Bhadrak Wildlife Division
Working Plan
2021

PART-II
FUTURE MANAGEMENT

CHAPTER 1

BASIS FOR PROPOSALS

1.1 General objectives of management

In view of the problems of environmental instability and ecological imbalance due to growing population pressure, the Government of India in 1988 had announced the new National Forest Policy. The principal focus of the new policy is on environmental conservation. Derivation of any economic benefit is subordinated to this principal aim. The State Government of Odisha had taken a number of policy initiatives aimed at conservation of forest. Clear felling of natural forest for the purpose of taking up afforestation had been stopped. Felling of green trees from evergreen and semi-evergreen forests was banned from 1990. This was followed by a ban on felling of green trees from any type of natural forests. In a series of Judgments in the last few years, the Hon'ble Supreme Court of India has not only laid emphasis on scientific management of forests but also redefined the term ''forest'' with much broader meaning and scope. The forests are no longer looked upon as merely a revenue regenerating resource but are mainly recognized for their crucial role in ensuring the environmental stability and ecological balance, which are vital for sustenance of all life forms.

In conformity with the above policy guidelines, the main objectives of the working plan for the forests of the division are as follows:

(1) To maintain environmental stability and ecological balance by adopting measures to protect, preserve and enrich the existing natural tree cover in existing PRF, village forests, and social forestry plantations with their flora and fauna.

(2) To apply a system of management that will ensure maximum degree of protection to soil and water, and protect the wildlife in good condition.

(3) To maintain or improve natural and man-made forest with the involvement of local communities.

(4) To protect and manage wildlife resources and their habitat with a view to conserve and to enrich biodiversity.

(5) Consistent with the above objectives, to ensure restoration of mangroves and Casuarina plantations as an effective shelterbelt with the participation of communities living near coastal areas.

(6) To encourage tree planting in the private lands to meet the local demand of forest produce largely from these areas.

(7) Management of TOF with villagers' participation.

(8) To create a massive awareness movement and ensure people's participation and involvement in the all-round protection and development of forests and wildlife of this division.

1.2 Method of treatment

It is proposed to achieve the above objectives by providing the following methods of treatment to this Wildlife Division:

1. This Division is devoid of any Reserved Forests and only one Proposed Reserve Forest is present in this division. As there is very nominal forest cover is found here. The plantations are carried on revenue lands, existing social forestry plantations, road side, canal side, rail side areas and lands under CAMPA. So, the Plantation Working Circle constituted under this Working Plan is an overlapping Working Circle. For plantations suitable areas are identified Range wise and allocated for plantations year wise manner.

2. The mangrove areas in the division will be protected, and more areas will be brought under mangrove vegetation. Local peoples support through Village Forest Committees will be encouraged. All mangrove areas will be sought under some legal protection cover.

3. Joint forest management (JFPM) programmes in the Working Plan will be encouraged by strengthening existing dormant VSSs and EDCs and forming new VSSs/ EDCs for Wildlife management and protection as well as eco restoration.

4. This Division acts as a buffer area for Bhitarkanika National Park and some of its area comes under Eco-sensitive Zone. So, protection and conservation of Salt Water Crocodile (*Crocodylus porosus*) and Olive Ridley Turtles (*Lepidochelys olivacea*) are the main focus of this Wildlife Division. In addition, protection and conservations of elephants will be concentrated in Bhadrak range adjoining Hadagarh sanctuary of Keonjhar WL division. To achieve this, scientific management of their habitat as well as extensive protection work has been prescribed in this Working Plan.

1.3 Constitution of Working Circles

Considering the above mention ground realities, the forests of Bhadrak Wildlife Division will be managed under the following Working Circles and Tree outside Forests:

i. Rehabilitation Working Circle,
ii. Plantation Working Circle,
iii. Protection (Overlapping) Working Circle,
iv. JFM (Overlapping) Working Circle and
v. Wildlife (Overlapping) Working Circle

1.3.1 The distribution/allotment of forest blocks to different Working Circles is shown forest block wise in the following format.

Table1.1:Constitution ofWorking Circles Forest Block Wise

Sl. No.	Name of the Forest Block	Area in Ha.	Area Diverted under FC Act in Ha	Area under this Plan in Ha.	Area allotted to different Working Circles in Ha.				
					Rehabilitation WC	Plantation WC	Protection (O)WC	JFM (O) WC	Wildlife (O) WC
Proposed Reserve Forest (PRF)									
1	Garmal	400.65	105.692	294.958	264.958	30	294.958	163.5	294.958
	Division Total	**400.65**	**105.692**	**294.958**	**264.958**	**30**	**294.958**	**163.5**	**294.958**
Un-demarcated Protected Forests (UDPFs)									
2	Banipahi	2125.51	0	2125.51	2125.51	0	2125.51	1888.21	2125.51
3	Bijayapatana	93.12	0	93.12	0	93.12	93.12	93.12	93.12
4	Bani Jungle	404.69	0	404.69	404.69	0	404.69	404.69	404.69
5	Outer Wheeler	106.53	39.81	66.72	66.72	0	66.72	66.72	66.72
6	Long Wheeler	21.25	2.01	19.24	19.24	0	19.24	19.24	19.24
7	Coconut Island	39.67	26.82	12.85	12.85	0	12.85	12.85	12.85
8	Small Wheeler	4.3	0.4	3.9	3.9	0	3.9	3.9	3.9
9	Short Island	16.9	1.6	15.3	15.3	0	15.3	15.3	15.3
10	Udabali (New)	485.83	0	485.83	485.83	0	485.83	485.83	485.83
	Division Total	**3297.8**	**70.64**	**3227.16**	**3134.04**	**93.12**	**3227.16**	**2989.86**	**3227.16**
Village Forests (VF)									
11	ArjunbindhaSantapur VF	4	0	4	0	4	4	4	4

12	Bhatapada Gudpal VF	1.044	0	1.044	0	1.044	1.044	1.044	1.044
13	Bodakasana VF	10	0	10	0	10	10	10	10
14	Aruha VF	0.536	0	0.536	0	0.536	0.536	0.536	0.536
15	Kamaria VF	1.98	0	1.98	0	1.98	1.98	1.98	1.98
16	Mirzapur VF	0.56	0	0.56	0	0.56	0.56	0.56	0.56
17	Deola VF	5	0	5	0	5	5	5	5
18	Arjunbindha VF	3	0	3	0	3	3	3	3
19	Kabirpur VF	5	0	5	0	5	5	5	5
20	Haripur VF	0.68	0	0.68	0	0.68	0.68	0.68	0.68
21	Babanbindha VF	5	0	5	0	5	5	5	5
22	Amargadia VF	3.68	0	3.68	0	3.68	3.68	3.68	3.68
23	Belnta VF	1	0	1	0	1	1	1	1
24	Dianary VF	1.84	0	1.84	0	1.84	1.84	1.84	1.84
25	Sibapur VF	1.6	0	1.6	0	1.6	1.6	1.6	1.6
26	Bansar VF	0.42	0	0.42	0	0.42	0.42	0.42	0.42
27	Jalahari VF	3	0	3	0	3	3	3	3
28	Chatrubhujapur VF	1.6	0	1.6	0	1.6	1.6	1.6	1.6
29	Goudabisanuapada VF	2.2	0	2.2	0	2.2	2.2	2.2	2.2
30	Belgadia VF	2.8	0	2.8	0	2.8	2.8	2.8	2.8
31	Alboga VF	0.2	0	0.2	0	0.2	0.2	0.2	0.2
	Division Total	**55.14**	**0**	**55.14**	**0**	**55.14**	**55.14**	**55.14**	**55.14**
	Grand Total	**3753.59**	**176.332**	**3577.258**	**3398.998**	**178.26**	**3577.258**	**3208.5(3208.5 Ha of forest area and 530.5 Ha from outside forest)**	**3577.258**

12	Bhatapada Gudpal VF	1.044	0	0	1.044	0	1.044	1.044	1.044	1.044
13	Bodakasana VF	10.00	0	0	10.00	0	10	10.00	10.00	10.00
14	Aruha VF	0.536	0	0	0.536	0	0.536	0.536	0.536	0.536
15	Kamaria VF	1.98	0	0	1.98	0	1.98	1.98	1.98	1.98
16	Mirzapur VF	0.56	0	0	0.56	0	0.56	0.56	0.56	0.56
17	Deola VF	5.0	0	0	5.0	0	5.0	5.0	5.0	5.0
18	Arjunbindha VF	3.0	0	0	3.0	0	3.0	3.0	3.0	3.0
19	Kabirpur VF	5.0	0	0	5.0	0	5.0	5.0	5.0	5.0
20	Haripur VF	0.68	0	0	0.68	0	0.68	0.68	0.68	0.68
21	Babanbindha VF	5.0	0	0	5.0	0	5.0	5.0	5.0	5.0
22	Amargadia VF	3.68	0	0	3.68	0	3.0	3.68	3.68	3.68
23	Belnta VF	1.0	0	0	1.0	0	1.0	1.0	1.0	1.0
24	Dianary VF	1.84	0	0	1.84	0	1.84	1.84	1.84	1.84
25	Sibapur VF	1.6	0	0	1.6	0	1.6	1.6	1.6	1.6
26	Bansar VF	0.42	0	0	0.42	0	0.42	0.42	0.42	0.42
27	Jalahari VF	3.00	0	0	3.0	0	3.0	3.0	3.0	3.0
28	Chatrubhujapur VF	1.6	0	0	1.6	0	1.6	1.6	1.6	1.6
29	Goudabisanuapada VF	2.2	0	0	2.2	0	2.2	2.2	2.2	2.2
30	Belgadia VF	2.8	0	0	2.8	0	2.8	2.8	2.8	2.8
31	Alboga VF	0.2	0	0	0.2	0	0.2	0.2	0.2	0.2
Grand Total :-		**3753.39**	**0**	**176.332**	**3577.258**	**3398.998**	**178.26**	**3577.258**	**3739.0** (3208.5 Ha of forest area and 530.5 Ha from outside forest Area)	**3577.258**

Table no. 1.2 Area allotted to different Working circles (in Ha.)					
Protection Overlapping W.C.	**Rehabilitation W.C.**	**Plantation W.C.**	**JFM O.W.C.**	**Wildlife Management overlapping W.C.**	**Total Working Plan Area**
3577.258 Ha	3398.998 Ha	178.26 Ha	3739.0 Ha	3577.258 Ha	3577.258 Ha

1.4 Period of Working Plan and necessity for intermediate revision

1.4.1 The period of the proposed Working Plan will be for a period of 10 years i.e, from 2020-21 to 2030-31 as prescribed in the National Working Plan Code, 2014. Intermediate revision of the Plan will not be necessary. If necessity arises, the prescriptions outlined in the Plan will be reviewed by the consultative committee under the chairmanship of PCCF with representation from RCCF/ CF (Working Plans). Similarly, based on the performance of the WP prescriptions the plan period may be extended up to 5 years beyond the stipulated plan period by designated authority with the recommendations of the standing consultative committee authorized for this purpose. Deviation, if any, proposed is subject to the approval by the competent authority.

CHAPTER 2

2. REHABILITATION WORKING CIRCLE

2.1. Name of the working circle

The Forest Blocks having natural vegetation with partly degraded due to heavy Biotic pressure, Grazing Pressure and other natural phenomena like Flood, Cyclone, Drought and at present the crop density is less than 40%. There are scattered tree growths which serve the purpose of mother trees and helps in natural regeneration. Establishment of regeneration from seed origin is difficult. The Ground Flora is mostly thorny species, weeds and hinders the establishment of recruits / seedlings from seed origin. This Working Circle i.e., **"Rehabilitation Working Circle"** is constituted covering 3398.998 ha of PRF and UDPFs of the Division.

2.2. General constitution of working circle

The depleted forest blocks having potency to rejuvenate, need immediate ceasing of degradation. The Mangroves in this Division are feared to have decreased considerable and dangerously, due to expansion of cultivation and encroachment in the form of irrational aquaculture practices in the mangrove areas. It is estimated that nearly 35% of the original expanse of mangroves has been lost already. Therefore, areas where canopy density **is less than 40 %** has been included in Rehabilitation Working Circle. Rehabilitation and restoration of mangroves hasbeen practiced for decades. The rationales for rehabilitating or restoring mangroves reflect specific ecosystem services, including creation or maintenance of forest stands for "sustainable" high yields, coastal protection, landscaping, conservation of biodiversity, or because laws require it (e.g., local regulations mandating "No Net Loss" of wetlands following development projects). Broad classes of rehabilitation and restoration methods include: (1) incorporation of mangroves into engineered hard coastal defense structures (2) monoculture plantations and (3) "ecological mangrove restoration" (EMR) approaches, in which the intertidal zone is manipulated (e.g., regraded, dredged, filled) so that biophysical conditions (particularly inundation) are within tolerable limits for mangrove establishment, growth, and reproduction has proposed an additional method, (4) "mangrove ecosystem design," which foregrounds people and their needs, and then uses those needs to define the set of ecosystem services to be included in the project. Subsequent rehabilitation or restoration activities are then focused on meeting those needs and services, given biophysical constraints. For example, in terms of regulating ecosystem services, growth rates and biomass accumulation

tend to be greater in young plantations than in older ones, but recruitment of saplings may increase with plantation age or be completely absent. Rehabilitated mangroves sequester more Carbon than the land-use cover-types they replace. Successful rehabilitation has led to rapid accumulation of biomass Carbon stocks, and over longer time scales can increase soil carbon stocks by 83 to 96 Mg C/ha. Rehabilitated mangroves on previously abandoned and exposed aquaculture ponds emit substantially less CO_2 from their soils than do the abandoned, exposed ponds themselves. Rehabilitated mangroves also provide provisioning ecosystem services that local communities benefit from and appreciate. These include construction materials and fuel wood, non-timber products such as natural dyes, and nursery grounds for molluscs collected for food. Following mangrove rehabilitation, fish catches by artisanal fishers often increase and positive influences on offshore commercial fish catches also have been observed. To regenerate and restore the degraded Mangrove Forest blocks, execution of rehabilitation measures is taken to constitute this Working Circle. Working Plan area assigned to the Rehabilitation Working Circle is 3398.998 Ha of area covering parts and full of 2 nos. of forest blocks i.e., 2 nos. of UDPFs. The Range wise detail is furnished in TableNo.2.1.

Table No. 2.1 Area allotted to Rehabilitation Working Circle

Sl. No.	Forest Block	Range	Total area in Ha	Area under this working circle (ha)	Remarks
1	Banipahi UDPF	Basudevpur WL Range	2125.51	2125.51	ANR plantation.
2	Banijungle UDPF	Basudevpur WL Range	404.69	404.69	ANR plantation.
3	Garmal PRF	Chandbali WL	294.958	264.958	The area comprises of mangrove vegetation. Therefore, the area is to be left undisturbed.
4	Outer Wheeler UDPF	Chandbali WL	66.72	66.72	

5	Long Wheeler UDPF	Chandbali WL	19.24	19.24	The area should be treated only when affected by natural calamities or other factors
6	Coconut Island UDPF	Chandbali WL	12.85	12.85	
7	Small Wheeler UDPF	Chandbali WL	3.90	3.90	
8	ShortIsland UDPF	Chandbali WL	15.30	15.30	
9	Udabali (New) UDPF	Chandbali WL	485.83	485.83	
Total			**3398.998 Ha**		

Table No. 2.2 Abstract of Area Allotted to Rehabilitation Working Circle			
Sl. no	**Name of Range**	**No of Forest Blocks**	**Area allotted in Ha**
1	Basudevpur WL Range	2	2530.2
2	Chandbali WL Range	7	868.798
TOTAL			**3398.998**

2.3. General Character of Vegetation:

The UDPFs coming under this working circle are mostly composed of Mangrove Vegetation. The mangrove vegetation is covered by *Avicennia alba, Avicennia marina, Avicennia officianalis, Acanthus illicifolius, Lumnitzera littorea, Aegialitis rotundifolia, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratia apetala, Sonneratia*

*caseolaris, Derris scandens, D. hererrophylla, Azima tetracantha, Kandelia candel and Capparies separia w*hich are commonly distributed. Along the river banks the vegetation can be also noticed. The dominant species is *Avicennia alba* and *Sonneratia apetala*. The commonly found shrubs are *Ceriopes decandra, Phoenix palludosa, Agicevas corniculatum* and *Cynometra iripa.* Now most of the areas have degraded plantations with scattered trees with crop density around 25-35% with GBH is less than 30 cm. Regeneration is visible but in avery slow rate.

2.4 Treatment series, Treatment sections and JFM areas

a) Constitution of Treatment Series

The planting area within both the UDPFs of this Division is allotted to Banipahi Treatment Series and Banijungle Treatment Series. The total area is as described below-

Table No. 2.3: Constitution of Treatment Series				
Sl. no	**Name of treatment series**	**Name of Range**	**Name of Forest Block**	**Area allotted in Ha**
1	Banipahi Treatment Series	Basudevpur WL Range	Banipahi UDPF	2125.51
2	Banijungle Treatment Series	Basudevpur WL Range	Banijungle UDPF	404.69
Total		**1 Range**	**2 UDPFs**	**2530.20**

b) Area allotted to different Treatment Sections

The area allotted to Banipahi Treatment Series is 2125.51 Ha. So, it is proposed to cover the allotted area in ten years. Hence it is divided into ten planting sections. Area allotted to Bani jungle is 404.69 Ha and it is divided into five planting sections.

Sl. no.	Treatment section	Name of UDPF	Area allotted (ha)	Year of operation
1	Banipahi I	Banipahi	212.551	2021-22
2	Banipahi II		212.551	2022-23
3	Banipahi III		212.551	2023-24
4	Banipahi IV		212.551	2024-25
5	Banipahi V		212.551	2025-26
6	Banipahi VI		212.551	2026-27
7	Banipahi VII		212.551	2027-28
8	Banipahi VIII		212.551	2028-29
9	Banipahi IX		212.551	2029-30
10	Banipahi X		212.551	2030-31
Total			**2125.51**	
11	Banijungle I	Banijungle	80.938	202-23

12	Banijungle II		80.938	2023-24
13	Banijungle III		80.938	2024-25
15	Banijungle IV		80.938	2025-26
15	Banijungle V		80.938	2026-27
Total			**404.69**	
Grand Total	**15 Sections**	**2 Blocks**	**2530.20**	

2.5 Blocks, compartments and JFM area

The area allotted is not allotted to any VSS for protection and management.

2.6 **Special objective of Management:** The special objective of management of this Working Circle will be:

a) To improve stocking of the existing mangroves & its associates and other indigenous miscellaneous species.

b) To stop degradation of mangrove patches and restoration of biodiversity, to obtain suitable habitat for wildlife & to assist soil and water conservation.

c) To protect and improve the existing mangrove habitats.

d) To provision ecosystem services that local communities benefit from and appreciate.

2.6.1. Analysis of the crop

The crop is mostly composed of mangrove species like *Avicennia alba, Avicennia marina, Avicennia officianalis, Acanthus illicifolius, Lumnitzera littorea, Aegialitis rotundifolia, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratiaapetala, Sonneratia caseolaris.* The vegetation of the Forest blocks allotted to this working circle is degraded and the open space found to be covered with weeds like *Ipomoea pescata*.

2.6.2. Silvicultural system

The silvicultural System to be adopted for this working circle is Silvicultural cleaning followed by Aided Natural Regeneration supplemented with enrichment plantation.

2.6.2.1. Silvicultural Cleaning-

This operation includes the following steps-

i. Removal of weeds

ii. Clearing of the ground

2.6.2.2. Aided Natural Regeneration

The area is inspected to assess the status of regeneration. If necessary, efforts are made to assist the process of natural regeneration by eliminating competing vegetation. If this fails, then the area with unsatisfactory regeneration is planted with *Rhizophora species*. Propagules are collected from the forest and planted within three days. A vacancy filling or beating-up is carried out where necessary inthe following year.

2.6.3. Rotation Period

There is no rotation period because mangroves act as carbon sequestration pool and to be left undisturbed.

2.6.4. Reducing factors and reduced areas

Not applicable for this working Circle.

2.6.5. Felling cycle

There will not be any felling operation is prescribed in this Working Circle as the mainobjective is to restock the Mangrove vegetation over the period of time.

2.6.6. Division into periods and allotment to periodic blocks (PB)

Not required for this Working Plan period.

2.6.7. Calculation of the yield

Not suggested for this working plan.

2.6.8. Table of felling

Not required

2.6.9. Method of executing the felling

As this working circle is constituted to restore the mangrove vegetation along the coast line of the only PRF present in this Division, this Working plan period will not take up any felling operation in Plantation working circle.

2.6.10. Subsidiary silvicultural operations cleaning and thinning

Not required for mangrove vegetation

2.6.11. Regeneration

Regeneration of most of the areas is very slow as a result; they are poorly stocked and hence require artificial regeneration measures.

2.6.12. Method of treatment

2.6.12.1. Ten Rules of Mangrove Rehabilitation

1. Assisted regeneration of mangroves through active planting of seedlings and wildings is required in areas of extensive historic deforestation with highly dependent communities vulnerable to typhoons with low food security.

2. Target rehabilitation areas should be in an intertidal location exposed during neap low tide (instead of spring low tide, the current practice), and reached by seawater during neap high tide. The middle and upper intertidal zones are therefore the most favourable.

3. Small, backyard nurseries enable communities to produce sufficient numbers of healthy mangrove seedlings such as *Avicennia marina*, for planting.

4. Wildings make an excellent source of plants for rehabilitation, but should be harvested sustainably so as not to affect natural recruitment.

5. Seafront planting is more successful using adapted seafront species, particularly *Sonneratia alba*, and by using taller, nursery-reared saplings of at least 0.5-1.0 m height.

6. *Rhizophora* propagules generally do not grow well in seafront zones and therefore cannot be relied upon for mangrove rehabilitation in greenbelts.

7. Fixed quadrat monitoring is the simplest, most efficient and robust form of monitoring for large scale rehabilitation initiatives.

8. Protective structures, including breakwaters and barriers, may be required in highly eroded areas with strong wave action to protect young mangrove plants.

9. Fences and signage can help protect young mangrove plants from boat traffic, fishing and gleaning activities, and domestic and wild animals.

10. Local government and community support is required from the outset for successful implementation of community-based mangrove rehabilitation projects.

2.6.12.2. Physical interventions required

Potential rehabilitation sites may therefore require interventions to optimize future mangrove growth and survival.

In some cases, local hydrology will have changed so dramatically that even areas that historically were mangrove forests cannot automatically be assumed to be suitable for rehabilitation.

Barriers are placed in front of the plantation to reduce the energy of oncoming waves giving some protection while young seedlings become established; of secondary benefit is the

increase in sediment elevation behind the structure.

2.6.13.2 Planting Strategy

1) Species Selection

Select species of mangroves naturally found in the area. Nearby wildings may also be directly planted in abandoned ponds, and for enrichment planting of inner seafront sites protected from wave action. Planting materials can be sourced from nurseries. Mangrove sizes for planting will depend on location and substrate:

➤ bigger sizes (minimum 50 cm to 1-1.5 m *for A. officianalis A. marina, S. alba, R. apiculata, R. mucronata* – for seafront planting, also very muddy portions of the areas.

➤ smaller sizes (minimum 30 cm A. marina, S. alba to 40-60 cm *R. macronata, Ceriops decandra* – no wave action.

2) Time of planting

Schedule planting during the season of least wave action. Consultation of a tidal calendar is required for daytime low tides. Because of the relatively lower elevation, seafront planting will require spring water low tides, while inner abandoned ponds can be planted during either spring or neap low tides.

3) Density and pattern for planting

➤ Inner sites along the seafront and in abandoned ponds with little wave action can be planted at 1.5-2.0 m intervals.

➤ Seaward sites exposed to frequent wave action and debris brought by the incoming tide need to be planted at closer intervals of 0.5-1 m (Fig. 16) and/or in clusters of 2-3 seedlings each.

➤ Offset the planting of seedlings in consecutive rows so that the columns appear in zigzag pattern, avoiding uniformly empty rows between rows of plants. For the 1st batch in a given site, do trial planting of a few rows, then observe for the next few months. Plant additional rows only if the seedlings/saplings show good growth and survival.

➤ Whether seafront sites or abandoned ponds, plant starting from the beach or landward portion moving in a seaward direction. This is a major change from the past practice of planting from the seaward boundary in a landward direction.

➤ Depending on the number of planters, 2-5 rows may be planted on a given day during the 2-4 hr planting window allowed by the tides.

2.6.13.3. Problems associated

Planting is only the first step towards restoring mangroves. During the first 1-2 years, the plants are vulnerable to various man-made and natural stressors. Therefore monitoring (of growth and survival) and maintenance (by removing algae, other pests) are two major activities in mangrove rehabilitation.

1) Physical

Wave action, flooding and burial in the substrate can damage young seedlings. This is a particular problem where inundation and sedimentation rates are high, as in the lower intertidal to subtidal flats. For example, seedlings planted in the lower intertidal zone dies within 3 months, mainly from inundation as evidenced by rotting stems.

2) Biological

a) Infestation of filamentous algae peaks in the summer and disappears with the rains; it is also frequently observed near fishponds which regularly drain effluents (containing excess feeds and fertilizers) to the sea. Heavy growth of filamentous algae (Enteromorpha, Cladophora and Oscillatoria) can choke and break seedlings.
b) Boring isopods identified as *Sphaeroma terebrans* attacks *Rhizophora* saplings. The crustaceans showed no apparent negative effects on mature *A. marina* trees.

3) Anthropogenic

Fishing gears, boat traffic, and gleaning (for shellfish and crabs) have negative impacts on mangrove plantations. Sites close to populated centers have problems with garbage and debris (fishing nets, plastic bags, etc.), and domestic animals (e.g., pigs, goats, cattle). In plantations near primary forests, wild animals such as boars and monkeys feed on newly planted Rhizophora.

2.6.13.4. Protection and Maintenance

- Regular patrolling should be undertaken for seafront plantations.
- The most effective way to remove barnacles is with long-nosed pliers do not use your bare hands as the shells have sharp edges, Rhizophora plantations are particularly prone to barnacle infestation, so a proactive solution is to avoid planting *Rhizophora* along the seafront (where they do not belong). Otherwise, avoid monoculture plantations that are vulnerable to pests by interplanting with *A. marina and/or S. alba.* Because it regularly

sheds its bark. *S. alba* is unaffected by barnacles and oysters.

- Relatively taller seedlings should be planted in seafront sites with high sediment load and in deeper water, so the higher leaves remain exposed and are less prone to gathering sediment and flooding, allowing the plants to survive.
- For protection from wave action, install barriers made of rocks or closely spaced bamboo poles. Such barriers also help to trap sediment and increase the substrate level, further enhancing plant growth. In places where erosion is a major problem, a breakwater can be constructed.

2.6.14. Associated regulations and measures

Prescriptions for rigid protection and closer of Grazing, regulations of rights & concessions will be made in accordance with the provisions of the Forests and Wildlife laws & rules in force in this Working Plan.

CHAPTER 3

3. PLANTATION WORKING CIRCLE

3.1. Name of the working circle

Plantation Working Circle

3.2. General Constitution:

This working circle includes an area of **178.26 Ha**. Natural mangrove vegetations in Garmal PRF and five VFs are included for management. The forest blocks included in this working circle are as below-

Table No. 3.1 Forest Blocks allocated to Plantation Working Circle

Sl. No.	Name of Forest Block	Total area in Ha	Area under Planation Working Circle in Ha	Remarks
1	Garmal PRF	294.958	30.00	Only 30 Ha of open area available for plantation and 15 Ha is used for mangrove plantation in 2021-22.
2	Bijaypatna UDPF	93.12	93.12	Encroached and need to be evicted for plantation
3	Arjunbindha-Santhapur VF	4.00	4.00	
4	Babanbindha VF	5.00	5.00	
5	Amargadia VF	3.68	3.68	
6	Kabirpur VF	5.00	5.00	

7	Jalahari VF	3.00	3.00	
Total			**113.8**	
8	Bhatapada Gudpal VF	1.044	1.044	The existing plantation of *Acacia auriculoformis* and Eucalyptus are to be harvested and the blank patches are to be planted
9	Bodakasana VF	10.00	10.00	
10	Aruha VF	0.536	0.536	
11	Kamaria VF	1.98	1.98	
12	Mirzapur VF	0.56	0.56	
13	Deola VF	5.00	5.00	
14	Arjunbindha VF	3.000	3.00	
14	Haripur VF	0.68	0.68	
16	Belanta VF	1.00	1.00	
17	Dianary VF	1.84	1.84	
18	Sibapur VF	1.60	1.60	
19	Bansar VF	0.42	0.42	
20	Chatrujabhujapur VF	1.60	1.60	
21	Goudabisinuapada VF	2.20	2.20	
22	Belagadia VF	2.80	2.80	
23	Alboga VF	0.20	0.20	
Total		**64.46**		
Grand Total			**178.26 Ha**	

Table no. 3.2 Range wise area allotted to plantation Working Circle		
Sl No.	**Name of Range**	**Area allotted in Ha**
1	Bhadrak WL	6.52
2	Chandbali WL	159.92
3	Dhamnagar	11.62
4	Basudevpur	0.2
Total	**4 Ranges**	**178.26**

3.3. General Character of Vegetation:

The PRF and UDPFs are mostly composed of Mangrove Vegetation. The mangrove vegetation is covered by *Avicennia alba, Avicennia marina, Avicennia officianalis, Acanthus illicifolius, Lumnitzera littorea, Aegialitis rotundifolia, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratia apetala, Sonneratia caseolaris, Derris scandens, D. hererrophylla, Azima tetracantha, Kandelia candel and Capparies separia w*hich are commonly distributed. Most part is impenetrable and provides congenial niche for many wild lives. Along the river banks the vegetation can be also noticed. The dominant species is *Avicennia alba* and *Sonneratia apetala*. The commonly found shrubs are *Ceriopes decandra, Phoenix palludosa, Agicevas corniculatum* and *Cynometra iripa.* The area included under the village forests consists of old plantations of mangrove as well as Eucalyptus and Casuarina. Now most of theareas have degraded plantations with scattered trees with crop density around 25-35% with GBH is less than 30 cm. No remarkable regeneration is visible.

3.4. Planting series, planting sections and JFM areas

3.4.1. Constitution of Planting Series

The planting area coming within PRF of this Division is allotted to Garmal Planting Series. Area under this planting series is 15 Ha. There are VFs which have been partially or fully encroached either by

individual or group/ community. It will be prime endeavor to get those area evicted and make those areas free from encroachment. The area free from encroachment is to be brought under plantation Working circle. So, the total area under the plantation working circle can be described as palatable area available under PRF and encroached area need to be evicted and planted under VFs. The village forests earlier covered under Social Forestry Plantations are included in SFP planting series where clear felling with standard and artificial regeneration will be carried out. So details of the area is as below-

Table No. 3.3 Constitution of Garmal Planting Series for Garmal PRF

Sl. no.	Name of planting section	Name of Range	Name of Forest Block	Area allotted in Ha	Year of Operation
1	Garmal I	Chandbali WL	Garmal PRF	15.00	2021-22
2	Garmal II	Chandbali WL	Garmal PRF	8.00	2022-23
3	Garmal III	Chandbali WL	Garmal PRF	7.00	2023-24
Total		**1 Range**	**1 PRF**	**30.00**	

The encroached areas are assigned to encroachment Eviction Series to put thrust on bringing back into administration fold of Forest Department and subsequently planting in series.

Table no. 3.4 Encroachment Eviction Series to be included under Plantation						
Sl. No	**Name of the planting section**	**Name of Forest Block**	**Name of Range**	**Area in Ha**	**Year of operation**	**Remark**
1	Bijaypatna UDPF I	Bijayapatna UDPF	Chandbali WL	18.00	2021-22	Eviction may be taken up in the proposed year orprior to next year
2	Bijaypatna UDPF II		Chandbali WL	18.00	2022-23	
3	Bijaypatna UDPF III		Chandbali WL	18.00	2023-24	
4	Bijaypatna UDPF IV		Chandbali WL	18.00	2024-25	
5	Bijaypatna UDPF V		Chandbali WL	21.12	2025-26	
6	Arjunbindha-Santhapur I	Arjunbindha-Santhapur VF	Chandbali WL	4.00	2022-23	
7	Babanbindha I	Babanbindha VF	Chandbali WL	5.00	2023-24	
8	Amargadia I	Amargadia VF	Bhadrak WL	3.68	2024-25	
9	Kabirpur I	Kabirpur VF	Chandbali WL	5.00	2026-27	
10	Jalahari I	Jalahari VF	Bhadrak WL	3.00	2027-28	
			TOTAL	**113.8**		

Table no. 3.5 Social Forestry Plantation Series to be included under Plantation

Sl. No	Name of the planting section	Name of Forest Block	Name of Range	Area in Ha	Year of operation
1	Bhatapada Gudpal I	Bhatapada Gudpal VF	Chandbali WL	1.044	2021-22
2	Bodakasana I	Bodakasana VF		10.00	2021-22
3	Aruha I	Aruha VF	Chandbali WL	0.536	2022-23
4	Kamaria I	Kamaria VF		1.98	2022-23
5	Mirzapur I	Mirzapur VF		0.56	2022-23
6	Deola I	Deola VF		5.00	2022-23
7	Arjunbindha I	Arjunbinda VF		3.00	2022-23
8	Haripur I	Haripur VF		0.68	2022-23
9	Belanta I	Belanta VF	Bhadrak Wl	1.00	2023-24
10	Dianary I	Dianary VF		1.84	2023-24
11	Sibapur I	Sibapur VF	Dhamnagar	1.60	2023-24
12	Bansar I	Bansar VF		0.42	2023-24
13	Chatrujabhujapur I	Chatrujabhujapur VF		1.60	2023-24
14	Goudabisi nuapada I	Goudabisi nuapada VF		2.20	2023-24
15	Belagadia I	Belagadia VF		2.80	2023-24
16	Alboga I	Alboga VF	Basudevpur	0.20	2023-24
			TOTAL	**34.46**	

3.4.2. Area allotted to different Planting Sections

The area allotted to Garmal Planting Series is 30 Ha only. The area is comparatively small. So it is proposed to cover the allotted area in **three years. Hence it is divided into three planting sections.** The Bijaypatana UDPF will be brought under plantation Working circle by bringing by its encroached areas by removing the encroachment gradually. So, the total area of UDPF under plantation Working circle will 93.12 Ha. The area can be divided into 5 planting sections. Also, the area under encroachment of Village Forests under Chandbali and Bhadrak Range after eviction need to be planted in 6 years by dividing the total area into 7 planting sections as below-

Table no. 3.6 Abstract of Planting Sections and area assigned to PRF, UDPF and VF

Sl no.	Name of Planting section	Forest	Area allotted (Ha)	Year of operation
1	Garmal I	Garmal PRF	15.00	2021-22
2	Garmal II		8.00	2022-23
3	Garmal III		7.00	2023-24
3	Bijaypatna I	Bijaypatna UDPF	18.00	2021-22
4	Bijaypatna II		18.00	2022-23
5	Bijaypatna III		18.00	2023-24
6	Bijaypatna IV		18.00	2024-25
7	Bijaypatna V		21.12	2025-26
8	Arjunbindha-Santhapur I	Arjunbindha-Santhapur VF	3.00	2022-23
9	Babanbindha I	Babanbindha VF	5.00	2023-24
11	Amargadia I	Amargadia VF	3.68	2024-25
12	Kabirpur I	Kabirpur VF	5.00	2026-27
13	Jalahari I	Jalahari VF	3.00	2027-28
14	Bhatapada Gudpal I	Bhatapada Gudpal VF	1.044	2021-22
15	Bodakasana I	Bodakasana VF	10.00	2021-22

17	Aruha I	Aruha VF	0.536	2022-23
18	Kamaria I	Kamaria VF	1.98	2022-23
19	Mirzapur I	Mirzapur VF	0.56	2022-23
20	Deola I	Deola VF	5.00	2022-23
	Arjunbinda I	Arjunbinda VF	3.00	2022-23
21	Haripur I	Haripur VF	0.68	2022-23
22	Belanta I	Belanta VF	1.00	2023-24
23	Dianary I	Dianary VF	1.84	2023-24
24	Sibapur I	Sibapur VF	1.60	2023-24
25	Bansar I	Bansar VF	0.42	2023-24
26	Chatrujabhujapur I	Chatrujabhujapur VF	1.60	2023-24
27	Goudabisi nuapada I	Goudabisi nuapada VF	2.20	2023-24
28	Belagadia I	Belagadia VF	2.80	2023-24
29	Alboga I	Alboga VF	0.20	2023-24
			178.26 Ha	

3.4.3. Abstract of Planting Sections-

Table No. 3.7 Year wise area allotted to different Planting Series										
Year / **Planting Series**	**2021 -22**	**2022 -23**	**2023 -24**	**2024 -25**	**2025 -26**	**2026 -27**	**2027 -28**	**2028 -29**	**2029 -30**	**2030 -31**
Garmal	15	8	7	0	0	0	0	0	0	0
Bijayapatna	18	18	18	18	21.12	0	0	0	0	0
Arjunbindha-Santapur	0	4	0	0	0	0	0	0	0	0
Babanbindha	0	0	5	0	0	0	0	0	0	0
Amargadia	0	0	0	3.68	0	0	0	0	0	0
Kabirpur	0	0	0	0	0	5	0	0	0	0
Jalahari	0	0	0	0	0	0	3	0	0	0
Bhatapada Gudpal	1.044	0	0	0	0	0	0	0	0	0
Bodaksasana	10	0	0	0	0	0	0	0	0	0
Aruha	0	0.536	0	0	0	0	0	0	0	0
Kamaria	0	1.98	0	0	0	0	0	0	0	0
Mirzapur	0	0.56	0	0	0	0	0	0	0	0
Deola	0	5	0	0	0	0	0	0	0	0
Arjunbindha	0	3	0	0	0	0	0	0	0	0
Haripur	0	0.68	0	0	0	0	0	0	0	0
Belanta	0	0	1	0	0	0	0	0	0	0
Dianary	0	0	1.84	0	0	0	0	0	0	0
Sibapur	0	0	1.60	0	0	0	0	0	0	0
Bansar	0	0	0.42	0	0	0	0	0	0	0
Chaturbhujpur	0	0	1.60	0	0	0	0	0	0	0

Goudabisi Nuapada	0	0	2.20	0	0	0	0	0	0	0
Belagadia	0	0	2.80	0	0	0	0	0	0	0
Alboga	0	0	0.20	0	0	0	0	0	0	0
Total	**44.044**	**41.756**	**41.66**	**21.68**	**21.12**	**5**	**3**	**0**	**0**	**0**
Grand total					**178.26 Ha**					

3.5. Blocks, compartments and JFM area

The forest area already allotted VSS as mentioned in JFM working circle chapter will managed by the respective VSS.

