WORKING PLAN

PURI (WILDLIFE) DIVISION.

For the Period 2021 to 2031.

By

Sri Harsha Bardhan Udgata, OFS-A (SB).

Divisional Forest Officer, Puri (Wildlife) Division, Puri.

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AUTHORS' PREFACE

The present Puri Wildlife Division was a part of erstwhile Puri Division with head quarter at Khordha before 2003. The forest area were managed as per the working Plan prepared by Sri Abhiram Das, IFS for the period 2007-08 to 2016-2017. The present plan prepared for the period 2021 to 2031 is prepared for the division with augmentation of some inputs of expired plan. Modern techniques, Satellite imagery interpretation, GIS facilities of Forest Head quarters & improved equipments have been utilised for the collection of Primary data, its computations, preparation of different types of maps with the support of many individuals, organisations directly or indirectly

It is a great privilege and opportunity on my part to write the first working plan of Puri Wildlife Division after its creation since 2003 basing on the National Working Plan Code 2014.The ORSAC and the NRSA, Hyderabad have played a crucial & vital role using the Remote sensing techniques for selecting sample points, collections of primary data from sample points and its analysis for calculating the growing stock and preparation of Maps. Due to their extensive help and co-operation, it could be possible to write the plan within a small span of time.

I extend my heartfelt thanks to my predecessor Sri Chittaranjan Mishra,IFS, who had drafted the PWPR. I am indebted to Mrs Pusa Zhule Mekro, IFS, Ex-RCCF, Bhubaneswar who had taken a lot of pain in giving proper shape to the PWPR.

I am very much thankful to Sri Sandeep Tripathy, IFS, Principal Chief Conservator of Forests& HoFF, Odisha, Sri AK Jayswal, IFS CCF (P&SM) for their inspiration and valuable guidance from time to time in drafting the working plan.

My sincere thanks to Sri Hari Sankar Upadhya, IFS, Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden, Odisha who has shared his valuable knowledge in the back drop of Wildlife Management to make the plan most subjective and thematic with lots of field inputs.

Credit must go to Sri Bhimasen Maharana; Rtd. DFO of this Department for sharing his vast knowledge in preparation of working plan.His effort is extremely commendable.

Sri Dibakar Mishra, IFS, RCCF Bhubaneswar circle has scrutinised the Part-I , Part-II, of the prepared working plan meticulously and has added his pragmatic views and knowledge of

long working in the field to make it more informative & go a long way in achieving the objectives of this plan.

I am thankful to DFO (T) Khordha for his support and Co- operation for providing information for preparation of this plan.

I am thankful to Heads of different line Departments of the District like Agriculture and Drainage Division. I extend my sincere thanks to Director, Meteorology Department for providing up-to- date primary Data required for preparation of this plan.

I am thankful to all Range Officers, Foresters, Forest Guards, ministerial staffs and Data Entry Operators of this Division for their Valuable assistance for bringing out this plan to lime light.

Sri Prasanta Kumar Swain, OFS-A (JB), Asst. Conservator of Forests (Admin) of this Division deserves all praise and commendation who has worked as an architect of this plan in timely collecting Data from field, different organisation, compiling voluminous Data, analysing the Data, writing the chapters by utilising his vast experience of working in the field in the back drop of National Working Plan Code 2014.

I hope, this Plan will lead to a sustainable management of Forest and act in direction of checking the global Climate Change being faced. It will provide vital guidance to field staffs, managers, planners, readers, Research scholars working in the field of Forestry & wildlife.

At the end, once again I extend my heartfelt thanks and appreciation to all for their cooperation.

Harsha Bardhan Udgata, OFS-A(SB)

Divisional Forest Officer.

