.
- Utilize suitable habitats to preserve the genetic diversity of aquatic plants, natural communities, and endemic species. For instance, bats utilize caves for roosting, and small clawed otter found only in second and third order streams and riparian patches.
- Reduce the impact of adverse influences on these special habitats to minimize their negative effects.

iii. Issues and Problems:

- Absence of consistent monitoring for this distinctive habitat.
- Special habitats, though unique, often receive less attention and are not prioritized on the management agenda of wildlife managers.
- Lack of documentation regarding the flora and fauna species inhabiting the unique habitat.
- Uncertainty regarding the impact of management interventions on this distinct habitat.
- Insufficiency in developing a specialized protection strategy for the unique habitat.
- Limited research conducted on the unique habitat to comprehend its ecological significance.

iv. Strategies:

- Special habitats within the Sahyadri Tiger Reserve (STR) will be identified and demarcated. These habitats will undergo periodic monitoring and documentation.
- This includes the protection, maintenance, and regular monitoring of special habitats such as natural water holes to safeguard them against adverse influences.
- Snags, dead and fallen trees, and down woody material will remain undisturbed, except in cases where they pose a hazard to wildlife or obstruct human mobility. These elements play a vital ecological role in supporting diverse species of mammals, birds, invertebrates, fungi, mosses, and lichens.
- Protection from illegal activities and human disturbance, particularly safeguarding against forest fires, is imperative.

- Research on various aspects of unique habitats, with the assistance of experienced technical institutes and organizations, is essential. Any interventions in such habitats should be supported by a robust research foundation.
- Develop standardized protocols for monitoring unique habitats, including specific indicators, parameters, and sampling methods tailored to the characteristics of each habitat type.
- Identify key ecological indicators that reflect the health and functioning of unique habitats, such as species diversity, habitat structure, vegetation composition, soil quality, water quality, and habitat connectivity.
- Conduct baseline surveys and assessments to establish the current status of unique habitats, including mapping habitat boundaries, documenting species occurrences, and assessing habitat quality and threats.
- Implement regular field surveys and monitoring activities to track changes in habitat condition and ecological dynamics over time. Use a combination of field observations, transect surveys, remote sensing, and camera trapping to collect data on key indicators.
- Analyze collected data using appropriate statistical and spatial analysis techniques to identify trends, patterns, and correlations in habitat dynamics, species distributions, and ecosystem processes.

v. Monitoring and Evaluation:

- Monitoring and evaluating unique habitats involve systematic observation, data collection, analysis, and assessment of habitat condition and ecological processes. For this purpose, we should involve research institutions.
- Keep all the periodic observation in the register which is specially maintained for unique habitat.
- Periodic visits of a senior officer to a unique habitat to monitor the status of protection of such areas.
- Implement long-term monitoring programs to track the effectiveness of conservation interventions, assess habitat resilience to disturbances, and evaluate the success of habitat restoration efforts over extended time frames.

7.2.1.3 Zone Plan for Grassland/ Meadow Management:

i. General:

Grasslands serve as crucial foraging grounds for herbivores, which are primary prey species for tigers. Managing grasslands ensures an adequate prey base for sustaining healthy tiger populations. Grassland is essential for maintaining and increasing the herbivore population and therefore existing grassland need to be maintained scientifically and new meadows are to be developed wherever the natural factors are favorable. Effective grassland management includes efforts to control invasive plant species that can outcompete native vegetation, degrade habitat quality, and disrupt ecosystem dynamics. grassland management in tiger reserves is integral to maintaining habitat diversity, supporting wildlife populations, and

promoting the overall ecological integrity of these protected areas. Recently, research is done on grassland mapping and composition by students from College of Forestry, Dapoli. List of grasses and grassland is given in (Atlas Map No 114)

Table 7.4 : Major Grasses Recorded in Sahyadri Tiger Reserve

Sr. No.	Species name	Vernacular name	Palatability Grade
1	*Dicanthium annulatum*	Lahan marvel	A
2	*Dicanthium caricosum*	Motha marvel	A
3	*Iseilema laxum*	Moshan	A
4	*Anthraxon lancifolius*	Turda	B
5	*Apluda mutica*	Tambat	B
6	*Arundinella leptochloa*	Nir	B
7	*Bothriochloa pertusa*	Vaidya	B
8	*Cynadon dactylon*	Harali	B
9	*Eragrostis unioloides*	Ranpoha	B
10	*Oplismenus burmannii*	Kalken	B
11	*Oplismenus compositus*	Futana	B
12	*Paspalum scrobiculatum*	Kodo	B
13	*Sacciolepis indica*	-	B
14	*Setaria pumila*	Ranbajra	B
15	*Eulalia trispicata*	Tambit	C
16	*Heteropogon contortus*	Kusal	C
17	*Themeda quadrivalvis*	Motha bhongda	C
18	*Themeda triandra*	Lahan bhongda	C

Table No.7.5: Statement showing existing, proposal and suitable area for grassland and its percentage with a total area of TR;

Name of Range	Existing Grasslands (ha)	Potential/Proposed Grasslands (ha)	Total Suitable Area (ha)
Koyna Wildlife Division	777.65 Ha	150.00	927.65
Chandoli Wildlife Division	3706.14 Ha	600.00	4306.14
Total	**4483.80 Ha**	**750.00**	**5233.80**
% to total core area	**7.40**	**1.25**	**8.72**

Note: Potential or proposed Grasslands sites to be developed on land to be acquired after relocating remaining villages and on untreated land of already relocated villages.

Following are the three strategies under which we are given a different set of prescriptions for the management of grasslands /meadows:

1. Grassland management in the village rehabilitated area:
2. Management of old Grassland/Meadows:
3. Maintenance of Grass blanks/Linear strips/View line
4. Management of Fern-infested grassland

ii. Objectives:

- Maintain and conserve existing grasslands to preserve biodiversity and ecosystem integrity.
- Improve the quality and productivity of grassland habitats to support healthy populations of herbivores and other wildlife species.
- Establish new grass blanks or meadows in suitable locations as additional grasslands.
- Restore degraded or overgrazed grasslands to their natural state with native species through appropriate management practices.
- Manage habitats to achieve their potential carrying capacity.
- Preserve habitat diversity to support a variety of animal species.
- Provide cover and space for both prey and predators, in addition to food resources.
- Ensure adequate food resources for herbivores to sustain prey populations for carnivores, including tigers.
- Establish and maintain connectivity between grassland patches to facilitate the movement of wildlife within the reserve.
- Manage and control the spread of invasive plant species that may threaten the health and diversity of grassland ecosystems.
- Implement fire management strategies to prevent and control wildfires, which can threaten grassland habitats and wildlife.

iii. Issues and Problems:

- Grasslands are afflicted by the infestation of various weed species and unpalatable grasses.
- Anthropogenic grasslands are susceptible to natural impacts, leading to secondary succession characterized by increased tree density along forest edges and invasion of woody species into grassland areas.
- Fire exerts significant influence on the structure and function of grasslands.
- The utilization of fire as a management tool for grasslands may inadvertently facilitate the proliferation of weeds and unpalatable species within these ecosystems.
- The combined effects of grazing and fire have a deleterious impact on habitat quality.
- Overgrazing by wild animals or livestock contributes to habitat degradation in meadows.
- The encroachment of new regeneration of tree species, weeds, and brushwood further diminishes grassland extent.
- In several areas within Chandoli National Park, valuable grasslands are being encroached upon and heavily infested by ferns.

- Woody shrubs and small trees growing on grasslands and farm bunds of relocated villages need to be uprooted using a JCB. Otherwise, they regenerate vigorously every year after being cut above the ground.
- Forest fires can spread into Grassland's areas, exacerbating fire incidents.
- Some meadows are characterized by very small size.
- Inadequate regular monitoring and assessment impede effective management and conservation efforts.
- The invasion of non-native plant species poses a threat to native flora and fauna, disrupting ecological dynamics and diminishing habitat quality.

iv. Strategies:

Following are the three strategies to develop and to maintain grassland.

1. Grassland management in the rehabilitated area of the village
2. Management of Existing Grasslands/Meadows:
3. Maintenance of Grass blanks/Linear strips/View lines
4. Management of Fern-infested grassland.

1. Grassland management in the rehabilitated area of the village:

Twenty-nine villages were rehabilitated from STR. Now, there is 8 village inside the core. Rehabilitation of these villages gives 750.00 ha flat area of agriculture land, gaothan land and other private land. This area needs to be developed into an ideal grassland which will increase the population of prey species and consequently predators' number too. Regular maintenance of these grassland and monitoring on utilization and changes in grassland is extremely necessary.

- Demarcate the outer boundary with a red double line at breast height.
- Mark grids of one-hectare plots by laying down a baseline, similar to plantation work.
- Assign a unique code to each grid and prepare a map.
- Erect five-foot poles to mark the corner points of each grid.
- Survey each grid to assess the composition of palatable grass species, weeds, regeneration, and unpalatable grass species, recording percentages grid-wise.
- Estimate the percentage of weed and non-palatable species coverage in each grid (e.g., 25%, 50%, 75%, or 100%) based on the survey findings.
- Utilize GPS to delineate polygons representing areas with different percentages of weed coverage and submit them, along with the estimates, to the Deputy Director's office.
- Conduct a comprehensive habitat assessment to understand the current ecological conditions and functions.
- Implement habitat restoration projects to rehabilitate degraded areas, focusing on soil stabilization and

invasive species removal.

- Establish a robust monitoring program to track changes in ecosystem dynamics and species interactions.
- Use controlled burning practices judiciously to maintain grassland structure and composition on experimental basis and enhance species diversity, but closely monitor its effect on grass composition. If the impact proves positive, continue the practice.
- Control invasive species in the initial stage of spreading through manual removal and other effective methods.

Working:

- To prevent the spread of forest fires from outside towards the grassland, it is recommended to maintain a 12-meter fire line annually along the grassland's boundary. If funding is not available, a minimum of a 6-meter fire line should be maintained with the assistance of protection labor from APCs.
- Criss-cross roads within the grassland and a 6-meter fire line along the outer boundary are essential measures to safeguard the grassland from spreading fires.

- Weed eradication should be prioritized, with a grid-wise survey supervised by a grass ecologist/specialist or senior officers. Identified grids for weeding should be addressed before the weed species enter their flowering season. It is crucial not to eradicate weeds after they have flowered. All collected weeds should be gathered at a designated location, stacked with roots facing upward, and once dried, they should be burned.
- To control invasion of trees on the grassland, it is recommended to implement a phased approach for annual tree removal, reducing the seed source of tree species. Selective retention of a few fruit trees in scattered locations for shade and fruit production is advised. Furthermore, any new regeneration of the same species found around the trees should be uprooted annually.

1. Demarcate seed collection plots for different grass species and collect seeds annually. These seeds can be utilized for enrichment of other grasslands and for restoration of those grasslands where weed eradication has recently been carried out.
2. Document activities by taking photographs before and after work, and record them in a register and MB book.
3. Submit GPS tracks, utilization certificates, completion certificates, and photos of the work done with funding requests.

   Reporting:
4. Foresters should meticulously document all activities conducted within a grassland during a financial year in the "Grassland Improvement Register." These entries should be subjected to a minimum of 50% verification by Range Forest Officers (RFOs). This register should be checked by senior officers

their remarks and suggestions.

5. Monitoring and evaluation remarks should also be recorded in the same register.

2. Management of Existing Grasslands/Meadows:

Existing grassland should regularly monitor and maintained for their quality and take management works every year accordingly. Succession is ongoing process as grassland are initial stage of succession hence species composition bound to change due to succession. Hence manage should be always vigilant in case of grassland. Hence, every year few works like maintenance of fire lines along the boundaries of grassland should maintained, uprooting of weeds and new regeneration of woody species, seed collection of palatable grass species should be done. We have identified following two type of management activities for existing grasslands.

a. Regular maintenance of existing grasslands
b. Management of overgrazed grasslands

a. Regular maintenance of Existing Grasslands:

1. Survey and demarcation:

- As they are old meadows, they are already surveyed and demarcated, only paint marking carried out every year to fix the grassland boundary.
- Demarcation of outer boundary by painting red double line at breast height.
- Remaining survey and demarcation activities as per grassland management in Rehabilitated area.

2. Working:

- To prevent the spreading of a forest fire from outside, 12-meter fire line/ 6 meters should be maintained every year along the boundary of grassland.
- Criss-cross road and 12-meter fire line are essential to keep some part of meadows safe from spreading fire.
- Weed eradication efforts should be prioritized following a grid-wise survey supervised by a grass ecologist/expert or senior officer. Weeding in identified grids should occur before the flowering season of weed species. Avoid eradicating weeds after the flowering season. Gather all weeds in one location and burn them after drying.
- In cases where trees are abundant in the grassland, implement a phased removal plan annually to reduce the seed source of tree species. Maintain only a limited number of fruit trees scattered throughout for shade and fruit production. Additionally, uproot any new regeneration of these trees each year.
- Identify and demarcate species-specific grass seed collection plots annually to gather seeds for the

restoration of other grasslands.

- Bamboo plantation in small clusters in few corners of grassland are done to enrich the grassland.
- Capture photographs of all activities before and after completion of work, and insert them into the register and MB book.
- Submit GPS tracks, utilization certificates, completion certificates, and photos of the work done with funding requests.
- Use controlled burning practices judiciously to maintain grassland structure and composition on experimental basis and enhance species diversity, but closely monitor its effect on grass composition. If the impact proves positive, continue the practice.

3. Reporting:

All the management activities done in the grass strips in financial year should be noted in "Grassland Improvement Register" by forester and at least 50% should be checked by RFO's. It should be made available to senior officers for checking while on field visit. Monitoring and evaluation remarks also write in the same register.

b. Management of overgrazed grassland: The heavy grazing of wild animals and livestock and repeated trampling will degrade the grasslands, leading to the grasslands becoming non-productive. A brief rest period is necessary for them to regain its productivity. Hence, this area requires a different set of prescriptions.

1. Survey, Demarcation and marking:

- As they are old meadows, they are already surveyed and demarcated, only paint marking carried out every year to fix the grassland boundary.
- Demarcation of outer boundary by painting red double line at breast height.
- Remaining survey and demarcation activities as per grassland management in Rehabilitated area.

2. Working:

- Good grasslands are always under severe pressure of grazing by herbivores and need to be given relief for recuperation. Heavily grazed meadows should be identified first and earmarked for reducing the grazing pressure.
- Keeping this in view, the PA Management should continue the ongoing practice of erecting chain-link enclosures/wooden enclosure by using local material and shade net before the monsoon in some parts of the grasslands and allow them to rejuvenate for 2-3 growing seasons. It is depending on its level of overgrazing/suppression.

- The enclosures can be reopened for animals after 2-3 seasons based on the recuperation level of the grassland. This operation should be conducted annually in various overgrazed or suppressed grasslands.
- Regular checks of chain link fencing should be conducted to identify any damage caused by wild animals jumping or dashing against the fence. Immediate repairs should be carried out to prevent accidents involving wild animals.
- It is advisable to use thatches to cover fences to avoid the accidents of herbivores.
- Broadcast palatable grass seeds collected locally from grass seed plots in enclosed plot.
- Uproot new regeneration and weeds from enclosed grasslands each year.
- At least 6-meter fire line should maintain in and around the fenced area.

3. Reporting:

All the management activities done in the grass strips in financial year should be noted in "Grassland Improvement Register" by forester and at least 50% should be checked by RFO's. It should be made available to senior officers for checking while on field visit. Monitoring and evaluation remarks also write in the register.

3. Management of Grass blanks/Linear strips/View line:

To increase the grassland area in a tiger reserve, some pro-active management interventions are needed. STR have unevenly distributed grassland and concentrated at very few places. Hence, identification and development of the potential grassland areas are critical to increase percentage of grassland in STR. With the help of GIS and Field survey, identify the potential area which can be converted in to grass blanks/grass patches/linear grass stripes. Following are the potential areas for this category:

a. Grass patches/Grass Blanks: small grass patches are available among the forest area and found scattered throughout tiger reserve. They need to be identified and maintain it for grasses and herbaceous vegetation. Such grass patches are small in size from 0.1 ha to 1.0 ha. Such patches are demarcated by a single ring of red paint at breast height on the periphery and measured by taking GPS polygon. From this identified area, small regeneration and coppices, unwanted shrubs and weed should be removed with the help of either protection labors of on APCs or special labors for this purpose if financial provision permit.

b. Linear grass strips and view line: there are a lot of potentials to develop grass areas in linear strips along the road and as 12-meter fire lines maintained as compartment boundary/outer boundary. In STR, ther is scope for developing 10–20-meter linear strip along the road by removing undergrowth. It could be done only in the plain area or where slope is not more than <15 ^{0}. These stripes also act as 'view line' for animal sighting to tourists without scaring to the animals. This will not only improve visibility and reduce fire risk by eliminating combustible material but will also encourage the growth of tender palatable shoots which

will attract herbivores and thus provide visitors with a better wildlife viewing experience.

Reporting:

All the management activities done in the grass strips in financial year should be noted in "Grassland Improvement Register" by forester and at least 50% should be checked by RFO's. It should be made available to senior officers for checking while on field visit. Monitoring and evaluation remarks also write in the register.

4. Management of Fern-infested grassland:

In a few locations on gentle slopes and flat areas within the southern part of Chandoli National Park, grasslands are being infested with ferns. The dense growth and underground mat-like root system of ferns gradually suppress the grass, leading to the domination of the entire area. Consequently, urgent action is required to address this issue, as the availability of plain and gently sloping areas is limited in the park. In 2021, we conducted an experimental treatment on such grasslands, which yielded highly encouraging results with a success rate of 95%. The treatment method employed for fern-infested grasslands is outlined below:

1. Survey, Demarcation and marking:

- As they are old grasslands, they are already surveyed and demarcated, only paint marking carried out every year to fix the grassland boundary.
- Demarcation of outer boundary by painting red double line at breast height, if grasslands are not demarcated previously.

2. Working:

In the summer, typically in March, crisscross deep ploughing should be conducted on selected areas of grassland.

- Leave the ploughed area to dry in sunlight for one to two weeks.
- Manually gather all parts of ferns and their root-mats, piling them into heaps. Once dried, these heaps should be burned.
- Between November and January, locally sourced seeds of palatable grass species should be collected from grass seed plots and stored properly for in-house use in grassland management.
- In June, following the first shower of monsoon rains, broadcast the collected palatable grass seeds from the grass seed plots.
- If satisfactory results aren't achieved from seed broadcasting, spread locally available grass mats, runners, or rhizomes from the same area.
- If budget allows, enclose the treated area with any type of compound.
- Continuously uproot any new fern regeneration and weeds from the grasslands. This is done every year.
- Strictly prohibit grazing and forestry activities in these grasslands for the initial two years.
- Maintain a fire line of at least 6 meters in and around the grassland boundary.

- Weekly monitoring of these grasslands by Foresters, and monthly monitoring by Range Forest Officers (RFOs) and Assistant Conservator of Forests (ACFs), with observations recorded in the Grasslands Improvement register to enhance grassland treatments next time.

3. Reporting:

All the management activities done in these grasslands in financial year should be noted in "Grassland Improvement Register" by forester and at least 50% should be checked by RFO's. It should be made available to senior officers for checking while on field visit. Monitoring and evaluation remarks also write in the register.

v. Monitoring and Evaluation:

- Maintain Grassland improvement register for each grassland and grass strips.
- Keep control plot and regular observations about changes in the species composition should be noted down in the special register.
- Monitoring/control plot or grids: observe these plots regularly for changes in grassland composition, weed species or other regenerations.
- The need of second- or third-year work of same grassland should be duly verified by ACF's.

7.2.1.4 Zone Plan for Weed Eradication and Eco-Restoration:

i. General:

Recent observations have highlighted changes and degradation in the habitat, necessitating restoration efforts through the zone plan. The objective focuses on mitigating degradation, with strategies tailored to the type and extent of degradation. These strategies may include periodic closures, soil conservation planning, specialized planting initiatives, weed control, and water source management. Once restoration objectives are achieved, restored zones can be reallocated to other zones as needed.

- The following changes have been observed in the wildlife habitats of the STR landscape. The surface fires invading from the adjoining villages has resulted in a general degradation of grasslands, with poor soil cover and moisture regime, giving rise to an infestation of weed/unpalatable species like *, Lantena camara and eupatorium spp* etc.
- Illegal Grazing in fringes and in many isolated parts of the core due to zigzag boundary shape degraded the habitat and ground flora due to feeding and trampling. It happens heavily mainly during growing season i.e. in the rainy season. These areas then only support the weeds species.
- In the summer season, water becomes scarce and is available at a few places only. So, it is to some extent a limiting factor but water management has reduced its gravity to a considerable extent. Stream

treatment is very important to store water in-situ in nullah.

Following are the areas where restoration work is required in the core zone; it is categorized into the 2 headings to give different prescriptions for each category:

1. Weed Eradication and Restoration
2. Restoration of landslide area

1. Weed Eradication and Restoration:

i. General:

There is a strong notion amongst foresters, researchers, and environmentalists to remove the exotic species from the forests. It is also to be pointed out that the removal of weeds completely from the habitat might lead to various problems. For example, most of the forest is devoid of a second and third level of plant diversity to support smaller mammals, reptiles, and bird communities. Activities will be conducted based on both experiential knowledge and scientific principles, ensuring the incorporation of wildlife needs for shelter, cover, and breeding activities. Each activity will be meticulously planned and executed with scientific rigor to optimize its effectiveness in supporting wildlife conservation goals. Weed eradication theme is given for those areas which heavily infested in a large area with the same weed species and it has replaced native flora.

Weeds are aggressive colonizers that spread rapidly, out-competing for other local plant species. They are usually not very palatable to either wild herbivores or domestic stock. A plant species gets the label "weed" if it is unwanted and crowds out other, more desirable species. In a PA, a plant species is certainly unwanted if it is an exotic (not naturally occurring in the area). Indigenous plants become weeds if they "take over" large areas and reduce natural species diversity in the process. As compared to the tiger reserves and protected areas in central India, weed infestation in core zone of STR is very less. Regular monitoring is essential to prevent the spread of weeds over extensive areas. Without consistent monitoring efforts, there is a significant risk that weed infestations could proliferate unchecked, potentially leading to the degradation of habitats and negative impacts on native biodiversity. Some are the most common weeds in STR: *Lantana camara (exotic shrub), Parthenium (Exotic herb), Chromolaena odorata (exotic shrub), and Eupatorium adenophorum (exotic shrub),* and indigenous weeds are *Agiratum conyzoides*, etc.

Causes of weed infestation: The proliferation of weed in a protected area is the result of disturbance due to heavy grazing by livestock, repeated forest fire or abandoned cultivation. Any form of weed control is ultimately successful, only if the cause of the weed infestation is brought under control. Even then, weed eradication is seldom practical or economically feasible over large areas. Weeds have very effective mechanisms for seed dispersal and often regrow vigorously from a root cutting.

Advantages of weeds: On degraded slope where nothing else grows weeds are better than no vegetation cover. Lantana thickets sometimes offer the only sufficiently dense cover for wildlife and it may act as a barrier that prevents the passage of cattle and other livestock. Many birds eat lantana fruits.

The area infested with invasive weed species like *Lantana camara, Parthenium*, *Chromolaena odorata, Mikania micrantha, and Eupatorium adenophorum* etc. will be identified and map these areas by taking GPS polygons before starting the work and regular weed removal operations will be carried out to prevent further spreading and deterioration of habitat. Management practices are given under the following headings:

a) Weed Eradication
b) Restoration of the area after eradication

ii. Objectives:

The objectives of weed eradication and restoration of the area are as follows:

- Eliminate exotic weed species from the habitat.
- Restore eradicated areas with native species.
- Enhance the carrying capacity of the habitat by increase the productivity of habitats.
- Provide food and cover for wildlife in previously degraded area.
- Minimize the adverse impact of exotic weed species on native wildlife.
- Promote the regeneration of canopy species, such as Bamboo, fruit trees etc.
- Prevent the spread of weeds to valuable wildlife habitats, such as water sources and grassland areas.

iii. Issues and Problems:

Following are the issues and problems of Weed eradication and restoration of an area:

- Exotic weed species have replaced native ground flora, disrupting the natural balance of the ecosystem.
- Weed species out-compete native plants, hindering the natural restoration of habitats.
- The adverse effects extend to the regeneration of native tree species, shrubs, and grasses.
- Wildlife that feeds on weed species may suffer adverse health effects, further impacting the ecological balance of the habitat.
- Certain species, such as Lantana camara, utilize weed species as cover for refuge, breeding, and resting. Removal of weed species in one stretch may have temporary effects, highlighting the necessity for proper planning to ensure adequate cover for animals.
- Weed species exhibit hardy characteristics, including prolific seed production and rapid growth. Therefore, it's crucial to conduct eradication efforts before flowering and continue treatment of the same area for 2-3 years to effectively manage weed populations.
- Complete weed eradication requires ongoing treatment and continuous monitoring of the succession process within the affected plots to prevent reinfestation and promote the restoration of native vegetation.
- Weed eradication entails significant costs and labor-intensive efforts, with results often realized over an extended period.

- Merely cutting weeds above ground without thorough uprooting may lead to persistent issues. Close monitoring during uprooting operations is therefore essential to ensure effectiveness.
- Failure to restore weed-eradicated areas naturally may result in the reoccupation of the same or different weed species. Restoration efforts should be informed by scientific study and consultation with experienced officers to prevent recurrence.

iv. Strategies:

1. The survey, Demarcation, and marking:

- Conduct surveys to identify and demarcate weed-infested areas accurately.
- Mark the outer boundary with a red double line at breast height for clear demarcation.
- Regularly repaint the markings each year to maintain visibility and track changes in the treated area over time.
- Use GPS technology to create polygons along the boundary of the weed-infested area for precise mapping and monitoring purposes.

2. Working:

Weed control methods suitable for use in protected areas can be costly, and the benefits in wildlife habitat improvement may be slow to materialize. Typically, weed eradication efforts focus on addressing small pockets of infestation to prevent further spread. In the case of woody weeds, strategies may aim to expedite their replacement through natural succession processes. Weed eradication activities include:

- Address the root cause of weed infestation by implementing measures such as protecting the area from grazing and fire, which can contribute to weed proliferation.
- Prioritize uprooting weeds before they flower, particularly during August and September when soil moisture facilitates easier removal with less labor.
- Foster the growth of native species by creating conditions conducive to their development. Many weeds thrive in light, so promoting the growth of native plants that eventually shade out weeds can be effective, albeit gradual. Carefully clearing weeds around native woody plant seedlings and saplings accelerates natural succession toward a more diverse flora. Caution is advised to avoid unintentionally removing weed competitors when clearing large patches of weed.

3. Eradication methods:

- **Weed Eradication:** Annual weeds should be eradicated by uprooting them before seed maturity, allowing space for other plants, primarily grasses, to thrive. Experience in some Protected Areas (PAs) suggests that intensive weeding for 2-3 years is necessary for non-weed species to regain dominance. Regular assessment post-weeding is crucial, with grass seed broadcasting being beneficial in certain cases.
- **Woody Weed Control:** Woody weeds like lantana should be uprooted to prevent denser growth from root

coppice. Extraction planning should coincide with the monsoon season when soil is moist and soft. Laborers handling thorny weeds must be equipped with protective gloves. Extracted material should be collected, heaped, and burned to ensure thorough removal, with the heat from the fire effectively killing any remaining weed stumps underneath. In some areas, three successive removal operations may be necessary, each starting after a thorough assessment of the previous results.

- **Restoration Post- Eradication:** Selected species should be promptly planted after eradication to prevent weed re-establishment. Bamboo has shown successful results in some cases. For highly palatable species, protection from wild and domestic ungulates may be required during the initial stage. Alluvial soils with good fertility often support tall and dense grass species growth.

4. Reporting:

Record all grassland improvement activities conducted within a single financial year in the "Grassland Improvement Register," with entries made by the forester. At least 50% of these entries should be verified by Range Forest Officers (RFOs). The register should be accessible to senior officers, who can provide remarks and suggestions.

- Preserve photographs, measurement books (MB), and estimates at the RFO office, ensuring their availability for inspection during visits by senior officers.
- Include monitoring and evaluation remarks in the same register to document the effectiveness of grassland improvement efforts over time.

v. Monitoring and Evaluation:

To enhance the effectiveness of weed eradication and restoration efforts, the following steps should be implemented:

- Maintain a dedicated register, akin to the plantations register, to systematically track progress.
- Establish control plots and conduct regular observations to monitor changes in species composition.
- Implement monitoring plots or grids to observe variations in species diversity, weed presence, and new regeneration on a regular basis.
- Evaluate the vegetation succession in areas where weeds have been eradicated and devise restoration plans accordingly, which may involve seeding or planting native species as necessary.
- Justify the necessity for additional work in subsequent years based on thorough investigations and field observations. Final decisions should be made by Assistant Conservator of Forests (ACFs).

Eco-restoration of landslide-prone areas in the Western Ghats is a critical endeavor aimed at mitigating environmental degradation, enhancing ecosystem resilience, and promoting sustainable land use practices. Landslides pose significant threats to biodiversity, water resources, and human settlements in this ecologically sensitive region. Therefore, implementing effective eco-restoration measures is essential to address these challenges and restore the ecological integrity of landslide-affected landscapes.

2. Restoration of Land slide area:

A comprehensive restoration plan for landslide-prone areas in forested regions entails a multi-faceted approach aimed at stabilizing slopes, enhancing vegetation cover, and promoting ecosystem resilience.

- Soil Stabilization: Implementing measures to stabilize soil, such as contour trenching, vegetative cover establishment, and bioengineering techniques (e.g., live staking, brush layering)., to prevent erosion and reduce landslide susceptibility. Construct check dams, retaining walls, and erosion control structures to manage surface water runoff and reduce soil erosion.
- Vegetation Restoration: Undertake afforestation and reforestation initiatives to restore native vegetation cover, enhance biodiversity, and stabilize slopes. Prioritize the planting of indigenous tree species with deep root systems that help bind soil and prevent erosion. Establish vegetative buffers along ridgelines, stream banks, and other vulnerable areas to mitigate erosion and landslide risks.
- Hydrological Management: Implement measures to manage water flow, including the construction of water retention structures (e.g., gabion check dams, contour bunds) and the restoration of natural drainage channels. Promote infiltration and groundwater recharge through soil conservation practices, such as mulching, contouring, and organic matter addition.
- Monitoring and Evaluation: Establish monitoring protocols to assess the effectiveness of restoration interventions and track changes in slope stability, vegetation dynamics, and hydrological processes. Regularly evaluate project outcomes and adapt management strategies based on monitoring results, stakeholder feedback, and changing environmental conditions.

7.2.1.5. Zone plan for Relocation of Sambar and Chital:

i. General:

As per WII report, STR has very low tiger density or no resident tiger population as compared to carrying capacity of STR (refer chapter no. 03 for more detail). There are many reasons for low tiger density in STR; one of them is a low density of prey base except few pockets of STR

There is a need for an in-situ increase of prey-base with support of the relocation of prey base mainly Spotted deer and Sambar. The process of prey augmentation has already been initiated and at present 50 individual animals comprising 49 spotted deer and 1 Sambar have been translocated from Sagareshwar WLS and released inside the 8.0 ha. 'Conservation Breeding Enclosure Facility' created at Zolambi Beat in Dhebewadi range of Chandoli Wildlife Division. Coordination with Katraj zoo and Solapur Zoo is also underway. Both these areas will provide a founder breeding population of Chital and Sambar. There is also possibility to translocate chital wild to wild from SGNP, TATR, BTR and PTR.

ii. Objectives:

- Enhance prey populations to support the carrying capacity of tigers, the apex predators and co-predator of the Sahyadri Tiger Reserve (STR).
- Optimize the utilization of available habitats within the reserve.
- Enhance the ecotourism value of Sahyadri Tiger Reserve, including Koyna Wildlife Division and Chandoli Wildlife Division.
- Alleviate predation pressure on the resident populations of Sambar and spotted deer.
- Ensure uniform utilization of potential habitats that currently lack these species.
- Build up Prey and Predator population up to carrying capacity of STR.

iii. Issues and Problems:

- In-situ growth of these species is difficult due to high predation pressure.
- Tiger movement is very less in these areas, might be due to low prey base.
- In-situ increase in the population of these animals will take a very long time as the existing population number is very less and some part is devoid of presence.
- Concrete and Systematic plan for continuous translocation of prey is needed and need to do translocation regularly, which is lacking now.
- Absence of grazer species like Chital as STR especially Core zone of Chandoli Wildlife Division has extensive Grasslands.

iv. Strategies:

- Develop a plan of the relocation of sambar and spotted deer and protocol for the implementation of it.
- Take required permission to capture, transport and release of these animals.
- The plan should explain source area, capturing methodology, transportation mode, all Veterinary aspects like capture method, health screening, emergency medicine and treatment etc., identification of release site, monitoring after the release of animal for continuous at least five years.
- Prepare a time table for implementation of the plan and appoint a Nodal Officer for this mission.
- Identify the suitable habitat to release of both species with help of GIS inputs.

v. Monitoring and Evaluation: Monitoring and evaluation as per protocol fixed for the relocation of Sambar and spotted deer. FD and DD should have taken weekly review of progress.

7.2.1.6 Zone Plan for Re-introduction of locally extinct species, tiger etc.

i. General:

The Sahyadri Tiger Reserve, nestled amidst the picturesque landscapes of the Western Ghats, stands as a bastion of biodiversity and a testament to our natural heritage. However, the once-thriving population of tigers that once roamed these forests has dwindled to extinction locally, leaving a poignant

void in the ecosystem. The absence of tigers, apex predators crucial for maintaining ecological balance, has disrupted the intricate web of life in the Sahyadri region, triggering cascading effects on wildlife populations, habitat dynamics, and ecosystem resilience.

The need for tiger reintroduction in the Sahyadri Tiger Reserve emerges as a compelling imperative to restore the ecological integrity of this iconic landscape and rekindle the spirit of wilderness that once reverberated through its verdant valleys and mist-clad peaks. Tiger reintroduction offers a beacon of hope, a transformative opportunity to revitalize degraded habitats, reestablish ecological processes, and secure the future of biodiversity in the Western Ghats.

ii. Objectives:

- Restore Ecological Balance: Reintroduce tigers to restore ecological balance and reestablish predator-prey dynamics crucial for maintaining healthy ecosystems in the Sahyadri Tiger Reserve.
- Enhance Biodiversity: Augment biodiversity by reintroducing tigers, apex predators that play a pivotal role in regulating prey populations and shaping habitat structure and diversity.
- Preserve Genetic Diversity: Reintroduce tigers to preserve genetic diversity and prevent the loss of unique tiger populations, contributing to the long-term viability of the species.
- Promote Tourism and Education: Utilize tiger reintroduction as a flagship conservation initiative to promote eco-tourism, raise awareness about tiger conservation, and foster public support for wildlife protection efforts.
- Support Socio-Economic Development: Generate socio-economic benefits for local communities through increased tourism revenue, job creation, and capacity-building opportunities associated with tiger conservation and eco-tourism initiatives.
- Strengthen Landscape Connectivity: Improve landscape connectivity by reintroducing tigers to the Sahyadri Tiger Reserve, facilitating genetic exchange, and enhancing the resilience of tiger populations in the Western Ghats.
- Contribute to Global Conservation Efforts: Contribute to global tiger conservation efforts by reintroducing tigers to suitable habitats within the Sahyadri Tiger Reserve, thereby expanding the range and distribution of tigers in India.
- Ensure Sustainable Management: Ensure the sustainable management of tiger populations through adaptive management strategies, habitat restoration initiatives, anti-poaching measures, and community engagement programs aimed at fostering coexistence between tigers and humans.

iii. Issues and problems:

- Prey Availability: Ensuring an adequate prey base, including suitable wild prey species such as deer and wild pig, is essential to support reintroduced tiger populations. Spotted deer translocation is not sufficient

and need to translocate it in large scale. However, fluctuations in prey abundance and competition from other predators could pose challenges to maintaining sufficient prey densities.

- Human-Wildlife Conflict: Reintroducing tigers into areas where human-wildlife conflict is prevalent may exacerbate tensions between local communities and wildlife, leading to retaliatory killings and livestock depredation, unless effective mitigation measures are implemented.
- Genetic Considerations: Reintroducing tigers into the Sahyadri Tiger Reserve requires careful genetic monitoring to prevent inbreeding and maintain genetic diversity within the tiger population.
- Poaching and Illegal Trade: Poaching for tiger parts and illegal wildlife trade remain significant threats to tiger populations globally. Reintroduced tigers may be vulnerable to poaching, especially in areas with inadequate law enforcement and monitoring capacity.
- Insufficient Staff: Staff strength is comparatively very less than other tiger reserve of Maharashtra state, it hampers overall monitoring and protection of tiger reserve.

iv. Strategies:

- Habitat Assessment and Restoration: Conduct comprehensive habitat assessments to identify suitable areas for tiger reintroduction, considering factors such as prey availability, habitat connectivity, and human-wildlife conflict risks. Implement habitat restoration initiatives, including reforestation, habitat management, and water source augmentation, to enhance habitat quality and suitability for tiger reintroduction.
- Prey Augmentation and Management: Implement prey augmentation programs to increase prey densities mainly Spotted deer and Sambar translocation. Implement sustainable prey management strategies to maintain optimal prey populations.
- Soft Release Facility: The process of capturing, transporting, and releasing tigers for reintroduction can cause stress and trauma to individuals, leading to potential health issues, behavioral problems, or reduced survival rates post-release. Hence, creating soft release facility for tiger reserve is very much required. Soft release facility is now created at Tanali beat in Chandoli Range of Chandoli Wildlife Division.
- Anti-Poaching and Law Enforcement: Strengthen anti-poaching and law enforcement efforts to protect reintroduced tigers from poaching and illegal wildlife trade. Enhance patrolling, surveillance, and intelligence gathering activities in reintroduction areas, deploying trained anti-poaching squads and utilizing modern technology such as camera traps and drones for monitoring and enforcement.
- Human-Wildlife Conflict Mitigation: Develop and implement comprehensive human-wildlife conflict mitigation plans to address potential conflicts between reintroduced tigers and local communities. Deploy measures such as Create well trained and equipped Rapid Response Team (RRT), organize Preliminary

Response Team (PRT)in each village and give training to all PRT members, compensation schemes for livestock losses, community-based early warning systems, and livelihood diversification programs to reduce human-wildlife conflicts.

- Community Opposition: Reintroducing tigers into areas where local communities have concerns or objections may face opposition, skepticism, or resistance, particularly if perceived risks to human safety, livelihoods, or cultural practices should adequately addressed or mitigated.
- Community Engagement and Support: Foster positive relationships with local communities through participatory decision-making, dialogue, and collaborative conservation initiatives. Involve local communities in tiger conservation efforts, providing opportunities for livelihood support, eco-tourism development, and capacity-building programs to promote coexistence and garner community support for tiger reintroduction.
- Ensuring the long-term sustainability of tiger reintroduction efforts in the Sahyadri Tiger Reserve necessitates ongoing commitment, adaptive management, and stakeholder engagement to address emerging challenges, evaluate program effectiveness, and promote coexistence between tigers and humans.
- Public Awareness and Education: Conduct public awareness campaigns and educational outreach programs in buffer zone villages and schools to raise awareness about the importance of tiger conservation, the ecological role of tigers, and the benefits of tiger reintroduction. Engage with schools, colleges, media outlets, and community organizations to disseminate information, promote conservation values, and mobilize public support for tiger reintroduction efforts.
- Research and Collaboration: Collaborate with scientific institutions, research organizations, and conservation NGOs to conduct research on tiger ecology, behavior, and population dynamics. Support scientific studies, ecological research, and monitoring initiatives to improve understanding of tiger reintroduction processes, inform management strategies, and contribute to global tiger conservation knowledge.
- Long-Term Commitment and Sustainability: Ensure long-term commitment and institutional support for tiger reintroduction programs, securing funding, resources, and political backing for sustained conservation efforts. Foster partnerships with government agencies, NGOs, academic institutions, and local stakeholders to build capacity, share expertise, and leverage collective action for the successful conservation and management of reintroduced tiger populations in the Sahyadri Tiger Reserve.

By implementing these concrete strategies in a coordinated and holistic manner, tiger reintroduction programs in the Sahyadri Tiger Reserve can maximize the likelihood of success, contribute to the recovery of tiger populations, and promote the proactive conservation measure in this iconic landscape.

v. Monitoring and Evaluation:

- With guidance of WII, establish a robust monitoring and evaluation framework to track the progress and success of tiger reintroduction efforts. Implement regular monitoring of tiger populations, prey densities, habitat conditions, human-wildlife conflicts, and socio-economic impacts, using standardized protocols and indicators to assess program effectiveness and inform adaptive management decisions.

7.2.1.7 Zone Plan for Eco-tourism:

i. General:

The primary objective of managing the Sahyadri Tiger Reserve (STR) is the in-situ conservation of tigers and their habitat. While eco-tourism emerges as a secondary outcome, it is essential to recognize that traditional tourism practices are not suitable for wildlife areas. Instead, eco-tourism should be viewed as a conservation tool rather than a revenue-generating business strategy.

The concept of eco-tourism aligns with the principles established by the International Eco-Tourism Society (TIES), which defines it as "responsible travel to natural areas that conserves the environment and improves the well-being of local people." In line with this definition, eco-tourism activities within the STR should adhere to certain principles:

- **Minimize Impact on Wildlife Habitat:** Eco-tourism activities should be designed and managed to minimize disruption to the natural habitat of wildlife within the reserve.
- **Build Environmental and Cultural Awareness and Respect:** Visitors should be educated about the importance of preserving the environment and respecting the cultural heritage of the area.
- **Provide a Positive Experience for Visitors and Hosts:** Eco-tourism experiences should aim to create positive interactions between visitors and local communities, enhancing mutual understanding and appreciation.
- **Provide Financial Benefits and Empowerment for Local People:** Revenue generated from eco-tourism should directly benefit local communities, empowering them economically and incentivizing conservation efforts.
- **Raise Sensitivity to Host Countries' Political, Environmental, and Social Climate:** Eco-tourism initiatives should promote awareness and sensitivity to the political, environmental, and social contexts of the host region, fostering responsible travel practices.

By adhering to these principles, eco-tourism can serve as a valuable tool for achieving conservation goals within the Sahyadri Tiger Reserve, contributing to the protection of its rich biodiversity while also benefiting local communities and promoting sustainable development.

ii. Objectives:

In redefining the eco-tourism approach within the Sahyadri Tiger Reserve (STR), a comprehensive framework emerges, emphasizing several key principles:

- **Highlighting Heritage Values:** Central to this approach is the showcasing of STR's wilderness as a repository of both natural, historical and cultural heritage as STR is UNESCO's World Natural Heritage Site declared in the year 2012. By emphasizing its significance in shaping the region's identity and history, visitors gain a deeper appreciation for its intrinsic value.
- **Promoting Nature, Environmental and Cultural Awareness:** Intertwined with eco-tourism initiatives is the integration of nature education programs. These efforts not only foster understanding and respect for the nature and environment but also highlight the importance of local traditions, enriching the visitor experience.
- **Providing Livelihood Opportunities:** A cornerstone of sustainable eco-tourism is ensuring direct benefits to local communities. By creating employment and income-generation opportunities, eco-tourism becomes a vehicle for equitable benefit sharing and fosters sustainable development within the region.
- **Prioritizing Wilderness Conservation:** Amidst eco-tourism endeavors, a steadfast commitment to wilderness conservation remains paramount. By focusing on preserving biodiversity and ecosystem integrity within ecologically sensitive landscapes, STR safeguards its natural resources for future generations.
- **Capacity Building for Local Communities:** Empowering local communities is essential for the success of eco-tourism initiatives. Through investment in capacity-building programs, communities are equipped to play a pivotal role in planning, providing, and managing eco-tourism facilities, fostering a sense of ownership in conservation efforts.
- **Regulating Eco-Tourism:** Upholding stringent regulations is fundamental to ensuring responsible eco-tourism practices. By aligning with standards set by the National Tiger Conservation Authority (NTCA) and pertinent judgments of the Honorable Supreme Court, eco-tourism activities within the core zone are conducted ethically and sustainably, minimizing adverse impacts on wildlife and habitats.

By adhering to these principles, the Sahyadri Tiger Reserve not only maximizes the positive impacts of eco-tourism but also safeguards its natural and cultural heritage, securing a legacy of conservation for future generations.

iii. Issues and Problems:

- Regularly violation of rules and regulations laid for ecotourism purpose.

- Resort mushrooming started in Amba range which may create disturbances for the movement of tiger and other wildlife. (Promotion to homestays in Amba, Udgiri, Ukhlu and other part of STR villages is needed).
- Go and No-Go zone for tourism infrastructure development is required clarity.
- As per existing rules, resorts in the buffer zone are not giving Conservation fee to TCF.
- Safari vehicles are not sufficient in number.
- Level of knowledge about local wildlife needs to increase in eco-guides and eco-guide number are not sufficient.
- Plastic litter is the problem which needs to be addressed by making strict rules.
- Speed, parking and movement of tourist/safari vehicles needs to be properly regulated.
- Safety of boat safari is most needed. Safari vehicles are not available.
- Basic facilities at eco-tourism are lacking.
- Modern Nature Education Centre and Ecotourism Complexes are yet not developed in STR.
- Online booking system, social media promotion, website is not available.
- Local involvement in Eco-tourism is not much.

iv. Strategies:

To achieve the above principal in letter and spirit, the detailed Eco-Tourism Plan which provides for the strategies to be adopted as per NTCA guidelines dated 15th October, 2012 is prepared and with approval of LAC, attached to TCP as Volume – I, Part-4.

The tourist visitation within the core area would be strictly following the guidelines issued by the NTCA (2013). The details regarding zonation, carrying capacity computation and related aspects are covered in Chapter 11 of Volume-I, Part-4.

v. Monitoring and Evaluation:

To ensure responsible eco-tourism practices within the core zone of the Sahyadri Tiger Reserve (STR), a robust monitoring and enforcement system is essential. Key measures include:

- **Establishing a Proper Monitoring System:** Implementing a comprehensive monitoring system to regulate eco-tourism activities within the core zone. This system would ensure adherence to established regulations and guidelines, minimizing the impact on wildlife and habitats.
- **Deploying a Special Eco-Tourism Patrol Team:** Forming a dedicated patrol team tasked with monitoring and enforcing eco-tourism regulations during designated periods. This team would actively patrol the reserve, addressing any violations promptly to maintain ecological integrity.
- **Implementing a Feedback and Complaint Redressal System:** Establishing a structured feedback mechanism for tourists to provide input on their experiences and report any concerns. A responsive

complaint redressal system would address grievances swiftly, improving visitor satisfaction and ensuring accountability.

- **Empowering the Local Advisory Committee:** The Local Advisory Committee would play a pivotal role in overseeing eco-tourism facilities within and around the reserve. Through biannual inspections, they would assess various aspects such as environmental clearance, coverage area, ownership, infrastructure, and staffing. This proactive approach would enable the committee to identify any shortcomings and recommend mitigation or retrofitting measures as necessary.
- **Monitoring Tour Operators' Activities:** In addition to facilities, the Local Advisory Committee would regularly monitor the activities of tour operators. This oversight ensures that tour operators adhere to guidelines and do not disturb wildlife while conducting tours within the tiger reserve. By maintaining vigilance over tour operators, the committee safeguards the well-being of both wildlife and visitors.

By implementing these measures, the Sahyadri Tiger Reserve can effectively regulate eco-tourism activities within its core zone, promoting sustainable practices while preserving its rich biodiversity for future generations.

7.2.1.8. Zone plan for Administration:

i. General:

Within this zone fall all administrative facilities, which are scattered across various locations, yet insufficient. The administrative infrastructure of Koyna Wildlife Division and Chandoli Wildlife Division forms the administrative zone of the Tiger Reserve. Offices and staff quarters are situated within this zone, which serves as the public interface area requiring proper landscaping and regular maintenance. Details about the administrative infrastructure are given in (Annexure 48,49 and 50)

ii. Objectives:

- Enhance infrastructure for both office and residential spaces for all staff, ensuring optimal facilities and a healthy work and living environment.
- Provide basic amenities and services to staff and their families residing in remote areas.
- improve the public interface of the Tiger Reserve and Forest Department, as the administrative zone receives visits from numerous individuals.
- To encourage and motivate a staff to reside in our facilities.

iii. Issues and Problems:

Within the administrative zone of the Sahyadri Tiger Reserve (STR), several infrastructure-related issues and problems have been identified, impacting both functionality and aesthetics. These include:

- **Insufficient Funding for Maintenance:** The lack of adequate funding makes it challenging to carry out regular maintenance of infrastructure, leading to deterioration over time.

- **Poor Cleanliness:** Especially evident during the rainy season, the lack of cleanliness around colonies, office premises, and other facilities detracts from the overall environment and poses hygiene concerns.
- **Neglected Painting and Preservation:** Many buildings and structures lack regular painting and preservation, diminishing their longevity and aesthetic appeal.
- **Inconsistent Colors:** Infrastructure elements are painted in different colors, often failing to blend harmoniously with their natural surroundings, disrupting the visual coherence of the area.
- **Delayed Maintenance:** Timely maintenance is not conducted, leading to increased costs and the exacerbation of infrastructure deterioration over time.
- **Lack of Basic Amenities:** Basic amenities are lacking in both colony and administrative premises, impacting the quality of life for staff and officers.
- **Inadequate Landscaping:** The absence of sufficient landscaping at residential and office premises detracts from the aesthetic appeal and fails to optimize environmental benefits.
- **Limited Recreational Facilities:** There is a dearth of playing areas and recreational facilities within colonies, limiting opportunities for relaxation and leisure activities for residents.
- **Lack of Security to campus:** Staff is residing in colony with their family need to give surety of security which is lacking at many colonies. Our colonies are always situated in remote location hence 24x7 security is required for colony.
- **Lack of basic facilities:** As our colonies are always located in remote locations hence, basic facilities like education, market and medical facilities are not available.

Addressing these infrastructure-related challenges is crucial for enhancing the functionality, appearance, and overall quality of life within the administrative zone of the Sahyadri Tiger Reserve. Through targeted interventions and resource allocation, these issues can be mitigated, ensuring a conducive environment for staff, officers, and visitors alike.

iv. Strategies:

To optimize the physical infrastructure and facilities within the administrative zone of the Sahyadri Tiger Reserve, strategic planning and adherence to specific guidelines are paramount. Here are several key strategies that should be implemented:

- **Develop Maintenance Protocols:** Establish a comprehensive protocol and 'schedule for the maintenance' of existing infrastructure, clearly outlining duties and responsibilities to ensure upkeep and longevity. Schedule of Maintenance for infrastructures in STR is given in Annexure no. 7.5
- **Implement Unique Coding System:** Assign a unique code to each infrastructure element, facilitating efficient identification and tracking. For example, STR/qtr-I/1 for STR/quarter type-I/ Number-1.
- **Establish New Colonies:** In wildlife areas, staff are often required to stay at anti-poaching camps located in remote regions where basic facilities are lacking. Therefore, it is prudent to establish a colony

for all range staff in the nearest town where essential amenities such as education, medical services, and markets are accessible. The presence of all staff families in this colony fosters a sense of security, as mutual support and assurance are readily available among the members. This setup also enables staff to focus on their work in the jungle without undue concern, knowing that their families are safe and supported in the colony.

- **Advance Financial Planning:** Engage in advance planning to secure sufficient funding for infrastructure maintenance and improvement, exploring diverse funding sources to meet budgetary requirements effectively.
- **Regular Cleanliness Drives:** Conduct regular cleanliness drives across all infrastructure areas, utilizing both available resources and voluntary efforts ('shramdan') to maintain cleanliness and hygiene standards.
- **Consistent Painting Maintenance:** As this area belong to heavy rainfall area, ensure regular painting of all infrastructure elements in adherence to existing norms, with colors chosen to blend seamlessly with the natural surroundings. Maintain uniform color codes throughout the Tiger Reserve for visual coherence.
- **Timely Repairs:** Promptly address minor repairs as they arise, preventing further deterioration and minimizing maintenance costs over time.
- **Utilize Technical Maintenance Teams:** Engage specialized technical personnel (civil engineer) through annual maintenance contracts to provide on-demand repair services, ensuring timely and efficient resolution of infrastructure issues.
- **Strategic Landscaping:** Implement well-planned landscaping initiatives within the administrative zone to enhance aesthetics and environmental quality, complementing the natural surroundings.
- **Create Recreational Facilities:** Develop recreational amenities such as sports facilities and children's parks within staff colonies, catering to the well-being and leisure needs of staff families.
- **Design Sensitization Spaces:** Incorporate open spaces and utilize blank walls of infrastructure to convey messages promoting wildlife conservation, fostering visitor awareness and engagement in conservation efforts.

By implementing these strategies, the Sahyadri Tiger Reserve can effectively manage and enhance its administrative infrastructure, ensuring functionality, durability, and alignment with conservation objectives.

v. Monitoring and Evaluation:

- Maintain different registers for a different type of infrastructure to keep records of maintenance e.g. Building register

- Regular visit of senior officers to different infrastructures and check the condition and maintenance work have done.
- Visits by a senior officer (at least ACF) while work is going on, to check the quality and to give suggestions.

7.2.1.9: Zone Plan for Removal of Exotic Plantation:

In STR Larger area planted by exotic tree at the time of construction of reservoir of Koyna. Removing exotic plant species from a wildlife area is a crucial step in habitat restoration and conservation. It also suggested in 3 consecutive cycles of Management Effectiveness Evaluation. Here are some key benefits and methods:

Objectives

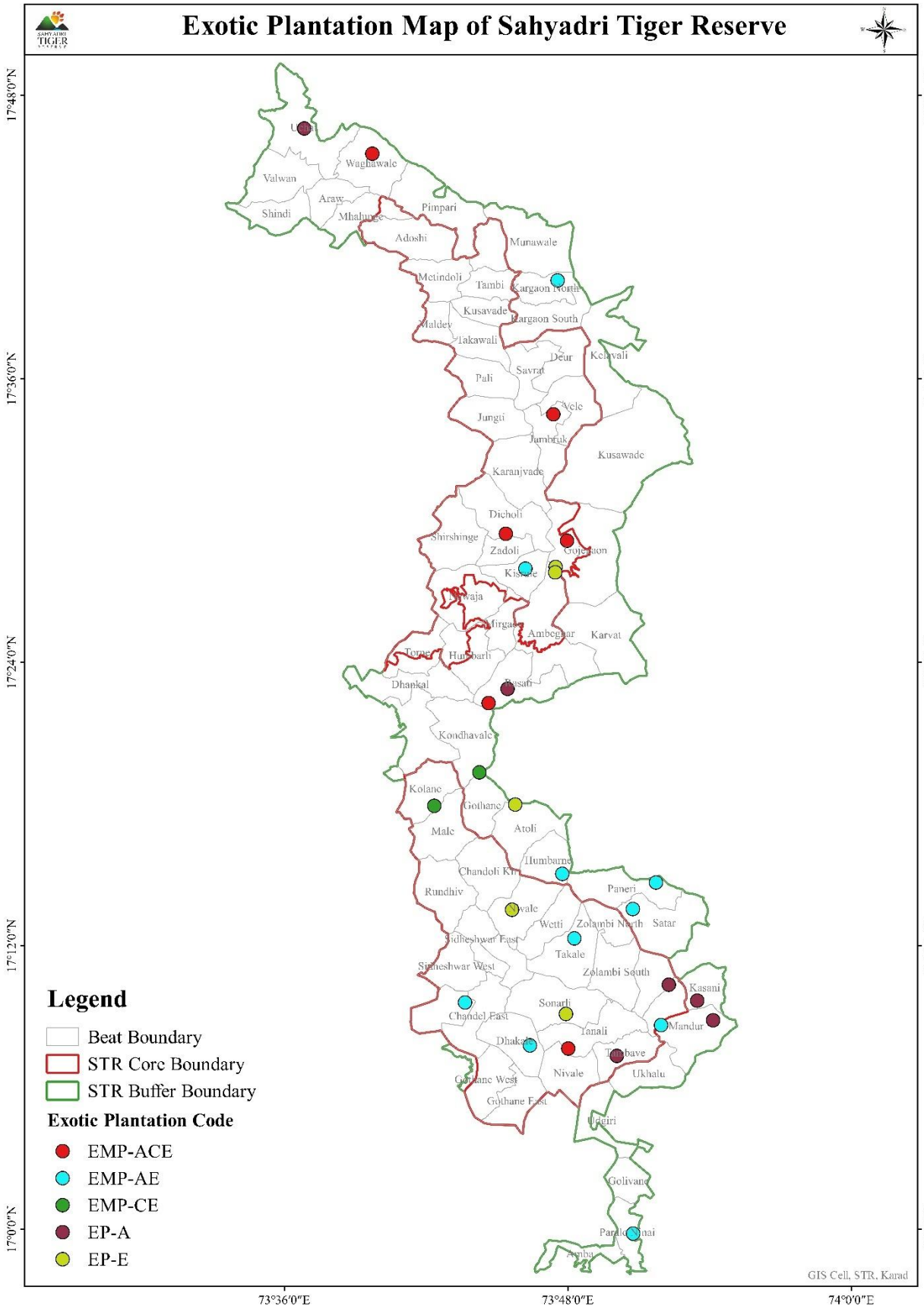
1. **Habitat Restoration:** Exotic plant species often outcompete native vegetation, reducing biodiversity and altering ecological processes. Removing them helps restore the natural habitat, providing better food and shelter for native wildlife.
2. **Improved Ecosystem Functioning:** Native plants are usually better adapted to local conditions and support a wider range of wildlife, including insects, birds, and mammals. Their removal can enhance nutrient cycling, soil stability, and water retention.
3. **Protection of Endangered Species:** Many exotic plants can displace native species that are critical for the survival of endangered or threatened animals.