3.6. **Special objective of Management:** In keeping sync with the Forest Policy and Plantation Guidelines; the special objective of management of this Working Circle willbe:

a. To improve stocking of the existing scrub forest, mangroves & its associates and other indigenous miscellaneous species.
b. To raise mixed plantations to enrich biodiversity, to obtain suitable habitat for wildlife & to assist soil and water conservation.
c. To protect and improve the existing plantations by suitable tending and cultural operations.
d. To maximize output by introducing improved technology like root-trainer, clonal technique etc. in plantation works.

3.6.1. Analysis of the crop

The crop is mostly composed of mangrove species like *Avicennia alba, Avicennia marina, Avicennia officianalis, Acanthus illicifolius, Lumnitzera littorea, Aegialitis rotundifolia, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratia apetala, Sonneratia caseolaris.* In Village Forest area, the tree species are mainly *Acacia auriiculoformis, Acacia mangium* and Eucalyptus.

3.6.2. Silvicultural system

The silviculture system to be adopted is 'Clear Felling with Standard & Restocking by

Artificial Plantation' through people's participation.

The species to be planted are *Acacia mangium, Acacia auriculoformis, Azadirachta indica, Cassia samea, Terminalia arjuna, Eucalyptus, Antocephalus kadamba, etc*

3.6.3. Rotation Period

The rotation period will be 10 years i.e., co-terminus with the plan period.

3.6.4. Harvestable diameters

The appropriate harvesting techniques for four major products can be suggested – Firewood or Charcoal- harvesting can begin at the time of the first thinning forplantations & all other planting strategies. Thinning and pruning can be used as a method of firewood harvesting. If the *Rhizophora & Bruguiera* plantation has been established solely for firewood, the tip of the seedlings can be split to encourage branching. Initial spacing for such plantation should be at least 1 x 1 m (10,000 seedlings/ha). This is done to encourage crown development & maximize the yield of branches for firewood. The plantation should be matured enough, with usual thinning & pruning, to support sustained harvesting between the 7th & 12th years after planting. At that time, firewood can be harvested exclusively from the top branches of individual trees allowing the lower branches to regenerate.

3.6.4.1. Piles, Poles, Posts and Timber -In the plantation developed for producing these products, it is possible and indeed desirable to harvest firewood. By aggressively pruning side branches after the first thinning (while leaving the crown alone), energy will be directed into producing more trunk wood and therefore bigger and taller poles more quickly. As thinning and pruning are used to produce firewood it also is possibleto shift to selective cutting and remove poles on an as needed basis. This would help to move the plantation towards a seed tree form of forestry where the largest seed or mother trees are kept for seedling production and the middle story is harvested for poles or posts.

3.6.4.2. Fodder- Traditionally, fodder harvesting has been done for cattle, buffalo and goats. Fodder (the leaves and shoots from the cut branches) is taken from pruning and thinning activities and given to these animals. Fodder can be obtained as part of thinning and pruning activities. It is important to make certain that there is enough fodder to support the number of animals you want to grow. Overgrazing by cattle and buffalo has caused significant loss to mangrove forests. Since the intention of regeneration is for sustainable forestry systems, no harvesting is prescribed for this Working Plan period.

3.6.5. Reducing factors and reduced areas

Not applicable for this working Circle.

3.6.6. Felling cycle

The felling cycle will be 10 years.

3.6.7. Division into periods and allotment to periodic blocks (PB)

Not required for this Working Plan period.

3.6.8. Calculation of the yield

One hectare of social forestry plantations is expected to provide 10 cum of timber and 8 tonnes of firewood. Therefore, as per the prescriptions provided in the SFP series.

Table No.3.8 Projected yield from village Woodlots of SFP.

Year	22-23	23-24	24-25	TOTAL
SFP series (ha)	11.044	11.756	11.66	34.46
Timber (Cum)	110.44	117.56	116.6	344.6
F. Wood (Ton)	88.352	94.048	93.28	275.68

3.6.9. Table of felling

Table no. 3.9 Table of felling of SFP series.

Sl. No	Name of the Series	Forest block Assigned	Name of Range	Area in Ha	Year of operation
1	Social forestry Plantation Series	Bhatapada Gudpal VF	Chandbali WL	1.044	2021-22
2		Bodakasana VF		10.00	2021-22
3		Aruha VF	Chandbali WL	0.536	2022-23
4		Kamaria VF		1.98	2022-23
5		Mirzapur VF		0.56	2022-23

6		Deola VF		5.00	2022-23
7		Arjunbindha		3.00	2022-23
8		Haripur VF		0.68	2022-23
9		Belanta VF	Bhadrak Wl	1.00	2023-24
10		Dianary VF		1.84	2023-24
11		Sibapur VF	Dhamnagar	1.60	2023-24
12		Bansar VF		0.42	2023-24
13		Chatrujabhujapur VF		1.60	2023-24
14		Goudabisi nuapada VF		2.20	2023-24
15		Belagadia VF		2.80	2023-24
16		Alboga VF	Basudevpur	0.20	2023-24
TOTAL				**34.46**	

3.6.10. Method of executing the felling

a) Consultation with VSSs: Prior to taking of Operation like demarcation, marking etc, the VSS / VFC is required to be consulted, if the area is assigned to VSS/ VFC. The process of harvesting and restocking is to be explained. The mechanism of Usufruct Sharing is to be decided and resolution to be passed to that effect. Sharing of produce either in monetary term or in kind to be specifically discussed & decided. In case of Village Forest the working cost is required to be adjusted against sale value / royalty of the produce so obtained. Voluntary contribution of labour by villagers for operations may also be examined to reduce the cost of operation. After harvesting, the planting modality is also to be discussed at length

b). Demarcation of the area: In case of Village Forests, the area / boundary is not demarcated on ground. It is required to demarcate the Village Forest as notified with the help of Revenue personal in presence of VFC Members. RCC pillars of 20cm x20cm x 120cm may be posted to keep the boundary line visible permanently. In all cases, the entire block is assigned for working in a single year; in that case only boundary line is of importance. This demarcation process is to start at least from April- May of previous year. For keeping the boundary line naturally demarcated, it is proposed to put Palm Seeds on the boundary at an interval of 5 meters which will grow to a tree within 5 years.

c) Selection of Standing Trees: As the system to be followed is "**Clear Felling with Standard",** it is required to mark the
standards initially. The criteria for selection of standards in general are furnished below.

- Timber species of greater importance,
- Any trees associated with sentiments of local villagers are to be retained as standard.

The number of Standard trees per hectare shall not be less than 25 and more than 75. A list of Standard Trees to be prepared and will be a part of Compartment History File. The information may be recorded in a standard format.

Suggested format:

1. Name of Range:
2. Name of Forest Block / Coupe:
3. Area under marking in Ha:
4. Year of Marking:
5. Name of Marking Officer & Designation

d) Marking of trees for felling: After selection of Standard trees, all remaining trees above 30cm GBH are marked for felling. However, marking on sensitive areas, the following marking rules are to be followed.

i) Trees near to perennial nala / river banks to a width of 40m measured from High Flood level are not to be marked.

ii) Tree on which bird's nests is observed is to be retained.

iii) Trees having cavity, suitable for nocturnal birds habitation up to five numbers per hectares is to be retained.

iv) Trees on rocky surface / above 300slope / high erosion prone area are not to be marked for felling.

Marking should be taken up by the section forester and to be checked by the Range Officer minimum up to 20% of marked trees. The marking list is to be prepared in quadruplicate in standard format with a standard estimate of timber and fire wood production. Marking is to be done in February / March of previous year to year of working.

e) Delivery of Coupes for Harvesting: The Coupe are to be delivered to OFDC Ltd for harvesting and marketing thereof. In case
the VSS is willing to participate in harvesting operation, they may be engaged by OFDC Ltd for felling / logging & conversion operation. The Coupe working may be allowed normally for nine months. Any extension of working period may be allowed as per administrative instruction / Odisha Forest Contract Rules, 1966.

The VSS / VFC may take up the harvesting operation as the yield expected will not be

economical to OFDC Ltd. In that case, the removal of trees and sharing will be under supervision of Range Officer / Forest Department

f) Felling of trees & Removal thereof:

The marked trees may be felled, converted and removed as per modern logging practices and the Odisha Timber and Other forest produce transit Rules, 1980 and up to date amendments thereof. The trees felled by axe and saw do not produce coppice shoots. As most of the species are good coppice, it is suggested to fell the trees with axe only. Subsequent logging may be taken up by saw or as convenient to OFDC Ltd / VFC as per modern logging practices.

g) Sharing of Produce in case of VSS / VFC area:

Sharing of forest produce, in case of VSS area will be regulated as per Para 11 of Joint Forest Management Resolution, 2011. In case of village Forests, the sharing of forest produce will be regulated as per Rule 9 of the Odisha Village Forest Rules, 1985.

h) Surrender of Coupe Area:

After harvesting the marked trees and removal thereof, the Coup area shall be surrendered by OFDC Ltd as soon as possible so as to take subsidiary silvicultural operation / planting activities on the same area. In case of harvesting by VFC, preliminary operation for planting may be taken up simultaneously.

3.6.11. Subsidiary silvicultural operations cleaning and thinning

The cleaning and thinning operations are not required for mangrove forests bur for village forests where felling will be carried out.

(a) Cleaning: As the silvicultural system adopted is clear felling, the cleaning operation involves

1. Removal of debris from the coupe and either buried under ground with a purpose to allow left over materials decompose and enrich soil organic content.
2. Fell & Remove the marked trees, if not removed by the OFDC Ltd.
3. Remove all weeds by cutting mechanically.
4. Make the coupe area suitable for taking up plantation.

(b) Thinning:

In the coupe area, if any advance growth is left unmarked / not removed for any consideration and the advance growth is at pole stage, it is required to take up thinning. In this case no thinning will be required as the felling cycle is ten year and clear felling with standard system is adopted.

3.6.12. Regeneration

The area assigned for fresh plantation is to be covered up through artificial Regeneration

i.e. Block Planting. The standard procedure for planting is to be followed as per Approved Cost

Norm. The standard procedure is described below for general reference. The assigned area is to be restocked through Artificial Regeneration i.e. by planting of seedlings with adequate Soil & Moisture Conservation measures.

3.6.12.1. General guidelines for Planting:

3.6.12.1.1. **Site specific plan (SSP):** Each plantation site should have site specific plan. This should be prepared by the ACF in consultation with the field staff and the Range officer. It will be a broad guide line. This should contain the scheme under which plantation will be done, site quality, aspect, altitude, soil type, condition of natural regeneration, suitable species to be planted, number of pits/mounds to be made, protections needed, method of protection and other items founded necessary by the ACF or staff. Whether involvement of local people is anticipated or not may also be clearly mentioned in the Site-Specific Plan.

3.6.12.1.2. **Planting works:** The following activities should be done for plantation sites:

Site selection: The actual site for plantation should be selected after reconnaissance survey by the field staff. Site will be selected on the basis of the crown density of the area. The density given in the working plan is as per the new density classification by Forest Survey of India, and is the average of the compartments or sub-compartments and not of the selected sites.

1. **Survey:** After this the surveyor should go with the concerned staff to the site and do survey and come up with the actual area. They will access the perimeter of the site for protection measures, number of plants, species etc. The surveyor will then make map of the areas. It is very important to make check plots during this survey at a rate of one check-plot per 5 hectares.

2. **Estimate:** On the basis of this survey the Range officer will prepare estimate of the plantation works. There is tendency on the part of the field staff to keep number of pits as per norms of the scheme without taking into account the availability of the natural plants in the field. Here the number of pits in the check plots should be clearly mentioned.

3. **Advance soil work:** Advance soil work and protection measures (barbed wire fencing should be preferred) will go side by side. The size of the pits/mounds will be as per the

plantation norms issued by forest Department. The number of pits/mounds may be decreased by the DFO as per the field situation. Advance soil work should be completed before or during winter so that enough seasoning of soil can take place.

4. **Action plan:** Soon after, the Range officer in consultation with the field staff and nursery in-charge should make plantation action plan. This will contain the name of forester and the forest guard, the species to be planted, the nursery from where these plants will come, the distance from nursery to plantation site.

5. **Preparation for planting:** Planning should be done quite in advance at the nursery level by segregating plantable planting material and earmarking specific nurseries with plantation sites. Transportation of planting material must be completed before monsoon. Plantation should be done on raised mounds in water-logging areas insteadof pits for which a separate cost norm could be prepared. Planting should be done intensively and completed as soon as possible so that the plants get maximum growing season in the planting year.

6. Species to be planted:

The following species are prescribed to plant in this Working circle as per the site requirement-

Mangrove species-

Avicennia alba, Avicennia marina, Avicennia officianalis, Lumnitzera littorea, Exoecaria agallocha, Phoenix Palludosa, Sonneratia apetala, Sonneratia caseolaris,Kandelia candel and Capparies separia etc.

Non-mangrove species-

Radhachuda, Arjuna, Mehogany, Sissoo, Karanja, Neem, Amla, Panasa, Amba, Baula, Chakunda, Kaitha, Bela, *Acacia auriculoformis, Acacia mangium, Eucalyptus* etc.

7. **After-care and assessment:** The following operation should be carried out in plantations raised during this plan period.

   1) Site wise plantation journal should be maintained & all inspections & subsequent treatments should be recorded.

   2) In the year of planting two weeding should be done - the first one after three weeks and the second one in September/October after monsoon.

3) The plantation areas should be completely protected from fire and grazing. All the activities should be recorded in the plantations journal.

4) The success percentage should be entered every year in the plantation journal and control form. In the next year of planting if, the mortality in the site is beyond permissible limit, then it must be recorded in the plantation journal.

3.6.12.1.3. Planting stock

productionMangrove Nursery-

It is a place for raising and tending mangrove seedlings until they are ready for planting. The development of nursery technologies ensures a reliable source of

planting materials. Planting healthy seedlings decreases mortality of plantation at the early stages. Major Activities in Nursery Establishment & Management are-

a. Nursery Site Selection
b. Designing and Building the Nursery
c. Operating and Managing the Nursery

a. Sites for nursery establishment

An upper or middle inter-tidal area, with gentle gradient and protected from waves and currents. The sites should be of silty-clayey mud (substratum) and areas should be flooded by tides daily and should lie close to a freshwater source.

b. Designing and Building the Nursery

- **Nursery beds-**

  All debris, grass etc. should be removed and level the land where the nursery beds are going to be done. In areas where the tidal range is low and thus the flooding is insufficient to maintain the seedlings, a drain should be dug to allow free flow of tidal water to and from the beds. The bed may be surrounded witha bamboo frame to demarcate the area. If no tree canopy is present, a shelterto avoid the seedlings being directly exposed to sunlight, should be erected above the beds. They should be located parallel to the tidal flow. Distance between two beds may be a minimum of 1m. Size of the bed may depend on the area available for the purpose. Board walks to move around nursery beds is convenient to work in the nursery. Edges of the beds may be supported with bamboo splits to avoid polythene bags being washed away with tides.

- **Preparation for raised nursery beds –**

  Growing plants on raised beds of sand is ideal to be established in the supra-tidal areas that could be irrigated with sea water to flush out the accumulated

salts in the root zone.

c. Operating and Managing the Nursery

- **Medium used in polythene bags-**

  Mud/ Soil collected from the mangrove areas A few holes should be made around and at the bottom of the

Figure 4.1 Filling muds in Polythene bags for mangrove nursery

- **Propagule planting methods –**

  Propagules with evidence of diseases, deformities or damages, small, non-uniformly coloured, broken or bruised propagules as well as those showing signs of attack by borer insects should be avoided. Propagules may be planted in a vertical position in 7" by 10" plastic bags filled with mangrove soil, partially embedded in the bed to prevent being washed away with the tides. The tapering end of the mature propagules should be gently pushed in the polybags up to 1/3rd or 1/4th of the hypocotyls' length.

- **Seed planting methods**

Avicennia - Sowing or placing the seed in a hole, at least one inch deep in the mud, in polythene bags or clay pots which can be transferred to planting site Sonneratia,– Broadcasting, transplanting young seedlings from the wild, in polythene bags Xylocarpus – Growing seeds in polythene bags

- **Wildlings**

Lumnitzera and *Sonneratia* seedlings can successfully be uprooted and placed in polybags for further growth under nursery condition, before it is being transplanted in the restoration site. Young seedlings (wildlings) of other mangrove species too could be used for restoration.

- **Nursery care**

In areas where the tides flush the nursery every day, no irrigation is required.

In areas where the tidal amplitude is low (such as in Sri Lanka) nursery.

seedlings may have to be irrigated with salt water. If the soil salinities build up, irrigation with freshwater twice a week may be appropriate Sea grasses, seaweeds and other debris that reach the nursery plants at high tide should be removed manually to prevent the plants being covered with them, which can result their death. Seedlings should be nursery raised nearly for 6 months until they are 30 – 40 cm long.

3.6.12.1.4. Mangrove planting / Transplanting techniques

Rhizophora that can tolerate high inundation and deep mud, should be planted closeto water. *Sonneratia and Excoecaria* be planted close to water in the upper reaches of estuaries where the salinity is low. *Avicennia and Lumnitzera* should be planted in the areas close to hinterland. *Ceriops and Bruguiera* be planted in areas between waterfront and landward.

Planting method

- **Rhizophora propagules (nursery grown seedlings and wildlings)-**

  Embed nearly 15 cm of the propagule in a hole made in the mud using a wooden stick. To avoid crab predation paint hypocotyls in yellow or place them inside a piece of bamboo (to cover the part hypocotyls easily eaten by crabs. Planting distance – 1.5m x 1.5m

- ***Sonneratia alba, Xylocarpus granatum, Heritiera littoralis and Avicennia marina-***

  Holes should be made using an auger/spade/ during low tide and place the seedling after cutting the polythene bag open. Planting distance should be - 2m x 2m (need 2500 seedlings/ha). Wildlings should be uprooted with a root-ball with a diameter half the height of the sapling and transported to the site of restoration by wrapping the root ball with a gunny bag or a polythene bag

- **Transplanting wildlings-**

  Holes appropriate for the size of the root ball should be dug in the mud during low tide and carefully place the root-ball wildling in it and later covered the roots with mud. Younger wildlings could be transplanted in polythene bags and raised in a nursery before being planted in the restoration site or older saplings could be root-balled and transplanted directly at the restoration site.

- **Use of fertilizer-**

  Five hundred grams of diammonium phosphate (DAP) and a few grams of iron oxide in a plastic bag. Seal it and punch two holes on one side of the bag with

a small nail. The bag should then be buried next to the tree with the holes facing the tree.

- **Fishbone channels**-In this method Plantation is resorted to in mud flats where infrequent tidal inundation is augmented through Fishbone Channels. Fishbone channels should be started along the embankment towards the existing Bani Forest. Planting of potted seedlings outside/without fishbone channels should be started from the edge of existing Bani Forest towards the embankment or area intended for fishbone.

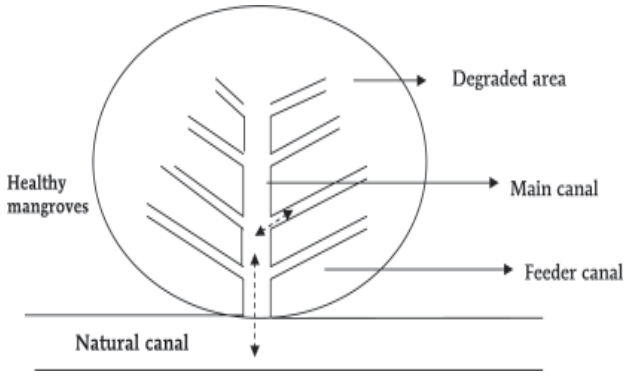


Figure 4.2 Layout of Fishbone Channel

3.6.13. Prescription for plantation in Village Forests after encroachment eviction

3.6.13.1. Barbed Wire Fencing

After eviction of the encroachment the area should be completely fenced by barbedwire to prevent encroachment again.

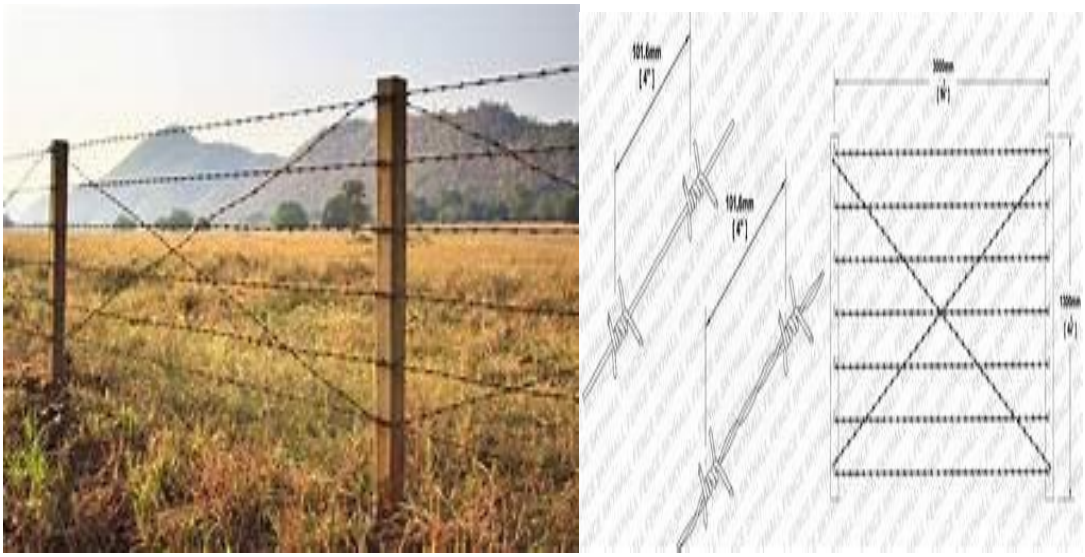


Figure No. 4.3 Barbed wire fencing with Pillars

3.6.13.2. Planting method

To restock forest areas by planting suitable tree, shrub and grass species. Raising of block plantation is a technical process and its various components and activities are discussed below:

3.6.13.2.1. Selection of species

Climatic variations occurring due to altitudes, aspects, temperature, rain fall, soil types have resulted into a number of forest types and vegetation types that vary from placeto place. Because of this, it is not possible to recommend any particular tree species for every area. However, while selecting the species for planting in a particular area the following points should be considered:

- The soil and climate of the area is suited to the growth of particular tree species,
- The species selected should meet the fodder, fruit and other requirements of the villagers living in the vicinity,
- The species selected suit the needs of birds and wild animals dwelling in the area. The species selected for planting should provide suitable cover and food to herbivores and carnivores.
- The species should be useful for water and soil conservation.

- The species should be able to meet the industrial and other local needs of the society. It should be borne in mind that the growth behaviour of any plant is considerably influenced by sunlight, temperature and fertility of soil. Some species have low moisture requirement. Where as many others require sizable quantity of water at the initial years of their growth.

3.6.13.2.2. Site development

Site development for a plantation includes clearance for planting and it involves, bush cutting, soil and moisture conservation works in 'nalas', construction of vegetative or stone check dams, marking of pits for planting of saplings etc. In addition, demarcation of boundary wall or fencing and inspection paths should be made to facilitate the movement of people engaged in plantation works. This work should be completed by the end of November. In hilly areas, Lantana, Eupatorium and other invading weeds and shrubs should be uprooted. While developing the site for planting, care should be taken to retain all indigenous species of trees and shrubs that are naturally growing in the area. They should not be cut and burnt along with weeds and thorny species. The planting design, location of plantation and size of plot is to be verified with review of Maps and aerial photo.

3.6.13.2.3. Digging of pits

After clearing the land sites for digging of pits, plantation should be marked on ground using a measuring tape to ensure the desired spacing. Wooden pegs or bamboo sticks shall be placed at the spot just at the centre of the pit. Pits of the size 30 cm x 30 cm and 30 cm depth should be dug. Pits should be deep enough to ensure that the roots of the plants do not curl up once the planting material is placed in it. The soil dug from the pits should be dumped close to the pit. While digging stones, roots of trees, grass or shrubs, if any, should be removed so that while filling the dug up earth back in the pits these are not mixed with the soil. The spacing of pits varies according to the planting scheme for different areas. Generally, the spacing between pit to pit, distances between lines is around 2.5mtr x 2.5mtr along the contour line. It may not be possible to follow this spacing strictly due to presence of boulders or trees. No pit should be dug within the vicinity of five meters from a tree. It is better for complete

the pitting works within end of March for better weathering of soil The spacing between the pits should however, not be less than 2.5mtr x 2.5mtr.

3.6.13.2.4. Planting of saplings

The plantation of sapling must be done in the first week of July when monsoon rain has begun. Planting of naked root plants should be completed as early as possible so as to take full advantage of the rain. The planting work should be done either during light rain or cloudy sky. The roots of the plants should be kept straight and the plant shall be put straight in vertical position. The collar of the plant should be kept at the surface level of the pit. After planting the sapling, the earth around it should be firmly pressed by hands or feet and while doing so the plant should be pulled about half inch to make sure that its roots is not bending. Bagged plants should be sprayed with water before planting. The polythene should be carefully removed so that the plant is not damaged. The plant with the soil intact should then be placed in the pit in straight position, the collar of the plant being in level with the ground. The soil around the plant should then the pressed firmly by hands only. Pressing by feet is likely to disturb the soil of the plant. The planted saplings should be of suitable thickness and height.

3.6.13.2.5. Replacement of dead plants/casualty replacement

Dead, dying or dry plants should be replaced by using healthy seedlings within 15 days of completion of planting work. 9. SOIL WORKING AND WEEDING Half moon pit shouldbe made around all the seedlings having inward slopes. For this purpose, a semi circular pit about 15 cm deep, 25-30 cm apart from the plant should be dug. The earth taken out from the pit is put around the base of the plant. This has double advantages; firstly, there will be no water logging at the base of the plant which may otherwise cause damage to the plant; secondly, the rain water collected around the plant will help in retaining the moisture for the plant. Naturally growing species which have been adopted at the time of site development should also be included in half moon pit making and weeding / hoeing operations. After the rains are over, capillary actions begin in the pits. This causes loss of moisture due to evaporation in the hot sun. To check this, weeding should be done in and around the pits. During this operation, grasses and weeds should be removed and the earth clumps should not be broken. Second weeding should be done in September end.

3.6.13.2.5. Insect and disease

Insect and diseases are present in all tree planting. Their presence is harmful to plant growth. It can be very difficult to diagnose insect and disease, they may be underground, inside the tree or microscopic. Sometime the multiple factors or combination of insects and disease may be causing the problems. There are some harmful insects are stem and root feeders, shoot or branch pests and defoliators. Weevil and white grubs feedings on stems and roots are typically the most destructive insects in a tree planting. Generally common plant diseases are root rots, cankers and rusts, foliar diseases. Root rots tend to cause slow twig and leader growth and an overall yellowing of the crown. Root rots often form in pockets rather than randomly across the planting. Controlling root rots is usually not practical. Swelling lesions, and/or weeping sap on the stems and branches could be signs of cankers and rusts. Cutting and removing infected parts of the tree is best option for control. Foliar diseases affect the needles or leaves. Maintaining good tree health and vigour are the best prevention measures for fighting off the insects and diseases that will attack the trees. This means selecting the appropriate species for the site, obtaining healthy stock, storing and handling seedlings properly, maintaining good soil fertility, controlling competing vegetation, and preventing animal damage. Further the application of insecticide and pesticide/ Fungicide is essential to control pest and diseases. All precautionary measures to be fallowed along with proper doses should be prepared during application of insecticide and pesticide in field.

3.6.13.2.7. Maintenance and after care of plantation

After care of plants in the plantation area is important and this includes:

- Periodical weeding and removal of grasses suppressing the plants,
- Maintenance and repair of inspection paths,
- Repair of boundary wall or fencing where ever necessary,
- To protect the plantation area from grazing and damage by wild animals and villagers cutting grass.

- To protect the area from fire, cleaning of dry grass and twigs, etc. from the area and cleaning of inspection paths,
- Cleaning of the outer periphery of the plantation area in two meter width,
- Keeping regular watch over the plantation area during the fire season and
- Seeking help and co-operation of the neighbouring villagers in the protection of the plantation area
- Under AJY the VSS members are required to take after care of plantation.

3.6.13.2.7. Maintenance in subsequent yearsSecond year

The casualty replacement works should be carried out in the second year. In this operation the dead plants are replaced by planting fresh saplings immediately at the onset of monsoon rains. Under normal conditions not more than ten per cent plants are required to be planted during the above operation in the second year. The reasons for mortality should be ascertained. The dead plants should be replaced by the species which are growing successfully. At least one weeding should be done and Half moon pit be made. The weeding, soil working and manuring operation is to be carried out within September. Fencing should be repaired where ever necessary. Proper attention is to be given for grazing and fire control.

Third and Fourth Year

Normally no beatings up operations are carried out during these years but full attention is given to protect the area from grazing and fire. However, soil working and weeding around the plants during the rainy season promoted the growth of seedlings. Therefore, provision of sufficient funds should be made for this purpose too.

3.6.13.2.8. Maintenance of fire lines

Forest fires are common feature. The extent of fire is generally more in the dense forests than in open forest area and the former suffered greater damage due to these fires. Most of the fires are man-caused (intentional or accidental). The total damage from forest fires is very large. Small trees and regeneration are often killed; severe fire can kill the large trees also. Protection of forests against fires is one of the important operations in forestry. Fire lines of sufficient width are cleared of vegetation and maintained all around the forests and run crisscross inside the forest so that a compact block or area is separated from other area. The width of these fire lines depends on many factors such as, type of forests, density, terrain, wind speed in the area etc. Such fire lines are usually cleared before the start of the fire season in order to avoid the spread of fires from one area

to another.

3.6.13.2.9. Maintenance of plantation journal

The plantation journal is to be maintained citing all details of Topography/soil/Climate, Year of plantation, plantation sites, species planted and year wise expenditure. The plantation map along with the GPS readings of all plantation pillars and photograph of planting operation is to be kept in journal. All details of planting activities year wise is to be written in plantation journal.

3.6.14. Associated regulations and measures

Prescriptions for rigid protection and closer of Grazing, regulations of rights & concessions will be made in accordance with the provisions of the Forests and Wildlife laws & rules in force in this Working Plan.

3.6.14.1 Plantation Control Form

After completion of planting, a plantation control form is required to be submitted by the Range Officer to regulate activities as per the prescription in the Working Plan.