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I. Abbreviations used

AJY	Aama Jungal Yojana
ALP	Alarnath Planting series
ANR	Aided Natural Regeneration
AR	Artificial Regeneration
CCF (P&SM)	Chief Conservator of Forests (Protection & Sustainable Forest Management)
CCF (T & D).	Chief Conservator of Forests (Training & Development)
CD Block	Community Development Block
COP	Conference of the Parties
C-PKDA	CAMPA -PKDA series
DLC	District Level Committee
EDC	Eco Development Committee
EPA	Entry Point Activities
ERS	Encroachment Removal Series
FAO	Food and Agriculture Organization
FDA	Forest Development Agency
FRH	Forest Rest House
GBH	Girth at Brest Height
GCF	Green Climate Fund
HoFF	Head of Forest Force
IGA	Income Generation Activities
JB	Junior Branch
KARS	Konark- Astaranga Rehabilitation Series
KPS	Kushabhadra Planting Series
MDF	Medium Dense Forest
MFS	Muhanmuha Felling Series
MGNREGA	Mahatma Gandhi National Rural Employment Guaranty Act
MRC	Mangrove Retreat Centre
NAP	National Afforestation Program
NDCs	Nationally Determined Contributions
NGO	Non Government Organization
NRSC	National Remote Sensing Centre
NTFP	Non Timber Forest Produce
OFDC Ltd	Odisha Forest Development Corporation Limited
OFS	Odisha Forest Service
ORSAC	Odisha Space Application Centre.
PCCF & HoFF	Principal Chief Conservator of Forests & Head of Forest Force
PKDA	Puri -Konark Development Authority

PRF	Proposed Reserved Forest
PWPR	Preliminary Working Plan Report
RCC	Reinforced Cement Concrete
RCCF	Regional Chief Conservator of Forests
REDD^{+}	Reduce Emissions from Deforestation and forest Degradation
RF	Reserved Forest
RKM	Row Kilometer
SB	Senior Branch
SFS	Sahana Felling Series
SSO	Simultaneous Silvicultural Operations
TMPS	Tavagolara- Manikapatna Planting series
TOF	Tree outside the Forest
TS	Treatment Section
UNFCCC	United Nations Framework Convention on Climate Change
VDF	Very Dense Forest
VF	Village Forest
VFC	Village Forest Committee
VFDF	Village Forest Development Fund
VSS	Vana Surakshya Samiti
WC	Working Circle
WL	Wildlife
WL Range	Wildlife Range

II. List of Flora:

Sl No	Local Name.	Botanical Name	Sl No	Local Name.	Botanical Name
Trees					
1	Acacia / Sunajhari	*Acacia auriculiformis*	34	Kasi	*Bridelia retusa*
2	Amba	*Mangifera indica L.*	35	Kendu	*Diospyros malabarica*
3	American Simili	*Ceiba pentadra*	36	Kendu	*Diospyros variegate*
4	Amla	*Phyllanthus emblica L.*	37	Khajuri	*Phoenix sylvestris*
5	Ankula	*Alangium salvifolium*	38	Kukuma	*Mallotus philippensis*
6	Arjuna	*Terminalia arjuna*	39	Kukurdanti	*Garuga pinnata*
7	Ata	*Annona squamosa L.*	40	Kumbhi	*Careya arborea*
8	Babool	*Acacia nilotica (L.) Delile*	41	Kuruma	*Haldina cordifolia*
9	Bahada	*Terminalia bellirica*	42	Kusuma	*Schleichera oleosa*
10	Bara	*Ficus benghalensis L.*	43	Kutaja	*Holarrhena pubescens*
11	Barakoli	*Ziziphus jujuba*	44	Mahala	*Ailanthus variegate*
12	Baula	*Mimusops elengii*	45	Mahanimba	*Melia azedarach*
13	Bela	*Aegle marmelos*	46	Mankada kendu	*Diospyros excelsa*
14	Bhalia	*Semecarpus anacardium*	47	Muchukunda	*Pterosprmum acerifolium*
15	Champa	*Michelia champaca L*	48	Naharakoli	*Antidesma acidum*
16	Chatiana	*Alstonia scholaris*	49	Nadia	*Cocus nucifera*
17	Debadaru	*Polyalthia longifolia*	50	Nima	*Azadirachta indica*
18	Desi badam	*Terminalia catappa*	51	Osta	*Ficus religiosa.*
19	Dhau	*Anogeissus latifolia*	52	Ou	*Dillenia indica*
20	Dimiri	*Ficus hispida L.f.*	53	Paladhua	*Erythrina variegate*
21	Eucalyptus	*Eucalyptus citridora*	54	Panas	*Artocarpus heterophylla*
22	Gohira	*Acacia leucophala*	55	Polanga	*Callophylum inophylum*
23	Gambhari	*Gmelina arborea*	56	Saguan	*Tectona grandis*
24	Gangasiuli	*Nyctanthes arbor-tristis.*	57	Sal	*Shorea robusta*
25	Genduli	*Sterculia urens*	58	Sana chakunda	*Cassia siamia*
26	Ghurudu	*Gardenia gummifera*	59	Siali	*Bauhinia variegate .*
27	Harida	*Terminalia chebula*	60	Sidha	*Lagerstroemia parviflora*
28	Jamun	*Syzygium cumini*	61	Simili	*Bombax ceiba .*
29	Kadamba	*Anthocephalus kadamba*	62	Sirisa	*Albizia procera*
30	Kaitha	*Limonia acidissima*	63	Sisoo	*Dalbergia lanceolaria*
31	Kaju	*Anacardium occidentale*	64	Sunari	*Cassia fistula*
32	Kanchana	*Bauhinia racemosa Lam.*	65	Tala	*Borassus flabellifer*
33	Karanja	*Pongamia pinnata*	66	Tentuli	*Tamarindus indica*
Shrubs					
67	Ammari	*Ipomoea carnea*	73	Dhataki	*Woodfordia fruticosa*