Table No. 7.6 Area table under exotic plantations

Sr. No.	Protected area	Range	Beat	Plantation code	Area (Ha)	DD-Latitude	DD-Longitude
1	Koyna WLS	Bamnoli	Kargaon	EMP-AE	5.65	17.6692	73.7928
2	Koyna WLS	Bamnoli	Uchat	EP-A	5.37	17.7764	73.6141
3	Koyna WLS	Bamnoli	Vele	EMP-ACE	49.7	17.5748	73.7898
4	Koyna WLS	Bamnoli	Waghawale	EMP-ACE	3.32	17.7586	73.6621
5	Koyna WLS	Koyna	Ambeghar	EP-E	127	17.4671	73.7914

6	Koyna WLS	Koyna	Dicholi	EMP-ACE	2.64	17.4905	73.7563
7	Koyna WLS	Koyna	Karvat	EP-E	32	17.4633	73.7911
8	Koyna WLS	Koyna	Kisrule	EMP-AE	104	17.4659	73.7701
9	Koyna WLS	Koyna	Koyna	EMP-ACE	12.9	17.3711	73.7441
10	Koyna WLS	Koyna	Kusawade	EMP-ACE	105	17.4856	73.7995
11	Chandoli NP	Chandoli	Chandel West	EMP-AE	98	17.1599	73.7275
12	Chandoli NP	Chandoli	Dhakale	EMP-AE	6.84	17.1296	73.7733
13	Chandoli NP	Chandoli	Golivane	EMP-AE	11	16.9969	73.8461
14	Chandoli NP	Chandoli	Khundalapur-Zolambi	EMP-AE	14.3	17.1439	73.8658
15	Chandoli NP	Chandoli	Mandur buffer	EP-A	96.4	17.1473	73.9025
16	Chandoli NP	Chandoli	Nandoli	EP-A	48.6	17.1724	73.8713
17	Chandoli NP	Chandoli	Nivale kolhapur	EMP-ACE	47	17.1274	73.8003
18	Chandoli NP	Chandoli	Sonarli	EP-E	50	17.1518	73.7987
19	Chandoli NP	Chandoli	Takale	EMP-AE	12.6	17.2051	73.8046

20	Chandoli NP	Chandoli	Tambave	EP-A	59.3	17.1222	73.8346
21	Chandoli NP	Chandoli	Vetti	EP-E	49.7	17.2253	73.7607
22	Chandoli NP	Dhebewadi	Atoli	EP-E	13	17.2995	73.7629
23	Chandoli NP	Dhebewadi	Humbarne	EMP-AE	22.5	17.2506	73.7961
24	Chandoli NP	Dhebewadi	Karale	EMP-AE	10.2	17.2445	73.8622
25	Chandoli NP	Dhebewadi	Kasani	EP-A	27.2	17.1612	73.8913
26	Chandoli NP	Dhebewadi	Paneri	EMP-AE	58.6	17.2258	73.8459
27	Chandoli NP	Helwak	Govare	EMP-CE	7.3	17.3222	73.7376
28	Chandoli NP	Helwak	Kolane	EMP-CE	9.53	17.2986	73.7058
29	Chandoli NP	Helwak	Rasati	EP-A	8.17	17.3811	73.7575



Map No. 7.1 Map of exotic plantations

Methods for Removal:

1. **Manual Removal:** Hand-pulling or digging out exotic plants is effective for small infestations or areas with sensitive native species.
2. **Mechanical Control:** Using tools like brush cutters, mowers, or chainsaws can be necessary for larger or more established exotic plants.
3. **Biological Control:** Introducing natural predators or pathogens specific to the exotic plant species can sometimes be an option, but this approach requires extensive research to avoid unintended consequences.

Challenges:

1. **Re-Growth:** Exotic plants may have extensive root systems or seeds that can remain dormant for years, requiring ongoing monitoring and management.
2. **Impact on Native Species:** Care must be taken to avoid inadvertently harming native plants and animals during removal efforts.
3. **Cost and Resources:** Depending on the size of the area and the extent of the infestation, removal efforts can be labor intensive and expensive.

In conclusion, while removing exotic plant species from wildlife areas can be challenging, it is a critical step in restoring and maintaining healthy ecosystems. It requires careful planning, proper techniques, and ongoing monitoring to ensure long-term success and biodiversity conservation.

7.2.2 Theme Plan:

Whatever the identified zones, at times they may not cover the entire area within the core area boundary. The remaining area, if any needs to be designated as 'Multiple Habitat Management Strategy Zone' and managed as per general habitat management approach. It is essential to distinguish such **azonal** requirements and a sub-plan for each of such requirements needs to be prepared to ensure a comprehensive treatment that refers to the entire area across the zones. Such sub-plans are called **Theme Plans**.

Each theme plan has to be self-contained. It would need to have its own specific objective/s, issues and problems related to the specific theme plan and strategies need to be formulated with the provision for monitoring and evaluation.

The plan is better organized this way for the planner and the manager. As in the case of zone plans, theme plans need to begin with objectives and end with monitoring and evaluation. For applying strategies and undertaking monitoring, issue and problem in such zones should be identified and then strategies

specific details of targets, areas, timing/period, techniques are essential. Evaluation procedures need to be laid down. A theme plan should link all concerned zones for application of its prescriptions. If there are any special provisions for any particular area or zone such reference must specifically be made.

The following theme plans (Overlapping) are being proposed for Sahyadri Tiger Reserve.

7.2.2.1 Theme Plan for Water management

7.2.2.2 Theme Plan for Forest Protection

7.2.2.3 Theme Plan for Forest Fire Protection

7.2.2.4 Theme Plan for Tiger/Wildlife and habitat Monitoring

7.2.2.5 Theme Plan for Communication, and Road network

7.2.2.6 Theme Plan for Wildlife Health and Surveillance and Management

7.2.2.8 Theme Plan for Eco-Development

7.2.2.8 Theme Plan for Staff development/Capacity Building

7.2.2.9 Theme Plan for retrofitting measures

7.2.2.10 Theme Plan for Herpetofauna Conservation

7.2.2.11 Theme Plan for Climate Change Mitigation

7.2.2.12 Theme Plan for Monitoring of World Natural Heritage Site (WHS)

7.2.2.13 Theme Plan for conservation and monitoring Endemic species.

7.2.2.14 Theme Plan for Monitoring of Feral Cattle in STR.

7.2.2.15 Theme Plan for Population Management of Feral Dogs in Wildlife Habitat:

7.2.2.16 Theme Plan for Strengthening Management Effectiveness and Ecological Integrity of Sahyadri Tiger Reserve

7.2.2.1 Theme Plan for Water Management :

i. General:

Water management is pivotal in wildlife management as it allows for the regulation of habitat usage by animals, thereby influencing habitat conditions. Understanding local rainfall patterns is essential for assessing water resources. Water management primarily entails identifying areas lacking surface water during dry periods and ensuring water availability, preferably by preserving and enhancing access to natural water sources. In cases where natural sources are insufficient, artificial water sources may need to be created. It is imperative to prevent the degradation of newly opened habitats due to excessive use by creating unnecessary more waterholes. Proper distribution of water sources is crucial to maintain habitat integrity. Water source development in wilderness area should only be undertaken if its necessity and objectives have been firmly established after careful consideration about its requirement in that particular location.

Waterholes act as focal points for wildlife activity, influencing spatial distribution and movement patterns

of various species within the reserve. Waterholes function as ecological corridors, promoting connectivity between different habitats and facilitating the dispersal of species, including apex predators like tigers. Maintaining a network of water sources enhances landscape permeability, genetic exchange, and population viability, crucial for long-term conservation efforts. Regular monitoring and management of water quality at waterholes help prevent the spread of waterborne diseases among wildlife populations. By implementing measures to minimize contamination and maintain hygienic conditions, the risk of disease outbreaks, which can have detrimental effects on both wildlife health and ecosystem dynamics, is mitigated.

Facilitating wild animals' access to natural water sources, such as areas with a high groundwater table or springs emerging from rock faces, is often more feasible and cost-effective than installing artificial water supplies. Natural sources are also aesthetically preferable to visually intrusive artificial constructions.

If gaps identified in a water survey cannot be addressed by providing access to natural sources, the consideration of artificial water sources becomes necessary. However, whichever option is chosen, it should be economical, easy to construct and maintain, and visually harmonious with the landscape.

Two overarching principles guide this decision-making process: (a) an unreliable water supply can be more detrimental than having no supply at all, and (b) numerous small water sources dispersed throughout the area are preferable to a few large ones. Tube wells or open wells, where applicable (since roads may not be accessible in all areas for tube well installation), can provide a reliable, high-quality water supply.

Abundant food in a habitat loses its value if water is not readily available nearby. From a wildlife perspective, a habitat lacking a water source is deemed inadequate. High-quality wildlife areas feature evenly distributed water points. Preventing water contamination from cattle is crucial to avoid disease outbreaks among wild animals, particularly ungulates. Currently, the STR boasts quite well-distributed water sources, both natural and artificial, except few areas in both divisions.

Existing Water Sources in the STR:

Table No.7.6: water sources available for wildlife in STR are as follows:

Sr. No.	Range	Round	Beat	Cmprt. No.	Name of the Water Hole	GPS Reading		Type of Waterhole	Natural / Artificial
						Latitude (N)	Longitude (E)		
1	Bamnoli	Valvan	Arav	346	Gadgyache Pani	17°42'33"N	73°35'49"E	Seasonal	Natural
2	Bamnoli	Valvan	Arav	344	Jambhul Pani ,Janani Mura	17°42'15"N	73°37'53"E	Seasonal	Natural
3	Bamnoli	Valvan	Arav	346	Humbarache Pani	17°42'46"N	73° 35' 6"E	Seasonal	Natural
4	Bamnoli	Valvan	Arav	345	_	17°42'35"N	73° 36' 27"	Seasonal	Natural
5	Bamnoli	Valvan	Arav	346	_	17°42'33"N	73° 35' 49"	Seasonal	Natural
6	Bamnoli	Valvan	Valvan	351	_	17°45'55"N	73° 35' 18"	Seasonal	Natural
7	Bamnoli	Valvan	Valvan	352	_	17°44'36"N	73° 36' 42"	Seasonal	Natural
8	Bamnoli	Valvan	Valvan	348	_	17°45'19"N	73° 38' 2"	Seasonal	Natural
9	Bamnoli	Valvan	Mhalunge	339	_	17°42'20"N	73° 40' 28"E	Seasonal	Natural

10	Bamnoli	Valvan	Mhalunge	339	_	17°43'17"N	73° 40' 10"E	Seasonal	Natural
11	Bamnoli	Valvan	Mhalunge	341	_	17°43'13"N	73° 40' 10"E	Seasonal	Natural
12	Bamnoli	Valvan	Mhalunge	341	_	17°42'39"N	73° 41' 19"E	Seasonal	Natural
13	Bamnoli	Valvan	Mhalunge	342	_	17°42'32"N	73° 39' 6"E	Seasonal	Natural
14	Bamnoli	Valvan	Mhalunge	302	_	17°42'8"N	73° 41' 46"E	Seasonal	Natural
15	Bamnoli	Valvan	Mhalunge	357	_	17°43'5"N	73° 39' 39"E	Seasonal	Natural
16	Bamnoli	Valvan	Mhalunge	_	_	17°42'35"N	73° 36'27"E	Seasonal	Artificial
17	Bamnoli	Waghavale	Uchat	367	_	17°45'59"N	73°36'48"E	Seasonal	Natural
18	Bamnoli	Waghavale	Uchat	351	_	17°45'55"N	73°35' 18"E	Seasonal	Natural
19	Bamnoli	Waghavale	Pimpari	299	Nala	17° 43' 39"N	73° 43' 14"E	Seasonal	Natural
20	Bamnoli	Waghavale	Pimpari	299	Nala Pimpari	17° 43' 25"N	73° 42' 56"E	Seasonal	Natural
21	Bamnoli	Waghavale	Pimpari	301	Nala Pimpari	17° 43' 27"N	73° 43' 27"E	Seasonal	Natural
22	Bamnoli	Waghavale	Pimpari	301	Nala Akalpe	17° 43' 36"N	73° 42' 20"E	Seasonal	Natural
23	Bamnoli	Waghavale	Pimpari	301	Nala Akalpe	17° 43' 54"N	73° 42' 9"E	Seasonal	Natural
24	Bamnoli	Waghavale	Pimpari	301	Nala Akalpe	17° 44' 29"N	73° 41' 43"E	Seasonal	Natural
25	Bamnoli	Waghavale	Pimpari	355	Nala Akalpe	17° 44' 27"N	73° 41' 34"E	Seasonal	Natural
26	Bamnoli	Waghavale	Pimpari	355	Nala Akalpe	17° 44' 28"N	73° 41' 17"E	Seasonal	Natural
27	Bamnoli	Waghavale	Pimpari	299	Pangharaniche Pani	17° 43' 25"N	73° 42' 58"E	Seasonal	Natural
28	Bamnoli	Waghavale	Pimpari	355	Khadkaliche Pani	17° 44' 10"N	73° 42' 5"E	Seasonal	Natural
29	Bamnoli	Met indoli	Kusapur	336	_	17°41'58"N	73°42'4"E	Seasonal	Natural
30	Bamnoli	Vele	Deur	372	Pandhare Pani	17°35'52.99"N	73°48'9"E	Seasonal	Natural
31	Bamnoli	Vele	Deur	372	Krutrim Panavtha	17°37'15"N	73°48'24"E	Seasonal	Artificial
32	Bamnoli	Vele	Vele	386	Makaluche Pani	17° 31' 46"N	73° 47' 7"E	Seasonal	Natural
33	Bamnoli	Vele	Vele	384	Mayniche Tale	17° 35' 32"N	73° 48' 27"E	Seasonal	Natural
34	Bamnoli	Vele	Vele	386	Gadyache Pani	17° 33' 14"N	73° 47' 48"E	Seasonal	Natural
35	Koyna	Takavali	Maldev	368	Pavtyache Pani	17°38'40.55"N	73°42'36.37"E	Seasonal	Artificial
36	Koyna	Takavali	Maldev	369	Pisacha Panvtha	17°38'36"N	73°43'34"E	Seasonal	Artificial
37	Koyna	Takwali	Pali	377	umbrache Pani	17°37'14.56"N	73°43'15.85"E	Seasonal	Natural
38	Koyna	Takwali	Pali	375	_	17°36'29"N	73°43'35"E	Seasonal	Artificial
39	Koyna	Takwali	Pali	376	_	17°36'18"N	73°45'23"E	Seasonal	Artificial
40	Koyna	Takwali	Jungti	390	Dindyache Pani	17° 34' 27"N	73° 43' 8"E	Seasonal	Natural
41	Koyna	Takwali	Jungti	388	Bhelyache Pani	17° 34' 47"N	73° 43' 53"E	Seasonal	Natural
42	Koyna	Takwali	Jungti	389	kokan kada Panvatha	17° 34' 39"N	73° 42' 52"E	Seasonal	Natural
43	Koyna	Takavali	Karanjawade	392	anjniche Pani	17° 33' 21"N	73° 45' 26"E	Seasonal	Natural
44	Koyna	Takavali	Karanjawade	394	Gadyache Pani	17° 32' 47"N	73° 45' 30"E	Seasonal	Natural
45	Koyna	Takavali	Karanjawade	393	kalamura Pani	17° 33' 20"N	73° 45' 23"E	Seasonal	Natural
46	Koyna	Shirshinge	Shirshinge	409	Neche maliche Pani	17° 28' 8"N	73° 42' 20"E	Seasonal	Natural
47	Koyna	Koyna	Koyna	424	Torane Doniche Pani	17°25'7.57"N	73°41'14.5"E	Seasonal	Natural
48	Koyna	Kusavade	Karvat	458	Marag Vagal	17°24'3.20"N	73°50'59.49"E	Seasonal	Natural
49	Koyna	Kusavade	Karvat	458	Upal Mali	17°24'22.02"N	73°50'56.93"E	Seasonal	Natural
50	Koyna	Kusavade	Karvat	461	Shendemadi	17°24'7.5"N	73°49'23.8"E	Seasonal	Natural
51	Koyna	Kusavade	Karvat	436	Kesavane	17°26'11.5"N	73°48'47.1"E	Seasonal	Artificial
52	Koyna	Kusavade	Karvat	459	Takenavada	17°24'32.7"N	73°50'6.78"E	Seasonal	Artificial

53	Chandoli	Nivale Ko.	Dhakale	33	Kokanewadi vthan Panavatha	17°7'42.6"N	73°46'22"E	Seasonal	Artificial
54	Chandoli	Nivale Ko.	Dhakale	33	Sambhartek Panvatha	17°6'50.2"N	73°46'46"E	Seasonal	Artificial
55	Chandoli	Nivale Ko.	Dhakale	_	_	17°6'57.1"N	73°46'11.5"E	Seasonal	Artificial
56	Chandoli	Nivale Ko.	Dhakale	_	_	17°6'54"N	73°46'25.1"E	Seasonal	Artificial
57	Chandoli	Nivle Ko.	Gothane	37	Nadi che Pani	17°5'54.5"N	73°46'57.7"E	Seasonal	Natural
58	Chandoli	Nivle Ko.	Gothane	39	Kkara Odha	17°6'50.09"N	73°45'26.9"E	Seasonal	Natural
59	Chandoli	Nivale Ko.	Nivle ko.	31	Nivle ko.Pani	17°7'43.7"N	73° 48'49.9"E	Seasonal	Natural
60	Chandoli	Mandur	Mandur	17	Savat Kada	17°8'25"N	73°52'49.4"E	Seasonal	Natural
61	Chandoli	Mandur	Mandur	17	Ericha Odha	17°8'6.22"N	73°53'12.6"E	Seasonal	Natural
62	Chandoli	Mandur	Mandur	17	Kasani cha Odha	17°9'8.5"N	73°54'00.5"E	Seasonal	Natural
63	Chandoli	Mandur	Nandoli	23	Main road nent Bandhara	17°10'45.9"N	73°52'17.3"E	Seasonal	Artificial
64	Chandoli	Nivale	Udgiri	984	_	17°6'39N	73°48'39"E	Seasonal	Natural
65	Chandoli	Nivale	Udgiri	984	_	17°3'56"N	73°48'15"E	Seasonal	Natural
66	Chandoli	Nivale	Golivane	_	_	16°59'18"N	73°50'6"E	Seasonal	Natural
67	Chandoli	Nivale	Golivane	_	_	17°00'04"N	73°00'4"E	Seasonal	Natural
68	Chandoli	Nivale	Golivane	_	_	17°1'34"N	73°50'44"E	Seasonal	Natural
69	Chandoli	Nivale	Golivane	_	_	17°00'30"N	73°50'26"E	Seasonal	Natural
70	Chandoli	Nivale	Golivane	_	_	17°2'11"N	73°50'12"E	Seasonal	Natural
71	Chandoli	Nivale	Golivane	_	_	17°1'55"N	73°50'16"E	Seasonal	Natural
72	Chandoli	Nivale	Golivane	_	_	17°00'06"N	73°50'19"E	Seasonal	Natural
73	Chandoli	Nivale	Golivane	_	_	16°59'7"N	73°50'57"E	Seasonal	Natural
74	Dhebewadi	Dhebewadi	Humbarne	532	Dakshi Tali	17°15'14"N	73°47'50"E	Seasonal	Natural
75	Dhebewadi	Dhebewadi	Humbarne	531	Aintas	17°15'09"N	73°47'05"E	Seasonal	Natural
76	Bamnoli	Valvan	Valvan	350	_	17°45'56"N	73° 35' 16"	Perennial	Natural
77	Bamnoli	Valvan	Mhalunge	339	_	17°42'12"N	73° 40' 13"	Perennial	
78	Bamnoli	Valvan	Mhalunge	339	_	17°42'13"N	73° 40' 24"	Perennial	Artificial
79	Bamnoli	Valvan	Mhalunge	340	_	17°43'14"N	73° 40' 24"E	Perennial	Artificial
80	Bamnoli	Valvan	Mhalunge	340	_	17°43'30"N	73° 40' 23"E	Perennial	Artificial
81	Bamnoli	Waghavale	Uchat	347	_	17°42'36"N	73° 35' 7"E	Perennial	Natural
82	Bamnoli	Waghavale	Pimpari	355		17°44'10"N	73° 42' 5"E	Perennial	Natural
83	Bamnoli	Met indoli	Kusapur	333	Angthyache ani Met indoli	17°40'11"N	73°41'44"E	Perennial	Natural
84	Bamnoli	Met indoli	Kusapur	331	Mhakaliche Pani	17°39'51"N	73°43'14"E	Perennial	Natural
85	Bamnoli	Met indoli	Kusapur	331	Ambyache Pani	17°39'37"N	73°43'19"E	Perennial	Natural
86	Bamnoli	Met indoli	Kusapur	331	khadakache Pani tambi	17°39'47"N	73°44'32"E	Perennial	Natural
87	Bamnoli	Met indoli	Kusapur	333	Vasotha kundh met indoli	17°39'47"N	73°41'52"E	Perennial	Artificial
88	Bamnoli	Met indoli	Kusapur	334	Nageshwar kundh	17°39'51.18"N	73°41'50.21"E	Perennial	Artificial
89	Kandat	Met indoli	Kusapur	302	_	17°41'56"N	73°42'25"E	Perennial	Natural
90	Bamnoli	Met indoli	Khirkhindi	304	Necha Pani	17°41'17.1"N	73°43'55.8"E	Perennial	Natural
91	Bamnoli	Met indoli	Khirkhindi	305	Kumbha Pani	17°41'1.3"N	73°45'05.4"E	Perennial	Natural
92	Bamnoli	Met indoli	Khirkhindi	302	Anjaniche Pani	17°41'58.5"N	73°42'46"E	Perennial	Natural
93	Bamnoli	Met indoli	Munavale	307	Menkecha Vhal Munavale	17°42'12.2"N	73°47'05.3"E	Perennial	Natural

94	Bamnoli	Vele	Deur	382	Injaiche Pani	17°36'52"N	73°48'19"E	Perennial	Natural
95	Bamnoli	Vele	Deur	370	Didyache Pani	17°37'59"N	73°47'8"E	Perennial	Natural
96	Bamnoli	Vele	Deur	380	Anjaniche Pani	17°34'20"N	73°48'59"E	Perennial	Natural
97	Bamnoli	Vele	Deur	380	Sonyache Pani	17°34'20"N	73°48'59"E	Perennial	Natural
98	Bamnoli	Vele	Deur	372	Kadyache Pani	17°32'8.33"N	73°48'30"E	Perennial	Natural
99	Bamnoli	Vele	Deur	372	Chipache Pani	17°37'23"N	73°48'59"E	Perennial	Natural
100	Bamnoli	Vele	Deur	382	Dhebevasti panvtha	17°36'39"N	73°48'18"E	Perennial	Natural
101	Bamnoli	Vele	Deur	380	Gundiche Pani	17°35'52.99"N	73°48'9"E	Perennial	Natural
102	Bamnoli	Vele	Vele	386	Madvnyache Pani	17° 34' 53"N	73° 48' 49"E	Perennial	Natural
103	Bamnoli	Vele	Vele	386	Dhavdkhaniche Pani	17° 34' 54"N	73° 48' 19"E	Perennial	Natural
104	Bamnoli	Vele	Vele	386	Yekant Tale	17° 34' 30"N	73° 48' 27"E	Perennial	Natural
105	Bamnoli	Vele	Vele	383	Dahacha Odha	17° 35' 54"N	73° 48' 9"E	Perennial	Natural
106	Bamnoli	Vele	Vele	383	Khadkaliche Pani	17° 34' 20"N	73° 48' 59"E	Perennial	Natural
107	Bamnoli	Vele	Vele	383	Talobache Pani	17° 35' 6"N	73° 46' 44"E	Perennial	Natural
108	Bamnoli	Vele	Vele	386	Nagobache Pani	17° 34' 25"N	73° 48' 24"E	Perennial	Natural
109	Bamnoli	Vele	Palsavade	250	Bhutnali cha Panvtha	17°37'56.33"N	73°50'47.14"E	Perennial	Natural
110	Koyna	Takavali	Maldev	_	Maldevkund Pani	17°38'7.92"N	73°42'24.36"E	Perennial	Natural
111	Koyna	Takavali	Maldev	_	Murdacha Panvtha	17°37'47"N	73°43'44"E	Perennial	Natural
112	Koyna	Takavali	Takwali	_	Pavtyache Pani	17°38'16.9"N	73°42'57.7"E	Perennial	Natural
113	Koyna	Takavali	Karanjawade	394	thosirache Pani	17° 33' 1"N	73° 44' 40.02"E	Perennial	Natural
114	Koyna	Takavali	Karanjawade	394	Aambyache Pani	17° 32' 36"N	73° 44' 55"E	Perennial	Natural
115	Koyna	Takavali	Karanjawade	934	Dindyache Pani	17° 32' 35"N	73° 44' 31"E	Perennial	Natural
116	Koyna	Takavali	Karanjawade	396	injalyache Pani	17° 30' 34"N	73° 45' 56"E	Perennial	Natural
117	Koyna	Shirshinge	Dicholi	_	Ozarache Pani	17° 31' 26"N	73° 44' 9"E	Perennial	Natural
118	Koyna	Shirshinge	Dicholi	_	Keliche Pani	17° 30' 15"N	73° 44' 44"E	Perennial	Natural
119	Koyna	Shirshinge	Dicholi	_	Humbarache Pani	17° 31' 26"N	73° 44' 48.12"E	Perennial	Natural
120	Koyna	Shirshinge	Dicholi	_	_	17°29'58"N	73°44'50.00"E	Perennial	Artificial
121	Koyna	Shirshinge	Shirshinge	411	Waghdoh Panvatha	17°28'58"N	73°43'30"E	Perennial	Natural
122	Koyna	Shirshinge	Shirshinge	411	Ambyache Pani	17°28'54"N	73°43'60"E	Perennial	Natural
123	Koyna	Shirshinge	Shirshinge	406	Dhupache Pani	17° 29' 22"N	73° 43' 5"E	Perennial	Natural
124	Koyna	Shirshinge	Shirshinge	405	Vharadnyache Pani	17° 30' 36"N	73° 42' 33"E	Perennial	Natural
125	Koyna	Shirshinge	Shirshinge	405	Aanand Pani	17° 29' 51"N	73° 42' 20"E	Perennial	Natural
126	Koyna	Shirshinge	Shirshinge	406	Maldiv Pani	17° 29' 30"N	73° 43' 9"E	Perennial	Natural
127	Koyna	Shirshinge	Kisarule	412	Ambyache Pani	17° 28' 38"N	73° 46' 35"E	Perennial	Natural
128	Koyna	Shirshinge	Kisarule	412	Muryache Pani	17° 28' 60"N	73° 46' 33"E	Perennial	Natural
129	Koyna	Shirshinge	Kisarule	412	Jambhliche Pani	17° 28' 57"N	73° 46' 33"E	Perennial	Natural
130	Koyna	Shirshinge	Kisarule	411	Zhadoliche Pani	17° 28' 20"N	73° 45' 20"E	Perennial	Natural
131	Koyna	Shirshinge	Kisarule	411	Aambegharche Pani	17° 28' 39"N	73° 44' 41"E	Perennial	Natural
132	Koyna	Shirshinge	Kisarule	411	Zhadoliche Pani	17° 28' 41"N	73° 45' 32"E	Perennial	Natural
133	Koyna	Shirshinge	Kisarule	412	Pablache Pani	17° 27' 56"N	73° 45' 15"E	Perennial	Natural
134	Koyna	Koyna	Navja	419	Umag Ketakiche Pani	17°27'59.9"N	73°42'24"E	Perennial	Natural

135	Koyna	Koyna	Navja	418	Ghodvnyache Pani	17°27'17.9"N	73°42'35.2"E	Perennial	Natural
136	Koyna	Koyna	Navja	421	Navja Taki	17°26'9"N	73°43'25.9"E	Perennial	Natural
137	Koyna	Koyna	Navja	421	Havaliche Pani	17°26'8"N	73°43'34.3"E	Perennial	Natural
138	Koyna	Koyna	Koyna	432	Sonivariche Pani	17° 24' 60"N	73° 43' 4"E	Perennial	Natural
139	Koyna	Koyna	Koyna	426	Jambaliche Pani	17°24'27.57"N	73°40'35.9"E	Perennial	Natural
140	Koyna	Koyna	Koyna	430	Humbarali Brubache Pani	17°25'31.53"N	73°42'21.22"E	Perennial	Natural
141	Koyna	Koyna	Koyna	430	Ugam Torane	17°24'11.58"N	73°42'32.9"E	Perennial	Natural
142	Koyna	Kusavade	Karvat	458	Vaghirane	17°23'51.04"N	73°50'46.83"E	Perennial	Natural
143	Koyna	Kusavade	Karvat	461	Pavnai Bavi	17°24'3.57"N	73°49'59.07"E	Perennial	Natural
144	Koyna	Kusavade	Karvat	461	Shendemadi	17°24'6.18"N	73°49'19.92"E	Perennial	Natural
145	Koyna	Kusavade	Karvat	461	Shendemadi	17°24'7.5"N	73°49'23.8"E	Perennial	Artificial
146	Koyna	Kusavade	Karvat	436	Kesavane	17°26'11.7"N	73°48'46.9"E	Perennial	Natural
147	Koyna	Kusavade	Karvat	459	Takenavada	17°24'33.6"N	73°50'7.8"E	Perennial	Natural
148	Koyna	Kusavade	Ambeghar	428	Chandyacha Odha	17°26'20"N	73°46'54"E	Perennial	Natural
149	Koyna	Kusavade	Ambeghar	428	Jakhnicha Odha	17°26'6"N	73°47'4"E	Perennial	Natural
150	Koyna	Kusavade	Ambeghar	436	Dastan Pani	17°25'20"N	73°46'55"E	Perennial	Natural
151	Koyna	Kusavade	Ambeghar	428	JambhulnicheE Pani	17°25'52"N	73°46'50"E	Perennial	Natural
152	Koyna	Kusavade	Ambeghar	436	Ghodebarache Pani	17°25'58"N	73°47'41"E	Perennial	Natural
153	Koyna	Kusavade	Ambeghar	428 P	Palashi Pani	17°25'58"N	73°46'50"E	Perennial	Natural
154	Koyna	Kusavade	Ambeghar	436 p	Bibvyache Pani	17°26'15"N	73°47'10"E	Perennial	Natural
155	Helwak	Helwak	Waghane	480	Gaothan Pani	17°19'59.1"N	73°41'37.6"E	Perennial	Natural
156	Helwak	Helwak	Waghane	490	Tikhatnyache Pani	17°19'56.8"N	73°42'17.5"E	Perennial	Natural
157	Helwak	Helwak	Waghane	481	Muradache Pani	17°20'38"N	73°41'37.5"E	Perennial	Natural
158	Helwak	Helwak	Waghane	480	Jalavanyache Pani	17°20'18"N	73°42'38"E	Perennial	Natural
159	Helwak	Helwak	Waghane	480	Bharanwadche Pani	17°20'15.1"N	73°42'13.5"E	Perennial	Natural
160	Helwak	Helwak	Waghane	492	Ranichi Tale	17°19'32"N	73°41'35.1"E	Perennial	Natural
161	Helwak	Helwak	Waghane	482	Dhokyache Pani	17°20'21"N	73°42'24.5"E	Perennial	Natural
162	Helwak	Helwak	Rasati	428	Ladiche Pani	17°22'27.1"N	73°40'30.3"E	Perennial	Natural
163	Helwak	Helwak	Rasati	427	Kutiche Pani	17°22'15.1"N	73°40'36.6"E	Perennial	Natural
164	Helwak	Helwak	Rasati	478	Houdache Pani	17°21'15.1"N	73°41'37.1"E	Perennial	Natural
165	Helwak	Helwak	Rasati	478	Nevhalache Pani	17°21'3.6"N	73°41'32.7"E	Perennial	Natural
166	Helwak	Helwak	Rasati	427	Ambyacha Dabara	17°22'15.1"N	73°40'36.9"E	Perennial	Natural
167	Helwak	Helwak	Rasati	478	Gaymukh Pani	17°21'23.1"N	73°41'24.5"E	Perennial	Natural
168	Helwak	Helwak	Rasati	427	Vajrache Pani - 1	17°21'58.4"N	73°41'12.6"E	Perennial	Natural
169	Helwak	Helwak	Rasati	427	Vajrache Pani - 2	17°21'56.3"N	73°41'34.8"E	Perennial	Natural
170	Helwak	Helwak	Rasati	478	Murdache Pani	17°20'44.1"N	73°42'34.3"E	Perennial	Natural
171	Helwak	Helwak	Rasati	433	Ketakiche Pani	17°23'1"N	73°42'34.3"E	Perennial	Natural
172	Helwak	Helwak	Rasati	427	Shatracha Panvatha	17°23'37.4"N	73°40'27.7"E	Perennial	Artificial
173	Helwak	Helwak	Govare	497	Rutakiche Pani	17°19'26"N	73°43'12"E	Perennial	Natural
174	Helwak	Helwak	Govare	497	Piprniche Pani	17°19'33"N	73°43'35"E	Perennial	Natural
175	Helwak	Helwak	Govare	497	Nilgiriche Pani	17°19'38"N	73°43'24 "E	Perennial	Natural

176	Helwak	Helwak	Govare	497	Tavshya Babar Pani	17°20'0"N	73°44'25"E	Perennial	Natural
177	Helwak	Helwak	Govare	497	Govariche Pani	17°19'52"N	73°43'31"E	Perennial	Natural
178	Helwak	Helwak	Govare	476	Gadgyache Pani	17°19'31"N	73°43'1"E	Perennial	Natural
179	Helwak	Helwak	Govare	477	Kaliche Pani	17°21'46"N	73°42'35"E	Perennial	Natural
180	Helwak	Helwak	Govare	475	Baviche Pani	17°21'24"N	73°43'38"E	Perennial	Natural
181	Helwak	Helwak	Govare	497	Bhairvnath Pani	17°19'21"N	73°43'56"E	Perennial	Natural
182	Helwak	Kolane	Kolane	1	Ketkiche Pani	17°18'14"N	73°42'30"E	Perennial	Natural
183	Helwak	Kolane	Kolane	1	Bondgyache Pani	17°18'2"N	73°42'42"E	Perennial	Natural
184	Helwak	Kolane	Kolane	2	Rashiche Pani	17°17'55"N	73°42'4"E	Perennial	Natural
185	Helwak	Kolane	Kolane	2	Jakhaniche Pani	17°18'8.7"N	73°42'18"E	Perennial	Natural
186	Helwak	Kolane	Kolane	1	Gavhardhavach e Pani	17°18'40"N	73°42'6.8"E	Perennial	Natural
187	Helwak	Kolane	Kolane	1	Havaliche Pani	17°18'22"N	73°42'58"E	Perennial	Natural
188	Helwak	Kolane	Kolane	–	Gavhaniche Pani	17°18'37"N	73°42'30"E	Perennial	Natural
189	Helwak	Kolane	Male	3,4	Sakvaricha Odha	17°18'35.3"N	73°43'9.5"E	Perennial	Natural
190	Helwak	Kolane	Male	3,5	Dagadicha Odha	17°18'10.6"N	73°43'19.7"E	Perennial	Natural
191	Helwak	Kolane	Chandoli Kh	12	Gaymukh	17°14'37.4"N	73°44'33"E	Perennial	Natural
192	Helwak	Kolane	Chandoli Kh	12	vitthalai	17°14'50.7"N	73°44'36.6"E	Perennial	Artificial
193	Helwak	Kolane	Chandoli Kh	12	Umbaracha Panvtha	17°14'39.8"N	73°43'57.3"E	Perennial	Artificial
194	Helwak	Rundiv	Rundiv North	5	Teribatti	17°14'51"N	73°41'33"E	Perennial	Artificial
195	Helwak	Rundiv	Rundiv North	5	Rundiv Gavthan	17°13'52.92"N	73°43'33.02"E	Perennial	Artificial
196	Helwak	Kolane	Rundiv North	5	Tiriche Pani	17°14'51"N	73°41'50"E	Perennial	Natural
197	Helwak	Rundiv	Rundiv south	6	Kutiche Pani	17°13'42"N	73°43'44"E	Perennial	Natural
198	Helwak	Rundiv	Rundiv south	6	Aodyache Pani	17°13'43"N	73°42'44"E	Perennial	Natural
199	Helwak	Kolane	Rundiv south	6	Kutiche Pani	17°13'24"N	73°43'24"E	Perennial	Natural
200	Helwak	Kolane	Rundiv south	6	Odhyache Pani	17°13'24"N	73°43'14"E	Perennial	Natural
201	Helwak	Rundiv	Siddhesh war	7	Kadyache Pani	17°10'44"N	73°42'9"E	Perennial	Natural
202	Helwak	Rundiv	Siddhesh war	7	Bailpani Panvatha	17°11'28"N	73°42'53"E	Perennial	Natural
203	Helwak	Rundiv	Siddhesh war	7	Anjanicha Motha Dhoh	17°11'37"N	73°42'54"E	Perennial	Natural
204	Helwak	Rundiv	Ambole	10	Jawali Gaothan	17°12'5"N	73°44'4"E	Perennial	Natural
205	Helwak	Rundiv	Ambole	10	Gavadyache pahi	17°10'58"N	73°45'29"E	Perennial	Natural
206	Helwak	Rundiv	Ambole	11	Nageche pahi	17°11'35"N	73°44'39"E	Perennial	Natural
207	Helwak	Kolane	Chandoli Kh	12	Umbarache Pani	17° 14' 59"N	73°43' 57"E	Perennial	Natural
208	Helwak	Kolane	Chandoli Kh	12	Kandar Doh	17° 14' 37"N	73°43' 57"E	Perennial	Natural
209	Chandoli	Nivale Ko.	Chandel East	35	kelache Pani	17°10'0.04"N	73°44'32.9"E	Perennial	Natural
210	Chandoli	Nivale Ko.	Chandel East	35	Shindewadi	17°8'23.8"N	73°43'42"E	Perennial	Natural
211	Chandoli	Nivale Ko.	Chandel East	35	Kundiche Pani	17°7'40.9"N	73°43'21.4"E	Perennial	Natural
212	Chandoli	Nivale Ko.	Chandel East	35	Chandel Odha	17°8'6.93"N	73°43'46.6"E	Perennial	Natural
213	Chandoli	Nivale Ko.	Chandel East	36	Ramnadi	17°9'52.6"N	73°42'49.8"E	Perennial	Natural
214	Chandoli	Nivale Ko.	Dhakale	33	Gavathan Pani	17°6'56.3"N	73°46'10.6"E	Perennial	Natural

215	Chandoli	Nivale Ko.	Dhakale	33	Kelache Pani	17°7' 17.9"N	73°46'4.7"E	Perennial	Natural
216	Chandoli	Nivle Ko.	Gothane	37	Gaothan Pani	17°5'54.5"N	73°46'15.1"E	Perennial	Natural
217	Chandoli	Nivle Ko.	Gothane	37	Mandavkar Pani	17°5'59.3"N	73°45'55.3"E	Perennial	Natural
218	Chandoli	Nivle Ko.	Gothane	39	Vakada aodha	17°6'55"N	73°44'36.8"E	Perennial	Natural
219	Chandoli	Nivle Ko.	Gothane	39	Bendache Pani	17° 6'0.4"N	73°44'44.5"E	Perennial	Natural
220	Chandoli	Nivle Ko.	Gothane	38	Gangotri	17°5'10.3"N	73°45'19.1"E	Perennial	Natural
221	Chandoli	Nivale Ko.	Nivle ko.	31	Muluk Pani	17°7'0.3"N	73°48'38"E	Perennial	Natural
222	Chandoli	Nivale Ko.	Nivle ko.	30	Khadkali Pani	17°6'42.5"N	73°47'41.8"E	Perennial	Natural
223	Chandoli	Nivale Ko.	Nivle ko.	31	Injole Pani	17°5'32"N	73°47'58.2"E	Perennial	Natural
224	Chandoli	Nivale Ko.	Nivle ko.	31	Ketaki Pani	17°6'53.2"N	73°48'20.3"E	Perennial	Natural
225	Chandoli	Nivale Ko.	Sonarli	28	Kasav Nala	17°8'37.1"N	73°48'25.6"E	Perennial	Natural
226	Chandoli	Nivale Ko.	Sonarli	28	Kaldhoh	17°8'6.63"N	73°48'28.5"E	Perennial	Natural
227	Chandoli	Nivale Ko.	Sonarli	29	Ketaki chain Pani	17°9'29.5"N	73°46'55.2"E	Perennial	Natural
228	Chandoli	Nivale Ko.	Sonarli	29	Dhanagar Pani	17°9'26.4"N	73°47'36.8"E	Perennial	Natural
229	Chandoli	Nivale Ko.	Sonarli	28	Durgewadin Odha	17°9'13.6"N	73°48'7.7"E	Perennial	Natural
230	Chandoli	Nivale Ko.	Sonarli	28	Vakate Odha	17°9'27.9"N	73°47'54.8"E	Perennial	Natural
231	Chandoli	Nivale Ko.	Sonarli	28	Transect Line Varil Pani	17°9'16.1"N	73°49'12.6"E	Perennial	Natural
232	Chandoli	Mandur	Tambave	27	Chapewadi Panvatha	17°7'36.9"N	73°51'35"E	Perennial	Natural
233	Chandoli	Mandur	Tambave	27	Mharakacha Panvatha	17°7'35.8"N	73°51'12.1"E	Perennial	Natural
234	Chandoli	Mandur	Tambave	27	Kolage Panvatha	17° 7'7.36"N	73°50'44.3"E	Perennial	Natural
235	Chandoli	Mandur	Tambave	27	Watch Tower Panvatha	17°7'19.6"N	73°49'48.1"E	Perennial	Natural
236	Chandoli	Mandur	Mandur	17	Machan Shejari	17°9'16"N	73°53'54"E	Perennial	Natural
237	Chandoli	Mandur	Mandur	17	Hela Pani	17°8'8.78"N	73°53'1"E	Perennial	Natural
238	Chandoli	Mandur	Nandoli	23	Jondhal Odha Panvatha	17°11'9.2"N	73°51'36.2"E	Perennial	Artificial
239	Chandoli	Mandur	Nandoli	23	Chandgewadi Panvatha	17°10'17.3"N	73°52'3.2"E	Perennial	Artificial
240	Chandoli	Mandur	Nandoli	23	Domblicha Panvatha	17°11'11"N	73°52'14.1"E	Perennial	Artificial
241	Chandoli	Mandur	Nandoli	23	Gavalanwadich e Pani	17°10'49"N	73°51'5.4"E	Perennial	Natural
242	Chandoli	Mandur	Nandoli	22	Patilwadi Pani	17°10'30.6"N	73°50'41"E	Perennial	Natural
243	Chandoli	Mandur	Nandoli	23	Jambhaliche Pani	17°10'68"N	73°51'10"E	Perennial	Natural
244	Chandoli	Mandur	Khundlap ur	24	Shendyache wadi	17°8'51"N	73°52'29"E	Perennial	Artificial
245	Chandoli	Mandur	Khundlap ur	24	Janai wadi	17°9'24"N	73°52'48"E	Perennial	Natural
246	Chandoli	Mandur	Zolambi	21	Hanmantache Pani	17°12'7.4"N	73°50'17.3"E	Perennial	Natural
247	Chandoli	Mandur	Zolambi	21	Vithalai Panvatha	17°12'22.3"N	73°49'49.5"E	Perennial	Artificial
248	Chandoli	Mandur	Zolambi	21	Lapan Grah Pani	17°11'11.79"N	73°50'23.80"E	Perennial	Natural
249	Chandoli	Nivale	Udgiri	982	_	17°5'2"N	73°48'58"E	Perennial	Natural
250	Chandoli	Nivale	Udgiri	984	_	17°4'11"N	73°48'54"E	Perennial	Natural
251	Chandoli	Nivale	Udgiri	987	_	17°3'6"N	73°50'36"E	Perennial	Natural
252	Chandoli	Nivale	Udgiri	982	_	17°5'32"N	73°47'58"E	Perennial	Natural

253	Chandoli	Nivale	Udgiri	982	_	17°4'48"N	73°48'22"E	Perennial	Natural
254	Chandoli	Nivale	Ukhalu	994	_	17°6'19"N	73°52'10"E	Perennial	Natural
255	Chandoli	Nivale	Ukhalu	994	_	17°6'21"N	73°52'35"E	Perennial	Natural
256	Chandoli	Nivale	Ukhalu	991	_	17°6'49"N	73°50'22"E	Perennial	Natural
257	Chandoli	Nivale	Ukhalu	993	_	17° 6'33.12"N	73°50'52.80"E	Perennial	Natural
258	Dhebewadi	Dhebewadi	Atoli	495	Gothan Odha	17°17'47"N	73°43'40"E	Perennial	Natural
259	Dhebewadi	Dhebewadi	Atoli	496	Khrvaticha Odha	17°19'7"N	73°44'25"E	Perennial	Natural
260	Dhebewadi	Dhebewadi	Atoli	496	Parytakicha Odha	17°18'3"N	73°44'36"E	Perennial	Natural
261	Dhebewadi	Dhebewadi	Atoli	496	Takyacha odha	17°19'2"N	73°44'22"E	Perennial	Natural
262	Dhebewadi	Dhebewadi	Atoli	494	Kektyacha Odha	17°17'58"N	73°43'39"E	Perennial	Natural
263	Dhebewadi	Dhebewadi	Atoli	494	Bambaracha Odha	17°17'46"N	73°43'50"E	Perennial	Natural
264	Dhebewadi	Dhebewadi	Atoli	520	Watch Tower Paulvat	17°17'12.6"N	73°45'7.1"E	Perennial	Natural
265	Dhebewadi	Dhebewadi	Atoli	521	Vaghajai Mandir Javal	17°17'35.9"N	73°45'36.3"E	Perennial	Artificial
266	Dhebewadi	Dhebewadi	Atoli	520	Maharukh odha	17°17'42.4"N	73°45'9.3"E	Perennial	Natural
267	Dhebewadi	Dhebewadi	Atoli	519	Kavathyachepa ni	17°16'21.1"N	73°45'26.8"E	Perennial	Natural
268	Dhebewadi	Dhebewadi	Atoli	527	navpani	17°15'51.5"N	73°45'53.9"E	Perennial	Natural
269	Dhebewadi	Dhebewadi	Atoli	527	Jilpani	17°15'54.8"N	73°45'55"E	Perennial	Natural
270	Dhebewadi	Dhebewadi	Atoli	524	Jakhaniche pani	17°16'34.9"N	73°46'23.9"E	Perennial	Natural
271	Dhebewadi	Dhebewadi	Humbarne	531	Chorane Pani	17°14'57"N	73°46'39"E	Perennial	Natural
272	Dhebewadi	Dhebewadi	Humbarne	529	Gimane Pani	17°15'26"N	73°46'13"E	Perennial	Natural
273	Dhebewadi	Dhebewadi	Humbarne	531	Baglacha Thada	17°15'3"N	73°47'43"E	Perennial	Natural
274	Dhebewadi	Dhebewadi	Humbarne	530	Aintas Pani-2	17°15'7"N	73°47'4"E	Perennial	Natural
275	Dhebewadi	Dhebewadi	Humbarne	532	Dukkar Tali	17°15'48"N	73°47'55"E	Perennial	Natural
276	Dhebewadi	Dhebewadi	Paneri	578	Natural terhole ulashitale navatha Paneri	17°14'13"N	73°48'41"E	Perennial	Natural
277	Dhebewadi	Dhebewadi	Paneri	578	Natural erhole choravane Satar	17°12'0.07"N	73°51'10.5"E	Perennial	Natural
278	Dhebewadi	Dhebewadi	Paneri	570	Natural terhole Botarbav Satar	17°15'6.67"N	73°48'41.54"E	Perennial	Natural
279	Dhebewadi	Dhebewadi	Karale	571	Doni Gothavde	17°14'31.15"N	73°51'5.41"E	Perennial	Natural

Out of all type of waterholes (both natural and artificial) 161 waterholes are perennial. Range wise details are given in the Table No.7.4

ii. **Objectives:**

1. Ensuring Water Availability: Maintain adequate water availability throughout the year, especially during the dry season, to meet the needs of wildlife populations, including tigers and their prey species.
2. Promoting Ecological Balance: Manage waterholes to support a diverse array of wildlife species, including herbivores, carnivores, and birds, thus fostering ecological balance within the tiger reserve ecosystem.
3. Minimizing Human-Wildlife Conflict: Strategically locate (away from village boundary) and manage waterholes to minimize conflicts between wildlife and human settlements, thereby reducing instances of livestock depredation and ensuring human safety.
4. Preventing Disease Transmission: Implement measures to maintain water quality and hygiene at waterholes to prevent the transmission of diseases among wildlife populations, particularly in areas where domestic animals congregate.
5. Enhancing Wildlife Monitoring: Utilize waterholes as focal points for wildlife monitoring and research activities, facilitating the collection of data on species abundance, behavior, and distribution within the tiger reserve.
6. Conserving Endangered Species: Manage waterholes in a manner that benefits endangered and threatened species inhabiting the tiger reserve, thereby contributing to their conservation and recovery efforts.
7. Supporting Natural Processes: Maintain natural hydrological processes and habitat dynamics associated with waterholes, ensuring the sustainability of ecosystems and minimizing human-induced disturbances.
8. Adaptive Management: Continuously monitor and assess the effectiveness of waterhole management strategies, and adapt management practices based on scientific research, stakeholder feedback, and changing environmental conditions.
9. Collaboration and Capacity Building: Foster collaboration among various stakeholders, including government agencies, local communities, and conservation organizations, to collectively manage and conserve waterholes for the benefit of wildlife in tiger reserves. Additionally, provide training and capacity-building initiatives for field staff involved in waterhole management to ensure effective implementation of management plans.

iii. **Issues and Problems:**

Waterholes play a critical role in the ecology and management of tiger reserves, serving as focal points for wildlife activity and crucial resources during dry seasons. However, various issues and challenges arise concerning their management and maintenance, impacting both wildlife conservation efforts and visitor experiences.

- Site selection and permanent water source for waterhole creation is very important.
- There are areas with a higher density of waterholes, while others still devoid of it.
- Waterhole in eco-tourism zone is not judiciously created considering the basic criteria.
- Cement concrete-made artificial waterholes disrupt the natural landscape's aesthetics, detracting from the sightseeing and photography experiences of eco-tourists.
- During summer, the risk of waterhole contamination is heightened, necessitating a rigorous monitoring system to prevent any untoward incidents.
- Occasionally, waterholes may remain dry for several days without detection by field staff, either knowingly or unknowingly. Therefore, a system of vigilant monitoring and reporting by senior officers is essential.
- Bore well or solar pump failures can lead to waterhole depletion. Contingency plans must be established to prevent any interruption in water supply, as even a single day without water can adversely impact local wild animals in summer.
- Some waterholes experience habitat degradation due to excessive use by a large number of wild animals during the summer season, as they congregate for both sustenance and water.
- Waterholes located near the boundaries of core zones are sometimes frequented by both wild animals and domestic livestock, as well as village dogs, increasing the risk of disease transmission from livestock to wildlife.
- Incidents of urea poisoning, grain poisoning, and poaching through snaring and trapping often occur in the vicinity of waterholes, particularly in areas with inadequate protection measures.

iv. **Strategies:**

A strategy is developed by considering these issues and problems in the present system of water management and thoroughly considering the guideline and constraints given by WII. Identifying natural water sources and ensuring wildlife access, protection, and minimal disruption to their natural settings is crucial. However, natural water sources are not evenly distributed across habitats, necessitating the creation of permanent artificial water sources to alleviate this constraint and facilitate uniform habitat utilization. Therefore, a well-researched strategy is imperative for water source development within the tiger reserve. This strategy should entail surveying and mapping existing water sources, gathering insights from

experienced field staff, and taking into account terrain, topography, and watershed knowledge. Planning for water augmentation requires consideration of certain general rules and constraints, which will be outlined in the following paragraphs:

A.General considerations for the development of supplementary water sources:

Manual of wildlife techniques for India published by WII, Dehradun and FAO, has given general rules, constraints, a guideline for choosing a site and guideline for site development for creation and development of artificial waterholes. Consideration of following general rules and constraints is must before creating any new waterhole. It should be checked before signing estimate or recommending the work by respective ACF's and Deputy Director.

General Rules:

- A gap in the water supply is not in itself is not a sufficient reason to establish an additional water source. A clear objective must be established.
- An unreliable supplementary supply is worse than no supply
- Providing access to natural water sources is preferable to constructing artificial ones.
- A large number of small and widely scattered sources are better than a few large sources, which may lead to over-concentration of animals around them.
- A water source per every 25 sq.km. (5x5 km grid) is adequate for most protected areas. An animal would thus have a maximum distance of 2.5 km to travel for water. (But, it is dependent on terrain and topography of the area. As per this Rule, we plot a map for existing perennial water sources. Please refer Map No. 115 and 135)
- All water bodies should be regularly checked for pathogens which may cause epidemics among animals.
- All water bodies should be regularly checked with litmus paper or using PH-meter to prevent any poisoning attempt. All waterholes should regularly and meticulously be checked at least in 300 mt. radius from the waterhole to prevent any undue incidences like poisoning, snaring etc.
- In the summer season, separate register should be maintained by each beat guard to note down all precautionary actions, they have taken every day to prevent attempts to poaching in and around a waterhole.

Constraints: kindly consider the following constraints in certain conditions, before creating new water source may involve some risks. For instance-

- Withdrawal of water, particularly groundwater, may alter natural processes of water cycling and lead to significant changes in the ecosystem. E.g. Water of bore well should be used judiciously, to avoid the over-use of groundwater.

- Water sources in a buffer zone or near the boundary of the core may bring domestic cattle into contact with wildlife, increasing the chances of disease transmission.
- Excessive water development in a dry area may raise the animal population to levels incompatible with food availability, leading to habitat degradation.
- Endemic and rare plants species may be adversely affected, therefore avoid water development in areas where these are present.
- Water development might trigger erosion on steep lands and fragile soils.
- Kindly, consider the above constraints, while planning as well as constructing the artificial waterholes in a new area.

A. Surveying and mapping of water sources:

The manager benefits from understanding the distribution and status of water sources during summer. Having this information readily available on a map facilitates two main actions: a) identifying seasonal water deficits and b) determining if additional water sources are required. Typically, mapping begins with locating perennial sources accessible to wildlife. If these prove insufficient, a survey of non-perennial sources becomes necessary to establish a foundation for a water development plan. Mapping encompasses natural sources available during scarcity periods, artificial sources to be replenished during such times, and water sources subject to significant disturbances.

Ultimately, all water sources may be located and classified by type and seasonal availability. As per Manual of Wildlife Techniques for India, WII, Dehradun and FAO, as a rule of thumb, "a water-dependent species should have no further than 2.5 km to walk to water". Hence, we have prepared a map showing all perennial water sources, both natural and artificial, with a buffer of 2.5 km around each water source and then identified 'Gaps' for making further action plan. Creation of any type of new waterhole should be supported with strong justification for selection of waterhole location.

B. Setting up Rain gauges: Long term rainfall data (mean distribution and intensity) are valuable in water source management and for understanding many biological phenomena important to wildlife management, such as vegetation, phenology and animal migration. There are automatic rain gauges at many locations in watershed of Koyna and Chandoli dam has been installed by Irrigation department to control over flood. The data from this rain gauges can use for management purpose. The Rain gauge suitable for high rainfall area is installed near anti-poaching camp at few places in Core and buffer zone. Mount a gauge at least 1 meter high and 10 meters away from trees or buildings. These gauges are read and emptied daily at 9.00 am. To record intensity, take a reading at shorter intervals e.g. hourly during actual rainfall. RFO should examine the records every two weeks and ACF to examine the same for every month. Tally for monthly and annual precipitation, for days of rain, and for high intensity if hourly reading were taken.

C. Guidelines for choosing a site for artificial waterhole:

- Choose a site near habitat edges (ecotones) where species from different habitats congregate.
- Choose a site which has shade trees and tall shrubs or grass to provide a cover nearby the waterhole.
- Avoid sites which are likely to be disturbed frequently, e.g. by livestock, local people or traffic.
- Waterhole is near to water source and if it is near APC or protection road, it should be beyond 25 mt

  i.e. safe distance for any wild animal.