Table no. 3.10 Plantation Control Form

Name of Planting Series	Year of Working	Area assigned in Ha	No. of standard trees marked	Quantum of timber/ firewood obtained	Area planted	Reason of deviation if any

CHAPTER 4

PROTECTION WORKING CIRCLE

4.1 Name of the working circle

Protection Working Circle

4.2 General Constitution of Working Circle

The national forest policy has stressed immediate and speedy programme for reconditioning of the mountainous regions, river valleys and coastal lands by establishment of forest protection over larger areas and preserving the existing ones. Policy resolves of the State Government is also to protect our ecologically sensitive and biologically diverse forests. So, the mangrove forest area along the coast of Bay of Bengal, the area with Crocodile

concentration, the nesting place Olive Ridley Turtle are to be brought under Protection Working Circle. Eco-fragile areas shall be covered by this Working Circle. The total area allotted to this Working Circle is **3577.258 ha**. Protection shall be classified into following categories and separate prescription need to be given against each to carry out the activities regularly.

a) Protection from grazing
b) Protection from illegal removal of forest produce
c) Protection of staffs from smugglers and theft (welfare scheme)
d) Provision of separate legal cell to deal with prosecution cases
e) Protection from encroachment
f) Prescription for protection and management of forests outside working plan area

Table no. 4.1 Total area under Protection Working Circle		
SL No.	**Name of the Forest Block**	**Area allotted toProtection WC**
1	**2**	**3**
1	Garamal PRF	294.958
2	Banipahi UDPF	2125.51
3	Bijayapatna UDPF	93.12
4	Bani Jungle UDPF	404.69
5	Outer Wheeler UDPF	66.72
6	Long Wheeler UDPF	19.24
7	Coconut Island UDPF	12.85
8	Small Wheeler UDPF	3.90
9	Short Island UDPF	15.30
10	Udabali(New) UDPF	485.83
11	Arjunbindha Santhpur VF	4.00
12	Bhatapada Gudpal VF	1.044
13	Bodakasana VF	10.00
14	Aruha VF	0.536
15	Kamaria VF	1.98
16	Mirzapur VF	0.56
17	Deola VF	5.00
18	Arjunbindha VF	3.00
19	Kabirpur VF	5.00
20	Haripur VF	0.68
21	Babanbindha VF	5.00
22	Amargadia VF	3.68
23	Belnta VF	1.00
24	Dianary VF	1.84
25	Sibapur VF	1.60
26	Bansar VF	0.42
27	Jalahari VF	3.00
28	Chatrujabhujapur VF	1.60
29	Goudabisa nuapada VF	2.20
30	Belagadia VF	2.80
31	Alboga VF	0.20
	Grand Total: -	**3577.258**

4.3 General Characteristics of vegetation

The vegetation of the area has the typical littoral and tidal swamp character. Mangroves are influenced by the river dominated setting where the dominant influence is of fresh water and sedimentary materials from upland catchments and tidal dominated settings near the sea face which often restricts both ariel extent of mangroves and their rate of growth. In this

condition, growth rate is reduced due to high salinity. The vegetation also represents conspicuous zonation of pure patches and also mangrove association distributed along the salinity gradient and distance to the water course. The area surrounded by water is well protected whereas the other side of inland area is prone to encroachment with non-forest activities.

The village forests are mostly encroached and the area under encroachment is either under habitation or agriculture or prawn farming.

4.4 Felling series, cutting sections and JFM areas

As Bhadrak Wildlife Division has very less forest cover as compared to the of total area, all the forest blocks are allotted to the Protection Working Circle. So, no felling operation is prescribed for this Working plan period. No area from this Working Circle is assigned to any VSS for protection and management.

4.4.1 Maintenance of Pillars PRF

To protect the Garmal PRF from encroachment and illegal entry the boundary is demarcated and 20 nos. of pillars are there to mark the boundary of the PRF. So maintenance is required for the pillars in regular interval. So a five year plan can be prescribed to maintain the 20 numbers of pillars.

Table No 4.2: Pillars of Garmal PRF

Sl No	Garmal PRFPillar No.	GPS reading
1	1	20°47'45"
		86°54'8"
2	2	20°47'46"
		86°54'11"
3	3	20°47'46"
		86°54'13"
4	4	20°47'47"
		86°54'25"
5	5	20°47'49"

		86°54'37"
6	6	20°47'53"
		86°54'48"
7	7	20°47'52"
		86°54'55"
8	8	20°47'48"
		86°55'7"
9	9	20°47'34"
		86°56'40"
10	10	20°47'44"
		86°55'29"
11	11	20°47'43"
		86°55'32"
12	12	20°47'42"
		86°55'40"
13	13	20°47'41"
		86°55'47"
14	14	20°47'38"
		86°55'55"
15	15	20°47'35"
		86°56'3"
16	16	20°47'34"
		86°56'7"
17	17	20°47'33"
		86°56'11"
18	18	20°47'31"
		86°56'18"
19	19	20°47'29"
		86°56'23"
20	20	20°47'28"
		86°56'29"

Table no. 4.3 One year maintenance Series for pillars of Garmal PRF		
Sl.No	**Pillar Numbers**	**Year of operation**
1	1-20	2021-22

4.5 Special Objectives of management

The objectives of management are: -

1. To protect the forest to maintain the environmental stability and restore the ecological balance wherever it has been disturbed.
2. To conserve vertical and horizontal the biological diversity of the area.
3. The mangrove habitat shall be rigidly protected from illegal biomass removal and allow them to grow under nature's own care and nursing.
4. To enhance the surveillance of the regular and temporary staff towards anti-poaching activities.
5. To check the illegal transportation of timbers and unauthorized saw pit and saw mill operations.

4.6. Silvicultural system

As the area included in the Working Circle are to be mainly protected without any consideration whatsoever for yield, no silvicultural system has been prescribed. However, for achieving the special objectives of this Working Circle the area should be rigidly protected from all sorts of biotic interference so as to keep it under nature's own care and nursing.

4.6.1 Rotation Period

As the objective is not to remove any forest produce from the assigned area, no rotation period is prescribed.

4.6.2 Harvestable diameters

The plan area is prone to cyclone. Due to the effect of cyclone, there is possibility of trees to be uprooted / wind fallen. It is required to salvage the wind fallen trees departmentally. No harvestable diameter is prescribed for wind fallen trees.

4.6.3 Reducing factors and reduced areas

Not required for this Working Circle.

4.6.4 Felling cycle

No felling cycle is prescribed.

4.6.5 Division into periods and allotment to periodic blocks (PB)

Not required for this Working Circle.

4.6.6 Calculation of the yield

Not required as the vegetation is protected against the effect of wind, tides and shifting of sand.

4.6.7 Table of felling

Not required for this Working Circle.

4.7 Associated regulations and measures

The areas outside the plan area where some Protection measures and interventions required for proper management of the Division.

4.7.1 Protection Squad

The members of the protection squad comprise of young energetic, enthusiastic local youth preferably from the Joint Forest Management Committee/ Eco Development Committee to be stationed at a strategic place of the Protection series. They should be equipped with all the amenities of Para Forest staff. These group should report forest offences of their respective areas and report it to the Head of the Protection squad who preferably would be a forest official of not below the rank of a Forester. The head of the protection squad wouldrecord all the activities of protection of the squad in a given format in day-to-day basis for theentire plan period.

❖ Duties and responsibility of the squad

To patrol inside their earmarked protection areas in daily basis to check.

a. Illicit felling
b. Poaching
c. Encroachment
d. Wildlife anti-depredation activities

Along with protection squads the Division has following facilities for protection of Wildlife and forest cover.

Table no. 4.4 Facilities available at the Division for Protection

Sl. No.	Items	Available in nos.	Remarks
1	Squads	4	CAMPA-2 General-1 Turtle Protection (CSS)-1
2	Mobile phones	50	Used for Forest protection and wildlife protection

3	VHF	3	
4	Speed boats	1	
5	Support boat	1	
6	Rowing boat	1	

4.7.2 Protection of Olive Ridley Turtles

Olive Ridley Sea turtles arrive in the small islands like Babubali Island, Wheeler Island, Coconut Island etc. in 2nd half of October every year. They mate in shallow waters and wait for right weather and an exposed sandy beach to lay their eggs. Mass nesting takes place between February to April. The eggs hatch approximately 50 days after the nesting and the hatchlingsgo back to the sea during the month of April/May.

During this period, patrolling should be organized by the Division with help of hired trawlers to prevent unauthorized entry of fishing vessels. Also, joint patrolling should be taken with Indian Coast. Illegal fishing vessels when apprehended should be prosecuted under Wildlife (Protection) Act, 1972.

Onshore and offshore camps are established to monitor turtle mortality, movement of illegal fishing vessels and organizing movement into the sanctuary area.

These camps are mostly manned by daily waged workers from the local community. Movement pattern of turtle congregation is monitored in the water during the course of patrolling. The beach is monitored and suitable sites for nesting are cleared of debris. At the time of mass nesting, census of nesting turtles should be carried out scientifically and the number is estimated. Steps are taken to prevent damage of eggs by dogs, wild animals like jackals and wild boars. At the time of hatching, steps are taken to prevent mortality by seagulls, crows etc. and if required the hatchlings are helped manually to enter into the sea. During the time of nesting and hatching, lights on the seaward side are switched off by DRDO authorities. The list of on-shore and off shore camps of this division for Olive Ridley Sea turtle protection are listed in Table no. 4.5.

Table no. 4.5 On Shore and Off Shore camps of Bhadrak WL Division

Year	Name of the Range	Name of the On-shore Camp	Name of the Off-shore Camp
2009-10	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali

2010-11	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2011-12	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2012-13	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2013-14	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2014-15	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2015-16	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
2016-17	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--
2017-18	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal, Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--
2018-19	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--

Prescription on protection of Olive Ridley

The following measures should be prescribed in protection of Olive Ridley turtles-

1. Patrolling during mating period up to end period of entry of hatchlings into sea
2. Protecting the eggs and hatchlings from dogs and wild boar by continuous guarding them by staffs and squad members
3. Prevention of fishing boats' illegal entry into nesting area

Facilities available in the Division

The following facilities available in this division for turtle protection-

1. Speed boat-1
2. Hired supporting boats-2

3. Off shore camp at Babubali with temporary stay facilities

Strengthening of Infrastructure

The following facilities are proposed under this working plan for better protection of Olive Ridley-

1. Supporting boat- 2
2. Speed boat- 1
3. Rowing boat- 2
4. Landing space/ floating jetty at Babubali

4.7.3 Elephant anti-depredation activities

Elephant Depredation Activities are observed in boarder areas adjoining to Hadagarh Sanctuary of Keonjhar Wildlife Division and some part of this Division falling under Agarpada Section of Bhadrak Range. The Elephant herd usually visit the areas where cultivation of mango, jack fruit and pineapple are done during ripening period and also at the time of harvesting of seasonal paddy and maize crops in that locality. Though very rare case of elephant depredation activity is seen in this division, the staffs should be always ready to face this challenge.

Prescription

i. Recording the movement of elephant and the damage that it does.
ii. Monitoring conflict will help one to pinpoint where the worst conflict occurs.
iii. Driving the elephant carefully with flash lights and sirens
iv. Public resentment leading to revengeful action by resorting to killing of wild animals shall be contained with instant solace by the forest officials.
v. On receipt of information regarding any wildlife depredation, an officer of and above the rank of Assistant Conservator of Forests shall visit the spot immediately. It would have been better to calm down the agitated people through instant payment of the compassionate amount.
vi. Since there is some paraphrenias to be maintained, the sanction of compassionate amount shall be done at earliest and such sanction order shall be handed over to the affected person.
vii. The affected family should be provided some additional benefit under other schemes of the department.

Infrastructures available for elephant anti-depredation activity are listed in the table 2.5.

Table 4.6 ELEPHANT DEPRADATION IN BHADRAK

(WL) DIVISION						
Sl. No.	**Name of the Range**	**Name of the Section**	**Location**	**Item of work**	**Quantity**	**Period**
1	Bhadrak (WL) Range	Agarpada1	Border area adjoining to Hadagarh Sanctuary of Keonjhar (WL) Division &portion of Bhadrak (WL) Division	Squad	1 no. (10 nos. members	Throughout the year
				Vehicle	1 no.	
				POL	3000 ltr.	
				Ancillaries	Spot light-4nos, Torch-8nos, Crackers, Night Vision Binaculars-2 nos., Night Vision Binaculars-2 nos., Camera-2nos., uniforms, Shoes, Temporary shed, installation of solar light, solar fencing etc.	

4.7.4 Protection of Salt-water Crocodiles.

As this Division is bordering to the Bhitarkanika National Park, it has also a goodpopulation of Salt water crocodile. The saltwater crocodiles are endangered species belonging

to the Order *Crocodylia* and Family *Crocodylidae*. The common English name for this crocodile is salt water crocodile or estuarine crocodile and the scientific name is *Crocodylus porosus.*

The broad activities under the crocodile protection will be the following:

1. Protecting thecrocodiles from human interference.

2. Public awareness of the importance of the crocodiles in ecosystems.

3. Regular patrolling in the rivers of Baitarini and Mantei.

4. Use of gill nets in the rivers, creeks and estuaries throughout the sanctuary should be strictly prohibited

4.7.5 Other prescriptions

- A functional Divisional Mobile Squad with vehicle, required staff and arms will be constituted. The Divisional Mobile will be deployed by the Divisional Forest Officer for regular patrolling to stop illegal transport and smuggling of timbers and supporting field staffs in emergencies.

- A prosecution cell with a Range Officer in charge shall be constituted at the Division Office to ensure proper liaison between the prosecuting officials and the public prosecutors. This will remarkably help in proper submission of prosecution report and other documents to the courts and also to keep a track on the proceeding of the case.

4.7.6. Communication System

All the area under this protection Working Circle is connected with mobile networks and all the squad shall be supplied with mobile phone connectivity with internet connection to communicate with the higher quarters.

4.7.8 Intelligence Network

The precursor of the successful detection offence case is the collection of intelligent networks. At the division level, some funds shall be placed with the Assistant Conservator of Forests (Enforcement) who shall spend the same under guidance of Divisional Forest Officer.

The dossier of the timber smugglers shall be prepared at the Range level and can be seriously dealt with the leadership of the Assistant Conservator of Forests (Enforcement).

4.7.9. Reward & Incentives

Annual individual and community rewards for effective protection of this Working Circle shall be given in regular basis to boost up their morals of the employees.

CHAPTER 4

PROTECTION WORKING CIRCLE

7.1 Name of the working circle

Protection Working Circle

7.2 General Constitution of Working Circle

The national forest policy has stressed immediate and speedy programme for reconditioning of the mountainous regions, river valleys and coastal lands by establishment of forest protection over larger areas and preserving the existing ones. Policy resolves of the State Government is also to protect our ecologically sensitive and biologically diverse forests. So, the mangrove forest area along the coast of Bay of Bengal, the area with Crocodile concentration, the nesting place Olive Ridley Turtle are to be brought under Protection Working Circle. Eco-fragile areas shall be covered by this Working Circle. The total area allotted to this Working Circle is **3577.258 ha**. Protection shall be classified into following categories and separate prescription need to be given against each to carry out the activities regularly.

a) Protection from grazing
b) Protection from illegal removal of forest produce
c) Protection of staffs from smugglers and theft (welfare scheme)
d) Provision of separate legal cell to deal with prosecution cases
e) Protection from encroachment
f) Prescription for protection and management of forests outside working plan area

Table no. 4.1 Total area under Protection Working Circle		
SL No.	**Name of the Forest Block**	**Area allotted toProtection WC**
1	**2**	**3**
1	Garamal PRF	294.958
2	Banipahi UDPF	2125.51
3	Bijayapatna UDPF	93.12
4	Bani Jungle UDPF	404.69
5	Outer Wheeler UDPF	66.72
6	Long Wheeler UDPF	19.24
7	Coconut Island UDPF	12.85
8	Small Wheeler UDPF	3.90
9	Short Island UDPF	15.30
10	Udabali(New) UDPF	485.83
11	Arjunbindha Santhpur VF	4.00
12	Bhatapada Gudpal VF	1.044
13	Bodakasana VF	10.00
14	Aruha VF	0.536
15	Kamaria VF	1.98
16	Mirzapur VF	0.56
17	Deola VF	5.00
18	Arjunbindha VF	3.00
19	Kabirpur VF	5.00
20	Haripur VF	0.68
21	Babanbindha VF	5.00
22	Amargadia VF	3.68
23	Belnta VF	1.00
24	Dianary VF	1.84
25	Sibapur VF	1.60
26	Bansar VF	0.42
27	Jalahari VF	3.00
28	Chatrujabhujapur VF	1.60
29	Goudabisa nuapada VF	2.20
30	Belagadia VF	2.80
31	Alboga VF	0.20
	Grand Total: -	**3577.258**

7.3 General Characteristics of vegetation

The vegetation of the area has the typical littoral and tidal swamp character. Mangroves are influenced by the river dominated setting where the dominant influence is of fresh water and sedimentary materials from upland catchments and tidal dominated settings near the sea face which often restricts both ariel extent of mangroves and their rate of growth. In this

condition, growth rate is reduced due to high salinity. The vegetation also represents conspicuous zonation of pure patches and also mangrove association distributed along the salinity gradient and distance to the water course. The area surrounded by water is well protected whereas the other side of inland area is prone to encroachment with non-forest activities.

The village forests are mostly encroached and the area under encroachment is either under habitation or agriculture or prawn farming.

7.4 Felling series, cutting sections and JFM areas

As Bhadrak Wildlife Division has very less forest cover as compared to the of total area, all the forest blocks are allotted to the Protection Working Circle. So, no felling operation is prescribed for this Working plan period. No area from this Working Circle is assigned to any VSS for protection and management.

4.4.1 Maintenance of Pillars PRF

To protect the Garmal PRF from encroachment and illegal entry the boundary is demarcated and 20 nos. of pillars are there to mark the boundary of the PRF. So maintenance is required for the pillars in regular interval. So a five year plan can be prescribed to maintain the 20 numbers of pillars.

Table No 4.2: Pillars of Garmal PRF

Sl No	Garmal PRFPillar No.	GPS reading
1	1	20°47'45"
		86°54'8"
2	2	20°47'46"
		86°54'11"
3	3	20°47'46"
		86°54'13"
4	4	20°47'47"
		86°54'25"
5	5	20°47'49"

		86°54'37"
6	6	20°47'53"
		86°54'48"
7	7	20°47'52"
		86°54'55"
8	8	20°47'48"
		86°55'7"
9	9	20°47'34"
		86°56'40"
10	10	20°47'44"
		86°55'29"
11	11	20°47'43"
		86°55'32"
12	12	20°47'42"
		86°55'40"
13	13	20°47'41"
		86°55'47"
14	14	20°47'38"
		86°55'55"
15	15	20°47'35"
		86°56'3"
16	16	20°47'34"
		86°56'7"
17	17	20°47'33"
		86°56'11"
18	18	20°47'31"
		86°56'18"
19	19	20°47'29"
		86°56'23"
20	20	20°47'28"
		86°56'29"

Table no. 4.3 One year maintenance Series for pillars of Garmal PRF		
Sl.No	**Pillar Numbers**	**Year of operation**
1	1-20	2021-22

7.5 Special Objectives of management

The objectives of management are: -

6. To protect the forest to maintain the environmental stability and restore the ecological balance wherever it has been disturbed.

7. To conserve vertical and horizontal the biological diversity of the area.

8. The mangrove habitat shall be rigidly protected from illegal biomass removal and allow them to grow under nature's own care and nursing.

9. To enhance the surveillance of the regular and temporary staff towards anti-poaching activities.

10. To check the illegal transportation of timbers and unauthorized saw pit and saw milloperations.

7.6. Silvicultural system

As the area included in the Working Circle are to be mainly protected without any consideration whatsoever for yield, no silvicultural system has been prescribed. However, for achieving the special objectives of this Working Circle the area should be rigidly protected from all sorts of biotic interference so as to keep it under nature's own care and nursing.

7.6.1 Rotation Period

As the objective is not to remove any forest produce from the assigned area, no rotation period is prescribed.

7.6.2 Harvestable diameters

The plan area is prone to cyclone. Due to the effect of cyclone, there is possibility of trees to be uprooted / wind fallen. It is required to salvage the wind fallen trees departmentally. No harvestable diameter is prescribed for wind fallen trees.

7.6.3 Reducing factors and reduced areas

Not required for this Working Circle.

7.6.4 Felling cycle

No felling cycle is prescribed.

7.6.5 Division into periods and allotment to periodic blocks (PB)

Not required for this Working Circle.

7.6.6 Calculation of the yield

Not required as the vegetation is protected against the effect of wind, tides and shifting of sand.

7.6.7 Table of felling

Not required for this Working Circle.

7.7 Associated regulations and measures

The areas outside the plan area where some Protection measures and interventions required for proper management of the Division.

7.7.1 Protection Squad

The members of the protection squad comprise of young energetic, enthusiastic local youth preferably from the Joint Forest Management Committee/ Eco Development Committee to be stationed at a strategic place of the Protection series. They should be equipped with all the amenities of Para Forest staff. These group should report forest offences of their respective areas and report it to the Head of the Protection squad who preferably would be a forest official of not below the rank of a Forester. The head of the protection squad wouldrecord all the activities of protection of the squad in a given format in day-to-day basis for theentire plan period.

❖ **Duties and responsibility of the squad**

To patrol inside their earmarked protection areas in daily basis to check.

e. Illicit felling
f. Poaching
g. Encroachment
h. Wildlife anti-depredation activities

Along with protection squads the Division has following facilities for protection of Wildlife and forest cover.

Table no. 4.4 Facilities available at the Division for Protection

Sl. No.	Items	Available in nos.	Remarks
1	Squads	4	CAMPA-2 General-1 Turtle Protection (CSS)-1
2	Mobile phones	50	Used for Forest protection and wildlife protection

3	VHF	3	
4	Speed boats	1	
5	Support boat	1	
6	Rowing boat	1	

7.7.2 Protection of Olive Ridley Turtles

Olive Ridley Sea turtles arrive in the small islands like Babubali Island, Wheeler Island, Coconut Island etc. in 2nd half of October every year. They mate in shallow waters and wait for right weather and an exposed sandy beach to lay their eggs. Mass nesting takes place between February to April. The eggs hatch approximately 50 days after the nesting and the hatchlingsgo back to the sea during the month of April/May.

During this period, patrolling should be organized by the Division with help of hired trawlers to prevent unauthorized entry of fishing vessels. Also, joint patrolling should be taken with Indian Coast. Illegal fishing vessels when apprehended should be prosecuted under Wildlife (Protection) Act, 1972.

Onshore and offshore camps are established to monitor turtle mortality, movement of illegal fishing vessels and organizing movement into the sanctuary area.

These camps are mostly manned by daily waged workers from the local community. Movement pattern of turtle congregation is monitored in the water during the course of patrolling. The beach is monitored and suitable sites for nesting are cleared of debris. At the time of mass nesting, census of nesting turtles should be carried out scientifically and the number is estimated. Steps are taken to prevent damage of eggs by dogs, wild animals like jackals and wild boars. At the time of hatching, steps are taken to prevent mortality by seagulls, crows etc. and if required the hatchlings are helped manually to enter into the sea. During the time of nesting and hatching, lights on the seaward side are switched off by DRDO authorities. The list of on-shore and off shore camps of this division for Olive Ridley Sea turtle protection are listed in Table no. 4.5.

Table no. 4.5 On Shore and Off Shore camps of Bhadrak WL Division

Year	Name of the Range	Name of the On-shore Camp	Name of the Off-shore Camp
2009-10	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali

2010-11	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2011-12	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2012-13	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2013-14	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2014-15	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal	Babubali
2015-16	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
2016-17	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--
2017-18	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal, Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--
2018-19	Chandbali (WL) Range	Karanjmal,Kalinali,Chandinipal,Dhamara	Babubali
	Basudevpur (WL) range	Chudamani, Kasia	--

Prescription on protection of Olive Ridley

The following measures should be prescribed in protection of Olive Ridley turtles-

4. Patrolling during mating period up to end period of entry of hatchlings into sea
5. Protecting the eggs and hatchlings from dogs and wild boar by continuous guarding them by staffs and squad members
6. Prevention of fishing boats' illegal entry into nesting area

Facilities available in the Division

The following facilities available in this division for turtle protection-

4. Speed boat-1
5. Hired supporting boats-2

6. Off shore camp at Babubali with temporary stay facilities

Strengthening of Infrastructure

The following facilities are proposed under this working plan for better protection of Olive Ridley-

5. Supporting boat- 2
6. Speed boat- 1
7. Rowing boat- 2
8. Landing space/ floating jetty at Babubali

7.7.3 Elephant anti-depredation activities

Elephant Depredation Activities are observed in boarder areas adjoining to Hadagarh Sanctuary of Keonjhar Wildlife Division and some part of this Division falling under Agarpada Section of Bhadrak Range. The Elephant herd usually visit the areas where cultivation of mango, jack fruit and pineapple are done during ripening period and also at the time of harvesting of seasonal paddy and maize crops in that locality. Though very rare case of elephant depredation activity is seen in this division, the staffs should be always ready to face this challenge.

Prescription

viii. Recording the movement of elephant and the damage that it does.
ix. Monitoring conflict will help one to pinpoint where the worst conflict occurs.
x. Driving the elephant carefully with flash lights and sirens
xi. Public resentment leading to revengeful action by resorting to killing of wild animals shall be contained with instant solace by the forest officials.
xii. On receipt of information regarding any wildlife depredation, an officer of and above the rank of Assistant Conservator of Forests shall visit the spot immediately. It would have been better to calm down the agitated people through instant payment of the compassionate amount.
xiii. Since there is some paraphrenias to be maintained, the sanction of compassionate amount shall be done at earliest and such sanction order shall be handed over to the affected person.
xiv. The affected family should be provided some additional benefit under other schemes of the department.

Infrastructures available for elephant anti-depredation activity are listed in the table 2.5.

Table 4.6 ELEPHANT DEPRADATION IN BHADRAK

(WL) DIVISION						
Sl. No.	**Name of the Range**	**Name of the Section**	**Location**	**Item of work**	**Quantity**	**Period**
1	Bhadrak (WL) Range	Agarpada1	Border area adjoining to Hadagarh Sanctuary of Keonjhar (WL) Division &portion of Bhadrak (WL) Division	Squad	1 no. (10 nos. members	Throughout the year
				Vehicle	1 no.	
				POL	3000 ltr.	
				Ancillaries	Spot light-4nos, Torch-8nos, Crackers, Night Vision Binaculars-2 nos., Night Vision Binaculars-2 nos., Camera-2nos., uniforms, Shoes, Temporary shed, installation of solar light, solar fencing etc.	

7.7.4 Protection of Salt-water Crocodiles.

As this Division is bordering to the Bhitarkanika National Park, it has also a goodpopulation of Salt water crocodile. The saltwater crocodiles are endangered species belonging

to the Order *Crocodylia* and Family *Crocodylidae*. The common English name for this crocodile is salt water crocodile or estuarine crocodile and the scientific name is *Crocodylus porosus.*

The broad activities under the crocodile protection will be the following:

5. Protecting thecrocodiles from human interference.

6. Public awareness of the importance of the crocodiles in ecosystems.

7. Regular patrolling in the rivers of Baitarini and Mantei.

8. Use of gill nets in the rivers, creeks and estuaries throughout the sanctuary should be strictly prohibited

7.7.5 Other prescriptions

- A functional Divisional Mobile Squad with vehicle, required staff and arms will be constituted. The Divisional Mobile will be deployed by the Divisional Forest Officer for regular patrolling to stop illegal transport and smuggling of timbers and supporting field staffs in emergencies.

- A prosecution cell with a Range Officer in charge shall be constituted at the Division Office to ensure proper liaison between the prosecuting officials and the public prosecutors. This will remarkably help in proper submission of prosecution report and other documents to the courts and also to keep a track on the proceeding of the case.

4.7.6. Communication System

All the area under this protection Working Circle is connected with mobile networks and all the squad shall be supplied with mobile phone connectivity with internet connection to communicate with the higher quarters.

4.7.8 Intelligence Network

The precursor of the successful detection offence case is the collection of intelligent networks. At the division level, some funds shall be placed with the Assistant Conservator of Forests (Enforcement) who shall spend the same under guidance of Divisional Forest Officer.

The dossier of the timber smugglers shall be prepared at the Range level and can be seriouslydealt with the leadership of the Assistant Conservator of Forests (Enforcement).

4.7.9. Reward & Incentives

Annual individual and community rewards for effective protection of this WorkingCircle shall be given in regular basis to boost up their morals of the employees.

CHAPTER 5

5. JOINT FOREST MANAGEMENT OVERLAPPING WORKING CIRCLE

5.1 Name of the working circle

Joint forest management overlapping working circle

5.2 General constitution of the working circle

Association of people in the management of forests can play an important role in the regeneration and protection of degraded forests. Govt. of India adopted the strategy of Joint Forest Management to solve many of its problem related to deforestation, environmental degradation, and rural poverty. National forest policy of 1988 is the guiding factor in shifting to this new policy. This concept essentially involves mobilizing local people for group action in managing specific forest areas adjacent to their villages or settlements and share responsibilities and benefits according to a well-defined mutually agreed set of rules and regulations. As a legal back up to the policy Government of India issued a circular on 1.6.1990 directing all State Governments to accept this new strategy in principle, The resolution No.10F (Pron.) 20 / 93 – 16700 / F & E dt.03.07.1993 issued by Government of Odisha during 1993 issued guidelines for the joint forest planning and management (JFM) programme in order to rehabilitate degraded forests (with density less than 0.25) with the active involvement and participation of the local community on benefit sharing basis. The programme provides for, constitution of village forest committees (VFC), preparation of micro-plans in consultation with the villagers, modalities of sharing of the usufructs etc.

The joint Forest Management Resolution of Government of Orissa entrusts the Gram Panchayats with the duty of convening a general meeting of all adults living in the selected village on the suggestion of the D.F.O/ Range Officer/forester, where the forest officials will explain the scheme of Joint Forest Management to the villagers. Based on the response, motivation and willingness of the villagers and after taking account of other related factors facilitating the community protection of the forest, the D.F.O will recommend the establishment of Vana Surakhya Samiti (VSS) of the village. According to the resolution, the VSS should include two adults, including a women member of every house hold living in the village as its members. the protection and management responsibility of the forest patch is

wholly entrusted to the members of the forest protection committee. It shall be the duty of the members to prevent forest offenses and pass on relevant information and intelligence in this regard to the forest department officials. The management activities of the forest are to be carried out by the executive committee of the VSS. Each VSS should have its own executive committee comprising ten to fifteen members, which should include Ward Members representing the village, six to eight representatives selected / elected by the villagers, the forester and Forest Guard concerned, and nominee of an NGO functioning in the local area to be selected by the D.F.O. The Forester of the locality concerned and the Naib Sarpanch (Vice-President of the gram panchayat) would be the convener and chairperson of the executive committee respectively.

In this working plan in view of the increased participation of local people in forest management due to the changes in forest management enunciated in the National Forest Policy, 1988 and the above Govt. orders. Forty-four numbers of VSS and twenty EDC have been formed in the Division under various projects/schemes. **In this working circle 3739.0 Ha (3208.5 Ha from plan area and 530.5 Ha outside plan area) of area is included and all the 44 VSSs and 20 EDCs formed for protection and conservation of forest areas, attached to these committees as per the MOU are also included in this working circle.** This is an overlapping working circle.

As this Division has no protected area, steps have to be taken to convert twenty EDCs (formed previously) into VSSs.

Under the JFM, both afforestation and entry point activities have been taken up in the VSSs. These activities have been largely funded by the externally aided projects. Helping SHG's in Income generation activities (IGA), and community-oriented works like mushroom cultivation training for ladies etc. have been taken up in different VSSs and EDCs. With this background it has been decided to constitute a JFM overlapping working circle in this working plan.

5.3. General Character of Vegetation:

The forests of this Division belong to 4B-Tidal Swamp Forests. Tidal forests grow near the estuaries or the deltas of rivers, swampy margins of Islands and along sea coasts. The soil is formed of silt, silt-loam or silt-clay and sand. The plants are typical halophytes which are characterized by presence of prop roots with well-developed knees for support and pneumatophores and viviparous germination of seeds.

Tidal forests one distinguished into the following four types with overlapping constituent species:

(i) Tree mangrove forests

(ii) Low mangrove forests

(iii) Salt water forests and

(iv) Brackish water forests

i. Tree Mangrove forests:

These forests occur on both east and west sea coasts. The best development occurs in Sundarbans. The forest floor is flooded with salt water daily. Plants may attain a height 10-15 meters and form an almost closed evergreen forest. The common trees of these forests are *Rhizophora mucronata, R. conjugata, Avicennia alba, Bruguiera conjugata, B. parviflora, B. caryophylloides, Kandelia candel, Xylocarpus molluccensis, X. granatuns, Ceriops tagal, Avicennia officinalis, Excoecaria agallocha, Sonneratia acida, Lumnitzera racemosa, L. littorea, Aegiceras carniculatum and two most frequently occurring palms; Nipafruticans and Phoenix paludosa*. In addition to these trees *Acanthus ilicifolius* and other shrubs also grow at places.

ii. Low Mangrove Forests:

These forests grow on soft tidal mud near estuaries, which is flooded by salt water. Forest is dense but the trees with leathery leaves attain maximum height of 3-6 m. The vegetation consists of a few species which show gregarious growth habit. Important tree species are *Ceriops decandra, Avicennia alba, Aegialitis rotundifolia and Excoecaria agallocha*. Besides, a common shrub *Acanthus elicifolius* and some grasses also occur at places. Low mangrove forests are more developed on east sea coast than on west coast.

iii. Salt water Mangrove Forests:

These forests occur beyond tree mangrove forests in big river deltas where the ground is flooded with tidal water. Silt deposition and salt content in soil are low. Tree height is upto

20 m or so but girth is not large. Forests are dense. Pneumatophores are common. The common plants are *Heritiera minor, Excoecaria agallocha, Ceriops decandra, Xylocarpus molluccensis, Bruguiera conjugata, Avicennia officinalis and Nipa* at places.

iv. Brackish Water Mangrove Forests:

They grow near the river deltas where forest floor is flooded with water at least for some times daily. Water is brackish (salty) but during rains it is nearly fresh. Tree height may reach 30 m or so. Forest is dense. Common species of the forests are *Heritiera minor, Xylocarpus molluccensis, Bruguiera conjugata, Avicennia officinalis, Sonneratia caseolaris,*
S. acida, Excoecaria agallocha, Ceriops decandra Cynometra ramiflora, Amoora cuculata,Pandanus, and two palms; Nipa and Phoenix paludosa.

The mangrove vegetation of Bhadrak Wildlife Division is covered by *Avicennia alba, Avicennia marina, Avicennia officianalis, Acanthus illicifolius, Lumnitzera littorea, Aegialitis rotundifolia, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratia apetala, Sonneratia caseolaris, Derris scandens, D. hererrophylla, Azima tetracantha , Kandelia candel and Capparies separia w*hich are commonly distributed. Most part is impenetrable and provides congenial niche for many wild lives. Along the river bank the vegetation is also luxuriant and quite expensive. The dominant species is *Avicennia alba* and *Sonneratia apetala*. The commonly found shrubs are *Ceriopes decandra, Phoenix palludosa, Agicevas corniculatum* and *Cynometra iripa.*

The composition and distribution of mangrove vegetation is mainly influenced by the salinity of water, the duration and frequency of tidal inundation they receive, degree of constant supply of fresh water, erosion and accretion of land which is a regular phenomenon in this area, Along the fringes of creeks and channels the tree species are most luxuriant. The water channels are mostly silted, which demands proper management to ensure tidal inundation.

The vegetation of the area has the typical littoral and tidal swamp character. Mangroves are influenced by the river dominated setting where the dominant influence is of fresh water and sedimentary materials from upland catchments and

tidal dominated settings near the sea face which often restricts both ariel extent of mangroves and their rate of growth. In this condition, growth rate is reduced due to high salinity. The vegetation also represents conspicuous zonation of pure patches and also mangrove association distributed along the salinity gradient and distance to the water course. The area surrounded by water is well protected whereas the other sideof inland area is prone to encroachment with non-forest activities.