68	Arakha	*Calotropis gigantea*	74	Dudura	*Datura metel*
69	Barkoli	*Ziziphus zuzuba*	75	Gaba	*Ricinus communis*
70	Basanga	*Justicia adhatoda*	76	Jajanga	*Phyllanthus reticulatus*
71	Begunia	*Vitex nigundo*	77	Kaniar	*Nerium oleander*
72	Chauli	*Glycosmis arborea*	78	Khajuri	*Phoenix acaulis*
79	Kukurdanti	*Pavetta tomentosa*	86	Nagaphani	*Opuntia stricta*
80	Mandara	*Hibiscus rosa-sinensis*	87	Nagari	*Clerodendrum viscosum*
81	Manjuati	*Lawsonia inermis*	88	Nalibaigaba	*Jatropha gossypifolia*
82	Masaparni	*Desmodium pulchellum*	89	Ranikathi	*Flemingia chappar*
83	Modimodica	*Helicteres isora*	90	Salaprni	*Desmodium gangeticum*
84	Murga	*Agave Americana*	91	Samarkana	*Clerodendrum serratum*
85	Nagairi	*Lantana camara*	92	Trikon siju	*Euphorbia neriifolia*
Herbs					
93	Agara	*Andrographis paniculata*	119	Guguchia	*Centella asiatica*
94	Ambiliti	*Oxalis corniculata*	120	Indramaris	*Acalypha indica*
95	Ankaranti	*Solanum virginianum*	121	Iswarajata	*Eragrostis ciliaris*
96	Apamaranga	*Achyranthes aspera*	122	Jadumari	*Boerhavia diffusa*
97	Badi anala	*Phyllanthus amarus*	123	Jyotismati	*Eusteralis stellata*
98	Badi anala (shree amla)	*Phyllanthus urinaria L.*	124	Kanasiri	*Colocasia esculenta*
99	Badi anala	*Phyllanthus virgatus*	125	Kanta leutia	*Amaranthus viridis*
100	Badi justimadhu	*Scoparia dulcis*	126	Keu	*Commelina benghalensis*
101	Bajramuli	*Sida acuta Burm.*	127	Kolthia	*Macrotyloma uniflorum*
102	Bana sorish	*Chrysopogon aciculatus*	128	Koilekha	*Glinus oppositifolius*
103	Banaada	*Zingiber sp.*	129	Krushanaprani	*Uraria lagopodiodes*
104	Banabhendi	*Abelmoschus manihot*	130	Lajakuli	*Mimosa pudica*
105	Banasaru	*Cleome viscosa*	131	Madarnga saga	*Alternanthera sessilis*
106	Banatulasi	*Ocimum americanum*	132	Mayurchulia	*Eclipta prostrate*
107	Bhrungaraja	*Eriocaulon ritchieanum*	133	Mutha	*Curcuma pseudomontana Graham*
108	Bhuin Kadamba	*Sphaerathus indicus*	134	Patalagaruda	*Rauvolfia tetraphylla*
109	Bhuin sadabihari	*Cassia occidentalis*	135	Pitasaga	*Evolvulus nummularius*
110	Bichamalia	*Evolvulus alsinoides*	136	Pokasungha	*Ageratum conyzoides*
111	Bilwakesar	*Cyperus rotundus*	137	Puruni	*Barleria cristata*
112	Bisalyakarani	*Tridax procumbens.*	138	Rasna	*Vanda tessellata*
113	Brhmanajhati a	*Sida cordata*	139	Sankhasaga	*Rungia pectinata*
114	Daskerenda	*Argemone mexicana*	140	Soap nut	*Acacia sinuate*
115	Gayasa	*Leucas aspera*	141	Sree tulasi	*Ocimum canum Sims*