- In buffer zones, ensure that wildlife has adequate access to water sources e.g. it should be sited at least 500 mt. away from a cattle camp. Camp residents should be instructed to avoid disturbance and limit cattle watering to the hours from 11.00 am to 03.00 pm.

C. Guideline for waterhole site development:

- Where a water source is within cultivated or open land, a corridor or gap with shrub or forest cover should be maintained for wildlife access to the water.
- Waterhole site should be preferably under the evergreen tree or shade tree to prevent water losses due to evaporation.
- In wildlife viewing areas make the waterhole look natural. Give it an irregular shape and slightly sloping edge. Use locally available stones. Put storage tank, pump and pipe underground or at least hide them from view by using locally available natural material. E.g. Eco-friendly or low-cost waterhole, Dugout Pond in clay soil or black cotton soil can also act as a waterhole.
- If you develop a site for the benefit of tourists observing wildlife from a vehicle track, keep it far enough away to prevent speeding vehicles from scaring the animals i.e. more than 25 mt.
- If timid species are involved consider building an earth bank between track and waterhole to shield approaching vehicles from drinking animals. Tourists can view animals by peeping over the top of the bank.

D. Prescriptions:

- **Mapping and surveying**: For planning, purpose collects the data from the field about both natural and artificial water sources and detailed information about its location, nature, status etc. We have collected detailed information about all type of water sources and it is categorized in the following 3 types:

Table No.7.7: Table showing the status of perennial waterholes in STR

Sr. No.	Types of Artificial Sources of Water	Structure to store water at surface
1	Bore well	• Cement Saucer • Cement rectangular tank • Low cost/ eco-friendly waterhole • Dug-out ponds • Natural Sinks
2	Open well	
3	Tanker	
4	Vantalav	• At one side of waterhole, access with gentle slope up to water is much needed
5	Vanbandhara	
6	Cement Bandhara	

Detail list of the waterhole with its name, location and status is given in Table.No. 7.6

All information shown on the map to understanding and clarity to area managers about all water sources in the area belongs to their jurisdiction. Following types of maps of different aspects of water resources attached in TCP Vol.-I, Part-3.

1. Natural waterholes as per types: Map No. 116
2. Artificial waterholes as per the source of water: Map No. 135 and table no 7.5
3. Man-made lake: Map No.- 117
4. Perennial water sources in 4 sq.km. grid: Map No.- 135
5. Perennial and Seasonal water sources in 4 sq. km. Grid: Map No.-115,135
6. 2.5 km. Buffer zone or cruising radius to perennial water sources: Map No.-116,115
7. 0.5, 1.0 and 1.5 km. Buffer zone or cruising radius to perennial water sources: Map No. – 115,135
8. Perennial water sources concerning to the watershed. : Map No.- 115 and table no 7.5

- **Prescriptions for Natural Waterholes:**

Natural waterholes include mainly, springs and water-pool in nullah bed. Natural waterholes in STR are both seasonal as well as perennial in nature. Many waterholes are smaller in size and it can support very less number of animals. Water level in the natural water sources will get reduce at the end of the summer season and sometimes during extreme events of summer or very less rainfall, it will get dried earlier than usual time. These are usually known to people of a nearby village and can susceptible to poaching. Hence, monitoring and protection is an important issue in the case of natural water sources. Following are the activities need to be implemented every year in pinch period when water becomes a limiting factor:

- During summer, conduct daily checks of waterholes to prevent poisoning through water.
- Record all observations in the waterhole checking register.
- Use litmus paper or a pH meter to inspect waterholes for signs of poisoning, documenting findings in the register.
- Monitor water levels during each visit.
- Assess the surrounding area of the waterhole from a protection standpoint.
- Minimize disturbances to natural waterholes such as excavation, deepening, or desilting, as past experiences have shown that such actions may lead to their drying up. It is important to recognize their natural setup, which may not be apparent to the naked eye. Human disturbances can result in water loss.
- Where necessary, facilitate access for wild animals to reach the waterhole with minimal intervention.
- Avoid excessive alteration of vegetation surrounding the waterhole.
- Maintain minimal disturbance in the vicinity.
- Take measures to prevent livestock or villagers from accessing these locations.

➢ **Prescriptions for Maintenance and Monitoring of existing artificial waterhole:**

In tiger reserve area, there are an insufficient number of natural waterholes which is unevenly distributed over the tiger reserve area. Hence, artificial waterholes are much needed to utilize the available habitat and to increase prey-predator density to its potential carrying capacity. Hereunder, the descriptions are given about type, distribution, nature and status of existing artificial water sources. By considering the existing system of artificial water sources, following prescriptions are given in order to maintain and create artificial water sources Recommended structure and well tested in the field for storing water is eco-friendly or low cost waterhole and go for Dugout pond wherever soil condition is suitable for structure. There are so many benefits in creation of the eco-friendly waterholes over the same size traditional cement saucers.

Table No.7.8 : Comparison between cement saucer and Eco-friendly /low cost waterhole

Sr. No.	Details	Eco-friendly/ low-cost Waterhole	Cement Saucer/ cement tank
1	Cost	Rs. 15000	Rs. 40000-50000
2	Time for construction	One day	More than one day
3	Skill for construction	Skilled labour not required	Skilled labour required
4	Process	Can prepare locally	Long process of tender

5	Water temperature	Remain low hence, preferred by wildlife over cement saucer (field observations)	Higher than low cost waterhole, hence, wildlife avoid to drink in cement saucer if options available
6	Maintenance	Less maintenance if, properly made and prepared by using recommended material. otherwise plastic sheet will tear due to hoofs and water losses by seepage	Cracks are usually seen due to expansion and shrinkage of base soil of material in rainy and summer season. Regular maintenance is needed to cementing the crack. Water losses are there through cracks.
7	Safety to wild animals	Much safe than cement saucer	Skidding of hoofed animals always observed in this water hole due to hard and uniformly smooth surface covered with water vegetation which is accelerating the skidding.
8	Water loss	Less	More due to more temperature
9	Shifting	It can be possible in low cost, but not recommended	Not possible
10	Look	Natural, merge with a wilderness of the area	Artificial, Shabby and eyesore to see

Fig.7.1 Eco-friendly waterholes

Fig.7.2 Eco-friendly waterholes

- Conduct daily checks of waterholes for protection purposes in accordance with guidelines.
- Record all observations in the waterhole checking register.
- Use litmus paper or a pH meter to detect signs of poisoning in waterholes, documenting observations in the register.
- Record water levels during each visit.
- Assess the surrounding area of the waterhole for protection considerations.
- Minimize disturbances in the area.
- Implement measures to prevent livestock or villagers from accessing these locations.
- Utilize local materials such as wood or bamboo for signage at waterholes, avoiding plastic, flex, or vinyl. Use grey, green, or black colors for writing.
- Ensure consistent water filling in each waterhole, particularly in cases of facility failure or water provision issues. Even a single day without water at a waterhole can be detrimental from a wildlife perspective. Staff sensitization and monitoring by senior officers are crucial in this regard.
- Monitor water availability weekly after January 15th, which should also factor into decisions regarding the closure of the Sariska Tiger Reserve (STR). Maintain a waterhole monitoring register at the range level.
- Conduct periodic testing of water quality and contamination, especially at water points requiring frequent filling.

- Periodically test water for pathogens and vectors, particularly at water points requiring frequent filling.
- Monitor the use of water points by other organisms that may serve as disease vectors, such as snails.
- Ensure surveillance and protection around water points near human settlements to prevent potential disease transmission from livestock.

➢ **Prescriptions for creation of new artificial waterhole:**

Considering that water availability influences habitat utilization, sometimes leading to overuse by wild animals, it's essential to assess the proximity of existing water points to proposed ones and evaluate habitat conditions before establishing new water sources. Exploring the feasibility of elevating water for gravity flow is crucial. Given the Sahyadri Tiger Reserve's sufficient water points, new sources should only be created if absolutely necessary and identified by the Assistant Conservator of Forests (ACF) at least. Here are some guidelines:

- Maintain a minimum distance of 2.5 km between two water points, slightly more than the average cruising radius of wild ungulates.
- Extend the use of solar pumps to all water points requiring regular replenishment, but avoid overuse.
- Implement a rotation-based desilting schedule for waterholes, ensuring a saucer shape or gentle slope on at least one side rather than abrupt edges during desilting.
- Regularly repair and maintain the reasonably well-distributed waterholes in the reserve.
- Replace hand pumps in artificial waterholes with solar pumps to ensure sufficient water for wildlife. However, keep the hand pumping mechanism operational as a backup in case of solar pump failure.

Table No.7.9: Types of Artificial Source of Water & Criteria For Selection of Site

Sr. No.	Types of Artificial Sources of Water	Criteria for selection of a site for waterhole and works prescribed which is in favor of wildlife.
1	Bore well	As per the recommendation of GSDA after field survey. It is only possible where the roads are in good condition for bore well machine to carry. There is problem of collapsing borewell after rainy season due to short casing and due to soil structure.
2	Open well	It is recommended in the hilly area where bore well machine can't reach and water tanker also can't reach due to hilly terrain and no road connectivity. After a thorough inspection, a site should be selected preferably with help of GSDA.
3	Water Tanker	If, Bore well or Open well get failed due to absence of underground water or unfavourable strata, waterhole should be provided by using tankers if motorable road present in that area.

4	Man-made lake	Safe access should be provided. Water receding area should have planted with khus grass if, grass or any other cover is absent to reach up to water. De-siltation is recommended if it will give water throughout the year. Construction of Dyke in a big lake where at the end of summer. For the construction of Dyke, it is important to identify a suitable site.
5	*Van-talav*	It is constructed where water storage should remain throughout the whole year. Select a site where Clay soil depth is at least 01 metre deep after a highest depth of Van-talav.
6	*Van-bandhara*	It is constructed where water storage should remain throughout the whole year. The core of Bandhara filled with black cotton soil and rammed well to make core cohesive and impermeable to water is very important and should do under close observation of RFO.
7	Cement Bandhara	It is constructed on Nullahs where water storage should remain throughout the whole year.

➢ **Prescriptions for Soil and Moisture Conservation (SMC) Works:**

SMC Works: STR has good forest density hence, SMC works are not recommended as good forest cover and ground cover is always accelerating water infiltration and soil conservation. These works are recommended in an area with open forest having tree density less than 10% or there is an area with the absence of ground cover due to heavy grazing and repeated fire. In such area, a systematic plan of treatment should prepare SMC works with 'top to bottom approach" of watershed management and along with strict protection measures to that area. This work should take only with written recommendation and justification of ACF about need of SMC work in selected area. Site selection for SMC should also personally verified by ACFs.

Nullah treatment: The health of nullahs (streams) plays a crucial role in sustaining biodiversity and ensuring water security for wildlife. Nullah treatment refers to a range of ecological interventions aimed at preserving and restoring these vital watercourses. Nullahs serve as lifelines for wildlife in STR providing water for drinking, and sustaining delicate ecosystems. Moreover, integrating traditional ecological knowledge/ wisdom with modern techniques enhances the efficacy of nullah treatment. This needs to be an ongoing initiative keeping in mind the scarcity of water some part of STR. While planning of nullah treatment, top-to- bottom approach should be adopted. The tiger reserve should take Nullah

treatment works in collaboration with the concerned department of the state government (GSDA/Irrigation/Agriculture) for selection of site and type of works to be taken. A survey of aquifer should also be carried out for their preservation and sustainable use.

v. **Monitoring and Evaluation:**

- The beat guard must keep a register for all waterholes within his jurisdiction, with each page certified by the Range Forest Officer (RFO) for validity.
- The register should adhere to a fixed format and be provided in printed form, designated as the "Waterhole Checking Register".
- Record the water level, indirect evidence of wildlife activity (such as pugmarks on PIPs around the waterhole and mud patterns), results of urea poisoning tests, and any observations of human presence or poaching attempts within a 300-meter radius of the waterhole after thorough inspection.
- Senior officers, including foresters and the field director, must review this register during their field visits without exception. Proper instructions should be provided in case of neglect in maintaining the waterhole.
- Document the names of wild animals observed visiting the waterhole by field staff during their visits.
- Conduct research and regular observations to assess the utilization of both newly created and existing waterholes, and monitor habitat changes due to overuse and concentration of wildlife during peak periods. Develop appropriate plans accordingly.
- Ensure all mandatory documents related to newly created waterholes and associated works are properly maintained and available for evaluation or visits.

7.2.2.2 Theme Plan for Forest Protection:

i. General: The protection theme plan for the tiger reserve serves as a comprehensive 'security plan', incorporating regular security audits to safeguard the habitat against various threats. The reserve faces numerous challenges, including the looming risks of revenge killings due to the delicate human-tiger interface and targeted poaching activities. This theme plan is structured around two main components: preventive measures and control operations.

Preventive steps are designed to fortify the reserve's defenses and typically encompass: Establishing permanent anti-poaching camps manned by frontline staff, equipped with wireless communication systems and surveillance technology. Strengthening the forest road network and providing vehicular support for rapid response, Ensuring adequate provision of arms and ammunition to enable effective deterrence against poachers, Implementing smart patrolling protocols such as M-STrIPES, leveraging intelligence gathering to enhance surveillance and patrol effectiveness, Conducting regular supervisory checks on patrolling intensity to maintain vigilance and responsiveness, Forming specialized patrolling squads trained in anti-poaching tactics and strategies, Deploying a dedicated force like Special

Tiger Protection Force (STPF) specifically trained and equipped for tiger protection duties, Continuously enhancing the skills and capabilities of frontline staff through training programs and skill development initiatives. By meticulously implementing these preventive measures, the tiger reserve aims to proactively mitigate threats and ensure the safety and security of its precious wildlife population.

Control operations within the protection theme plan entail a comprehensive set of actions to swiftly respond to security threats and enforce law and order within the tiger reserve. These operations consist of: Establishing clear duty rosters for frontline staff and specialized units, ensuring continuous coverage and readiness for response, Implementing round-the-clock surveillance using state-of-the-art technology such as drones, cameras, and satellite imagery to monitor critical areas and detect suspicious activities in real-time, Facilitating seamless exchange of information between patrolling squads, anti-poaching camps, and supervisory personnel to coordinate response efforts and share intelligence on potential threats, Employingproactive measures to deter and intercept poachers, including ambush patrols, decoy operations, and intelligence-driven raids on known poaching hotspots, Swiftly apprehending offenders caught engaging in illegal activities within the tiger reserve, with a focus on preventing further harm to wildlife and habitats, Conducting thorough investigations at crime scenes to gather evidence, document offenses, and identify perpetrators, leveraging forensic techniques and expert analysis, Collaborating with law enforcement agencies and judicial authorities to ensure the prosecution of offenders, seeking maximum penalties for wildlife crimes to deter future violations. By meticulously executing these control operations, the tiger reserve aims to maintain a robust security posture, deter illegal activities, and safeguard its biodiversity for future generations.

The security audit should be based on the enabling provisions of the Wildlife (Protection) Act, 1972, rules/orders framed by the state government, rules framed by the center (NTCA/Project Tiger), and guidelines/SOPs of NTCA/Project Tiger. An appraisal of risk, specific to the site needs to be done while examining the practices in-vogue to identify the gap/shortcomings. The audit should focus on legal violations if any, besides the response shown by the management to security threats. In particular, the innovations have done (based on SWOT) for surveillance and networking should be critically examined. Since, this one forms the basis for intelligence-based enforcement. The security incident response (as per season) shown by the frontline vis-à-vis the desired supervisory checks should prominently figure in the audit.

Other important components include: To effectively combat wildlife crime and enhance protection efforts, a comprehensive approach is essential. This involves:

Capacity Building: Providing frontline personnel with the necessary skills and knowledge to operate effectively in rugged terrain. Ensuring frontline personnel possess the physical fitness required to conduct rigorous fieldwork/legwork in challenging terrain. This includes fitness training and equipping them with basic legal and wildlife provisions knowledge.

1. Technical Expertise: Ensuring frontline staff have the technical expertise to safeguard offence sites and reconstruct crime scenes, leveraging modern technology where appropriate.

2. Patrolling Intensity: Increasing patrolling intensity in sensitive areas of wildlife habitat to deter and detect illegal activities.

3. Arms and Ammunition Status: Regular assessment of the status of arms and ammunition and its regular training to ensure frontline personnel are adequately equipped to handle potential threats.

4. Wildlife Crime Litigations: Monitoring ongoing litigations, particularly those involving Schedule 1 and Schedule 2 Part II animals, in courts of law.

5. Community Engagement: Engaging with local communities to garner support for wildlife protection efforts, including sensitizing the judiciary and implementing innovative initiatives. This may involve deploying local workforce in patrolling and utilizing them as informants.

6. Market Monitoring: Regular monitoring of local countryside markets, railway stations, bus stands, and highways to curb wildlife trafficking and related activities.

7. Liaison and Monitoring: Establishing liaison with outlets selling pesticides and monitoring livestock and human injuries to assess the sensitivity towards retaliatory killings. Additionally, checking water points around wildlife habitats for contamination and poisoning.

In Sahyadri Tiger Reserves (STR), prioritizing wildlife protection is paramount, with all other endeavors viewed as supplementary to this core objective. Given the region's inherent socioeconomic challenges and the relentless threats posed by illegal wildlife trade, the significance of forest protection becomes even more pronounced. The details are provided in Chapter 10 and Security plan.

ii. Objectives:

1. Comprehensive Habitat Protection: Develop and implement strategies to comprehensively protect the habitat of wildlife species within the Tiger Reserve, ensuring the integrity and viability of their ecosystems.

2. Effective Anti-Poaching Measures: Establish and enforce robust anti-poaching measures to prevent the illegal killing of wildlife species, aiming for zero poaching incidents within the Tiger Reserve.

3. Community Engagement and Awareness: Engage local communities in wildlife protection efforts, raising awareness about the importance of conservation and fostering a sense of stewardship towards the Tiger Reserve's biodiversity.

4. Capacity Building and Training: Provide training and capacity-building initiatives for frontline staff and local stakeholders involved in wildlife protection, equipping them with the necessary skills and knowledge to effectively carry out their roles.

5. Surveillance and Monitoring: Enhance surveillance and monitoring systems within the Tiger Reserve to detect and deter illegal activities, including wildlife trafficking, habitat destruction, and encroachment.

6. Collaboration and Partnerships: Forge partnerships with government agencies, non-governmental organizations, research institutions, and local communities to strengthen wildlife protection efforts through collaborative initiatives and resource sharing.

7. Research and Conservation Initiatives: Support research initiatives aimed at understanding the ecological dynamics of the Tiger Reserve and implementing conservation interventions based on scientific findings to ensure the long-term viability of its wildlife populations.

8. Adaptive Management and Enforcement: Continuously evaluate and adapt wildlife protection strategies based on monitoring data and emerging threats, while ensuring strict enforcement of regulations to uphold the integrity of the Tiger Reserve's conservation objectives

.**iii. Issues and Problems:**

- The core zone of the tiger reserve comprises seven inhabited villages, exerting significant biotic pressure on the surrounding forest ecosystem. This pressure manifests in various forms, including the persistent threats of poaching, forest fires, illegal grazing, and encroachment. These villages, being situated within the core zone, pose a continuous risk to the integrity of the reserve's biodiversity and habitat. Moreover, the buffer zone of the reserve is home to an additional 82 villages, each contributing to the collective biotic pressure on the adjacent core zone area.

- Electrocution is currently not major issue but it is potential issue in near future
- Collection of Medicinal plant products like *Narakya*, NTFP collection, fuel wood collection, poaching for bush meat and trespassing for trekking on forts, temple tourism, illegal fishing this are very important issues to address by area manager.
- The illegal activities of poaching and the collection of wildlife and their associated articles for national and international trade pose significant threats to biodiversity and ecological balance within the Tiger Reserve. Poaching, driven by demand for wildlife products in traditional medicine, fashion, and exotic pets, decimates populations of endangered species and disrupts ecosystems.
- The protection road network within the Tiger Reserve is limited due to the rugged terrain, posing challenges for effective surveillance and enforcement efforts.
- The core zone of the reserve is subdivided into two distinct blocks, each characterized by an irregular shape with a long outer boundary. This geographical configuration creates vulnerabilities that facilitate unauthorized entry by poachers into the Tiger Reserve (TR) and their subsequent escape without detection.
- The susceptibility to fire within the area is influenced by the prevalence of grasslands and the presence of a large shepherd community in the surrounding buffer zone. The practice of burning grasslands is common among the shepherd community, driven by the belief that it promotes the growth of fresh grass in the subsequent season.
- Sometimes temporary majur already worked on APC as protection labour, may be involved in illegal activities as they know the area and presence of wildlife.

iv. Strategies:

1. The Strategies for Forest Protection and Anti-poaching activities:

a) Establishment and maintenance of Anti-poaching Camps/Protection Camp

b) Field Patrolling and Surveillance

c) Strengthening of Check Post

d) Wildlife Highway Patrolling

e) Communication Network

f) Intelligence Gathering

g) Inter Division coordination and co-operation meetings and joint patrolling strategies

h) Capacity Buildings for the Field Staff

i) Effective co-ordination with Line Agencies

j) Deployment Special Tiger Protection Force

k) Establishing Cyber Cell

l) patrolling in Weekly Market

2. Anti-Poaching Operations

One of the best protection strategies in the STR has been the anti-poaching operations by involving local tribal's and other communities. 42 Anti-poaching camps/ (Protection huts) have been established in the most sensitive and vulnerable areas of the Tiger Reserve and manned by anti-poaching watchers and Uniformed Beat Subordinates on 24 hours basis. In addition to this, new Protection Huts will be established wherever it is found necessary. The Protection Huts watchers keep on rotating every month. The Protection huts watchers cover around 5-8 km route length by foot patrolling every day and record condition of the area, evidence of humans, wildlife sighted and offence detected. Intrusion and record of the sightings and evidence of wildlife maintained in registers in each camp. The anti-poaching camps will be connected over wireless to secure the field reports on a daily basis. The continued presence of anti-poaching watchers in the camps will act as a biggest deterrence against any illegal activity in the Tiger Reserve and adjoining forest divisions.

3. Criteria for Selecting Anti-Poaching Camps/Protection Huts.

The following considerations are made for selecting an anti-poaching camp.

a) Location in terms of known areas of frequent animal movement.

b) Location in terms of vulnerability for poaching incidences.

c) Significance of location with regard to the seasonal availability of crucial resources (food, water, shade and breeding areas of animals)

d) Better accessibility to forest roads for patrolling and supply of rations for anti-poaching camps.

e) Closer proximity to perennial streams for the suitable living condition.

f) Suitability of locations for establishing communication facilities.

4. Proposal to strengthen the Anti-Poaching Camps: Overall Strategy

It is necessary to supply the following infrastructure for Anti-Poaching Camp.

a) Minimum wages as per Govt norms per month per Watcher.

b) Torchlight, cells, operational expenses transportation, hunter shoes and two sets of uniform and maintenance of camp shed accessories to be provided.

c) Minimum 2 persons per camp to be ensured for a proper functioning of camp.

d) Walkie-Talkies and communication accessories to be provided for each camp.

e) A separate register to be maintained for scientifically documenting patrolling details and everyday field data to be communicated to the headquarters.

f) Proper training to be provided for the field staff on the use of GPS and Compass to get the proper location of animals. GPS and Compass to be given for each camp.

g) Adequate utensils and medical kits to be supplied periodically for each camp to strengthen their field personnel moral in protection measures.

h) Periodical meeting with the higher officials (Range Officers and DFO) to be organized for the anti-poaching watchers as part of confidence building mechanism. Such programmes will fine tune the functional ability of the ground staff in an appreciable manner. A separate fund to be earmarked for such as meeting.

i) Group Insurance Scheme to be made available for all the anti-poaching watchers and a separate tie-up an arrangement to be organized with various line agencies and NGOs.

j) Internal sports materials to be supplied for each camp as part of the improvement of their mental skills.

k) Separate health camp to be organized for all the protection labours.

l) Proper hygienic water supply to be ensured in each camp for their daily use.

m) LPG connection to be provided for each camp.

n) Data on M Stripes to be properly collected and passed on to the Head Quarters every week. Training on data compilation to be provided for the APW by the higher officials in a periodical manner. The template needs to be simplified for an efficient data collection from the field. Data collection on M Stripes has to be periodically documented and discussed with the field personnel to improve the patrolling strategy in concern beat/section/range.

o) Proper field kits to be supplied for the APW.

p) Training should be given on intelligence gathering and interrogation for the APW with the assistance of police and legal departments.

q) All the APW should be trained in driving and use of arms.

r) Comprehensive health camp should be organized once in three months for the APW with the

involvement of Rural Health Camp Programme/ NGOs.

s) The mechanism of cash reward may be constituted for successful detection of forest offences and this might motivate the moral capacity of the Protection labourers.

5. Strengthening Protection Measures:

The following activities are required to strengthen anti-poaching operations.

a) Rotation of staff for patrolling. Each patrolling staff in the anti-poaching camp must be done with the leadership of uniformed field staff.

b) Patrolling teams to be formed for specific areas.

c) There is a need to concentrate on border areas especially, entry and exit points of poachers and lay ambush.

d) Documentation on visible indicators, human trails.

e) Regular visit to vulnerable areas and paint markings.

f) Night patrolling on foot, and also patrolling without the use of torch lights.

g) Upgraded vigilance during weekends and ensuring that the staffs are on leave on a staggered basis.

h) Detailed log activities to be maintained by the staff in the prescribed formats.

i) Intercamp visits by the watchers.

j) Identification of vulnerable areas is a continuous process.

k) Senior staff regularly stays in the camp.

l) Codification of the camps is important and a common code must be evolved for the division.

m) Periodic contact with the bordering division's anti-poaching camps and joint patrolling.

6. Check Post and Communication Facilities

All check posts should be equipped with a proper network of communication facilities in order to strengthen the protection measures. This should be carried out on apriority basis.

7. Proposed Protection Measures-

i. Conservation awareness programme for various stakeholders.

ii. Strengthening of existing anti-poaching camps by providing all infrastructure facilities.

iii. Ensure proper training on patrolling for Anti-Poaching Watchers, especially intelligence gathering and use of equipment.

iv. A separate cell attached with the CF / DFO office to be commissioned with related line departments to prevent illegal trafficking of Tiger and other wildlife products.

v. Periodical workshop on strengthening protection measures to be organized with interstate officials. The minutes of the workshop to be forwarded to the policy makers for an effective implementation procedure and action.

vi. Sufficient annual budgetary commitment must be ensured from the state treasury for conservation of tigers with special allocation for its protection measures.

8. New Check Posts

New permanent and temporary check posts to be established in sensitive parts in STR limits as part of increasing vigilance to prevent illegal activities.

Table No.7.10: Protection Related training suggested for field staff and officers are given below:

S.N.	Topic for Training	S.N.	Topic for Training
1	Values and ethics to be kept in mind and followed while performing duties.	30	Criminal threats to natural resources in and around PAs
2	Concepts and principles of conservation and ecology	31	Human Rights
3	Operational security	32	Use of force
4	Roles and Responsibilities	33	Community collaboration
5	Teamwork	34	Drill and Discipline
6	Values and ethics to be kept in mind and followed while performing duties.	35	Concepts and principles of conservation and ecology
7	Physical training	36	Weapon handling (elective)
8	Witness (Confidence building, maintenance, protection)	37	Wildlife protection legislation and court procedure
9	Survival skill	38	Evidences types and collection methods
10	Equipment use and maintenance	39	First-aid
11	Camouflage and concealment	40	Arresting procedure
12	Radio communication	41	Mission Planning and orders
13	Hand signals	42	Marksmanship (elective)
14	Orienteering and navigation	43	Immediate action drill (elective)
15	Tracking	44	Patrol
16	Surveillance training	45	Combative
17	Rapid response to emergency situation (elective)	46	Unexploded ordnance, land mines and booby traps (elective)
18	Search & raids	47	Standard Operating Procedure

19	Vehicle check points	48	Wildlife Crime Information Gathering
20	Temporary basis	49	Ambush
21	Basic crime scene response and photography	50	Basic Identification of wildlife products and derivatives
22	Night operations	51	Interview and interrogations
23	Snaring and de-snaring	52	Data collection
24	Unexploded ordnance, land mines and booby traps (elective)	53	Joint operations and co-operating with other enforcement agencies
25	Combative	54	Interview and interrogations
26	Standard Operating Procedure	55	Waterborne operations (elective)
27	Wildlife Crime Information Gathering	56	Debriefing and reporting
28	Basic crime scene response and photography	57	Joint operations and co-operating with other enforcement agencies
29	Basic Identification of wildlife products and derivatives	58	Pesticide crime/wildlife poisoning investigation

v. Monitoring and Evaluation:

In order to monitoring and evaluation of protection work, periodic security auditing of tiger reserve is required to assess the threats, assessment of current protection strategies and accordingly to set conservation-oriented patrol standards. The biggest threat to tiger conservation is poaching due to rising demand of tiger body parts and derivatives in consumer countries. Every tiger living in the wild is under risk; therefore, security audit of our tiger reserve with international standards should be done as per protocol developed by NTCA for strengthening of tiger protection in the tiger reserve.

There is need to evaluate the security status of the tiger reserve from time to time to be able to assess current status, understand gaps in security and take necessary steps to fill those gaps in view of ever-increasing poaching pressures also involving newer techniques and technologies.

Security Audit (SA) is an exercise to assess the threat levels in a TR and current strategies available to address those threats. It consists of three exercises: 1. Threat Assessment 2. Protection Assessment and 3. Conservation Oriented Patrol Standards (COPS). Security plan also acts as monitoring and evaluation mechanism for the implementation of Security Plan.

Law Enforcement Monitoring (LEM) is a site- specific way of keeping track of our Law Enforcement efforts. 'Site specific' because every protected area is different and its Law Enforcement needs vary. While results can be compared between different years in the same PA, they cannot be compared between sites. Keeping in mind the above points, Security Audit (SA) protocols are developed to help Tiger Reserve managers is regularly tracking the progress of their enforcement efforts to tackle poaching in their sites, while the status assessment is conducted by independent team constituted by NTCA at regular interval.

Security Audit is an independent assessment and this exercise is done by independent teams constituted by the NTCA every year. However, based on the protocol, self-assessment may be done by the TR managers.

Security audit provides an overview, from an outside perspective, of where the gaps in the provision of protection and enforcement services occurs, allowing the TR management to redress these shortfalls and thereby improve the protection it offers to the biodiversity it is mandated to preserve.

EXERCISE 1: THREAT ASSESSMENT:

This is a process of identification and analysis of those key factors that endanger the valuable assets within a TR. Threat Assessment aids TR managers in drawing up effective protection strategies for their parks.

Step 1: Identification of Threats:

1. Identification of key biological resources of the TR (e.g. key species like tiger, Giant squirrel etc)

2. There can be three types of threats:

- Current threat - immediate threat to the valuable asset of the 'TR (e.g. poaching, fire, habitat destruction, grazing, illicit felling, mining, encroachment etc.)
- Near future threat -can be threat to the valuable asset of the TR in next 2-3 years (e.g. a road expansion)
- Future threat - can be threat to the valuable asset of the TR in next 4-5 years (e.g. industrial growth, rail construction and human resource of the TR)

3. List different types of threats —this should be done in consultation with the stakeholders and from the existing threat data/crime data. It is advisable to use at-least 3-5 years of threat data.

Step 2: Assessment of Threats:

Each threat identified in the above step shall be critically analysed in terms of extent, distribution and trend. This step will help 'TR managers in understanding the distribution of different threats and the damage they cause to the TR.

List of information TR managers would need for threat assessment (but not restricted only to these question)

- Data (both temporal and spatial) on all threats.
- A map on distribution of key species in the conservation site/TR.
- A map of important man-made features (human habitations, roads, religious places, high tension

overhead electric lines, villages etc.).

- The road infrastructure including all main and secondary roads in and around TR. An indication of which roads are fair-weather and which are usable year-round.
- Rivers, canals, bridges, mountain passes (or other choke points) and established tracks with specific emphasis on which seasons they can be used for transportation.
- All known commonly used entry/exit points around the 'TR.
- Points at which poaching incidents have happened (priority species and prey) in the last five years?
- The areas in & around the TR which have populations of known traditional hunting communities and also any points indicating temporary camps used for illegal activities.
- Database of local communities known to support external poachers repeatedly.
- Details of the hunting communities name of communities, permanent settlement or nomadic.
- Cultural & Religious places (temples/dargah/ashrams etc.) inside the TR and periodicity of visits by people-regularly or few times a year.
- Points where well-known poachers are known to reside in the area (in at least a 100 km radius). As much information about these individuals is possible e.g. where they from are, what is their present social status, who all are their key associates near the TR.
- List of well-known /already identified trade centres in the area (in at least a 500 km radius).
- Localities which have a higher concentration of licensed firearms. What is the trend of consumption of cartridges in such areas?
- Estimate of types and numbers of arms that are/maybe used for poaching in nearby areas to TRs
- Map sharing electricity transmission lines inside TR and in fringe areas.
- Map sharing Police Stations/Chowkis in the vicinity/inside TRs and their contact details.
- Schedule of weekly market in fringe area.
- Map showing location of iron smiths in the fringe areas.
- Map showing entry and exit points of the TR.
- Database of the iron smiths of the area.
- The areas, which suffer from high human-wildlife conflict, especially with respect to species like the tiger, leopard, bear or elephant. Sensitive areas for crop depredation? Relative dependence of crop on local community's livelihood?
- The cropping pattern of adjoining areas and the different crop protection measures including illegally put up measures like live electric wire or snares.
- Measures being adopted for minimizing/control of Human wildlife Conflict.
- List of water bodies, close to the periphery of the TR that attract wild animals especially during summer.
- Details of wildlife crime incidents (past 5 years) with international/Pan India/ interstate ramification

and links.

- Nature and status of coordination with line departments.
- No. and location of encounters with poachers (past 5 years).
- Prosecution success in last 5 years (with own resources and outside support)
- Location of breeding tigresses.
- Details of dispersing (probable) tigers- Phase IV monitoring details.
- Availability/non availability of readily accessible and sufficient maintenance budget for equipment and infrastructure.
- Extent and mechanism of tourism revenue sharing with local communities.
- Staff welfare mechanism (leave, camp facilities, medical aid, school facilities, accident insurance/ ex- gratia, security etc.) in place including casual staff.

Step 3: Analysis (Format):

This step includes the analysis of all the threat data TR managers have collected in step two and producing the threat report. Some of the outputs TR managers will get after the threat analysis;

- Maps with distribution of threats
- Threat score cards
- Priorities on the basis of threat scores
- Recognition of the attackers/offenders/potential offenders
- Threat trends

Step 4: Security Plan:

A Security Plan shall be developed through a work/meeting with the TR authorities and other stakeholders concerned. The SP shall also be supported by an operation plan/ implementation plan.

EXERCISE 2: PROTECTION ASSESSMENT:

This is a process of gathering information on current protection practices in place to effectively address threats to species and their habitat. An exercise is carried out in consultation with the TR authorities where sets of questions are asked to TR management and frontline staff to gather information on protection, backed by evidence and field verification.

Step I: Consultation Workshop:

1. Conduct a consultation workshop with the TR manager, enforcement and patrol teams/staff/ officers.
2. Communicate the workshop schedule well in advance and provide them the list of information you would need to complete the SA.

3. Make sure that all relevant people listed in point 1 attend and actively participate in the discussion.
4. It is evidence-based assessment therefore all information provided by the TR authorities should have supporting documents (e.g., Latest list of staff to verify the actual number of staff on ground).

Step 2: Field Verification:

The assessment team to verify the information gathered during the workshop and do Field verification through field visits. For field verification, at least 50% each of range offices anti-poaching camps/chowkis will be selected based on a stratified random basis to represent the entire TR. The field

verification formats will be used for the purpose scorecards. This will help in finding any disparity in the information provided at the TR HQ with the field realities.

Step 3: Visualizations of Results:

Most TR managers may not be interested in detailed reports and therefore appropriate info graphics shall be used to represent threat assessment and protection assessment. They can however access detailed reports as well.

EXERCISE 3: CONSERVATION ORIENTED PATROL STANDARDS (COPS):

COPS are a set of indicators TR managers to assess the patrol regime. It is an evidence-based assessment tool that helps TR managers to monitor and evaluate their patrol strategies.

1. An Enforcement Plan must be in place for the Tiger Reserve:

- The enforcement plan will be based on the enforcement strategy as per the Security Plan and will provide the guidelines for patrol activities and planning. It should contain:
- Situation: Containing a list of threats to TR, maps, aerial photos etc.
- Mission (Objectives): Maintain an effective compliance and enforcement capacity to mitigate the impacts of users, visitors and illegal activities.
- Execution (Methodology):

i. Maintaining regular reserve patrols particularly along the boundaries.
ii. Ensuring the effective deployment of the enforcement and compliance members towards controlling illegal activities, enforcing legislation and regulations.
iii. Mapping areas where illegal activities occur and maintaining an inventory/ record of incidents.

- Administrative and logistics:

i. Essential provisions for transportation, clothing, and equipment

ii. A safety and risk requirements

2. Minimum of fifteen days/ Nights of Enforcement Patrols per Month:

The patrol schedule and adequate staff numbers may allow for 100% coverage over the month, but at the minimum, a random 50% coverage using available staff is required. This is to include night patrols. Day/nights are for 24 hours periods of actual coverage. i.e. 15x24 hrs.

3. Coverage of Accessible Areas of the Tiger Reserve:

Patrols have to cover at least 75% of all readily accessible areas of the TR per month. If the area is accessible to the public, it must be patrolled. At least 75% of all accessible areas covered per month.

4. Minimum of Four Team Members:

If patrolling by vehicle or boat, this may be reduced to three members. In addition to normal enforcement patrol requirements and efficiency (contact & cover officers) this is also an officer safety issue. If a patrol staff/ officer is injured then two of the staff can carry him out, while one is available for point, or one person can stay with the injured staff while the other two go for assistance. If the patrolling party is travelling by vehicle or boat, then the difficulty with the transport of apprehended persons or injured individual changes, therefore three persons may be adequate.

5. Include an Officer Trained to Collect Evidence:

At least one of the enforcement patrol team must be trained in wildlife crime scene investigations (WCSI) and informant handling and interrogation techniques.

6. Powers of Arrest & Detention Procedures:

Enforcement patrols within the Forest Department must have powers of arrest. This includes the powers of detention a necessity until the suspect has been charged and arraigned in court. Protocols and procedures must exist to cover officer safety, prisoner rights, safety, & well-being, as well as specifications for the holding facilities prior to processing tor court.

7. Enforcement Patrols must be supported by an Information Network:

There has to be an intelligence-based enforcement. As in many areas of LE, confidential informers (CIs) are a crucial part of the system. Most TRs are too large to be adequately patrolled. Therefore, using informants and targeting known hotspots or suspected individuals, will make the patrols more effective. (UNODC claim that 86% of border seizures result from informers)."

8. **Mobile/Rapid Response Teams (RRT):**

RRTs consisting of TR staff effectively deployed to respond to "hot spots" and other illegal activities not covered by regular patrols. This mobile team is internally staffed, allowing for standardized training, operating procedures, protocols, equipment, control and immediate response if needed.

9. **Some Protection Staff should be permanently based on Site:**

These staff may either be in a camp, check post or a guard house/Chowkis at the TR's entrance or other available sites. The public must:

- In an emergency or circumstances requiring assistance, be able to contact staff at a known location.
- Be aware that there exists a staff presence in the area to show "ownership" of the TR-that Government is paying attention to its TRs.

10. A Communication System must be in Place between Patrol Teams and Headquarters

The type of communication system will only be as sophisticated as budgets and terrain allow. However, staff must be able to get emergency assistance by some method.

11. A Law Enforcement Monitoring (LEM) Tool Should Be in Place:

Some LEM tool is being used such as M-STrIPES (We must be able to keep track of results, plan for future activities, analyze results and show improvements).

12. Tactical Maps are available of the Tiger Reserve and Surrounding Areas:

Actual maps (not something contained electronically) these should be of the Topographic type Scale 1:50,000 and 1:25,000, "GIS" produced maps often do not include areas outside the TR. The TR is not an "island". It is essential that the maps include all the surrounding areas, and are suitable for posting on a wall, so that coloured pins designating various crimes can be affixed.

13. All Major Access Points/Routes should be controlled:

There should be "Gate house/ Barrier/ Check posts at the entrance/s to the TR, or on all roads traversing the TR, to welcome visitors, monitor traffic access and egress, and search suspicious vehicles if necessary. This forms part of the visible deterrent approach.

14. Include Multiple Agencies:

Different Government legislation and regulations apply. The enforcement staff must consist of personnel trained, authorized and capable of properly carrying out all their duties.

15.Training Standards:

Training standards vary at local, regional, or country level. Training should conform to the ASEAN I Competence Standards for Protected Area Staff (Appleton 2003), IUCN Global Register of Competences for PA Staff Appleton 2016) and the Anti-Poaching Ranger (frontline staff) Training Guidelines (Lotter et al 2016) or any other standard set by the NICA.

Note: all the standard proforma is available in document namely 'Protocol for Security Audit of Tiger Reserve' on the NTCA website as well as GTF website.

7.2.2.3 Theme Plan for Forest Fire Protection:

i. General:

The core zone of Sahyadri Tiger Reserve is particularly susceptible to forest fires, with Chandoli National Park being more prone than Koyna Wildlife Sanctuary. Chandoli National Park, housing five villages within its core zone and boasting approximately 3000 hectares of grasslands, faces a heightened risk of forest fires due to various anthropogenic activities. These include ***raab***-burning before the paddy cultivation season, burning of private land for Nachani cultivation, ***dhura*** burning along farm bunds, intentional burning as retaliation against forest staff, and villagers burning their own grasslands in anticipation of regrowth. Conversely, the core zone of Koyna Wildlife Sanctuary enjoys a natural shield against forest fires, courtesy of its eastern border with the Koyna reservoir and a western escarpment that hinders access to potential culprits. While the sanctuary does have two villages within its core zone, both are situated on the eastern side of the reservoir, further reducing the risk of forest fires. The fire season typically begins in mid-December and persists until the onset of the monsoon, with the majority of fires being anthropogenic in nature and scarce records of natural fires in the area. Given these conditions, an effective fire management strategy with preventive and control measures is imperative. In November, a comprehensive Forest Fire Protection plan will be formulated for each season, delineating clear duties and responsibilities and allocating sufficient funds for implementation in the field.

ii. Objectives:

- Prevent and minimize the occurrence and spread of forest fires within the tiger reserve.
- Protect wildlife habitats, biodiversity, and ecosystem services from the impacts of forest fires.
- Ensure the safety of visitors, local communities, and reserve personnel during fire incidents.
- Attain a goal of Zero Fire incidents through stringent preventive measures and rapid response protocols.
- Implement a Zero response time policy upon receiving fire alerts, ensuring immediate action to contain fires.
- Establish a 24x7 alert system during the fire season to promptly detect and address potential fire hazards.
- Protect unique habitats and grasslands from the threat of wildfires through proactive mitigation

strategies.

iii. **Issues and Problems:**

- The majority of forest fires in STR are deliberate acts.
- Instances of revenge fires have also been reported.
- Chandoli National Park faces a high risk of fire due to extensive grasslands.
- Inadequate road infrastructure hampers access to fire-affected areas.
- Absence of fire lines along ridges in hilly terrain exacerbates fire containment efforts.
- There is a lack of serious investigation into the post-impact assessment of fire incidents.

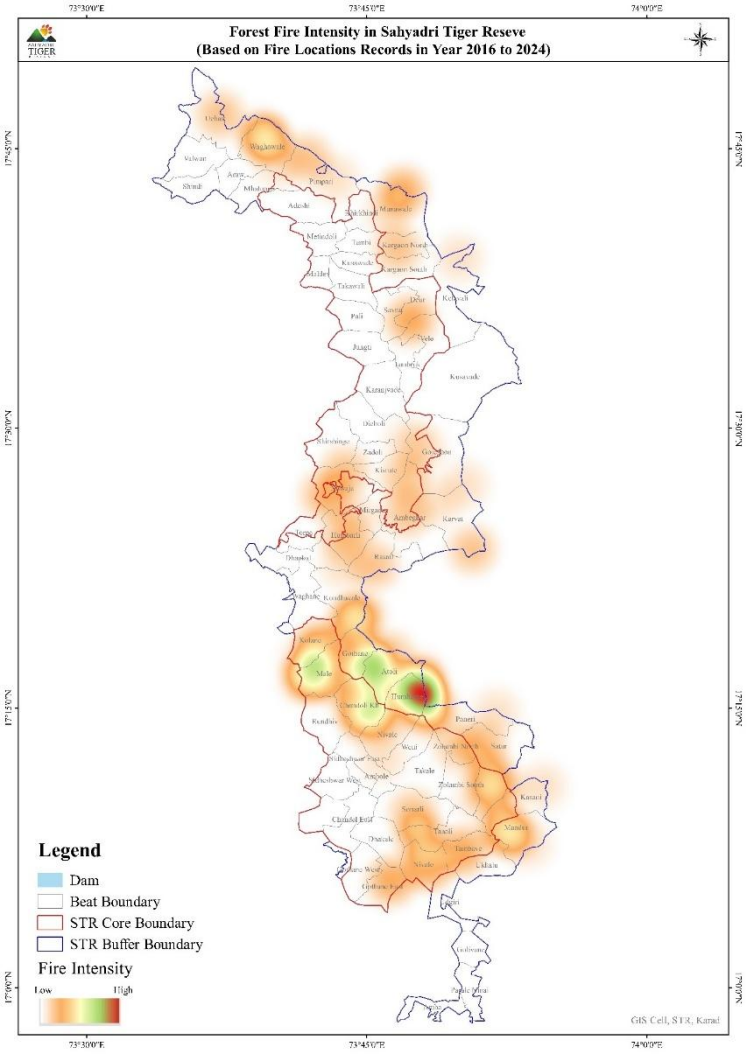
Table No.7.11 Fire incidences in past five years

Sr.No.	Year	Name of Division	Name of Range	Name of Village
1	2019-2020	Koyna WL Division	Patan	Karvat
2	2019-2020	Koyna WL Division	Patan	Kusawade
3	2019-2020	Koyna WL Division	Bamnoli	Munawale
4	2019-2020	Koyna WL Divisio N	Bamnoli	Munawale
5	2019-2020	Chandoli WL Division	Dhebewadi	Humbarne
6	2019-2020	Chandoli WL Division	Dhebewadi	Humbarne
7	2019-2020	Chandoli WL Division	Dhebewadi	Paneri
8	2019-2020	Chandoli WL Division	Helwak	Atoli
9	2019-2020	Chandoli WL Division	Helwak	Atoli
10	2019-2020	Chandoli WL Division	Dhebewadi	Paneri
11	2019-2020	Chandoli WL Division	Dhebewadi	Paneri
12	2019-2020	Chandoli WL Division	Dhebewadi	Paneri
13	2019-2020	Chandoli WL Division	Dhebewadi	Paneri
14	2019-2020	Chandoli WL Division	Helwak	Atoli
15	2019-2020	Chandoli WL Division	Helwak	Chandoli Kh
16	2019-2020	Chandoli WL Division	Chandoli	Tambave
17	2019-2020	Chandoli WL Division	Chandoli	Sonarli
18	2019-2020	Chandoli WL Division	Dhebewadi	Nandoli
19	2020-2021	Koyna WL Division	Patan	Ambeghar
20	2020-2021	Koyna WL Division	Patan	Ambeghar

21	2020-2021	Koyna WL Division	Patan	Karvat
22	2020-2021	Koyna WL Division	Patan	Karvat
23	2020-2021	Koyna WL Division	Kandat	Waghavale
24	2020-2021	Koyna WL Division	Kandat	Uchat
25	2020-2021	Koyna WL Division	Bamnoli	Kargaon
26	2020-2021	Koyna WL Division	Patan	Vele
27	2020-2021	Koyna WL Division	Kandat	Waghavale
28	2020-2021	Koyna WL Division	Kandat	Pimpari
29	2020-2021	Koyna WL Division	Bamnoli	Munawale
30	2020-2021	Koyna WL Division	Koyna	Koyna
31	2020-2021	Chandoli WL Division	Koyna	Rasati
32	2020-2021	Chandoli WL Division	Helwak	Gothane
33	2020-2021	Chandoli WL Division	Amba	Nivale Ko
34	2020-2021	Chandoli WL Division	Dhebewadi	Vetti
35	2020-2021	Chandoli WL Division	Helwak	Chandoli Khurd
36	2020-2021	Chandoli WL Division	Helwak	Kolane
37	2020-2021	Chandoli WL Division	Dhebewadi	Humbarne
38	2020-2021	Chandoli WL Division	Dhebewadi	Paneri
39	2020-2021	Chandoli WL Division	Dhebewadi	Paneri
40	2020-2021	Chandoli WL Division	Helwak	Kolane
41	2020-2021	Chandoli WL Division	Helwak	Male
42	2020-2021	Chandoli WL Division	Helwak	Kolane
43	2020-2021	Chandoli WL Division	Helwak	Male
44	2020-2021	Chandoli WL Division	Helwak	Atoli
45	2020-2021	Chandoli WL Division	Dhebewadi	Humbarne
46	2020-2021	Chandoli WL Division	Dhebewadi	Humbarne
47	2020-2021	Chandoli WL Division	Koyna	Rasati
48	2021-2022	Koyna WL Division	Bamnoli	Kargaon
49	2021-2022	Koyna WL Division	Kandat	Uchat
50	2021-2022	Koyna WL Division	Patan	Ambeghar
51	2021-2022	Koyna WL Division	Patan	Ambeghar
52	2021-2022	Koyna WL Division	Koyna	Navja
53	2021-2022	Koyna WL Division	Koyna	Navja
54	2021-2022	Koyna WL Division	Kandat	Waghawale
55	2021-2022	Koyna WL Division	Bamnoli	Munavale

56	2021-2022	Koyna WL Division	Kandat	Pimpari
57	2021-2022	Koyna WL Division	Koyna	Koyna
58	2021-2022	Koyna WL Division	Kandat	Waghawale
59	2021-2022	Koyna WL Division	Patan	Deur
60	2021-2022	Koyna WL Division	Patan	Karvat
61	2021-2022	Koyna WL Division	Patan	Kusawade
62	2021-2022	Koyna WL Division	Patan	Deur
63	2021-2022	Koyna WL Division	Kandat	Waghawale
64	2021-2022	Koyna WL Division	Kandat	Waghawale
65	2021-2022	Chandoli WL Division	Helwak	Goware
66	2021-2022	Chandoli WL Division	Helwak	Atoli
67	2021-2022	Chandoli WL Division	Helwak	kolane
68	2021-2022	Chandoli WL Division	Helwak	kolane
69	2021-2022	Chandoli WL Division	Helwak	Goware
70	2021-2022	Chandoli WL Division	Chandoli	Khundlapur
71	2022-2023	Chandoli WL Division	Dhebewadi	Humbarne
72	2022-2023	Chandoli WL Division	Helwak	Atoli
73	2022-2023	Chandoli WL Division	Chandoli	Tambve
74	2022-2023	Chandoli WL Division	Amba	Nivale Ko
75	2022-2023	Chandoli WL Division	Helwak	Gothane
76	2022-2023	Chandoli WL Division	Amba	Nivale Ko
77	2022-2023	Chandoli WL Division	Chandoli	Khundlapur
78	2022-2023	Chandoli WL Division	Dhebewadi	Nandoli
79	2023-2024	Koyna WL Division	Koyna	Rasati
80	2023-2024	Chandoli WL Division	Chandoli	Khundalapur
81	2023-2024	Chandoli WL Division	Chandoli	Khundalapur
82	2023-2024	Chandoli WL Division	Helwak	Atoli
83	2023-2024	Chandoli WL Division	Helwak	Atoli
84	2023-2024	Chandoli WL Division	Chandoli	Mandur
85	2023-2024	Chandoli WL Division	Dhebewadi	Humbarne
86	2023-2024	Chandoli WL Division	Helwak	Male
87	2023-2024	Chandoli WL Division	Helwak	Kondhavale
88	2023-2024	Chandoli WL	Helwak	Chandoli Kh

		Division		
89	2023-2024	Chandoli WL Division	Helwak	Goware
90	2023-2024	Chandoli WL Division	Dhebewadi	Humbarne
91	2023-2024	Chandoli WL Division	Helwak	Goware
92	2023-2024	Chandoli WL Division	Helwak	Goware
93	2023-2024	Chandoli WL Division	Helwak	Kolane
94	2023-2024	Chandoli WL Division	Helwak	Atoli
95	2023-2024	Chandoli WL Division	Helwak	Kolane
96	2023-2024	Chandoli WL Division	Helwak	Atoli
97	2023-2024	Chandoli WL Division	Dhebewadi	Humbarne
98	2023-2024	Chandoli WL Division	Dhebewadi	Humbarne



Map No.7.1 Forest fire intensity, heat map of STR

iv. **Strategies:** It includes preventive and controls measures:

- Fire prevention measures (fire lines, deployment of fire watchers, control burning along forest roads, entrusting beats to Eco-Development Committees (EDCs) with provisions for incentives for local people in case the area is maintained free from fire)
- Fire control measures (fire beating through squads, use of extinguisher/blower).
- Strategies are given in detail in the chapter no. 10.

iv. **Monitoring and Evaluation:**

- Fire Danger Rating: Establish a fire danger rating system based on weather conditions, fuel moisture levels, and other relevant factors to assess the risk of fire occurrence and guide management decisions.
- Post-Fire Assessment: Conduct post-fire assessments to evaluate the ecological impacts of forest fires on wildlife habitats, vegetation dynamics, and soil properties, and develop strategies for habitat recovery and restoration.
- Analysis of the data and history of forest fire and see the trend of a forest fire.
- Analysis of the reasons of fire incidences very carefully by ACF and give a report.
- Evaluate the result of current fire plan and give the suggestion for preparation of a plan for the next fire season.
- Identify susceptible area from past history.

7.2.2.4 Theme Plan for Tiger/Wildlife and habitat Monitoring:

i. General:

Monitoring the population size, abundance, density of tiger, co-predator, prey, habitat quality, level of habitat utilization, and disturbance levels within the tiger reserve (TR) are crucial tasks for wildlife managers. Of utmost importance in the tiger conservation plan is the monitoring of tiger populations, co-predators, prey base, and habitat quality. The National Tiger Conservation Authority (NTCA) has reviewed existing tiger estimation methodologies and developed refined protocols, now implemented in Phase-IV monitoring. Daily intensive (yet non-intrusive) monitoring of tigers, along with periodic assessments of habitat status and prey base across all seasons, is essential. It's imperative to employ both traditional and state-of-the-art monitoring protocols in a complementary manner to ensure comprehensive wildlife monitoring.

.ii. Objectives:

- To know the population size or density of tiger, co-predator and prey base in TR
- To know the trend of change in the population size or density of wild animals over the period
- To calculate the carrying capacity of TR
- To know the quality of habitat and to intervene in the habitat if required to improve it.
- To know the level of human disturbance in the habitat and impact of it.
- To intervene in wildlife habitat proactively and scientifically to achieve the objective of TCP.

iii. Issues and Problems:

- The capacity building needed to carry out monitoring exercise and the use of instruments for the exercise.
- Collection, analysis, and mapping of collected data has not been done regularly.
- Analysis of Phase-IV, MSTrIPES, and regular tiger monitoring, is done at TR level. However, after submission of Phase- I, data, its expected analysis and results are not received back to the TR. Hence, its difficult for TR authorities to be aware of prey base density, habitat quality and human disturbance level.

iv. Strategies:

Strategies are given in detail in chapter no. 09

v. Monitoring and Evaluation:

It is done as per existing protocols. Phase-I exercise should be monitored while actual exercise when going on in the field in order to get quality data collection. Prey base density, habitat quality and human disturbance level in TR depend on the quality of data of phase-I. It should be done twice a year, in winter and once in summer. This exercise should carry out through Tiger Cell in coordination with RFOs and whole exercise should be monitored by respective ACFs.

7.2.2.5 Theme Plan for Communication and Roads networks:

i. General:

STR has a good infrastructure of wireless communication spread all over the TR area except some remote part of deep valleys. Network of protection road is comparatively good in Chandoli wildlife division but road network is very less developed in Koyna Wildlife Division due to its hilly terrain, deep valleys, escarpment on western side and long stretched reservoir. Well-developed protection road network and communication lead a major role in achieving the goal of protection as per strategy. Use of all these systems is depending on regular maintenance and regular use of all infrastructure. Well, designed "Maintenance Schedule" for infrastructure maintenance in tiger reserve is very much needed. Regular monitoring and periodical review about the status of these systems by senior officers will keep these systems running smoothly. Creating a theme plan for communication networks and roads within a tiger reserve involves balancing the need for connectivity with minimizing ecological impact. Following are the objectives, issues and problems and strategies for the efficient running of all these systems.

ii. Objectives:

- Enhance communication networks to improve management efficiency, emergency response, and visitor safety within the tiger reserve.
- To use of all the facilities efficiently.
- To keep regular maintenance
- To strengthen the protection level in the tiger reserve.

iii. Issues and Problems:

1. **Communication:** official communication mainly done by using a wireless system. Regular maintenance of instruments, range of wireless is not covering all area of TR, few staff members are not using wireless intentionally, timely repairing of handsets, not using the code language while passing message through wireless mainly about offence related messages etc. To keep sufficient provision for a fund to give royalty against the use of frequency for wireless. Processing of royalty of wireless is pending since last 2-3 years due to technical glitches of filing it online.