5.4 Felling series, cutting sections and JFM areas

5.4.1 Allotment of area to different Felling Series/ treatment Series

As per record, there are forty-four numbers of VSS and twenty EDC have been formed in the Division under various projects/schemes. The area under JFM overlapping Working Circle includes area assigned to VSS and EDC i.e., 3208.5 Ha from PRF/UDPF (Plan area) and 530.5 Ha of Social Forestry Plantation areas (outside plan area). Total area assigned to this working circle is **3739.0 Ha.**

5.5 Blocks, compartments and JFM area

Table no. 5.1 Area assigned to VSS Forest Block wise

Sl. No.	Name of Range	No. of Forest Block &	Area assigned to JFM(O) WC in Ha
1	Chandbali	1 (PRF)	163.5
2	Chandbali	3 (UDPF)	670.0
Total			**833.5**

Table no. 5.2 Name of VSS and area assigned in PRF & UDPF

Sl. No.	Name of PRF/ UDPF	Name of Range	Name of VSS/ EDC	Area assigned in Ha
1	Garmal	Chandbali	Jaydurgapatna	123.5
			Jyostnamayi	40
2	Banipahi, Banijungle and Bijaypatna	Chandbali	Saratprasad	200
			Kishoreprasad	150

			Shasikadeipur	20
			Kanakprasad	100
			Karanjamal	200
Total				**833.5**

Table no. 5.3 List of EDC under Bhadrak WL division & area assigned in PRF & UDPF

Sl. No.	Name of the Range	Name of the Section	Name of the EDC	Name of the village	Forest type	Area in Ha. Assigned to VSS
1	Basudevpur WL	Basudevpur	Mohanpur	Mohanpur	UDPF	237
2	Basudevpur WL	Basudevpur	Kantipur	Kantipur	UDPF	121
3	Basudevpur WL	Basudevpur	Eram	Eram	UDPF	65
4	Basudevpur WL	Bideipur	Dipiora	Dipiora	UDPF	193
5	Basudevpur WL	Bideipur	Balimunda	Balimunda	UDPF	252
6	Basudevpur WL	Basudevpur	Parapokhari	Parapokhari	UDPF	95
7	Basudevpur WL	Basudevpur	Sanakrushnapur	Sanakrushnapur	UDPF	125
8	Basudevpur WL	Bideipur	Khatuasahi	Khatuasahi	UDPF	46
9	Basudevpur WL	Bideipur	Bideipur	Bideipur	UDPF	130
10	Chandbali WL	Karanjamal	Gouraprasad	Gouraprasad	UDPF	130
11	Chandbali WL	Karanjamal	Baincha	Baincha	UDPF	107.5
12	Chandbali WL	Karanjamal	Kuamara	Kuamara	UDPF	179.5
13	Chandbali WL	Karanjamal	Hrudyaprasad	Hrudyaprasad	UDPF	90
14	Chandbali WL	Karanjamal	Karanpali	Karanpali	UDPF	78
15	Chandbali WL	Karanjamal	Bijaypatana	Bijaypatana	UDPF	81
16	Chandbali WL	Karanjamal	Nandapatana	Nandapatana	UDPF	115
17	Chandbali WL	Karanjamal	Dhankuta	Dhankuta	UDPF	95
18	Chandbali WL	Karanjamal	Narendrapur	Narendrapur	UDPF	115

19	Chandbali WL	Karanjamal	Saratprasad	Saratprasad	UDP F	80
20	Chandbali WL	Karanjamal	Kanakprasad	Kanakprasad	UDP F	40
					TOTAL	**2375**

Table no. 5.4 List of VSS under Bhadrak WL Division formed outside Forest Area

Sl No.	Name of the Range	Name of the Section	Name of the VSS	Name of the village	Name and status of Forest Land	Area in Ha. Assigned toVSS
1	Chandbali WL	Chandbali	Gopaldohara	Gopaldohara	Social Forestry Plantation	5
2	Chandbali WL	Chandbali	Kunjakalika	Kunjakalika	Social Forestry Plantation	15
3	Chandbali WL	Chandbali	Kudakaniha	Kudakaniha	Social Forestry Plantation	10
4	Chandbali WL	Chandbali	Kaudiapal	Kaudiapal	Social Forestry Plantation	20
5	Basudevpur WL	Basudevpur	Chudamani	Chudamani	Social Forestry Plantation	55
6	Basudevpur WL	Basudevpur	Kismatkrushnapur	Kismatkrushnapur	Social Forestry Plantation	100
7	Basudevpur WL	Basudevpur	Nuagaon	Nuagaon	Social Forestry Plantation	17
8	Basudevpur WL	Basudevpur	Mirzapur	Mirzapur	Social Forestry Plantation	12
9	Basudevpur WL	Basudevpur	Binayakpur	Binayakpur	Social Forestry Plantation	10
10	Basudevpur WL	Basudevpur	Lunga	Lunga	Social Forestry Plantation	10
11	Basudevpur WL	Bideipur	Malikadeipur	Malikadeipur	Social Forestry Plantation	10
12	Dhamnagar WL	Bhandaripokhari	Bhagada	Bhagada	Social Forestry Plantation	10
13	Dhamnagar WL	Bhandaripokhari	Uttargadia	Uttargadia	Social Forestry Plantation	10

14	Dhamnagar WL	Bhandaripokhari	Kotsira	Kotsira	Social Forestry Plantation	10
15	Dhamnagar WL	Bhandaripokhari	Badabanasta	Badabanasta	Social Forestry Plantation	10
16	Dhamnagar WL	Bhandaripokhari	Khadisinga	Khadisinga	Social Forestry Plantation	10
17	Dhamnagar WL	Dhamnagar	Adampur	Adampur	Social Forestry Plantation	7
18	Dhamnagar WL	Dhamnagar	Kanjia	Kanjia	Social Forestry Plantation	7
19	Dhamnagar WL	Dhamnagar	Karanji	Karanji	Social Forestry Plantation	12
20	Dhamnagar WL	Dhamnagar	Saradpur	Saradpur	Social Forestry Plantation	8
21	Dhamnagar WL	Dhamnagar	Bhandaripadi	Bhandaripadi	Social Forestry Plantation	11.5
22	Dhamnagar WL	Dhamnagar	Rajendrapur	Rajendrapur	Social Forestry Plantation	8
23	Dhamnagar WL	Dhamnagar	Kothar	Kothar	Social Forestry Plantation	10
24	Dhamnagar WL	Dhamnagar	Bankura	Bankura	Social Forestry Plantation	5
25	Dhamnagar WL	Dhamnagar	Talapada	Talapada	Social Forestry Plantation	5
26	Dhamnagar WL	Dhamnagar	Daipur	Daipur	Social Forestry Plantation	5
27	Bhadrak WL	Bhadrak	Chunida	Chunida	Social Forestry Plantation	15
28	Bhadrak WL	Bhadrak	Balabhadrapur	Balabhadrapur	Social Forestry Plantation	12.5

29	Bhadrak WL	Bhadrak	Kalei	Kalei	Social Forestry Plantation	10.5
30	Bhadrak WL	Bhadrak	Erada	Erada	Social Forestry Plantation	10
31	Bhadrak WL	Bhadrak	Kaupur	Kaupur	Social Forestry Plantation	10
32	Bhadrak WL	Bhadrak	Amargadia	Amargadia	Social Forestry Plantation	15
33	Bhadrak WL	Bhadrak	Samaraipur	Samaraipur	Social Forestry Plantation	5
34	Bhadrak WL	Bhadrak	Korkora	Korkora	Social Forestry Plantation	10
35	Bhadrak WL	Agarpada	Ramkrushnapur	Ramkrushnapur	Social Forestry Plantation	30
36	Bhadrak WL	Agarpada	Naranpur	Naranpur	Social Forestry Plantation	10
37	Bhadrak WL	Agarpada	Brundabanpur	Brundabanpur	Social Forestry Plantation	10
Total area						**530.5**

Table no. 5.5 Range wise list of VSS/EDC in Bhadrak Wildlife Division

Name of Range	VSS/EDC formed	Area assigned (in hectare)
Basudevpur	16	1478.00
Bhadrak	11	138.00
Chandbali	22	1994.50
Dhamnagar	15	128.50
Total	**64**	**3739.00**

5.6 Special objectives of Management

1. To involve the local people in planning, protection, regeneration, development and management of forest areas on a sustainable basis.

2. To improve the livelihood conditions of people living in the forest fringe villages.

3. To prevent encroachment, illicit felling, smuggling of forest produce and poaching of wild animals and to perform such other functions which are helpful to develop forest resources.

4. To bring the people in remote areas who are away from main stream of development to the main stream of administration and development.

5. To perform the special tasks like Sea Turtle Conservation and overall Socio-Economic Development of Mangrove areas (Coastal VSSs), etc.

6. The Coastal Villages where there is no forest area, VFCs are planned for taking people's cooperation, for conservation of Mangroves and shelter belt / wind break plantations (Casuarina) raised in Sea Coast to prevent Sea / stream bank erosions.

5.6.1 Analysis of the crop

The Forests assigned to this working circle are mostly degraded in nature. Crop varies from natural Mangrove vegetation to monoculture like Eucalyptus plantation. Crop density also varies from 15-20% in case of natural forest and less than 30% in plantations.

5.6.2 Silvicultural system

This is an overlapping working circle covering plantations and areas allotted in different working circles such as Protection Working Circle, Wildlife Management Working circle and Plantation Working Circle. The Micro plan of VSS and EDCs is required to be revised after approval of this working plan.

5.6.3 Rotation Period

The Forests assigned to this working circle are mostly degraded in nature. The most of the plantations have trees having girth less than 30 cm and if some trees are having girth more than 30 cm, they present in a scattered manner. So harvesting is not prescribed in this working circle.

5.6.4 Methods of Execution

The resolution No.10F (Pron.) 20 / 93 – 16700 / F & E dt.03.07.1993 issued by Government of Odisha during 1993 contains the guideline as well as procedure for implementation of Joint Forest Management. The control and management are always subject to the prevalent guideline and instruction of the Government. However, it is necessary to provide the following prescriptions in order to accomplish the special objectives of management of this Working Circle as well as facilitating the effective working of Joint Forest Management.

5.6.4.1 Institutionalization of V.S.S

VSS plays an important role in implementation of Joint Forest Management. It is highly essential to strengthen this base level people's institution. Prior to formation, the study of ethology of the stake holders is essential. A sense of motivation should be developed through massive sensitizations programme. This should be followed by empowering the VSS in decision making. Efforts should be made to make them fully aware of their duties and responsibilities to become an active partner with the forestofficials for Joint Forest Management.

5.6.4.2 Preparation of Micro Plan

This is the guiding document of Joint Forest Management. Though elaborate procedure has already been prescribed for preparation of such Micro Plan in the guidelines issued by Government, still three basic aspects namely (i) Conservation of biodiversity, (ii) Need of the forests for resilience and improvement and (iii) The need for other supporting non-forest activities shall be assessed properly and considered as a guiding factor for preparation of the plan document. This is the micro treatment plan for that area within the ambit of the prescription of the main working circle to which the areais assigned. The Forester being the ex-officio Member Secretary of the VSS shall prepare the micro plan with the villagers in a participatory process. The micro plan so prepared by the Forester shall be examined by the Range Officer and forwarded to the Division Office. The Assistant Conservator of Forests shall ratify the aforesaid proposal

recommended by the Range Officer. In case of any disagreement, the matter shall bereferred the matter to the Divisional Forest Officer whose decision shall be the final.

5.6.4.3 Capacity Building

Regular training and awareness campaign shall be organized to enhance the capacityof the people. Only through such process the VSS can be stabilized and built-up necessary capacity to discharge their function effectively. The frontier staff like the Foresters and Forest Guards should concentrate on this matter. Once this foundation is consolidated, it can move ahead smoothly and steadily. Hence, it is reiterated that the field level functionaries shall adopt a dedicated approach in the beginning for formation of VSS. Meetings shall be conducted regularly and sincerely. Instead of acting as an arbitrator, the forest officials should play the role of facilitator or moderator for the people who should be groomed to solve their own problem. Protection and conservation of wildlife, Conflict resolution, and participation of women actively are the focal points. These are valuable ingredients of a strong VSS. Very often it is observed that VSS having dominated women and youth executive committee is

successful one. So, the efforts shall be made to encourage the participation of women and youth actively in VSS.

5.6.4.4 Support Activities

The non-forestry activities like Pisciculture, Mushroom production, cultivation of Banana, Pineapple, Papaya, Drumstick, bamboo craft making etc. shall be encouraged to augment their income and livelihood. However, this list is only indicative but not exhaustive. The Forester and Forest Guard shall assess the skill and adaptability of the VSS and provide them a galaxy of options with the cost benefit analysis for choice. The Range Officer and if necessary, the D.F.O. should make the marketing arrangement ofthe items produce by the VSS for ensuring appreciable income. This is essential to make the system sustainable.

5.6.4.5 Expansion of Joint Forest Management

At present 64 no. of VSS have been constituted in this Division assigning an area of 3985.5 ha. Efforts should be made in the plan period to bring all uncovered villages especially around the village forests assigned to this Overlapping Working Circle underthe fold of Joint Forest Management after following due procedure. On the whole Joint Forest Management being unique panacea to address the current problems of forest conservation, it should be extended to cover maximum people and maximum area to the permissible extent as per the policy of the Government.

5.7 Other Regulations

Besides the prescriptions provided in the foregoing paras, some other regulations are necessary to augment the former for effective results. These are the following.

5.7.1 Monitoring & Evaluation

Periodical assessment is necessary to improve the implementation by removing the bottlenecks noticed. Normally the monitoring is done regularly through departmental staff but the evaluation should be done by an independent agency for providing the correct position. The evaluation shall be made in an objective manner for which the Divisional Forest Officer should prescribe a suitable format containing point wise scoring system. Each year in the month of April, such evaluation shall be done for the performance of preceding financial year. Also, third party evaluation should be done for the VSS/EDCs to monitor their activities.

5.7.2 Review

The evaluation report shall be examined through a review by a committee comprising of all Range Officers under the Chairmanship of Assistant Conservator of Forests. This committee will finalise the list of best three VSS basing on the scores in the evaluation report and also shortlist the shortcomings along with remedial measures. This will be treated as a guiding factor for the next course of action on Joint Forest Management.

5.7.3 Rewards

Recognition of any meritorious work is always the best stimulant for any person or organisation to proceed further. VSS showing commendable performance shall be rewarded as a token of recognition to their work. It shall encourage a healthy competition among the VSS to propagate the Joint Forest Management. So, it is prescribed to reward Seven VSS each year covering all Ranges with a citation and cash. Such VSS shall be felicitated either on Independence Day or on Republic Day celebration or Wildlife Week Celebration.

5.7.4 Convergence with other Rural Development Activities

Joint Forest Management cannot be fully successful in isolation. An integrated approach along with other developmental activities will make the process easier and quicker for achievement. The local Range Officer shall explore this aspect in consultation with his counter parts of other departments particularly B.D.O., Tahsildar, V.A.S., Agriculture Officer, Horticulturist etc. and ensure the needful coordination for converging various activities in the village.

5.7.5 Publicity

Wide publicity is of immense important for successful implementation of Joint Forest Management. Exposure visit to the successful VSS area is needed. The success story shall be circulated. Frequent awareness programme shall be organised to attract the villagers towards the benefits of Joint Forest Management. The Range Officer shall take initiative for discussion on this issue in various Village / Gram Panchayat / Panchayat Samiti level forums through regular interactions with the concerned PRI members. The Forester and Forest Guard shall assist the Range Officer in ensuring due publicity of the programme.

CHAPTER 6

WILD LIFE (OVERLAPPING) WORKING CIRCLE

6.1 Name of the working circle

Bhadrak Wildlife Division consists of one Proposed Reserve Forest, 9 Un-demarcated Protected forests, and 21 Village forests. The terrestrial as well as riverine and marine wildlife are present in the division. The terrestrial wildlife such as Rhesus monkey, fishing cat, otter, water monitor lizards are present outside the working plan area. The riverine and marine wildlife areas do not have co-terminus jurisdiction with the forest blocks and there are no declared marine or riverine protected areas in Bhadrak Division. Therefore, an overlapping working circle encompassing the entire terrestrial, riverine and marine areas is formed in to a 'Wildlife (Overlapping) Working circle'.

6.2 General constitution of the working circle

Nature has endowed the present tract dealt with, with magnificent assets, which in its variety and beauty compares favourably with that of any other part of the state or country even though considerably depleted than in the past. Since wildlife forms the part of the total ecosystem, it is essential to give consideration in order to maintain the ecological balance and equilibrium. This working circle encompasses 3577.258 Ha in Bhadrak Wildlife Division including forests, marshy land, riverine and marine areas. It contains the areas with all types of tree growth and non-tree growth areas. The detailed list of forest blocks included in Wildlife (Overlapping) Working Circles is as below.

Table No: 6.1 Details of forest blocks in Wildlife (Overlapping) Working Circle.

Sl. No.	Name of the Range	Forest Block	Compt.	Area in Ha.
Protected Reserve Forests.				
1.	Chandbali	Garmal	-	294.958
Un-demarcated Protected Forests.				
1.	Chandbali/ Basudevpur	Banipahi	-	2125.51
2.	-do-	Bijayapatana	-	93.12

				(Completely encroached)
3.	Basudevpur	Banijungle	-	404.69
4.	Chandbali	Outer wheeler	-	66.72
5.	-do-	Long wheeler	-	19.24
6.	-do-	Coconut Island	-	12.85
7.	-do-	Small wheeler	-	3.90
8.	-do-	Short Island	-	15.30
9.	-do-	Udabali (new)	-	485.83
		Total		**3277.16**
1.	Chandbali	Arjunbindha Santhapur	-	4.0
2.	-do-	Bhatapada Gudpal	-	1.044
3.	-do-	Bodakasan	-	10.0
4.	-do-	Aruha	-	0.536
5.	-do-	Kamaria	-	1.98
6.	-do-	Mirjapur	-	0.56
7.	-do-	Deola	-	5.0
8.	-do-	Arjunbindha	-	3.0
9.	-do-	Kabirpur	-	5.0
10.	-do-	Haripur	-	0.68
11.	-do-	Babanbindha	-	5.0
12.	Bhadrak	Amargadia	-	3.68
13.	-do-	Belnta	-	1.0
14.	-do-	Dianary	-	1.84
15.	Dhamnagar	Sibapur	-	1.6
16.	-do-	Bansar	-	0.42
17.	-do-	Jalahari	-	3.0
18.	-do-	Chatrubhujapur	-	1.6
19.	-do-	Goudabisanuapada	-	2.2
20.	-do-	Belgadia	-	2.8
21.	Basudevpur	Alboga	-	0.2
		Total		**55.14**
		GRAND TOTAL		**3577.258**

6.3 General characteristics of Fauna:

The major species and their characteristics are described below.

1. Olive Ridley:

The Olive Ridley Sea Turtles *Lepidochelys olivacea* are the second smallest seaturtles in the world next to the Kemp Ridley *Lepidochelys kempii.* They have a circumtropical distribution and occur in India, Mexico, Costa Rica, and the Arab peninsula, further to coastal Africa along the warm tropical and subtropical waters of the Indian and Pacific Oceans.

Their populations are well known for 'arribada' (a Spanish term, meaning 'arrival by sea') wherein 1000s of pregnant turtles arrive at the same beach site to lay their eggs and nest for the next few days. The mass nesting sites for *L. olivacea* include Costa Rican and Mexican beach and the Odisha coast along the Pacific and Indian Ocean respectively. In Odisha, Gahirmatha Wildlife Sanctuary in Kendrapadadistrict is the largest known nesting centre for *L. olivacea* with 1–8 lakh turtles nesting per year. In Gahirmatha, breeding of *L. olivacea* starts in November and mass nesting occurs in January–March. They have the ability to delay nesting in response to heavy rainfall, because high moisture level in the beach sand reduces hatching success in the nest.

The Gahirmatha sanctuary acts as a temporary habitat for migrating turtles, which is in Rajnagar Wildlife Division, whereas nesting happens on Dr. Abdul Kalam Island, which is in Bhadrak Wildlife Division. The numbers of turtles participating in mass nesting are variable. Sporadic nesting by a few individuals of *L. olivacea* along the coast is common. After 45–50 days of incubation, the hatchlings return to the sea in April.

Rayleigh's test was done by DFO, Bhadrak Division to determine if the onset (in lunar days) of 15 mass nesting events between 2003 and 2020 (Table 5.4) was non-uniformly distributed across a lunar month. Results indicated a highly non-uniform distribution ($n=15$, $r=0.504$, $z=3.81$, $z_{critical}=2.945$, $\alpha=0.05$) with a mean lunarday of 22.44 (i.e. the onset of mass nesting is at the beginning of fourth quarter moon).

Table 6.2 : Mass nesting data of *L.olivacea*, 2020.

Day	Population in nos
14 March	10,076
15 March	68,311
16 March	98,135
17 March	98,700
18 March	95,541
19 March	32,841
20 March	3,600
Total	407,204

Table 6.3: Mass-nesting turtles,2015–2020

Year	Population numbers
2015	4,13,334
2016	51,995
2017	6,03,962
2018	6,64,897
2019	4,50,949
2020	4,07,204

Hatching within a nest is synchronous and emergence occurs through group-digging behaviour customarily described as 'social facilitation'. The emergence of hatchlings from a single nest occur in 1 to 4 cohorts over a few days, with the first cohort having the largest number of hatchlings. Before emergence, hatchlings rest in an air-filled pit in sandy soil and during emergence, the surface sand sags into thepit, leaving a depression described as 'emergence crater'.

Table 6.4: Date of initiation of 15 arribada events and corresponding lunar days, 2003–2020

No	Year	Date of initiation of arribada	lunar days (out of 29.53 days in a lunar month)	Sl. No	Year	Date of initiation of arribada	lunar days (out of 29.53 days in a lunar month)

1	2003	28Feb	26.8	9	2013	17 March	5.4
2	2007	11Feb	23.1	10	2015	12 March	21.3
3	2009	20Mar	23.2	11	2016	03 March	23.7
4	2010 *	24Feb	10.2	12	2017	22 Feb	25.3
5	2010**	19Mar	2.4	13	2018	04 March	16.4
6	2011*	26Feb	23.2	14	2019	26 Feb	21.4
7	2011**	20Apr	16.7	15	2020	14 March	19.6
8	2012	15Mar	22.3	-	-	-	-

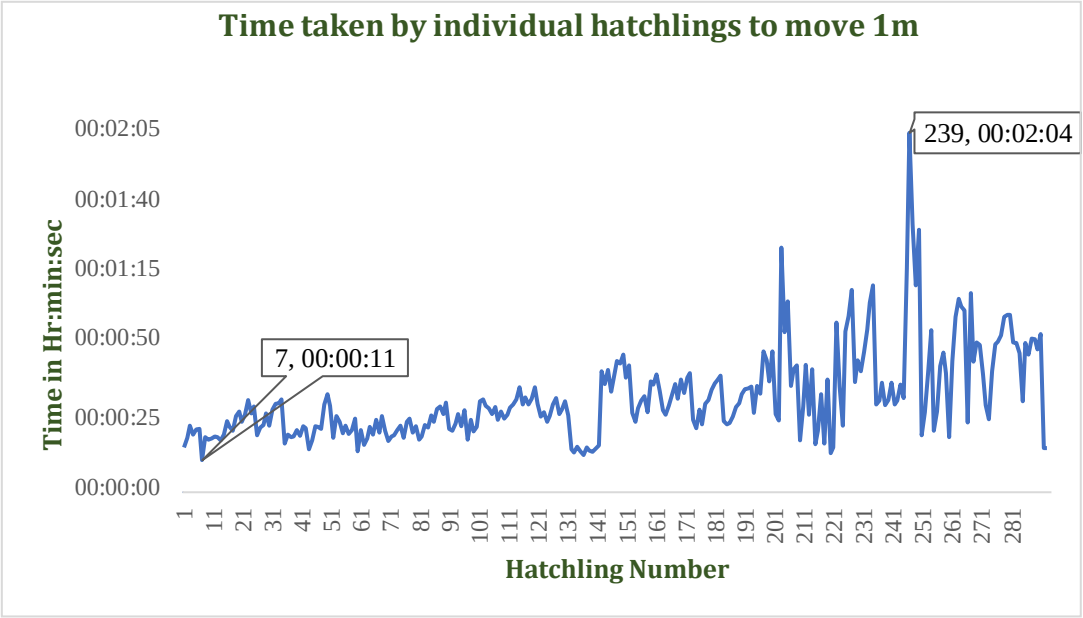
Source of mass nesting data: Archives of Rajnagar Wildlife division, Kendrapada, Odisha Forest Department.

* First mass nesting, ** Second mass nesting.

Hatchling emergence in *L. olivacea* has been studied using various methods. Among them, the numbers of hatchlings leaving the emergence crater is considereda reliable index of hatchling emergence. Hatchlings emerge nocturnally and move towards negative surface gradient. Also, hatchlings exhibit positive phototaxy. Since the sea surface reflects moon light better than the land surface, they move seawards. Artificial illuminations placed on the land distract the seaward movement of hatchlings. In the absence of artificial illumination, disorientation in hatchling movement is high on new moon days.

The average minimum time taken by hatchlings in Gahirmatha, based on a study conducted in 2020 , to move one metre is 11 sec whereas the maximum timeis 2 min 4 sec. The average time taken by hatchlings to move one metre is 33 sec (SD = ± 15 sec). The average time taken by hatchlings in Gahirmatha to reach thesea is 17 min 22 sec (SD =± 5 min 30 sec) for a mean distance of 34.55 m.

The olive Ridleys are mostly carnivorous, feeding on creatures such as jellyfish, snails, crabs, and shrimp. They will occasionally eat algae and seaweed as well. Hatchlings, most of which perish before reaching the ocean, are preyed upon by crabs, raccoons, pigs, snakes, and birds, among others.



2. Salt Water Crocodile

The Salt Water Crocodile, (Crocodylus porosus) is a crocodile native to salt and brackish water in eastern coast of India. It is listed as 'Least Concerned' on IUCN Red List. It was hunted for its skin throughout its range up to the 1970s, and is threatened by illegal killing and habitat loss. It is regarded as dangerous for people who share the same environment

The saltwater crocodile is a large and opportunistic hypercarnivore apex predator. It ambushes most of its prey and then drowns or swallows it whole. It is capable of prevailing over almost any animal that enters its territory, including other apex predator such as sharks, varieties of freshwater and saltwater fish including pelagic species, invertebrates such as crustaceans, various reptiles, birds and mammals including humans.

The saltwater crocodile has a wide snout compared to most crocodiles. A pair of ridges runs from the eyes along the centre of the snout. The scales are oval in shape and the scutes are either small compared to other species or commonly are entirely absent. In addition, an obvious gap is also present between the cervical and dorsal shields, and small, triangular scutes are present between the posterior edgesof the large, transversely arranged scutes in the dorsal shield. The relative lack of scutes is considered an asset useful to distinguish saltwater crocodiles in captivity or in illicit leather trading, as well as in the few areas in the field where sub-adult or

younger saltwater crocodiles may need to be distinguished from other crocodiles. It has fewer armour plates on its neck than other crocodilians.

Young saltwater crocodiles are pale yellow in colour with black stripes and spots on their bodies and tails. This colouration lasts for several years until the crocodiles mature into adults. The colour as an adult is much darker greenish-drab, with a few lighter tan or grey areas sometimes apparent. Their tails are grey with dark bands.

Female saltwater crocodiles are smaller in size than their male counterparts, normally reaching a maximum length of 2.5 to 3 m. With its long, powerful tail, webbed hind feet, and long, powerful jaws, the saltwater crocodile is a superbly adapted aquatic predator. As in all crocodilians, the eyes, ears and nostrils are located on top of the head, allowing the crocodile to remain almost totally submerged when lying in water, helping to conceal it from potential prey, while a special valve at the back of the throat allows the mouth to be opened underwater without water entering the throat.

The saltwater crocodile is considered to be more aquatic than most crocodilians, and is less heavily armoured along the back and neck. Saltwater crocodiles have a variety of prey. Juveniles are restricted to small insects, amphibians, reptiles, crustaceans, and small fish. Adults feed on crabs, turtles, snakes, birds, buffalo, wild boar, and monkeys. Saltwater crocodiles hide in the water exposing only their eyes and nose. They lunge at prey, often killing it with a single snap of the jaws, then drag the prey under water where it is more easily consumed.

The census data of Salt-Water Crocodiles for the years 2020 and 2021 is mentioned below. From the census data of last 11 years (annexure XVI), It is seen that salt water crocodile population has seen an increase in Baitarini and Mantei rivers. (Annexure XVI).

Table 6.5: Crocodile Census Report of 2020 and 2021					
Sl .No	**Year**	**Male**	**Female**	**Hatchlings**	**Total**
1	2021	19	18	25	62
2	2020	27	8	17	52

3. Elephants:

The Asian elephant is the largest land mammal in Indian Sub-continent. They inhabit dry to wet forest and grassland habitats and prefer forage plants. Asian elephants have adapted to surviving on resources that vary based on the area. Asian elephants are extremely sociable, forming groups of six to seven related females that are led by the oldest female, the matriarch. Like African elephants, these groups occasionally join others to form larger herds, although these associations are relatively short-lived. More than two-thirds of an elephant's day may be spent feeding on grasses, but it also eats large amounts of tree bark, roots, leaves, and small stems. Cultivated crops such as bananas, rice, and sugarcane are favorite foods. Elephants are always close to a source of fresh water because they need to drink at least once a day.

Bhadrak Wildlife Division does not have any permanent habitat for elephants. The elephants enter the division from Hadgarh Wildlife Sanctuary in Keonjhar wildlife Division and temporarily resides in community forests and private orchards in Agarpada section of Bhadrak WL Range. Their movement is frequent between April and August.

4. Water Monitor Lizard.

The **Asian water monitor** (*Varanus salvator*) is a large varanid lizard nativeto South and Southeast Asia. It is one of the most common monitor lizards in Asia, present in east India, close to water. It is listed as Least Concern on the IUCN Red List and is among the largest squamates in the world

Water monitors defend themselves using their tails, claws, and jaws. They are excellent swimmers, using the raised fin on their tails to steer through water. They

are carnivores, and consume a wide range of prey. They are known toeat fish, frogs, rodents, birds, crabs, and snakes. They have also been known to eat turtles, as well as young crocodiles and crocodile eggs. Water monitors have been observed eating catfish in a fashion similar to a mammalian carnivore, tearing off chunks of meat with their sharp teeth while holding it with their front legs and then separating different parts of the fish for sequential consumption. When encountering smaller prey items, the water monitor will subdue it in its jaws and proceed to violently thrash its neck, destroying the prey's organs and spine which leaves it dead or incapacitated. The lizard will then proceed to swallow it whole.

In dominantly aquatic habitats their semiaquatic behavior is considered to provide a measure of safety from predators. Paired with their generalist diet, this is thought to contribute to their ecological plasticity. When hunted by predators suchas the king cobra, they will climb trees using their powerful legs and claws. If this evasion is not enough to escape danger, they have also been known to jump from trees into streams for safety.

Monitor lizards are traded globally and are the most common type of lizard to be exported and is one of the most exploited varanids. Its skin is used for fashion accessories such as shoes, belts and handbags which are shipped globally, with as many as 1.5 million skins traded annually. Other uses include a perceived remedy for skin ailments and eczema, novelty food in Indonesia, as aphrodisiac and pets.

5. Fishing Cats

The **fishing cat** (*Prionailurus viverrinus*) is a wild cat of South and Southeast Asia. Since 2016, it is listed as Vulnerable on the IUCN Red List. Fishing cat populations are threatened by destruction of wetlands and have declined severely over the last decade. The fishing cat lives foremost in the vicinity of wetlands, along rivers, streams, oxbow lakes, in swamps, and mangrove.

The fishing cat is thought to be primarily nocturnal, and is very much at home near water. It can swim long distances, even under water. Adult males and females without dependent young are solitary. Females have been reported to range over areas of 4 to 6 km^2, while males range over 16 to 22 km^2 . Adults have been observed to make a "chuckling" sound and their main prey is fish. Since Bhadrak Division consists of many wetlands, fishing cat population is quite high.

The fishing cat is threatened by destruction of wetlands, which are increasingly being polluted and converted for agricultural use and human settlements. The conversion of mangrove forests to commercial aquaculture ponds and the targeted killing of fishing cats is also prevalent where there is human/animal conflict. Over-exploitation of local fish stocks and retaliatory killing are also significant threats.

6. Otters

Otters are carnivorous mammals in the subfamily **Lutrinae**. For most otters, fish is the staple of their diet, supplemented with frogs, crayfish and crabs Some otters are experts at opening shellfish, and others will feed on available small mammals or birds. Prey-dependence leaves otters very vulnerable to prey depletion. They are notable for their ability to use stones to break open shellfish on their stomachs. This skill must be learned by the young.

Otters are active hunters, chasing prey in the water or searching the beds of rivers, lakes, etc. Most species live beside water, but river otters usually enter it only to hunt or travel, otherwise spending much of their time on land to prevent their fur becoming waterlogged. Sea otters are considerably more aquatic and live in the ocean for most of their lives.

7. Rhesus Monkey.

The **rhesus macaque** (*Macaca mulatta*), colloquially is a species listed as least concern in the IUCN Red List of Threatened Species in view of its wide distribution, presumed large population, and its tolerance of a broad range of habitats. It is nativeto India and has the widest geographic range of all non-human primates, occupying a great diversity of altitudes and a great variety of habitats, from grasslands to arid and forested areas, but also close to human settlements. They are most known for human-wildlife conflicts, involved in depredation of crops, attacking humans, etc. Bhadrak Wildlife Division is not an exception when it comes to human-wildlife conflicts.

8. Egrets

The little egret (*Egretta garzetta*) is a species of heron in family Ardeidae. It isa white bird with a slender black beak, long black legs. As an aquatic bird, it feeds inshallow water and on land, consuming a variety of small creatures. It

breeds colonially, often with other species of water birds, making a platform nest of sticks in a tree, bush or reed bed. A clutch of three to five bluish-green eggs is laid and incubated by both parents for about three weeks. The young fledge at about six weeks of age.

The great egret (*Ardea alba*), also known as the common egret is a large, widely distributed egret with subspecies found in Asia. The species breeds in colonies in trees close to large lakes with reed beds or other extensive wetlands, preferably at height of 10–40 feet (3.0–12.2 m). It begins to breed at 2–3 years of age by forming monogamous pairs each season. Whether the pairing carries over to the next season is not known. The male selects the nest area, starts a nest, and then attracts a female. The nest, made of sticks and lined with plant material, could be up to 3 feet across

9. Cormorants

The **Indian cormorant** or **Indian shag** (*Phalacrocorax fuscicollis*) is a member of the cormorant family. It is found mainly along the inland waters of the Indian Subcontinent. It is a gregarious species that can be easily distinguished from the similar sized little cormorant by its blue eye, small head with a sloping forehead anda long narrow bill ending in a hooked tip.

This medium-sized bronze brown cormorant is scalloped in black on the upper plumage, lacks a crest and has a small and slightly peaked head with a long narrow bill that ends in a hooked tip. The eye is blue and bare yellow facial skin during the non-breeding season. Breeding birds have a short white ear tuft. Sexes are similar, but non-breeding adults and juveniles are browner. This cormorant fishes gregariously in inland rivers or large wetlands of peninsular India and in estuaries and mangroves but not on the open coast. They breed very locally in mixed species breeding colonies.

The breeding season is July to February but depends on rainfall and water conditions. The nest is a platform of twigs placed in the forks of partially submerged trees or those growing on islands. The nests are placed in close proximity to those of other Indian cormorants, storks or waterbirds in dense colonies, often with several tiers of nests. The usual clutch is three to five eggs which are bluish green

and with a chalky surface. The Indian cormorant makes short dives to capture the fish and a group will often fish communally.