116	Gharapudia	*Oldenlandia corymbosa*	142	Talamuli	*Crotalaria albida*
117	Ghasa	*Elephantopus scaber*	143	Thalakudi	*Catharanthus pusillus*
118	Ghasa	*Eleusine indica*	144	Torania	*Aerva lanata*
Climbers					
144	Akanabindhi	*Cissampelos pareira .*	153	Gajapippali	*Scindapsus officinalis*
145	Anantamool	*Hemidesmus inducus*	154	Gila	*Caesalpinia bonduc (L.) Roxb.*
146	Anantamool	*Tylophora indica*	155	Gopakanhu	*Cryptolepis buchananii*
147	Aparajita	*Clitoria ternatea*	156	Guluchi	*Tinospora cordifolia*
148	Baidonka	*Mucuna puriens*	157	Hadajoda	*Cissus quadrangularis.*
149	Banakolatha	*Atylosia scrabaeoides*	158	Kaincha	*Abrus precatorius*
150	Banamalli	*Jasminum arborescens*	159	Kantatabausa	*Bambusa aurindinasia*
151	Bichhuati	*Tragia involucrate.*	160	Lata palas	*Butea parviflora*
152	Donkari	*Clerodendrum phlomidis*	161	Male bamboo	*Dendrocalamus strictus*
162	Muturi	*Smilax zeylanica.*	168	Pita alu	*Dioscorea wallichii*
163	Nirmuli	*Cuscuta reflexa*	169	Pitatarada	*Luffa acutangula*
164	Panairi	*Aristolochia indica*	170	Satabari	*Asparagus racemosus*
165	Pingu	*Celastrus paniculata*	171	Siali	*Bauhinia vahlii*
166	Pita alu	*Dioscorea bulbifera*	172	Uturuli	*Pergularia daemia*
167	Pita alu	*Dioscorea pentaphylla*			
Creepers.					
173	Kanshari nata	Ipomoea bilaba	179	Pipula	
Grasses				180	Gutukanka
174	Bena	Vetiveria zizaniodes	181	Kanishri	
175	Beruhan		182	Nali Grass	*Phragmiteskarka*
176	Juna		183	Paniakhia Khala	
177	Jola				
178	Duba	*Cynodon dactylon*			
Mangrove species					
184	Rai	*Rhizophorastylosa*	189	Guan	*Cynometrairipa*
185	Bani	Avicennia alba	190	Sindukula	*Heteropogon contrortus*
186	Keruan	Sonnertia apetala	191	Har kanchi	*Dilivaria ilicifolia*
187	Teluguni/kharsi	Aegiceras majus	192	Garani	*Ceriopsdecandra*
188	Luni Jhudanga		193	Habali	*Dolichandronespathacea*