2. **Roads:** STR has very less road network. Length of the road network in STR is approximately 200 km. Following are the few issues related to roads in STR:

- Road repairing always starts late due to funding are not available on time.
- Regular and timely fund are not available for maintenance.

- Protection roads are got heavily damaged due to high average rainfall for long period, hence, lot of funds required to repair every year.
- Intermittent rain during winter and summer, wash out the repairing work of road.
- Some patch required, special repairing which require more fund than normal estimate of road repairing.
- Hilly terrain, deep valleys, escarpment on western side and long stretched reservoir is limitations for creating new protection roads in Koyna Wildlife Division.
- Various MEE-TR recommended to develop good protection road network in STR

iv. Strategies:

Develop a comprehensive master plan for communication networks and roads that aligns with the conservation goals and management objectives of the tiger reserve. Integrate communication networks and road infrastructure into the long-term conservation planning and management of the tiger reserve. Develop maintenance plans to ensure the ongoing functionality and ecological integrity of communication networks and roads while minimizing disruption to wildlife habitats and ecosystems.

1. **Communication:**

Communication is very important to protection point of view for quick dissemination of instructions, reporting and messages. There is no mobile network available in most of TR arae. One way, it is an advantage for protection, we have communication with a wireless system and offenders/trespassers, have no means of communication to get information on our movement. But, our wireless network should be maintained and used by staff and officers, regularly. Following are the strategies to strengthen the communication system, mainly wireless.

- To develop a protocol for repairing, maintenance and use of wireless equipment e.g. Walkie-talkie, Base station, repeater etc.
- Annual maintenance contract for any service agency for regular maintenance and periodical checking.
- To give a daily patrolling report to the control room only through wireless.
- To develop a code language for the dissemination of information and instructions.
- Training to staff about use, upkeep and use of code language.
- There is need of special technical person to look after smooth functioning of network.

2. **Road**:

- Developing a road network strategy for wildlife protection in a tiger reserve area requires careful planning and implementation to minimize disturbance to wildlife and habitat.
- Road maintenance should start immediately after end of rainy season.

- Sufficient funds provision should be done in advance at least provisional funds in TCF.
- Special repairing at required patches is very important for make all-season use of road.
- Trenches along the roadside, it can be both side or uphill side can save a road in the rainy season. Drainage, Hume-pipe or causeway at the proper place will save road in the rainy season which is important to allow our patrolling vehicle movement in rainy season too, when TR area will become very susceptible to illegal activities.
- Special repairing should cover the same road in continuation.
- Do cross-drainages on slope at the end of the month of May.

v. **Monitoring and Evaluation:**

- Establish monitoring protocols to assess the effectiveness of communication networks and roads in meeting management objectives
- Maintain different registers for a different type of infrastructure to keep records of maintenance.
- Regular visit of senior officers to different infrastructures and check the condition and maintenance work have done.
- Visits by a senior officer (at least ACF) while work is going on, in order to check the quality and to give suggestions.

7.2.2.6: Theme Plan for Wildlife Health Surveillance and Management:

i. **General:** Creating a theme plan for wildlife health surveillance and management in a tiger reserve is crucial for maintaining the well-being of both wildlife populations and the surrounding ecosystem. Application of veterinary science, conservation medicine and biomedical science in the Wildlife health management has become very important nowadays. Looking at the current scenario of an outbreak of different emerging diseases, zoonotic disease at a local and global level; we must understand the disease ecology of the free ranging wild animals and its impact on the captive population of these wild animals, domestic animals and global economy. Understanding diseases ecology, carrying out a necessary investigation, diagnosis of the disease should be a mandate to formulate the wildlife management strategy for the same. Wildlife Health Surveillance on regular basis is an essential component of wildlife management, especially, for the isolated populations of the critically endangered and endangered species such as Tiger, Leopard, Wild dog, Pangolin, Barking deer, Gaur, Chousingha, Mouse deer and reptiles including Python in STR.

Also, as per S - 33-A of Wildlife (Protection) Act 1972 the livestock present in or within 5 km. of Sanctuary/protected area are required to be immunized and hence the cattle should be vaccinated regularly with the help of District Animal Husbandry officer of Animal Husbandry Department, to

ensure that no transmission of diseases takes place to and from domestic animals and vice versa.

- **ii. Objectives:**
- To Monitor and assess the health status of wildlife populations to detect and respond to emerging threats promptly.
- To Prevent the spread of infectious diseases among wildlife populations and mitigate the risk of transmission to humans and domestic animals.
- To Enhance the capacity of reserve staff to diagnose, treat, and manage wildlife health issues effectively.
- To Implement measures to improve habitat quality and reduce environmental stressors that impact wildlife health.
- To understand disease ecology of free ranging wild fauna
- To study the status of transmission of diseases from domestic animals to wild animals and from wild animals to domestic animals
- To investigate the mortality in free ranging wild animals
- To prevent the disease transmission to and from the domestic animals, wild animals a vice versa
- To detect the disease-causing pathogens in time and check the spread of infectious diseases
- To create awareness among the villagers and staff regarding the importance of diseases in wildlife and domestic animals
- To conduct annual vaccination of all the livestock populations, in villages in core and buffer zone
- To check the efficacy of the vaccination on a regular basis
- To conduct the post-mortem with all possible investigation techniques to arrive at the conclusive diagnosis.

i. Issues and Problems:

- There are many times our field staff are observed unnatural mortalities but we treat it is natural. The reason remains always unknown.
- Death of any wild animal not done by any predator, it is not investigated by the Veterinary Officer and it will treat as a natural death. But it should be investigated for health condition of that animal.
- Intermittent mortality of Gaur (*Bos gaurus*) may happen due to Foot and Mouth Disease (FMD) and other diseases of viral and bacterial origin.
- Tuberculosis in herbivorous has been reported and has been suspected in Hanuman langur (*Semnopithecus entellus*).
- Mortality in domestic dogs (*Canis lupus familiaris*) due to Rabies has been reported at some places.
- Mortality of Wild dogs is also reported.

- Mortality in large number in birds of multispecies and few species of mammals observed.
- Sometimes, mortality in herbivorous including Gaur, wild pig and other animals observed due to unidentified diseases has been reported regularly but remains a mystery.

- It is easy to observe changed or abnormal animal behavior in any wild animal during routine foot patrolling but, it is not included in their patrolling mandate and field staffs are not trained accordingly.
- It is the most neglected subject in day-to-day wildlife management practices and needs to give priority.

ii. Strategies:

- **To understand disease ecology of free ranging wild fauna**: To conduct research on the disease of free ranging wildlife with the help of Animal Husbandry Department, Veterinary College, scientific non-government organizations or veterinary organizations with sufficient provision of funding for research on a particular topic related to wildlife health management.
- **To study the status of transmission of diseases from domestic animals to wild animals and from wild animals to domestic animals:** research on diseases of free ranging wild animals and domestic animals like cattle, dogs and cats and poultry from the villages in core and buffer villages of the STR is needed. To analyze the finding of the research project conducted and formulate strategies to avoid unforeseen casualties of wild animals.
- **To investigate the mortality in free ranging wild animals:** Conduct detail post-mortem with the help of a team of wildlife veterinarians and with the help of experienced veterinarians from animal husbandry department or Veterinary organizations. Keep a post mortem kit and sample collection kit at each range. Compilation and analysis of data of post mortem conducted should be done on a regular basis.
- **To prevent the disease transmission to and from the domestic animals, wild animals a vice versa:** Vaccination of domestic cattle, cat, dogs and poultry from the villages in a buffer area of the tiger reserve as per prescribed program. Conduct Wildlife Disease Risk Analysis once in six months to assess if the disease is a threat to the free ranging wildlife and up to what extent. It must involve the assessment and reassessment of the threats and its impact.
- **To detect the disease-causing pathogens in time and check the spread of infectious diseases:** Sending samples for disease investigation to well recognized laboratories and take appropriate and timely action, if required.
- **To create awareness among the villagers and staff regarding the importance of diseases in wildlife and domestic animals:** To organize workshops/training program in vernacular language to aware villagers, staff to understand the importance of disease in wildlife and domestic animals.
- **To monitor water bodies (including natural and artificial) and habitats frequented by wild animals, on**

a regular basis. Water sample should be sent to the respective laboratories to check for the presence of pathogens or poisons.

- **To conduct annual vaccination and deforming of all the livestock populations, in villages in core and buffer zone:** Annual vaccination for FMD, PPR, Rabies, Rinderpest, Anthrax and other commonly found diseases should be considered as a priority. Also, deforming of domestic animals should be conducted on a regular basis.
    - **To organize animal health camps for domestic animals in villages in the core and buffer area of the protected area.** Health checkup camps will allow us to assess the common disease condition in the domestic animal population and its severity in the village. The data can be corroborated with the findings from the wild animals.
    - **To check the efficacy of the vaccination on a regular basis:** Pre and post vaccination titer of the animal should be analyzed to assess the efficacy of the vaccination done in the domestic animal population. Animal husbandry department, veterinary college staff and students, veterinary organizations and NGO's can be involved in this project.
    - **To conduct the post-mortem with all possible investigation techniques to arrive at the conclusive diagnosis.** Post mortem investigation should be carried out very carefully and should involve experienced veterinarians.
    - **To include veterinary science, conservation medicine in management practice**: We need to organize the multi-stakeholders meet once in a year or once in six months. It should include authority from Veterinary College, Animal Husbandry department, wildlife area managers, veterinary organizations, animal welfare organizations and individual working on disease aspects of animals. It will help to include and implement the veterinary perspective in wildlife management.
    - **Collaboration and Partnerships**: Foster collaborations with government agencies, research institutions, and conservation organizations to leverage expertise and resources for wildlife health initiatives.
    - **Technology Integration**: Utilize advanced technologies such as remote sensing, GIS, and molecular diagnostics to improve disease surveillance, monitoring, and data analysis.
    - **Emergency Response Plans**: Develop protocols and procedures for responding to wildlife health emergencies, including disease outbreaks, mass mortalities, and wildlife rescue operations.
    - To prepare a basic stock of requisite chemical immobilization equipment, drugs, tranquillizers, sedatives, narcotics, anesthetics, anti-dotes etc. should be kept to deal with contingencies, in this regard.
    - Provide training and professional development opportunities for reserve staff, including wildlife veterinarians, biologists, and field technicians, to enhance their skills in wildlife health management and surveillance.
    - To train the frontline staff for sample collection in case of mortalities of wild animals, scat collection and its

analysis at the field level, providing first aid to the wild animals in distress

- To conduct a Wildlife Disease Risk Analysis workshop to understand the ecology of Wildlife diseases
- To formulate the strategy for euthanizing wild animals, if needed.
- Research on Study on behavior of a sick individual and healthy individual and assessment of nutrition status of the free ranging wildlife

- **Wildlife Disease Risk Analysis required to do regularly:**
  - Surveillance, monitoring and outbreak investigations as a source of information
  - Active and passive surveillance with statistical modeling
  - Screening test: Selection, interpretation and sample size calculation for effective analysis of the disease outbreak risk in wild animals
  - Formulating modeling for the assessment of the risk of wildlife disease, its monitoring and management.
  - Prediction of Bacterial, a viral, parasitic, fungal infection in a wild animal metapopulation

- **Wildlife health management program in any protected areas is grouped under 6 categories.**
  - Preventive Measures - All possible field veterinary measures during a dry spell.
  - Health Monitoring Operation - Physical condition of key endangered species.
  - Disease Diagnostic Operations – Emphasis on forensic analysis.
  - Disease Control Operations – Preventive, Evaluation and monitoring.
  - Disease Impact Assessment – Utilizing veterinary research personally.
  - Evaluation of Management Strategies–Periodical evaluation by the DFO/DD.
  - The above aspects will be taken into account to deal with the wildlife health management plan of the STR.

iii. Monitoring and Evaluation:3

- Regular monitoring of program through wildlife veterinary unit of STR and timely reporting and consultation with DD and FD.
- Establish monitoring indicators and protocols to assess the effectiveness of wildlife health surveillance and management activities.
- Regularly evaluate the health status of wildlife populations and habitats within the reserve and track progress towards achieving predefined objectives.
- Use monitoring data to adapt and refine wildlife health strategies based on emerging trends and challenges.
- Detail documentation of all related incidences of wild health and disease outbreak.

- Analyze the trends of disease outbreaks or unnatural deaths.

7.2.2.7: Theme Plan for Eco-Development:

i. General:

The concept of community participatory approach is being launched and implemented for the management of natural resources in several parts of the globe. Involving people's participation in managing protected areas in a sustainable fashion is part of the National Forest Policy (1988) of the Government of India. The strategy of community participatory approach was successfully implemented in some parts of India. In addition to people's participatory program i.e. eco-development schemes are being implemented in protected areas as part of the Biodiversity Conservation Program. This strategy of conservation is commonly referred to as community participation/people's participation / joint forest management/ Ecodevelopment program.

The new approach could also help us to protect forest cover and its biodiversity, mostly by ways of providing a livelihood for local communities who regularly depend on forest resources. Such a practice is one of the key strategies for the protection of endangered species and their habitats that are being increasingly fragmented into habitat corridors of smaller conservation units. Eco-development program is implanted in Villages adjoining to STR since, 2011-12. total of 19 villages covered under this program up to 2014-15. In the financial year 2015-16, the government of Maharashtra started a new scheme for 'Eco-development' in buffer villages in project mode, named as Dr. Shyama Prasad Mukharji Jan Van Vikas Yojana. Every village is supported with the fund of Rs. 25.00 lakh for comprehensive development of villages and providing livelihood opportunities. This scheme created a lot of goodwill and support of villagers to the tiger reserve. Until now 59 villages covered under this Scheme.

ii. Objectives:

- To reduce the dependency of forest and forest side dwelling communities on forest based natural resources.
- To give site-specific conservation friendly package of measures for environmentally compatible development.

- To improve the current practices and also develop ecologically sustainable and economically viable packages of alternatives that are acceptable to people.
- To get the willing participation of the people concerned, and to build mutual trust between managers and people.
- To converge ongoing programs of the other line agencies of government for the development of these forest dependent villages.
- To maintain biological diversity, productivity and the integrity of tiger reserve by achieving social fencing through eco-development program.
- To share the duties and responsibilities of conservation as well as benefits of conservation between TR and Villages.

iii. Issues and Problems:

- Dependence of villagers for a natural resource on adjoining forest area for their bonafide needs.
- No other acceptable alternative is available in their village.
- There is no livelihood opportunity available at local level.
- TR needs to reduce biotic pressure in order to achieve the objectives of wildlife conservation.
- Lack of coordination between different government line agencies working in these villages.
- Lack of mutual trust between the TR administration and Local people.

iv. Strategies:

- Comprehensive Government Resolution of eco-development based on past ten years' experience of implementation of eco-development program.
- Consultation with villages through gram-sabhas about the implementation of eco-development program.
- Gram sabha Resolution for implementation of eco-development program
- Selection of executive committee or Eco-development Committee as sub-committee of Gram-panchayat in Gram-sabha.
- MoU between village and area manager
- Preparation of micro-plan with the participation of villagers i.e. PRA, RRA etc.
- Selection of work or benefits and beneficiary in gram sabha.
- While giving the benefits to beneficiary all the related government rules of purchase or construction of infrastructure should be followed.
- Other government agencies working in rural areas with their programs and similarly the voluntary bodies, all need to join hands in the context of securing the eco-

development objectives.

- Meeting of the executive committee once in each month for planning.
- ACF and RFO should take a review meeting of all EDC once in a month.
- Meeting-cum-workshop should arrange once in three months for all the EDC at Division level.
- **Institutional Strengthening:** Strengthen local institutions and community-based organizations to ensure the sustainability of eco-development initiatives beyond the project duration.
- **Diversification of Livelihoods:** Encourage diversification of livelihood options to reduce dependency on a single source of income and increase resilience to environmental and economic shocks.
- **Integration with Conservation Goals**: Ensure that eco-development initiatives are aligned with the conservation objectives of the tiger reserve and contribute to the overall protection of its biodiversity.

v. Monitoring and Evaluation:

- Social Audit in Gram sabha
- Financial Audit through CA
- Third party Evaluation of program through special committee/ Social science institute

We should develop a comprehensive theme plan for eco-development in a tiger reserve that promotes sustainable livelihoods, enhances community well-being, and contributes to the conservation of biodiversity and natural resources.

7.2.2.8: Theme Plan for Staff development/Capacity Building:

i. General: Section 38V (3) of the Wildlife Protection Act, 1972 (as amended in 2006) provides for incorporating staff development and deployment plan in reserve specific tiger conservation plan. As legwork is important and fundamental in the day-to-day protection/management of a tiger reserve, the staff development plan needs to be prepared.

ii. Objectives:

- To achieve effective protection as a frontline staff is the backbone of protection system in TR.
- To increase the motivation level of frontline staff working in a wildlife area.
- To develop the basic skill required for working in a wildlife area.
- The welfare of frontline staff and his families.

iii. Issues and Problems:

- Low motivation in staff working in wildlife
- High risk as workplace in wildlife and remote area
- Legwork is more in the wildlife area
- Compulsory stay in Anti-poaching Camps, hence no mobile network and entertainment facility available.
- Remoteness of workplace make situation him compulsory to stay away from family for long period. He is always in anxiety about safety of his family.
- The cost of maintaining the stay at two places i.e. one for himself at headquarter as most of the wildlife headquarters are at a remote place and another for his family at nearby town where he will get minimum facilities of education, medical and market etc.

- Low level of interest and knowledge about wildlife.
- No additional incentive or allowance of working in highly remote and high-risk area.

iv. Strategies:

1. Age Profile of the staff in position and addressing the problem of simultaneous ageing:

By and large, it is seen that most of the frontline personnel staff are in the same age group simultaneously owing to the same year of recruitment. The frontline staff and other officials have very good field knowledge resulting in good practices. It is important that such practices and traditions are passed on to their juniors so that the reserve can become a field learning center of its own in the long run. Further, such lessons learnt over a period of time foster refinement leading to excellence. Therefore, it is important to have a three yearly projection of future staff vacancies, so as to enable the timely appointment of new staff, with sufficient time for field training.

2. Capacity Building: The following thematic areas are important for capacity building of frontline staff :

- Basic knowledge of field craft, wild animal evidence and their identification/collection
- Knowledge of local flora/fauna, floral associations, inter-specific and intra-specific associations amongst wild animal species, internecine combats amongst larger cats like a tiger and anti-predator strategies for wild ungulates, vocalizations, advertisements, wildlife techniques and data collection, jurisprudence, use of GPS/Camera trap/range finder and related basic tools.
- Basics of self-defense, anti-poaching operations, day to day regimen for physical fitness
- Making opportunistic observations of wild animals, crime scene analysis and evidence collection, use of forensic kits and basics of sample collection/packaging.
- Tiger monitoring based on camera trap IDs, other evidence, mapping of resident tigers leading to Spatial-temporal forecasting, monitoring of livestock kills.

- Use of firearms, their maintenance and police attachment in an ongoing manner.
- Innovative techniques for wildlife crime related information gathering, surveillance and sharing of intelligence
- Intelligence based enforcement and monitoring patrolling intensity
- Fundamentals of fire protection, forest road repair and minor civil works
- Monitoring the health status of wild animals, prophylactic immunization, testing quality/contamination of artificial water points.
- Exposure to chemical immobilization, rescuing wild animals causing distress and wild animals in distress (barring natural prey-predator/internecine interactions), use of BOMA technique, maintenance of rapid response teams.
- Basics of hospitality management, first-aid and trauma training etc.

3. Staff Deployment Strategy:

Staff postings in a tiger reserve come under the category of "non-family posting", is located in remote and inaccessible areas, often prone to vector borne diseases, snake bites and encounters with wild animals and poachers. Therefore, it is important to institutionalize an internal policy of staff rotation to ensure exposure to all staff members (subject to physical fitness and other unforeseen exigencies). After successful completion of his tenure of three years, he should get choice posting as far as possible. Detailed Staff Development plan can refer in Chapter no.8 and point no. 8.5.

4. Staff Welfare:

The staff welfare measures should, inter-alia, include:

- Insurance coverage for accidents, death.
- Entertainment facilities at anti-poaching camps.
- Robust communication facility as the working place is high risk area.
- Institutionalizing special ex-gratia system for the nearest kin of deceased staff from the tiger conservation foundation.
- Organizing health camps of annual health check-up and treatment for staff and his family members.
- Providing fair priced material outlets for staff posted in remote camps.
- Ensuring safe drinking water to staff posted in patrolling camps
- Construction of student hostels/family hostels in nearby towns to provide accommodation to children/family of frontline staff.
- Institutionalizing e-learning to benefit children of frontline staff in collaboration with government and like-

minded organizations.

- Other welfare activities for staff and their family member through tiger conservation foundation like sport facilities, Children Park, park visits, health check-up, award system for staff children for best performance in education etc.

v. Monitoring and Evaluation:

- By evaluating the fieldwork of staff
- By evaluating the achievement of different targets of field works
- By assessing the Quality of field works
- Motivation level of staff by judging the self-initiative in the fieldwork
- Appraisal of field performance by laying out site-specific criteria
- Recognizing exemplary performance
- Every year Internal Evaluation on the basis of MEE-TR and Security Audit

7.2.2.9: Theme Plan for retrofitting measures:

i. General:

The artifacts/heavily used infrastructure, commonly found within (or around) the core/critical tiger habitat and the required retrofitting measures/safeguards for wildlife safety are indicated below:

ii. Objectives:

- To prevent the accident of wildlife due to development infrastructure
- To develop wildlife and eco-friendly infrastructure in and around the TR, if there is no alternative for creating such infrastructure.
- To achieve the minimum impact of this infrastructure on wildlife.

iii. Issues and Problems:

- Road kills of wild animals on road passing through core.
- Disturbance to the free movement of wildlife.
- Adverse impact on the increase in population of wildlife.
- Impact of existing infrastructure on wildlife movement like open wells.
- Streamline existing structure in order to achieve free movement of wild animals

iv. Strategies:

1. **Roads**: There is no any National highway, State highway and ZP tar roads passes through both

part of core areas. Only there are few village roads for connectivity with villages in core area. There is very rare possibility of road kill on this road. These all villages are in process of rehabilitation, hence there is no possibility of expansion of these roads. They will be only maintained for management and protection purposes. But tourist vehicle and protection vehicle of tiger reserve will be regularly keep using this road, hence few regulations for these vehicles are need to follow:

- Speed limits to be prominently displayed and strictly enforced on roads passing through the reserve. i.e. during day time the limit will be 30 Kmph and during the night it will be 20 kmph.
- Regulating speed limits of vehicles at crossing point used by wild animals (use of speed breakers and signage's)
- Installing 24x7 e-Surveillance at such crossing points to monitor/record wild animal movement
- Creating manned barriers (as required) at sensitive points close to habitations
- Deployment of interceptor tools to keep track of the speed limit of tourist.
- No entry for tourist at night time.
    - The shrubs and grasses alongside the roads/railway tracks must be at least 6 m sides on each side so as to improve the visibility of animal presence and to avoid a sudden hit.

2. Railway:

No railway lines are passing through Core or buffer area of STR.

3. Open well/canal:

There are several open wells (used/ unused) in villages within and around the tiger reserve, which should be catalogued and covered or construct a parapet wall or fenced to prevent accidents involving wild animals. It should be taken on priority through eco-development program.

4. High tension wires:

There is always possibility of poaching of wild animals by electrocution as it is very effective and easy. Hence, it is important to insulate such transmission lines in the vicinity of villages. This can be a collaborative initiative with the electricity department of the state. Joint patrolling with the electricity department and Police department along these lines is very important to prevent poaching.

5. Large Lakes/Dams:

The Koyna and Chandoli dam have two big reservoirs is an important qualifier of the habitat owing to the large impoundment and surrounding drawdown areas. No special retrofitting measures are required, but for maintaining a minimum impoundment level in the interest of wildlife is necessary. With help of irrigation

department, to prevent the agriculture in water receding area (i.e. '*Gaal-per'* in the local language).

v. Monitoring and Evaluation:

- Regular monitoring on accident due to this infrastructure and keep record of incidence.
- Past history of accidents of wild animals should be analyzed and identify accident-prone patches/locations along above infrastructure.

7.2.2.10 Theme Plan for herpetofauna conservation:

i. General:

The Sahyadri region is renowned for its high biodiversity, including a rich diversity of reptiles and amphibians. Many of these species are endemic to the Western Ghats, making them particularly vulnerable to habitat loss and other threats. Reptiles and amphibians serve as important indicators of ecosystem health. Their presence, abundance, and diversity can provide valuable insights into the overall ecological condition of habitats within the tiger reserve. Herpetofauna play key roles in ecosystem functioning, including pest control, nutrient cycling, and maintaining ecological balance. Certain species may also act as prey for larger predators, contributing to food webs and trophic interactions. Many reptile and amphibian species in the Sahyadri Tiger Reserve are threatened or endangered due to habitat loss, fragmentation, climate change, and other anthropogenic pressures.

Conservation efforts are urgently needed to prevent further decline and loss of these species. Protecting habitats that support herpetofauna is essential for their conservation. This includes preserving intact forests, wetlands, streams, and other critical habitats that serve as breeding sites, foraging areas, and refuges for reptiles and amphibians. Herpetofauna provide unique opportunities for scientific research and discovery. Studying their behavior, ecology, and physiology can enhance our understanding of evolutionary processes, species interactions, and ecosystem dynamics, with potential applications for conservation and management. Given these compelling reasons, prioritizing herpetofauna conservation in the Sahyadri Tiger Reserve is essential for safeguarding biodiversity and its maintaining ecosystem integrity.

During survey in STR, in total, the survey identified 66 species of herpetofauna belonging to 44 genera, 21 families with four species listed in the threat category of as IUCN Red List (IUCN Red List 2017). Of the 66 species, amphibian (22 species), lizard (20 species) and snakes (24 species) consisting each almost one third of the total numbers (Tables 10 to 12). It is important to note that the STR landscape is home for four IUCN Red Listed amphibian species, which includes one critically endangered species (*Pseudophilautus amboli* Biju & Bossuyt, 2009), two endangered species (*Xanthophryne koynayensis* Soman, 1963; *Uperodon mormorata* Rao, 1937) and a vulnerable species *(Nyctibatrachus humayuni* Bhaduri

& Kripalani, 1955).

The present study and existing records show that the Sahyadri harbors 40 endemic species which constitutes 0.72% of the total Western Ghats endemism. In scientific assessment on developing conservation planning for Rare, Endangered and Threatened species of herpetofauna in Sahyadri Tiger Reserve, using a combination of species richness, diversity of herpetofauna as a whole and considering RET species (arrived based on endemicity and IUCN Red List Category), identified the areas of Chandoli andKoyna ranges of the reserve are the most vital for long-term conservation. The possible reason for these two ranges showing numerically higher species richness both in terms of overall and RET species could be related to historical background of Protected Area status that these two ranges enjoyed in the past.

In a large spatial scale, abundance of herpetofauna is naturally influenced by three ecological and evolutionary factors viz. (i) biogeography effect, (ii) the effects of mountain refuges, and (iii) the ecological requirements of the species (Rey Benayas et al. 2006; Meliadou and Troumbis, 1997; James and Shine, 2000). Besides natural effect, manmade changes to natural habitats in the form of loss, fragmentation and degradation have also been recorded as the major artificial threat to the herpetofauna assemblage (Gibbons et al., 2000; Alfords and Richards, 1999; Gibbons and Stangell, 1999). Human disturbance to natural habitats in the form of alteration in natural habitats and forest management techniques (Block et al. 1998), type of forestry practices (Greenberg et al. 1994), highways inside the parks (Boominathan et al. 2009; Baskaran and Boominathan 2010; Griffin 2015) are well established to affect the herpetofauna directly and indirectly.

ii. Objectives:

- To protect and conserve the diverse reptile and amphibian species within the reserve through targeted conservation initiatives, habitat restoration, and scientific research, thereby ensuring the long-term survival and ecological integrity of herpetofauna populations in their natural habitats.

iii. Issues and Problems:

- Issues and problems in herpetofauna conservation in the Sahyadri Tiger Reserve include habitat loss and fragmentation due to forest fire and biotic pressure, illegal wildlife trade, invasive species, climate change impacts, and limited research and conservation efforts specific to reptiles and amphibians.

iv. Strategies:

- The Sahyadri Tiger Reserve lying in northern Western Ghats (also called island habitat), continues to be of interest to taxonomists as new species are being described especially in this northern landscape. It shows the area has yet not been studied comprehensively for its species richness and diversity.
- While rigorous habitat loss or fragmentation are not management issues yet, anthropogenic pressure, a moderate level of human settlements along with cattle grazing pressure and NWFP collection prevailing in the reserve, are all causes for habitat degradation, which may lead to

decrease in habitat quality as well species diversity. Thus, human dependency from enclave and peripheral villages on the natural habitats need to be minimized to the maximum level possible.

- The mature forest patches (evergreen, semi evergreen, deciduous and grassy lands) play a very important role, in the survival and persistence of a large number of amphibian and reptile species. So, maintaining such habitat will increase the species diversity as well would be a healthy forest.
- Small-scale, circle-shaped clear-cuts, thinning, or site preparations and grass land management could reduce major land-use effects, edge area, and patchiness, while encouraging spatial heterogeneity (Hunter, 1990).
- For understanding herpetofauna assemblage and niche overlapping the microhabitats playing one of crucial role. The reptiles and amphibians prefer leaf litter, dead or decayed logs, and the tree trunk/bark point to the importance of conserving these to ensure the survival of the species. The dead and fallen trees should not be removed for any purpose.
- For special emphasis of this species should be given priority to conserving such marshy lands (temporary waters), which is the abode of herpetofauna ensuring complete protection from fire and other biotic disturbance.
- There are few herpetofauna species recorded (Sahyadri Park and adjacent areas) an earlier study (Anonymous, 1978 and Ghate & Padhye, 2012), but could not be located in the present survey indicating either its total absence or species rarity. It would be ideal to develop a system intense monitoring these lower taxa.
- The people residing in the edge of the forest (human settlements and buffer zone villages) frequently kill even non-poisonous snakes due to their ignorance. An awareness program would be beneficial to the people and also protect snake species.
- The herpetofauna seasonal migration (peak monsoon time) most of them killed by vehicle trafficking especially buffer zone road network to identify those important places and minimize the vehicle traffic or to develop speed breaker system could me more effective to conserve these lower vertebrates.
- Given the legislation, though relocation of enclave villages is legally not possible, but any village showing personal interest for relocation, may be relocated on priority with appropriate relocation package.

v. Monitoring and Evaluation:

- Future monitoring studies should employ a large diversity of sampling techniques to derive accurate inventory statistics to explore large scale. Seasonal sampling would bring broader level ecological questions to conserve herpetofauna species in Sahyadri Tiger Reserve.

7.2.2.11 Theme Plan for Climate Change Mitigation in STR

As outlined in the National Wildlife Action Plan 2017-31, a priority project involves establishing a data collection network to assess the impact of climate change on various ecosystems and their ecological services. These findings are to be integrated into the Tiger Conservation Plans (TCPs) of Tiger Reserves and Management Plans of Protective Areas, alongside adaptive or mitigation measures. The new additional criteria i.e. 2.8 is added in fifth cycle of MEE-TR. It was just two additional criteria in previous MEE-TR on climate change for assessment for addressing issues relating to climate change & carbon capture in the tiger reserves.

Carbon sequestration is vital for counteracting the release of greenhouse gases into the atmosphere, primarily from human activities like burning fossil fuels. Ecosystems play a crucial role in this process by storing carbon, especially in forests, making terrestrial-based carbon sequestration widely recognized. The study assessed carbon storage in the Sahyadri Tiger Reserve, Maharashtra.

A carbon sink acts as a reservoir that collects and stores carbon compounds, regulating Earth's climate by removing greenhouse gases from the atmosphere. Terrestrial ecosystems, including forests and grasslands, store significantly more carbon than the atmosphere. Understanding carbon storage and sequestration is essential for landscape management decisions, such as protection or development.

Despite their importance, trees' role in climate change mitigation is often underestimated due to insufficient quantification of their ecosystem services. Trees act as carbon sinks by absorbing carbon dioxide during photosynthesis and storing it as biomass. Climate mitigation plans by governments may impact forests, yet the complex relationships between land cover changes, carbon sequestration, and wildlife habitats are not fully understood.

Quantifying sequestered carbon traditionally involves complicated and costly methods, often limited in scope. Remote sensing combined with ground-based observations offers a more accessible approach to generate carbon data and identify potential carbon credit locations.

The study aimed to assess carbon storage and sequestration in the Sahyadri Tiger Reserve, focusing on above-ground tree biomass. Vegetation sampling and satellite imagery analysis were conducted to estimate tree cover and biomass. Using volume equations and biomass calculations, the average carbon stock was determined to be 94.98 t/ha, totalling 3,063,966 tons for the reserve. Considering societal costs, the estimated carbon credit for the reserve is approximately USD $110,302,793, according to the United States Environmental Protection Agency.

The Sahyadri TR landscape is indeed leveraging clean energy initiatives, primarily through wind and hydro-electricity projects like the Koyna and Warna plants. Satara district, nestled within the Sahyadri hills, holds a significant position in wind power generation in Maharashtra. The region's topography and wind patterns make it conducive for harnessing wind energy, with a prerequisite of at least 18 km/h annual mean wind speed for effective generation.

Among the 11 tahsils of Satara, 8 have embraced windmill projects. The district boasts a substantial number of windmills, totaling 1872, capable of generating 1506.41 MW of electricity. Notably, areas like Patan and Jaoli Tahsil, which encompass the tiger reserve, contribute significantly to this capacity. Specifically, they house 907 windmills generating 537.17 MW, constituting approximately 34.99% of the district's total wind energy production capacity. This underscores the region's commitment to sustainable energy practices.

Table.7.19: Cabon stock calculated for the three ranges: Koyna, Helwak and Chandoli, in STR

Forest range	Above Ground Biomass ± SE (t/ha)	Carbon ± SE (t/ha)
Koyna	208 ± 24.71	97 ± 12.29
Helwak	266.81 ± 40.73	125 ± 19.14
Chandoli	147.56 ± 16.88	69.35 ± 7.
Overall STR	202.09 ± 16.33	94.38 ± 7.67

(Source: Report on Evaluation of OUV of Western Ghats, Sahyadri sub-cluster for long term monitoring of Ecosystem services. By, WII)

Objectives:

1. To reduce carbon loss with multifaceted approach.
2. To enhance carbon sequestration in Sahyadri Tiger reserve.
3. To Implement a range of mitigation measures to curb climate change-induced disruptions to habitats and ecosystems.

Issues and Problems

i. Forest fire-related carbon loss in forested areas.
ii. Carbon loss from forest fires in privately-owned areas within buffer zones.
iii. Carbon loss from domestic fuelwood usage in buffer zone villages.
iv. Carbon loss resulting from private forest wood extraction.
v. Carbon loss triggered by natural calamities such as landslides and siltation.
vi. Carbon emissions from vehicles and machinery employed in management activities.
vii. Increase in carbon footprint due to rampant use of modern equipment and utilities.
viii. Regulations within Tiger Reserves prohibiting wood extraction inadvertently hinder plant regeneration, thus constraining carbon sequestration.

ix. Extreme weather conditions due to climate change impact carbon sequestration.

Strategies:

Assessing carbon storage, capture, and loss in Sahyadri Tiger Reserve is vital for managing climate change and biodiversity. Initiatives to reduce carbon loss and enhance capture involve a multi-faceted approach, considering natural processes and human activities. There is need of preparing detailed plan to reduce carbon loss from TR, to increase carbon dioxide capture and about how to adapt management to predicted climate change.

1. **Fire Management:** To prevent carbon loss resulting from forest fires, several measures can be implemented. Early detection of fires, swift deployment of response teams, and the execution of emergency response plans are crucial. Additionally, raising public awareness about fire risks and prevention is essential. Identifying fire-prone areas and implementing targeted preventive measures, such as creating barriers and reducing fuel loads, can help slow the spread of fires. Enforcing strict regulations to prevent unauthorized burning is paramount. Implement controlled burning and fire prevention measures to minimize the risk of wildfires, which can lead to significant carbon loss in forest ecosystems. Conduct prescribed burns in a controlled manner to reduce fuel buildup and promote ecosystem health. In addition to this fire originating in privately owned land and spreading to forest area can be controlled by raising awareness and creating goodwill among private land owners of adjoining forest area.

2. **Promotion of Sustainable Livelihoods:** Support sustainable livelihood initiatives that reduce reliance on activities leading to carbon loss, such as unsustainable logging or land conversion. Providing alternatives for fuelwood viz LPG and solar based power supply units can drastically reduce carbon loss. Beside this alternative income opportunities that align with conservation goals, such as eco-tourism or sustainable resource harvesting can also be provided. This will help reduce wood extraction from private land as well.

3. **Reforestation and Afforestation:** Undertake reforestation and afforestation projects to increase forest cover and enhance carbon capture capacity. Prioritize the planting of native tree species adapted to local conditions and ecosystems. Plantation of native fruit trees can be encouraged on private land with help of NGOs by utilizing CSR funds.

4. **Forest Protection and Restoration:** Measures to protect forests from deforestation, illegal logging, and encroachment must be strengthened. Furthermore, implementing restoration programs to rehabilitate degraded forest areas can enhance their capacity for carbon capture..

5. **Promotion of Sustainable Agriculture:** Encourage sustainable agricultural practices such as agroforestry, organic farming, and conservation agriculture within and around the reserve. These practices can help maintain soil carbon stocks and reduce emissions associated with conventional agriculture.

6. **Promotion of ecofriendly equipment and utilities:** To mitigate carbon loss and enhance carbon sequestration in the Sahyadri Tiger Reserve, employing eco-friendly equipment and utilities is crucial. This strategy involves transitioning to electric vehicles, wind and solar-powered machinery, and energy-efficient utilities to reduce carbon emissions. Sustainable forestry practices and eco-friendly utilities can also increase carbon sequestration, preserving biodiversity and critical habitats. Engaging local communities through education and partnerships with governmental agencies, NGOs, and private sectors further strengthens these efforts. By prioritizing sustainability and conservation, we can safeguard the reserve for future generations while mitigating climate change impacts.

7. **Invasive Species Management:** Control and manage invasive plant species that can outcompete native vegetation and reduce carbon storage. Implement strategies to prevent the spread of invasive species and restore habitats affected by their presence.

8. **Wetland Conservation and Restoration:** Protect and restore wetland ecosystems within the reserve, as they are important carbon sinks. Implement measures to prevent drainage, pollution, and degradation of wetlands, allowing them to continue sequestering carbon.

9. **Carbon Farming:** Explore opportunities for carbon farming initiatives, such as agroforestry systems that integrate trees into agricultural landscapes to sequester carbon while providing additional benefits such as soil fertility and biodiversity conservation.

9. **Carbon Offsetting and Payments for Ecosystem Services (PES):** Opportunities for carbon offsetting schemes or Payments for Ecosystem Services (PES) programs should be explored, where landowners or communities would be incentivized financially for conserving forests or adopting carbon-friendly practices. Incentives and promotions for non-timber forest product (NTFP) processing and ecotourism activities could be provided to local communities, encouraging a shift away from forest resources that hinder carbon sequestration.

10. **Community-Based Conservation:** Local communities should be engaged in conservation efforts and empowered to participate in decision-making processes related to carbon management. Partnerships with indigenous communities and traditional knowledge holders are fostered, recognizing their role as stewards of the land.

11. Education and Awareness: Awareness should be raised among stakeholders, including local communities, policymakers, and visitors, about the importance of carbon sequestration and the role of the Sahyadri Tiger Reserve in mitigating climate change. Environmentally-friendly behaviors and practices should be promoted to reduce carbon emissions and enhance carbon capture.

12. Research and Innovation: Research initiatives are supported to improve understanding of carbon dynamics in the Sahyadri ecosystem and identify innovative approaches for carbon management and conservation. Collaboration between scientists, practitioners, and local communities should be encouraged to address knowledge gaps and develop practical solutions.

By implementing these initiatives in a coordinated and collaborative manner, Sahyadri Tiger Reserve can contribute significantly to carbon mitigation efforts while conserving its biodiversity and ecosystem services.

- **Monitoring and Evaluation:** In the fifth cycle of MEE-TR, 2.8 criteria are added to assess the measures taken by TR to reduce carbon loss from tiger reserve and to increase carbon dioxide capture. And about how to adapt management to predicted climate change. Measures taken by TR management towards these efforts, should be regularly monitored. A data collection network would be developed for assessment of the impact of climate change on all ecosystems with respect to their ecological services. A comprehensive carbon monitoring program could be established to measure carbon stocks in different ecosystems within the reserve, including forests, grasslands, wetlands, and other habitats. Remote sensing technologies, ground-based measurements, and modelling techniques can be utilized to estimate carbon storage.

7.2.2.12: Theme Plan for Monitoring of Values of World Natural Heritage Site (WHS):

i. General:

The Western Ghats stand out on the global stage as a region of profound significance for biodiversity conservation, boasting not only rich biological diversity but also remarkable geological, cultural, and aesthetic values. Stretching approximately 1,600 km. along India's western coast, these mountains, nestled 30-50 km. inland, span across six states: Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra, and Gujarat. Unlike their Himalayan counterparts, the Western Ghats are ancient, predating the towering Himalayan range. Their influence extends beyond their physical presence; the Western Ghats play a pivotal role in shaping India's monsoon weather patterns.

The Western Ghats serve as an "Evolutionary Ecotone," embodying the concepts of both the "Out of Africa" and "Out of Asia" hypotheses regarding species dispersal and vicariance. This term encapsulates the region's unique role as a transitional zone where diverse flora and fauna have evolved in response to historical geological events and environmental gradients. Through this lens, the Western Ghats becomes

not just a geographic feature but a living testament to the dynamic interplay of evolutionary forces shaping life on Earth.

The Western Ghats play a vital role in conserving diverse habitats under threat, and recognizing its importance in safeguarding such critical habitats and species, the Western Ghats emerges as a cornerstone in global conservation efforts.

Biodiversity thrives within the Western Ghats, earning them a place among the world's eight 'hottest hotspots' of biological diversity, alongside Sri Lanka. These mountains host an exceptional array of flora and fauna, with over 325 globally threatened species calling this region home. Among these are 229 plant species, 31 mammal species, 15 bird species, 43 amphibian species, 5 reptile species, and 1 fish species. Alarmingly, 129 species are classified as Vulnerable, 145 as Endangered, and 51 as Critically Endangered, underlining the urgent need for conservation efforts in this ecologically precious region.This continental region hosts an impressive diversity of flora, with approximately 4,000 to 5,000 plant species, a substantial portion of which are endemic. Notably, among the nearly 650 tree species documented in the Western Ghats, an astounding 54% are found nowhere else on Earth.

The richness of animal life in the Western Ghats is equally striking, with amphibians, reptiles, and fishes exhibiting exceptionally high levels of endemism. For instance, of the approximately 179 amphibian species identified, a remarkable 65% are endemic to the region. Similarly, 62% of reptile species and 53% of fish species are unique to the Western Ghats.

Koyna WLS and Chandoli NP, (these both PA's are part of Sahyadri Tiger Reserve) designated as a part of the UNESCO's World Natural Heritage Site have given significant recognition of its exceptional natural and cultural value on a global scale. This reserve not only serves as a vital habitat for the majestic tiger but also harbors a plethora of other wildlife species, including endemic flora and fauna unique to the Western Ghats region.

Moreover, the Sahyadri Tiger Reserve is imbued with cultural significance, with indigenous communities coexisting harmoniously with nature for centuries. Their traditional knowledge and sustainable practices add layers of cultural heritage to the reserve, enriching its tapestry of diversity.

The Whole Sahyadri range is witnessing rapid development activities leading to habitat disturbance and degradation. Factors such as pollution due to industrial and agro-expansion and tourism related development is shrinking more and more pristine habitats throughout the range. It is time now to get aware of such causes, find ways to reduce them and ensure continued survival of the unique living organisms found nowhere else other than the Sahyadri. Now 4 serial sites from Sahyadri ranges ie. Koyna WLS, Chandoli, NP, Radhanagari WLS and Kaas plateau are declared as World Natural Heritage Sites. Regular monitoring of these sites is needed hence this theme plan is conceived.

ii. Objectives:

- To establish a comprehensive monitoring and evaluation framework aimed at preserving the both Protected areas of STR i.e., Koyna WLS and Chandoli NP's status as a World Heritage Site by tracking key indicators, assessing conservation interventions, and ensuring effective management practices.

iii. Issues and Problems:

While the Sahyadri Tiger Reserve is a significant natural habitat and a part of the World Heritage Site due to its biodiversity and importance for tiger conservation, following are the various issues and problems associated with its management and conservation of this world heritage site.

- Poaching and Illegal Wildlife Trade
- Human-Wildlife Conflict
- Habitat Loss and Fragmentation
- Lack of Funding and Resources
- Inadequate Infrastructure and poor monitoring
- Climate Change
- Invasive Species

iv. Strategies:

- These world heritage sites are part of Sahyadri tiger reserve hence systematic and well-planned management and protection strategies are in place. By implementing these strategies like Anti-Poaching Measures, Habitat Protection and Restoration, Community Engagement and Livelihood Improvement, Enhanced Funding and Resources, Climate Resilience Planning, Invasive Species Management, Collaborative Partnerships in a coordinated manner, it is possible to effectively manage and solve the issues and problems facing the these WHS and ensure its long-term conservation as a World Heritage Site.
- Establish Clear Objectives and Indicators: Define clear conservation objectives, such as reducing poaching incidents, minimizing human-wildlife conflicts, and improving habitat quality. Develop specific, measurable, and time-bound indicators to track progress towards these objectives, such as the number of tiger sightings, the rate of deforestation, and the frequency of human-wildlife conflicts.
- Baseline Data Collection: Conduct comprehensive baseline surveys and assessments to gather data on key indicators before implementing conservation interventions. This may include wildlife population surveys, habitat assessments, socio-economic surveys of local communities, and assessments of illegal activities such as poaching and logging.
- Utilize Technology and Remote Sensing: Harness advances in technology such as remote sensing, geographic information systems (GIS), and satellite imagery to monitor changes in land cover, habitat

fragmentation, and wildlife populations. Use camera traps, GPS tracking devices, and other telemetry tools to monitor the movement and behavior of tigers and other wildlife species.

- Adaptive Management: Use monitoring and evaluation findings to inform adaptive management decisions. Adjust conservation strategies and interventions based on the results of monitoring data and feedback from stakeholders. Continuously iterate and refine approaches to address emerging threats and challenges facing the WHS.
- Regular Evaluation and Feedback: Periodically evaluate the effectiveness of conservation interventions against established objectives and indicators. Analyze monitoring data to identify trends, assess progress, and determine whether interventions are achieving desired outcomes. Solicit feedback from stakeholders to identify challenges, constraints, and opportunities for improvement.
- Report and Communication: Communicate monitoring and evaluation findings to stakeholders through regular reports, meetings, workshops, and outreach activities. Transparency and accountability are essential for building trust and support for conservation efforts. Share success stories, lessons learned, and best practices to inspire greater engagement and collaboration.

v. Monitoring and Evaluation:

By implementing following robust monitoring and evaluation processes, we can effectively track progress, identify areas for improvement, and ensure the long-term conservation of the World Heritage Site as follows:

- Implement Monitoring Protocols: Establish standardized monitoring protocols and methodologies to collect data on key indicators regularly. This may involve deploying camera traps, conducting ecological surveys, monitoring poaching activities, and engaging with local communities to gather information on human-wildlife interactions.
- Engage Stakeholders in Monitoring: Involve local communities, NGOs, research institutions, and government agencies in monitoring efforts. Train local community members as citizen scientists to collect data on wildlife sightings, habitat changes, and human-wildlife conflicts. Foster partnerships with academic institutions and research organizations to conduct scientific research and monitoring activities.

Monitoring of Indicator Species in STR, a World Heritage Site:

An Indicator species Approach suggested by the WII through the report on monitoring outstanding Universal Values of STR (Sharma at, all, 2018) to assess the ecosystem condition and its effect on services like water. Indicator species defines a trait or character of the environment. For long-term monitoring of the Outstanding Universal Values (OUV) of Sahyadri Tiger Reserve, Malabar Giant Squirrel (Mammal), Nilgiri Wood Pigeon (Bird) and Koyna Toad (Amphibian) three species selected from different taxa as Indicator species of

ecosystems. This was the first attempt to use these species as potential indicator value of the ecosystem services in STR, a World Heritage Site in India.

The aim of the Indicator Species Approach method is to assess the indicator value of the selected vertebrate species as 'Candidate Indicators' in Sahyadri Tiger Reserve for long-term monitoring of their population.

Monitoring and Evaluation:

The locations of species need to collect using Line Transect Method and Random Sampling method can be used for collecting number of individuals, age, habitat, habit and location of the species between 07:00 hrs to 10:00 hrs. Collected data will be analyzed using Maxent distribution model to identify species distribution, population, suitable habitats and associated ecosystem services components, and disturbance.

Species Distribution Models: It is a flexible tool which can be used to guide management and have direct implications in formulations of policies. In particular, distribution models can aid with individual species management plans and also identify potential habitat refugia and key regions for protection or corridors.

7.2.2.13: Theme Plan for conservation and monitoring of endemic species in STR:

i. General:

The Sahyadri Tiger Reserve, nestled within the Western Ghats of India, harbours a rich diversity of endemic species, including plants, animals, and microorganisms, crucial for maintaining ecological balance and biodiversity. These endemic species represent unique genetic lineages that have evolved over millions of years, contributing to the resilience and adaptive capacity of ecosystems. Serving as indicators of habitat health, they offer valuable insights into ecological integrity and serve as early warning signals of environmental degradation. A unique endemic species of amphibian, the Koyna Toad *Bufo koyanensis* as well as fan throated lizard *Sarada superba* is reported from STR Landscape which is the type locality of these species. Other endemic amphibians, such as *Indotyphlus*, (a Caecilian), Wrinkled Frog *Nyctibatrachus* sp are also reported. Due to this uniqueness of STR landscape, we are promoting our tiger reserve with tagline of "*Land of Endemics*" (List of endemic species to STR is in (Annex no. 1 and 2)

Moreover, endemic species are deeply intertwined with the cultural heritage of local communities, playing significant roles in indigenous practices and beliefs. Their presence enhances the touristic appeal of the reserve, attracting nature enthusiasts and researchers while providing opportunities for environmental education. The conservation of endemic species in the Sahyadri Tiger Reserve not only safeguards local biodiversity but also contributes to global conservation efforts, as the reserve is part of the Western Ghats biodiversity hotspot. Prioritizing collaborative conservation initiatives, research endeavors, and community engagement is crucial to ensuring the survival of these unique species for future generations and promoting sustainable development in the region.

Conserving endemic species in the Sahyadri Tiger Reserve requires a comprehensive approach that combines scientific research, community engagement, habitat restoration, and effective monitoring strategies.

ii. Objectives:

- Conservation of endemic species found in STR and it's landscape.
- Documentation of distribution of endemic species
- Monitoring of endemic species and recording population trends.

iii. Issues and Problems:

- Data Deficiency and Knowledge Gaps
- Endemic species overlooked in conservation efforts
- There are always fear of extinction
- Adverse impact of invasive species and habitat degradation on endemic species.
- Effect of Climate Change on occurrence of endemic
- Poaching and Illegal Wildlife Trade

iv. Strategy:

To address the conservation challenges facing endemic species in the Sahyadri Tiger Reserve, a comprehensive strategy is needed that tackles each issue effectively:

1. **Species Inventory and Assessment:**
   - A thorough inventory of endemic species within the reserve should be conducted, including plants, animals, and microorganisms.
   - The population status, distribution, habitat requirements, and threats faced by each endemic species should be assessed.
   - Systematic surveys and research projects should be undertaken to fill knowledge gaps regarding the distribution, abundance, and ecological requirements of endemic species.
   - Collaboration with research institutions, universities, and local experts should be engaged to gather data and share findings to inform conservation decisions.
2. **Special Conservation Efforts for Endemic Species:**
   - Awareness among stakeholders about the importance of endemic species conservation should be raised through targeted outreach programs, workshops, and educational campaigns.
   - Endemic species should be incorporated into conservation planning frameworks, ensuring they receive equal attention and prioritization in funding allocations and resource management.
3. **Proactive Measures to Prevent Extinction:**

- Proactive conservation measures such as habitat restoration, captive breeding, and reintroduction programs for endemic species at high risk of extinction should be implemented.
- Species recovery plans with specific conservation targets and timelines should be developed, closely monitoring population trends and implementing adaptive management strategies as needed.

4. **Control of Invasive Species and Habitat Degradation:**

- Invasive species control measures and habitat restoration initiatives should be implemented to mitigate the impacts of invasive species and habitat degradation on endemic species.
- Habitat protection efforts should be strengthened through the establishment of protected areas, buffer zones, and conservation corridors to safeguard critical habitats from further degradation.

5. **Mitigation of Human-Wildlife Conflict:**

- Measures to reduce human-wildlife conflicts, such as the installation of fencing, construction of wildlife corridors, and development of alternative livelihood options for affected communities, are implemented.
- Coexistence between humans and wildlife is promoted through community-based conservation initiatives, education programs, and conflict resolution mechanisms.

6. **Education and Outreach:**

- Educational materials and outreach programs targeting schools, colleges, and the general public are developed to foster a sense of stewardship towards endemic species and their habitats.
- Interpretive centers and nature trails within the reserve are established to provide visitors with information about the unique biodiversity of the Sahyadri region.

7. **Collaborative Partnerships:**

- Partnerships with governmental agencies, non-profit organizations, research institutions, and local communities are forged to mobilize resources and expertise for conservation efforts.
- Participation in regional and international conservation networks is prioritized to share knowledge, exchange best practices, and advocate for policy reforms to support endemic species conservation.

8. **Adaptive Management and Policy Advocacy:**

- Adaptive management strategies that allow for flexibility in conservation interventions based on scientific research and monitoring data should be adopted.

By addressing these issues comprehensively and implementing targeted conservation actions, the Sahyadri Tiger Reserve can effectively protect and conserve its endemic species for future generations.

v. Monitoring and Research:

To ensure effective monitoring of endemic species, the following steps should be taken:

Long-term monitoring programs should be established, employing scientific methods such as camera trapping, transect surveys, and genetic analysis to track population trends. Monitoring protocols should be developed to track endemic species populations over time, recording changes in abundance, distribution, and habitat preferences. Collaboration with research institutions and conservation organizations to conduct studies on the ecology, behaviour, and conservation genetics of endemic species.

7.2.2.14: Theme Plan for Monitoring and Management of Feral Cattle Population:

i. General:

Feral cattle, descendants of domesticated breeds, have been observed in the Koyna and Chandoli Wildlife Sanctuary, posing unique challenges to conservation efforts in these protected areas. These cattle are believed to have originated from abandoned or escaped domestic herds, adapting to the wild environment over generations. Their presence raises concerns regarding habitat degradation, competition with native wildlife for resources, and potential disease transmission.

MEE-TR-2018 reported that feral cattle as a prey base for predators in STR. The current prey base in the Tiger Reserve is 9.2 wild prey/ sq. km. and 10 feral cattle/sq. km. With a good population of leopards and wild dogs, the current prey status is inadequate for supporting a viable population of tigers. Till now, we found that Wild dog and tiger (Scat analysis) used to kill feral cattle in STR. Our field staff observed that leopard is also kill small calf of feral cattle but it is rarely. There are around 500 feral cattle in the reserve. The management has plans to remove them from the CTH. The MEE team feels that the feral cattle in Sahyadri serve a useful purpose as they act as a prey buffer and in all likelihood their number will be kept in check by the leopards.

In MEE-2022 report, mentioned that There are a good number of feral cattle in STR that will be a good prey base. For effective management, there should be a systematic monitoring of these feral cattle. Necropsy of such feral animals killed by wildlife should be done. If possible, forensic analysis should be carried out for any possible disease, along with immunization. Internal MEE-2021 report mentioned that the rehabilitated village sites have developed into grasslands and meadows, which are being used by feral cattle and sometimes by domestic cattle, defeating the purpose of developing grasslands and meadows for wild herbivores. It is necessary to let the true benefit of grasslands and meadows percolate down to the wild herbivores. Castrations of feral cattle needs to be done. It is true that they may be contributing some proportion of food to the leopard but this familiarity with the feral cattle can give rise to conflict situation in future when the old leopards are driven away from their territory and start inhabiting areas near human habitations. Basically, wildlife thrives on availability of habitat. If improving the

prey base is one of our objectives then why compromise with feral cattle (largely buffaloes) who are now so being preyed upon by leopards.