10. Sea Gull:

Seagulls, are seabirds of the family Laridae in the suborder Lari. Gulls are typically medium to large birds, usually grey or white, often with black markings on the head or wings. They typically have harsh wailing or squawking calls; stout, longish bills; and webbed feet. Most gulls are ground-nesting carnivores which take live food or scavenge opportunistically, particularly the *Larus* species. Live food often includes crustaceans, molluscs, fish and small birds. Gulls have unhinging jaws which allow them to consume large prey. Gulls are typically coastal or inland species, rarely venturing far out to sea, except for the kittiwakes. The species take up 2–4 years for maturing in to adults. Large white-headed gulls are typically long-lived birds.

Gulls nest in large, densely packed, noisy colonies. They lay two or three speckled eggs in nests composed of vegetation. The young are precocial, born with dark mottled down and mobile upon hatching. Gulls are resourceful, inquisitive, and intelligent, the larger species in particular, demonstrating complex methods of communication and a highly developed social structure. For example, many gull colonies display mobbing behavio, attacking and harassing predators and other intruders. Many species of gulls have learned to coexist successfully with humans and have thrived in human habitats. Others rely on kleptoparasitism to get their food.

They are abundantly present in Kanika island, babubali and Dr.Abdul Kalam Island in Bhadrak Division.

11. Red Ghost Crabs

Crustaceans occupy both aquatic and terrestrial habitats with tremendous adaptive diversity). The semi-terrestrial, non-commercial Red Ghost Crab, *Ocypode macrocera* (H. Milne-Edwards, 1852), (Crustacea: Decapoda: Ocypodidae) occurs in tropical and sub-tropical intertidal regions throughout the world, particularly in India and the Indian Ocean region. These crabs are fast runners, moving rapidly into their burrows or into sea water to escape their enemies. They are nocturnal, generalist scavengers and predators on small animals. These crabs are observed in

100 m wide coastal zones and found active during day and night and remain in burrows during hottest part of the day. Burrowing behaviour of these crabs increases oxygenation of soil, facilitates decomposition of organic material, entraps mangrove seedlings, and helps in the process of bioturbation.

Table 6.6 : Details of burrows, burrow density, number and density of *Ocypode macrocera* in the quadrats

Location	Total area of each quadrat (sq. m)	Total no. of burrows counted	Burrow density (per sq. m)	Total no. of crabs counted	Crab density (p/sq. m)
Quadrat I	25	64	2.56	52	2.08
Quadrat II	25	73	2.92	64	2.56
Quadrat III	25	48	1.92	41	1.64
Quadrat IV	25	61	2.44	46	1.84
Total	100	246	Avg = 2.46	203	Avg =2.03

They are abundantly present in Kanika island and meagrely present in Babubali island. During the study in Kanika island, the density of burrows was found to vary from 1.92 to 2.92 per sq. m and that of crabs in the study area from 1.64 to 2.56 per sq. m.

Regarding shape of burrows, Plaster of Paris casts were taken from 10 old, abandoned burrows to examine burrow architecture. Nine burrows were found to be J-shaped, and one was L-shaped but with the distal end bent slightly downwards. Length of burrows varied from 30 to 51 cm, and height from 27 to 31 cm. The diameter of the burrow entrances ranged from 3.82 cm to 4.14 cm, whereas at the distal end, it ranged from 3.5 cm to 3.82 cm.

Regarding the feeding behaviour, *Ocypode macrocera* were seen scavenging and feeding on detritus throughout the day. They scavenge on carcasses of marine animals washed ashore. Scavenging on dead butterflies, puffer fish, and eel was observed. No intra-specific competition was observed. The crabs tried to drag small fish carcasses into their burrows for feeding. Black Crow *Corvus capensis* were competitors and caused disturbance to the scavenging *O. macrocera* population. Crabs scavenge on carcasses left over by the crows, and never go near the carcass while the crows are scavenging.

As detritus feeders, *O. macrocera* scrape the sand using their claws, ingest it, and release characteristic pellets almost every second. During low tide, they move to the freshly exposed sand and scrape the sand to ingest marine detritus. They move swiftly in a zig-zag manner, creating picturesque scraping patterns. At the sight of threats, they retreat into their burrows, coming out once in a while cautiously, and scraping the sand near the burrow entrance.

6.4 Special Objectives of management

The special objectives of management of this working circle are:

1. To provide improved habitat especially mangroves and coastal, so as to ensure conducive atmosphere for the wildlife .
2. To conserve vertically and horizontally the biological diversity of the area and to improve the cover and value of existing forest area.
3. To create favourable conditions for wildlife.
4. To protect mangrove habitat rigidly from illegal biomass removal and allow them to grow under nature's own care and nursing.

5. Protection of wildlife in general and endangered species in particular.
6. To enhance the surveillance of the regular and temporary staff towards anti-poaching activities and anti-smuggling activities.
7. To resolve man-animal conflicts and preventing its adverse impacts.
8. To create awareness among the public of the importance of conservation of wildlife in general and its importance in Bhadrak WL Division.
9. To conduct regular census to make an inventory of all the wildlife in the division.
10. To develop skill and human resource of the staffs to ensure professional wildlife management.

6.5 Method of Treatment:

This working circle revolves around the following activities-

i. Habitat management
ii. Protection Measures to address the threats.
iii. Man-Animal conflict resolution
iv. Capacity Building & Infrastructure Development.
v. Research and Development.
vi. Awareness Creation.

6.5.1 Habitat management

6.5.1.1. Objectives of habitat management

a. To maintain quality habitat in a natural ecosystem.
b. To develop habitat where it is deteriorated or where limiting factor/ factors have developed.

6.5.1.2. Principle of habitat management

a. It should be framed after thorough studies and justification in accordance with the needs of the wildlife.
b. The practice must be evaluated for their effect on other natural resources land uses etc. So, the proposed practices should not be against the benefits of the other species and natural resources along with the target species.
c. The improvement practices must simulate natural conditions/ ecosystem perpetuating native flora and fauna.

d. Manipulation should be engineered following topographical characteristics of the area.

To provide good habitat for the wild life in the Division, the degraded and the blank areas should be improved by planting more mangrove and fruit bearing trees. Mostly protection of mangroves and maintenance of the channels and creeks will be very much effective in conservation of wildlife in this division.

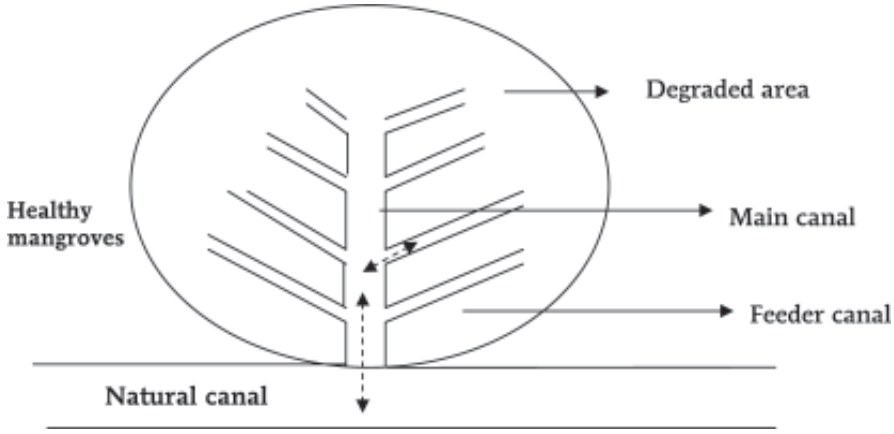
6.5.1.3 Mangrove Habitat Management

Champion and Seth have classified the Mangrove forest as 4B/TS2, forest type and the mangrove forest is defined as "Typically a closed evergreen forest of moderate height composed of trees specially adapted to survive on tidal mud which is permanently wet with salt water and submerged in every tide." This type is found on mudflat of the delta streams, the tails of the islands, and over more extensive areas near sea face wherever accretion is in progress. The ground is flooded daily by salt water and never has time to day out. Mangroves are a specialized forest ecosystem and hence there is an emergent need to recognize and protect them at the same level as other forests like Evergreen or Deciduous forest types and not as so-called wastelands.

The only PRF of this Division namely Garmal PRF covers 295.29 Ha. of mangrove forest. Also, other UDFs are also having mangrove and its associate species. The mangrove vegetation is covered by *Avicennia alba, Avicennia marina, Avicennia officianalis, Exoecaria agallocha, Phoenix Palludosa, Heritiera, fomes, Sonneratia apetala, Sonneratia caseolaris, Kandelia candel, Lumnitzera littorea, Acanthus illicifolius, Aegialitis rotundifolia, Derris scandens, D. hererrophylla, Azima tetracantha* and *Capparies separia* which are commonly distributed. Mangrove associates include Most part is imperturbable and provides congenial niche for many wildlife.

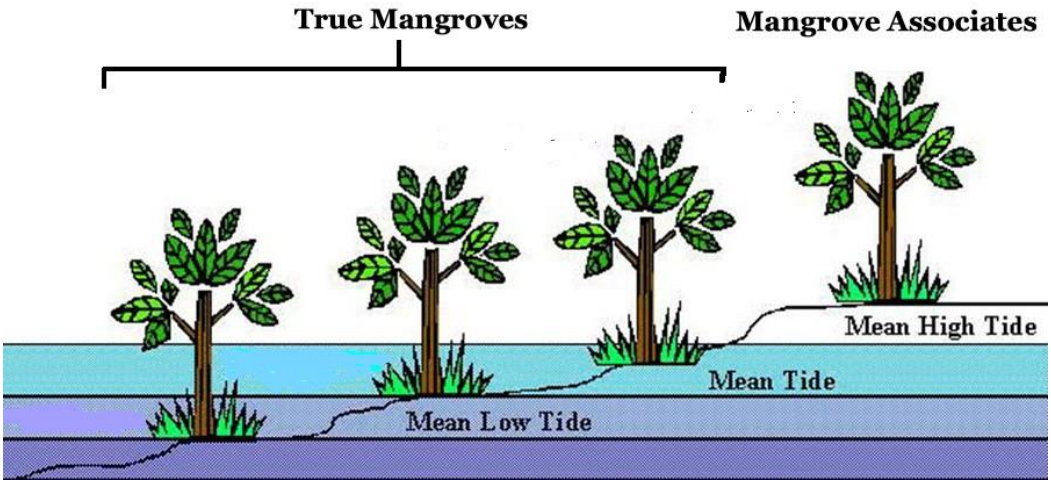
Therefore, mangrove habitat conservation will include

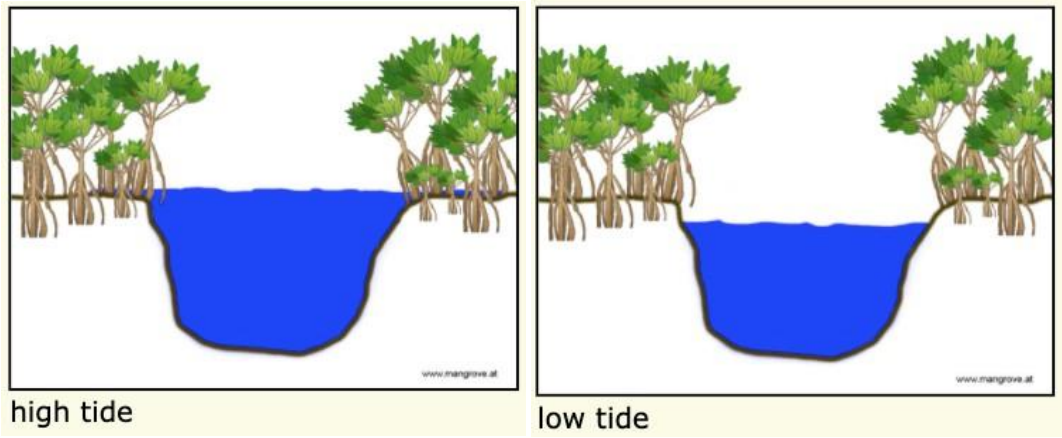
1) Maintaining and managing herringbone canals in degraded OFSDP mangrove plantations in Un-demarcated protected forests of Basudevpur range.



2) Fencing the Garmal PRF in patches where human-interference is most, with barbed-wire fences to reduce anthropogenic pressures on mangrove habitat.
3) Targeted removal and clearancr of weeds such as *Prosopis juliflora* from Garmal PRF and other UDPFs. *Prosopis juliflora* has encroached upon mangrove habitat and now constitute 10–15 % of the population.

4) Plantation of mangroves and its associates along the riverine tracts to enhance mangrove cover and Tree outside Forest (ToF) cover. The up-stream will be planted with species such as *Sonneratia apetala, Sonenratia caseolaris, Kandelia candel, Excoecaria agallocha, Heretiera kanikensis* etc. The downstream bordering coastal area will be planted with species such *Avicennia alba, Avicennia marina, Avicennia officianalis, Lumitzera littorea, etc.*





5) Preventing and reducing collection of forest produce such as leaves of *Pheonix palludosa* from forest area which results in degradation. Pheonix palludosa is collected by women from local villages for making brooms.
6) Preventing and reducing collection of firewoods from mangroves forests.
7) Maintenance of mud-flats along the Baitarini and mantei riverine tracts and Kanika island which act as habitat for salt-water crocodiles and red ghost crabs.

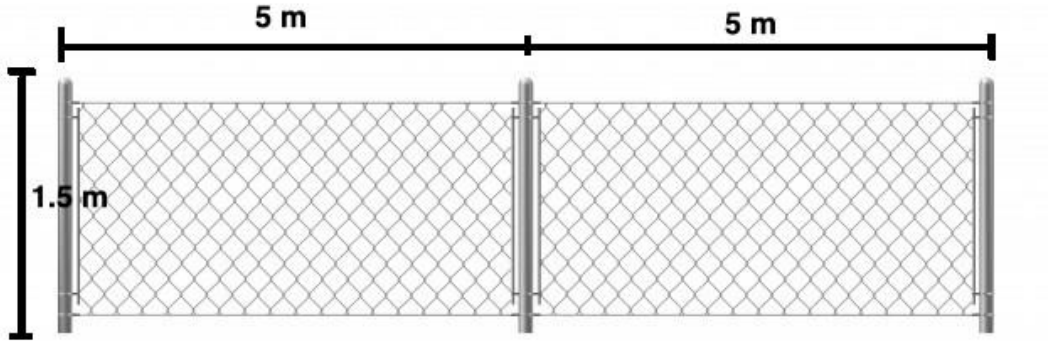
8) Waste collection and beach cleaning in Kanika and Babubali island to remove plastic and other non-biodegradable and biodegradable wastes.

6.5.1.4. Olive Ridley Turtles Habitat Management:

Olive Ridley Turtles habitat conservation is extremely important since Dr. Abdul Kalam Island acts as one of the 6 mast nesting sites in the world and Gahirmatha serves as temporaryhabitat for migrating turtles. The steps for habitat conservation includes

1) Illegal fishing is to be curbed in Gahirmatha sanctuary and adjoining waters between November and May through off-shore patrolling. The turtles die to asphyxiation when caught in the trawler nets which enhances their mortality rate.

2) To ensure that Turtle Exclusion Devices (TEDs) are used by the trawlers fishing outside the sanctuary waters to reduce the mortality rate.
3) There should be chain fencing of 1.5 metre height between the nesting beach and the DRDO facility for 1.5 Km to prevent land-based predators from entering the nesting site and it should be maintained before every nesting season. This measureis necessary because predators such as Wild Boars and Stray Dogs dig the nest and prey on the hatchlings.



4) Removal of Ipomea pes-capreae from the site every nesting season to make the beach sand loose for turtles to nest. Every year, Ipomea pes-capreae grow and spread on the beach sand with its roots making it compact. The turtles will face difficulty to dig the nest since the sand is hard and compact.

5) To ensure that the lighting of DRDO facility on Dr. Abdul Kalam Island and Dhamra port is nil or minimal during the nesting and hatching season to prevent the mis- orientation in the movement of turtles/turtle hatchlings.
6) Hatcheries may be established in sporadic nesting sites such as Kanika Island to enhance the hatching and survival rate. Kanika island witnessed the Olive Ridley nesting for the first time in 2021.

6.5.1.5 : Salt Water Crocodile Habitat Management:

. As this Division is bordering the Bhitarkanika National Park, it has also a good population of Salt water crocodile. The saltwater crocodiles are endangered species belonging to the Order *Crocodylia* and Family *Crocodylidae*. The broad activities under the crocodile conservation will be the following:

1. To protect the remaining population of crocodilians in their natural habitat by protecting them from human interference.

2. Public-relation should be among the local people to make aware of the importance of the crocodiles in ecosystems.

3. Habitat development should be done like plantations, digging and renovation of creeks and digging of ponds.

4. Prey population such as mud crabs and fishes should be ensured through strict prohibition of fishing in and around national park.

5. Though poaching is not a big problem in this Division, it may happen at any time if protective measures are let loose. The staff should be trained and sensitized towards the protection of the wildlife and equipped with the requisite knowledge about the common wildlife and its handling buy having trainings. To wean the poachers away from poaching, a massive awareness programme should be undertaken for antipoaching strategies.

6. Encroachment on the mangrove habitat for rehabilitation, agriculture and prawn culture, etc. should be banned.

7. Use of gill nets in the rivers, creeks and estuaries throughout the sanctuary should be regulated.

8. Degraded mangrove forest should be taken up for restoration, plantation and rigid protection.

6.5.1.6 : Waterfowl Habitat Management:

Every year, waterfowl census is conducted in the month of January for the last which shows the steady increase from 2735 birds in 2014 to 14032 in 2020 (Annexure XIV). The waterfowl census has served as biological indicators for gauging the health and productivity of wetlands in the absence of wider ecological information. The waterfowl habitats are prone to threats such as Inflow of sewage resulting in highly pollution in water bodies, growing population and resultant, changes in habitat quality, eutrophication of water bodies, etc. Also, there is inadequate data on water quality, limnology, hydrology, sustainable uses, watershed development and conservation of wetland values. Therefore, conservation of their habitats is highly necessary to retain the existing population and there is an urgent need to create awareness on the need for protection, conservation and restoration of wetlands for posterity. The measures include,

1) Making an inventory of all water bodies, both in forest and revenue land in the district.
2) Periodic assessment of water quality so as to ensure good quality of habitat.
3) Regular de-siltation and de-weeding, with the help of district administration.

4) Requesting district administration for efficient sewage and effluent management at source.
5) Threat to mangroves and swampy wetlands need to be urgently looked into and direct inflow of wastes need to be prevented. Water quality and biological parameters need to monitored and assessed from time to time, especially biological productivity and biodiversity
6) Effective protection measures to prevent illegal poaching and smuggling of water birds.

6.5.2 Protection Measures to address the threats.

Due to diversity of wildlife in Bhadrak WL Division, i.e. terrestrial, marine and riverine, the threats to wildlife are also diverse. The measures that should be taken for protection of wildlife are as follows.

1. This Division has precious wildlife like Salt water crocodile, Dolphins and many species of water birds. So, census shall be carried out to know the status of wildlife every year. The census shall be taken up every year as follows-

6.7: Types of census in Bhadrak WL Division

Sl no.	Types of census	Range involved	Frequency
1	Water fowl	All Ranges	Once in a year
2	Crocodile	Chandbali	Once in a year
3	Dolphin	Chandbali & Basudevpur	Once in a year

Though poaching is not a big problem in the forests of the Mangalore Division, it may happen at any time if protective measures are let loose. The staff should be trained and sensitized towards the protection of the wildlife and equipped with the requisite knowledge about the common wildlife and its handling buy having trainings.

6.5.3 Man-animal conflict

Man-animal conflict is a rare phenomenon in this division. However, some man-crocodile and man-elephant conflict have been recorded in past few years. This management issue is being addressed through approaches such as training the staffs to handle such situations. Also, awareness among people is very much needed to handle these situations.

Prescriptions

1. The local communities shall be provided with water sources like tube well & borewell for drinking water and other household activities. This will help to resolve man crocodile conflict by stopping them entering into rivers.
2. Signages shall be installed in vulnerable water bodies to aware people about crocodile attack.
3. Immediate action should be taken in releasing funds during animal depredation.
4. Elephant movement shall be monitored and report will be shared with local communities.
5. Solar lamps will be distributed to households residing adjacent to elephant movement areas.

6.7.7. Conservation & Protection of Elephants: Elephant Depredation Activities are observed in boarder areas adjoining to Hadagarh Sanctuary of Keonjhar Wildlife Division and some part of this Division falling under Agarpada Section of Bhadrak Range. The Elephant herd usually visit the areas where cultivation of mango, jack fruit and pineapple orchard during ripening period and also at the time of harvesting of seasonal paddy and maize crops in that locality. Though very rare case of elephant depredation activity is seen in this division, the staffs should be always ready to face this challenge.

Prescription:

i. Recording and uploading the location and movement of elephant 24/7.
ii. Monitoring the movement of poachers, if any.
iii. Driving the elephant carefully with flash lights and sirens away from human settlements.

iv. Public resentment leading to revengeful action by resorting to killing of wild animals shall be contained with instant solace by the forest officials.

v. On receipt of information regarding any wildlife depredation, an officer of and above the rank of Assistant Conservator of Forests shall visit the spot immediately. It would have been better to calm down the agitated people through instant payment of the compassionate amount.

vi. Since there is some paraphrenias to be maintained, the sanction of compassionate amount shall be done at earliest and such sanction order shall be handed over to the affected person.

vii. The affected family should be provided some additional benefit under other schemes of the department.

Infrastructures: available for elephant anti-depredation activity are listed in the table no 6.8.

Table 6.8: ELEPHANT DEPRADATION IN BHADRAK (WL) DIVISION

Sl. No.	Name of the Range	Name of the Section	Location	Item of work	Quantity	Period
1	**2**	**3**	**4**	**5**	**6**	**7**
1	Bhadrak (WL) Range	Agarpada	Border area adjoining to Hadagarh Sanctuary of Keonjhar (WL)Division & portion of Bhadrak (WL) Division	Squad	1 no. (10 nos. members	Through out the year
				Vehicle	1 no.	
				POL	3000 ltr.	
				Ancillaries	Spot light-4nos, Torch-8nos, Crackers, Night Vision Binaculars-2nos., Night Vision Binaculars-2 nos., Camera-2nos., uniforms, Shoes, Temporary shed, installation of solar	

					light, solar fencing etc.	

7.1 Name of the chapter

CHAPTER 7

TREE OUTSIDE FOREST

The percentage of forest cover under administrative control of forest department in Bhadrak WL Division is 2.12 % of the area of Bhadrak district. Apart from this, revenue forests and trees outside forest are present, to which forest department contributes through plantations under various schemes like State Plan, Mahatma Gandhi National Rural Employment Guarantee Scheme, Urban tree plantations, National Afforestation Programme – Forest Development agency, farm forestry, etc. This tree outside forest cover equally contributes to the green cover of the division, like Protected Reserve Forests and Village Forests. Therefore, management strategies are required to maintain and manage the Tree outside forests (ToF), for which ToF Working Circle is constituted.

7.2 General constitution:

The plantations raised under urban tall seedlings plantation and forest development agency will be considered as block and will be calculated in hectares. Whereas the road side plantations raised under Avenue plantations will be considered in Running Kilometres (RKm). The total area under management of ToF will be 1515 Ha and total RKM will be 656 RKM. Thedetailed lists of plantations are given below.

Table 7.1: List of plantations under Urban Tall Seedling Plantation (State Plan)

S.N	Year	Range	Name of the Site	Seedlings	Ha
1	2012-13	Bhadrak	Bhadrak Autonomous College	300	0.75
			Bhadrak Womens College	50	
			Baripada Engineering College	800	
			Bhadrak Road PS	20	
			Balipatna UGME School	30	
		Chandbali	Dakha high school	56	0.35
			Girls high school	10	
			Chandbali fire station	30	
			Chandbali college	450	
			Baligaon gosala campus.	16	

		Basudevpur	Fire station Campus,	110	0.19
			Balinagar Basti School	15	
			Range Campus	20	
			AB High School	60	
			Police Station campus	10	
			NAC campus	60	
			Tripti College	15	
			Court Campus	15	
2	2013-14	Bhadrak	Law college New Bus stand	200 30	0.625
			Police Reserve	50	
			Baripada Engineering College	720	
		Basudevpur	Court premises	25	0.06
			Mandari College campus	20	
			Trupti College Campus	13	
			Govt Girls High School	36	
3	2014-15	Bhadrak	Charampa college	250	0.94
			Kuansa PS	130	
			DSP Vigilance Office	100	
			New Bus Stand	41	
			Aparitibinda	630	
			Kuasa Veterinary Office	349	
		Basudevpur	Bhikari Charan Nodal	11	0.007
			Radhanathpur Primary School	34	0.02
			TOTAL		**2.942**

Table 7.2: List of Urban Avenue Plantations under State Plan

S.N	Year	Range	Name of the Site	RKM
1	2012-13	Chandbali	Baligaon – Fire Station Road	3.012
			Panchapada – Fire Station Road	2.9
			Chandbali to Bintar	0.92
		Basudevpur	Range Office – Tarini Chak	0.24
			Tarini Chak – Dhamra	0.14
			Tarini Chak – Court Road	0.14
			Prema Home – Mataji Mata	0.06
			Bairabpur – Suan Road	0.2
2	2013-14	Basudevpur	Balinagar – Nuanei Canal Road	1.98
			Fire Office – Balinagar	0.116
			Mandari Chak – Sendagada	0.204
			Mangala Mandir – New India SahiRoad	0.344
3	2014-15	Bhadrak	Panchutikiri – Chakradharpur	2.064
			Mandarigudi Chak – Balaji Chak	3.04

			Fire office to Agri office	.044
			Radhanathpur – Radhkanthpur	0.672
4	2015-16	Bhadrak	Sangat – Uttarabahini	3
			Upper Baghurai – Harisankarpur Canal	5.0
		Basudevpur	Sabarpur – Ertal	8.0
5	2016-17	Basudevpur	Bairabpur – Suan	6.0
			Erein CanalChak – Bania	6.0
			TOTAL	**44.074**

Table 7.3: List of Avenue Plantations under State Plan

S.N	Year	Range	Name of the Site	RKM
1	2012-13	Bhadrak	Bhimapur – Barada Road	3.0
		Dhamnagar	Payasahi Chak – Astak Road	4.0
2	2013-14	Bhadrak	Chunida – Tankuni	4.0
			Jalanga – Talanga	4.0
		Chandbali	Chandbali – Kanda Road	4.0
			Mausuda – Singiti	4.0
			Sindol – Nuasahi Road	4.0
		Basudevpur	Laxmidasput – Charibatia	6.0
			Artung – Barapur	6.0
		Dhamnagar	Dhusuri – Dapanakiani	8.0
3	2014-15	Bhadrak	Nalanga – Andabazaar Road	5.0
			Kandachak – Mohantypada Road	5.0
		Chandbali	Kanda – Nedubali	6.0
			Singiti – Icchapur	4.0
		Basudevpur	Arandua – Narsinghpur	5.0
			Kasia – Kantianali Road	5.0
		Dhamnagar	Dakhinabada Hanuman Chak – Gahiratikiri Road	10.0
4	2015-16	Chandbali	Sangat – Uttarabahini	3.0
			Kandha – Gheekoli	6.0
		Basudevpur	Bekamudi – Belasulia	2.0
			Laxmidaspur – Jaykrushnapur	2.0
			TOTAL	**100**

Table 7.4: List of Avenue Plantations under MGNREGS

S.N	Year	Range	Name of the Site	RKM
1	2012-13	Bhadrak	Taranga – Baroda Canal bank	2.0
			Idia – Adalpank Road	2.0
			Baligaon – Tintaraghat	4.0

		Chandbali	Mousuda – Nalagohira	3.0
			Nalgunda – Palaspur	2.0
			Ghadi – Keranga – Laxmiprasad Chak	3.0
		Dhambnagar	Dobal to Sendapur Road	2.0
			Bedapur to Pardhani Road	4.0
			Khadipada to D. Anandapur	3.0
			TOTAL	**25**
2	2013-14	Bhadrak	Adia to Nuapokhari Road	4.0
			Kaupur to Anija Road	4.0
			Talanga to Kantagadia Road	4.0
			Talanga to Ambruli Road	4.0
			Talanga to Ambruli Canal Bank	3.0
		Chandbali	Gadi – Nachibindha Road	6.0
			Bindha – Kelasahi Road	4.0
			Tihidi – Matiasahi	4.0
			Kamaria – Sankarpur	4.0
			Tihidi – Totapada	4.0
			Tididi – Moharampur	4.0
			Tentulidiha – Bhuinbruti Road	6.0
			Karandiamal – Krishanapur chalk Rd	6.0
			Manipur – Nuagaon Road	3.0
		Dhamnagar	Dakhinabada – Haldigadia canal Road	3.0
			Haldigadia – Parbati Road	3.0
			Kanti – Kuigaon Road	3.0
			Nerada – Akhuapada Canal Bank	3.0
			Biruan – Jahangir Road	4.0
			Hasnabada – Andoldiha Road	4.0
		Basudevpur	Kamargaon – Binadanda Road	6.0
			Brahmanigaon – Narendrapur Road	6.0
			Arhua – Arandua Road	4.0
			Laxmidaspur – Bhedanaikani	4.0
			TOTAL	**100**
3	2014-15	Bhadrak	Nalanga – Kalei Canal Road	4.0
			Rahanja – Basuapada	4.0
			Sabarang – Ereda road	4.0
			Itua – Chakrapadi Thakurani Canal Rd	4.0
			Chakrapadhi – Rampur Chhaka Road	4.0
		Chandbali	Badasinghpur – jyotisinghpur Road	12.0
			Kolha – Barasara Road	6.0
		Dhamnagar	Dhakhinabada – Chilapadi	4.0
			Nadigaon – Miraghat	4.0
			Khangra – Mishrapur	4.0
			Ranigadia – Radho	3.0
			Biroli – Sarana	2.0
			Banasahi – Laguan Canal Bank	3.0
			Chandrabhanupur – Haldigadia	4.0

		Basudevpur	Eram – Adia Road	4.0
			TOTAL	**66**
4	2015-16	Bhadrak	Ichhapur – Erein	4.0
			Toranapada – Gormati	4.0
			Kantapada – Nalanga	4.0
			Raimani – Kaupur	5.0
			Padhanpada – Padakana	4.0
			Dhanaghera – Bankatira	5.0
			Bishalkana – B. Gotha	4.0
		Chandbali	Bhuinbruti – Nuagaon	6.0
			Badsinghpur – Rampur	6.0
		Dhamnagar	Gualia – Anaharpur	6.0
			Payimohura – Naguan	4.0
			Chingidipur – Jalamandua	4.0
		Basudevpur	Aruha – Belda	4.0
			TOTAL	**60**
5	2016-17	Bhadrak	Chandipur – Padakana	4.0
			Purusandha G.P.	4.0
			Patrasahi – Rasunapadi	4.0
		Chandbali	BhuibrutiNuagaon – TarniniChhak	4.0
			TentulidihiChhak – Kandiasahi	4.0
			Baincha – Dhanakuta	4.0
			Hrudayprasad – Guansul	6.0
		Basudevpur	Gobindapur – Rajgharpokhari	4.0
			Parapokhari – Biras	4.0
			Kasipur – Joragadia	4.0
			Bhagabanpur – Andola	4.0
		Dhamnagar	Nandabazar – Kalyani	4.0
			TOTAL	**50**
6.	2017-18	Bhadrak	Annapal College – Antapur Village	4
			Patrasahi – Chadheia	4
			Nimnapada – Basantia	4
		Chandbali	Madhapur – Mohantisahi	4
			Guansul – Khandapita	4
			B. C. Road – Paliabindha	6
		Basudevpur	Arandua – Aruha	4
			Ertal – Lunga	4
			Balimunda – Gokulpur	4
		Dhamnagar	Chatabara to Ranjit	6
			Mangalpur to Bilana	4
			Dillo to Kalyani	2
			TOTAL	**50**
7	2018-19	Bhadrak	Asura Canal Chak – Palli Road	6
			Asura Chak – Kodabaruan Canal Road	6
		Chandbali	Ugratara – Bhatapada	4
			BalichatriBangalipada School –Satibati	4

			Haripur – Badanahunipal	6
		Basudevpur	Jaykrushnapur – Balimeda	4
			Laxmiprasad – Purusottampur	4
			Suan – Eram	6
		Dhamnagar	Totasahi – Sankhula	6
			Kothar – Binayakpur	4
			TOTAL	**50**
8	2019-20	Bhadrak	Andheipalli Canal Road	6
			Panapadi Chhaka – Jirinia Village	4
			Purusandha Chandimandir – Munduli Village	4
		Chandbali	Bentalpur Chhaka – Kaudiapal	6
			Sahapur – Kandragadia Road	6
		Basudevpur	Iswarpur – Barahpur	4
			Hatasia – Kurubatia	4
		Dhamnagar	Kothar – Kalyani	6
			TOTAL	**40**
9	2020-21	Bhadrak	Bonth – Salandi Canal Bank	6
			Aptira – Banktira	4
			Kaupur – Arajipatana	4
		Chandbali	Pirahat – Charibatia Ghata	10
			Bijaynagar Chhaka – Gobindpur	4
			Darapur to Balipada Road	10
		Basudevpur	Panda Sahi Chhaka – BrahmanigaonChhaka	4
			Dashadiha – Pala	6
			Gadi– Gopabandhunagar	4
		Dhamnagar	Balipokhari – Akhuapada Canal Road.	4
			Kalyani – Kankara Canal Road.	6
			Ambligaon – Bhatasahi.	4
			Dakhinabada – Banasahi	4
			TOTAL	**70**
		TOTAL		**511**

7.5: AR & ANR Plantations under NAP-FDA & MGNREGS

Range	Year & Scheme	Name of VSS (AfforestationSite)	Afforestation Activities in Ha.				
			AR	ANR	Bamboo	Mixed	Total
Bhadrak	2007-08 NAP-FDA	Kalei	7.0	2.0	2.5	1.0	12.5
		Chuninda	6.0	4.0	3.5	1.0	14.5
		Balabhadrapur	-	3.0	2.0	0.5	5.5
Dhamnagar	2007–08 NAP-FDA	Uttargadia	7.0	-	1.5	2.0	10.5
		Badabanasta	10.0	-	2.0	5.0	17.0
		Bhagada	7.0	-	2.0	2.0	11.0
		Khadisinga	6.0	-	1.5	2.0	9.5

		Kotasira	-	5.0	2.0	3.0	10.0
		Adampur	-	6.0	2.0	2.0	10.0
		Rajendrapur	3.0	4.0	2.0	2.0	11.0
		Saradhapur	3.0	-	1.5	2.0	6.5
		Kanjia	-	2.0	0.5	1.0	3.5
		Karanji	3.0	1.0	1.5	1.0	6.5
		Bhandaripadi	3.0	-	0.5	2.0	5.5
Chandbali	2007–08 NA – FDA	Jaydurgapatna	22.0	100.0	1.5	-	123.5
		Jyotsnamayee	10.0	-	1.5	-	11.5
		Kanakprasad	20.0	-	1.0	-	21.0
		Saratprasad	10.0	-	1.0	-	11.0
		Kishoreprasad	20.0	-	1.5	-	21.5
		Hrudayprasad	20.0	-	2.0	-	22.0
		Karanjmal	15.0	-	3.0	-	18.0
		Karanpali	15.0	-	1.0	-	16.0
		Bijaypatna	15.0	100.0	2.0	-	117.0
		Sasikadeipur	2.0	-	4.0	-	6.0
Basudevpur	2007-08 FDA	Kantipur	60.0	58.0	5.0	3.0	126.0
		Nuagan	22.0	5.0	3.0	2.0	32.0
		Mirzapur	4.0	5.0	2.5	-	11.5
		Eram	5.0	-	2.5	-	7.5
		Chudamaniadia	10.0	5.0	3.0	3.0	21.0
		Sanakrushnapur	25.0	-	2.5	2.5	30.0
		Kismat Krushnapur	30.0	-	3.0	1.0	34.0
		Balimunda	40.0	-	5.0	2.0	47.0
Chandbal	2008-09 NAP-FDA	Gopaldohara	5.0		-	-	5.0
		Kaudiapal	6.0	-	-	-	6.0
		Kunjakalika	6.0	1.0	-	-	7.0
		Kudakanthi	8.0	1.0	-	-	9.0
		Chhedak	19.5	15.0	-	-	34.5
		Jhadakata	-	7.0	-	-	7.0
Bhadrak	2008-09 NAP-FDA	Amargadia	2.0	12.0	-	-	14.0
		Samraipur	-	2.0	-	-	2.0
		Korkora	-	2.0	-	-	2.0
		Ramkrushnapur	7.0	1.0	-	-	8.0
		Brundabanpur	6.5	1.0	-	-	7.5
Dhamnagar	2008-09 NAP-FDA	Kothar	5.0	7.0	-	-	12.0
		Talapada	3.0	5.0	-	-	8.0
		Bamkura	5.0	7.0	-	-	12.0
		Daipur	7.0	4.0	-	-	11.0
		Khadimahara	8.0	7.0	-	-	15.0
		Balipokhari	5.0	3.0	-	-	8.0
		Chatrubhujapur	-	12.0	-	-	12.0

Basudevpur	2008-09 NAP-FDA	Lunga	2.0	3.0	-	-	5.0
		Binayakpur	-	2.0	-	-	2.0
		Mallikadeipur	2.0	5.0	-	-	7.0
		Bideipur	3.0	3.0	-	-	6.0
		Grand Total	**500.0**	**400.0**	**70.0**	**40.0**	**1010.0**
Dhamnagar	**2013-14 MGNREG**	**Kanjiapala**	**5.0**	-	-	-	**5.0**

Table 7.6 : Distribution of seedlings under various Schemes

S.N	Year	Scheme	Seedlings
1	2012-13	State Plan	1,00,000
2	2013-14	State Plan – 13th FC – Increasing Tree Outside Forest	3,50,000
3	2014-15	State Plan – 13th FC – Increasing Tree Outside Forest	3,50,000
		State Plan – Farm Forestry	5,00,000
4	2015-16	State Plan– 13th FC – Increasing Tree Outside Forest	1,25,000
		State Plan – Farm Forestry	2,40,000
5	2016-17	State Plan – Farm Forestry CAMPA	70,000 30,000
6	2017-18	MGNREGS	1,50,000
7	2018-19	IGC GM M	1,38,200 2,52,300
8	2020-21	CAMPA OEMF MGNREGS	2,00,000 1,00,000 1,50,000
		TOTAL	**27,05,500**

7.3 Characteristics of Vegetation:

In India, FSI has defined Tree Outside Forest as "All trees growing outside recorded forest areas irrespective of size of patch". TOF (Rural) include agroforestry, farm forestry,

along the farm bunds and homesteads, orchards, in common & government non-forest lands,

in parks and gardens, along roads, canals and railway line in rural areas and TOF (Urban) include forests, street trees, trees in parks and gardens, and trees in derelict corners. The cover of Tree Outside Forest is so vast and huge in area that assessment of TOF by Bhadrak WL Division is difficult due to manpower shortage and technicalities like Remote Sensing, GIS,etc.