III. List of Fauna:

Sl No	Local Name. / English name	Scientific Name	Schedule (As in WPA,1972)	Sl No	Local Name. / English name	Scientific Name	Schedule (As in WPA,1972)
Mammals.							
1	Hyena	*Hyaena hyaena*	Sch.III	12	Ratel/Honey Badger	*Mellivora capensis*	Sch I
2	Spotted Deer	*Axis axis*	Sch.III	13	Small Indian Civet	*Viverricula indica*	Sch II
3	Jackal	*Canis aureus*	Sch.II	14	Common palm Civet	*Paradoxurus hermaphrodites*	Sch II
4	Porcupine	*Hystrix indica*	Sch. IV	15	Indian Wild Pig	*Sus scrofa*	Sch III
5	Fishing Cat	*Prionailurus viverrinus*	Sch. I	16	Pati Mankada	*Rhesus Macaque*	Sch II
6	Jungle Cat	*Felis chaus*	Sch.II	17	Large Bandicoot Rat	*Bandicota indica*	Sch V
7	Small Indian Mongoose	*Herpestes javanicus*	Sch. II	18	Three striped Palm Squirrel	*Funambulus palmarum*	Unlisted
8	Hare	*Lepus nigricollis*	Sch. IV	19	Fruit Bat	*Pteropus giganteus*	Sch V
9	Common Langur	*Semnopithecus entellu*	Sch. II	20	Black Bearded Tomb Bat	*Taphozous melanopogon*	Not listed
10	Smooth Coated Otter	*Lutrogale perspicillata*	Sch. II	21	Olive Ridley Turtle	*Lepidochelys olivacea*	Sch I
11	Indian Fox	*Vulpes bengalensis*	Sch II	22	Indian Flap Shelled Turtle (panka Kaincha)	*Lissemys punctata*	Sch I
Reptiles.							
23	Common Rat Snake	Aesculapian snake	Sch. II (Part-2)	30	Burmese Python	*Python bivittatus*	Sch I
24	Forsten's Cat Snake	Boiga forsteni	Sch IV	31	Russel's Viper	*Daboia russelii*	Sch. II (Part-2)
25	Common Wolf Snake	Licodon aulicus	Sch IV	32	Monitor Lizard	*Varanus bengalensis*	Sch.II
26	Green Vine snake	*Ahaetulla nasuta*	Sch IV	33	Water Monitor Lizard	Varanus salvator	Sch I
27	Banded Krait	*Bungarus fasciatus*	Sch. IV	34	Common Garden Lizard	Calotes versicolor	Unlisted
28	Buff Striped keelback (Mati Biradi)	*Amphiesma stolatum*	Sch IV	35	Indian Chameleon	Chamaeleo zeylanicus	Sch II
29	Indian Cobra	*Naja naja*	Sch. II (Part-2)	36	Peninsular Rock Agama(Endua)	Psammophilus dorsalis	Unlisted
Birds.							
37	Khaparakhee	*Anbinga melanogaster*	Sch.IV	40	Panikua	*Phalacrocorax carbo*	Sch.IV