These observations in various MEE-TR, shows that there is need scientific study and monitoring trend of feral cattle population, their part in the food of predator's diet, observation about disease spread in wild animals' population, competition for food with wild herbivores etc. hence this theme plan suggested:

ii. Objectives:

- To assess population dynamics and trend of feral cattle
- To evaluate habitat impacts due to feral cattle population
- To understand the competition of feral cattle with wild herbivores for food.
- To understand the feral cattle part in the food in the predator's diet in STR.
- To monitor disease transmission from feral cattle to wild herbivores populations
- To track habitat utilization patterns of feral cattle even in different season.

iii. Issues and Problems:

- Lack of knowledge about impact of feral cattle population on habitat, herbivores, and on diet of predators.
- No availability of data about feral cattle for taking sound decision of feral cattle remove or not from habitat or about taking measures about control over population.
- Currently, any data about feral cattle is not available with STR to take wise decision about feral cattle management
- Currently no monitoring of feral cattle is involved in MSTrIPES.
- Regular interaction of feral cattle with wild herbivores especially with the Gaur are observed but its impact on Gaur population is not known.

iv. Strategy:

- **Regular Monitoring of feral cattle during foot patrolling:** field staff should note following observation about feral cattle during their routine field patrolling about the number, sex, activities, kill of any feral cattle, cattle behaving abnormal, diseased cattle, any interaction with other wild herbivores, preferred area for grazing or resting if any, new calf's, lactating mothers, behavior among group members etc.

- Camera trap data should of feral cattle should analyzed in detail to understand above aspects.
- **Recording and analyzing population trends:** Regular population surveys will be conducted using techniques such as transect surveys, camera traps, and genetic sampling. Population size, age structure, sex ratio, and reproductive rates will be estimated through mark-recapture studies and demographic analyses. Population trends will be monitored over time to identify fluctuations and assess management interventions' effectiveness. Collaboration with research institutions and wildlife experts

will facilitate the analysis of population data and identification of key factors influencing population dynamics.

- In MEE-2022 report, mentioned that there are a good number of feral cattle in STR that will be a good prey base. For effective management, there should be a systematic monitoring of these feral cattle. Necropsy of such feral animals killed by wildlife should be done. If possible, forensic analysis should be carried out for any possible disease, along with immunization.
- **Evaluation of Impacts on Ecosystem and Habitat:** Habitat assessments will be conducted to quantify habitat modification and degradation caused by feral cattle. Field surveys will assess grazing pressure, soil erosion, and impacts on native flora and fauna. Collaboration with ecologists and conservation biologists will aid in developing habitat models and predictive tools for assessing long-term habitat impacts. GPS collars or satellite tracking devices will be deployed on a subset of feral cattle individuals to monitor their movement patterns and home ranges. Telemetry studies will track feral cattle movements and behavior in different habitat types and seasons.
- **Feral cattle Hotspot Identification:** Spatial data will be analysed to identify areas with high feral cattle activity and habitat degradation using GIS and spatial analysis techniques. Field surveys will validate hotspot locations and prioritize management interventions. Regular monitoring programs will be implemented in hotspot areas to track changes in feral cattle abundance and habitat conditions over time.
- **Interactions with Native Wildlife:** Research will be conducted to understand the ecological impacts of feral cattle on native wildlife species emphasizing competition of feral cattle with other ungulates and feral cattle population acting as a prey base for major predators. Targeted monitoring programs will be implemented to assess interactions between feral cattle and key wildlife species. Management strategies will be developed to minimize negative impacts and promote coexistence between feral cattle and native wildlife.
- **Disease Transmission Monitoring:** A disease surveillance program will be established to monitor feral cattle health and detect potential disease outbreaks. Regular health assessments and sample collection for disease screening and monitoring will be conducted. Collaboration with veterinary professionals and public health authorities will facilitate the identification and response to disease threats effectively. Biosecurity measures will be implemented to prevent disease transmission between feral cattle, domestic livestock, and native wildlife species.
- By implementing proactive management strategies, we can mitigate the ecological impacts of feral cattle and safeguard the biodiversity of these vital ecosystems.

v. **Monitoring:**

This comprehensive monitoring strategy will enable management authority to effectively assess population dynamics, evaluate habitat impacts, identify hotspots, monitor disease transmission, and track movement patterns of feral cattle in the Sahyadri Tiger Reserve, contributing to their effective management and conservation within the ecosystem.

7.2.2.15 Theme Plan for Population Management of Feral Dogs in Wildlife Habitat:

i. General:

The control of feral dog populations in wildlife habitats is essential for the protection of biodiversity and the health of ecosystems. By combining prevention, humane control measures, public involvement, and long-term monitoring, this plan aims to reduce the negative impacts of feral dogs on wildlife while respecting ethical considerations and community values. Successful implementation will require collaboration, adequate resources, and an adaptive approach to manage ongoing challenges.

ii. Objectives:

- To develop and implement effective strategies for the control and management of feral dog populations in wildlife habitats to reduce negative impacts on native wildlife, ecosystems, and public health.
- Reduce the population of feral dogs in wildlife habitats while minimizing harm to native wildlife and ecosystems.

iii. Issues and problems:

- **Predation**: Feral dogs hunt native wildlife, including vulnerable species, leading to population declines.
- **Competition for Resources**: Feral dogs compete with native carnivores and herbivores for food and shelter, potentially causing imbalance.
- **Disease Transmission**: Feral dogs are vectors for zoonotic diseases, such as rabies, distemper, and canine parvovirus, which can affect both wildlife and domestic animals.
- **Disturbance to Breeding and Habitat Use**: The presence of feral dogs can disturb wildlife breeding sites, nesting areas, and migration patterns. For example, dogs may raid bird nests, destroy burrows, or disturb sensitive habitats, impacting species' ability to reproduce and thrive.
- **Hybridization with Wild Species**: Feral dogs may interbreed with wild canid species like wolves, foxes, or coyotes, leading to genetic dilution and the loss of unique genetic traits that are important for conservation efforts.
- **Public Health Concerns:** Feral dogs pose several public health risks, both for local human populations and for domestic animals.
- **Disease Transmission**: Feral dogs are often carriers of zoonotic diseases (diseases that can be transmitted from animals to humans) and can spread illnesses like rabies, canine distemper, parvovirus, and leptospirosis. These diseases can affect wildlife populations and domesticated animals, as well as humans who may come into contact with infected animals or their waste.

- **Bites and Attacks**: In some instances, feral dogs can become aggressive toward humans or livestock, particularly in areas where they are hungry or feel threatened. Bites or attacks on people or animals can lead to injury and the spread of disease.

- **Tourism Impact**: In wildlife areas or national parks where, eco-tourism is a key revenue source, the presence of feral dogs can negatively affect the experience of visitors. Dogs may interfere with wildlife viewing, hiking, or other activities, potentially reducing tourism revenues.

iv. Strategies:

A. Assessment and Monitoring

- **Population Assessment**: Conduct regular surveys to estimate feral dog population sizes, distribution, and behaviors in STR.
- **Ecological Impact Monitoring**: Track the impact of feral dogs on local wildlife populations, especially endangered species or those of conservation concern.
- **Disease Surveillance**: Monitor for the spread of diseases transmitted by feral dogs, and assess risks to both wildlife and human populations.

- **Public Awareness and Education**: Launch educational campaigns targeting owners to prevent dogs' movement in wildlife areas.

B. Control Measures:

1. **Humane Trapping and Removal**:
   - **Live Traps**: Deploy humane traps to capture and relocate feral dogs.
   - **Capture, Neuter/Spay, and Release (CNR)**: For certain populations, a CNR program may be implemented to reduce reproductive rates in areas where total eradication is not feasible.
   - **Euthanasia**: In cases where relocation or rehabilitation is not possible or appropriate, euthanasia may be necessary to prevent further ecological damage and suffering.
2. **Habitat Restoration**: Enhance habitats to reduce attraction to feral dogs, such as removing food sources.
3. **Sterilization and Contraception**:
   - **Contraceptive Implants**: Research and implement the use of contraceptives (such as chemical sterilant) to control the population of feral dogs in the short to medium term, particularly in inaccessible or protected areas.
   - **Vaccination**: Vaccinate feral dogs against rabies and other diseases to prevent the spread of zoonotic infections.
4. **Collaboration with Local Communities and Agencies**:
   - Work with local animal welfare organizations, community groups, and local governments to coordinate control efforts.
   - Offer incentives for people to report sightings or assist in the capture of feral dogs.
   - Collaborate with wildlife agencies, conservationists, and veterinarians to implement best practices for both animal welfare and ecosystem health.

5. Public Engagement and Communication

- **Community Involvement**: Involve local communities in feral dog management efforts through volunteer programs, public meetings, and outreach initiatives.
- **Transparency**: Keep the public informed about the goals, progress, and successes of feral dog control programs. Use media platforms, websites, and newsletters to maintain communication.

- **Partnerships**: Build partnerships with conservation organizations, wildlife protection groups, and veterinary associations to gain broad support and expertise for the initiative.

6. Timeline

- **Short-Term (1-2 years)**:
  - Conduct baseline surveys and assessments.
  - Implement education and awareness programs.
  - Begin trap-neuter-return or removal operations in key areas.
- **Medium-Term (3-5 years)**:
  - Expand control programs to additional areas as needed.
  - Introduce sterilization and contraception initiatives.
  - Continue population monitoring and adjust strategies as necessary.
- **Long-Term (5+ years)**:
  - Achieve a significant reduction in the feral dog population in high-priority areas.
  - Promote long-term ecosystem recovery and stabilization.
  - Establish sustainable management frameworks to prevent reoccurrence.

v. Monitoring and Evaluation:

- **Regular Reviews**: Set up a monitoring and evaluation framework to assess the effectiveness of feral dog control strategies over time.
- **Data Collection**: Collect data on population dynamics, wildlife recovery, disease incidence, and ecological changes to adjust management practices.
- **Adaptive Management**: Be prepared to adjust strategies based on ongoing research, monitoring outcomes, and feedback from stakeholders.

7.2.2.16 : Theme Plan for Compliance of Management Effectiveness Evaluation (MEE):

i. General:

Sahyadri Tiger Reserve, situated within the ecologically important Western Ghats landscape, serves as a critical refuge for tiger conservation and the preservation of biodiversity. The Management Effectiveness Evaluation (MEE) framework offers a systematic means to assess and strengthen the effectiveness of management interventions, governance structures, and conservation outcomes. Prescribed by the National Tiger Conservation Authority (NTCA), the MEE is a structured assessment tool designed to evaluate how effectively tiger reserves achieve their conservation objectives by examining context, planning, inputs, processes, outputs, and outcomes.

Analysis of the last four MEE cycles (2010, 2014, 2018, 2021 (Internal MEE), and 2022) for Sahyadri Tiger Reserve has revealed management gaps along with actionable measures that need to be addressed to enhance adaptive management, ensure accountability, strengthen ecological and administrative performance, and align site-level management with national tiger conservation priorities. Details of weaknesses, actionable points, and compliance made so far are given in chapter no. 14.

The expected outcomes of this theme plan include improvement in MEE scores across all assessment elements, enhanced accountability and transparency in management processes, strengthened protection

measures and habitat management practices, better integration of scientific inputs, monitoring, and management actions, and a long-term improvement in the status of tigers and their prey base in Sahyadri Tiger Reserve.

This theme plan defines the objectives, key issues, strategies, and monitoring mechanisms required to ensure full compliance with the NTCA-prescribed MEE framework.

ii. Objectives:

1. **To ensure 100% compliance with all MEE protocols and timelines:** This objective focuses on adhering strictly to the guidelines, formats, and timelines prescribed under the MEE framework, ensuring the timely submission of assessments, accurate reporting, and full participation of all relevant management units in the evaluation process.
2. **To strengthen governance, planning, and resource allocation in line with MEE standards:** It aims to improve institutional mechanisms, decision-making processes, and coordination while aligning annual planning, budgeting, and deployment of financial and human resources with MEE criteria and conservation priorities.
3. **To systematically assess management inputs, processes, outputs, and outcomes during internal MEE in Sahyadri Tiger Reserve:** This objective emphasizes conducting regular internal evaluations to comprehensively review resources, management actions, implementation efficiency, and conservation results, thereby identifying gaps and opportunities for improvement.
4. **To fulfill gaps and weaknesses in protection, habitat management, staff capacity, and community engagement reported in the last MEE reports:** It seeks to address deficiencies highlighted in previous MEE cycles by strengthening protection infrastructure, improving habitat and prey management, enhancing staff skills and training, and fostering better involvement of local communities in conservation efforts.
5. **To integrate MEE findings into the Annual Plan of Operation and perspective management planning:** This objective ensures that MEE recommendations directly inform short-term operational plans and long-term management strategies, making evaluation outcomes an integral part of planning, implementation, and review processes.
6. **To promote adaptive and evidence-based management for long-term tiger conservation:** It focuses on using monitoring data, scientific inputs, and MEE findings to adapt management strategies in response to changing ecological and administrative conditions, thereby improving conservation effectiveness over time.
7. **To ensure transparency, accountability, and continual improvement in management practices:** This objective aims to establish clear documentation, regular reviews, and follow-up mechanisms that enhance accountability at all levels and foster a culture of learning and continuous improvement in tiger reserve management.

iii. Issues:

- **Inadequate documentation and data consolidation:** Records related to management actions, protection efforts, ecological monitoring, and administrative processes are often scattered and

inconsistently maintained. This hampers systematic analysis, weakens institutional memory, and limits the use of reliable evidence during MEE assessments and planning exercises.

- **Limited integration of MEE findings into Annual Plans of Operation:** Recommendations and gaps identified through MEE assessments are not sufficiently reflected in annual planning and budgeting. As a result, MEE outcomes remain largely evaluative rather than being translated into concrete management actions and resource allocation.
- **Limited monitoring of ecological and management performance indicators:** Regular tracking of key indicators such as habitat quality, prey availability, patrolling effectiveness, and staff performance is inadequate. This restricts the ability to assess trends, identify emerging threats, and measure management effectiveness over time.
- **Limited exposure of frontline staff to MEE concepts:** Frontline personnel often have insufficient awareness and training regarding MEE objectives, criteria, and processes. This reduces their participation and ownership in data collection, reporting, and implementation of corrective measures.
- **Weak outcome and impact assessment:** Management assessments tend to focus more on activities and outputs rather than measurable conservation outcomes and long-term impacts, such as improvements in habitat condition, species recovery, and threat reduction.
- **No or insufficient follow-up on previous MEE compliance and recommendations:** Recommendations from earlier MEE cycles are not systematically tracked or reviewed, leading to recurring deficiencies, limited accountability, and missed opportunities for adaptive management and continuous improvement.

iv. Strategies:

4.1 Institutional Strengthening

To ensure effective implementation and sustained compliance with the Management Effectiveness Evaluation (MEE) framework, institutional mechanisms will be strengthened at multiple levels. A dedicated MEE Coordination Cell will be constituted at the STR Headquarters, with corresponding MEE sections established in the offices of the Deputy Director (DD) and Field Director (FD). These units will be responsible for maintaining systematic records, coordinating evaluations, and ensuring timely reporting and follow-up actions. Furthermore, an Assistant Conservator of Forests (ACF)– level nodal officer will be designated in the Field Director's office to oversee MEE compliance and facilitate inter-divisional coordination.

4.2 Planning and Documentation

Effective planning and documentation form the backbone of MEE compliance. All data related to protection, habitat management, wildlife monitoring, and community engagement will be standardized in prescribed formats to ensure consistency and comparability. A system of digital archiving will be developed for patrol records, habitat interventions, wildlife monitoring data, and management actions to improve data accessibility, accuracy, and long-term storage. Further, outcomes and recommendations from MEE assessments will be formally integrated into key planning instruments, including

- **Annual Plan of Operation (APO)** to guide yearly budgeting and activity planning, and

- **Tiger Conservation Plan (TCP) revisions**, ensuring that long-term strategies are aligned with evaluation findings and emerging management needs.

4.3 Protection and Process Improvement

Protection mechanisms will be continuously strengthened through enhanced patrolling using the M-STrIPES platform, enabling real-time tracking, spatial analysis, and performance monitoring of field patrols. Regular evaluations of patrol effectiveness—covering coverage, frequency, detection of threats, and response time—will be undertaken to identify gaps and improve field deployment strategies. Protection outputs such as patrol intensity, offence detection, and threat mitigation will be explicitly linked to relevant MEE indicators, ensuring that protection efforts directly contribute to improved evaluation scores and conservation outcomes.

4.4 Capacity Building:

Capacity building of frontline and supervisory staff will be prioritized to ensure effective implementation of MEE-related activities. Periodic training programs will be organized for frontline staff, range officers, and supervisory officers, focusing on: Understanding the MEE framework and indicators, Accurate data collection, validation, and reporting, and Practical use of GPS, GIS, M-STrIPES, and other monitoring tools. In addition, exposure visits to high-performing tiger reserves will be facilitated to enable experiential learning, sharing of best practices, and adoption of innovative management approaches suited to local conditions.

4.5 Adaptive Management

MEE will be used as a tool for adaptive and performance-oriented management. Compliance with MEE indicators and implementation of recommendations will be integrated into the Key Result Areas (KRAs) of field officers to enhance accountability. Based on evaluation outcomes, weak or underperforming areas identified through MEE will be prioritized for corrective interventions. Management strategies will be reviewed mid-term to allow timely course correction and improved outcomes. Further, budgetary allocations will be rationalized and reallocated in line with MEE findings, ensuring that critical gaps in protection, habitat management, or capacity building receive focused financial support.

v. Monitoring & Evaluation:

- **Internal Self-Assessment by STR Management** The management of STR will conduct annual or biannual internal self-assessments to review progress against management objectives, operational effectiveness, and compliance with MEE actionable points.
- **Independent MEE Evaluation as per NTCA Schedule** An independent Management Effectiveness Evaluation (MEE) will be carried out every four-year cycle by the National Tiger Conservation Authority (NTCA). This ensures objective assessment of management performance, governance, protection measures, habitat management, and community engagement.
- **Review Meetings on MEE Compliance** Regular review meetings will be organized to monitor compliance with MEE recommendations at multiple administrative levels
- **Field Director Level** Periodic reviews to assess implementation status, resolve field-level constraints, and ensure timely action.

- **CWLW level** Higher-level monitoring to provide strategic guidance, inter-departmental coordination, and policy-level support for effective implementation.
- **Documentation of Action Taken Reports (ATR)** All recommendations emerging from MEE assessments will be systematically followed up through regularly updated Action Taken Reports (ATR). These reports will document progress, timelines, responsible officers, and outcomes, ensuring transparency and accountability throughout the implementation process.
- **Use of Evaluation Findings for Continuous Improvement** Findings from self-assessments and independent evaluations will be actively used to refine management strategies, improve operational efficiency, and strengthen conservation outcomes. Lessons learned will guide adaptive management practices, capacity building, and future planning for sustained improvement.

Chapter – 8

Research, Monitoring, Training & Wildlife Health

Investing in continuous monitoring and research initiatives to assess the impact of existing threats and track the effectiveness of implemented mitigation measures would provide valuable insights for adaptive management. Tracking the effectiveness of implemented mitigation measures and adapting strategies accordingly based on ongoing monitoring and evaluation could lead to more efficient conservation outcomes. (Bridging The Gap: Unveiling effectiveness of India's tiger reserve management, NTCA, report 2024)

8.1. Research Priorities, Main Projects and Implementation

The research priorities in STR are given below:(Annexure No. 40)

- Faunal and Floral survey of the buffer area of Sahyadri Tiger Reserve with special reference to the wildlife covered under various schedules appended to Wildlife (Protection) Act, 1972 and also other endangered, threatened and keystone species.
- Field survey to assess the status of flora and fauna as per IUCN Red data listing.
- Study on feasibility/suitability of the site to reintroduce locally extinct species like tiger, spotted deer etc.
- Regeneration survey of buffer of Sahyadri Tiger Reserve with special emphasis on endangered plants. This research activity should explain particular focus on the flora which the wild animals feed on especially during the scarcity period.
- Assessment of territories and home ranges of important carnivores reported in the buffer of Sahyadri Tiger Reserve and also seasonal fluctuations in their movement.
- Surveillance and monitoring of wildlife health with help of Veterinary University.
- Testing of forest soil to assess the mineral deficiency, so that adequate mineral could be supplemented through salt licks, waterholes etc.
- Survey of water holes in order to test its hygiene with respect to infestation by helminthes, a harmful protozoan etc.
- Response of the wildlife to the changes introduced by management like habitat manipulation i.e. maintenance of grass strips and view-lines along the protection roads, weed eradication, meadow management along with study of grasses.
- Methods to avoid crop depredation by wild animals to the agricultural fields in and around the Sahyadri Tiger Reserve. These methods should not put the wild animals under stress and be cost effective.

- Photographic monitoring of habitat conditions, in order to provide time series of habitat conditions and habitat factors undergoing changes. This should be done particularly before and after the occurrence of the event viz. onset of fire season, grazing, various seasons, clearing etc.
- Monitoring the impact of tourism on the Wildlife.
- Monitoring the tourist inflow and preferences though feedback
- Carbon stock mapping and climate changes
- Resource dependency of primary stakeholders on forests
- Possible ecologically sustainable livelihood options
- Models of biodiversity conservation through livelihood improvement
- Ecosystem services with special reference to watershed value
- Indigenous strain of cattle and cultivar
- Monitoring changes in the vegetation composition of the buffer forest due to biotic pressure.

8.2 Research Project in Sahyadri Tiger Reserve

Table.8.1: Ongoing Research Projects in STR

Sr. NO.	Name of Research Topic	Name Of University	Researcher
1	Praposal for Conduct study on Grassland mapping in STR	Dr. Balasaheb Sawant Kokan Krishi Vidyapeeth Dapoli and Sahyadri Tiger Reserve	Deepanjali Deepak Jambhale
2	Consent for Conducting study on Biodiversity of STR	Dr. Balasaheb Sawant Kokan Krishi Vidyapith Dapoli and Sahyadri Tiger Reserve	Urvija Uttam Dhoke
3	Ecological Studies of Wilddog (Cuonal Pinus) in STR and its Landscapes	Shivaji University Kolhapur	Sonal Shivanand Prabhulkar
4	The Soil Carbon Content and its evolution	Indian Institute of Science Education and Research, Pune	Dr. Shreyas Mangave
5	Eco System Services and Human Wildlife Interactions In the Buffer Area of Koyana Wildlife Sactuary	Earth Planet Organisation and Sahyadri Tiger Reserve	Aakash Bhimrao Patil
6	Assesment of Wildlife Crime in an aroung Koyana Wildlife Sanctuary (STR)	Bharati Vidhyapeeth, Institute of Environmental Education and Research, Pune	Vinayak Dhondiba Sapte
7	Study On Bats of STR	Sahyadri Tiger Reserve Kolhapur	
8	Scientific Documentation On STR	Sahyadri Tiger Reserve Kolhapur	

8.3 Monitoring Framework

8.3.1 Framework

- Monitoring is a continuous process in management. Following things needs to be monitored continuously: -
- Wild animal population estimates.
- Existing preservation plots and sample plots.
- Wildlife health
- The dependency of people on P.A.
- Wildlife tourism.
- Sources of water.
- Weed eradication area
- Monitoring the trend of change of Predator, Co-predator, Wild dog, Sloth bear population and abundance of prey species
- Monitoring the change in vegetation composition especially in the area under constant biotic pressure and area which is rehabilitated.
- Micro-habitats are extremely important and it shall be monitor regularly as it is highly sensitive for endemic species.
- Biotic pressure in TR
- Monitoring of changes in Grassland areas.
- All research works will be carried out with prior permission of NTCA and Chief Wildlife Warden of the Maharashtra State or authorized officer. Related document for research permission is attached (Annexure No.51)
- Regular feedback of such ongoing project needs to be conveyed by Principal Investigator to the concerned Area ACF/ DFO(Core) and review of such projects/ progress at least once in a quarter be made by the Field Director.
- All Researchers must give necessary intimation of at least 7 days before their visit to the concerned Range Officer. They should enter their entry and outgoing, necessary feedback while they are visiting a particular area, in a separate register in the range office. Failure to do so may attract a penalty of Rs. 500/- minimum for the first time of the violation and it will be doubled for subsequent happenings. The amount so collected will be deposited in STR foundation.
- No night halt in the Core Zone will be allowed unless specially permitted by Chief Wildlife Warden, M.S. or authorized officer.

- Leaving the projects without proper & prior reasoning, unnecessary delays in completion of the projects without intimation and permission of STR field Director is a mere waste of Government money and time of officials. Such researchers or related institute/ organization may be penalized, blacklisted and will be prohibited to carry out any research and other activities in STR as well as any other PAs of Maharashtra state.
- Need to discuss with PA managers before finalizing results about the findings.
- Need to submit a draft copy of research paper to Field Director before publishing in any publication.
- It is mandatory to provide author credit to the relevant forest officers who guide and support the field study.
- Need to submit one copy of the final report and research paper to Field Director. If fail to submit or deny to give such copy of report, such researchers or related institute/ organization may be penalized, blacklisted and will be prohibited to carry out any research and other activities in STR as well as any other PAs of Maharashtra state.

Some important Institutes for research-

- There is a need to utilize available expert agencies as necessary in scientific investigation, such as the following:
- Wildlife Institute of India, Dehradun,
- Zoological Survey of India,
- Botanical Survey of India,
- Shivaji University, Kolhapur
- Savitribai Phule Pune University, Pune
- Kolhapur Agriculture College, Kolhapur
- Veterinary University, Nagpur
- Veterinary College, Shiraval, Satara
- Mahatma Phule Krishi Vidyapeeth, Rahuri
- Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
- College of Forestry, Dapoli
- National Centre for Biological Sciences, Bangalore
- Other state and national universities
- Kundal Forest Academy, Kundal
- Local colleges which have experts in a particular subject

Establishing Field Laboratory –

- There is a need for a well-equipped field laboratory in tiger reserve at a suitable location to support field studies and to house field collection of samples for training and investigation purpose. There is a need for a good availability of computers and facilities on information technology under the supervision of a qualified Research Officer –Ecologist and allied staff. It can also serve as a center of data collection and analysis of different kinds of data which is religiously collected from the field but it is not largely analyses and utilize in decision making. Data collected in field patrolling, PIP observations, camera trap data, tourism data, offence data, data of EDC work, social data etc should be collected at one place and need to be analyzed and submit a report to DD and FD. This analysis should be providing to RFO's also.

8.3.2 Sahyadri Wildlife Research Facility:

A wildlife research center serves several crucial purposes:

1. **Conservation:** It helps in understanding wildlife populations, their habitats, and the threats they face. This knowledge is vital for conservation efforts aimed at protecting endangered species and preserving biodiversity.

2. **Ecological Balance:** Wildlife research centers study the interactions between different species and their environments. This research helps in maintaining ecological balance and preventing the overpopulation or extinction of certain species, which can have cascading effects on entire ecosystems.

3. **Human-Wildlife Conflict Mitigation:** Understanding animal behavior and ecology can help in mitigating conflicts between humans and wildlife. Research centers can develop strategies to minimize conflicts such as crop raiding, attacks on livestock, and human-wildlife encounters.

4. **Disease Management:** Wildlife research centers play a crucial role in monitoring and managing diseases that affect both wildlife and humans. Understanding the spread of diseases among wildlife populations can help in preventing outbreaks and controlling zoonotic diseases.

5. **Education and Outreach:** These centers often engage in public outreach and education programs to raise awareness about wildlife conservation and the importance of preserving natural habitats. They also provide training and resources for students and professionals interested in wildlife research and conservation.

6. **Policy Development:** Wildlife research centers generate scientific data and expertise that inform policy decisions related to wildlife management, habitat protection, and environmental regulations.

Overall, wildlife research centers are essential for advancing our understanding of the natural world and implementing effective strategies for wildlife conservation and sustainable management.

8.3.3 GIS Cell: A Geographic Information System (GIS) cell holds significant importance in various fields due to its capability to capture, store, manipulate, analyze, manage, and present spatial or geographic data. Special GIS cell is very important for tiger reserve for following reasons:

Integrating Geographic Information Systems (GIS) into tiger conservation efforts offers numerous benefits:

1. **Habitat Mapping**: GIS technology allows conservationists to map tiger habitats accurately. This mapping helps identify critical habitats, corridors, and areas where tigers are likely to roam, aiding in the development of effective conservation strategies.
2. **Monitoring Tiger Populations**: GIS can be used to collect and analyze data of camera traps, data on tiger sightings, tracks, and signs of activity. By overlaying this information with habitat maps, conservationists can estimate tiger population densities and monitor population trends over time.
3. **Human-Wildlife Conflict Analysis**: GIS helps in analyzing spatial data related to human-tiger/wildlife conflicts. By mapping conflict hotspots and understanding the underlying causes, conservationists can develop targeted interventions to mitigate conflicts and reduce human-tiger/wildlife conflicts.
4. **Identifying Priority Areas for Protection:** GIS analysis can identify priority areas for tiger conservation based on factors such as habitat quality, connectivity, and potential threats. This information helps conservationists allocate resources more effectively and focus conservation efforts where they are most needed.
5. **Corridor Planning and Management**: GIS facilitates the identification and planning of wildlife corridors that connect fragmented tiger habitats. By mapping land use patterns and barriers to movement, conservationists can design corridors that promote genetic exchange and facilitate the movement of tigers between populations.
6. **Law Enforcement and Anti-Poaching Efforts**: GIS can be used to map poaching incidents, illegal trade routes, and other threats to tigers. This information helps law enforcement agencies target their patrols and enforcement efforts more effectively, leading to improved protection for tigers and their habitats.

Overall, the integration of GIS technology into tiger conservation efforts enhances data-driven decision-making, improves monitoring and management strategies, and contributes to the long-term survival of tigers in the wild.

8.3.4 Tiger Cell

A separate 'Tiger Cell' within a Tiger Reserve plays a crucial role in collecting and analyzing data for conservation and management of tiger populations and their habitats. Here are some key points highlighting its importance:

1. **Tiger Monitoring and Research:** The Tiger Cell is responsible for monitoring tiger populations within the tiger reserve and its landscape through various methods such as camera trapping, DNA analysis, and

satellite tracking. This data is essential for estimating population trends, assessing habitat quality, and identifying threats to tiger survival.

2. **Habitat Management and Protection**: The Tiger Cell coordinates efforts to protect and restore tiger habitats within the reserve by providing research inputs.

3. **Collaboration and Networking**: The Tiger Cell often collaborates with other tiger reserves, forest divisions, conservation organizations, government agencies, and international bodies to share information, best practices, and resources for tiger conservation. This networking facilitates coordinated conservation efforts at regional and global scales.

4. **Ecological Monitoring and Management:** Beyond tigers, the Tiger Cell is involved in monitoring the overall ecological health of the reserve, including prey populations, vegetation dynamics, and ecosystem processes. Maintaining a balanced ecosystem is essential for the long-term survival of tigers and other wildlife.

5. **Research and Innovation**: The Tiger Cell may conduct or support research projects aimed at understanding behavior, ecology, genetics, and disease dynamics of tiger, co-predators and its prey. This research contributes to the development of effective conservation strategies and adaptive management practices.

Overall, the Tiger Cell serves as a focal point for tiger conservation efforts within a Tiger Reserve, bringing together various stakeholders to ensure the survival and recovery of this iconic species in its natural habitat.

8.4 Training Needs Assessment

The TCP covers at length, theme plans for capacity building. The needs relating to in-service training for field personnel should be in tune with the thematic areas under capacity building as stated in theme plan for staff development. This would be in accordance with the theme plan prescribed for the core/critical tiger habitat. However, the frontline personnel in a buffer area needs to be a multi-tasker to tactfully handle the human-tiger interface issues, participatory planning and socio-cultural appraisal. Therefore, a special module (one-week field training) should be developed to build up the skills of such personnel to handle site-specific interface/social issues, including effective communication. Theme plan for training is given in para no. 11.4

8.5 HRD Plan and Staff Development Plan:

Administrative structure:

Field Director, an officer of the rank of Chief Conservator of Forests is administrative and managerial head of Sahyadri Tiger Reserve. The office of Field Director is based at Kolhapur. Field Director is assisted by Deputy Director, Koyna Wildlife Division at Karad and Deputy Director, Chandoli Wildlife Division at Karad. Assistant Conservators of Forests are responsible for leading the forest sub-divisions.

Administrative Hierarchy of STR:

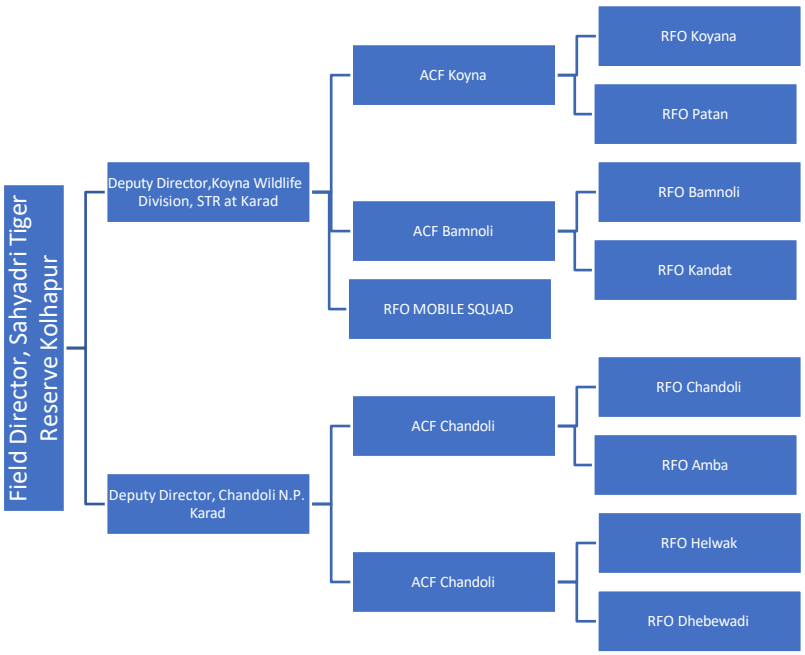


Fig.8.1: Administrative Structure of STR

Primary Objectives:

1. To have a suitable administrative setup for tiger reserve.
2. To provide efficient administration for attaining conservation and protection goals through implementing TCP.
3. To ensure human resources development through identification of weaknesses and arranging suitable training and skill development modules.
4. To provide amenities to all staff for efficient functioning and working in the field.
5. To evolve a better performance monitoring mechanism to access the performance of all staff.

Specific Objectives:

A staff development plan for a tiger reserve would be specifically tailored to address the unique challenges and requirements of managing and conserving tiger populations and their habitats. Here are some key objectives that such a plan might include:

- **Tiger Conservation Expertise:** Enhancing the knowledge and skills of staff members in tiger monitoring, population estimation, habitat management, anti-poaching strategies, and human-tiger conflict resolution.
- **Wildlife Law Enforcement:** Providing specialized training on wildlife laws, enforcement techniques, and intelligence gathering to combat poaching, illegal wildlife trade, and other threats to tigers and their prey species.
- **Habitat Management**: Training staff in habitat restoration, landscape planning, fire management, and invasive species control to improve the quality and connectivity of tiger habitats within the reserve.
- **Community Engagement:** Equipping staff with the skills necessary to engage with local communities living in and around the tiger reserve, fostering collaboration, addressing human-tiger/wildlife conflicts, and promoting sustainable livelihoods that reduce pressure on tiger habitats.
- **Ecotourism Management:** Providing training on ecotourism principles, visitor management, interpretation techniques, and infrastructure development to generate revenue for conservation while minimizing disturbance to wildlife.
- **Research:** Building capacity in scientific research methods, data analysis, and monitoring protocols to assess tiger population trends, habitat status, and the effectiveness of conservation interventions.
- **Enhanced Expertise**: Providing specialized training in areas such as wildlife management, forestry techniques, biodiversity conservation, forest law enforcement, and community engagement to enhance the expertise of staff members.
- **Emergency Response:** Conducting drills and training exercises to prepare staff for rapid response to emergencies such as wildlife rescues, natural disasters, disease outbreaks, and human-wildlife conflicts.
- **Technology Adoption:** Introducing and training staff on the use of technology such as camera traps, GPS tracking devices, drones, and remote sensing for wildlife monitoring, law enforcement, and habitat mapping.
- **Collaboration and Networking:** Facilitating collaboration with other tiger reserves, government agencies, research institutions, NGOs, and international organizations to share best practices, resources, and expertise in tiger conservation.

- **Capacity Building for Stakeholders:** Extending training and capacity-building initiatives to local stakeholders, including forest department staff from neighboring areas, conservation NGOs, local communities, and tourism operators, to create a broader support network for tiger conservation efforts.
- **Promoting Best Practices**: Promoting the adoption of best practices in Wildlife and forest management, including s habitat management, protection technique, ecosystem restoration, fire management, community engagement and climate change adaptation strategies etc.
- **Encouraging Innovation:** Fostering a culture of innovation and creativity among staff members to develop new approaches, tools, and methodologies for addressing emerging challenges in forest/Wildlife/Tiger conservation and management.
- **Fostering Environmental Awareness:** Conducting awareness campaigns and educational programs for staff members to enhance their understanding of the importance of forests, Wildlife, biodiversity conservation, and the role of the forest department in sustainable development.
- **Continuous Learning:** Encouraging a culture of continuous learning and professional development among staff members through access to resources such as online courses, research publications, and networking opportunities.
- **Monitoring and Evaluation:** Establishing mechanisms for monitoring and evaluating the effectiveness of staff development initiatives, including regular performance assessments, feedback mechanisms, and impact evaluations.
- **Promoting Leadership Development:** Identifying and nurturing leadership potential within the department through mentorship programs, leadership training, and opportunities for career advancement.
- **Capacity Building:** Strengthening the capacity of forest department staff through targeted training programs, workshops, and seminars to equip them with the necessary skills and knowledge for sustainable forest management, wildlife and tiger conservation, and protection.

Overall, the objective of a staff development plan for a tiger reserve is to build a skilled, dedicated, and well-coordinated team capable of effectively protecting and conserving tiger populations and their habitats, ensuring their long-term survival in the wild.

Problems:

The problems and challenges in achieving these objectives are as follows:

- The available positions do not align with the requirements.
- A significant number of positions remain unfilled due to prolonged recruitment delays.

- Staff members exhibit reluctance to be stationed in Protected Areas, often attempting to avoid joining or seek transfers out.
- Essential roles, such as wireless operators, boat driver etc, lack sanctioned post within the Tiger Reserve.
- There is no provision for compensating staff members who serve extended periods at field stations, resulting in financial strain from maintaining separate households. This contributes to high levels of disenchantment and absenteeism.
- No planned infrastructure development and availability of basic facilities at many anti-poaching camps, including water supply and electricity, requires enhancement.

Strategies:

Following strategies for a staff development plan tailored to a tiger reserve:

A. **Strategies are required to enhance performance in different areas.**:

- **Training Programs:** Implement regular training programs focused on protection, intelligence and surveillance, habitat management, Wildlife monitoring and any other tiger conservation aspects, including workshops, seminars, and field exercises. These programs should cover various aspects such as tiger monitoring techniques, wildlife law enforcement, habitat management, and community engagement.
- **Skill Enhancement:** Offer specialized training to enhance staff skills in areas such as wildlife monitoring using technology (e.g., camera traps, GPS), data analysis, habitat restoration, and conflict resolution etc.
- **Leadership Development:** Identify potential leaders within the reserve staff and provide opportunities for leadership development through mentoring, leadership training, and participation in decision-making processes.
- **Cross-Training:** Encourage cross-training opportunities where staff members can gain experience in different roles within the reserve, fostering a more versatile and adaptable workforce.
- **Community Engagement Training:** Equip staff with the necessary skills to effectively engage with local communities living in and around the tiger reserve, promoting awareness, cooperation, and sustainable livelihoods that reduce human-wildlife conflicts.
- **Technology Adoption**: Provide training on the use of modern technology for wildlife monitoring, law enforcement, and management, including GPS devices, camera traps, drones, and data management software.

- **Ecotourism Management:** Offer training programs on ecotourism principles, visitor management, interpretation techniques, and infrastructure development to generate revenue for conservation while minimizing disturbance to wildlife.
- **Research Collaboration:** Foster collaboration with research institutions and universities to provide staff with opportunities for scientific research and collaboration on conservation projects, enhancing their skills and knowledge base.
- Performance Evaluation and Feedback: Establish a system for regular performance evaluation and feedback to identify areas for improvement and tailor training programs to meet staff needs effectively.
- **Incentives and Recognition:** Recognize and reward staff members who demonstrate outstanding performance and dedication to tiger conservation through incentives, awards, and opportunities for career advancement.
- **Networking and Collaboration:** Facilitate networking opportunities with other tiger reserves, conservation organizations, government agencies, and international partners to share best practices, experiences, and resources.
- **Continuous Learning Culture:** Foster a culture of continuous learning and professional development by providing access to resources such as online courses, workshops, conferences, and scientific literature.
- **In-house training facilities** will be developed. Refresher courses for important management activities such as MSTrIPES, census methodologies etc. will be organized regularly. Vertical and horizontal integration and experience sharing will be promoted. The training modules must contain case studies and experience sharing by the participants. The participants must be selected so as to represent all levels of the hierarchy. Experiences coming out of successful innovations and initiatives must be shared and implemented to improve the delivery.

By implementing these strategies, a tiger reserve can effectively build the capacity of its staff members, empowering them to contribute more effectively to tiger reserve management and conservation efforts and ensuring the long-term sustainability of the tiger reserve's conservation goals.

B. Identification of skills and training areas

Training modules addressing new challenges in protection, intelligence and surveillance, habitat management, wildlife monitoring, etc., need to be developed. A definite annual schedule for these modules is essential for personnel assigned to the Wildlife wing. Training needs according to tiger reserve management will be identified for improvement of knowledge and skills of staff. These will include:

- Basic training in forestry and wildlife.

- Training in unarmed combat, ambush techniques and information gathering.
- Exposure to the working of other departments such as Police, Revenue, and Land records, Veterinary, Agricultural department etc.
- Training on Wildlife Conflict Management, wildlife forensics.
- Training of Field staff about wild animal rescue techniques.
- Training in various aspects of wildlife monitoring, scat analysis, camera trapping.
- Legal issues and enforcement- Staff shall not only be trained in forest and wildlife laws but shall also be made conversant with the provisions of IPC and CrPC, Evidence act and other relevant laws.
- Intelligence gathering and processing - The people living around the protected areas have information about illegal activities. However, lack of proper communication mechanism prevents flow of this information. the staff are not accustomed to gathering this information, and this issue requires rectification. Staff will be trained in information gathering techniques.
- Training on Wildlife crime detection, crime scene investigation and report writing: Staff should be trained in filing proper preliminary offence reports, procedures to be followed during inquiry and interrogative techniques and other methodologies and essential requirements for filing complaints, for production of offenders in court of law, collection, handling and forwarding of material evidence.
- Use and maintenance of firearms, GPS equipment, PDA and wireless sets etc.
- M-STRIPES based patrolling system will be improved for effective anti-poaching activity in the Reserve.

Table No.8.2: Training Schedule

Sr.No.	Training Details	Period
1	Phase I, Camera trapping, Census techniques, Disaster management	October and April
2	Law enforcement, evidence collection, Account procedure, VEDC Works, Maintenance of Land Records, Stress management, Motivation, Communication & presentation skills, First aid	June / July
3	PIP, Habitat management works (Waterhole, Meadow etc.), Wireless operative procedure	At the end of monsoon (September)
4	Swimming, basic boat Training (Driving & Maintenance, Life saving techniques)	September
5	RRT, PRT training and mock practice	Quarterly
6	Fire prevention, control & awareness	December
7	Use of fire arms	As per need

C. Creation and restructuring of executive setup-

To streamline administration and improve management, the following changes are required:

- Regular evaluation of the administrative setup is necessary to adjust or create posts as needed.
- Efforts must be made to fill vacant positions through recruitment or on a contractual basis.
- Range reorganization is proposed to enhance efficiency.
- Clear definitions of duties and responsibilities for all positions will be established, and procedures for various activities will be codified and distributed to relevant parties.
- Technical positions will be filled on a contractual basis according to requirements.
- Regular meetings with other agencies, particularly enforcement agencies, will be conducted.

D. Human Resource Development:

- Bio data of every staff member will be compiled and regularly updated for accurate records.
- Regular professional and personal counselling sessions will be conducted for field staff.
- Measures to appreciate excellent performance will be developed to motivate staff, supported by a comprehensive performance monitoring and evaluation system.
- Due to the remote and challenging terrain of the STR, a one-step pay structure will be implemented.
- Ensure timely salary for all the permanent, temporary and contractual staff.
- Institutionalized incentives and rewards system will be established, with necessary government approvals sought for the implementation of provisions of Section 60(A) of the Wildlife (Protection) Act.
- Regular supply of uniforms and field gear such as boots, cycles, torches, and raincoats will be ensured.
- Medical support facilities, including first-aid kits at protection huts, offices, and vehicles, will be regularly replenished.
- Periodic medical check-ups for staff will be organized.
- Sessions on Vipashyana, Yoga, motivation, and stress management will be arranged for field staff.
- Annual sports and cultural activities will be organized for all staff members.
- Financial literacy campaigns will be conducted for staff.
- Daily wage laborers will be covered by insurance schemes like e-Shram or similar, considering their vulnerability while performing duties in the Tiger Reserve alongside field staff.
- Entertainment facilities will be provided at every anti-poaching camp to engage staff during their leisure time.
- Encourage staff to improve their skills and pursue their hobbies.

E. Infrastructure and transportation enhancement to aid the staff:

- To ensure better functioning and performance of duties, all staff members should be equipped with proper transportation and infrastructure, indirectly contributing to staff development.
- Staff quarters, protection huts, check posts, and all other infrastructure must be maintained in good condition with a set maintenance schedule. The layout of existing buildings and infrastructure will be mapped for future development planning. Dilapidated buildings will be restored or replaced with appropriately designed structures.
- Family accommodations at suitable Tehsil/District levels where all facilities required for families of staff are available for personnel posted in ranges/rounds/beats are necessary. Repair and renovation of existing staff quarters and amenities will be prioritized.
- More patrolling camps will be established with basic facilities such as sufficient light, toilets, kitchens, and safe drinking water.
- Electricity or solar power backup will be provided to all residential complexes and protection huts where feasible.
- All transportation vehicles including jeeps, boats, and others will be maintained in good condition with an annual vehicle maintenance schedule in place to ensure smooth and swift movement for all situations. Ensure sufficient fund for maintenance and fuel.
- The wireless network will be improved through technological upgrades and user training to enhance efficiency.

F. **Performance monitoring mechanism:**

Proper performance monitoring and evaluation mechanism should be in place to assess the staff and recognize the better performing staff: Following are the few mechanisms keenly implemented.

- Confidential reports
- K.R.A. (Monthly)
- Monthly diar

G. Appreciation Mechanism:

Some of appreciation measures need to be adopt as follows:

- Sukanya Samriddhi- On birth of girl child to staff, Sukanya Samriddhi account is opened with some initial contribution from STR Conservation Foundation.
- Best performing candidate should be given a Tour to other tiger reserves along with his/her family.
- Special awards on 15 august, 26 January, Foundation Day, Wildlife week- in the fields of Protection, crime detection & investigation, VEDC works, Biodiversity documentation etc.
- Exhibition of photos (Biodiversity/Landscape) by field staff in nearby Tehsil/District places

- Reward should be given to Best Protection camp/ Beat/Round/Range in STR.
- Monthly award to candidate who successfully complete MSTrIPES patrolling targets. He/she will get opportunity to have a dinner with Special Guest/Field director along with family.
- Ensure opportunity of sharing his/her experience on big stage/newspaper/Newsletter/radio/ TV Channels.

8.6 Wildlife Health Monitoring

1. Vaccination: Regular vaccination has been done by Zilla Parishad and state government animal husbandry department. STR Kolhapur is always ready to provide vehicle and field staff to help the veterinary staff for vaccination with following vaccines
   i. Foot and mouth disease vaccine
   ii. Black quarter vaccine
   iii. Haemrregic septicemia vaccine

2. Vaccination of the street dogs of buffer zone villages by Veterinary Doctor against rabies

3. Veterinary (Wildlife) officer must be appointed permanently with mobile van, well equipped with medicines, equipment's and other accessories. Veterinary officer must visit at least once in a week to every zone to monitor the herbivores and carnivores' animals to check their health and its behavior with well-trained RRT team and walkie talkie should be provided to the team.

4. Training to be provided to RRT team and field staff: Monthly training and practice must be given to RRT team as well as field staff by veterinary, by experts on subjects like how to identify weak animals, exhausted animals, aggressive animals and abnormal behavior of wild animals and how to control them.

5. Well-equipped lab as well as operation theatre and post mortem room should be constructed and necessary medicines, vaccines and equipment's should be provided, so that treatment and operation can be conducted at STR landscape itself.

6. Transit Treatment Centre should be constructed with this place at Koynanagar as it is center point of tiger reserve.

7. Rescued animals should be GPS tagged before releasing after treatment.

Mortality Survey

Annual figures about death of the animals of schedule-I and schedule-II shall be collected from the RFOs working in buffer zone and the same shall be entered in the register of office of Field Director, Sahyadri Tiger Reserve so that year wise mortality for 5 to 10 years span shall be calculated. The protocol as prescribed by the NTCA with respect to mortality of Tiger and other animals shall be complied carefully.

CHAPTER 9

TIGER POPULATION AND HABITAT ASSESSMENT

Monitoring status of tigers, co predator, prey base and evaluating habitat quality constitutes of the most important components of the tiger conservation plan. The existing methodology of tiger estimation has been reviewed and refined methodology has been developed by NTCA. Now Tiger population estimation is being carried out as per Phase-IV monitoring protocol.

Day to day intensive (but unobtrusive) monitoring of tiger is crucial apart from an assessment of the habitat status (welfare factors, prey base) at periodic intervals, covering all the seasons. Both traditional, as well as state of the art monitoring protocols, need to be used in a mutually complementary manner.

9.1 Daily Monitoring Protocol:

The daily monitoring protocol becomes extremely important in the buffer/peripheral area owing to the co-occurrence of people and wild animals. Thus, it becomes important to incorporate the livestock movement pattern as well, in addition to wild animals as indicated below:

9.1.1 Traditional methods:

- Recording/Collecting field evidences – Presence/Droppings/Spoor/Pugmarks and others of wild animals
- Recording evidences/sightings of livestock and maintaining seasonal grazing maps
- Keeping track of wandering pastoral groups with sheep
- Monitoring areas with livestock depredation
- Monitoring water points particularly during the dry season
- Monitoring fruit/flower bearing trees favored by wild animals and also collected by people as NTFP to prevent lethal encounters (ex: sloth bear presence near mahua trees)
- Making field observations in prescribed format (species/sex/group size/marker animals/phonological qualifiers/untoward incidents/evidence of natural kill/poaching and others)

9.1.2. State of the art monitoring protocol:

- Use of M-STrIPES (Atlas Map No. 87)
- Tiger scatology for DNA in low tiger density areas not amenable to camera trap
- 24x7 electronic surveillance using intelligent infrared/thermal camera system for recording animal presence/movements at sensitive points.

The phase IV monitoring protocol of the NTCA combines both traditional as well as state-of-the-art methods for year-round monitoring in tiger reserves (tiger/prey base/habitat status). This needs to be done on a priority basis, with due capacity building of frontline staff.

9.1.3 Forecasting:

The day-to-day monitoring data (spread over seasons) needs to be plotted on the habitat map (G.I.S. layers of cover/welfare factors /infrastructure/human settlements /unique habitat features/ M-STrIPES output) in an ongoing manner to identify high-density pockets of prey species, tiger and co-predators. This exercise would highlight several species specific "obligatory points" as well as species-specific most frequented areas (season wise). Any change in the recurring spatial occupancy of prey/predator species should be taken as an alert /forecast for a thorough appraisal to eliminate the possibility of target killing.

9.2 Tiger Population Estimation Framework (Phase- I, II, III and IV):

- Snapshot assessment (once in four years) of tiger/co-predators/prey species/habitat status, during the country level tiger assessment by the NTCA (Double Sampling method: phases I, II and III)
- Yearly publication of phase-I and phase-IV monitoring results (minimum tiger numbers) as prescribed by the NTCA
- Creating reserve specific camera trap photo repository of a tiger as a shred of supporting evidence for minimum number/fixing ID of the aberrant tiger/ascertaining repeat captures vis-à-vis adjoining protected area/division

Framework (Phase I, II, III and IV):

The tiger population monitoring is normally a total count (census) of countrywide tiger population every 4 years and within tiger reserve every year. The census is based on intensive monitoring of tigers within areas identifying individual tigers by visual inspection of pugmarks, tracing/plaster cast. This methodology has come under severe criticism. Major limitations of this technique are (1) it relies on subjective (expert knowledge) identification of tigers based on their pugmarks. (2) The pugmarks of a tiger are likely to vary within a substrate, tracings/casts and the tiger's gait: (3) it is not possible to obtain pugmarks of tigers from all tiger occupied landscapes, and (4) the method attempts a total count of all tigers.

An alternative proposed by tiger biologists is to use individually identified tiger by camera traps in capture-recapture statistical framework to estimate tiger densities.

The other two potential methods that can be used in smaller sample areas for monitoring source tiger populations are the individual identification of tigers from digital images of their pugmarks and tiger DNA profiles obtained from scats and other non-invasive techniques.

Stage I: Spatial mapping and monitoring of tigers, prey and habitat:

This stage consists of mapping of forest beat taking it as a unit of sampling. The sampling is systematically distributed in all beats of tiger occupied forests. The detailed methodological approach for sampling is given in the field guide by Y. Jhala Q. Qureshi and R. Gopal, 2017. The target data are extremely

easy to collect and requires minimum technical skills. The spatial data generated is scientifically robust, amenable for statistical analysis and inference. Since several replicate surveys will be undertaken in each beat, it will enable to model tiger occupancy, detection probability of tiger signs and relative sign density at a high spatial resolution. The data will be analyzed in a GIS domain. Several spatial and attribute data like human density, livestock density, road network, topographical features, forest type and cover, meteorological data, poaching pressures and landscape characteristics will be used as covariates to model tiger occupancy and relative abundance in a landscape and individual forest patches. Time series analysis of the data at a larger spatial resolution is likely to have sufficient precision for monitoring spatial occupancy of tigers in association with changes in tiger prey, habitat quality and anthropogenic pressures.

Stage II: Spatial and attribute data

The spatial and non-spatial data that are likely to influence tiger occupancy of a landscape is used for modelling in a GIS domain. The vegetation map, terrain model, night light satellite data, drainage, transportation network, forest cover, climate data, Normalized Difference Vegetation Index, livestock abundance, human density, socio-economic parameters, etc. is used for modelling habitat condition and tiger occupancy. Beat-wise vegetation sampling is done to generate broad vegetation map. This modelling helps in determining the current spatial distribution of tigers, potential habitats, threats to crucial linkages between occupied landscapes and conservation planning.

Stage III: Estimating the population of tigers and its prey

This answers the question of how many tigers and ungulates are there.

Tiger numbers:

Tiger conservation unit is stratified into tiger conservation sign abundance classes of a high, medium, low and no tiger sign at the beat and larger special resolution. (Range 100 sq.km.)

All known techniques of tiger density estimates are used depending on the logistic possibility within each landscape: capture-recapture based on camera traps, mark-recapture based on pugmarks, and DNA profile obtained from tiger scat. These densities will then be extrapolated for the areas under various density classes within the landscape to arrive at a tiger population estimate.

Tiger prey:

Stage I of the protocol reports encounter rates on line transect sufficient for monitoring trends in ungulate population and site-specific occupancies. Pellet group counts on transects serve as an index to the presence of ungulate species and pellet relative abundance, especially in disturbed areas where actual sightings may be difficult.

Stage IV: Intensive monitoring of source populations

It is expected to monitor the source population of tigers in the reserve by the following methodology.

Photo registration of tigers:

Pictures of individual tigers obtained by camera traps or by regular cameras should be maintained in the form of a photo identity album. Records should be kept of the location, condition breeding status, injury, etc.) and associated tigers whenever a tiger is sighted. This will provide crude data on ranging patterns demography and mortality.

Tiger pugmarks and other signs:

Regular monitoring of tiger signs (pugmarks tracings, plaster casts, etc) should be undertaken in every beat at a weekly interval within a monthly compilation of data. With experience and exposure to the resident tigers and their pugmarks, the forest staff may be able to identify individual tigers from their track set characteristics. Sign surveys and individual tiger monitoring should become a regular task for every guard as practiced in STR. The monthly data should be mapped and maintained to analyze trends.

Monitoring by telemetry in select areas:

Use of modern technology of VHF, GPS and satellite telemetry to study and monitor aspects of demography, meta-population dynamics (dispersal, ranging patterns), mortality, predation ecology and behavior is expected.

In all source populations, tiger abundance and density should be estimated using camera traps, digital images of pugmarks and/or DNA profile from non-invasive methods biannually.

The Project Tiger directorate will play the overall supervisory and coordination role for all the phases and tasks under each phase of the monitoring.