Therefore, the data acquired from Forest Survey of India will be utilized to assess the general characteristics of TOF vegetation for period till 2009. After 2009, the plantations done by forest department and the seedlings distributed to the public for various purposes like agroforestry, farm forestry, etc will be analysed to assess the characteristics of vegetation.

In 2008-09, the following species dominated the composition of TOF in Bhadrak WL Division and 69 % of the trees were in Diameter at Breast Height (DBH) class of 10–30 cm. Theestimated volume of TOF in Bhadrak WL Division was 12.5 lakh cu.m.

Table 7.7: Species composition of TOF in 2008-09

Species	No of Trees in Diameter Class			Total
	10-30 cm	30-50 cm	50+ cm	
Acacia arabica	180447	4561	0	185008
Acacia lenticularis	76783	3041	0	79824
Albizzia species	87632	21457	760	109849
Azadirachta indica	127731	10099	0	137830
Borassus flabelliformis	23522	319311	5322	348155
Butea monosperma	152805	760	0	153565
Cocos nucifera	169141	206128	760	376029
Mangifera indica	206721	96449	12618	315788
Phoenix sylvestris	71861	51628	0	123489
Pongamia pinnata	105697	17157	0	122854
Samanea samam	49257	32271	3518	85046
Syzygium cumini	64200	13616	760	78576
Tamarindus indica	38524	26018	2519	67061
Terminalia arjuna	72257	24498	2020	98775
Rest Of Species	773489	104483	30080	908052
Total	2200067	931477	58357	3189901

Source: Forest Survey of India’s assessment in 2008-09

After 2009, the plantations and distributed seedlings were taken in to account. In Avenue plantations, the species composition is dominated by maha neem (*Melia azadirachta*) , karanj (*Pongamia pinnata*), arjuna (*Terminalia arjuna*), radha chuda, chatian, acacia, sissoo, etc. The survival of the plantations are about 60 % and the species are mostly tolerant to water logging, shade bearing, flowering and of aesthetic value. Parts of the plantations not surviving or damaged due to various reasons such as water logging, 'Bulbul' & 'Amphan' cyclone, etc are required to be restocked.

In the National Afforestation Programme – Forest Development Agency plantations undertaken in the years 2007-08 and 2008-09 in revenue land, the species present are *Acacia mangium, Acacia auriculoformis, Azadirachta indica, Cassia samea , Terminalia arjuna, Eucalyptus, Antocephalus kadamba, etc.* The plantations consisted of AR, ANR, Bamboo and Mixed.

In seedling distribution, the main species focused based on public demand were *Acacia auriculoformis, Acacia mangium, Tectona grandis, Casuarina equisetifolia, Peltophorum pterocarpum.* The main purpose of distribution of seedlings was to increase the area of Tree Outside Forest through farm forestry, agro-forestry, community plantations, roadside plantations, etc. In avenue plantations, arjuna, karanj, neem, maha neem, pesta badam, etc are the main species.

The riverine tract from Chandbali forest jetty till beginning of Garmal PRF in Dhamra is 26 kilometers in length. This linear patch consists of species such as Sonneratia apetala, Sonneratia caseolaris, Kandelia candel, Acanthus ilicifolius, Ceriops decandra, Avicennia alba,Avicennia marina, and mangrove associates inland.

7.4: Prescriptions for FDA Plantations:

NAP-FDA plantations in Bhadrak WL Division were undertaken in the years 2007-08 and 2008-09. Around 500 Ha of Artificial Regeneration, 400 Ha of Assisted Natural Regeneration, 70 Ha of Bamboo and 40 Ha of Mixed Plantations were executed in all four ranges of Bhadrak WL Division. For management of these plantations under the current Working Plan, prescriptions are considered only for AR and Mixed plantations of 540 Ha under NAP-FDA.

7.4.1 : Special Objectives of Management:

The objectives of management of these plantations are mentioned below.

1. To increase tree cover of the district through TOF plantations.
2. Harvesting the timber from trees of harvestable diameters and sharing the benefits of harvest with the Vana Surakhya Samiti that executed the plantations as per JFM Resolution, 2011.
3. Meeting the timber, firewood and other minor forest produce requirement of villages.
4. To enhance participatory forest & natural resource management among villagers.
5. To increase biomass production by planting quick growing species.
6. To plant species which provides increased carbon sequestration.
7. To create wind break / shelter belt as protection against cyclone
8. To improve the aesthetic value of the surrounding area.

7.4.2 : Plantations included for Management:

The list of plantations mentioned in table 6.4 under the scheme NAP-FDA will beincluded for management.

7.4.3 : Treatment Series & Sections:

The entire FDA plantations have been included in one FDA Treatment Series with 10FDA Treatment Sections, which are mentioned in the table.

7.8: FDA Treatment Series & Sections

FTS	Year of Treatment	Name of the site	AR	Mixed	Total	Year of Plantation
FTS – 1	2021-22	Kalei	7.0	1.0	8.0	2007-08
		Chuninda	6.0	1.0	7.0	
		Balabhadrapur	-	0.5	0.5	
		Uttargadia	7.0	2.0	9.0	
		Badabanasta	10.0	5.0	15.0	
		Saradhapur	3.0	2.0	5.0	
				TOTAL	**44.5**	
FTS – 2	2022-23	Jaydurgapatna	22.0	-	22.0	2007-08
		Bhagada	7.0	2.0	9.0	
		Khadisinga	6.0	2.0	8.0	
		Kotasira	-	3.0	3.0	
		Adampur	-	2.0	2.0	
				TOTAL	**44.0**	
FTS – 3	2023-24	Jyotsnamayee	10.0	-	10.0	2007-08
		Kanakprasad	20.0	-	20.0	

		Rajendrapur	3.0	2.0	5.0	
		Kanjia	-	1.0	1.0	
		Karanji	3.0	1.0	4.0	
		Bhandaripadi	3.0	2.0	5.0	
		Sasikadeipur	2.0	-	2.0	
				TOTAL	**47.0**	
FTS – 4	2024-25	Saratprasad	10.0	-	10.0	2007-08
		Kishoreprasad	20.0	-	20.0	
		Hrudayprasad	20.0	-	20.0	
				TOTAL	**50.0**	
FTS – 5	2025-26	Karanjmal	15.0	-	15.0	2007-08
		Karanpali	15.0	-	15.0	
		Bijaypatna	15.0	-	15.0	
				TOTAL	**45.0**	
FTS – 5	2026-27	Kantipur	30.00	3.0	33.0	2007-08
		Nuagan	22.0	2.0	24.0	
				TOTAL	**57.0**	
FTS – 6	2027-28	Kantipur	30	0.0	30.0	2007-08
		Chudamaniadia	10.0	3.0	13.0	
		Mirzapur	4.0	-	4.0	
				TOTAL	**47.0**	
FTS – 7	2028-29	Balimunda	40.0	2.0	42.0	2007-08
		Eram	5.0	-	5.0	
				TOTAL	**47.0**	
FTS – 8	2029-30	Sanakrushnapur	25.0	2.5	27.5	2007-08
		Kismat Krushnapur	30.0	1.0	31.0	
				TOTAL	**58.5**	
FTS – 9	2030-31	Gopaldohara	5.0	-	5.0	2008-09
		Kaudiapal	6.0	-	6.0	
		Kunjakalika	6.0	-	6.0	
		Kudakanthi	8.0	-	8.0	
		Chhedak	19.5	-	19.5	
		Ramkrushnapur	7.0	-	7.0	
		Brundabanpur	6.5	-	6.5	
				TOTAL	**58.0**	
FTS – 10	2031-32	Kothar	5.0	-	5.0	2008-09
		Amargadia	2.0	-	2.0	
		Talapada	3.0	-	3.0	
		Bamkura	5.0	-	5.0	
		Daipur	7.0	-	7.0	
		Khadimahara	8.0	-	8.0	
		Balipokhari	5.0	-	5.0	
		Lunga	2.0	-	2.0	
		Mallikadeipur	2.0	-	2.0	
		Bideipur	3.0	-	3.0	

		TOTAL	**42.0**	
		GRAND TOTAL	**540**	

7.4.4 : Silviculture System & Rotation Period:

The silviculture system to be adopted is 'Rehabilitation & Restocking by Artificial Plantation' through people's participation.

The species planted are *Acacia mangium, Acacia auriculoformis, Azadirachta indica, Cassia samea , Terminalia arjuna, Eucalyptus, Antocephalus kadamba, etc.* The rotationperiod will be 10 years i.e. co-terminus with the plan period.

7.4.5 : Harvestable Diameter:

Diameter-limit cutting is the practice of harvesting all of the trees on a patch that are larger than a certain diameter. In forestry terms, tree diameter is measured at breast height, defined as 4 ½ feet above ground level, called as diameter at breast height (DBH). The DBH fixed for various species in FDA plantation is mentioned below.

Table 7.9 : Exploitable Diameter / Girth of Trees

S.N	Species	DBH in cm	GBH in cm
1	*Acacia mangium*	29	90
2	*Acacia auriculoformis*	29	90
3	*Azadirachta indica*	38	120
4	*Cassia saemea*	48	150
5	*Terminalia arjuna*	38	120
6	*Eucalyptus*	48	150
7	*Antocephalus kadamba*	38	120

7.4.6 : Method of Execution of Felling:

For executing the prescriptions, the sequence of operation is as follows.

a) Demarcation of Area:

The area / forest block or part there f is assigned for working in a particular year. It is designed to demarcate the area in previous year at six months priorto working. After demarcation, the demarcating line may be marked by placing stone cairns (size: 60 m dia at top, 100 cm dia at bottom & 60 cm height or by placing demarcation pillars (size: 15 cm x 15 cm x 120 cm) with numbers. For easy identification, black paint double ring at Breast Height on adjacent trees may also be given List of pillars posted along with the GPS location may also be prepared and annexed to the marking list along with map of the assigned area. On preliminary reconnaissance survey of the assigned area, if no exploitable trees are available, the area is to be demarcated as to prevent future encroachments. After demarcation, a signboard depicting Name of Treatment Series, Name of Section, and Year of Operation is to be placed at a conspicuous place.

b) Marking of Trees:

The trees selected for removal are required to be marked based on the following marking principle.

1. All dead and uprooted trees / poles to be marked.
2. 2/3 fallen trees / dead but standing trees are to be left per hectare from wildlife management point of view.
3. No green tree marking is permissible on any consideration except threat to life and properly due to positional hazards.
4. No woody interlinking climbers to be cut during marking.
5. Marking is to be taken up by trained foresters and cross checked by the concerned Range Officer.

c) Removal of Trees:

In case of FDA plantations, the VSS may be given priority for felling / conversionetc. In case VSS expresses its inability, then departmental working is recommended. The sharing of forest produce between VSS and Forest Department is to be as per provisions of JFM Resolution, 2011.

7.4.7 : Subsidiary Silvicultural Operations:

After coupe working, subsidiary silvicultural operations are to be carried out to maintain the hygiene of the area. As most of the assigned area is of plantation origin and natural regeneration is scanty, silviculture cleaning is limited to removal of debris, cutting of succulent annual climbers and maintaining the natural saplings scattered over the area. The debris is to be buried under sand / soil to allow decomposition and enrich the soil organic content. As the crops are thinly populated, no thinning operations will be required.

7.4.8 : Restocking of FDA plantations:

The assigned area is required to be restocked by planting through 'Artificial Regeneration'. The following species are suitable to be planted.

1. *Terminalia arjuna*
2. *Melia Azadirachta*
3. *Pongamia pinnata*
4. *Azadirachta indica*
5. *Anogeissus acuminata*
6. *Dalbergia sissoo*
7. *Terminalia catapa*
8. *Tamarindus indica*
9. *Acacia auriculoformis*
10. *Acacia mangium*

7.5: Riverside Plantation of Mangroves:

Mangroves are trees or shrubs that grow in salty water in hot places like the tropics. Mangroves make a special saltwater woodland or shrubland habitat, called a *mangrove forest* or *mangals.* Mangroves are the only trees that are capable of thriving in salt water. They form unique intertidal forests at the edge of land and sea. They provide valuable ecosystem services such as carbon sequestration, coastal and riverine protection, food production, denitrification, etc. Since Bhadrak WL Division has good riverine track, i.e. Baitarini river entering in to Bay of Bengal, it will make a suitable habitat for mangroveplantations.

7.5.1 : Special Objectives of Management:

i. To enhance the areal cover of mangroves.

ii. To stabilize the riverine tract by reducing erosion caused by impacts of floods, storm surges, currents, waves and tides.

iii. To protect water quality by removing nutrients and pollutants from rivers and tidal insurges before they reach seagrass habitats and coral reefs.

iv. To provide nursery habitat for all riverine fishes, especially endangered ones.

v. To provide a good habitat to animals/ reptiles which require marshy land and brackish water.

vi. To provide shelter to a range of wildlife species including birds, and honey bees.

vii. To serve as nesting areas for coastal birds such as little blue herons, great egrets .

viii. To ensure carbon sequestration since mangroves capture massive amounts of carbon dioxide emissions and other greenhouse gases from the atmosphere

ix. To promote ecotourism in areas adjoining Bhitarkanika National Parks.

7.5.2 : Area included for Management:

The riverine tract from Chandbali forest jetty till beginning of Garmal PRF in Dhamra is 26 kilometers in length. This linear patch consists of species such as Sonneratia apetala, Sonneratia caseolaris, Kandelia candel, Acanthus ilicifolius, Ceriops decandra, Avicennia alba, Avicennia marina, and mangrove associates inland. This linear patch with blank spaces in between can be saturated with linear mangrove plantations.

7.5.3 : Planting Series & Sections

The entire 26 Km stretch is taken as a single 'Mangrove Plantation Series' with 5 'Mangrove Plantation Sections.

6.10: Mangrove Plantation Series.

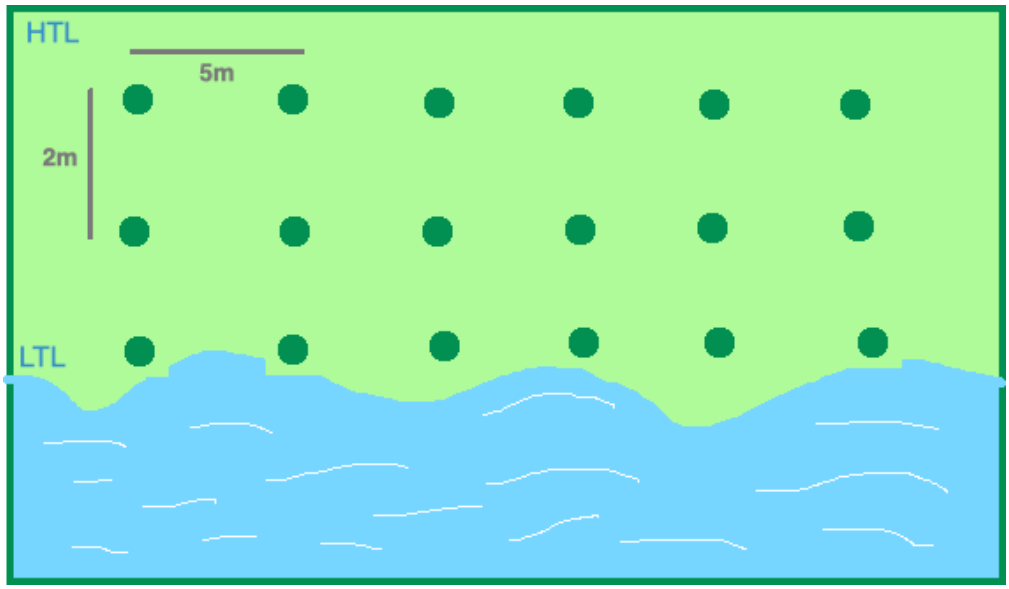
Plantation Section	Kilometres to be covered	Year of Plantation (to be undertaken)
MPS – 1	6	2021-22
MPS – 2	5	2022-23
MPS – 3	5	2023-24
MPS – 4	5	2024-25
MPS - 5	5	2025-26
TOTAL	**26**	

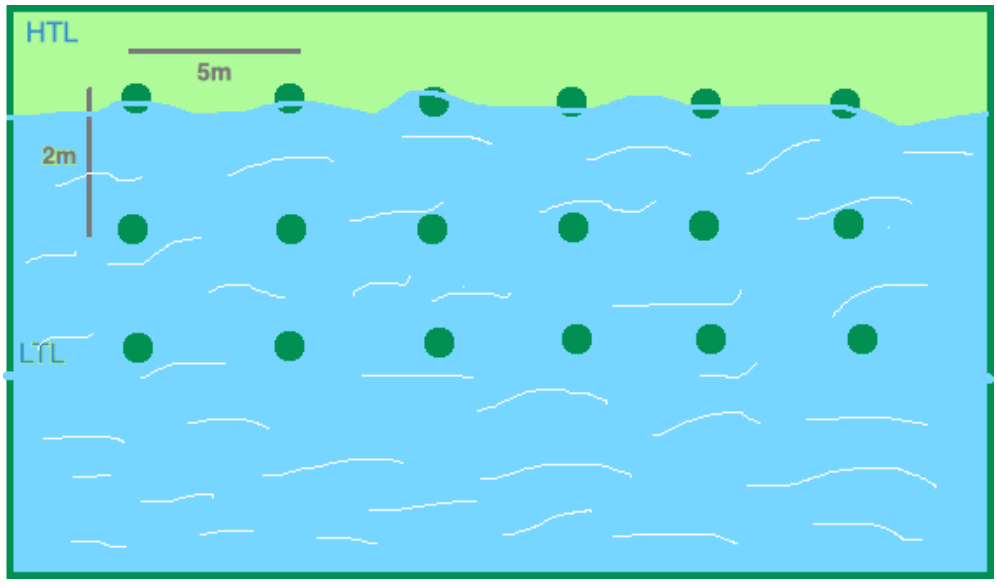
7.5.4 : Method of planting

i. A linear patch of the riverine stretch to be planted for a particular year will first be demarcated using GPS and on the field.

ii. In the linear patch, blank spaces or mud flats will be identified for the plantation and the maximum distance of the patch from the low tide line will be recorded.

iii. The plantation can be done in one to four rows parallel to the river flow with space of 2 m between each rows.





iv. The number of rows will depend on the river bank area available adjacent to the river till High Tide Line.

v. The plantation can be implemented using seedlings raised in the nursery or directly through hypocotyls between high tide line and low tide line.

vi. Each and every patch of plantation must be fenced with by spreading fishing nets supported by RCC pillars to prevent entry of cattle and grazing. The fences are to be maintained for 3 years since year of plantation.

vii. Regular uprooting of grasses and weeds must be carried for 4 years since year of plantation.

7.5.5. : Choice of Species:

The choice of species, depending on the site characteristics will include,

1. *Sonneratia apetala*
2. *Sonneratia caseolaris*
3. *Kandelia candel*
4. *Ceriops decandra*
5. *Avicennia alba*
6. *Avicennia marina*
7. *Excoecaria agallocha*

7.8 : Prescriptions for Avenue Plantations:

Lot of Avenue plantations have been raised during the last working schemes period but no specific managements prescriptions are in place to manage the plantation area. This section aims at providing prescriptions for existing plantations and a scheduled target of plantations for next 10 years.

7.8.1 : Objectives of Management

The objectives of Avenue plantations are

1. To enhance the green cover of the division through plantations or creation of green belts outside forests.
2. To enhance biodiversity through plantation of different species.
3. To reduce air and noise pollution by planting pollution attenuating or pollutant absorbing species.
4. To reduce greenhouse effect in urban areas of the division.
5. To enhance aesthetic value of the landscape.
6. To act as wind breaks during cyclones.
7. To act as carbon sinks through carbon sequestration.

8. To make habitat for avifaunal species.
9. To provide shade to people on pavement.

7.8.2 : Avenue plantations Included for Management:

The list of plantations of last decade mentioned in Table No 2, 3 & 4 are included in this Working Circle for management.

7.8.3 : Allotment to Treatment Series & Sections:

The entire avenue plantations executed between 2012-12 to 2020-21 under various schemesin Bhadrak Wildlife Division have been included in one Treatment Series named 'Avenue Treatment Series' and been divided in to 10 Treatment Sections. Since the year 2013-14 consists of many avenue plantations (i.e. 140 RKM), it is accommodated in two treatment sections (ATS 2& ATS 3).

Table 7.11: Avenue Treatment Series

TS	Year of Treatment	Name of the Site	RKM	Year of Plantation
ATS 1	2021-22	Taranga – Baroda Canal bank	2.0	2012-13
		Idia – Adalpank Road	2.0	
		Baligaon – Tintaraghat	4.0	
		Mousuda – Nalagohira	3.0	
		Nalgunda – Palaspur	2.0	
		Ghadi – Keranga – Laxmiprasad Chak	3.0	
		Dobal to Sendapur Road	2.0	
		Bedapur to Pardhani Road	4.0	
		Khadipada to D. Anandapur	3.0	
		Baligaon – Fire Station Road	3.012	
		Panchapada – Fire Station Road	2.9	
		Chandbali to Bintar	0.92	
		Range Office – Tarini Chak	0.24	
		Tarini Chak – Dhamra	0.14	
		Tarini Chak – Court Road	0.14	
		Prema Home – Mataji Mata	0.06	
		Bairabpur – Suan Road	0.2	
		Bhimapur – Barada Road	3.0	
		Payasahi Chak – Astak Road	4.0	
		TOTAL	**37.912**	
ATS 2	2022-23	Adia to Nuapokhari Road	4.0	2013-14
		Kaupur to Anija Road	4.0	
		Talanga to Kantagadia Road	4.0	
		Talanga to Ambruli Road	4.0	

		Talanga to Ambruli Canal Bank	3.0	
		Gadi – Nachibindha Road	6.0	
		Bindha – Kelasahi Road	4.0	
		Tihidi – Matiasahi	4.0	
		Kamaria – Sankarpur	4.0	
		Tihidi – Totapada	4.0	
		Tididi – Moharampur	4.0	
		Tentulidiha – Bhuinbruti Road	6.0	
		Karandiamal – Krishanapur chalk Rd	6.0	
		Manipur – Nuagaon Road	3.0	
		Dakhinabada – Haldigadia canal Road	3.0	
		Haldigadia – Parbati Road	3.0	
		Kanti – Kuigaon Road	3.0	
		TOTAL	**69.0**	
ATS 3		Nerada – Akhuapada Canal Bank	3.0	
		Biruan – Jahangir Road	4.0	2013-14
		Hasnabada – Andoldiha Road	4.0	
		Kamargaon – Binadanda Road	6.0	
		Brahmanigaon – Narendrapur Road	6.0	
		Arhua – Arandua Road	4.0	
		Laxmidaspur – Bhedanaikani	4.0	
		Balinagar – Nuanei Canal Road	1.98	
		Fire Office – Balinagar	0.116	
		Mandari Chak – Sendagada	0.204	
		Mangala Mandir – New India SahiRoad	0.344	
		Chunida – Tankuni	4.0	
		Jalanga – Talanga	4.0	
		Chandbali – Kanda Road	4.0	
		Mausuda – Singiti	4.0	
		Sindol – Nuasahi Road	4.0	
		Laxmidasput – Charibatia	6.0	
		Artung – Barapur	6.0	
		Dhusuri – Dapanakiani	8.0	
		TOTAL	**73.644**	
ATS 4	2024-25	Nalanga – Kalei Canal Road	4.0	2014–15
		Rahanja – Basuapada	4.0	
		Sabarang – Ereda road	4.0	
		Itua – Chakrapadi Thakurani Canal Rd	4.0	
		Chakrapadhi – Rampur Chhaka Road	4.0	
		Badasinghpur – jyotisinghpur Road	12.0	
		Kolha – Barasara Road	6.0	
		Dhakhinabada – Chilapadi	4.0	
		Nadigaon – Miraghat	4.0	
		Khangra – Mishrapur	4.0	

		Ranigadia – Radho	3.0	
		Biroli – Sarana	2.0	
		Banasahi – Laguan Canal Bank	3.0	
		Chandrabhanupur – Haldigadia	4.0	
		Eram – Adia Road	4.0	
		Panchutikiri – Chakradharpur	2.064	
		Mandarigudi Chak – Balaji Chak	3.04	
		Fire office to Agri office	.044	
		Radhanathpur – Radhkanthpur	0.672	
		Nalanga – Andabazaar Road	5.0	
		Kandachak – Mohantypada Road	5.0	
		Kanda – Nedubali	6.0	
		Singiti – Icchapur	4.0	
		Arandua – Narsinghpur	5.0	
		Kasia – Kantianali Road	5.0	
		Dakhinabada Hanuman Chak – Gahiratikiri Road	10.0	
		Sangat – Uttarabahini	3.0	
		TOTAL	**114.94**	2015-16
ATS 5	2025-26	Ichhapur – Erein	4.0	
		Toranapada – Gormati	4.0	
		Kantapada – Nalanga	4.0	
		Raimani – Kaupur	5.0	
		Padhanpada – Padakana	4.0	
		Dhanaghera – Bankatira	5.0	
		Bishalkana – B. Gotha	4.0	
		Bhuinbruti – Nuagaon	6.0	
		Badsinghpur – Rampur	6.0	
		Gualia – Anaharpur	6.0	
		Payimohura – Naguan	4.0	
		Chingidipur – Jalamandua	4.0	
		Aruha – Belda	4.0	
		Sangat – Uttarabahini	3.0	
		Upper Baghurai – Harisankarpur Canal	5.0	
		Sabarpur – Ertal	8.0	
		Sangat – Uttarabahini	3.0	
		Kandha – Gheekoli	6.0	
		Bekamudi – Belasulia	2.0	
		Laxmidaspur – Jaykrushnapur	2.0	
		TOTAL	**89.0**	
ATS 6	2026-27	Chandipur – Padakana	4.0	2016-17
		Purusandha G.P.	4.0	
		Patrasahi – Rasunapadi	4.0	
		BhuibrutiNuagaon – TarniniChhak	4.0	
		TentulidihiChhak – Kandiasahi	4.0	
		Baincha – Dhanakuta	4.0	

		Hrudayprasad – Guansul	6.0	
		Gobindapur – Rajgharpokhari	4.0	
		Parapokhari – Biras	4.0	
		Kasipur – Joragadia	4.0	
		Bhagabanpur – Andola	4.0	
		Nandabazar – Kalyani	4.0	
		Bairabpur – Suan	6.0	
		Erein CanalChak – Bania	6.0	
		TOTAL	**62**	
ATS 7	2027-28	Annapal College – Antapur Village	4	2017-18
		Patrasahi – Chadheia	4	
		Nimnapada – Basantia	4	
		Madhapur – Mohantisahi	4	
		Guansul – Khandapita	4	
		B. C. Road – Paliabindha	6	
		Arandua – Aruha	4	
		Ertal – Lunga	4	
		Balimunda – Gokulpur	4	
		Chatabara to Ranjit	6	
		Mangalpur to Bilana	4	
		Dillo to Kalyani	2	
		TOTAL	**50**	
ATS 8	2028-29	Asura Canal Chak – Palli Road	6	2018-19
		Asura Chak – Kodabaruan Canal Road	6	
		Ugratara – Bhatapada	4	
		BalichatriBangalipada School –Satibati	4	
		Haripur – Badanahunipal	6	
		Jaykrushnapur – Balimeda	4	
		Laxmiprasad – Purusottampur	4	
		Suan – Eram	6	
		Totasahi – Sankhula	6	
		Kothar – Binayakpur	4	
		TOTAL	**50**	
ATS 9	2029–30	Andheipalli Canal Road	6	2019-20
		Panapadi Chhaka – Jirinia Village	4	
		Purusandha Chandimandir – Munduli Village	4	
		Bentalpur Chhaka – Kaudiapal	6	
		Sahapur – Kandragadia Road	6	
		Iswarpur – Barahpur	4	
		Hatasia – Kurubatia	4	
		Kothar – Kalyani	6	
		TOTAL	**40**	
ATS 10	2030–31	Bonth – Salandi Canal Bank	6	
		Aptira – Banktira	4	
		Kaupur – Arajipatana	4	

		Pirahat – Charibatia Ghata	10	
		Bijaynagar Chhaka – Gobindpur	4	
		Darapur to Balipada Road	10	
		Panda Sahi Chhaka – BrahmanigaonChhaka	4	
		Dashadiha – Pala	6	
		Gadi– Gopabandhunagar	4	
		Balipokhari – Akhuapada Canal Road.	4	
		Kalyani – Kankara Canal Road.	6	
		Ambligaon – Bhatasahi.	4	
		Dakhinabada – Banasahi	4	
		TOTAL	**70**	
		GRAND TOTAL	**656**	

7.8.4 : Treatments Prescribed:

The following prescriptions are recommended for the avenue plantation sites from 2012-13 to 2020-21.

1) The avenue plantation site is to be visited and existing plants are to be recorded in following form.

Name of Treatment Section	Name of the plantation, Year, Scheme& distance in RKM	Name of Species	Height in mts	Girth at Breast Height in cm	Present Condition	Remarks

2) Concerned department dealing with roads may be requested to paint the trees onthe roads with fluorescent paint to ensure visibility during night which will also prevent damage to trees.
3) If any tree is badly damaged and if it is above 30 cm GBH, it is recommended to remove and replace it with a new plant.
4) Any old/diseased tree, likely to fall and pose a danger to life and property should be marked and recorded. After joint verification and recommendation of removal by Range Officer, Tahsildar, R&B / NHAI, the Divisional Forest Officer can take stepsin consultation with District Authority for its removal.
5) All damaged/fallen trees due to imapact of cyclones or gusting winds should be restored as soon as possible in the manner mentioned below.

a. Assess the damage. Some branches may be broken and hanging in the tree, others may be partially attached, and in some cases, entire forks may be split.
b. Plan which branches must be removed and where the removal cut should be made.
c. Remove all damaged branches at the nearest lateral branch, bud, or main stem and not in the middle of a branch.
d. Fallen trees can be straightened by bringing it back to original position with the help of ropes, after which foreign soil can be added to make soil mound at the base of the tree. The positioned-tree can be fastened to other permanent structures nearby with help of ropes or other mechanical support.

7.8.5 : Prescriptions for Plantations & Target:

As said earlier, Bhadrak has only 2.12 % of forest cover. Therefore, plantations outside forests are required to enhance the green cover of the district. Avenue plantations on highways and PMGSY roads are always considered as a reliable method to enhance green cover. Therefore, plantations can be under various schemes such as State Plan, MGNREGS, target for next 10 years is as mentioned below.

Table 7.12: Avenue Plantation Target for WP period.

Sl. No	Year	Target
1.	2021-22	50 RKM
2.	2022-23	50 RKM
3.	2023-24	50 RKM
4	2024-25	50 RKM
5	2025-26	50 RKM
6	2026-27	50 RKM
7	2027-28	50 RKM
8	2028-29	50 RKM
9	2030-31	50 RKM

10	2031-32	50 RKM

1) The road side plantation could be planned at Van Surakhya Samiti (VSS) or GramPanchayat level for the rural roads already constructed under PMGSY, state schemes, MGNREGS and other schemes which do not have proposal/ scope of widening in future
2) The species of plantation will be selected which are suitable to local agro climatic conditions and are of utility to the villagers of the area.
3) The project on road side plantation will be prepared with details of road covered, length of road, and species of plants to be planted with number of plants.
4) Road maps marked with existing plantation if any, proposed plantation under MGNREGS with species of plants can be prepared and along with project couldbe placed before VSS / Gram Sabha for discussions, prioritization and consultation.
5) For watering, weeding and hoeing of plants a schedule based on the species planted will be prepared which will be followed.
6) Number of rows will depend on the availability of land on road side. However, as far as possible, efforts can be taken to plant two rows of the saplings on each side of the road.