38	Panikua	*Phalacrocorax carbo*	Sch.IV	41	Dubdubi, Panidubuki	*Tachybaptus ruficollis*	Sch.IV
39	Chota Panikua	*Pbalacrocorax niger*	Sch.IV	42	Bada Baga	*Casmerodius albus*	Sch.IV
43	Jhalia Baga, Majhia Baga	*Mesophoyx intermedia*	Sch.IV	67	Chanchana	*Accipiter badius*	Sch.IV
44	Jatia Baga, Kuji Baga	*Ardea cinerea*	Sch.IV	68	Kurara Pakshi	*Pandian haliaetus*	Sch.IV
45	Nali Baga , Khaira Baga	*Ardea purpurea*	Sch.IV	69	Kurubala, Urubala	*Haliacetus leucogaster*	Sch.IV
46	Pili Baguli	*Butorides striatus*	Sch.IV	70	Baja	*Circaetus gallicus*	Sch.IV
47	Kantia Baga ,	*Ardeola grayii*	Sch.IV	71	Kalamundia Baja	*Falco peregrines*	Sch.IV
48	Lal Baga, Karni Baguli	*Ixobrycbus cinnamomeus*	Sch.IV	72	Gunduri	*Francolinus pondicerianus*	Sch.IV
49	Haladi Baga	*Ixobrycbus sinensis*	Sch.IV	73	Dahuka	*Amaurornis phoenicurus*	Sch.IV
50	Kantia Baga	*Dupetor flavicollis*	Sch.IV	74	Bena Dahuka	*Porzana fusca*	Sch.IV
51	Andharua Baga, Ratichara Baga, Bieli Baga	*Nycticorax nycticorax*	Sch.IV	75	Mandiakhaee	*Gallinula chloropus*	Sch.IV
52	Manika Jodi	*Ciconia episcopus*	Sch.IV	76	Hootuma	*Gallicrex cinerea*	Sch.IV
53	Gendalia	*Anastomus oscitans*	Sch.IV	77	Jui Kaima	*Fulica atra*	Sch.IV
54	Chitrita Kraoncha , Mahukanko	*Mycteria leucocephala*	Sch.IV	78	Kamapakshi	*Porphyrio porphyrio*	Sch.IV
55	Kalamundia Baga, Dhala Bajeni	*Dhala Bajeni*	Sch.IV	79	Kukubha	*Hydrophasianus chirurgus*	Sch.IV
56	Dhusura Bajeni	*Plegadis falcinellus*	Sch.IV	80	Chasama Akhi Chadhei	*Esacus recurvirostris*	Sch.IV
57	Duba Hansa	*Anser indicus*	Sch.IV	81	Ranapa Chadhei	*Himantopus himantopus*	Sch.IV
58	Hansrali	*Dendrocygna Javanica*	Sch.IV	82	Kuji Batahana	*Glareola lacteal*	Sch.IV
59	Panda Hansa, Chakrabaka, Chakua	*Tandorna ferruginea*	Sch.IV	83	Dhusura Mundia Ten Telen	*Vanellus cinereus*	Sch.IV
60	Gaheera Lanja, Lanja Gendi	*Anas acuta*	Sch.IV	84	Haladi Munha Ten Teien	*Vanellus malabaricus*	Sch.IV
61	Haladi Thantia Gendi, Barnahansa	*Anas poecilorhyncha*	Sch.IV	85	Nadi Kulia Ten Teien	*Vanellus duvaucelii*	Sch.IV
62	Chatua Gendi	*Anas clypeata Linnaeus*	Sch.IV	86	Ten Teien	*Vanellus indicus*	Sch.IV