9.3 Habitat Assessment Framework:

- Laying permanent transects and assessment of habitat status using the methodology prescribed in the country level tiger assessment exercise (needs to be done yearly)
- Time series monitoring of the entire habitat using remotely sensed data in the GIS for an assessment of anthropogenic grassland regression, a progression of woodland due to "arresting" of ecological succession owing to managerial interventions/anthropogenic disturbances/natural stochastic events/manipulation by gregarious wild animals

The data compilation/analysis should be done as prescribed for the double sampling exercise.

9.3.1 Sampling for Vegetation, Human Disturbance, and Ungulate Pellets (Phase-I):

To quantify the habitat parameters and determine the relative abundance of ungulates sampling will be done along the same line transect on which ungulate encounter rates were estimated. For economy of

time and effort, it would be possible to first sample the line transects during early morning hours for ungulate encounter rate and then while returning along the same line, sample for vegetation and ungulate pellets. Sampling for vegetation, ungulate dung and human disturbance will be done only once on a line transect.

i) Again, a beat will be the sampling unit, and sampling will be done along the established line transects.

ii) The beginning and endpoint coordinates of the line transect need to be recorded using a GPS unit.

iii) The same principle of laying line transects as explained in the section on ungulate encounter rates is applicable here

iv) Vegetation would need to be sampled every 400 m along the transect.

v) The vegetation would need to be quantified visually in the following categories for each plot:

9.3.1.1 In 15 m. radius circular plot:

i) Broad vegetation type and associated terrain type eg. mixed teak forest on hilly terrain, sal forest on flat land, etc.

ii) Within a distance of approximately 15 m of the observer the five most dominant trees need to be listed in the order of dominance (abundance)

iii) The observer needs to list the 5 most dominant shrub species in order of dominance (abundance) within 15m of the location. He needs to categorize shrub density (under-story vegetation) as absent, very low, low, medium, and dense. Shrubs will be assessed on five-point scale (0 to 4 i.e. absent to most abundant) for density estimation.

iv) If weeds are present, their abundance needs to be scored on 0 to 4 scales (0 being absent and 4 high abundance) and the three most common weeds seen in 15m need to be listed in order of abundance.

v) Within the same 15 m distance, the observer needs to record several signs of looping, woodcutting, and presence/absence of a human foot trail.

vi) The observer needs to visually quantify the canopy cover at the location. The observer should subjectively classify the proportion of the sky above him that is covered by canopy foliage and categorize it into <0.1, 0.1-0.2, 0.2-0.4, 0.4-0.6, 0.6-0.8, >0.8 canopy cover.

vii) A mention needs to be made in the datasheet regarding the number of permanent human settlements, human population, and livestock population present in the beat (to the best of his knowledge).

viii) A mention needs to be made based on the observers' knowledge if any non-timber forest product is collected from the beat. If yes, which NTFP and to score the magnitude of collection on a 5-point scale (0-no collection 4-high rate of the collection).

ix) All the observation writes in the prescribed format given as annexure.

9.3.1.2 In 1 m radius circular plot:

The observer needs to use a 2m long stick to define an imaginary circle around him with the stick as the diameter. Within this circular plot (2m diameter) the observer needs to a) quantify the per cent ground cover, i.e. the proportion of the ground covered by herbs, grasses, litter, and bare ground, b) List the 3 most dominant grass species, and herb species in order of dominance. All the observation writes in the prescribed format given as annexure

9.3.1.3 Sampling for Ungulate Pellets:

Ungulate abundance will also be indexed by enumerating their faecal pellets. This exercise will be done on the same line transect that has been sampled for ungulate encounter rate. To save time, this exercise could be done after the line transect has been sampled in the early morning for ungulate encounters. Details of line transects location with start and endpoints of all beats of core zone in STR is given in (Atlas Map No.120)

- At every 400 m along the transect (line of walk) the observer needs to sample an area of 2m by 20m, perpendicular to the transect for quantifying ungulate pellets. This is done by using the 2 m long stick held at the centre horizontally in his hand and by walking slowly, 20m right and left of the transect alternately at every 400 m.
- All ungulate pellets encountered need to be recognized to ungulate species and recorded in appropriate columns of the attached datasheet.
- The number of faecal pellets needs to be counted. In cases where the pellets occur in large heaps, then they should be categorized into the following categories: A (50-100), B (100-200) and C (>200).
- In areas where small livestock like sheep and goat are known to be grazed, it is possible that fecal pellets of these can be confused with wild ungulates especially those of chital. In such areas, mentions being made that goat or sheep graze the area.
- In the last row of the datasheet, the observer needs to report if ungulate/animal listed in the data sheet occurs in the sampled beat to the best of his knowledge irrespective of whether its pellets/dung were recorded in the plots or not.
- All the observation writes in the prescribed format given.

9.3.1.4 Sampling for Tiger, Leopard, and Other Carnivore Sign Encounter Rate:

To obtain data on the presence, absence and intensity of use of a beat by tigers and other carnivores, quantify the relative abundance of tiger, leopard, and carnivore signs in an area. The following procedure needs to be followed for data collection:

- A beat will be considered as a sampling unit.
- Areas within the beat that have the maximum potential for tiger occupancy will be intensively searched.

- Since tigers and leopards have a tendency of using dirt roads, trails, footpaths, river beds and nullah, these landscape features within the beat need to be searched intensively.
- One to three persons who know the terrain and habitat features of the beat should search tiger sign.
- There should be 3-5 separate searches (in different compartments within the beat and/or at different times 1-5 days apart) each search covering about 4-6 km distance in areas having the best potential for tiger presence. It is important to record the distance covered and the time spent during each search separately (in the data sheet-1) and accurately. If time is spent resting or in other activities while searching, this duration should be reported separately. If possible, the GPS coordinate of the beginning point of each search path should be recorded.
- The total minimum distance covered while searching for tiger and other carnivore sign should be 15 km per beat.
- Tiger and leopard signs should be classified into the following categories 1) Pugmark trails, 2) Scats (Old: dry with hair and bones visible; Fresh: dry but intact with a shiny surface; Very Fresh: soft, moist, and smelly, 3) Scrapes, 4) Scent marks (spray, rolling), 5) Rake marks on trunks, 6) Actual sighting, 7) Roaring (vocalization).
- A brief description of the topography and forest type is to be recorded for each sign.
- In case of pugmark trails, each trail set is considered as one sign (not each pugmark as one sign). In case a tiger (or other carnivores) continues to walk along a dirt road for a long distance (say 1 km), then this should be considered as one sign, and a comment recorded in the remarks section of the data regarding distance covered by a pugmark trail of a single tiger.
- Tiger and leopard signs if encountered outside the sampling route should also be recorded with GPS coordinates (if available) and with appropriate comments.
- Special emphasis should be given to sign of tigress and leopards with cubs, and any authentic evidence of tiger cubs (sightings of cubs, lactating tigress, tracks, etc.) obtained within the past twelve months should be mentioned in the datasheet.
- While sampling for tiger and leopard signs, a record should also be kept for signs of any other carnivore that are encountered.
- The number of livestock that is killed by predators within the past three months needs to be recorded in the questionnaire following the datasheet.
- It is important to report data sincerely. There may likely be reliable information that tiger/leopard is present in the beat being sampled, but no tiger/leopard signs are recorded during the intensive search survey. In such cases, mention should be made in the remark's column of the datasheets. However, failure in obtaining tiger sign from a beat is equally important as recording tiger/leopard signs and for appropriate analysis of this data, the actual data should be reported.

- All the observation writes in the prescribed format given.

9.3.1.5 Sampling for Ungulate Encounter Rates:

This protocol outlines a simple method for quantifying ungulate abundance in an area based on visual encounters while walking along fixed-line transects. The following procedure needs to be followed for data collection:

- A beat would be considered as the unit for sampling.
- After considering the shape, size, vegetation, and terrain type of the beat, a transect line of a minimum of 2 km and not exceeding 4 km will be marked for sampling.
- The transect line should traverse similar habitat (broad vegetation types) as far as possible. If the beat is composed of 2 or 3 distinct vegetation types eg. Mixed Teak Forest comprising 40% of the beat and the remaining 60% comprised of Miscellaneous Forest with bamboo, then 2 separate line transects should be marked for sampling.
- The line transect within a beat may be broken up into 2 or more segments so that each segment has a minimum length of 2 km and traverses' similar habitat.
- Care should be taken that a line transect is not located near a busy road nor should it run parallel to a river or other features of the landscape which may bias sighting of ungulates.
- For each transect the point of beginning and endpoint coordinates (Latitude and Longitude) should be recorded by a global positioning system.
- The broad forest type and terrain type that the transect traverses needs to be recorded.
- Each transect should be walked by 1-2 persons during the early morning hours (6:30 AM to 8:30 AM). Preferably one of the persons walking should be a good field person who can spot wildlife.
- A record should be kept of all mammals and peafowl seen during the walk in the prescribed format (see datasheet). For each animal sighting the following needs to be recorded: 1) serial no of the sighting, 2) time of the sighting, 3) species (eg. sambar, chital, wild pig, peafowl, langur, etc.), 4) group size – number of animals of the same species in the group sighted, it is important to try to count the number of animals in the group as accurately as possible. Animals are considered to belong to two different groups if the closest animals from the two groups are separated by a distance of over 30 m.
- If possible, the number of young (fawns/calves less than 1 year of age) seen in the group should also be recorded.
- Broad habitat category (vegetation and terrain type) needs to be recorded for each sighting eg. S. No.5. 12 chitals (10 adults and 2 young) were seen at 6:40 am, in a mixed teak forest, gently undulating terrain.

- Each line transects needs to be walked at least on three different mornings for estimating ungulate encounter rates.
- All the observation writes in the prescribed format given.

9.4 Spatial Database Development:

The process given in 9.1, 9.2 and 9.3 will form the basis of development of data. The help of GPS/ GIS will be taken to develop the database.

- Creation of time series habitat monitoring database in the G.I.S. using remote sensing
- Creation of seasonal Spatio-temporal maps of major wild animal species in the G.I.S.
- Creation of tiger home range atlas based on radio telemetry data (core area and adjoining forest/protected areas)
- Creation of tiger camera trap photo repository

9.5 Analysis and Reporting Framework:

Monthly data received will be analyzed for distribution of animals, habitat, sighting etc. by RFO & ACF and then through Deputy Director and Field Director, the data will be submitted to APCCF, PCCF(Wildlife) and NTCA.

The analysis on phase IV monitoring/tiger/prey/habitat status assessment needs to be done as per the peer-reviewed methodology of NTCA/WII while reporting the outcome on an annual basis to the NTCA.

9.6 Monthly Return for the Death of Wild Animals:

A monthly report about the death of wild animals should be prepared in following pro-forma by Range Forest Officers of each range and should be submitted to Field Director through Deputy Director. Field Director will further submit it to NTCA and Chief Wildlife Warden.

Table.9.1: Performa for Death Of Wild Animal

Sr. No.	Division	Range	Place of offence RF/PF/Other Govt./Pvt. area (Specify)	Name of agency (Forest/RDD/ Police/CBI etc.)	Name of Species their No. with sex (M/F)	Scientifi c Name	Schedule to which it belongs
1	2	3	4	5	6	7	8
--	--	--	--	--	--	--	--

Cause of Death			WL articles seized (skin/bones/antlers & others) specify	Other Items Seized (tools, weapons, vehicle)	P.O. R. No.	Date	Act. & sections under which offence was registered	Present status of the case. Give details	Remarks
Natural	Accidental Specify	Poaching Trapping/ Poisoning/ Electrocution/Other methods- specify							
9	10	11	12	13	14	15	16	17	18
--	--	--	--	--	--	--	--	--	--

[Ref: - The Director (Project Tiger), Ministry of Environment and Forests, letter No. PS/ IGF (PT)-Misc, Dt. 11/3/200

Chapter 10

PROTECTION AND INTELLIGENCE GATHERING

The Sahyadri Tiger Reserve stands as a rich repository of invaluable genetic diversity and natural wealth. Its geographical proximity to densely populated districts such as Satara, Sangli, Kolhapur, and Ratnagiri, coupled with over 82 villages along its core zone perimeter, exposes it to significant vulnerabilities. In adherence to Project Tiger, safeguarding this reserve takes precedence, with a dedicated focus on a comprehensive "tiger agenda" within its core habitats. This necessitates a robust and tailored security infrastructure, reinforced by cutting-edge surveillance systems and manned by highly skilled frontline personnel.

Consequently, this chapter assumes the character of a "security plan" within Volume-I, Part-4, encompassing critical elements like fundamental protection infrastructure, patrol strategies, deployment of rapid response units, intelligence gathering, and seamless coordination across district and state levels via the tiger cell.

10.1 Tiger Cell:

At the state level, a Tiger Cell has been instituted under the Director General of Police, Maharashtra State, with the Principal Chief Conservator of Forests (Wildlife), Maharashtra State serving as Co-Chairman and the Chief Conservator of Forests (Wildlife), East Nagpur (formerly upgraded to Additional Principal Chief Conservator of Forests), acting as the Member Secretary. This initiative was formalized through Government Resolution No. WLP-10-2000/C.N.10/F-1, Mumbai, dated September 28th, 2006. Regionally, Tiger Cells operate with a three-tiered structure, chaired by a Special Inspector General of Police, and facilitated by the concerned Chief Conservator of Forests (Wildlife) as the Member Secretary, along with the relevant Chief Conservator of Forests (Territorial) as a member.

Due to the vast area covered by the Sahyadri Tiger Reserve (STR) spanning four districts, each district hosts its own Tiger Cell. Led by the Superintendent of Police and co-chaired by the Deputy Conservator of Forests (Territorial), with the Divisional Forest Officer (Vigilance) serving as the Member Secretary, these cells ensure coordination and information exchange at the district level. For instance, the Tiger Cells for Satara District comprise members from DD STR (Koyna) and DD STR (Chandoli), while the Tiger Cell for Sangli, Kolhapur, and Ratnagiri Districts includes the Deputy Director from Chandoli.

These Tiger Cells facilitate regular meetings to discuss protection strategies, seizures, patrolling tactics, and other pertinent issues. It fosters seamless coordination between law enforcement agencies and forest/wildlife authorities, thereby enhancing the protection of forests and wildlife. Regular monthly meetings are proposed for Tiger Cells in Satara and Sangli, Kolhapur, and Ratnagiri Districts to ensure ongoing

coordination and collaboration between the Police and Forest/Wildlife wings.

Threat Assessment:

Table NO. 10.1 - Threat Assessment

Time Line	Threats	Threat Category
Immediate threat	Forest Fire	Medium
	Vegetation invasion on meadows	Medium
	Biotic pressure of core villages	High
	Illegal grazing in the buffer and core area resulting habitat degradation, pressure on natural resource, risk of disease spread.	High
	Poaching & revenge killing	Low
Near future threat next 2-3 years	Depredation of habitat	Low
	Proposed roads, proposed mine projects, private land use change in TR & Corridor	High
	Increasing trend in Human wildlife conflict	High
	Religious congregation	Low
	Invasive weed	High
Future threat next 4-5 years	Disease transmission	Low
	Human resource for TR Management	High
	Increase in uncontrolled tourism	Low
	Forest fire & degradation	High
	Soil erosion & land slides	High

*Assessment of threats and the present threats are elaborated in Security Plan Vol

10.2 The Strike Force/Special Tiger Protection Force:

The establishment of a Special Tiger Protection Force (STPF) emerges as a crucial strategy for safeguarding the Sahyadri Tiger Reserve (STR). Currently, the STR lacks a dedicated STPF unit, prompting the submission of a proposal to the government for its approval and sanction.

Once established, the STPF will play a pivotal role in protecting the tiger reserve, particularly focusing on the core area boundary and the buffer zone. The force will function primarily as a Strike Force, conducting regular patrols to deter illegal activities such as poaching. To ensure optimal readiness, Strike Teams will engage in frequent mock drills to assess their preparedness and response times. Moreover, the

presence of the STPF will serve as a powerful deterrent, sending a clear message to potential poachers and encroachers. Special attention will be given to patrolling areas backwater, wildlife Breeding zones, and other sensitive zones, including markets within the buffer area.

Key points outlining for the Special Tiger Protection Force (STPF) to enhance protection of the Sahyadri Tiger Reserve:

1. **Establishment and Sanction:** Initiate the process of establishing an STPF unit by submitting a proposal to the government for approval and get it sanctioned.
2. **Strategic Deployment:** Deploy STPF units strategically, focusing on patrolling the core area boundary and buffer zones where illegal activities, such as poaching, grazing, Forest fire, and Encroachments are prevalent.
3. **Strike Force Functionality:** Utilize the STPF primarily as a Strike Force, tasked with conducting regular patrols, surveillance, and enforcement actions to deter and apprehend poachers and encroachers.
4. **Mock Drills:** Conduct regular mock drills for STPF Strike Teams to assess their level of preparedness, tactical capabilities, and response times in various scenarios.
5. **Psychological Deterrence:** Leverage the presence of the STPF as a psychological deterrent against poaching and other illegal activities, sending a strong message to potential offenders.
6. **Focus on Sensitive Areas:** Prioritize patrols around water sources, and other sensitive areas within the buffer zone, where wildlife is particularly vulnerable to threats.
7. **Protocol Development:** Develop a detailed operational protocol at the Sahyadri Tiger Reserve level for the effective utilization of the STPF, outlining roles, responsibilities, and standard operating procedures.
8. **Collaboration with Local Authorities:** Foster collaboration between the STPF and local law enforcement agencies to coordinate efforts, share intelligence, and strengthen enforcement actions against wildlife crime.

9. **Training and Capacity Building:** Provide specialized training to STPF personnel in wildlife conservation, law enforcement techniques, use of firearms, and conflict resolution to enhance their effectiveness in protecting the STR.
10. **Integration with Rapid Rescue Teams:** Coordinate with Rapid Rescue Teams stationed at strategic locations within the reserve to ensure swift response to wildlife emergencies, including rescue operations and conflict mitigation.
11. **Regular Monitoring and Evaluation:** Implement mechanisms for regular monitoring and evaluation of STPF operations, performance metrics, and effectiveness in achieving conservation goals.
12. **Community Engagement:** Foster positive relationships with local communities by involving them in conservation efforts, raising awareness about the importance of wildlife protection, and encouraging reporting of suspicious activities to the STPF.

10.3 Strategy for Protection and Communication:

Priority in the management of a Tiger Reserve must be given to effective 'Anti-Poaching' measures and a well-structured 'Patrolling Strategy'. The necessity for a dependable, 24/7 wireless communication system, strategically positioned forest patrolling camps, and a vigilant, motivated frontline staff is self-evident.

10.3.1 The details of the existing strategy for protection in STR are as below:

- Establishment and maintenance 36 permanent and 01 temporary anti-poaching/protection camps at sensitive locations in the core area. An average area of each APC is 32.37 sq km. A Forest Guard with 2 to 3 laborers camps at these Protection Huts 24x7 and patrols the nearby forest areas at a different time.
- Anti-poaching camps, which consist of frontline staff deployed in patrolling camps, are equipped with wireless communication facilities. Over the past two years, efforts have been made to enhance the existing wireless system by introducing mobile handsets in the field and erecting new base stations and towers. These additions aim to bolster the effectiveness of the wireless system. Once these towers and repeater stations are outfitted with intermediate wireless stations, the wireless system will operate at its maximum capacity. Currently, STR has a total of 45 wireless base stations and plans to establish an additional 20 locations.
- Every October and November, all roads spanning over 270 km are meticulously repaired, ensuring a reliable communication network for staff members. Strengthening these roads could significantly enhance their utility for both patrolling and tourism purposes.
- The tiger reserve is equipped with a fleet consisting of 20 four-wheel vehicles, including 1 tractor,

1excavator, 3 minibuses, 1 truck, and 1 tempo, along with 6 bikes and 26 boats/Hodi's. Each Range Forest Officer (RFO) and Assistant Conservator of Forest (ACF) has dedicated vehicles for protection purposes. These vehicles are actively utilized for day and night patrolling throughout the tiger reserve.

- As an experimental initiative, 'Live Fencing with Deep Trench' is being considered for implementation in select areas along the village boundaries where agricultural fields and settlements directly adjoin the core or buffer forest areas. This measure aims to mitigate the conflict between humans and animals while minimizing the direct impact of human activities on the forest ecosystem. The strategy is particularly beneficial in restricting the movement of wild animals beyond the core area, and its implementation is recommended wherever feasible.
- Currently, there are over 9 check posts stationed along public roads that traverse the tiger reserve area, as well as 10 unbanned barriers installed on old village and cart roads leading into the reserve. Due to the high edge-to-area ratio of the tiger reserve, there is a pressing need for an extensive barrier system to close off all roads. As a solution, we propose the installation of an additional 60 unmanned barriers, each to be permanently secured with a lock.

- A daily patrolling schedule is meticulously designed, considering the area's vulnerability from a protection perspective. Each camp is assigned a duty chart monthly
- In every patrolling camp or chowki, monitoring and daily observation registers are maintained in the local language. Field personnel utilize these registers to document their daily observations during foot patrols. The prescribed formats for recording such observations, including offenses, evidence of animals, and observations of Potential Informers of Poaching (PIPs), are Form-5 and Form-6, provided by the National Tiger Conservation Authority (NTCA).
- The Sahyadri Tiger Reserve maintains a system of surprise checks at chowkies and patrolling camps conducted by senior officers, including the Field Director, Deputy Director, and Assistant Conservator of Forests (ACFs).
- Annexure 10.24 of the security plan involves maintaining a record of local village-level market days in peripheral areas. Additionally, staff members are deployed in civilian attire to monitor any potentially illicit incidents or transactions concerning wildlife
- Regular monitoring of vehicles passing through the core zone is ensured through the operation of 9 manned barriers or check nakas. Additionally, senior officers conduct surprise checks at these points monthly to enhance oversight and enforcement measures.
- This office oversees the Core or Critical Tiger Habitat (CTH) and Buffer areas, where incidents such as livestock depredation, loss of human life, or crop damage by wild animals are reported. Special cases are promptly addressed, and compensation is provided in accordance with the Citizen's Charter.

- We have planned to create a 'Wildlife Crime Dossier' to facilitate the exchange of information regarding wildlife crime and offenders among the various forest departments. This initiative aims to foster collaboration and enable joint action and preventive measures.
- Special site-specific protection measures are planned and implemented annually, particularly during the monsoon season, under initiatives like 'Operation Monsoon'. These measures are tailored to the unique terrain and accessibility of different areas within the reserve.
- Special teams of field staff and Flying Squads are consistently monitoring the surrounding areas of the Tiger Reserve. Their focus is on identifying the presence of gangs and nomadic pastoral groups, as well as maintaining an inventory of their temporary settlements.
- In 59 out of the 82 buffer villages, Village Eco Development Committees (EDCs) have been established to implement social fencing measures around the tiger reserve.
- At the range level, dossiers of habitual/ incorrigible offenders are maintained, to help in tracing new crimes to old offenders.
- All the crime data are mapped on a 1:50,000 scale indicating the offence type wise sensitive area.
- Patrolling camp and chowki staff are directed to routinely gather field evidence, such as pugmarks and other indirect signs, to aid in identifying individual carnivores, like tigers. To ensure continuous monitoring, camera traps have been installed in each beat throughout the year, with data collected twice weekly. Records detailing the movement of each individual tiger, along with its corresponding movement map, are maintained monthly.
- At least five Pressure imprecation pads (PIPs) are designated per beat following the rainy season, with observations recorded during patrolling and documented in the prescribed format provided by the NTCA.
- A Protection and Response Team (PRT), comprising village youth, is established in villages to assist staff in apprehending individuals engaged in wildlife crime and to provide support during incidents of human-wildlife conflict.
- Regular training sessions on wildlife crime investigation and intelligence gathering are conducted for

field staff.

- The Sahyadri Tiger Reserve (STR) has established robust coordination with various line agencies including the Police, Zilla Parishad, Maharashtra State Electricity Distribution Company Limited (MSEDCL), and the Irrigation Department.

10.3.2 M-STrIPES:

The system comprises two components: a) field-based protocols for patrolling, law enforcement, recording wildlife crimes, and ecological monitoring, and b) a customized software for storage, retrieval, analysis, and reporting. Presently, law enforcement and ecological monitoring are in place, yet the generatedinformation is ad hoc and seldom available in a format conducive to informed decision-making within an adaptive management framework. To address this gap, "M-STrIPES" has been introduced.

This system conducts statistical computations of various parameters such as occupancy, precision, sample size, and evaluates trends over appropriate temporal and spatial scales for tiger, other carnivore, and prey populations, as well as human impacts, illegal activities, and law enforcement investments. M-STrIPES generates reports and maps synthesizing information on illegal activities, wildlife crime, protection efforts, and ecological status at desired temporal and spatial scales to guide management decisions. If implemented as intended, the system can significantly reduce managers' response time to detrimental events like poaching or habitat degradation, serving as a comprehensive tool to monitor the pulse of a tiger reserve.

The Sahyadri Tiger Reserve initiated M-STrIPES in February 2017 with technical assistance from the NGO Wildlife Conservation Trust (WCT) in Mumbai. Initially, it was conducted manually using GPS devices and handwritten pro-formas. Data from each range were collected weekly, compiled, and analyzed at the Deputy Director's office, with final reports and remarks sent to range offices for necessary adjustments in staff patrolling patterns. Currently, the compatibility of mobile handsets/PDAs is being tested for a transition to online operations.

Progress of MSTrIPES in STR from last two years

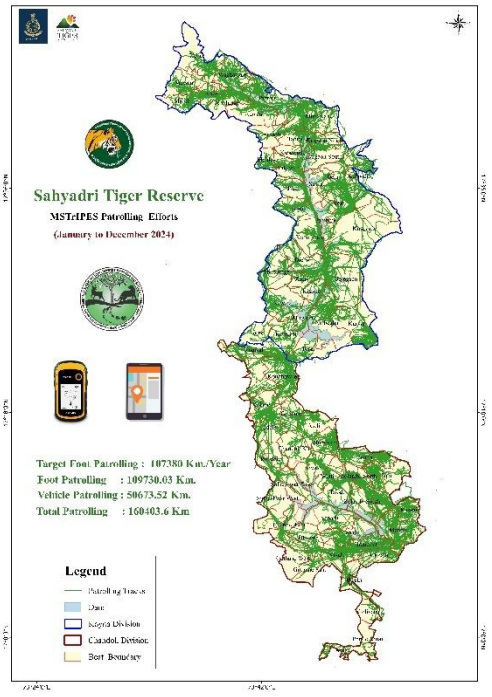


Table.10.2: Statement shows target and achievement of foot patrolling and time spent during patrolling

Sahyadri Tiger Reserve MSTrIPES Report - 2023						
Sr.No.	**Range**	**Total Protocols**	**Protocol Achieved**	**Protocol Not Achieved**	**% Achieved**	**% Not Achieved**
1	Koyna	156	107	49	68.59	31.41
2	Bamnoli	156	86	70	52.13	44.87
3	Helwak	120	73	47	60.83	39.17
4	Chandoli	180	107	73	59.44	40.56
5	Dhebewadi	60	47	13	78.33	21.67
Total		**672**	**420**	**252**	**62.5**	**37.5**

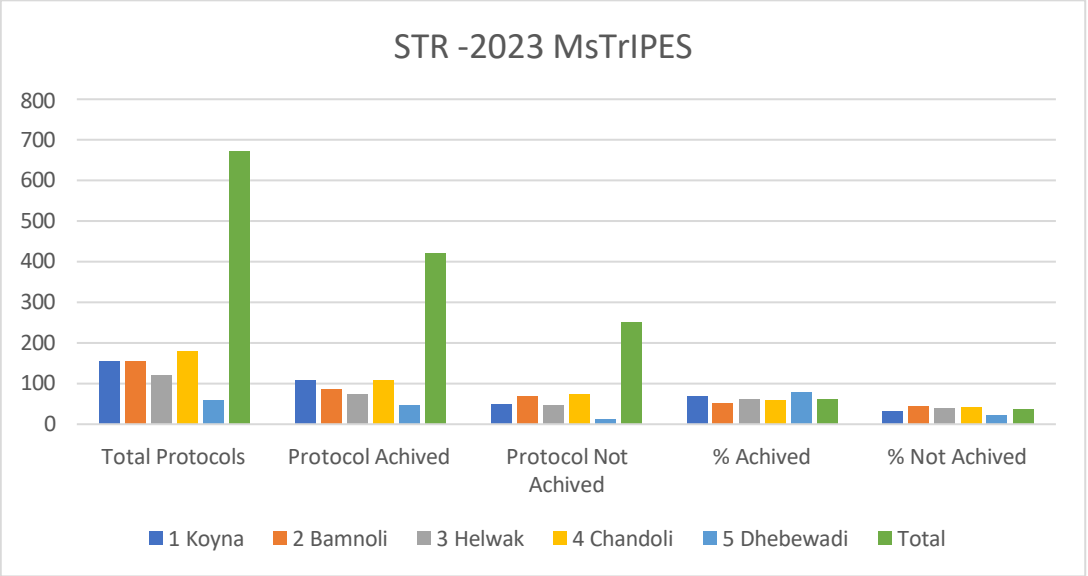


Fig.10.1 Range Wise Monthly MSTrPES Patrolling.

10.3.3 Proposed strategy for enhanced field protection

The Sahyadri Tiger Reserve faces vulnerability to poaching primarily due to its habitat, proximity to human settlements, and diverse land uses, making it susceptible to electrocution and targeted revenge killings. Hence, the traditional field protection methods necessitate periodic review for reinforcement and adjustments. This can be broadly categorized into three aspects:

- Intelligence gathering
- Efficient communication
- Enforcement actions guided by gathered intelligence

Table.10.3: Strategy For Enhanced field Protection

Intelligence gathering	Effective communication	Enforcement, based on intelligence
-Tiger/Leopard/Wild animal presence -Gathering information from the local workforce -Cattle depredation -Local market survey -The ID of carnivore causing depredation (camera trap)	-Use of wireless and its housekeeping (solar charges in places without electric supply) with around the clock control station linking core/buffer/ adjoining forest divisions -Use of electronic surveillance along the sensitive periphery (between core and buffer) -Use of camera trap/mobile phone interface in sensitive areas (only for frontline staff)	-Information scrutiny on a day-to-day basis and sharing with patrolling teams -Day to day patrolling chart based on the information and duty allocation -Supervisory checks for

-Wildlife mortality/poaching -Caracas (wildlife/cattle) -Fire (especially during antler shedding period) -Unauthorized vehicular entries leading to core habitat -Pesticide sale and use -Random/Sudden checking at railheads/flag stations/bus stops/roadway -Reconnaissance of water points	-Ensuring vehicular mobility for transporting patrolling parties -Creating temporary patrolling camps equipped with wireless	patrolling intensity -Feedback and rapid action -Ongoing capacity building of frontline staff and fitness test -Equipping patrolling parties with arms, ammunition/ accessory equipment -Evolving site-specific patrolling protocols (summer/ monsoon/ winter) -Deploying group patrols (if necessary)

All the categories necessitate a state-of-the-art approach incorporating site-specific, modern technology while ensuring frontline personnel are equipped to utilize them effectively. The suggested actions corresponding to the indicated categories, along with a menu of potential (though not exhaustive) actions for intelligence/information gathering, are illustrated diagrammatically below.

Additionally, the tiger reserve should conduct an annual "security audit" to assess the factual status and preparedness of the management regarding protection protocols, as outlined in the Security Sub-Plan of STR, detailed in Volume-I, Part-4.

10.4 Fire Protection:

The Mix deciduous habitat of Sahyadri Tiger Reserve is particularly susceptible to forest fires, which are predominantly anthropogenic in nature. Occurring from mid-February to mid-June, these fires are largely attributed to activities such as Non-Timber Forest Product (NTFP) collection, grazing, and occasional retaliation against forest staff actions. Given these risks, it is imperative to establish a robust fire management strategy comprising both preventive and control measures.

To effectively address this challenge, a comprehensive Forest Fire Protection/Management Plan needs to be developed each December, ahead of the fire season. This plan should delineate specific duties and responsibilities, allocate necessary resources, and outline preventive and control measures. Adequate funding must be provisioned to ensure the seamless implementation of the plan, enabling timely and effective management of forest fires within the reserve.

10.4.1 Fire Management Strategy in STR:

i) Preventive measures:

Fireline Burning: To prevent the spread of forest fires from outside to inside the Tiger Reserve and mitigate internal spread, clearances and controlled burns should be conducted along the outer boundaries, road edges, and compartment boundaries. A buffer zone of 12 meters, 6 meters, and 3 meters should be maintained respectively before the onset of the fire season, starting from February 15th.

Table No.10.4: Statement showing total length of different type of fire lines in STR

Fireline (km.)	Koyna WLS	Koyna	Patan	Bamnoli	Kandat	Chandoli NP	Chandoli	Amba	Dhebewadi	Helwak	Total (STR)
A class	240.05	85	131.8	15	16	154.55	19.73	27.5	55.32	52	**394.6**
B class	69.09	40	19.3	14	15	291.98	-	16	173.98	102	**361.07**
Total	309.14	125	131.8	29	31	446.53	19.73	43.5	229.3	154	**755.67**

b. Establishment of Fire Watchtowers and Reserve Firefighting Squad:

Erecting fire watchtowers strategically atop elevated points to swiftly detect and report fires. These watchtowers should be manned 24/7 by fire watchers who can immediately alert the control room in case of any fire incidents. Additionally, deploying a specialized fire-fighting squad with minimal response time is crucial. This squad should be stationed either at range headquarters or other strategic locations, adequately trained, and equipped to combat fires effectively.

- Ensure the operational readiness of wireless communication systems throughout the fire season to facilitate prompt response and coordination.

-Utilize fire blowers, which have proven effective in controlling fires within the reserve. These blowers not only aid in extinguishing fires but also assist in clearing fire lines by removing leaf litter post-burning.

Table No.10.5: Details of existing and proposed Fire Watch Towers and Fire Protection Squad in STR is shown in the following table:

Sr.no	Beat	Range	Type	Place Name	Status	Condition	Latitude			Longitude		
							D	M	S	D	M	S
1	Khundlapur	Chandoli	Iron	Janayivaadi	Existing	Good	17	8	31.3	73	52	22.4
2	Nandoli	Chandoli	Iron	Nandoli	Existing	Good	17	10	46.6	73	50	37.9
3	Mandur(Buffer)	Chandoli	Iron	Mandur(Buffer)	Existing	Good	17	8	43	73	53	58.5
4	Takale	Chandoli	Iron	Takale	Existing	Good	17	21	7.2	73	81	52.2
5	Tambve	Chandoli	Iron	Tambve	Existing	Good	17	7	18.6	73	49	55.8
6	Gothne	Chandoli	Iron	Gothne	Existing	Good	17	7	7.4	73	44	27.34
7	Sonarli	Chandoli	Iron	Sonarli	Existing	Good	17	9	18.24	73	47	10.51
8	Chandoli West	Chandoli	Iron	Chandoli West	Existing	Good	17	9	51.3	73	42	50.3
9	Chandoli Khurda	Helwak	Iron	Chandoli Khurda	Existing	Good	17	15	27	73	44	16.3
10	Amboli	Helwak	Iron	Amaboli	Existing	Good	17	12	27.5	73	45	54
11	Atoli	Dhebewadi	Iron	Atoli	Existing	Good	17°	17"	20.4'	73°	45"	22.7'
12	Nivale	Amba	Fabricate	Nivale	Existing	Good	17	11	84.5	73	81	28.76
13	Navaja	Koyna	RCC	Navaja	Existing	Good	17	27	8	73	42	49
14	Pali	Koyna	Iron	Pali	Existing	Good	17	36	16	73	43	56
15	Shirshinge	Koyna	Iron	Shirshinge	Existing	Good	17	29	15.87	73	44	3.85
16	Jungati	Koyna	Iron	Junkathi	Existing	Good	17	34	26.22	73	44	36.96
17	Maldev	Bamnoli	Iron	Maldev	Existing	Good						
18	Kusavade	Patan	Iron	Kusavade	Existing	Good	17	37	36.92	73	42	57.67
19	Ambeghar	Patan	Iron	Ambeghar	Existing	Good						

c. Publicity and Awareness:

During the fire seasons, it is imperative to conduct regular meetings in neighboring villages and maintain continuous communication with local communities to mitigate intentional fires. Eco-Development Committees (EDCs) and Joint Forest Management (JFM) Committees hold significant responsibility in forest protection and can actively contribute during the fire season. Prior to the onset of fire season, creating awareness and sensitizing residents is crucial. This can be achieved through village-level meetings, distribution of pamphlets, and posting informative posters in local vernacular languages to effectively engage and educate the community.

d. Analysis of Old data for planning:

Utilize remotely sensed time-series data from the FSI Fire Alert Service to create a Fire Sensitivity Map within a Geographic Information System (GIS). Incorporate this map into the design of an annual fire management strategy, specifically tailored for each year's fire season.

ii) Fire Control Measure:

Upon detection of a fire by the fire watch tower staff or through the FSI fire alert system, immediate communication is initiated with the in-charge forester, Range Forest Officer (RFO), and Fire Protection/Extinguisher Squads, as well as personnel stationed at all Anti-Poaching Camps (APCs) in the vicinity, regardless of range boundaries. This communication is facilitated through wireless or mobile phones.

The reserve's Fire Fighting/Extinguisher squad is promptly dispatched to the fire site equipped with leaf blowers and all necessary firefighting equipment to extinguish the fire and minimize its spread. The fire unit maintains readiness to mobilize to the fire site at any time of the day. The RFO ensures that a First-aid kit and an adequate supply of drinking water are readily available at the fire site to address any medical emergencies that may arise during firefighting operations.

The following additional measures are proposed for controlling forest fire:

- **Strategic Location Identification for Fire Watch Towers:** Utilize GIS to strategically position Fire Watch Towers for maximum coverage with minimal towers. Deploy dedicated and well-trained staff equipped with essential gear like GPS, compass, maps, torches, wireless communication devices, and necessary supplies.
- **Temporary Watch Towers:** Erect sturdy temporary watch towers capable of withstanding adverse weather conditions, fortified with locally available materials to ensure durability.

- **Communication System Maintenance and Upgrade:** Regularly maintain and upgrade communication systems including roads, wireless networks, vehicles, and mobile phones to facilitate efficient coordination and response during fire emergencies.
- **Training in Fire Ecology and Firefighting:** Provide comprehensive training in fire ecology and firefighting techniques, emphasizing the use of fire blowers, first-aid, heat season precautions, and fire containment strategies. Utilize experienced forest officers, firefighting schools, or department resources for training.
- **Past Fire Data Review and Action Planning:** Analyze past fire data annually to develop action plans for sensitive areas, ensuring proactive measures are in place to mitigate fire risks.
- **Fire Alert Registration:** Encourage registration for fire alerts on platforms such as the FSI website and NASA website prior to the fire season, enhancing early warning capabilities.
- **Active Fire Control Rooms:** Maintain 24x7 active fire control rooms at range offices, Divisional Forest Officer (DD) offices, and Forest Department (FD) offices to facilitate real-time information exchange and coordination during fire incidents.
- **Community Sensitization:** Conduct regular meetings and sensitization programs for villagers on forest fire prevention and management strategies to foster community involvement and awareness.
- **Public Road Monitoring:** Monitor public roads traversing the core zone by gathering information from passing individuals at checkpoints to ensure early detection of potential fire threats.
- **Research Focus:** Prioritize research on the impact of forest fires as an integral part of forest management practices to inform effective fire management strategies.
- **Sign board Installation:** Install signboards in highways and sensitive areas to raise awareness among the public and tourists about fire prevention measures and regulations.

iii) Post Fire Management and Documentation:

1. **Verification of Extinguished Fire**: Following fire suppression efforts, the same team should conduct thorough checks along the perimeter of the burnt area to ensure complete extinguishment.
2. **Measurement of Burnt Area:** Utilize GPS technology to delineate the burnt area and complete necessary formalities for documenting the offense.
3. **Assessment of Damage:** Estimate the approximate loss incurred due to the fire incident.
4. **Prompt Reporting:** Immediately relay detailed reports, including essential information, to the control rooms of the Divisional Forest Officer (DD) and Forest Department (FD) office, as well as share the report on the official WhatsApp Group for swift dissemination of information.

5. **Timely Reporting:** Submit daily, weekly, fortnightly, and monthly reports in the prescribed format without any delay, ensuring comprehensive documentation of fire incidents and their aftermath.

10.4.2 Impact of Fire on Habitat and Wildlife:

The Mix deciduous forests and grasslands within the Sahyadri Tiger Reserve (STR) face significant risk of fire incidents. This fire-prone season typically spans from mid-February to mid-June, following the conclusion of the winter season. Unlike some regions, natural fires are uncommon here, with the majority being caused by human activities, whether accidentally or deliberately. Ground fires have profound implications for both wildlife and their habitats. They disrupt the natural succession of plant communities, altering the abundance and distribution of wildlife, and causing damage to seedlings, saplings, and shrubs. This results in the creation of openings and impedes regeneration processes.

In areas highly susceptible to fires, such as the deciduous forests of the sanctuary, the diversity of plant species is notably reduced. Furthermore, unpalatable weeds tend to proliferate in areas that have been repeatedly burnt by fires. The dynamics of grasses and their associated species have also been altered due to the frequent occurrence of fires. Despite these impacts, there has been a lack of comprehensive investigation into the post-fire effects on deciduous forests within the sanctuary as part of management practices. Therefore, there is a pressing need for studies to assess the impact of fires on both animal and plant ecology, to inform effective conservation planning efforts.

10.5 Intelligence Gathering and Coordination:

Enhanced coordination with the police department at range levels is imperative. Staff members should undergo training in intelligence gathering concerning wildlife crimes. Villagers typically cooperate and inform local staff about any suspicious movements in and around the reserve. The Government of Maharashtra has recently allocated the Secret Service Fund for the Forest Department, as per Finance Department Notification No. MAAKHA-1011/CR.152/2011/Viniyam dated 22.01.2013, which must be effectively utilized, as outlined in Annexure 10.15 and 10.16 of the Security Plan.

Furthermore, leveraging the support of various NGOs active in this sector is essential; their expertise can be maximized. Notably, the Wildlife Protection Society of India has introduced an award scheme for individuals who provide information about wildlife offenses.

CHAPTER 11

ECO-TOURISM AND INTERPRETATION

Eco-Tourism in the context of Tiger Reserve is ecologically sustainable nature-tourism, which is emerging as an important component of the tourism industry. It is distinct from mass tourism, having sustainable, equitable, and community based effort for improving the living standards of local host community living on the fringes of the Tiger Reserve. Eco-Tourisms are proposed to be fostered with financial support to the host community through soft loans from Eco-development committees, following site-specific Eco-Tourism plan and carrying capacity of Tiger Reserve.

11.1. Objectives Of Eco-Tourism Plan :

The primary objectives of the ecotourism plan for Sahyadri TR are threefold:

1. **Conservation**: To ensure the long-term preservation of the tiger population and its habitat, while safeguarding other flora and fauna within the reserve.
2. **Community Engagement**: To involve local communities in ecotourism activities, providing them with economic benefits and fostering a sense of ownership and responsibility towards the reserve.
3. **Sustainable Tourism**: To develop and manage tourism activities in a way that minimises environmental impact and promotes environmental education and awareness among visitors.

Following are the secondary objectives:

1) Highlight the heritage values of STR's wilderness.
2) Build environment and cultural awareness, nature education and respect.
3) Provide livelihood opportunities to local communities and benefit sharing.
4) Wilderness conservation in ecologically sensitive landscapes.
5) Capacity building of local communities in planning, providing and managing ecotourism facilities.

11.2. Eco-Tourism In Sahyadri Tiger Reserve

Sahyadri Tiger Reserve

Sahyadri Tiger Reserve is a biodiversity hotspot, home to a myriad of species beyond the Tiger, including numerous endemic and endangered species of plants, birds, and mammals. The reserve plays a crucial role in maintaining ecological balance and serves as a vital corridor for wildlife movement. Its conservation is not only imperative for the survival of the tiger but also for the preservation of global biodiversity.

Challenges and Opportunities, Vision and Mission:

Challenges:

- Human-Wildlife Conflict: Ensuring the safety of both tigers and local communities.

- Habitat Degradation: Mitigating the impact of deforestation, poaching, and illegal activities.
- Visitor Impact: Managing the ecological footprint of tourism to prevent habitat disruption and pollution.

Opportunities:

- Economic Development: Providing sustainable livelihoods through employment and entrepreneurship in ecotourism.
- Education and Awareness: Promoting conservation education among visitors and locals.
- Research and Monitoring: Facilitating scientific research to monitor wildlife health and habitat conditions.

Vision: To establish Sahyadri Tiger Reserve as a model of eco-tourism where conservation and community prosperity go hand in hand, creating a harmonious balance between human activity and natural preservation.

Mission: To develop and implement a comprehensive eco-tourism plan that leverages the natural and cultural assets of Sahyadri Tiger Reserve, ensuring the protection of its biodiversity while providing sustainable economic opportunities for local communities and enriching the visitor experience.

Strategic Approach

The ecotourism plan will employ a multifaceted approach, focusing on:

- **Zoning**: Ecotourism will be divided in to different zones so as to facilitate the tourists effectively
- **Eco-friendly Infrastructure**: Developing facilities and services that adhere to sustainable practices, including waste management, renewable energy use, and environmentally friendly construction materials.
- **Community Partnerships**: Collaborating with local communities to create tourism products that reflect and respect their cultural heritage, providing training and capacity-building programs.
- **Visitor Management**: Implementing guidelines and regulations to control visitor numbers, behavior, and access to sensitive areas to minimise ecological disturbances.
- **Monitoring and Evaluation**: Establishing robust systems to monitor the environmental and socio-economic impacts of tourism activities, ensuring adaptive management practices.

Sahyadri Tiger Reserve was formed on 5th January 2010 as the fourth Tiger Reserve in the state of Maharashtra spreading over two protected areas those of the Koyna Wildlife Sanctuary and Chandoli National Park. STR is located in Sahyadri ranges of the Western Ghats. these areas constitute rich evergreen, semi evergreen and moist deciduous forests. These forest areas encompass several river valleys like Krishna, Koyna, Warana etc. Recently (1st July 2012) the area has been included as a part of World Heritage Site by UNESCO in the meeting held at Petusberg, Russia.

I. Core of Tiger reserve is divided into two parts comprising Chandoli National Park and the Koyna Wildlife Sanctuary. Both the parts are well connected with a corridor. The Tiger reserve is also connected with Tillari Conservation Reserve, Radhanagari WLS and Kali & Bhadra Tiger Reserve of Karnataka via different corridors.

II. Besides Tiger, STR is abode of number of wild animals like Leopard, Wild dog, Sloth bear, Gaur, Sambar, Barking deer, Four Horned Antelope, Wild Pig etc. along with rare ones like Giant Squirrel, Common Indian Civet, Palm Civet, Indian Porcupine, and Jungle Cat, Rusty-spotted Cat etc.

III. The Forests of STR got the status of 'Important Bird Area' from Birdlife International. It provides good opportunity to see / study the birds and butterflies for the tourists, students and scientists. Migratory birds can be seen here in large numbers during winter season.

IV. Forests of Chandoli and Koyna declared as (MPCA) Medicinal Plant Conservation Area for its rich medicinal values. Koyna & Chandoli reservoirs with grasslands and forest edge, plateaus and rocky cliffs (Kokan Kada) at some places provide wonderful habitat and scenic beauty to STR. .

V. Other tourist spots in the vicinity of the Sahyadri Tiger Reserve are Amba & Kumbharli Ghat, Agashiv caves of Karad, Thoseghar waterfalls, Historical-Pratapgad fort, hill station-Mahabaleshwar, Ghera Dategad is famous for sword shape well, Guru Ramdas Swamis abode-Sajjangad, Ajinkyatara fort, Khandoba temple of Pali. These all are important tourist & pilgrimage destinations. Tapola lake is important tourist hub. attracts thousands of water lovers in summer. Kas plateau is very famouse for its beautiful flowering plants attracts nature lovers during Sept-Oct months every year. These all places are nearby Satara. in Kolhapur district, Historical Pavankhind & Vishalgad are the main tourist attractions. All these spots are in Satara & Kolhapur district. All these values make Sahyadri Tiger Reserve a favourite area for ecotourism, interpretation and conservation education.

11.3. Eco-Tourism Zoning:

Salient Features of the Tourism Zones:

Tourism zoning is a strategic tool used to manage and regulate tourism activities within Tiger Reserve. By delineating specific areas for different types of tourism and related activities, zoning ensures that the environmental impact is minimised, wildlife habitats are protected, and the visitor experience is enhanced. This approach balances the needs of conservation, tourism, and local communities, making it a cornerstone of sustainable management in the reserve.

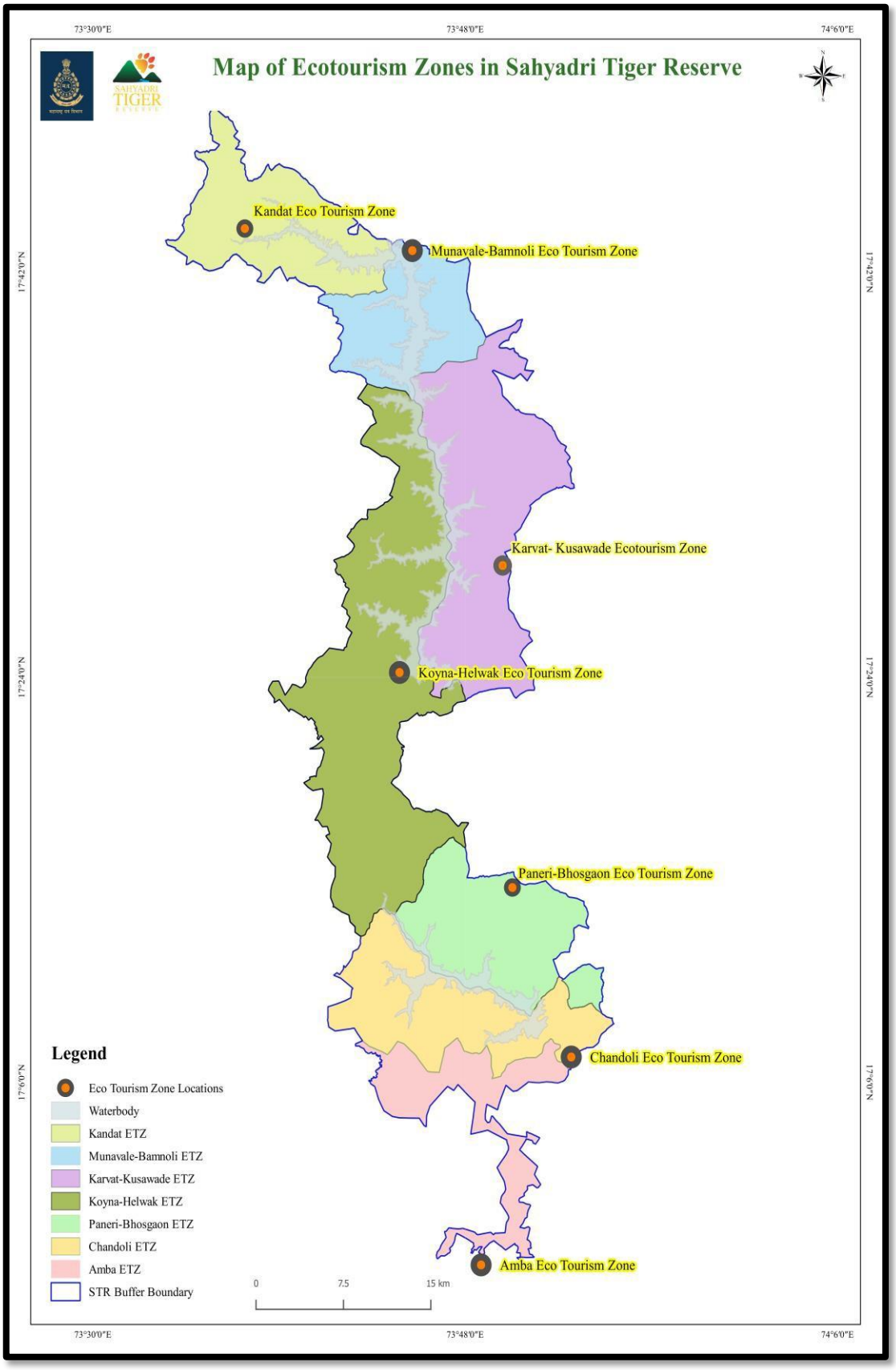
Tourism zones are carved out meticulously to ensure least possible disturbance to the ecological environment of the Tiger Reserve. The tourism zone covers land intended for a variety of tourist activities,

facilities and places. Development may range from small interpretive centres to large nature parks, depending on the location of the zone. Services and facilities, including tourist accommodation, souvenir shops, restaurants and entertainment, may also be located in this zone.

A planning scheme may include land in this zone to grow the local economy and cater to the needs of existing and future local residents and workers in an area. It can also identify the range of activities that may occur, how new buildings should look and fit in with local character and ensure activities do not cause harm to the natural environment. After careful planning, Sahyadri Tiger Reserve has been restricted to seven zones.These seven zone will have a separate Ecotourism complex and seven entry gates for tourists. Surely the new Zone policy will help boost tourism in the region.

Table.11.1 Following are the proposed Zones with entry gate location :

Sr. No.	Name of the Zone	Zone No.	Gate location
1	Kandat Ecotourism Zone	Zone number 1	Aarav, Tal-Mahabaleshwar, Dist-Satara
2	Bamnoli-Munawale Ecotourism Zone	Zone number 2	Bamnoli,Tal- Jawali, Dist-Satara
3	Karvat-Kusavde Ecotourism Zone	Zone number 3	Karvat, Tal-Patan, Dist-Satara
4	Koyna-Helwak Ecotourism zone	Zone number 4	Koyna, Tal-Patan, Dist-Satara
5	Paneri-bhosgaon Ecotourism zone	Zone number 5	Paneri, Tal -Patan, Dist- Satara
6	Chandoli Ecotourism zone	Zone number 6	Mandur, Tal-Shirala, Dist - Sangli
7	Amba Ecotourism Zone	Zone number 7	Amba Tal-Malkapur, Dist - Kolhapur



Map.11.1: Eco-Tourism Zones in STR

Proposed Eco-tourism activities and facilities in Eco-tourism zones of Sahyadri Tiger Reserve:

Ecotourism Activities:

1. Guided Wildlife Safaris

- Description: Conducted by trained Eco guides, offer visitors the chance to see wildlife in their habitat.
- Types: Jeep safaris
- Benefits: Provides educational insights and ensures safe and minimal-impact wildlife viewing.

2. Bird Watching Tours

- Description: Specialised tours focused on the diverse avian species within the reserve.
- Features: Early morning and late afternoon sessions, led by ornithologists or experienced bird watchers.
- Benefits: Promotes awareness of bird conservation and biodiversity.

3. Cultural Tours

- Description: Visits to nearby villages and communities to experience local culture, traditions, and crafts.
- Features: Traditional performances, handicraft workshops, and home-stay experiences.
- Benefits: Supports local economies and promotes cultural heritage.

4. Photography Workshops

- Description: Workshops and tours specifically designed for wildlife photography enthusiasts.
- Features: Led by professional wildlife photographers, with tips on capturing wildlife and landscapes.
- Benefits: Enhances visitor skills and promotes ethical wildlife photography.

5. Conservation Education Programs

- Description: Interactive programs and workshops focused on conservation issues and initiatives within the reserve.
- Features: Seminars, presentations, and hands-on activities such as tree planting.
- Benefits: Raises awareness and educates visitors on the importance of conservation efforts.

Ecotourism Facilities:

1. **Interpretation Centers**

- Description: Information hubs providing educational exhibits, brochures, maps, and guides about the reserve. Centers focused on educating visitors about the local ecosystem, wildlife, and conservation efforts.

- Features: Interactive displays, audio-visual presentations, and souvenir shops.
- Benefits: Enhances visitor knowledge. Deepens visitor understanding of the reserve's biodiversity.

2. Eco-Camps

- Description: Accommodation facilities designed with sustainable practices.
- Features: Solar power, rainwater harvesting, waste recycling, and use of local materials.
- Benefits: Minimizes environmental impact and provides comfortable lodging options.

3. Sustainable Transport Options

- Description: Eco-friendly transportation within the reserve.
- Types: Electric safari vehicles, bicycles, and solar-powered boats.
- Benefits: Reduces carbon footprint and noise pollution.

4. Rest Areas and Observation Points

- Description: Designated spots for visitors to rest and enjoy the scenery.
- Features: Benches, shade structures, water stations.
- Benefits: Provides safe and comfortable spots for relaxation and wildlife viewing.

5. Community-Run Facilities

- Description: Enterprises managed by local communities, such as restaurants, and souvenir/craft shops.
- Features: Traditional decor, local cuisine, and handmade crafts.
- Benefits: Promotes local culture and provides economic benefits to the community.

6. Research Stations

- Description: Facilities for scientific research and monitoring within the reserve.
- Features: Laboratories, field equipment, and accommodation for researchers.
- Benefits: Supports ongoing conservation research and initiatives.