7.8.6. Selection of Species for Avenue Plantations:

Bhadrak Division is geographically located in coastal area where water logging and salinity are high compared to other districts of Odisha. Therefore, physiological, soil, water and other characteristics should be considered while choosing the species. Also, monotony of species can be maintained for 1–2 RKM on both the sides of the road to enhance aesthetic beauty. Apart from the above, avenue plantations are done along the stretches which are first point of generation of vehicular pollution. The concern for neutralizing ill effects of pollutions is shared globally. Various researches, case studies and pilot projects conducted over the years identifies green belt as the effective means of pollution control. Vehicles are the mobile sources of gaseous as well as particulate pollution.

As Green belts have to face stressed climatic conditions involving intake of high level of pollutants (SO2, CO, CO2 & & SPM), it is important to select species with high pollution tolerance index and effective pollution sorption capacity. Components of green belts on

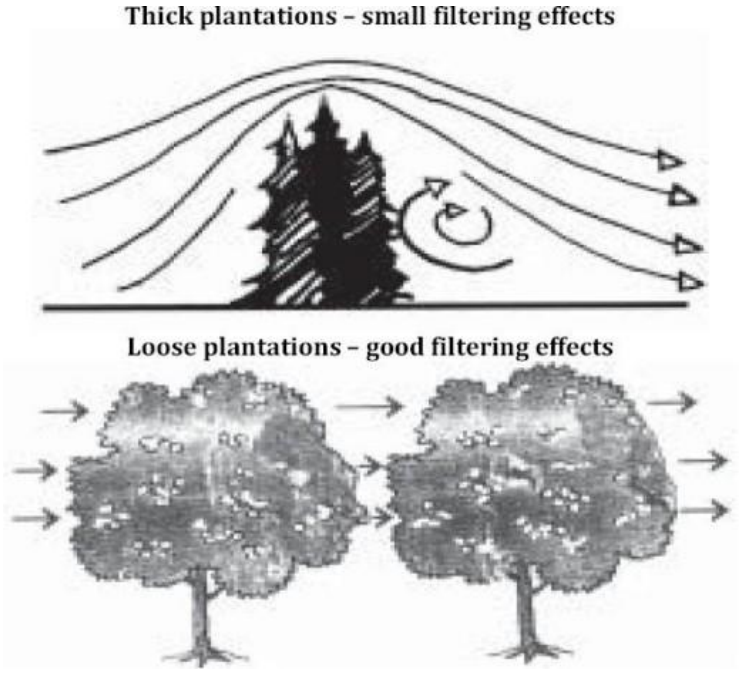
roadside hence should be both absorbers of gases as well as of dust particulates including even lead particulates. Bhadrak district comprises of one municipality and two NACs, which are sources of urban pollution. There pollution attenuating species are required to be planted and to choose them, **'Plantation Species Matrix'** published in the report of National Highway Authority of India can be followed. **Plantation Species Matrix** is a mathematical decision making tool for selection of suitable tree/shrub species for roadside plantations. It takes in toaccount the following factors while deciding the score of a particular species.

1. Pollution Attenuation Capability: Every tree/shrub species has different capability for absorption, which depends on various factors such as its Canopy Size, Leaf Area, Stomata Size, tolerance capability etc. It is also important to mention that in moist conditions tree/shrubs show higher pollution sorption capacity. The pollution attenuation factor (Af) for sources releasing at ground level is given by:

   $$Af = Qwa/ QB$$

   Af = ratio of mass flux of pollutant reaching at distance X1 and X2 in the absence of Ground Biomass (QWB) to the mass flux reaching at the same distance in the presence of the GB (QB)

2. Canopy Shape and Size: Dense foliage helps in better trapping of pollutants and also works as wind break. Openness in canopy allows better filtration capacity whereas large canopy surface area works as noise barrier.



3. Leaf Area: Larger leaf size helps in greater retention of pollutants. Leaf area density has direct correlation with pollution attenuation coefficient. Large and broad leaves with axilliary hairs have better dust retention capacity. Similarly leaves with complex shape and large circumference posses' higher dust capture capability.

Pinnate Compound Palmate Compound Doubly-Compound

4. Stomatal Index: Stomatal apertures inside phyllosphere is the entry point for gaseous pollutants where it gets absorbed and further converted into sugars and amino acids by mesophyll cells through metabolism process. High stomatal density, high index and large stomata give high transpiration rate thereby allowing higher sorption capacity.
5. Evergreen / Deciduous
6. Growth Rate of a plant
7. Tolerance of a plant to multiple pollutants.

Based on the above factors, scores of around 41 species from report of NHAI is collated and listed below. Higher the score, higher the pollution attenuating and absorbing capacity of the species. The score may play a major role in selection of species for avenue plantations in and around municipalities and Notified Area Councils.

Scientific Name	Common Name	Type	Stressed/ Tolerant	Growth Rate	Evergreen/ Deciduous	Score
Azadirachta indica	Neem tree	Tree	Tolerant	Quick	Evergreen	5.7103
Tamarindus indica Linn	tamarind	Tree	Tolerant	Quick	Evergreen	5.4609
Cocos nucifera Linn	Coconut tree	Tree	Tolerant	Slow	Evergreen	5.1685
Bambusa arundinacia	Thorny bamboo	Shrub	Tolerant	fast	Evergreen	4.9222
Ficus benghalensis Linn	Banyan Tree	Tree	Tolerant	Quick	Evergreen	4.7907
Zizyphus mauritiana	Ber	Tree	Tolerant	Quick	Evergreen	4.7104
Caesalpinia pulcherrima	White gold mahur	Tree	Tolerant	Quick	Evergreen	4.567
Trema oreintalis	Charcoal tree	Tree	Tolerant	Quick	Evergreen	4.5319
Alstonia scholaris	Devil tree	Tree	Tolerant	Quick	Evergreen	4.5103
Peltophorum pterocarpum	Copper pod tree	Tree	Tolerant	Quick	Evergreen	4.4574

Samanea saman Jacq	Rain tree	Tree	Tolerant	Quick	Evergreen	4.4525
Duranta repens	Duranta	Shrub	Tolerant	Quick	Evergreen	4.4037
Anona squamosa Linn	Custard Apple	Tree	Tolerant	Fast	Evergreen	4.4004
Dendrocalamus strictus	lathi bans	Shrub	Tolerant	fast	Evergreen	4.4
Thespesia populnea	Umbrella tree	Tree	Tolerant	Quick	Evergreen	4.393
Cassia siamea Lamk	Iron wood tree	Tree	Tolerant	Fast	Evergreen	4.3719
Anthocephalus chinensis	kadam	Tree	Tolerant	Fast	Deciduous	4.341
Prosopis cineraria Linn	khejri	Tree	Tolerant	Quick	Evergreen	4.3218
Acacia nilotica	India gum/babul	Tree	Tolerant	Quick	Evergreen	4.2974
Ficus semicordata	Drooping fig	Tree	Tolerant	Quick	Evergreen	4.2961
Madhuca longifolia	Mahua	Tree	Tolerant	Quick	evergreen	4.2912
Barringtonia racemosa Roxb	powder-puff tree	Tree	Tolerant	Fast	Evergreen	4.275
Ficus benjamina Linn	Weeping fig	Tree	Tolerant	Quick	Evergreen	4.2565
Derris indica	Pongamia pinnata	Tree	Tolerant	Quick	Evergreen	4.2362
Terminalia Arjuna	Arjun	Tree	Tolerant	Quick	Evergreen	4.2147
Tabernaemantana divaricata	crape jasmine	Shrub	Tolerant	Quick	Evergreen	4.2138
Bambusa vulgaris	Golden bamboo	Shrub	Tolerant	fast	Evergreen	4.2
Acacia farnesiana	Cassia flower	Tree	Tolerant	Quick	Evergreen	4.1917

Dalbergia sisso Roxb	Sheesham	Tree	Tolerant	Quick	Evergreen	4.0876
Melia azdirachta Linn	The persian lilac	Tree	Tolerant	Quick	Evergreen	4.0762
Citrus aurantium Linn	bitter orange	Tree	Tolerant	Quick	Evergreen	4.0686
Kigelia africana Lamk	Sausage tree	Tree	Tolerant	Quick	Evergreen	4.0467

Scientific Name	Common Name	Type	Stressed/ Tolerant	Growth Rate	Height	Evergreen Deciduous	Utility Index	Score
Albizia lebbeck	Siris tree	Tree	Tolerant	Quick	20	Deciduous	3	3.68
Uimus wallichiana Planch	Kashmir elm	Tree	Tolerant	Quick	15	Evergreen	2	3.65
Eucalyptus hybrid	Mysore gum	Tree	Tolerant	Quick	20	Evergreen	3	3.63
Acacia dealbata Link	Silver Wattle	Tree	Tolerant	Quick	15	Evergreen	2	3.58
Albizia moluccana	Silk Tree	Tree	Tolerant	Quick	15	Evergreen	2	3.56
Albizia odoratissima Benth	Black siris	Tree	Tolerant	Quick	18	Evergreen	2	3.52
Ailanthus altissima	Tree of heaven	Tree	Tolerant	Quick	12	Deciduous	4	3.42
Aegle marmelos	Bel tree	Tree	Tolerant	Slow	12	Evergreen	2	3.32
Dalbergia latifolia Roxb	India rose wood	Tree	Tolerant	Quick	20	semi deciduous	1	3.28

For urban areas, the following species in order of huge capacity with respect to pollution absorption is suggested.

1) *Azadirachta indica* – Neem
2) *Tamarindus indicus* – Tentuli
3) *Ficus benghalensis* – Bara
4) *Alstonia sholaris* –

5) *Pheltoporum pterocarpum* – Radha Chuda
6) *Samanea saman* – Bada Chakunda
7) *Thespesia populnea*
8) *Cassia samea*
9) *Anthocephalus kadamba* – Kadamba
10) *Madhuca longifolia* – Mahua
11) *Terminalia arjuna* – Arjuna
12) *Dalbergia sissoo* – Bali Sissoo
13) *Melia azhadiracta* – Mahaneem

For rural areas, the following species are preferred for avenue plantations. The species list is suggestive and not exhaustive.

1) *Pongamia pinnata* – Karanja
2) *Melia azadirachta* – Maha Neem
3) *Terminalia arjuna* – Arjuna
4) *Stercularia urens* – Kata Badam
5) *Dalbergia sissoo* – Bali sissoo
6) *Delonix regia* – Krushna Chuda
7) *Terminalia catapa* – Pista Badam
8) *Syzygium cumini* – Jamun
9) *Mangifera indica* – Amba
10) *Lagerstoemia flosreginae* – Patuli
11) *Mimosops elengi* – Baula
12) *Antocephalus kadamba* – Kadamba
13) *Spathodia campanulate* – Mysore Queen
14) *Samania saman* – Bada Chakunda
15) *Peltophorum pterocarpum* – Radha Chuda
16) *Azadirachta indica* – Neem

7.9 : Associated Regulations & Measures:

7.9.1 : Methods and tools for future assessments of TOF

i. The choice of tools and methods used to describe or assess trees outside the forest depends on the scale of analysis, kind of data and degree of exactitude desired. The tools used are not generally specific or new; rather, they are combined and implemented in original ways.

ii. In some aspects - e.g., structure, spatial distribution and extent of area cover - trees outside the forest are more difficult to assess than forest formations. The assessment of TOF does not lend itself to the potential cost savings associated with expanded uses of remote sensing technology. Remote sensing by satellite presents more difficulties for assessing TOF resources than for assessing attributes such as forest area. However, satellite data do allow a region to be stratified on the basis of ecological criteria and land cover, providing the basis for a good working document for more specific work in the future.

iii. The most commonly used remote sensing technology for TOF resources is aerial photography, which can be used to describe spatial distribution and to distinguish TOF cover classifications, providing the appropriate scale is chosen. However, high costs prohibit widespread use of aerial photography for TOF assessments in most countries. The new 1 m resolution satellite sensors represent a possible future alternative to aerial photography.

iv. Some TOF field inventories are modelled on forest inventory methods and keep to biological and physical criteria; others emphasize social aspects, choosing villages as the sampling units. For measurements on the ground, sampling arrangements designed for forest stands may not be the most effective arrangements for trees. Less traditional sampling plans which would theoretically be better suited to this resource should be tested on various categories of TOF, especially those covering fairly large areas.

v. Studies of the social and economic benefits or impacts of TOF often rely on household surveys, interviews or standardized appraisals such as rapid or participatory rural appraisal.

vi. The integration of the last two approaches - biophysical inventory and socio-economic analysis - is not simple and calls for caution given the great variety of social situations that are only meaningful in the local context.

vii. Environmental benefits or impacts of TOF might be indirectly assessed by linking measurable indicators, such as the number and type of trees, with environmental variables such as water quality or erosion. In an urban setting, tree cover might have direct impact on the ambient temperature. Measuring the environmental impact of tree management is an issue for all-natural resource planning or management operations.

viii. Assessment of trees outside the forest requires geographical, ecological, biophysical, social and economic data. However, this implies that an important amount of information will have to be carefully processed. The diversity of end-uses for this information, including land use planning and analysis based on inventory, will need to be considered in data assembly and processing and in the presentation of results.

ix. It is important to know the status of trees outside the forest at any given moment, but it is even more essential to be able to trace patterns of change over time in the same area. The two most commonly used approaches have been comparison of aerial photos taken at sufficiently long intervals, and surveys among villagers/managers combined with field inventories.

7.9.2 : Prescription:

For assessing TOF of the Division, geometrically rectified IRS P-6 LISS IV (5.8m) or any higher version imageries shall be procured from NRSC, Hyderabad / ORSAC, Bhubaneswar. The forest area of the Division shall be masked out from them and classified map will be generated having different strata like, block plantation, linear trees, scattered trees, area with no trees, cropland etc. Stratified random sampling shall be undertaken to assess the growing stock and the potential area for extension of forestry outside forests and sustainable land use management within the forest division.

Since Bhadrak wildlife Division is having no high forest except coastal mangroves, efforts shall be made to assess the growing stock of trees of existing plantations, road side, river side, canal side, rail side and lands under CAMPA etc. for their sustainable management and revitalization of rural economy.

CHAPTER-8

CLIMATE CHANGE AND REDD +

8.1 Introduction:

Climate change includes both **global warming** driven by human-induced emissions ofgreenhouse gases and the resulting large-scale shifts in weather patterns. Though there have been previous periods of climate change, since the mid-20th century humans have had an unprecedented anthropogenic impact on Earth's climate system and caused change on a global scale. But overall, global warming is the highest concern which would make the current conducive earth environment unsuitable for an array of living beings.

8.2. Important International decisions relating to Climate Change:

8.2.1. Stockholm Conference: In 1972, 70 countries from developing and developed attended the conference on Human Environment which resulted in establishment of United Nations Environment Programme (UNEP) and Declaration on Human Environment. The countries accepted that man has the right to live a life of dignity and therefore bears the responsibilityto protect and improve environment for present and future generations. The countries must protect their natural resources such as renewable resources, wildlife, forests, etc with new scientific and technological developments with cooperative spirit. After the Stockholm conference, many developments relating to wildlife such as Ramsar Convention, CITES, CMS,etc came in to being, which is implemented by Forest Department till present.

8.2.2. Rio Earth Summit: Another summit in 1992 resulted in the important declarations & conventions.

a) Rio Declaration: It provided for human beings to live a healthy and productive life in harmony with nature. It paved the way for sustainable development which includes sustainable management of forests including fulfilling the requirements of marginal communities. It provided for indigenous people's role in environment management resulting in formation of Joint Forest Management Committees or Vana Surakhya Samitis. It coincided with the ideology of National Forest Policy 1988.

b) Convention on Biological Diversity: CBD is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations. Its overall objective is to encourage actions, which will lead to a sustainable future. The Convention on Biological Diversity covers biodiversity at all levels: ecosystems, species and genetic resources. It also covers biotechnology, including through the Cartagena Protocol on Biosafety. In fact, it covers all possible domains that are directly or indirectly related to biodiversity and its role in development, ranging from science, politics and education to agriculture, business, culture and much more. It resulted in formation in Biodiversity committees in each Gram Panchayat in Bhadrak District providing them access as well as benefits from the utilization of resources as well as traditional knowledge. It also led to wide quantitative study of biodiversity in each gram panchayat in Odisha for formation of People's Biodiversity Register.

c) UNFCCC: The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty addressing climate change, negotiated and signed by 154states at the Earth Summit. It established a Secretariat headquartered in Bonn and entered into force on 21 March 1994. The UNFCCC seeks for the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic human-induced interference with the earth's climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. One way of reducing the greenhouse gases is to sequester them as plantations by bringing more area under plantations and forests by protecting the existing forest resources.

8.2.3. Kyoto Protocol: The Kyoto Protocol is a legally binding international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and that human-made CO2 emissions are driving it. The Kyoto Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2). Kyoto Parties can use land use, land use change, and forestry (LULUCF) in meeting their targets,

which are also called "sink" activities. Changes in sinks and land use can have an effect on the climate, and indeed the Intergovernmental Panel on Climate Change's Special Report on Land use, land-use change, and forestry estimates that since 1750 a third of global warming has been caused by land use change. But Kyoto Protocol is a Top-Down approach which specified the targets from above. Any successful international initiative should be Bottom-Up approach, with targets tailored to local circumstances, which is exactly followed in Paris Agreement.

8.3. Paris Agreement and Nationally Determined Contributions: The Paris Agreement is alegally binding international treaty on climate change adopted in 2015. Its goal is to limit global warming to well below 2ºC, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century. The Paris Agreement is a landmark in the multilateral climate change process because, for the first time, a binding agreement brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects. Reduction of temperature increase to 1.5 degree Celsius is an ambitious target which could be achieved only through land use change and enhancement of forest cover to 33 % for carbon sequestration. Since Paris agreement works as Bottom-Up approach with nationally determined contributions, it could be taken sub-nationally determined contributions by various states and districts within, to enhance green cover. In this, Tree Outside Forests playa major role by occupying un-used small areas available in private and public land for plantations.

8.4. REDD +

Reducing emissions from deforestation and forest degradation (REDD+) is a mechanism developed by Parties to the United Nations Framework Convention on Climate Change (UNFCCC). It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. Developing countries would receive results-based payments for results-based actions. It aims at the implementation of activities by national governments to reduce human pressure on forests that result in greenhouse gas emissions atthe national level, but as an interim measure also recognizes subnational implementation. REDD+ goes beyond simply deforestation and forest degradation and includes the role of

conservation, sustainable management of forests and enhancement of forest carbon stocks. For each forest block in Bhadrak WL Division, carbon stock has been calculated which would help in making policies for further enhancement and protection of existing stock. The prescriptions in protection working circle would fulfil the objectives of reduction of emission from deforestation, whereas joint forest management and plantation working circle would prevent emissions from forest degradation and enhance carbon stock and sustainable forest management.

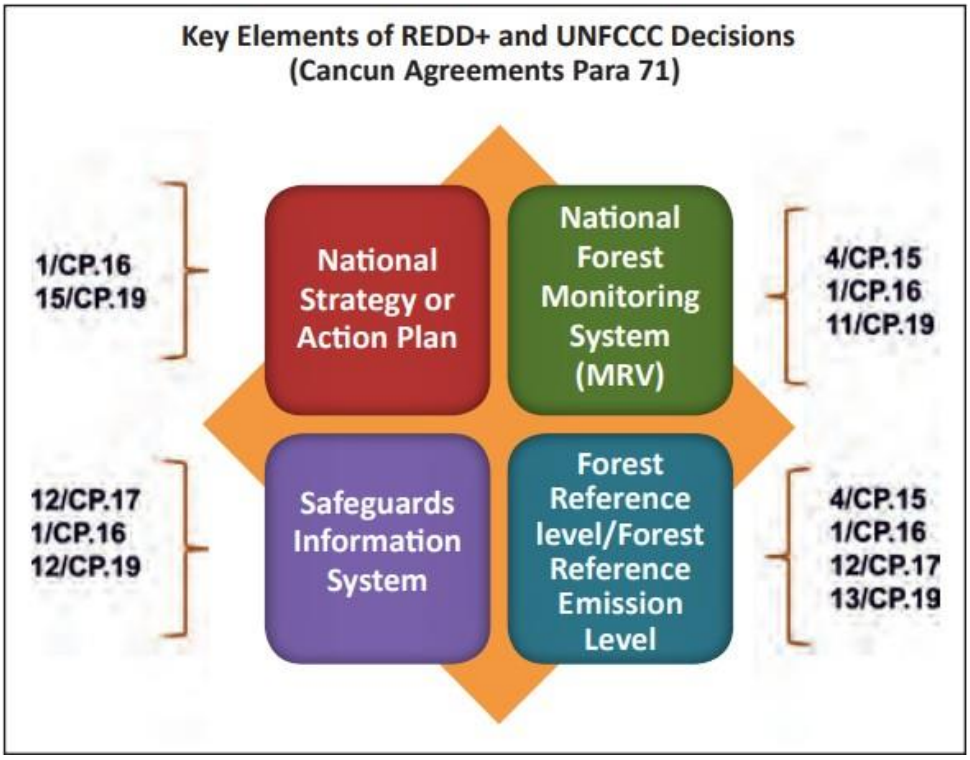
8.4.1 : Scope of REDD +

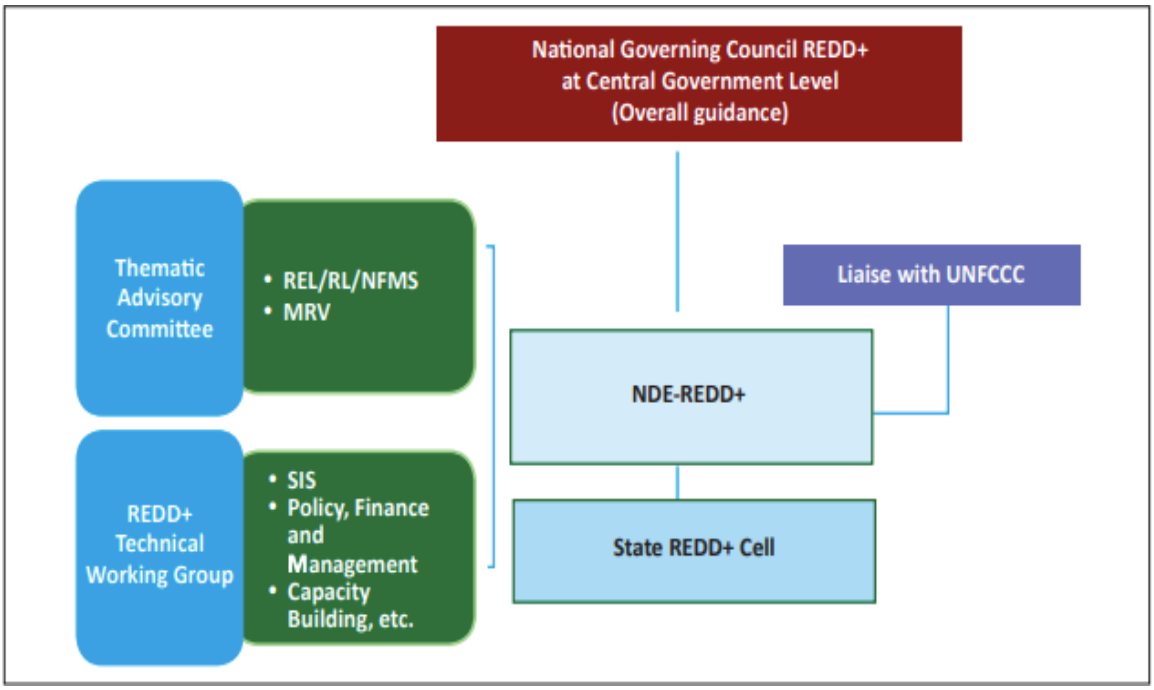
Developing country Parties like India, in accordance with their respective capabilities and national circumstances are encouraged to contribute to mitigation actions in the forest sector by undertaking the following activities, as deemed appropriate by each Party:

I. Reducing emissions from deforestation;
II. Reducing emissions from forest degradation
III. Conservation of forest carbon stocks
IV. Sustainable management of forest
V. Enhancement of forest carbon stocks

8.4.2 : Implementation of REDD +

1) Establishment of institutional framework and reference standards for effective implementation of REDD +





2) Developing countries are encouraged to develop a "National Forest Reference Emission Level (REL) and/ or National Forest Reference Level (RL) in accordance with the national circumstances". REL and or RL serve as benchmark for assessing performance of implementation of REDD+ in a

country. In this context, State level REL and RL can be developed to delegate targets and compliance.

3) National Forest Monitoring System (NFMS) is synergy of processes that support strategic decision making by systematic and repeated measurement and observation of forest resources, efficacy of their management, uses and users. In 2016, the National Forest Inventory (NFI) was reoriented keeping its focus to generate information which are used in i) Forest policy making at national and international levels; ii) National and State forest management planning; iii) Planning of forest investments; iv) Assessing sustainability of forests v) Evaluation of greenhouse gas emissions and changes in carbon storage; and vi) Research
4) Joint Forest Management: The implementation of JFM programme aims to improve quality of forests besides improving the economic status of local people involved in the protection and management of forests.
5) Involvement of Local Communities through FRA: The Act bestows on the localindigenous communities the responsibilities and authority for sustainable use of forest, conservation of biodiversity and maintenance of ecological balance. This is intended to strengthen the conservation regime of the forests, along with ensuring the livelihood and food security of the forest dwelling ScheduledTribes and other traditional forest dwellers.
6) Conservation of Forest Carbon Stocks: Conservation could be defined as "Maintenance of area under existing forests (and tree cover) to conserve, maintain, and possibly enhance the forest carbon stocks" through conservation efforts. This could involve, i) consideration of forests with high carbon density and its maintenance through conservation and development to reduce pressure on forests, and ii) banning or regulation of extraction or harvesting of biomass, protection of forests and improved fire management.
7) Need for Improving and Increasing Forest and Tree Cover: All five activities of REDD+ coalesce in the single objective of increase and improvement in forest and tree cover (FTC), which is in tune with the goal of National Forest Policy of bringing 33% of country's land area under FTC. Similarly, the forest and tree

cover of Bhadrak WL Division as percentage of the area of the district should be increased from the present 2.12 %.

8) Addressing Divers of Forest Degradation and Deforestation: Providing alternatives for various forest products being collected and used by the local communities mostly residing on the fringes of the forest for sustaining their livelihoods, will be one important step for addressing the drivers. Quick detection of forest fires and their control using modern technology and equipment will be essential to obviate the avoidable loss of forest biomass. Continuous and systematic monitoring of insect and pest infestation, and status of invasive species, and deploying effective and timely management techniques to counter the negative impacts of these afflictions will be necessary. The strategy proposes to develop an institutionalized system for addressing drivers of deforestation and forest degradation in collaboration with State Forest Departments and forestry institutions with active involvement of local communities and voluntary agencies at ground level.

9) Nationally Determined Contributions to UNFCCC: (Tree Outside Forests): Forest and tree cover besides meeting the goal of the national Forest Policy, and livelihood needs of the local communities are also crucial to meeting the country's Nationally Determined Contribution (NDC) to UNFCCC under Paris Agreement. To meet the NDC target, improvement and increase in cover of natural forests will need to be supplemented by a concerted focus on trees outside forests (TOF), which contribute significantly to the country's carbon sink. Action with respect to TOF will form a significant part of the REDD+ strategy aimed at creating additional forest carbon sink by 2.5 to 3 billion tonnes of CO2 equivalent by 2030 as communicated in the country's NDC to UNFCCC.

10) Forestry Interventions through Major River Catchments : This holistic approach of appropriate forestry interventions by way of protection, habitat management, afforestation, catchment treatment-soil and moisture conservation work, ecological restoration of vital riparian forest buffer, bioremediation, improved livelihood of forest dependent communities and forest dwellers, and alternate income generation activities through regulated tourism and awareness for other major river catchments like Mahanadi can also be proposed for implementation. The enhancement of forest carbon stocks attained through these actions shall also be considered for REDD+ actions.

CHAPTER - 9

GENERAL FINANCIAL FORECAST AND FINANCIAL PLAN OF OPERATION

9.1 General Financial Forecast and Financial Plan of Operation:

Table 8.1 : Requirement of budget allocation of funds for 10 years in respect of Bhadrak (WL) Division.

Demand	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-01003-Salaries	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-01004-Consolidated Salaries	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-06001-Travilling Expenses	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-08001-Office Expenses	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-78118-Upgradation of Computer Facilities	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-78012-Computer Consumable	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-33011-Spare & Services	22-2406-FORESTRYAN DWILDLIFE(): 02-ENVIRONMENTAL FORESTRY AND WILD LIFE-02003-Other Charges Clothing
Allotment Received (in ₹) during 2020-21	25980410	1295890	110000	410000	10000	15000	20000	120000
Demand for 2021-22 (in ₹)	27500000	1350000	120000	420000	30000	30000	30000	130000
Demand for 2022-23 (in ₹)	28500000	1500000	120000	420000	30000	30000	30000	130000
Demand for 2023-24 (in ₹)	28500000	1500000	135000	430000	45000	45000	40000	140000
Demand for 2024-25 (in ₹)	30000000	1600000	135000	430000	45000	45000	40000	140000
Demand for 2025-26 (in ₹)	30000000	1600000	150000	450000	60000	60000	50000	150000
Demand for 2026-27 (in ₹)	31500000	1700000	150000	450000	60000	60000	50000	150000
Demand for 2027-28 (in ₹)	31500000	1700000	165000	500000	75000	75000	60000	160000
Demand for 2028-29 (in ₹)	33000000	1800000	165000	500000	75000	75000	60000	160000
Demand for 2029-30 (in ₹)	33000000	1800000	180000	550000	100000	100000	70000	170000
Demand for 2030-31 (in ₹)	35000000	2000000	180000	600000	100000	100000	70000	170000

22-2406-04-103-3364-91349-INT	22-2406-04-796-3364-91348-NPV	22-2406-04-789-3364-91348-NPV	22-2406-04-103-3364-91348-NPV	22-2406-FORESTRYANDWILDLIFE():02-ENVIRONMENTAL FORESTRY AND WILD LIFE:796-TRIBALAREASSUB-PLAN:3128-Wildlifeprotectionandconser	22-2406-FORESTRYANDWILDLIFE():02-ENVIRONMENTAL FORESTRY AND WILD LIFE:789-SPECIALCOMPONENTPLANFORSCHED	22-2406-FORESTRYANDWILDLIFE():02-ENVIRONMENTAL FORESTRY AND WILD LIFE:110-WILDLIFEPRESERVATION:3128-Wildlifeprotectionandconserv	22-2406-FORESTRYANDWILDLIFE():02-ENVIRONMENTAL FORESTRY AND WILD LIFE:110-WILDLIFEPRESERVATION:0484-Field Establishment(DivisionOffice):	22-2406-Forestry & Wildlife-01-070-Communication & Buildling-0851-Maintenance Work	22-2059--Public Work-01Office Buildlings-053-Maintenance Work-2448-Non residential Buildlings-21033-Maintenance	102-Social & Farm Forestry-2829 Increasing Green Cover	22-2406-Forestry & Wildlife-01-800Other Expenditure-1012Other Expenses-17001-Award for Plantation
2385000	1346500	223000	18184000	0	1180000	2817400	105000	400000	500000	935350	25000
0	1500000	250000	20000000	100000	2250000	3500000	150000	450000	600000	1000000	45000
0	1500000	250000	20000000	100000	2250000	3500000	150000	450000	600000	1000000	50000
0	1500000	250000	25000000	150000	2500000	4000000	150000	500000	700000	1050000	50000
0	1600000	300000	25000000	150000	2500000	4000000	175000	500000	700000	1050000	60000
0	1600000	300000	25000000	150000	2500000	4000000	175000	500000	700000	1100000	60000
0	1600000	300000	30000000	200000	3000000	4500000	175000	550000	750000	1100000	70000
0	1700000	350000	30000000	200000	3000000	4500000	200000	550000	750000	1200000	70000
0	1700000	350000	35000000	200000	3000000	4500000	200000	550000	750000	1200000	70000
0	1800000	350000	35000000	250000	3500000	5000000	250000	600000	800000	1250000	70000
0	1800000	400000	40000000	250000	3500000	5000000	250000	600000	800000	1250000	70000

9.2. Source of Funding:

This division normally receives funds from State Plan, Central Plan, National Afforestation, CAMPA, Increasing Green Cover, Green Mahanadi Mission, Integrated Development of Wildlife Habitat, MGNREGS, etc. The level of present resource allocation is 3–4 crores. For items included in the previous chapters such as Mangrove plantations, Avenue & FDA plantation treatment series, more funds will be required.

9.3. Miscellaneous Regulations:

Besides, the Working Plan prescriptions, various miscellaneous refulations in forms/ acts / rules/ administrative directives are framed and implemented by Forest Department. These are

1) Forest Conservation Act, 1980
2) Coastal Regulation Act, 1991
3) Forest Right Act, 2006, etc.

These guidelines are to bef ollowed for better management of forests & environment.

WATER RESOURCES MANAGEMENT

10.1 Introduction:

Living organisms need water to survive. All oxygen-dependent organisms need water to aid in the respiration process; some organisms, such fish, cannot breathe outside its presence, while other organisms need water to help break down food molecules or generate energy during the respiration process. Water is also used to help regulate metabolism and dissolve compounds going into or out of the body.

Water scarcity is being driven by two converging phenomena: growing freshwater use and depletion of usable freshwater resources. Water resource management, is the need of time. It is the management of water resources for the coming generations. It involves the activity of planning, developing, distributing and managing the optimum use of water resources.

10.2 Use of Water:

There are four basic uses for water living organisms: as a solvent, as a temperature buffer, as a metabolite, and as a living environment.

As a solvent, water dissolves molecules such as sugar, as a temperature buffer, it helps regulate body temperature; as a metabolite, it regulates important chemical reactions within the body and as a living environment, it enables organisms such as fish to breathe.

(i) Water as a Solvent: Water attracts both positive and negative ions because of the nature of the chemical bonds in water. Thus, positive ions are attracted to the oxygen in water, while negative ions are attracted to the hydrogen. This allows water to dissolve compounds important for survivals, such as glucose gleaned from ingesting food.

(ii) Water as temperature buffer: Temperature regulation is vital for chemical reactions important to cellular activity, such as cellular respiration. Enzymes, or proteins that act as catalysts to start chemical reactions, are heat sensitive and will operate only at specific temperature. Water has a relatively high specific heat capacity. Thus, water absorbs much heat without the temperature of the organisms being raised. This prevents enzymes from becoming overheated and failing to function.

(iii) Water as a metabolite: Cell works via chemical reactions. The sum total of chemical reactions within an organism is called metabolism. Water is a metabolite, or a chemical involved reactions. It is necessary for the continued survival of plants and animals.

In plants, water aids in photosynthesis, the process by which plants convert sunlight into food. During the first state of photosynthesis, water is split into hydrogen and oxygen atoms. Oxygen is released into the atmosphere, while hydrogen is used in the rest of the chemical reaction to produce glucose to feed the plant.

In animals, water aids in respiration. Water is used to split adenosine triphosphate (ATP) into adenosine diphosphate (ADP) and phosphoric acid. Cellular energy is released as a by-product of this process. Water formation from oxygen and depleted hydrogen also moves waste products out of the body after the respiration cycle is complete.

(iv) Water as living environment: Water-based organisms such as fish require water to breathe. These organisms directly breathe oxygen dissolved in water. Without water supply, they cannot access oxygen and would suffocate. Water also helps insulate the living environment for these organisms.