7. Waste Management System

- Description: Facilities and systems for proper waste disposal and recycling.
- Features: Composting toilets, recycling bins, and waste segregation.
- Benefits: Ensures cleanliness and minimizes environmental impact.

8. Renewable Energy Installations

- Description: Infrastructure to harness renewable energy sources.
- Types: Solar panels, wind turbines, and bioenergy units.
- Benefits: Reduces reliance on fossil fuels and promotes sustainable energy use.

The comprehensive range of ecotourism activities and facilities at Sahyadri Tiger Reserve is designed to provide enriching experiences for visitors while ensuring the protection and preservation of the reserve's natural and cultural heritage. By promoting sustainable practices and involving local communities, the reserve aims to create a model of ecotourism that benefits both people and wildlife.

PROPOSED ECOTOURISM ACTIVITIES & FACILITIES :

Facilities & Activities at Ecotourism Complex :

- Nature Education centre
- Ticket counter
- Information centre
- Souvenir shop
- Children play area
- Adventure Sports
- Tents
- Youth Hostel
- Canteen
- Toilets / Washrooms
- Parking bay
- Information Boards & signages
- Drinkable water
- Butterfly Garden
- Open Auditorium
- Cycle trails
- Entrance Gate
- Auditorium
- Nature trail
- Watch tower
- Gajibo
- Nature library
- 3D map
- Statues of wildlife
- Ecoguide centre
- Tourist waiting room
- seating arrangement (benches)
- skywalk
- selfie points
- Digital Nature Education facility
- Nature experience centre

Facilities & Activities at Ecotourism :

- Nature trail
- Trekking
- Waterfalls
- Jungle Safari
- Bird watching
- Butterfly watching
- Sahyadri Nature festival
- Nature Education Camp
- Nature Sports
- Agro Tourism
- Nectar Festival
- Bird count programme
- Eco meditation (Forest bathing
- water-sports
- Nature experience
- Painting & Poster competition
- Cycle safari
- Adventure tourism
- Monsoon tourism

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IVITIES To Enhance ecotourism

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11.4. Organization Setup and Management:

Currently, there is no staff earmarked for the tourism management in the STR. Respective ACFs, RFOs, Foresters and Forest Guards are responsible for looking after tourism related responsibilities in the STR. The tourist influx into the STR has been increasing steadily for the past several years and has also consequently enhanced the workload of the officers/ staff. These preoccupations and demanding schedules hamper normal duties to a considerable extent. Effective tourism management in the STR also requires specially earmarked staff exclusively for this purpose. The STR Management requires the following staff for tourism management:

Table No.11.2: Staff Required for Tourism Management

Sl. No.	Name of Post	No. of Posts
1	Range Forest Officer	1
2	Forester	2
3	Forest Guard	7
4	Ecotourism Manager (Contractual)	4
5	Nature Ex. Officer	4

11.5. Determination of Carrying Capacity:

Table No.11.3 The carrying capacity for Vehicle safari in Core of STR is given below :

Sr. No.	Eco-tourism zones	Total Tourism road (km)	(ECC) Carrying Capacity	Online entry 66%	Offline Gate entry 24%	Reserve Quota 10%
1	Bamnoli-Monawale ETZ	9.77	35	23	8	4
2	Koyna-helwak ETZ	15.00	37	24	9	4
3	Chandoli ETZ	36.00	90	60	22	8
	Total	**60.57 km**	**162**	**107**	**39**	**16**

Table No.11.4 The carrying capacity for Nature treks in Core of STR is given below :

Sr. No.	Eco-tourism zones	Total Tourism road (km)	(ECC) Carrying Capacity	Online entry 66%	Offline Gate entry 24%	Reserve Quota 10%
1	Kandat ETZ	0	0	0	0	0
2	Bamnoli-Monawale ETZ	9.94	85.39	56	20	9
3	Karvat-Kusavde ETZ	10	34.45	22	8	4
4	Koyna-helwak ETZ	21.14	115.49	76	28	11
5	Paneri-Bhosgaon ETZ	0	0	0	0	0
6	Chandoli-Mandur ETZ	28.29	127.12	84	32	12
7	Amba ETZ	0	0	0	0	0
	Total	**69 km**	**362**	**238**	**88**	**36**
*Details of carrying capacity (with calculations) are given in chapter 11 of Eco-tourism plan Vol-3 and Annexure						

Table No.11.5: Percentage area for Eco Tourism in Core Zone

Core Zone Area of STR (Sqkm)	Area of Eco-Tourism	% Area for Eco Tourism in Core Zone
600.12	42.38	7.06

- The separate Annexure of carrying capacity is given. The distribution of vehicle for each gate, for morning/afternoon safari as well as online/offline will be amended by Field Director, Sahyadri Tiger Reserve as per the field condition & requirements.
- Number of vehicle permitted to enter core can be reduced if vacancy of field posts exceed 25%.
- Presently light Motor vehicle (Jeep/Car and Mini-Bus) are permitted to enter the core zone of

Sahyadri Tiger Reserve (Maharashtra) for tourism. Heavy vehicles, 3 wheelers and 2 wheelers are not permitted for tourism purpose.

- Following regulations are prescribed in this plan for private vehicles entering in core for tourism.
- Presently all four wheel light motor vehicles are permitted for tourism it will be allowed till 15th June of year. (If private vehicles acquired by locals and registered with foundation are not equal to 1.5 times the carrying capacity, the Conservator of Forest, Sahyadri Tiger Reserve may increase the date).
- In Future only private vehicles and modified canter registered with Sahyadri Tiger Conservation Foundation will be permitted.
- It will be mandatory that the vehicles will pprocure Pollution under Control (PUC) Certificate every 6 months. Any vehicle without a proper PUC certificatete will be rrestricted from enteringg the Rreserve.
- All the vehicles entering the Tourism Zones of the Reserve will strictly adhere to the emission standard of at least Bharat IV norms. While registering Private vehicles (SUV-MUV) / Canter like vehicle the preference will be given to first EDC then local person then local resorts and others. The number of vehicles for registration in a gate will be restricted to twice the number of vehicle allowed per trip in core. The vehicle registered will be allowed on rotation system. This will be regulated by respective Range Forest Officer so that all vehicles registered with Foundation will get opportunity of employment. It is decided in LAC, all private Vehicles will have to register with foundation on payment of Rs. 1000/- as fee (Non-refundable) per year and Rs 5000 Deposit. For registration following will be the conditions.
    1) Vehicle should in condition as per RTO norms.
    2) Seating arrangement and condition of vehicle should be good condition.
    3) Vehicle should have valid insurance.
    4) Vehicle should have valid PUC Certificate.

11.6. Implementation of Eco-tourism Guidelines:

In recent times, vast changes in eco-tourism policy of the State and Central Government have taken place. The Supreme Court of India in its order dated 16th October 2012 in Civil Appeal no. 21339/2011 directed States to prepare eco-tourism for each Tiger Reserve as per National Tiger Conservation Authority's eco-tourism policy circulated vide no. F. No. 15-31/2012-NTCA dated 15th October 2012. This eco-tourism plan is prepared as per guidelines of NTCA and State Government resolution no.WLP-2012/C.N. 309/F-1, Mumbai, dated 9th November 2012.

Eco-tourism provides for sustainable management of the resource without putting any

pressure on it. The tourists visiting the Park will be refrained from using polythene bags. The tourist's resorts will also be advised to minimize the use of plastic bags etc. They will also be advised to use solar cookers, solar water heaters, solar lighting, etc. to reduce the use of fossil fuels. They will also be advised to recycle the water and reduce the use of water.

Eco-tourism also provides for the involvement of local people and addressing them livelihoods. The local people get employment as tourists guides. They give information to tourist about forest and wildlife in the area and their importance. They also take care of maintaining the discipline in the tourists. Capable Eco-development Committee (EDC) should be entrusted with this management of eco-tourism complex. Responsibility for protection and maintenance can be shared by EDC in turn benefit can be given the EDCs.

The local people can also get their livelihood by offering tourists their local dishes. They have to be trained about the hygiene and hospitality formalities. The local people can also sale handicrafts articles as souvenir. The EDCs will be encouraged to provide tourism facilities such as homestay, tent facilities and catering which will increase employment an earning.

11.7. Park Interpretation Program:

It is important to convert a tourist visiting the Park into eco-tourist. This is possible by an interpretation program. In future, it is proposed to create new Interpretation centre at Koyna-Helwak, Bamnoli, Chandoli, and Amba tourism gate for making better utilization to increase tourists awareness The interpretation facility linked with good camping facility to provide in-depth awareness and interpretation input to the visitors and students. While staying in the 'Nature Awareness Centers', Visitors and Students can feel the Nature and get the first-hand experience of wilderness and then can be the good ambassador for the conservation and STR

The books, leaflets and other information material shall be provided for visitors with information about the Park and also the do's and don'ts. However, details have been separately discussed in Eco- Tourism Plan of STR.

Separate Eco-Tourism Plan is prepared as per NTCA guidelines dated 15.10.2012 and Maharashtra Government Resolution dated 09.11.2012 and 21.01.2013 and the draft plan is approved by LAC in the last meeting of LAC at Satara on 18.10.2023. As this plan should be treated as part of Tiger Conservation Plan as per NTCA instruction, detailed Eco-Tourism Plan is annexed as Volume-I, Part-5 of the Tiger Conservation Plan.

CHAPTER 12

MISCELLANEOUS ISSUES

12.1 Housekeeping of Departmental Elephants –

Sahyadri Tiger Reserve has not any captive elephant today. Elephants are useful for patrolling in the monsoon season when the communication by roads becomes very difficult as well as elephant proved very useful during man-animal conflict especially in the incidences like straying of a tiger. STR needs at least 3-4 elephants for this purpose

12.2 Wildlife Health Monitoring –

12.2.1 Wildlife Health Monitoring Protocol: The primary objective of this protocol is to establish a systematic framework for monitoring the health status of wildlife, particularly tigers and their prey species, within tiger reserves. By implementing regular health assessments and surveillance measures, this protocol aims to detect and mitigate potential threats to wildlife populations, ensuring their long-term conservation and well-being.

Key Components of Wildlife Health Monitoring Protocol are as follows:

1. **Baseline Health Assessment**:

- Conduct comprehensive health assessments of key wildlife species, including tigers, ungulates, and other carnivores, to establish baseline health parameters.
- Capture and sedate animals using safe and ethical techniques, ensuring minimal stress and risk to both animals and personnel.
- Collect biological samples (blood, faeces, urine, hair) for disease screening, genetic analysis, and monitoring of physiological parameters.
- Perform thorough physical examinations to assess body condition, musculoskeletal health, and signs of injury or disease.

2. **Disease Surveillance**:

- Implement regular disease surveillance programs through field staff to monitor the prevalence and spread of infectious diseases among wildlife populations during their patrolling.
- Conduct targeted screening for known pathogens affecting tigers and their prey, including viral, bacterial, and parasitic infections.
- Utilize advanced diagnostic techniques, such as PCR assays and serological testing, for accurate detection of pathogens.

- Collaborate with veterinary laboratories, veterinary universities and research institutions to enhance disease surveillance capabilities and facilitate data sharing.

3. **Ecological Monitoring**:

- Integrate wildlife health monitoring with broader ecological monitoring programs to assess the impact of environmental factors on animal health.
- Monitor changes in habitat quality, prey abundance, and human-wildlife interactions that may influence the health of wild animal populations.
- Use remote sensing technologies and ecological surveys to track habitat use patterns and identify potential disease hotspots within the reserve.

4. **Community Engagement:**

- Engage local communities living in and around tiger reserves in wildlife health monitoring initiatives to promote conservation awareness and collaborative management efforts.
- Provide training and capacity-building opportunities for community members to participate in wildlife health surveys and data collection activities.
- Foster partnerships between conservation organizations, government agencies, and local stakeholders to facilitate information sharing and mutual support.

5. **Data Management and Analysis:**

- Establish a centralized database for storing and managing wildlife health data, including clinical records, laboratory results, and ecological monitoring data.
- Use statistical modelling and spatial analysis techniques to identify trends, patterns, and potential health risks within the tiger reserve.

6. **Response and Intervention:**

- Develop contingency plans and response protocols for managing disease outbreaks and other health emergencies affecting wildlife populations.
- Coordinate rapid response teams comprising trained veterinarians, wildlife biologists, and park rangers to investigate and address health threats promptly.
- Implement targeted interventions, such as vaccination campaigns, habitat management measures, and population control strategies, to mitigate disease transmission and promote wildlife health.

By adhering to this comprehensive protocol for wildlife health monitoring in tiger reserves, conservation authorities can enhance their capacity to safeguard the health and resilience of wild animal populations

and their associated ecosystems. Through regular surveillance, data-driven management, and proactive intervention strategies, we can strive towards the sustainable conservation of these iconic and endangered species for future generations.

12.2.2 Vaccination of Livestock and Domestic dog: As per S - 33-A of Wildlife (Protection) Act 1972 the livestock kept in or within 5 km of Sanctuary are required to be immunized and hence the cattle are vaccinated in regularly with the help of District Animal Husbandry Officer and Veterinary Officer (Wildlife) STR. This is to ensure the wildlife from contagious disease spread from domestic animals.

Fortunately, there is no history of any major disease outbreak to wildlife in this area. Any suspicious death of a wild animal is checked with the help of local or departmental veterinary officers and samples are collected and sent to the laboratory. This practice should be continued for every unnatural death of wild animal and birds.

Vaccination of cattle of villages in an around the protected area is done to prevent the spread of any epidemics and no cattle is allowed to pass through the reserve. TR has a long and zigzag perimeter expose a lot of area for grazing and it very difficult to prevent them from contacting with the wild. If cattle entered illegally in TR, it should be vaccinated and a certificate issued by the competent Animal Husbandry Officer. Immunization camps need to be organized timely for domestic cattle through respective Zilla Parishad Veterinary Officers to prevent the spread of foot and mouth disease (FMD), Anthrax disease, etc. to wildlife.

12.2.3 Body Condition Scoring:

The field staff will be asked to observe and monitor the general body condition of a wild animal during their field visits. The front line staff will be trained by the veterinary officer of this project regarding the Body Condition Scoring of wild animals. They will be asked to fill information in the prescribed format is as below:

The format for evaluating Body Condition Score of wild animal

Name of the PA …… Species ……

Division …… Date……

Range …… Comp. /Survey No. ……

Age	Sex	Score given for observation of different Body parts									Total score	Remarks
		1	2	3	4	5	6	7	8	9		

Note: - 1) Shoulder, 2) Ribs, 3) Pelvic, 4) Vertebral column, 5) Abdomen, 6) Tail, 7) Body Posture, 8) Skin, 9) Locomotion

Score determination 1) 0-4 best, 2) 5-7 good, 3) 8-10 poor. From this score, the general health condition of the wild animal will be ascertained.

The general condition will be observed and the health of wild animal will be determined by from 1) general appearance and behavior, 2) bone structure and joints, 3) moist nostrils, 4) jaw, teeth and mouth, 5) ribs, 6) chest, 7) vertebral column, 8) limbs and its locomotion, 9) skin appearance.

Based on the above observatory parameters from distance the general health of an animal can be predicted this will help us to monitor the health status of a wild animal at different location and time.

Fortunately, there is no history of any major disease to wildlife in the STR. But, intermittently deaths of Gaurs are observed in Kandat range of Koyna Division.

Wildlife Health Monitoring in Tiger Reserves.

12.2.4 Preventing Disease Spread from Livestock to Wild Animals: A Vital Conservation Imperative

The interface between domestic livestock and wild animals presents a significant risk for the transmission of infectious diseases, threatening the health and viability of wildlife populations. Implementing effective measures to prevent disease spread is essential for conserving biodiversity and maintaining ecosystem integrity. Key Strategies are as follows:

1. Controlled Grazing Practices:

- Implement controlled grazing regimes to minimize direct contact between domestic livestock and wildlife in shared habitats.
- Strict control over illegal grazing in core zone to prevent livestock intrusion into sensitive wildlife areas, particularly those frequented by endangered species.

2. Vaccination Programs:

- Implement vaccination programs for domestic livestock to control and prevent the transmission of zoonotic diseases to wild animals.
- Target vaccines against priority pathogens identified through surveillance efforts, such as bovine tuberculosis and foot-and-mouth disease.

3. Surveillance and Monitoring:

- Conduct regular surveillance of both domestic livestock and wildlife populations to monitor the prevalence of infectious diseases and identify potential transmission pathways.

- Utilize diagnostic testing and epidemiological research to assess the risk of disease spillover and inform targeted intervention strategies.

4. Public Awareness and Education:

- Raise awareness among livestock owners, farmers, and local communities about the importance of preventing disease transmission to wild animals.
- Provide education on proper waste management, hygiene practices, and responsible livestock husbandry to reduce environmental contamination and disease spread.

6. Collaborative Management Approaches:

- Foster collaboration between wildlife conservation agencies, veterinary universities and other authorities, and livestock stakeholders to develop integrated management approaches.
- Establish joint task forces and stakeholder forums to coordinate disease control efforts and share best practices for mitigating disease risks.

Preventing the spread of diseases from livestock to wild animals is essential for maintaining the health and resilience of ecosystems. By implementing a combination of controlled grazing practices, vaccination programs, surveillance efforts, public education, and collaborative management approaches, we can mitigate the risk of disease transmission and safeguard both wildlife and livestock populations.

12.2.5 Preventing Disease Spread from Domestic Dogs to Wild Animals in Tiger Reserves: A Conservation Imperative:

Domestic dogs pose a significant risk of transmitting diseases to wildlife populations in tiger reserves, potentially causing outbreaks that threaten the health and survival of vulnerable species. Implementing proactive measures to prevent disease spread is crucial for safeguarding the integrity of these ecosystems. Key Strategies are as follows:

1. Controlled Access and Management:

- Implement regulations to control the movement of domestic dogs within and around tiger reserves, including restrictions on free-roaming dogs.
- Enforce responsible pet ownership practices, such as vaccination requirements, and population control measures, to reduce the prevalence of unowned and unvaccinated dogs.

2. Vaccination Programs:

- Conduct targeted vaccination campaigns in the villages of buffer zone to immunize domestic dogs against common pathogens that pose a risk to wildlife, such as rabies, distemper, and parvovirus.
- Collaborate with veterinary authorities and animal welfare organizations to provide accessible and affordable vaccination services for local communities residing near tiger reserves.

3. Community Engagement and Education:

- Engage local communities in awareness campaigns and educational programs highlighting the importance of preventing disease transmission from domestic dogs to wild animals.

4. Population Management:

- Implement strategies for managing free-roaming dog populations through humane methods, such as trap-neuter-vaccinate-return (TNVR) programs and adoption initiatives.

5. Surveillance and Monitoring:

- Establish surveillance programs to monitor the health status of both domestic dogs and wild animals in tiger reserves, with a focus on detecting potential disease outbreaks.
- Conduct regular disease screening and diagnostic testing to identify pathogens of concern and assess the prevalence of infections in domestic dog populations.

Preventing the spread of diseases from domestic dogs to wild animals is essential for maintaining the health of wild animals of tiger reserves. By implementing a combination of controlled access, vaccination programs, community engagement initiatives, population management measures, and surveillance efforts conservation authorities can mitigate the risk of disease transmission and protect the long-term viability of these iconic ecosystems.

12.3 Status of Forest Rights Act implementation and disposals of claims concerning TR :

The Forest Rights Act (FRA), also known as the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, serves several important purposes aimed at recognizing and securing the rights of forest-dwelling communities, particularly indigenous and tribal groups. The primary purpose of the FRA is to recognize and vest forest rights and occupation in forest land in forest-dwelling Scheduled Tribes and other traditional forest-dwelling communities. This includes both individual and community rights to access, use, and manage forest resources sustainably. But in STR, there is not any rights recognized or pending to recognize. In the Sahyadri Tiger Reserve (STR), there are no rights currently recognized, nor are there any pending for recognition.

12.4. Medicinal Plants Conservation Area, Navaja:

12.4.1 The Forest department of Maharashtra had implemented in the field, the UNDP-CCF-I, IND/97/947 project on "Medicinal Plants Conservation and Sustainable Utilization", to work alongside local communities and NGOs to document, protect and manage a network of 13 Medicinal Plants Conservation Areas (MPCAs) in the forest habitats.

The project aimed at demonstrating a scientific program for in-situ conservation and sustainable utilization of the medicinal plants. The UNDP project was executed by Ministry of Environment and Forests and jointly implemented by the State Forest Department, Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore and Rural Communes, Mumbai. The forest department through its field staff had implemented the program in the field, whereas the FRLHT provided the technical inputs. The Rural Communes coordinated the activities of 13 such MPCAs in Maharashtra.

Navaja village in the Koyna Wildlife Sanctuary is one such place where MPCA activities are in progress. Though the area is in the sanctuary, because of the floral attributes of the area – both forest and private, the accessibility, the opportunity to study such a project on the periphery of the sanctuary offered challenges.

12.1: Basic data for the area is as follows:

Sr. No.	Item	Details	Sr. No.	Item	Details
1	District	Satara	5.	Division	Wildlife Divn. Kolhapur
2.	Tahsil	Patan	6.	P.A.	Koyana WLS
3.	Village	Navaja	7.	Range	Koyana
4.	Area – Forest Compartment No.Private Area Survey No. Total	420P - 90Ha. 421P - 90Ha. 422P - 70Ha. 250Ha. 79P-17.73Ha. 267.73 Ha.	8.	Distances	1. Pune - 260 Km. 2. Kolhapur - 150 Km. 3. Satara - 130 Km. 4. Patan - 45 Km. 5. Koyana - 12 Km.
9	Latitude	17° 24' N	10	Longitude	73° 45' E
11	Altitude	800 mtr.	12	Avg. Rainfall	6100 mm.
13	Geology - Rock	Deccan Trap Basalt	14	Soil	Red lateritic with small boulders
15	Forest Type- Seth & Champian	West Coast Semi Evergreen 2A/C-2	16	Density	0.5 to 0.8
17	Crop	Middle to Old aged	18	Dominant Species	Syzigium cuminii (Jambhul), Memecylon edule (Anajani), Actidephane hookeri(Pisa).
19	Water Source - Perennial	Ozarde Nala	20	Species Identified so far	152 species (List Attached)

The local NGO involved in the management of this MPCA is "Shri Manaidevi Aushadhi Vanaspati Sanvardhan Sahakari Sanstha, Navaja" which is a co-operative society of the Navaja villagers especially established for this purpose on 30th July 2001.

The activities taken up so far –

- 3 Women self-help groups were formed and are maintained.
- Collection of **a)** seeds – Hirda, Behada, Awala,Jambhul, Shikekai and

  b) leaves – Bedaki was carried out in private areas, now stopped.

- Species Identification of some part has been carried out and named but exercise needs to be continued.
- In 2002, plantation with 970 seedlings of 191 species was carried out in 1 ha. of Private area was carried out as a Demonstration Garden, but later on it was not effectively maintained.
- An entry of Rs. 5/- per visitor was being collected by the MPCA management committee for the maintenance of the area. Tourists visiting the MPCA area are given information about the plants of medicinal value.

Table No.12.2: The details of tourists who visited MPCA in past* years are as follows –

Sr. No.	Year	No. of Visitors	Collection as per Rs.5/-	Expenditure Rs.	Balance Rs.
1.	2007-08	1370	6850	5970	880
2.	2008-09	1903	9515	8320	1195
3.	2009-10	2560	12800	11280	1520
4.	2010-11	3995	19975	17870	2105
5.	2011 -12	4247	21235	18845	2390

(*There are no medicinal plantations done by STR in recent years.)

Under the guidelines laid down, Navaja MPCA has successfully created a demonstration plot near the *Ozarde* waterfalls, mobilized Women Self-help groups, raised nursery of medicinal plants, developed nature-trails with signages and documented the flora of the MPCA.

Being a part of a PA, Objectives of Navja MPCA have been limited to

- To protect Medicinal Plants Conservation Area with the help of the local villagers,
- To collect and document the knowledge regarding the traditional use of medicinal plants from the local community – *Vaidus* (Folk-healers).
- To provide information of important, vulnerable, endangered and threatened plants of medicinal value.

- To find out by observation, the usage of medicinal plants by some wild animals.

The strategy to achieve the objectives is as follows –

- To protect the area from grazing and fire, in this regard help of "Shri Manaidevi Aushadhi Vanaspati Sanvardhan Sahakari Sanstha, Navaja" which is a co-operative society of the Navja villagers was mobilized. The scheme itself will work as a part of Village Eco-Development and may be tried at other villages where ever reciprocated. For that the MPCA management committee may be permitted to increase entry fee from RS. 5 to Rs. 10 for adults (50% for the students and totally off for the residents of Buffer and Core zone areas) and may be doubled after every 5years, provided satisfactory progress shown by the MPCA management committee.
- Protection of boundary marks and boundary - Once marked to be maintained by the MPCA management committee.
- Identification and labelling of all type of herbs, shrubs, trees, grasses including rare, endangered and threatened species.
- Providing signages giving details of the species of medicinal value.
- Maintenance of nature trails in the demonstration garden and MPCA.
- To provide booklets, brochures and leaflets to villagers and tourists – The members of the MPCA management committee will guide the tourists.
- To seek expert help (outsourcing) – It is essential in first 2 years as to get taxonomy knowledge and that too in various seasons all-round the year. Botany Department of Shivaji University, Kolhapur is expected to be a good source.
- To create extension in Navaja area towards existing MPCA.
- To implement the strategy, the fund requirement 2013-14 to 2022-23 is shown in Annexure V.

As these funds are expected to be available from 13th finance commission funds, the requirement has been shown separately.

12.5: Important Bird Area (IBA):

- Chandoli National Park and Koyna Wildlife Sanctuary part of Sahyadri Tiger Reserve are indeed recognized as Important Bird Areas (IBAs) due to their significance for avian biodiversity. IBAs are designated based on specific criteria developed by Birdlife International, a global partnership of conservation organizations, to identify and conserve areas that are critical for bird conservation.
- Chandoli National Park and Koyna Wildlife Sanctuary are categorized into A1(Threatened Species) and A2 (Endemic Bird Area 123 Western Ghats).

- Both Chandoli National Park and Koyna Wildlife Sanctuary are located in the Western Ghats, a region known for its rich birdlife and high levels of endemism. These protected areas provide important habitats for a diverse range of bird species, including resident birds, migratory species, and endemic species that are found nowhere else in the world.
- The Western Ghats harbors a remarkable variety of bird species, including forest birds, waterbirds, raptors, and many others. The mosaic of habitats within Chandoli National Park and Koyna Wildlife Sanctuary supports a wide array of birdlife, making them significant sites for birdwatching and ornithological research.
- The designation of Chandoli National Park and Koyna Wildlife Sanctuary as Important Bird Areas highlights their importance for the conservation of avian biodiversity. It underscores the need for effective protection and management of these areas to ensure the survival of their bird populations and their habitats.
- Conservation efforts in Chandoli National Park and Koyna Wildlife Sanctuary, as well as in other IBAs across the Western Ghats, focus on habitat conservation, monitoring of bird populations, and community engagement to promote sustainable practices that benefit both birds and people.

Following list of important bird species has been recorded in both Chandoli National Part and Koyna Wildlife Sanctuary part of Sahyadri Tiger Reserve. Birds are categorized as per its global significance and conservation status:

Table 12.3: List of Species as per IUCN status

Sr.No.	Name Species	Scientific Name
Critically Endangered		
1	White-rumped Vulture	*Gyps bengalensis*
2	Long-billed Vulture	*Gyps indicus*
3	Red-headed Vulture	*Aegypius calvus*
Vulnerable		
4	Asian Woollyneck	*Ciconia episcopus*
5	Nilgiri Wood-pigeon	*Columba elphinstonii*
6	Indian Spotted Eagle	*Clanga hastata*
Near Threatened		
7	River Tern	*Sterna aurantia*

8	Alexandrine Parakeet	*Psittacula eupatria*
9	Great Pied Hornbill	*Buceros bicornis*
10	Painted Stork	*Mycteria leucocephala*
11	Black-headed Ibis	*Threskiornis melanocephalus*
12	Black-tailed Godwit	*Limosa limosa*
Endemic Bird Area 123: Western Ghats		
13	Nilgiri Wood-pigeon	*Columba elphinstonii*
14	Malabar Parakeet	*Psittacula columboides*
15	Malabar Grey Hornbill	*Ocyceros griseus*
16	Malabar Lark	*Galerida malabarica*
17	Grey-headed Bulbul	*Pycnonotus priocephalus*
18	White-bellied Blue Flycatcher	*Cyornis pallipes*
19	Indian Rufous Babbler	*Turdoides subrufus*
20	Small Subnird	*Leptocoma minima*
21	Vigor's Sunbird	*Aethopyga vigorsii*
Biome 10: Indian Peninsula Tropical Moist Forest		
22	Malabar Pied Hornbill	*Anthracoceros coronatus*
23	White-cheecked Barbet	*Megalaima viridis*
24	Malabar Whistling-thrush	*Myophonus horsfieldii*
25	Indian Scimitar-babbler	*Pomatorhinus horsfieldii*
26	Loten's Sunbird	*Cinnyris lotenius*
Biome 11: Indo-Malayan Tropical Dry Zone		
26	Jungle Bush-quail	*Perdicula asiatica*
27	Plum-headed Parakeet	*Psittacula cyanocephala*
28	Brown-headed Barbet	*Megalaima zeylanica*
29	Black-rumped Flameback	*Dinopium bengalense*
30	Malabar Lark	*Galerida malabarica*
31	Common Woodshrike	*Tephrodornis pondicerianus*
32	Small Minivet	*Pericrocotus cinnamomeus*

33	Indian Robin	*Saxicoloides fulicata*
34	Rofous-bellied Babbler	*Dumetia hyperythra*
35	Ashy Prinia	*Prinia socialis*
36	Jungle Prinia	*Prinia sylvatica*
37	White-bellied Drongo	*Dicrurus caerulescens*
38	Brahminy Starling	*Sturnus pagodarum*
39	Grey-headed Starling	*Sturnus malabaricus*

For bird conservation in the Sahyadri Tiger Reserve (STR), several actions can be taken to protect and enhance avian biodiversity within the reserve:

- Habitat Management: Assess and manage habitats within the reserve to ensure they meet the ecological requirements of bird species. This may involve maintaining diverse vegetation structures, including both mature forests and successional stages, as well as managing water sources, wetlands, and grasslands.
- Protection of Key Habitats: Identify and prioritize the protection of critical habitats that support high concentrations of bird species, including breeding sites, feeding areas, and stopover sites for migratory birds.
- Species Monitoring: Conduct regular surveys and monitoring programs through citizen science initiative to track bird populations and assess changes in abundance, distribution, and diversity over time. This information can inform management decisions and conservation priorities.
- Threat Mitigation: Identify and address threats to bird populations within the reserve, such as habitat loss, fragmentation, invasive species, poaching, pollution, and climate change. Implement measures to mitigate these threats, such as habitat restoration, control of invasive species, and enforcement of regulations.
- Research and Data Collection: Conduct scientific research to better understand the ecology, behavior, and conservation needs of bird species in the Sahyadri Tiger Reserve. Collect and analyze data on bird populations, habitat use, and threats to inform conservation planning and management.
- Community Engagement: Engage local communities living in and around the reserve in bird conservation efforts. Raise awareness about the importance of birds and their habitats, and involve communities in monitoring, research, and conservation activities.
- Education and Outreach: Develop educational programs and materials to promote bird conservation and environmental awareness among visitors, tourists, school children, and local communities.

Organize birdwatching events, workshops, and nature trails to foster appreciation for birds and their habitats.

- Collaboration and Partnerships: Collaborate with government agencies, non-governmental organizations, research institutions, and local stakeholders to coordinate bird conservation initiatives, share resources and expertise, and leverage support for conservation efforts.
- Capacity Building: Build the capacity of reserve staff, local communities, and other stakeholders involved in bird conservation through training programs, workshops, and skill development initiatives.
- Long-term Planning and Funding: Develop and implement a comprehensive bird conservation strategy and management plan for the Sahyadri Tiger Reserve, with clear goals, objectives, and action plans. Secure long-term funding and institutional support for bird conservation activities within the reserve.
- By implementing these measures, the Sahyadri Tiger Reserve can effectively conserve avian biodiversity of this landscape and contribute to the broader efforts to protect birds in the Western Ghats region.

12.6: Key Biodiversity Area (KBA):

The KBA Standard has been approved by the International Union for Conservation of Nature (IUCN) Council and was launched at the World Conservation Congress in Hawai'i in 2016. The KBA criteria are explicitly designed to cover all levels of ecological organisation, including genetic diversity, species and ecosystems. Key Biodiversity Areas (KBAs) are the most important places in the world for species and their habitats. Faced with a global environmental crisis we need to focus our collective efforts on conserving the places that matter most. The KBA Program supports the identification, mapping, monitoring and conservation of KBAs to help safeguard the most critical sites for nature on our planet – from rainforests to reefs, mountains to marshes, deserts to grasslands and to the deepest parts of the oceans. Chandoli National Park and Koyna Wildlife Sanctuary, both are declared as Key Biodiversity Areas (KBA) of Sahyadri Tiger Reserve for the significant biodiversity importance.

Chandoli National Park (24942), India, Asia

The Chandoli National Park qualifies as a Key Biodiversity Area of the international significance because it meets one or more previously established criteria and threshold for the identifying sites of biodiversity importance. Its status as KBA has confirmed. The year of assessment was done in 2016. It has categorized in to terrestrial system. Elevation of the site is around 589 to 1044. The area of KBA is 321.8 sq.km. It is a legacy site. The protected area coverage is around 50%. The KBA classification is global/regional TBD.

Table 12.4: List of Species as per IUCN Status

Taxa Group	Scientific Name	Common Name	IUCN Red List
Aves	*Nectarinia minima*	Crimson-backed Sunbird	LC
Aves	*Columba elphinstonii*	Nilgiri Woodpigeon	VU
Aves	*Sarcogyps calvus*	Red-headed Vulture	CR
Aves	*Gyps bengalensis*	White-rumped Vulture	CR
Aves	*Gyps indicus*	Indian Vulture	CR
Aves	*Ocyceros griseus*	Malabar Grey Hornbill	LC
Aves	*Ciconia epscopus*	Asian Woollyneck	VU
Aves	*Psittacula columboides*	Malabar Parakeet	LC
Aves	*Cyornis pallipes*	White-bellied Blue-flycatcher	LC
Aves	*Turdoides subrufa*	Rufous Babbler	LC
Aves	*Pycnonotus priocephalus*	Grey-headed Bulbul	NT
Mammalia	*Panthera tigris*	Tiger	EN
Mammalia	*Cuon alpinus*	Dhole	VU

Koyna Wildlife Sanctuary (18269), India, Asia

The Koyna Wildlife Sanctuary qualifies as a Key Biodiversity Area of the international significance because it meets one or more previously established criteria and threshold for the identifying sites of biodiversity importance. It's status as KBA has confirmed. The year of assessment was done in 2007. It has categorized in to freshwater and terrestrial system. The area of KBA is 490.44 sq.km. It is a legacy site. The protected area coverage is around 72.60%. The KBA classification is global/regional TBD.

Table no 12.5 : List of Species as per IUCN Status

Taxa Group	Scientific Name	Common Name	IUCN Red List
Amphibia	*Pedostibes tuberculosus*	Malabar Tree Toad	VU
Amphibia	*Xanthophryne koynayensis*	Koyna Toad	EN
Amphibia	*Nyctibatrachus humayuni*	Bombay Night Frog	VU
Aves	*Nectarinia minima*	Crimson-backed Sunbird	LC
Aves	*Columba elphinstonii*	Nilgiri Woodpigeon	VU
Aves	*Gyps bengalensis*	White-rumped Vulture	CR
Aves	*Gyps indicus*	Indian Vulture	CR
Aves	*Ocyceros griseus*	Malabar Grey Hornbill	LC
Mammalia	*Panthera tigris*	Tiger	EN
Mammalia	*Cuon alpinus*	Dhole	VU

- Species Monitoring: Conduct regular surveys and monitoring programs through citizen science initiative to track bird populations and assess changes in abundance, distribution, and diversity over time. This information can inform management decisions and conservation priorities.

- Research and Data Collection: Conduct scientific research to better understand the ecology, behavior, and conservation needs of bird species in the Sahyadri Tiger Reserve. Collect and analyze data on populations, habitat use, and threats to inform conservation planning and management.

12.7: Human Health Care:-

Health check-ups camps are regularly arranged for field staff and villagers of EDC village by the department and with help of NGO's like Krishna Hospital, Lion club, Sawarde, WCT, Mumbai and Mandeshi Foundation, Mhaswad. Training on First-aid and trauma are also given to field staff. Every anti-poaching camp and the patrolling vehicle is provided with a first-aid kit. There is a need to regularly change medicine of First-aid box which is either expired or finished. Every Forester are responsible to check first-aid kit checking during his visit to Anti-poaching camp in his jurisdiction. Medical Check-up activities for villagers are much needed initiative; it will create a lot of goodwill towards tiger reserve.

Ensuring the health and well-being of forest staff working in tiger reserve is paramount for both their safety and effectiveness in conservation efforts. While these settings offer unique challenges, proactive measures can significantly mitigate risks and promote better healthcare practices.

1. **Preventive Measures**: Emphasize the importance of preventive healthcare measures such as vaccinations, regular health check-ups, and hygiene protocols to minimize the risk of infectious diseases prevalent in jungle environments.

2. **First Aid Training**: Provide comprehensive first aid and trauma training tailored to jungle conditions, equipping forest staff with the skills to handle common injuries and emergencies encountered in remote areas.

3. **Medical Supplies**: Ensure adequate provision of medical supplies, including basic medication, wound care materials, and emergency kits, in remote forest stations to address minor ailments and injuries promptly.

4. **Communication and Emergency Response**: Establish reliable communication channels and emergency response protocols to facilitate timely assistance in case of medical emergencies or accidents occurring deep in the jungle.

5. **Psychological Support**: Recognize the psychological challenges faced by forest staff working in isolation and high-stress environments. Offer counselling services and mental health support to address stress, anxiety, and trauma-related issues.

6. **Environmental Hazards Awareness**: Educate Forest staff about potential environmental hazards such as poisonous plants, venomous creatures, and hazardous terrain, enabling them to take proactive measures to mitigate risks.

7. **Nutritional Support**: Provide access to nutritious food supplies to maintain the health and energy levels of forest staff during extended stays in jungle environments, preventing malnutrition and fatigue.

8. **Vector-Borne Disease Management**: Implement strategies for managing vector-borne diseases prevalent in jungle areas, including mosquito-borne illnesses like malaria and dengue fever, through insect repellents, bed nets, and environmental control measures.

Prioritizing human healthcare for forest staff stationed in tiger reserve not only safeguards their well-being but also enhances their effectiveness in biodiversity conservation and protection efforts. By implementing comprehensive healthcare strategies tailored to the challenges of jungle settings, we can ensure the safety and resilience of those dedicated to preserving our natural ecosystems.

12.8 : Sacred Groves in STR: Community Based Conservation

Sacred groves are patches of forests or woodlands that are protected by communities or religious groups due to their cultural or spiritual significance. These groves serve as refugees for a diverse range of flora and fauna, often containing endemic and globally threatened species. The importance of sacred groves for conservation lies in their role as havens for biodiversity. They provide habitats for numerous plant and animal species, including many that may be rare or endangered. Since, these groves are typically protected by cultural or religious beliefs, but they often face conservation challenges by the pressure of various human activities.

By preserving sacred groves, communities not only protect their cultural heritage but also contribute to broader conservation efforts. These areas can act as reservoirs of genetic diversity, providing opportunities for the study and conservation of unique species. Additionally, the presence of sacred groves can help maintain ecosystem services such as water regulation, soil conservation, and climate regulation, benefiting both local communities and the broader environment.

Sahyadri Tiger Reserve has so many sacred groves in core and buffer area. There are 91 villages and hamlets in buffer area and 7 villages in core area. Many villages are relocated due to dam construction. So far, 44 sacred groves have been recorded in STR (Table.12.6). These sacred groves play vital role in the biodiversity conservation of Sahyadri Tiger Reserve by providing home to endemic and threatened species of flora and fauna.

The sacred groves are traditionally conserved by local communities for decades. These sacred groves protect the large trees and habitat of last remaining primary forest patches in northern Western Ghats. Many medicinal, endemic and globally threatened plant species also found in these sacred groves. They play an important role for the flagship species like Great Indian Hornbills, Malabar Pied Hornbill, Malabar Grey Hornbill and Indian Grey Hornbill by providing nesting, roosting and feeding habitats. These Sacred Groves plays an important role by being **'stepping-stones'** by forming links between wildlife corridors of birds and few mammals throughout the Sahyadri landscape. Also, these sacred groves are home to many endemic birds like Nilgiri-wood pigeon, white-checked barbet, vigorous sunbird, Malabar Parakeets, Malabar whistling thrush and Malabar grey hornbill. Malabar Giant Squirrels, Mouse Deer, Gaur, Barking Deer and Sambar also utilize the habitat of the sacred groves. Local community members have seen leopard and tiger visiting these sacred groves.

Overall, sacred groves play a vital role in safeguarding endemic and threatened species of flora, fauna, and local traditional cultures, serving as living museums of biodiversity and cultural diversity and contributing to the conservation of ecosystems on a global scale. It is important to conserve these sacred groves by monitoring and maintaining through community engagement and long-term conservation planning.

Fig.12.1: Akalpe Sacred Grove of Kandat

Fig.12.2: Arav Sacred Grove of Kandat

Table.12.6 List of Sacred Groves of Sahyadri Tiger Reserve:

Sr.No.	Name of Sacred Grove	Village	Beat	Range	WL Division
1.	Ambeshwar	Amba	Amba	Amba	Chandoli
2.	Adishtidevi- Asoba	Amba	Amba	Amba	Chandoli
3.	Shri Kalamadevi	Udgiri	Udgiri	Amba	Chandoli
4.	Ambabai Mandir	Ambewadi	Ukhalu	Amba	Chandoli
5.	Kundi	Kundi	Gothane	Amba	Chandoli
6.	Marleshwar	Marleshwar	Gothane	Amba	Chandoli
7.	Durgewadi	Durgewadi	Tanali	Chandoli	Chandoli
8.	Shevtai Devi Temple	Mandur	Mandur	Dhebewadi	Chandoli

9.	Mahadev Mandir Sacred	Nivi-Shevtai Trail	Mandur	Dhebewadi	Chandoli
10.	Bambarwadi	Bambarwadi	Mandur	Dhebewadi	Chandoli
11.	Mahadev Mandir	Kasani	Kasani	Dhebewadi	Chandoli
12.	Bhairavnath Temple	Karpewadi	Kasni	Dhebewadi	Chandoli
13.	Bhairi Bhavani Devi Temple	Maingdewadi	Satar	Dhebewadi	Chandoli
14.	Bhairavnath Temple	Jinti	Satar	Dhebewadi	Chandoli
15.	Walmiki	Palshi	Paneri	Dhebewadi	Chandoli
16.	Bhairi Bhavani	Bhairavgadh	Kolne	Helwak	Chandoli
17.	Waghjai Temple	Atoli	Atoli	Helwak	Chandoli
18.	Male	Male	Male	Helwak	Chandoli
19.	Ambamata Temple	Bopoli	Dhankal	Helwak	Chandoli
20.	Shiv Mandir	Dhankal	Dhankal	Helwak	Chandoli
21.	Kalkai Mandir	Torne	Torne	Koyna	Koyna
22.	Shivshankar Mandir	Navja	Navja	Koyna	Koyna
23.	Navlai Devi	Rasati	Rasati	Koyna	Koyna
24.	Padmavati Temple	Palasari	Kusawde	Patan	Koyna
25.	Hanuman Temple	Maral	Kusawade	Patan	Koyna
26.	Janaidevi Temple	Kusawade	Kusawade	Patan	Koyna
27.	Injai Sacred Grove	Ambavne	Karvat	Patan	Koyna
28.	Bhairavnath Temple	Dhulaiwadi	Gojegaon	Patan	Koyna
29.	Bhairavnath Temple	Kathi	Gojegaon	Patan	Koyna
30.	Bhairav Ban	Bharsakle	Karvat	Patan	Koyna
31.	Jambhulban	Bharsakle	Karvat	Patan	Koyna
32.	Janai Devi Temple	Aral	Gojegaon	Patan	Koyna
33.	Janaidevi Temple	Vele-Dhene	Vele	Patan	Koyna
34.	Ambavde	Ambavde	Kargaon North	Bamnoli	Koyna
35.	Munavale	Munavale	Munavale	Bamnoli	Koyna
36.	Janaimata Temple	Phalani, Andhari	Munavale	Bamnoli	Koyna
37.	Shri Datta Mandir Math	Majare, Shevandi	Munavale	Bamnoli	Koyna
38.	Khirkhindi	Khirkhindi	Khirkhindi	Bamnoli	Koyna
39.	Kedarnath Temple	Akalpe	Pimpri	Kandat	Koyna
40.	Utteshwar	Nivali	Waghavale	Kandat	Koyna
41.	Shankar Bhagwan Temple	Valwan	Valwan	Kandat	Koyna
42.	Jom Mallikarjun Temple	Parwat	Waghavale	Kandat	Koyna
43.	Nirpji Temple	Kandat	Uchat	Kandat	Koyna
44.	Aarav	Aarav	Aarav	Kandat	Koyna

Fig.12.3: Ambaiwadi Sacred Grove, Ukhalu, Amba Range

Conservation and Monitoring of Sacred groves:

Sacred groves are patches of original forest and it's gene bank of native flora and fauna in this landscape. Hence, conservation of these sacred groves with participation of local communities is important. Awareness about value of preservation of these sacred groves among the new generation is needed to make young generations conscious towards this our cultural and natural heritage. The Sahyadri Hills, known for their rich biodiversity and cultural significance, host numerous sacred groves revered by local communities. Managing and monitoring these groves is crucial for preserving their ecological integrity and cultural heritage.

Management of sacred groves in the STR involves a holistic approach that integrates ecological conservation, cultural sensitivity, and community engagement. Conservation efforts focus on protecting the diverse flora and fauna within the groves, preventing any extraction from Sacred groves. Preventing major land use change in surrounding area of sacred groves by taking local community and sacred grove committee.

Monitoring plays a vital role in assessing the health and biodiversity of sacred groves. Ecological surveys, wildlife monitoring, and vegetation assessments help track changes over time and inform conservation strategies. Additionally, documenting cultural practices and rituals associated with the groves preserves traditional knowledge and strengthens community bonds.

Community involvement is key to successful management and monitoring initiatives. Local stakeholders, including indigenous and traditional communities, actively participate in decision-making processes, conservation activities, and resource management efforts. This fosters a sense of ownership and stewardship among community members, ensuring the long-term sustainability of sacred groves in the STR.

Overall, effective management and monitoring of sacred groves in the STR require collaboration between government agencies, conservation organizations, local communities, and other stakeholders. By safeguarding these natural and cultural treasures, we can protect the unique biodiversity and cultural heritage of the region for future generations.

CHAPTER 13

Organization, Administration and Budget

13.1 Tiger Steering Committee -

The Wildlife (Protection) Amendment Act of 2006, Chapter-IVB, Section 38U, established on September 3rd, 2006, outlines the formation of a st3eering committee by State Governments. This committee's primary objective is to ensure the coordinated monitoring, protection, and conservation of tigers, their co-predators, and prey animals within states where tigers inhabit. The committee is chaired by the Chief Minister of the respective state, with the Vice-chairperson position held by the Minister for Forests. Additionally, the Chief Wildlife Warden serves as the ex-officio member-secretary of the committee.

Table No.13.1: Following are the members of Steering Committee for Maharashtra State

Sr.No.	Name	Remarks
1	The Chief Minister	Chairperson
2	The Minister in-charge of Wild Life	Vice-Chairperson
3	such number of official members not exceeding five including at least two Field Directors of tiger reserve or Director of National Park and one from the State Government's Departments dealing with tribal affairs	Member
4	Three experts or professionals having qualifications and experience in conservation of wild life of which at least one shall be from the field of tribal development	Member
5	Two members from the State's Tribal Advisory Council	Member
6	One representative each from State Government's Departments dealing with Panchayati Raj and Social Justice and Empowerment	Member
7	Chief Wildlife Warden of the State is the Member	Secretary, ex officio

The Steering Committee for Maharashtra State has been constituted, vide GR No. WLP-10-06/CN.296/F-1 dated 13.08.2008 under the Chief Minister (Annexure 13.1). Recently, the Steering Committee has been reconstituted vide GR No. WLP-10-06/C.N.296/ (Part-1)/F-1 dated 7th Feb. 2013.

13.2 Tiger Conservation Foundation

13.2.1 Introduction:

The Wildlife (Protection) Amendment Act of 2006, No. 39 of 2006, dated September 3rd, 2006, in Chapter-IVB, Section 38X, introduces the provision for establishing Tiger Conservation Foundations

within states to oversee the management of Tiger Reserves. These foundations are tasked with supporting conservation efforts for tigers and biodiversity, as well as spearheading eco-development initiatives involving local communities.

In line with this, the Government of Maharashtra approved the establishment of the STR Conservation Foundation through GR No. WLP-10-11/CR-260/F-1 on November 8th, 2011. Subsequently, the Sahyadri Tiger Reserve Conservation Foundation was formally registered under the Mumbai Public Trust Act, 1950, as a public trust, with registration number E-2643 dated May 4th, 2012.

The Foundation's Rules & Regulations have been duly approved, and its operational account has been set up to collect revenue generated from eco-tourism activities. These funds are earmarked for conservation and eco-development initiatives within the Tiger Reserve.

13.2.2 Aims & Objectives of the Foundation:

The Tiger Conservation Foundation shall, inter alia, have the following objectives:-

(a) To facilitate ecological, economic, social and cultural development in the tiger reserve and adjoining landscape;
(b) To provide support to safeguard the natural environment in the tiger reserve and relevant places in the adjoining areas;
(c) To support eco-development, eco-tourism, research, environmental education, training, management in related fields to support the implementing agency;
(d) To facilitate creation and maintenance of such assets, as deemed necessary;
(e) To solicit technical, financial, social and other supports from diverse sources in conformity with the law; and
(f) Anything incidental or ancillary to the above mentioned objectives.

13.2.3 Some important events regarding the Foundation:

1. NTCA accorded in-principle approval to STR, vide their letters no. 15-01/2007-NTCA,(Part) Dated the 21st August 2008 and 15-15/2008- NTCA Dated 5 January 2009.
2. Government of Maharashtra accorded their in-principle approval to STR vides their Notification No. WLP. 1008/Letter No.232/F.1 dated 5th January 2010.
3. Government of Maharashtra accorded its approval for STR Conservation Foundation Vide GR No. WLP-10-11/CR-260/F-1 dated 8 November 2011.

4. The Deputy Charity Commissioner, Kolhapur issued the Certificate of Registration of the Foundation bearing No. E-2643/FS dated 04/05/2012.
5. Saving bank account has been opened for the deposits with the Bank of Baroda, Shivaji Chauk Branch, Kolhapur bearing account No.04340100027940 and Bank of Maharashtra , Rajarampuri , Sector 8 Branch, Kolhapur bearing account number 60211898756 for financial transactions of the foundation. To deposit revenue generated from tourism separate bank account at Bank of Baroda, Shivaji Chauk branch, Kolhapur bearing an account number 04340200001570. Revenue Statement of the annual budget of STR is shown in Chapter No.13 – 13.5

13.3: Co-ordination with line agencies:

Effective coordination with various agencies and departments is essential for the efficient management of conservation efforts. Here's how collaboration with specific entities can enhance management:

1. **Revenue Department**: Collaboration with the Revenue Department is crucial for tasks such as village rehabilitation and maintaining law and order. The District Collector serves as the head, and the respective Deputy Conservator of Forest of Territorial Division plays a pivotal role as the nodal officer. Their assistance is vital in mobilizing resources and coordinating efforts. During rehabilitation, coordination with departments like Land Records, Public Works Department (P.W.D.), Maharashtra State Electricity Distribution Company Limited (MSEDCL), Irrigation Department, Rural Development, Health, Education, and Town Planning is imperative.

2. **Zilla Parishad**: Coordination with Zilla Parishad is vital as they undertake numerous village development activities. Z.P. oversees tasks such as providing bio-gas facilities, vaccination programs, and improving healthcare services. Additionally, Z.P. implements employment generation initiatives like sericulture (Tassar Silk), horticulture, bee-keeping, fisheries, poultry farming, bamboo cultivation, and dairy farming in EDC villages. Other activities such as stall feeding, water harvesting structures, and soil and moisture conservation works are also under the purview of Zilla Parishad.

3. **Police Department**: Collaboration with the Police Department is essential for the protection of forests and wildlife. Coordination is particularly necessary with the District Tiger Cells of Satara, Sangli, Kolhapur, and Ratnagiri. These cells, led by the Superintendent of Police, convene monthly to discuss relevant issues. References to Government Resolutions (GR) such as WLP. 10-2000/C.N. 10/ F-1 dated August 1, 2003, and another GR with the same number dated November 7, 2000, highlight the establishment and importance of District Tiger Cells in facilitating coordination between the Revenue and Forest Departments.

Table No.13.2: Structure of District Tiger Cell

Sr.No.	Name	Remark
1	Superintendent of Police	President
2	Deputy Conservator of Forest (Territorial Division)	Add-President
3	Divisional Forest Officer, Vigilance	Member Secretary
4	Deputy Conservator of Forest, Wildlife	Member
5	Police Inspector, Local Crime Branch	Member
6	Executive Engineer, MSCEB	Member
7	Honorary Wildlife Warden	Member
8	Superintendent of Police , Railway	Static/Guest

4. **Animal Husbandry Department**: Working in tandem with the Animal Husbandry department is essential for vaccinating cattle in both interior and fringe villages. Additionally, in cases of animal deaths due to offenses, unknown causes, sickness, epidemics, or transmitted diseases, conducting post-mortems to determine the cause of death is necessary. The assistance of the Livestock Development Officer is invaluable in such instances.

5. **Forest Department**: Coordination with neighboring territorial divisions of the Forest Department, including DyCF Satara, DyCF Sangali, DyCF Kolhapur, DFO Chiplun, and DCF Thane, is vital for village rehabilitation and conducting joint patrols in fringe and sensitive areas. Moreover, cooperation with tiger-bearing area divisions such as Kolhapur (WL), Kolhapur (T), and Sawatwadi (T) is essential for effective management.

6. **Irrigation Department**: The Sahyadri Tiger Reserve encompasses the catchment areas of two dams in western Maharashtra, namely Koyna (Shivsagar) and Chandoli (Vasantsagar) reservoirs. Therefore, collaboration with the Irrigation Department is necessary for the protection and management of habitats within these areas. Coordination ensures the preservation of habitats and the sustainable management of water resources for the benefit of the reserve's biodiversity.

13.4 Staff Deployment

Currently, the Sahyadri Tiger Reserve (STR) comprises a workforce of 94 Forest Guards, 30 Foresters, 9 Range Forest Officers, 05 Assistant Conservators of Forest, 01 Divisional Forest Officer (DD), 01 Deputy Conservator of Forest (DD), and 01 Conservator of Forest and Field Director. Supporting this core team are administrative staff including 01 Head Clerk, 01 Stenographer, 06 Accountants, 16 Clerks, 10 Permanent Labours, 3 Drivers, 1 Launch Tandel, 1 Launch Driver, 2 Peons, 1 Naek, 4 Surveyors (with an additional surveyor), 1 Ranger Surveyor, and 1 Sectional Engineer.

According to Government Resolution (GR) WLP-2012/L.N.-240/F-1 dated August 21, 2012, unified control has been sanctioned by the state government. A proposal for the reorganization of the tiger reserve has been submitted to the Principal Chief Conservator of Forest (HoFF), Maharashtra State, Nagpur.

The current allocation of beats stands at 75 for an area of 1165.57 square kilometers, resulting in an approximate area of 15.54 square kilometers per beat. This falls significantly short of the accepted norm of 7.5 square kilometers for Protected Areas, as per State Government Resolution No. TRS 06/2001/219/F-6 dated May 8, 2003.

Additional posts are deemed necessary to fulfil specific management requirements such as those for Buffer Zones, Eco-tourism, Veterinary services, Livelihood Generation activities, Eco-development programs, Nature Interpretation & Research, and Nature Education purposes. Special interaction meetings with local communities and their representatives are essential for effective Buffer and Eco-tourism management.

Following Project Tiger guidelines (GOI), the Sahyadri Tiger Reserve is to be organized based on a Core-Buffer strategy. A proposal for reorganization has been submitted, suggesting the formation of two units, namely Koyna and Chandoli, each with its own core and surrounding buffer zone. These units will be overseen by separate Deputy Directors, who will also act as Drawing and Disbursing Officers (DDOs) for their respective conservation units. Detailed proposals for reorganization, including new ranges and beats, are outlined in Annexures 36 to 39 , and corresponding maps in No.170 and 172

As per the reorganization proposal, 3 new ranges and 19 new beats are recommended. Round Officers, Forest Guards, and additional office staff are to be compensated from the territorial division of the Kolhapur circle. Furthermore, existing posts such as RFO (Wildlife) Karad, RFO Western Ghat Development Kolhapur, and RFO SFD, Social Forestry Higoli DIvision will be converted into RFO Patan, RFO Amba, and RFO Kandat respectively.

To facilitate research activities, two Ecologists, along with necessary allied staff and a dedicated vehicle, are proposed to be stationed at the Sahyadri Research Facility located at Rasati, Koyna Range.

For veterinary purposes, 1 veterinary officer with headquarters at Karad, along with 2 Assistants and 1 Peon, will monitor both buffer and core areas for wildlife health monitoring, vaccination programs, domestic dog birth control measures, fodder development, prey augmentation, and tiger translocation efforts.

Additionally, a contractual post for technical works is deemed necessary as detailed in chapter no. 8.

13.4.1 Amenities to the staff:

In the vast expanses of forest and wildlife areas, where conservation efforts intersect with the challenges of remote locations and rugged terrain, the frontline staff emerges as the backbone of preservation and protection. These dedicated individuals, ranging from forest guards to range officers, form the first line of defense against threats to biodiversity and habitat degradation. However, their work environment often presents numerous hardships, including isolation, harsh weather conditions, and limited access to basic amenities.

As stewards of our natural heritage, it is imperative to recognize the critical role played by these frontline warriors and address their needs for adequate amenities. Providing suitable infrastructure and facilities is not merely a matter of comfort; it is a strategic investment in enhancing operational efficiency, morale, and ultimately, the effectiveness of conservation efforts.

In this context, this document delves into the pressing need for amenities tailored to the requirements of field staff operating in forest and wildlife areas. It explores the challenges they face, the specific amenities required to support their work, and the potential benefits of addressing these needs. By prioritizing the well-being and working conditions of frontline staff, we lay a foundation for strengthened conservation outcomes and sustainable management of our precious natural resources.

13.4.1.1 Buildings: Several buildings for staffs need to be built for existing and newly created ranges and existing ones currently needs special repairs and maintenance also.

i. Office Buildings: As per the proposed reorganization need of the Office building for newly formed ranges viz. Kandat, Patan and Amba at their respective headquarters. As per previous ranges concern there is need of office building also where there is no office building. Construction of new building for office

of Conservator of Forest and filed director is ongoing. There are sufficient office buildings to all officers of DD Koyna. Still new office building for DD Chandoli + ACF Dhebewad + ACF Chandoli (Currently holding the office in officers quarter building) and ACF Bamnoli needs to be constructed. Building For foresters in-charge of round is required at their head-quarter as presently they have no office building as such.

ii. Staff Quarters: Residential quarters of the frontline staff are required to be built taking into account educational and medical facilities. At present, there are very few staff quarters. But these are not adequate considering the present and required staff strength. List of existing quarters is as given in Atlas Map. No 124. Presently the field staff of sahyadri Tiger Reserve is posted at Head Quarters in interior forests where there are no school and medical facilities. The families of the staff are to be kept at a faraway place for schooling (HQs like Koyna, Bamnoli, Kandat, Helwak, Dhebewadi, Chandoli, Amba, Patan etc.). It is proposed to construct a family hostel/accommodation at Satara, Karad, Mandur, Shirala and Khed as these places are very near to tiger reserve and children of staff get better facilities for education. The existing buildings (Atlas Map.No.124) are not sufficient to house the staff and new buildings at Rasati, Bamnoli, Khed, Mandur, Amba, Dhebewadi, Helwak are proposed as per requirement. Quarters for RFOs, ACF's, Deputy Director and ministerial staff is required at Karad and Satara. Quarters for ACF and ministerial staff of FD office is required at Kolhapur.

iii. Protection Camps : Existing Protection Huts shall be strengthened by providing facilities of mesh wire fencing, toilet blocks, solar electrification, wireless communication, source of clean water with a year round supply of water where ever possible. Existing and proposed protection camps in STR are given in Atlas Map No.125

iv. Ministerial Staff – For the ministerial staff, besides project allowance, provisions like roomy and pleasant working atmosphere (fans, drinking water, toilet and cleanliness) for them needs to be provided. Also, providing the office equipment like computers/ printers/ stationery with necessary annual maintenance arrangement for better function. v. Frontline Staff - As the security, monitoring and interaction with the local people and also as the image of STR is dependent mainly on the frontline staff. Considering their working in the difficult conditions, the following amenities and incentives have been proposed to be provided to them besides TR allowance. • Providing good quality protection camps with the essential amenities of a toilet, solar lighting/ charging, ration box and grocery, drinking water, first aid box, field shoes, raincoats, sleeping bags, sweaters and communication facilities. • Good wireless communication network. • Providing at least 2 laborers for each protection camp on a shift basis to facilitate for the regular day and night patrolling. • Addition allowances based on MSTrIPES patrolling and outstanding works. vi. RFOs and above - • Providing a suitable vehicle with a regular driver, a laptop and a PDA to each officer. •

Personal attendant (a daily wager) for emergency needs in view of their heavy touring away from the Head Quarters.

vii. Daily wage laborers – • Insurance coverage of Rs.10 lakhs each through postal insurance scheme. • Providing those sufficient facilities at APC for a comfortable stay. • Providing personal kit like raincoat, T-shirt, shoes, water bags, bag pack, torch, walky-talky etc.

13.4.2 Rewards and Incentives: STR management has already a fair system of rewards and incentives to encourage the performance of the frontline staff and officers. It should be continued in future also. Such rewards and incentives may include commendation, speedy promotion, opportunities for special training and cash remuneration etc. Funds from the STR Conservation Foundation or from any special trust can be utilized for this purpose every year. Selection should be done on fair and transparent criteria and through special committee organize for this purpose.

13.5 Fund Raising Strategies:

The funding for proposed initiatives within the Sahyadri Tiger Reserve (STR) primarily stems from multiple sources, ensuring a diversified financial base to support conservation efforts. The Centrally Sponsored Scheme serves as a significant contributor, supplemented by funds generated from interest on deposits from the tiger conservation foundation and the Compensatory Afforestation Fund Management and Planning Authority (CAMPA). Additionally, resources from various State Level Schemes and the Eco-Tourism Development Scheme are tapped into. Gate entry revenue and income from tourist activities are channeled into the STR Conservation Foundation, alongside donations from Non-Governmental Organizations and Corporate Social Responsibility (CSR) initiatives facilitated through the Foundation.

However, it is essential to acknowledge that the funds received often fall short of the requirements and lack consistency in their availability. This inconsistency poses challenges to the effective execution of conservation strategies and the fulfilment of commitments. Therefore, there is an urgent need for funding to be reliable, timely, and sustained to ensure uninterrupted progress.

Additional funding sources include allocations from the District Planning Committee, Tourism funds at the State Sector level, CAMPA funds, and resources from the Finance Commission. Adhering to the Project Tiger guidelines, the STR operates on a Core-Buffer strategy, with separate complements of field staff and Deputy Directors assigned to each unit. These officials also serve as Drawing & Disbursing Officers (DDOs) for their respective conservation units, facilitating efficient financial management.

Recognizing that Sectored Integration is pivotal in Buffer Zone Management, allocations from various sectors complement Project Tiger funding, thus warranting their continuity and integration into the overall funding framework. By ensuring a stable and diverse funding base, the STR can effectively implement its conservation objectives and sustainably manage its ecosystem.

13.6 Schedule of Operations:

Each management practice and intervention within the Sahyadri Tiger Reserve (STR) necessitates timely and periodic implementation to ensure the effective conservation of its diverse ecosystem. An indicative schedule outlining the various activities and interventions is provided in Annexure 13.6. The schedule of operations for specific works is detailed in the following appendices:

1. **Proposed Soil and Moisture Conservation Work:** This includes measures aimed at preserving soil integrity and maintaining moisture levels within the reserve's ecosystem.

2. **1/5 Boundary Demarcation:** The delineation of boundaries, crucial for defining the extent of the reserve and preventing encroachment or unauthorized activities.

3. **Proposed Protection Roads and Patrolling Routes:** Development of roads and designated routes for patrolling purposes to enhance surveillance and protection of wildlife habitats.

4. **Proposed Works for Creation and Maintenance of Water Sources:** Initiatives focused on creating and maintaining water sources to ensure adequate hydration for wildlife and vegetation.

5. **Proposed Meadow Development and Maintenance:** Efforts aimed at developing and sustaining meadows within forested areas, vital for biodiversity and ecosystem health.

6. **Proposed Meadow Development in Evicted Villages:** Plans for the development of meadows in areas previously occupied by villages, facilitating habitat restoration and ecological balance.

7. **Proposed Weed Eradication:** Strategies for the eradication of invasive plant species that pose a threat to native flora and fauna.

8. **Proposed Buildings for Offices and Staff Quarters/Colonies:** Construction plans for office buildings and residential quarters to accommodate staff members involved in conservation efforts.

9. **Proposed Anti-Poaching Camps, Checkpoints, and UMB (Unmanned Barrier):**

Establishment of camps, checkpoints, and unmanned aerial vehicle bases to bolster anti-poaching measures and enhance surveillance capabilities.

By adhering to the outlined schedules and implementing these interventions effectively, the STR can safeguard its natural resources and maintain ecological balance for the benefit of present and future generations.

13.7 Activity Budget:

The necessity of an activity budget for wildlife and tiger reserve areas is paramount in ensuring effective conservation management and sustainable development. Here's why:

1. **Resource Allocation**: An activity budget provides a systematic allocation of financial resources to various conservation activities such as habitat restoration, anti-poaching measures, wildlife monitoring, and community engagement programs. This ensures that funds are distributed efficiently based on the priority needs of the reserve.

2. **Prioritization of Activities**: With limited financial resources available, an activity budget helps prioritize conservation efforts based on their urgency and importance. It allows reserve managers to identify key areas where investment is most needed, thereby maximizing the impact of available funds.

3. **Cost Estimation**: By detailing the costs associated with each conservation activity, an activity budget provides a clear understanding of the financial requirements for implementing specific initiatives. This enables accurate cost estimation and helps prevent budget overruns or shortfalls.

4. **Monitoring and Evaluation**: An activity budget serves as a monitoring and evaluation tool, allowing reserve managers to track expenditure against planned activities. It facilitates accountability and transparency in financial management, ensuring that funds are utilized effectively and in line with conservation objectives.

5. **Long-term Planning**: Developing an activity budget encourages long-term planning for wildlife and tiger reserve areas. It enables reserve managers to forecast financial needs over multiple years, facilitating strategic decision-making and ensuring continuity in conservation efforts.

6. **Stakeholder Engagement**: An activity budget can be used as a communication tool to engage stakeholders, including government agencies, NGOs, local communities, and donors. It provides clarity on how funds are being utilized and encourages collaboration and support for conservation initiatives.

Statement of the annual budget of STR is shown in Chapter No.13 – 13.5 STR Management has to undertake a wide range of management practices/ activities in the tiger reserve throughout the year. These activities/ interventions have to be approved based on the APO submitted to the State Government. The budget for implementation of the Tiger Conservation Plan comes from following sources. 1. Government of India Centrally Sponsored Scheme Project Tiger from NTCA. 2. State Government Plan Scheme like Eco-Development, Protection, Building construction, Soil and moisture conservation, Finance Commission, CAMPA (State and Central) etc. 3. State Government Non-Plan Funds. 4. Interest on deposit of Sahyadri Tiger Conservation Foundation

The annual budget of the Sahyadri Tiger Reserve (STR) is detailed in Chapter No.13 – 13.5 providing a comprehensive overview of the financial resources allocated for conservation activities. Given the diverse range of management practices and interventions required within the tiger reserve throughout the year, it is imperative to secure funding from various sources. These activities and interventions are approved based on the Annual Plan of Operations (APO) submitted to the State Government.

The budget for implementing the Tiger Conservation Plan is sourced from the following channels:

1. Government of India Centrally Sponsored Scheme Project Tiger from NTCA: Funding from the National Tiger Conservation Authority (NTCA) under the Government of India's Centrally Sponsored Scheme Project Tiger forms a significant portion of the budget. This support enables the implementation of key conservation initiatives outlined in the Tiger Conservation Plan.

2. State Government Plan Schemes and District Planning Committee: Various State Government plan schemes, such as Eco-Development, Protection, Building construction, Soil and moisture conservation, Finance Commission, and CAMPA (State and Central), contribute towards the implementation of the conservation plan. These schemes provide essential financial support for a range of activities aimed at protecting and preserving the tiger reserve's biodiversity and ecosystem.

3. State Government Non-Plan Funds: Additional funding from State Government Non-Plan Funds supplements the budget for conservation efforts. These funds are essential for meeting operational expenses, infrastructure development, and other essential activities within the tiger reserve.

4. **Interest on Deposit of Sahyadri Tiger Conservation Foundation**: The interest accrued on deposits made by the Sahyadri Tiger Conservation Foundation serves as another source of funding for the Tiger Conservation Plan. This revenue stream provides sustained financial support for conservation initiatives and helps address the ongoing needs of the tiger reserve.

In essence, an activity budget for wildlife and tiger reserve areas is essential for efficient resource management, effective conservation planning, and the sustainable development of these critical ecosystems. By leveraging these diverse funding sources, the Sahyadri Tiger Reserve can effectively implement its Tiger Conservation Plan and fulfil its mandate of protecting and conserving the rich biodiversity of the region

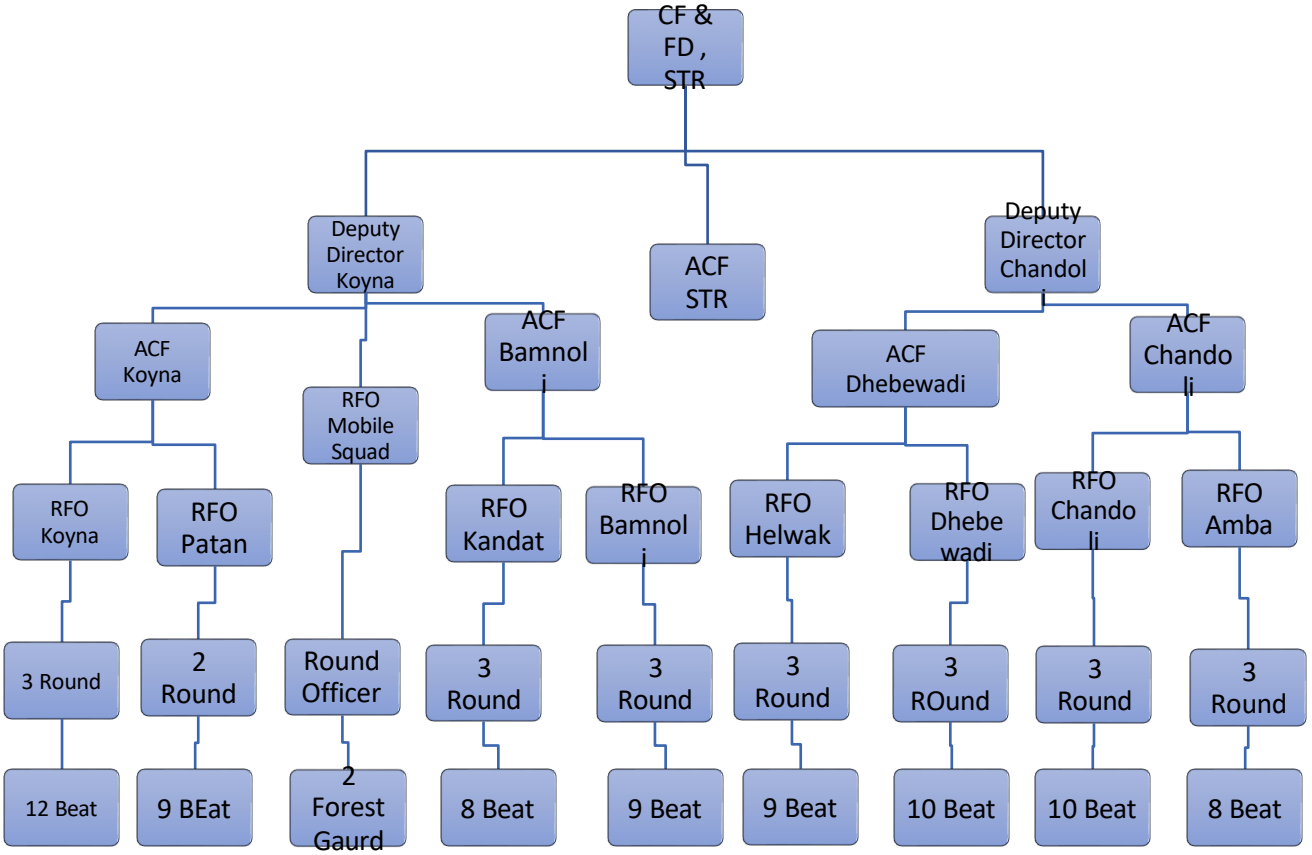

Fig No.13.1: Organizational Structure of STR

CHAPTER 14

MONITORING AND EVALUATION

Monitoring and evaluation are integral components of any conservation plan, providing essential feedback for continuous improvement and effective management. The Sahyadri Tiger Reserve's monitoring and evaluation criteria are crucial for assessing the progress and impact of proposed activities.

By systematically monitoring and evaluating conservation activities-based criteria fixed by NTCA and State Government, the Sahyadri Tiger Reserve can assess its progress, identify areas for improvement, and adapt management strategies to achieve its conservation objectives effectively. This iterative process of monitoring and evaluation is essential for promoting transparency, accountability, and continuous learning in conservation management. The following criteria are prescribed for monitoring and evaluation of the activities proposed in this Plan: -

14.1 Criteria:

Tiger Conservation Plan for STR is planned for 10 years, starting for 2023-24 to 2032-33. There shall be provision for mid-term evaluation after 5th year to set right if any changes required in the prescription as per the field results. Monitoring and evaluation are now recognized as an important tool for managing conservation programs and the STR management ensures to undertake it for facilitating the decision making and accountability to measure and assess appropriateness, effectiveness and efficiency of conservation initiatives and actions.

Monitoring and evaluation can identify the exact direction of a management initiative, the course it takes to reach there and the appropriateness of this direction using resources in the most cost-effective manner. In short, effective monitoring and evaluation ensure that these initiatives are delivering the desired outcomes and the PA management is achieving the intended results. The criteria for monitoring and evaluation are of 2 types.

1) Physical criteria

2) Qualitative criteria

The physical criteria consist of completion of physical activity of any work e.g. Creation of a meadow or a water source. However, the durability of the meadow or the retention of water in the water source and use of the meadow by an herbivore or the use of water source by wild animals is the qualitative criteria. The physical criteria are thus a mechanical activity while the qualitative criteria need a close observation for over a time period.

So, the physical evaluation of all works carried out by respective ACF's in CF and FD Office in a

financial year and should be completed in May/June of next year and submit a report to DD and FD. The qualitative evaluation should be started from next year of completion of physical evaluation and should be carried out continuously for two to 5 years (Observation period depends on the type of works or management activity e.g. weed eradication area and meadow areas should be monitored regularly every year without fail). This will be the responsibility of the Field Director to complete physical and qualitative evaluation of each and every work in the given time frame.

Criteria conducted by WII-

The assessment of monitoring and evaluation of ongoing works has been formalized by Wildlife Institute of India (WII), Dehradun. For STR, Monitoring Effectiveness Evaluation (MEE) will be done by the NTCA team. The STR management should keep this as a guideline and can have a self-assessment every year after works done.

14.2 Process:

The control forms for the different activities for the process of monitoring and evaluation of the work. The control forms are for the following activities.

1) 1/5 boundary demarcation.
2) Fire protection.
3) Water sources and their distribution.
4) Habitat improvement.
5) Animal diseases.
6) Soil and moisture conservation.
7) Illicit cutting.
8) Crop damage.
9) Eco-development works.
10) Animal count (Census): Phase-I and Phase- IV

Control forms will be prepared in three sets and two sets will be sent to Additional Chief Conservator of Forests (Wildlife) West, Mumbai up to 30th September each year for onward submission to the Chief Wildlife Warden & Principal Chief Conservator of Forests (WL) Maharashtra State, Nagpur.

Compartment histories shall also be maintained in the forms given as Range Forest Officer shall complete the compartment history in two copies and after the scrutiny by Assistant Conservator of Forests, same shall be submitted to Field Director, through DFO/DD concerned. One copy of this will be returned to the Range Forest Officer for information and necessarily follow up action.

14.3 Self Evaluation Process using NTCA Evaluation method (Internal MEE)

NTCA has formulated certain procedure and forms to assess and evaluate any Tiger Reserve. The procedure is called as Assessment of Management Effectiveness Evaluation (MEE). This assessment and its formats are in Table No.14.1 and 14.2 . Considering it as a baseline the further self-evaluations and assessments as given below. It will facilitate the managers in all cadres to know where they are and what is to be done.

No separate infrastructure is recommended. Every year in April 4th week this exercise shall be carried out in 4 phases.

Phase-1: In 4th Week of April - Assessment by Range Officers for their ranges in comparison to the previous year and comparison to MEE assessment.

Phase-2: In the 1st Week of May – Scrutiny with reasons by ACFs for their ranges of reports submitted by the RFOs and compilation for their jurisdictions.

Phase-3: In the 2nd Week of May – Scrutiny with reasons by DD/DFO s submitted by the ACFs and compilation for their jurisdictions.

Phase-4: At the End of May – Scrutiny with reasons by the Field Director submitted by the DD/DFOs and Suggestions & Guidance to the DD/DFOs and one copy submit to APCCF (Wildlife) and PCCF (Wildlife), MS.

14.4 Management Effectiveness Evaluation for STR

The four yearly 'Management Effectiveness Evaluation' (MEE) of the tiger reserves in India was initiated by the National Tiger Conservation Authority in collaboration with Wildlife Institute of India in 2005-06. It is being done every 4 years through independent experts.

In 2014, the National Tiger Conservation Authority (NTCA) recommended that annual evaluations of conservation efforts should be conducted by the respective state forest departments. Subsequently, in accordance with decisions made by the Government of Maharashtra during the 2015-16 period, detailed instructions were issued by the Chief Wildlife Warden of Maharashtra state. These instructions outlined the process for conducting evaluations at the tiger reserve level "internally" for the initial year. This internal evaluation would be followed by an independent evaluation at the state level. This structured approach ensures that conservation efforts are regularly assessed and allows for both self-assessment at the tiger reserve level and external evaluation at the state level, promoting accountability and facilitating improvements in tiger conservation strategies over time.

In 2021, the Sahyadri Tiger Reserve (STR) conducted an Internal Evaluation. This evaluation involved a third-party team comprising experienced wildlife experts and retired forest officers, including

Shri. Ajay Pillariseth (Retd. DFO), Dr. Anish Andheria (Wildlife Conservation Trust, Mumbai), and Dr. Vinayak Patil (Assistant Professor, College of Forestry, Dapoli). Internal MEE is carried out in month of February, 2021. During this field exercise many people have interacted and several places were visited. Stakeholders like villagers, guides, gipsy drivers, resort owners and tour operators, eco-tourists, EDC members, staff, researchers, NGOs etc. were also consulted wherever possible. The report from this Internal MEE was utilized to develop an action plan for focused management of the Tiger Reserve. Efforts were made to implement this action plan before the next scheduled MEE by the NTCA in 2022, which marks the fifth cycle of evaluations. Internal MEE report is submitted to CWLW and NTCA. This exercise later followed by all other tiger reserves in Maharashtra on instruction of CWLW. The report of Internal MEE-2021 is available on the STR website.

This internal evaluation exercise proved to be very helpful during NTCA-level MEE in the year 2022 and STR could get the "Very Good" category first time in last four cycles. Overall Rank is also improved from 35th rank in MEE- 2018 to 27th MEE-2022 among all 51 tiger reserves of country. The report is available on the NTCA website. Following graphical representation shows the improvement in MEE-TR ranking of STR due to consistent and focused efforts of STR administration and its stakeholders.

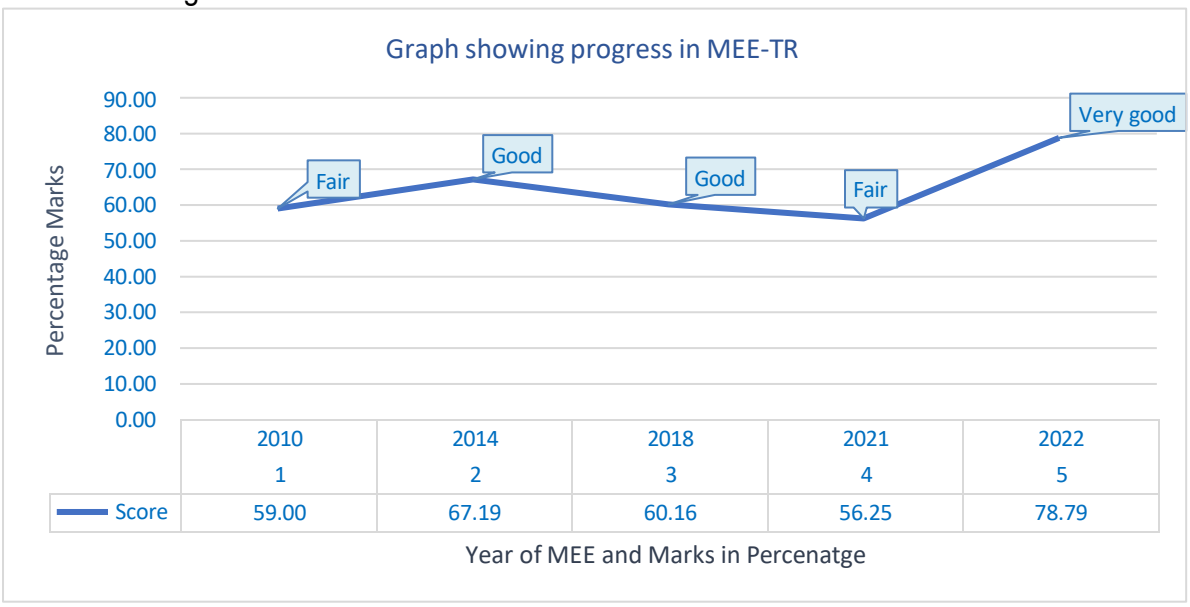

Fig No.14.1: MEE- 2021 is given in above graph is done as 'Internal MEE' carried out by STR and NTCA has carried out MEE in the year 2010. 2014, 2018 and 2022 .

14.5: NTCA-WII level MEE:

The MEE exercise, adopted from International Union for Conservation of Nature and Natural Resources' (IUCN's) World Commission on Protected Areas framework, has emerged as the most

significant approach to help and enhance the management perspectives of Tiger Reserves and their associated landscape connectivity. This framework includes consideration of design issues, the adequacy and appropriateness of management systems and processes and the delivery of Tiger Reserves objectives including conservation of values.

IUCN's World Commission on Protected Areas (WCPA) provides a framework for assessing the management effectiveness of protected areas through six elements i.e. context, planning, input, process, output and outcomes. It begins with establishing the context of existing values and threats, progresses through planning and allocation of resources (inputs) as a result of management actions (process) and eventually produces goods and services (outputs) that result in impacts or outcomes.

For assessment of each of the six elements of the MEE Framework, 33 criteria (Table 14.1) have been developed for MEE of Tiger Reserves in India. Explanatory notes on 'Criteria', wherever needed, were provided to guide the assessment process. A detailed matrix was developed and included as a part of assessment to make the scoring more objective after assigning differential weightages to different criteria/indicators. Against each 'Criteria' the evaluation team indicated appropriate 'Reference document(s)' and also provided 'Remarks'. The scores by themselves will not help in providing the complete picture unless supported by observations/ remarks that qualify such scores. This is important for the NTCA, the field managers concerned, the future of the tiger and associated species, the local people and ecosystems. Detail criteria is attached as Table No.14.1 and 14.2

Table 14.1: List of 33 criteria/indicators adopted for fifth cycle of MEE of Tiger Reserves 2022

Element	**Indicator Name**
Context	1.1 Are the values of the Tiger Reserves (TR) well documented, assessed and monitored? 1.2 Are the threats to TR values well documented and assessed*? 1.3 Is the 'Core Area' of TR free from human and biotic interference and the "Buffer Area" under unified Control? 1.4 Has the TR complied with the four Statutory+ Requirements (SR) along with Tripartite MoU and three Standard Operation Procedures (SOP)? 1.5 Has the Action Points of Previous MEE been Addressed Substantially?
Planning	2.1 Status of Tiger Conservation Plan (TCP)? 2.2 Does the TR safeguards the threatened biodiversity values? 2.3 Are stakeholders given an opportunity to participate in planning process? 2.4 Are habitat management programs systematically planned, relevant and

	monitored, and contribute effectively to tiger and other endangered species conservation? 1.5 Does the TR has an effective Protection Strategy (PS)* and Security Plan and Security Audit (SA) in place? 2.6 Has the TR been effective in the mitigation of human-wildlife conflicts? 2.7 Is the TR integrated into a wider ecological network/ landscape following the principles of the ecosystem approach? 2.8 Is the TR being consciously managed to prevent carbon loss and to encourage Further carbon capture/ climate change mitigation?
Input	3.1 Are personnel adequate, well organized and deployed with access to adequate resources in the Tiger Reserve (TR)*? 3.2 Are resources (vehicle, equipment, building etc.) adequate, well organized and managed with desired access? 3.3 Are financial resources other than those of the State linked to priority actions and are funds adequate, released timely and utilized? 3.4 Are financial resources from the State linked to priority action and funds adequate, timely released and utilized for the management of Tiger Reserve? 3.5 What level of resources are provided by Donors other than government sources?
Process	4.1 Does the TR have manpower resources trained in wildlife conservation for effective TR management? 4.2 Is TR staff management performance linked to achievement of management objectives? 4.3 Is there effective public participation in TR management+ and does it show in Making a difference? 4.4 Is there a responsive system for handling complaints and comments+ about TR management? 4.5 Does TR management address the livelihood issues+ of resource dependent communities, especially of women? 4.6 Has the TR planned and implemented creation of inviolate zone by means of Voluntary Village Relocation and phasing out of tourism from the Core/ Critical Tiger Habitat (CTH)?
Output	5.1 Is adequate information on TR management publicly available? 5.2 Are visitor services and facilities appropriate and adequate?

	5.3 Are research/ monitoring related trends systematically evaluated and routinely reported and used to improve management? 5.4 Is there a systematic maintenance schedule and funds in place for management of infrastructure/assets?
Outcome	6.1 Are populations of threatened species declining, stable or increasing? 6.2 Is the population of tigers showing a declining, stable or increasing trend? 6.3 Have the threats+ to the TR being reduced/ minimized? Or is there an increase? 6.4 Are the expectations of visitors+ generally met or exceeded? 6.5 Are local communities supportive of TR management?

The scores of all 33 'criteria/indicators' were pooled together for each Tiger Reserves and a percentage rating was calculated for each Tiger Reserve. This interpretation classifies the results into four categories based on the percentage of maximum possible score: 50-59% rated as 'Fair'; 60-74% rated as 'Good'; 75-89% rated as 'Very Good' and >= 90% rated as "Excellent". Slight modification of these categories and the introduction of the category "Excellent" was done in order to accommodate substantial improvement (higher scores viz. >= 90%) made by the Tiger Reserves during 5th cycle of MEE. List of Comparative Score of last 4 MEE and one Internal MEE for STR is given in the following tables:

Table.14.2**:** Statement showing the comparative score of All MEE's of STR is given below:

Management Effectiveness Evaluation (MEE) of Tiger Reserves (TRs) in India							
MEE Audit Score							
Name of Elements	**Criteria No.**	**Details of Criteria**	**Marks**				
			2010	**2014**	**2018**	**2021**	**2022**
1. Context: -	**1.1**	Are the values of the TR well documented, assessed and monitored?	Nil	7.5	5	5	7.5
	1.2	Are the threats to TR values well documented and assessed?	Nil	7.5	5	5	7.5
	1.3	Is the 'Core Area' of TR free from human and biotic interference?	Nil	7.5	5	7.5	7.5

	1.4	Has the TR complied with four Statutory Requirements (SR) along with Tripartite MoU and three Standard Operation Procedures (SOP)?	Nil	10	7.5	7.5	10
	1.5	Is the 'Core' and 'Buffer' of the Tiger Reserve under unified management of Field Director? (Removed in MEE 2022)	Nil	Nil	10	10	Nil
	1.5	Has the actions points of previous MEE been addressed substantially? (Newly added in MEE 2022)	Nil	Nil	Nil	Nil	10
	Total=5	**Total-**		**32.5**	**32.5**	**35**	**42.5**
				40	**50**	**50**	**50**
		%		**81.25**	**65**	**70**	**85**
2. Planning: -	**2.1**	Status of Tiger Conservation Plan (TCP)?	Nil	10	10	7.5	10
	2.2	Does the TR safeguard the threatened biodiversity values?	Nil	5	5	7.5	7.5
	2.3	Are stakeholders given an opportunity to participate in planning process?	Nil	7.5	5	5	7.5
	2.4	Are habitat management program systematically planned, relevant and monitored, and contribute effectively to Tiger and other endangered species conservation?	Nil	5	5	5	7.5
	2.5	Does the TR have an effective Protection Strategy (PS) and Security Plan and Security Audit (SA) in place?	Nil	7.5	7.5	5	7.5
	2.6	Has the TR been effective in mitigation of human-wildlife conflicts?	Nil	7.5	5	7.5	7.5
	2.7	Is the TR integrated into a wider ecological network / landscape following the principles of the ecosystem approach?	Nil	5	5	5	10
	2.8	Is the tiger reserve being consciously managed to prevent carbon loss and to encourage further carbon capture/climate change mitigation (Newly added in MEE 2022)	Nil	Nil	Nil	Nil	7.5
	Total=8	**Total-**		**47.5**	**42.5**	**42.5**	**65**

				70	**70**	**70**	**80**
		%		**67.86**	**60.71**	**60.71**	**81.25**
3. Inputs:-	**3.1**	Are personnel adequate, well organized and deployed with access to adequate resources in the Tiger Reserve (TR)?	Nil	7.5	7.5	2.5	7.5
	3.2	Are resources (vehicle, equipment, building etc.) adequate, well organized and managed with desired access?	Nil	5	5	5	7.5
	3.3	Are financial resources other than those of the State linked to priority actions and are funds adequate, released timely and utilized?	Nil	7.5	7.5	5	7.5
	3.4	Are financial resources from the State linked to priority action and are funds adequate, released timely and utilized?	Nil	7.5	7.5	2.5	7.5
	3.5	What level of resources are provided by donors other than government sources (NGOs)?	Nil	7.5	7.5	5	7.5
	Total=5	**Total-**		**35**	**35**	**20**	**37.5**
				50	**50**	**50**	**50**
		%		**70.00**	**70.00**	**40.00**	**75.00**
4. Process:-	**4.1**	Does the TR have manpower resources trained in wildlife conservation for effective TR management?	Nil	7.5	5	5	10
	4.2	Is TR staff management performance linked to achievement of management objectives?	Nil	5	7.5	5	7.5
	4.3	Is there effective public participation in TR management and does it show in making a difference?	Nil	7.5	7.5	5	7.5
	4.4	Is there a responsive system for handling complaints and comments about TR management?	Nil	7.5	5	5	7.5
	4.5	Does TR management address the livelihood issues of resource dependent communities, especially of women?	Nil	7.5	7.5	7.5	7.5
	4.6	Has the TR planned and implemented creation of inviolate zone by means of the Voluntary 'Village Relocation' and phasing out of tourism from the	Nil	7.5	7.5	7.5	7.5

		Core/Critical Tiger Habitat (CTH)?					
	Total= 6	**Total-**		**42.5**	**40**	**35**	**47.5**
				60	**60**	**60**	**60**
		%		**70.83**	**66.67**	**58.33**	**79.17**
5. Output-	**5.1**	Is adequate information on TR management publicly available?	Nil	5	7.5	2.5	7.5
	5.2	Are visitor services and facilities appropriate and adequate?	Nil	7.5	5	5	7.5
	5.3	Are research/ monitoring related trends systematically evaluated and routinely reported and used to improve management?	Nil	7.5	5	7.5	10
	5.4	Is there a systematic maintenance schedule and funds in place for management of infrastructure/ assets?	Nil	7.5	5	5	7.5
	total = 4	**Total-**		**27.5**	**22.5**	**20**	**32.5**
				40	**40**	**40**	**40**
		%		**68.75**	**56.25**	**50.00**	**81.25**
6. Outcomes:-	6.1	Are populations of threatened species declining, stable or increasing?	Nil	5	2.5	5	7.5
	6.2	Is the population of tigers showing a declining, stable or increasing trend?	Nil	5	2.5	5	5
	6.3	Have the threats to the TR being reduced? Minimized? Or is there an increase?	Nil	7.5	5	7.5	7.5
	6.4	Are the expectations of visitors generally met or exceeded?	Nil	5	5	5	7.5
	6.5	Are local communities supportive of TR management?	Nil	7.5	5	5	7.5
	Total=5	**Total-**		**30**	**20**	**27.5**	**35**
				50	**50**	**50**	**50**
		%		**60.00**	**40.00**	**55.00**	**70.00**
		Grant Total Marks		**215**	**192.5**	**180**	**260**

	Total points= 33	**Total Marks**		**320**	**320**	**320**	**330**
		Percentage	**59.00**	**67.19**	**60.16**	**56.25**	**78.79**
			Fair	**Good**	**Good**	**Fair**	**Very Good**

Table.14.3: Management Weaknesses and Actionable Points identified in last four cycles of MEE i.e. 2010, 2014, 2018 and 2022.

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	• Village Presence and Anthropogenic Pressure: Presence of 15 villages in the Core with additional anthropogenic pressure from surrounding villages, contributing to habitat disturbance. • Mining and Windmills Impact: Mining outside the reserve and the establishment of windmills causing disturbance, pollution, and landscape damage. • Threats to Private Forests (Malki Lands): Felling in Malki lands (private forests), leading to habitat loss and disturbance to wildlife species. • Kumri Cultivation Threat: Kumri cultivation posing a threat to the landscape and ecosystem. • Inadequate Staff Strength and Capacity: Poor staff strength and capacity, requiring urgent augmentation for effective	• Anthropogenic Pressure and Village Presence: Continuous presence of villages in the core area, contributing to persistent habitat disturbance. • Inadequate Staff Strength and Capacity: Ongoing lack of sufficient staff and capacity for effective reserve management. • Resentment and Lack of Awareness: Persistent local resentment, possibly driven by new regulations, coupled with inadequate awareness. • Delayed Core and Buffer Notification: Continued delays in notifying the core and buffer areas, indicating a lack of immediate action. • Fragmented Tiger	• Village Relocation and Anthropogenic Activities: Recognize the success of relocating 32 villages to reduce anthropogenic activities, but continue incentivized voluntary relocations to further minimize human impact and enhance conservation efforts. • Tiger Repopulation Strategies: Expedite the implementation of projects to augment the cheetal population, providing a robust prey base. Focus on strategic locations and expand efforts to encourage transiting tigers to establish residency. • Camera Trap Placement Enhancement: Improve the sampling scale of camera trap deployments, ensuring comprehensive coverage, especially in the western edge of Chandoli National Park and buffer forests between Radhanagri and

	reserve management. Resentment and Lack of Awareness: Resentment towards the reserve, possibly driven by new regulations; lack of awareness about regulations affecting local communities. • Need for Core and Buffer Notification: Delay in notifying the Core and Buffer areas, requiring immediate action. • Village Resettlement Priority: Urgent need to address the resettlement of villages in the core area. • Mitigating Anthropogenic Pressures: Planning and handling anthropogenic pressures from surrounding villages sensitively to gain local support. • Eco-tourism and Livelihood Initiatives: Prioritize awareness building, EDC formation, and involvement of communities in ecotourism and livelihood improvement activities. • Clear Planning for Buffer Areas: Clearly plan the functioning of buffer areas, explain regulations to communities to avoid misunderstandings. • Ecologically Sensitive Area (ESA) Demarcation: Demarcate Ecologically Sensitive Areas around the reserve to contain mining activities.	Movement Corridor: Persistence of fragmentation in the critical tiger habitat connected by a buffer on private lands. • Highway Upgrades and Corridor Threats: Ongoing threats to the critical corridor due to highway upgrades passing through buffer areas. • Inaccessible Terrain and Infrastructure Deficiency: Longstanding issues with inaccessible terrain, loss of local terrain knowledge, and insufficient infrastructure. • Legal Handling Challenges: Continuous challenges in legal handling due to the complex jurisdiction involving multiple administrative units. • Limited Prey Base and Biotic Interference: Sustained issues with a limited prey base, coupled with ongoing biotic interference. • Land Use Demands and Illegal Activities: Persistent challenges with growing demands for land and inadequate regulation of illegal activities. • Administrative Coordination Challenges: Ongoing difficulties in coordination with other departments due to the reserve's spread over four districts.	Chandoli. This enhances habitat use assessments for various species. • Habitat Preservation and Connectivity: Emphasize habitat preservation and connectivity with neighboring reserves. Develop a comprehensive management plan to reduce human impacts, enforce strict anti-poaching measures, and explore alternative livelihoods to enhance conservation. • Population Recovery Planning: Initiate population recovery plans for tigers in collaboration with source populations like Kali Tiger Reserve and corridor forests through Goa. Prioritize reducing human impacts, controlling poaching, and restoring a robust prey base before considering tiger augmentation. • Invasive Species Management: Implement systematic management plans to address the invasion of Ageratum conyzoides, Chromolaena odorata, Mesosphaerum suaveolens, Lantana camara, Mimosa diplotricha, and Xanthium strumarium. Prioritize removal efforts in areas where invasion is potentially in the initial stage. • Corridor Protection and Collaboration: Strengthen collaborations with forest departments of neighbouring states, law enforcement agencies, and relevant authorities to protect and preserve the Sahyadri Tiger Reserve and its connecting corridors. Focus on joint

	• Illegal Activities and Insufficient Infrastructure: Illegal activities like tree felling, inadequate staff, and infrastructure requiring urgent augmentation. • Delayed Notifications and Lack of Awareness Campaign: Need for quick notifications and a comprehensive awareness campaign to counter misinformation and engage local communities effectively. • Higher-Level Planning for Connectivity: Recognizing the need for higher-level planning to ensure connectivity within the conservation landscape spanning four states.	• Threats to Unique Plateau Biodiversity: Continued existence of windmills posing a threat to the ecologically unique plateau. • Uncertain Tiger Population and Hunting Impact: Ongoing uncertainty regarding the resident tiger population, occasional visits reported, and an impact of hunting. • Fragmentation due to Mining and Exotic Plantation: Continued fragmentation of the tiger corridor due to previous mining and the impact of largescale exotic plantation. • Distant Source Population and Unregulated Developments: Persistent challenges with a distant source population, transient tiger visits, and a lack of regulation for developments.	operations, anti-poaching measures, and ensuring overall wildlife safety. • Continuous Monitoring and Research: Invest in continuous monitoring and research initiatives to assess the impact of existing threats, track the effectiveness of implemented mitigation measures, and adapt strategies accordingly. This will contribute to the long-term conservation and sustainability of Sahyadri Tiger Reserve. • Community Engagement and Awareness: Engage local communities in conservation efforts, raise awareness about the importance of tiger reserves, and explore community-based conservation models. This will foster a sense of ownership and support for the protection of Sahyadri Tiger Reserve
2014	• Inaccessible Terrain: Lack of tracks or routes, and loss of local terrain knowledge, making the reserve's terrain inaccessible. • Infrastructure and Facilities Deficiency: Insufficient infrastructure and facilities, especially in terms of equipment and trained staff, hindering effective conservation. • Legal Handling Challenges: Need for a special counsel or legal officer to handle cases in various courts, given the		

	complex jurisdiction involving multiple administrative units. • Limited Prey Base: Pilot studies indicate a limited prey base for carnivores, potentially impacting the predator ecosystem. • Biotic Interference: Poaching, collection of Non-Timber Forest Products (NTFP), firewood gathering, grazing, fires, and road traffic in the buffer area causing biotic interference. • Land use demands: Growing demands for land for windmills, resorts, and roads, reducing suitable habitat for wildlife dispersal. • Infrastructure Improvement: Enhance infrastructure for the protection network, staff housing, and monitoring and communication. • Ecotourism Potential Untapped: Recognize the potential for ecotourism in the UNESCO recognized Western Ghats complex; build community-based ecotourism for improved conservation outcomes. • Voluntary Relocation: Consider voluntary relocation programs for villages within the Tiger Reserve. Incentives for Staff: Provide incentives, such as one-step higher pay and allowances, to Sahyadri staff in difficult and tribal-dominated areas. • Unified Command for Buffer Areas: Transfer buffer areas in different divisions under a unified command to strengthen management. • Additional Staff Deployment: Deploy additional staff, increase their strength, establish a robust communication network, and		

	provide incentives to enhance protection efforts. • Ungulate Species Repopulation: Explore the possibility of repopulating habitats with ungulate species to support ecosystem balance.		
2018	• Uncertain Tiger Presence: Lack of confirmed tiger presence in the reserve despite reported evidence, with unclear reasons for their disappearance. • Inadequate Field Staff Facilities: Field staff unfamiliar with staying in camps, facing inadequate facilities and equipment. Temporary camps in some areas, especially Chandoli, with an ineffective wireless network. • Staff Unaware of SOPs: Frontline staff unaware of Standard Operating Procedures (SOPs) issued by the National Tiger Conservation Authority (NTCA). • Traditional Hunting and Poaching: Ongoing traditional hunting and poaching for bush meat in the area. • Critical Tiger Habitat Disruption: Two separate units of the Critical Tiger Habitat connected by a forested buffer facing incompatible land-use issues, including deforestation for resorts. The national highway upgrade poses a threat to the critical corridor. • Inexperienced Guards: Young and untrained guards not acclimatized to forest life. • Poor Management Integration: Limited management efforts to consolidate the two protected areas constituting the Tiger Reserve, with insufficient internal roads in Koyana		

	Wildlife Sanctuary and deteriorating road conditions in Chandoli National Park. • Inadequate Prey Base: The current prey base in the Tiger Reserve is inadequate to support a viable population of tigers. • Unassessed Impact of Leopard Release: Release of leopards in the Tiger Reserve without a scientific assessment of the impact on the already prey-deficient ecosystem. • Lack of Risk Analysis: Absence of risk analysis, especially related to wildlife crime, for identifying highrisk areas within the reserve		
2022	• Uncertain Tiger Population: Absence of resident tigers; evidence from genetic analysis and sporadic camera traps suggests occasional visits by about eight tigers from Radhanagari WLS to Vishalgad CR. • Hunting and Poaching Impact: Traditional hunting and poaching for meat possibly contribute to low prey density, hindering direct sightings of wild animals. • Inaccessible Terrain: Undulating terrain and a vast water body make the Koyna part of Sahyadri Tiger Reserve challenging for proper surveillance and access to the interior. • Fragmented Tiger Movement Corridor: Two distinct units of the Critical Tiger Habitat connected by a forested buffer, but the corridor is on private lands, leading to potential incompatible land-use. • Highway Upgrades and Corridor Threats: Upgrading of national and regional highways		

	passing through the buffer and corridor areas poses a threat to wildlife movement. • Fragmentation due to Mining: Fragmentation of the tiger movement corridor likely caused by previous bauxite mining in the area. • Exotic Plantation Impact: Largescale plantation of exotic species in Koyna, affecting edge habitats and potentially impacting biodiversity. • Distant Source Population: The source population of tigers is far away; only transient tigers visit, with no settled population. • Unregulated Commercial Developments: Lack of regulation and monitoring for commercial developments in corridor/ connectivity areas. • Administrative Coordination Challenges: Spread over four districts, making coordination with other departments and administrative control challenging. • Threats to Unique Plateau Biodiversity: Existence of windmills on the ecologically unique and sensitive lateritic plateau (Sada) poses a threat to biodiversity and heritage values.		

14.6 : Maintaining the Records of Works Done in Financial Year:

Records of all works done in the respective financial year should be recorded carefully and preserve. These records are very useful for monitoring and evaluation of various works. Following are the registers are needed to be maintained.

1. **Measurement Books**: These books are maintained for recording the measurement of all type of infrastructure and physical structures created and maintained in the financial year. All the measurement should be recorded by RFO himself. And cross-checked by ACF.

2. **Habitat Improvement Registers**: This register should be maintained for recording all the works related to habitat management and improvement activities like weed eradication, meadow development, Linear habitat improvement activities like view line maintenance, Fruit tree plantations etc. It is like plantation register, it includes noting of dates of various activities, year wise observations in changes in the composition of vegetation, the impact of works on habitat, utilization of the same area by wildlife should be noted in the registers regularly.

14.7 The Control forms:

Control forms are standardized in working plans or are found in Forest Manuals applicable to a particular State. Standardized forms are also used to file the annual administrative reports (AAR), while those already in use must continue to be used as pertinent. The record of all the operation carried out according to the prescriptions of this plan will be maintained in the control forms. This plan recommends several forms in addition to tracking the annual progress of strategies i.e. AAR, for evaluation of prescriptions, impacts and problems.

The prescribed pro-forma of control forms is given in Annexure. Three sets of control forms will be prepared by and duly signed by respective Forest Guard, Forester and RFO and two sets will be sent annually to the Deputy Director office, not later than 1st July of each year. Deputy Director will be sent annually, one set of control form and abstract of control forms of division to Field Director Office up to 15th August. Field Director will be sent abstract of whole tiger reserve to APCCF (Wildlife) West, Mumbai Office and PCCF (Wildlife), Maharashtra State, Nagpur office up to 31st August.

14.8 Registers and records including spatial data:

The following updated (till last financial year) **registers and records** will be maintained by the division:

1. Compartment histories
2. Divisional Note Books
3. Fire records and registers
4. Registers of boundary pillars
5. Plantation journals (along with a list of plantations raised area and location)
6. Register of land records (RF, PF, UF etc)/ Form-1 Register
7. Register of rights and concessions
8. Register of grants and funds and expenditure (under various schemes)
9. Register of land transferred to another department or under FC act and FRA
10. Register of soil and water conservation works

11. Register of Grassland management
12. Register of invasive species and its eradication
13. Register of Water hole management
14. Register of Status of Tiger, Co-predator and Prey base
15. Register of all offences
16. Register of offenders/Offender Dossiers
17. Register of Ecotourism
18. Register of eco-development works
19. Register of Man- animal conflicts
20. Register of licensed gun holders
21. Register of Deviation
22. Register of Employment (Generated due to various works in TR)

An annual inspection of Deputy Director Office by Field Director and Range offices by Deputy Director Office mandatory within three months of completion of the financial year to have checks on annual statements in control forms and deviation statements and maintenance of registers and various records.

14.8.1 : Divisional Note Book:

Important events in the division will be recorded in Divisional Notebook by Deputy Director. This will include Habitat improvement works, man-animal conflict incidences, water availability in pinch period, the status of health of the wild animal, fire damages, poaching of wild animals, Waterfowl census, Waterhole census, the Water level in a natural waterhole, Phase-I and Phase-IV results, MSTrIPES target and achievement and any other important event.

14.8.2 Maintenance of Compartment histories:

Maintenance of compartment histories is a standard practice in forest management. A compartment is the smallest unit of management delineated on the ground and recorded on maps. What a manager observes in a given area at a given point in time is just a snapshot of the area attributes and events. Only the compartment histories can throw light on how and why a particular picture has developed.

It is the chronicled history however that provides an insight into changes in resources. The importance of management history is therefore quite obvious in the context of making right decisions whether they relate to the short or the long-term planning.

The system of maintaining compartment histories on an annual basis needs to be revived if it is not in operation. It would involve prescribing the modalities of information gathering, annual

documentation and verification. The office, who writes the TCP, needs to identify and lay down the pertinent staff responsibilities. The value of compartment histories in upgrading management is grossly underplayed. There is no better way of evaluating habitat trends on which important management decisions are based. Information entry and retrieval could be made more efficient by using a computerized system with appropriate software for analysis. Compartment based information can be put on a GIS. However, until such time as these are not developed or that such a system is inaccessible, the currently prescribed approach must prevail.

The compartment history format devised based on forestry considerations has been modified to suit the objectives of wildlife management. It thus has a set of three maps, complemented by the description of various parameters. The maps should be on the same scale as that of a standard beat map viz the old 4 inches to a mile scale (1:15000).

Each compartment will have an annually recorded history. The Forest/ Wildlife guard should be trained to record straightforward and simpler items of inventory. It would be the responsibility of the respective section foresters and range officers to complete the compartment history at the end of each financial year. An officer of the level of an ACF should check at least 30% of the compartment histories at random for their authenticity and the next higher officer should verify likewise at least 10% of the record.

It is not possible to visualize all items of infrastructure, attributes, operations or events. Those which do not find a place in the listing but are considered important should be added. Every effort should be made to trace out the previous record of compartment histories and establish their status. While it will not be possible to bridge the gaps in the record, whatever is available should be kept on permanent record and reviewed for a better understanding of the management history. Compartment histories should be frequently reviewed by Deputy Director to improve management strategies. They would be especially important at the time of the revision of plans.

Although there are several entries in the format, most relate to the existing baseline information. Once this information is posted, new entries on the annual basis would be few at a time. A compartment can have only a few of the attributes listed and the number of events likewise will be limited.

Compartment History Forms i.e. the records of various wildlife management activities and observations made in the past year in all the compartments will be maintained in Compartment History Form No. I to VII.

1. WLM Compartment History Form No. I: Habitat elements and physical infrastructure (topographic map)
2. WLM Compartment History Form No. II: Vegetation & Land use (topographic map)

3. WLM Compartment History Form No. III: Events and management activities (topographic map)
4. WLM Compartment History Form No. IV: Compartment Description
5. WLM Compartment History Form No. V: Physical Infrastructure and Attributes
6. WLM Compartment History Form No. VI: Operations
7. WLM Compartment History Form No. VII: Events & Attributes

Compartment History Form No. I, II and IV have been written for each compartment during the preparation of this plan by Deputy Director. Other records & forms will be prepared & maintained immediately by RFOs. Each compartment will have a separate file for its record. One copy of the compartment history will be kept in the Deputy Director Office and the other in the Range Office. Every year, in July, the Range Forest Officer will fill in the columns in the compartment history forms and submit the same to the Deputy Director Office, who will get them scrutinized by the Assistant Conservator of Forests, who will get them and signed them. One copy of the forms will be filed in the divisional compartment history file of Survey Section and another copy will be returned to the Range Forest Officer and kept in RFO Office.

The copies of annual compartment history files kept in Survey Section of division Office, after completion will be supplied yearly in the month of August to the office of the Field Director, STR office Kolhapur for filling in the compartment history files, maintained in his Office. After making entries in the compartment history files, maintained in the Office of the Field Director, STR, Kolhapur, the same will be returned to the Dy. Directors in the month of September every year.

Each Compartment must have a separate file for its records. Compartment history forms must be maintained & updated every year in time in the Survey Section of office of Deputy Director since they keep the record of past management practices and their effects on the habitat and wildlife.

14.8.3 Record of Deviations and Implemented Targets:

The Plan should provide for the maintenance of a book called the 'Tiger Reserve Book' as the case may be to record deviation proposals, made and approved. This will include annually deferred targets which might be accomplished during the overall plan period. There also might be strategies put off indefinitely for compelling reasons. There might be new strategies not previously included in the plan. All should be recorded. The book should always be placed with the management plan. At the time of revision of the plan, the deviation proposals need to be referred to especially on matters which relate to strategies in the field. Further, a record should be maintained for each category of the strategy proposed and undertaken e.g. fire protection, maintenance of waterholes, control of weeds etc. This should record the physical and financial targets, achievements, operational problems if any etc. This is essential for

evaluating plan performance. The book can be completed as relevant by referring to the prescribed control forms. For this purpose, each range also needs to maintain a 'Range Book'.

14.8.4 Record of Employment Potential:

This should consider all categories posts, regular engagement of persons, those engaged on contractual basis or daily wage basis for each management action under the various strategies. Employment potential needs to be projected in the plan in terms of the number of men per months. The total should be summarized in this chapter in terms of the year round and seasonal employment opportunities, totaling up the potential for the plan period. The implementing officer (RFOs) will maintain his record of actual separately.

14.9 A Pocket Field Guide for Plan Implementation:

The field guide is meant to present the essence of the plan strategy application, complete in all technical details and the regulations concerned for each strategy as might be relevant. It is a field action document meant to be carried by all field or front-line personnel and therefore must be written with the economy to the point.

The field guide must have (i) a preamble to state its purpose and utility (ii) the objectives listed by their priority (iii) the constitution of zones by area (iv) a map of administrative units such as division, range, round, beat superimposed by the zones (v) the all-important section on strategy details and application. The first three do not bear elaboration. The last two are discussed in some detail.

The section on strategy should first deal individually with all zonal strategies, separating each zone for obvious reasons. This should be followed by individual azonal strategies. Each strategy must be complete in all its technical details of execution, the standards it must attain and the regulations that need to be observed. Where monitoring is involved, the aspects relating to its execution must be specified. Where necessary, diagrams may be included.

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