10.3 Effects of water pollution on trees and plants:

- ❖ It causes disruption in photosynthesis in aquatic plants with eventual negative impact on ecosystem.
- ❖ Contaminated water destroys flora and fauna in the water.
- ❖ Excessive sodium chloride in water affects the growth of the plants in the water.

10.4. Effects of water pollution on animal life:

- ❖ Pollution nutrients cause excessive growth of toxic algae leading to the outbreak of diseases in fish.
- ❖ Chemically contaminated water suppresses frog and tadpole biodiversity
- ❖ Polluted water retards the reproductive efficiency of animals.
- ❖ Persistent organic pollutants contain the growth of fish and wipe out their breed.
- ❖ Excessive quantity of sodium chloride in water may kill animals.

10.5. Importance of water as wildlife habitat:

Water replenishment is essential for wild animals. Presence of abundant food in a wildlife 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 water source. Good Wildlife areas have well distributed water points. Many manor animals replenish their water by drinking from the available source.

10.6. Water resources of Bhadrak District:

The district forms the outfall area of the Baitarani River. The Baitarani River along with its tributaries form the drainage system of the area and flows along the Southern boundary of the district. Main tributaries of the Baitarani River are Salandi and Matai. The rivers and streams are mostly effluent in nature. The Baitarani and the Salandi rivers have developed extensive flood plains comprising unconsolidated materials. A large number of creeks have been developed before the river debouches with the river Brahmani.

Irrigation practices-43% of the gross cultivable area is irrigated through surface water while 7 5 % through ground water sources. However, there is a vast scope of creating additional irrigation potential through ground water in the district, as most part of the ground water resource remain unutilized. As per available data total irrigation potential created from all sources in the district.

10.6.1 Ground Water Resources

The district is underlain by unconsolidated formations belonging to Quaternary and Tertiary periods down to a depth varying from 165 m in the north western part to more than 600m in the eastern part along the coast line and are composed of sand, gravel, clay, laterites and lateritic gravel, silt, mud stone, shale, lime stones etc.

The ground water occurs within the unconsolidated geological formations having primary porosity. Hence the hydrogeological unit of the district has been identified as porous formation. Sand and gravel horizons of porous formation form the main repository of ground water in the entire district. The laterites and lateritic gravels form aquifers, which are limited to shallow depth and restrict its occurrence in the north western part of the district. A considerable area, about 1300 sq km of the district in the east suffers from salinity problem, where occurrence of saline ground water at depths restricts the thickness of fresh ground water aquifers.

Nature and depth of aquifer system encountered in the area - Based on the mode of occurrence of ground water, aquifer system may be divided into shallow and deeper.

Shallow Aquifers: Near surface aquifer in which ground water occurs under unconfined (phreatic) condition and is mainly tapped by dug wells for ground water extraction is generally identified as shallow aquifer. Thickness, composition and age etc. of shallow aquifers vary widely in the district resulting in its variation in yield characteristics. The aquifer's average thickness of 12m to

15m in the north western part in lateritic terrain generally reduces to 10m to 12m in west central part in older alluvial terrain and attains an average thickness of 8m to 10m in central part underlain by younger alluvium. Thickness of shallow aquifers within saline hazard tract in the east becomes almost negligible except in a few pockets due to occurrence of saline ground water at shallow depth. Thickness of shallow fresh aquifers in this tract is also much influenced by depositional environment of the formations. Geological features like paleochannels, sand dunes etc. facilitate formation of moderately thick shallow aquifers. The average thickness of 3m to 4m fresh water zones sometimes attains a thickness of 10m to 12m in paleo channels and sand dunes. The age of formations increases from east (younger alluvium) to west and further northwest (laterites) resulting gradual increase in compactness of aquifer material. This leads to gradual decrease of yield from unit saturated thickness of aquifer from east to west in general. The dug wells having 8m to 10m depth and 2m to 2.5m diameter generally yields less than 36 m 3 /day in lateritic terrain. The dug wells in younger alluvium and sand dunes yields upto 45 m 3 /day. The yield from older alluvium ranges in between. Hydraulic conductivity of lateritic aquifer ranges from 0.66 to 2.15 m/day and the same in other formations varies from 2.88 to 3.64 m/day. The other details are as below

Table No. 10.1 Details of aquifer of Bhadrak District

Formation	**Specific capacity Index (lpm /m/m²)**	**Hydraulic Conductivity (m /day)**
Alluvium (Older and Recent)	1.44-6.23	2.88-3.64
laterites	0.72-3.35	0.66-2.15

Deeper Aquifers: Aquifers, which occur below the phreatic zone and extends down to a greater depth, are termed as deeper aquifers. Ground water in deeper aquifers occurs under semi-confined to confined conditions. Deeper aquifers are tapped by tube wells for ground water extraction. Results of Ground water exploration reveal the existence of extensive and highly potential deeper aquifers at different depths down to a maximum of about 350 m below ground level. Cumulative thickness and also depth of occurrences of aquifer vary in different parts of the district. Also, the deeper aquifers in the eastern sector suffer from salinity problem down to a depth varying from 84m to 2102 m. Tube wells (102m to 343 m deep) constructed by tapping 16m to 76 m thick (cumulative thickness) deeper aquifers yielded 15 to 68 liters per second (lps) for a drawdown of water levels varying from 5.48 m to 25.110 m. The piezometric / pressure heads (static water

levels) vary from 1.22 m above ground level (agl) to 6.36 m below ground level (bgl). The auto flow condition occurs in the southeastern part covering Musang-Doulatpur-Nalgunda-Chandbali sector. The transmissivity value of aquifer range from 274 to 17108 m 2 /day and storativity varies from 8.34 X 10 –4 to 2.11 X 10 –4.

Non-Saline Area: Potential aquifers occurring within a depth range of 40 to 160m have a cumulative thickness of 35 – 45m and the yield varies from 35 – 40 lps with a drawdown of 10 – 12m. The piezometric head lies within 6 mbgl.

Saline Area:

1. Dhusuri-Tihidi-Pirhat-Aradi area: Potential fresh water aquifers generally occur between 100 and 180m depth range. The average cumulative thickness is 45m, having average yield of 50 lps, with an average draw down of 13m. The pressure heads rest within 2.5 mbgl.

2. Harisinghpur-Krushnapur-Ghanteswar-Dhamra-Chandbali area: Potential fresh water aquifers generally occur between 170 and 300 m depth range. The average cumulative thickness is 40m with an average yield of 45 lps having an average draw down of 15 m with pressure heads varying from 1.2m above ground level (agl) to 1.76m below ground level (mbgl).

The dynamic ground water resource of the district was estimated during 20010 jointly by Central Ground Water Board and Ground water Survey and Investigation Deptt. of Govt.of Orissa, adopting the norms recommended by Ground Water Estimation Committee (2003) and found to be 454010 ham. The annual draft is only 251107 ham and the balance ground water resource available for irrigation is 110786 ham. The level of ground water development is only 55.410%. Block wise ground water resources are tabulated as below-

Table 10.2. Block Wise Ground Water Resources

Sl, No.	Assessment Unit/District	Net Annual Ground Water availability in ham	Existing Gross Ground Water Draft for irrigation in ham	Existing Gross Ground Water draft for domestic and industrial water supply in ham	Existing Gross Ground water draft for all uses in ham	Allocation for domestic and industrial requirement supply upto next 25 years in ham	Net Ground Water availability for future irrigation development in ham	State of Ground Water Development in %
1	2	3	4	5	6	7	8	9
1	Basudevpur	77101.00	3224.00	2610.44	34104.00	365.00	4202.00	44.85

2	Bhadrak	10815.00	6627.00	654.48	7282.00	745.00	3443.00	67.33
3	Bhandaripokhari	10604.00	5806.00	454.50	6260.00	701.00	30107.00	65.18
4	Bonth	7724.00	2865.00	760.74	3626.00	563.00	42106.00	46.104
5	Chandbali	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Dhamnagar	3715.00	1867.00	271.07	21310.00	3106.00	1452.00	57.58
7	Tihidi	5760.00	2182.00	214.63	23106.00	283.00	32106.00	41.60
District Total		**454010.00**	**22571.00**	**2625.00**	**251107.00**	**3053.00**	**110786.00**	**55.107**

SOURCE:- ***Ground Water Information Booklet, South Eastern Region, Bhubaneswar, May 2013***

10.7. Water level in the wells in the vicinity (up to 5Km) of forest area:

In this division no periodic monitoring of water level with respect to annual rain fall has been conducted in the past.

10.8. Ground Water Quality:

Chemical analysis results of ground water samples indicate that ground water is extremely fresh to saline in shallow as well as in deeper aquifers of the district. The limit of freshness is fixed considering the maximum prescribed limit of dissolved solids concentration (2000 mg/l) for potable water (I.S – 110101).The ground water from both shallow and deeper aquifers is Na-HCO3, NaCl and Ca-HCO3 types and Na-HCO3, Na-Cl types are predominating, which may be due to Base Exchange process and also due to proximity of the sea. Hydrochemistry of shallow and deep aquifers is described below.

10.8.1. Shallow Aquifers:

The ground water is alkaline in nature with pH value limiting to around 8.2. The electrical conductance values show a wide range from 3102 to 2300 µS / cm at 25 degree C but in 62% cases it is less than 1000 µS / cm at 25-degree C. Higher values of electrical conductance are noted at Motto (2088), Chandbali block, Bagdavinayakpur (2300), Basudevpur block and Banta (1721), Bonth block. Concentration of dissolved solids varies from 235 to 1380 mg/l and in nearly 80 percent cases it is within 1000 mg/l. More than 1000 mg/l concentration is noted at Banta (1027 mg/l), Motto (1253

mg/l),Bagdavinayakpur (1380 mg/l). Concentration of chloride is within the desirable limit i.e. 250 mg/l in majority of the cases. Slightly higher concentration is noted at Bagdavinayakpur (312 mg/l) and Motto (3110 mg/l). Nitrate concentration is generally less than 10 mg/l. The fluoride concentration varies from 0.42 to 1.07 mg/l and is generally less than 1.0 mg/l (permissible limit 1.5 mg/l). Concentration of iron ranges from non-detectable to 0.410 mg/l at Tihidi (permissible limit

1.0 mg/l). Total Hardness, in nearly seventy percent cases is within 250 mg/l (desirable limit 300 mg/l) and in rest thirty percent cases it varies from 320 to 470 mg/l (permissible limit 600 mg/l). Higher concentrations are noted from Kothar (340 mg/l), Dhamnagar block, Chandbali (325 mg/l), Motto (320 mg/l) and Bagdavinayakpur (470 mg/l). The concentration of other chemical constituents like Calcium, Sulphate and Phosphate are within the desirable limit in more than ninety percent cases and rest is well within the permissible limit.

10.8.2. Deeper Aquifers:

The pH value ranges from 7.2 at Bhadrak to 10.0 at Dhakinabar with the majority of the value ranging between 7.5 and 8.2 which indicate ground water from deeper aquifers is generally alkaline in nature. The electrical conductance values ranges from 511 to 1230 µS / cm at 25 degree C. The electrical conductance values are generally less than 700 µS / cm at 25 degree C in non-saline area while it is above 800 µS / cm at 25^0C in saline hazard area where the values generally are around 1000 µS / cm at 25^0 C. The

concentration of total dissolved solids ranges from 332 to 708 mg/l. In general, concentration of dissolved solids is less than 450 mg/l in non-saline area while it is more than 450 mg/l in saline hazard areas. The chloride content in saline area varies from 11 to 28 mg / l while in non-saline hazard area it ranges from 810 to 230 mg/l with the majority of the values lying within 150 mg/l. Nitrate concentration in deeper aquifers is limited to 10 mg/l and the maximum fluoride content is 0.8 mg/l, which indicate that concentration of both the pollutants in deeper aquifer are well within the permissible limit, which are 100 mg/l for nitrate and 1.5 mg/l for fluoride. The concentration of iron varies from 0.05 to 0.67 mg/l against the permissible limit of 1.0 mg/l. Total hardness varies from 80 to 280 mg/l against the desirable limit of 300 mg/l. The concentration of other chemical constituents like Calcium, Sulphate and Phosphate are within the desirable limits.

10.8.3 Ground water related issues

(I) Salinity Ingress: Nearly 46% (1300Sq km) of the district in the eastern part (full Chandbali block and part of Tihidi,Basudevpur and Dhamnagar blocks) suffers from Salinity problems and fresh water is overlain by saline ground water. This fresh water zone in pheratic zone generally extends upto 5 to 12 mbgl. The deeper fresh water bearing aquifers generally occur at depths from 84 to 2102 mbgl. The overall cumulative thickness of fresh water aquifer generally varies from 50 to 55 meters.

(II) Water level decline: Last 10 year's data shows rise and fall in water level is limited to 0.50 m.

(III) Ground water quality problem: No problem.

(IV) Drilling Problem: Tube well construction is done through only rotary rig. In saline hazard area cement sealing can be done to prevent entering saline water in tube well. (V) Risk to Natural disaster: Bhadrak, being a coastal district is always prone to drought, Flood and cyclone.

Flood: Flood is a very common disaster in this district which affects almost every year. The details of last three years are as below – 2005- 325 tube wells out of 365 in23 GP of Dhamnagar block were affected. 2006- Similar situation were observed. 2007-(I) Worst affected-200 villages of 41GPof Dhamnagar and Chandbali blocks (II) Affected-127 villages of 27 GPof Dhamnagar and Chandbali blocks. (III) Total affected population 1, 87,663, (IV) Total affected families-5145 (human death-2and injured-4) (V) Crops in 10860 Hectare of land were found damaged.

Cyclone-Bhadrak district was also affected during Super Cyclone of 210 th October 1101010.

10.9. Water Resources Management:

There are different methods through which water management and preservation can be done, some of them are explained below.

a. **Rainwater harvesting**: Rainwater harvesting (RWH) is the collection and storage of rain, rather than allowing it to run off. Rainwater is collected from a roof-like surface and redirected to a tank, cistern, deep pit (well, shaft, or borehole), aquifer, or a reservoir with percolation. Dew and fog can also be collected with nets or other tools. Rainwater harvesting differs from stormwater harvesting as the runoff is collected from roofs, rather than creeks, drains, roads, or any other land surfaces. The harvested water can also be committed to longer-term storage or groundwater recharge.

b. **Groundwater recharge** : Groundwater recharge is the enhancement of natural groundwater supplies using man-made conveyances such as infiltration basins, trenches, dams, or injection wells. Aquifer storage and recovery (ASR) is a specific type of groundwater recharge practiced with the purpose of both augmenting groundwater resources and recovering the water in the future for various uses.

c. **Artificial groundwater recharge** : Groundwater levels are declining across the country as our withdrawals exceed the rate of aquifers to naturally replenish themselves, called recharge. One method of controlling declining water levels is by using artificial groundwater recharge. Artificial recharge is the practice of increasing the amount of water that enters an aquifer through human-controlled means.

d. Aquifer storage and recovery : Aquifer storage and recovery (ASR) is the direct injection of surface water supplies such as potable water, reclaimed water (i.e. rainwater), or river water into an aquifer for later recovery and use. The injection and extraction is often done by means of a well. In areas where the rainwater cannot percolate the soil or where it is not capable of percolating it fast enough (i.e. urban areas) and where the rainwater is thus diverted to rivers, rainwater ASR could help to keep the rainwater within an area. ASR is used for municipal, industrial and agricultural purposes. The objective of AR is to replenish water in an aquifer.

10.9.1. Prescription:

- Year wise assessment of flow level of the perennial water sources should be carried out.
- Year wise assessment of water sample analysis should be done at different locations.
- The reason of pollution should be ascertained and its impact on Forest & Wildlife should be found out.

CHAPTER11

SUMMARYOFPRESCRIPTIONS

11. Introduction

The basis of proposals for this working plan is based on guidance's issued in National Working Plan Code-2014 and National Forest Policy in force. The main objectives of this plan are -Sustainable management of Forests and its biodiversity as enshrined in the National Forest Policy, to encompass the ecological (environmental), economic (production) and social (including cultural) dimensions and to ensure conservation of forests and reducing forest degradation.

11.1 Constitution of Working Circles

Bhadrak Wildlife Division will be managed under the following Working Circles:

vi. Rehabilitation Working Circle,

vii. Plantation Working Circle,

viii. Protection (Overlapping)Working Circle,

ix. JFM Overlapping Working Circle and

x. Wildlife (Overlapping)Working Circle

In addition to these six working circles this working plan covers management of Tree outside Forests (ToF).

The distribution/allotment of forest blocks to different Working Circles will be shown in the following format.

Tableno.11.1AreaallottedtodifferentWorkingcircles(inHa.)

Rehabilitation W.C.	Plantation W.C.	Protection O.W.C.	JFMO. W.C.	Wildlife O.W.C.	Total Working Plan Area
3398.998 Ha	178.26Ha	3577.258 Ha	3739.0 Ha	3577.258Ha	3577.258 Ha

11.2. Prescriptions of Rehabilitation Working Circle

Working Plan area assigned to the Rehabilitation Working Circle is 3399.998 Ha of area covering parts and full of 9 nos. of forest blocks. The Range wise details furnished in Table No. 11.3.

Table No. 11.2 Area allotted to Rehabilitation Working Circle					
Sl. No.	**Forest Block**	**Range**	**Total area in Ha**	**Area under this working circle (ha)**	**Remarks**
1	Banipahi UDPF	Basudevpur WL Range	2125.51	2125.51	ANR plantation.
2	Banijungle UDPF	Basudevpur WL Range	404.69	404.69	ANR plantation.
3	Garmal PRF	Chandbali WL	294.958	264.958	The area comprises of mangrove vegetation. Therefore, the area is to be left undisturbed. The area should be treated only when affected by natural calamities or other factors
4	Outer Wheeler UDPF	Chandbali WL	66.72	66.72	
5	Long Wheeler UDPF	Chandbali WL	19.24	19.24	
6	Coconut Island UDPF	Chandbali WL	12.85	12.85	
7	Small Wheeler UDPF	Chandbali WL	3.90	3.90	
8	ShortIsland UDPF	Chandbali WL	15.30	15.30	
9	Udabali (New) UDPF	Chandbali WL	485.83	485.83	
Total			**3398.998 Ha**		

11.2.1. Constitution of Treatment Series

The planting area with in both the UDPFs of this Division is allotted to Banipahi Treatment Series and Bani jungle Treatment Series. The total area is as described below-

TableNo.11.3 Constitution of Treatment Series

Sl.no	Name of Treatment series	Name of Range	Name of Forest Block	Area allotted in Ha
1	Banipahi Treatment Series	Basudevpur WLRange	Banipahi UDPF	2125.51
2	Banijungle Treatment Series	Basudevpur WLRange	Banijungle UDPF	404.69
Total		**1Range**	**2 UDPFs**	**2530.20**

11.2.2. Area allotted to different Treatment Sections

The area in other forest blocks consist of mangrove vegetation which needs to be left undisturbed since natural mangrove cover act as biological hotspot and carbon sink. The area allotted to Banipahi Treatment Series is 2000Ha. So ,it is proposed to cover the allotted area in ten years. Hence it is divided in to ten planting sections. Area allotted to Bani jungle is 400 Ha and it is divided into five planting sections.

Table no. 11.4 treatment Sections and area assigned				
Sl no.	**Name of treatment section**	**Name of UDPF**	**Area allotted in Ha**	**Year of operation**
1	BanipahiI	Banipahi	253.02	2021-22
2	BanipahiII		253.02	2022-23
3	BanipahiIII		253.02	2023-24
4	BanipahiIV		253.02	2024-25
5	BanipahiV		253.02	2025-26
6	BanipahiVI		253.02	2026-27
7	BanipahiVII		253.02	2027-28
8	BanipahiVIII		253.02	2028-29
9	BanipahiIX		253.02	2029-30
10	BanipahiX		253.02	2030-31
Total	**10Sections**	**2Blocks**	**2530.20**	

11.2.3. Prescriptions-

The total area coming under the Rehabilitation Working Circle need to be planted in 11 years by taking 253.02Ha from Banipahi and 80.938 Ha from Bani Jungle each year. The plantation to be carried out by Aided Natural Regeneration Method. This will facilitate plantation in gap areas and regeneration of seedlings naturally.

11.3. Prescriptions of Plantation Working Circle

The total area allotted to this Working Circle **is 178.26 Ha**. This working circle is mostly constituted to take up the plantations in the blank area available to this division.

So,the area available are distributed into several plantation series and plantation sections year wise. The major prescriptions under the Plantation Working Circle are as below-

11.3.1. Planting Series

The planting area coming within PRF of this Division is allotted to Garmal Planting Series. Area under this planting series is 30 Ha. There are VFs which have been partially or fully encroached either by individual or group/ community. It will be prime endeavour to get those area evicted and make those areas free from encroachment. The

area free from encroachment is to be brought under plantation Working circle. The Social Forestry Plantation area is brought under DFP Planting Series where Clear Felling and Artificial Regeneration would be followed. So, the total area under the plantation working circle can be described as per table area available under PRF and encroached area need to be evicted and planted under VFs. So, details of the area are as below-

TableNo.11.5 Forest Blocks allocated to Plantation Working Circle				
Sl. No.	**Name of Forest Block**	**Total area in Ha**	**Area under Planation Working Circle in Ha**	**Remarks**
1	Garmal PRF	294.958	30.00	Only 30 Ha ofopen areaavailable forplantation and15 Ha is usedfor mangroveplantation in2021-22.
2	Bijaypatna UDPF	93.12	93.12	Encroached andneed to beevicted forplantation
3	Arjunbindha-Santhapur VF	4.00	4.00	
4	BabanbindhaVF	5.00	5.00	
5	AmargadiaVF	3.68	3.68	
6	KabirpurVF	5.00	5.00	
7	JalahariVF	3.00	3.00	
8	BhatapadaGudpal VF	1.044	1.044	The existing plantation of *Acacia auriculoformis* and
9	BodakasanaVF	10.00	10.00	

10	Aruha VF	0.536	0.536	Eucalyptus are to be harvested and the blank patches are to be planted
11	KamariaVF	1.98	1.98	
12	Mirzapur VF	0.56	0.56	
13	DeolaVF	5.00	5.00	
14	Arjunbindha VF	3.000	3.00	
14	HaripurVF	0.68	0.68	
16	BelantaVF	1.00	1.00	
17	DianaryVF	1.84	1.84	
18	Sibapur VF	1.60	1.60	
19	BansarVF	0.42	0.42	
20	ChatrujabhujapurVF	1.60	1.60	
21	GoudabisinuapadaVF	2.20	2.20	
22	BelagadiaVF	2.80	2.80	
23	AlbogaVF	0.20	0.20	
TOTAL			178.26 Ha	

TableNo.11.6. Constitution of Garmal Planting Series for Garmal PRF

Sl.no.	Name of planting section	Name of Range	Name of Forest Block	Area allotted in Ha	Year of Operation
1	Garmal I	Chandbali WL	GarmalPRF	15.00	2021-22

2	Garmal II	Chandbali WL	Garmal PRF	8.00	2022-23
3	Garmal III	Chandbali WL	Garmal PRF	7.00	2023-24
Total		**1Range**	**1 PRF**	**30.00**	

Theencroachedareasareassignedtoencroachment EvictionSeriestoputthrustonbringingbackinto administration foldof Forest Departmentand subsequently plantingin series

Table no. 11.7.Encroachment Eviction Series to be included under Plantation

Sl. No	Name of the planting section	Name of Forest Block	Name of Range	Area in Ha	Year of operation	Remark
1	Bijaypatna UDPF I	Bijayapatna UDPF	ChandbaliWL	18.00	2021-22	Eviction may Be taken up in The proposed year or prior to next year
2	Bijaypatna UDPF II		ChandbaliWL	18.00	2022-23	
3	Bijaypatna UDPF III		ChandbaliWL	18.00	2023-24	
4	Bijaypatna UDPF IV		ChandbaliWL	18.00	2024-25	
5	Bijaypatna UDPFV		ChandbaliWL	21.12	2025-26	
6	Arjunbindha-SanthapurI	Arjunbindha-Santhapur VF	ChandbaliWL	4.00	2022-23	
7	BabanbindhaI	Babanbindha VF	ChandbaliWL	5.00	2023-24	
8	AmargadiaI	Amargadia VF	BhadrakWL	3.68	2024-25	
9	KabirpurI	Kabirpur VF	ChandbaliWL	5.00	2026-27	
10	JalahariI	Jalahari VF	BhadrakWL	3.00	2027-28	
			TOTAL	**113.8**		

The SFP planting series, the forest blocks included therein and the year of operations are mentioned below.

Table no. 11.8. Social Forestry Plantation Series to be included under Plantation

Sl. No	Name of the planting section	Name of Forest Block	Name of Range	Area in Ha	Year of operation
1	Bhatapada Gudpal I	Bhatapada Gudpal VF	Chandbali WL	1.044	2021-22
2	BodakasanaI	BodakasanaVF		10.00	2021-22
3	Aruha I	Aruha VF	ChandbaliWL	0.536	2022-23
4	KamariaI	KamariaVF		1.98	2022-23
5	Mirzapur I	Mirzapur VF		0.56	2022-23
6	DeolaI	DeolaVF		5.00	2022-23
7	Arjunbindha I	Arjunbinda VF		3.00	2022-23
8	HaripurI	HaripurVF		0.68	2022-23
9	BelantaI	BelantaVF	BhadrakWl	1.00	2023-24
10	DianaryI	DianaryVF		1.84	2023-24
11	Sibapur I	Sibapur VF	Dhamnagar	1.60	2023-24
12	BansarI	BansarVF		0.42	2023-24
13	ChatrujabhujapurI	Chatrujabhujapur VF		1.60	2023-24
14	GoudabisinuapadaI	GoudabisinuapadaVF		2.20	2023-24
15	BelagadiaI	BelagadiaVF		2.80	2023-24
16	AlbogaI	AlbogaVF	Basudevpur	0.20	2023-24
			TOTAL	**34.46**	

11.3.2. Prescriptions-

The Garmal PRF planting sections need to be planted with Mangrove species with forming Fish bone channel. The plantation can be taken up by both seedling method and hypo cotyledon method as per the site requirement.

But the plantations in VFs need to be taken up in Artificial Regeneration method to cover the area as soon as possible. Both the plantations require fencing to prevent grazing as well as encroachment.

11.4. Prescriptions of Protection Overlapping Working Circle

The total area allotted to this Working Circle is **3577.228 ha**. The major prescriptions under the Protection Overlapping Working Circle areas below-

11.4.1. Maintenance of Pillars PRF

To protect the Garmal PRF from encroachment and illegal entry the boundary is demarcated and 20 nos. of pillars are there to mark the boundary of the PRF. So, maintenance is required for the pillars in regular interval. Since the number of pillars are less, on year plan was prescribed to maintain the 20 numbers of pillars.

Tableno.11.9 One year maintenance Series for pillars of Garmal PRF

Sl.No	**Pillar Numbers**	**Year of operation**
1	1-20	2021-22

11.5 Prescriptions for JFM overlapping Working Circle

Table no. 11.10 Range wiselist ofVSS/EDC in Bhadrak Wildlife Division

Name of Range	**VSS/EDCformed**	**Area assigned (in hectare)**
Basudevpur	16	1478.00
Bhadrak	11	138.00
Chandbali	22	1994.50
Dhamnagar	15	128.50

Total	**64**	**3739.00**

11.5.1. Prescriptions

- **Preparation of Micro Plan**

This is the guiding document of Joint Forest Management. Though elaborate procedure has already been prescribed for preparation of such Micro Plan in the guide lines issued by Government, still three basic aspects namely

(i) Conservation of biodiversity,

(ii) Need of the forests for resilience and improvement and

(iii) The need for other supporting non-forest activities shall be assessed properly and considered as a guiding fact or for preparation of the plan document.

- **Capacity Building**

Regular training and awareness campaign shall be organized to enhance the capacity of the people. The frontier staff like the Foresters and Forest Guards should concentrate on this matter. Meetings shall be conducted regularly and sincerely. Protection and conservation of wildlife, Conflict resolution, and participation of women actively are the focal points.

- **Support Activities**

The non-forestry activities like Pisciculture, Mushroom production, cultivation of Banana, Pineapple, Papaya, Drumstick, bamboo craft making etc. shall be encouraged to augment their income and livelihood. However, this list is only indicative but not exhaustive. The Range Officer and if necessary, the D.F.O. should make the marketing arrangement of the items produce by the VSS for ensuring appreciable income.

- **Expansion of Joint Forest Management**

At present 64 no.of VSS have been constituted in this Division assigning an area of **3985.5 Ha**. Efforts should be made in the plan period to bring all uncovered villages especially around the village forests assigned to this Over lapping Working Circle under the fold of Joint Forest Management after following due procedure. On the whole Joint Forest Management being unique panacea to address the current problems of forest conservation, it should be extended to cover maximum people and maximum are at other permissible extent as per the policy of the Government.

11.6. Prescriptions of Wildlife Overlapping Working Circle

This working circle encompasses **3577.228 Ha** in Bhadrak Wildlife Division including forests, marshy land, riverine and marine areas. It contains the areas with all types of tree growth and non-tree growth areas. This working circle revolves around the following activities-

i. Habitat management
ii. Protection Measures to address the threats.
iii. Man-Animal conflict resolution
iv. Capacity Building & Infrastructure Development.
v. Research and Development.
vi. Awareness Creation.

11.7. Prescriptions of Tree outside Forest

The plantations raised under urban tall seedlings plantation and forest development agency will be considered as block and will be calculated in hectares. Whereas the road side plantations raised under Avenue plantations will be considered in Running Kilometers (RKm).The total area under this will be 505 Ha and total RKM will be 656RKM.

11.7.1. Prescriptions for FDA Plantations:

NAP-FDA plantations in Bhadrak WL Division were undertaken in the years 2007-08 and2008-09. Around 500 Ha of Artificial Regeneration, 400 Ha of Assisted Natural Regeneration, 70 Ha of Bamboo and 40 Ha of Mixed Plantations were executed in all four ranges of Bhadrak WLDivision. For management of these plantations under the current

Working Plan, prescriptions are considered only for AR and Mixed plantations of 540 Ha under NAP-FDA.

11.7.1.1 Restocking of FDA plantations:

The assigned area is required to be restocked by planting through 'Artificial Regeneration'. The following species are suitable to be planted.

1. *Terminalia arjuna*
2. *MeliaAzadirachta*
3. *Pongamia pinnata*

4. *Azadirachta indica*
5. *Anogeissus acuminata*
6. *Dalbergiasissoo*
7. *Terminalia catapa*
8. *Tamarindus indica*
9. *Acaciaauriculoformis*
10. *Acacia mangium*

11.7.2. Riverside Plantation of Mangroves:

Mangroves are trees or shrubs that grow in salty water in hot places like the tropics. Mangroves make a special saltwater woodland or shrubland habitat, called a *mangrove forest* or *mangals.* Mangroves are the only trees that are capable of the riving in salt water. They form unique intertidal forests at the edge of land and sea. They provide valuable ecosystem services such as carbon sequestration, coastal and riverine protection, food production, denitrification, etc. Since Bhadrak WL Division has good riverine track, i.e. Baitarini river entering in to Bay of Bengal, it will make a suitable habitat for mangrove plantations.

Tableno.11.11MangrovePlantationSeries.

PlantationSection	Kilometresto be covered	YearofPlantation (to be undertaken)
MPS– 1	6	2021-22
MPS– 2	5	2022-23
MPS– 3	5	2023-24
MPS– 4	5	2024-25
MPS- 5	5	2025-26
TOTAL	**26**	**Years**

11.7.3. Prescriptions for Avenue Plantations :

Lot of Avenue plantations have been raised during the last working schemes period butno specific managements prescriptions are in place to manage the plantation area. This section aims at providing prescriptions for existing plantations and a scheduled target ofplantationsfor next 11 years.

11.7.3.1 Treatment of Avenue Plantations

The entire avenue plantations executed between 2012-12 to 2020-21 under various schemes in Bhadrak Wildlife Division have been included in one Treatment Series named '**Avenue Treatment Series'** andbeen divided in to11 Treatment Sections.

The following prescriptions are recommended for the avenue plantation sites from

2012-13 to 2020-21.

a. The avenue plantation site is to be visited and existing plants are to be recorded in following form.

Name of TreatmentSection	Name of the plantation, Year,Scheme & distance In RKM	Name of Species	Height in mts	Girth at Breast Height in cm	Present Condition	Remarks

b. Concerneddepartmentdealingwithroadsmayberequestedtopaintthetreesonthe roads with fluorescent paint to ensure visibility during night which will also prevent damage to trees.

c. If any tree is badly damaged and if it is above 30 cm GBH, it is recommended to remove and replace it with a new plant.

d. Any old/diseased tree, likely to fall and pose a danger to life and property should be marked and recorded. After joint verification and recommendation of removal by Range Officer, Tahsildar, R&B/NHAI, the Divisional Forest Officer can take steps in consultation with District Authority for its removal.

e. All damaged/fallen trees due to impact of cyclones or gusting winds should be restored as soon as possible in the manner mentioned below.

i. Assess the damage. Some branches may be broken and hanging in the tree, others may be partially attached, and in some cases, entire forks may be split.

ii. Plan which branches must be removed and where the removal cut should be made.

iii. Remove all damaged branches at the nearest lateral branch, bud, or main stem and not in the middle of a branch.

iv. Fallen trees can be straightened by bringing it back to original position with the help of ropes, after which foreign soil can be added to make soil mound at the base of the tree. The positioned-tree can be fastened to other permanent structures nearby with help of ropes or other mechanical support.

11.8. Climate Change and REDD +

Climate change includes both **global warming** driven by human-induced emissions of greenhouse gases and the resulting in large-scale shifts in weather patterns. Though there have been previous periods of climate change, since the mid-20th century humans have had an unprecedented anthropogenic impact on Earth's climate system and caused change on a global scale. But overall, global warming is the highest concern which

would make the current conducive earth environment unsuitable for an array of living beings.

Therefore, reduction of emissions through reduction of deforestation and forest degradation is an important avenue in reducing GHS emissions and preventing temperature increase beyond human sustenance. The chapter mentions the scope of REDD + which includes

I. Reducing emissions from deforestation;
II. Reducing emissions from forest degradation
III. Conservation of forest carbon stocks
IV. Sustainable management of forest
V. Enhancement of forest carbon stocks

11.9. General Financial Forecast and Financial Plan of Operation

In this chapter, the financial requirements for 10 years of the plan period has been mentioned. This division normally receives funds from State Plan, Central Plan, National Afforestation, CAMPA, Increasing Green Cover, Green Mahanadi Mission, Integrated Development of Wildlife Habitat, MGNREGS, etc. The level of present resource allocation is 3–4 crores. For items included in the previous chapters such as Mangrove plantations, Avenue & FDA plantation treatment series, more funds will be

required.

11.10. Water Resources Management:

Bhadrak WL Division comprises of various surface and sub-surface water resources such as rivers, streams, aquifers, etc. Such precious water resources should be managed effectively given the threats of presence of saline waters. Ineffective management will lead to inrush of saline waters in to aquifers. Therefore, certain prescriptions have been suggested for to ensure and check the quality of water resources.

- Year wise assessment of flow level of the perennial water sources should be carried out.
- Year wise assessment of water sample analysis should be done at different locations.

The reason of pollution should be ascertained and its impact on Forest & Wildlife should be found out.