63	Dhala Gendi	*Nettapus coromandelianus*	Sch.IV	87	Kalaa Lanjia Dangua	*Limosa limosa*	Sch.IV
64	Baja	*Elasnus caeruleus*	Sch.IV	88	Patragiria	*Philomachus pugnax*	Sch.IV
65	Sankha Chila	*Haliastur Indus*	Sch.IV	89	Ghantuala	*Pluvialis fulva*	Sch.IV
66	Matia Chila	*Milvus migrans*	Sch.IV	90	Daa Bentia	*Numenius arquata*	Sch.IV
91	Nali Kadua Khumpi	*Tringa totanus*	Sch.IV	117	Pecha	*Athene brama*	Sch.IV
92	Chhunchi Munia Chaahaa	*Tringa stagnatilis*	Sch.IV	118	Bhadabhadalia	*Coracias benghalensis*	Sch.IV
93	Chataka Chaaha	*Tringa glareola*	Sch.IV	119	Macharanka, Dhobanee	*Ceryle rudis*	Sch.IV
94	Chaha Chadei	*Actitis hypoleucos*	Sch.IV	120	Macharanka	*Halcyon smyrnensis*	Sch.IV
95	Pani Gunduri	*Rostratula benghalensis*	Sch.IV	121	Macharanka	*Alcedo atthis*	Sch.IV
96	Bhadaka Huruda, Chaha Chadhei	*Gallinago gallinago*	Sch.IV	122	Balisua	*Merops philippinus*	Sch.IV
97	Seema	*Calidris minuta*	Sch.IV	123	Sabuja Balisua	*Merops orientalis*	Sch.IV
98	Seema, Chuin Seema	*Calidris temminckii*	Sch.IV	124	Barbet, Kutur	*Megalaima zetlanica*	Sch.IV
99	Samudra Kuaa	*Larus brunnicephalus*	Sch.IV	125	Barbet, Sindurmundi	*Megalaima haemacephala*	Sch.IV
100	Gangachilli	*Larus ichthyaetus*	Sch.IV	126	Pania Patri	*Upupa epops*	Sch.IV
101	Nadi Machharanka	*Sterna aurantia*	Sch.IV	127	Kathahana	*Picus canus*	Sch.IV
102	Roosee Gangoi, Caspuan Machharanka	*Sterna caspia*	Sch.IV	128	Kathahana	*Dinopium benghalensis*	Sch.IV
103	Tippaarla	*Chlidonias hybridus*	Sch.IV	129	Haladibasanta	*Oriolus chinensis*	Sch.IV
104	Kapota	*Sterptopelia decaocto*	Sch.IV	130	Bulbul	*Pycnonotus cafer*	Sch.IV
105	Kapota	*Sterptopelia chinensis*	Sch.IV	131	Bulbul	*Pycnonotus jocosus*	Sch.IV
106	Harada	*Treron phoenicoptera*	Sch.IV	132	Bulbul	*Pycnonotus luteolus*	Sch.IV
107	Harada	*Treron bicincta*	Sch.IV	133	Lamba Lanjia Machhikhai	*Terpsiphone paradise*	Sch.IV
108	Nahaka Sua	*Psittacula eupatria*	Sch.IV	134	Chumchumi, Tinti Chadhei	*Nectarinia zeylonica*	Sch.IV
109	Sua	*Psittacula eupatria*	Sch.IV	135	Baramashi (kalamundia)	*Lonchura Malacca*	Sch.IV
110	Kautia Chanchana	*Hierococcyx various*	Sch.IV	136	Baya	*Ploceus philippinus*	Sch.IV

111	Cuckoo	*Clamtor coromandus*	Sch.IV				
112	Koili	*Eudynamys scolopacea*	Sch.IV				
113	Kumbhatua	*Centropus sinensis*	Sch.IV				
114	Pecha, Katha Pecha	*Strix ocellata*	Sch.IV				
115	Laxmi Pecha	*Tyto alba*	Sch.IV				
116	Pecha	*Otus bakkamoena*	Sch.IV				
Aquatic animals / Fishes							
137	Khanga	*Trinchesia kanga*		145	Chasa		
138	Dahal			146	Jagar		
139	Harakura			147	Kantal		
140	Kantia	*Mystus species*		148	Ghodia		
141	Kokali			149	Panu		
142	Khuranta			150	Potei		
143	Sahal			151	Pania khia		
144	Gandua			152	Mandia crab		

Vision 2030-31
For Puri (Wildlife) Division, Puri

The present working Plan has been drafted with a vision to achieve different goals on various sectors by 2030-31 i.e. by end of Plan Period. The Sector wise vision for Puri Wildlife Division perceived is as follows.

A. Increasing Forest Cover:

The Forest cover of Puri WL Division is less than Five Percent of the Geographical area of the division. Due to the Cyclone **"Phani"** occurred during May, 2019 most of the tree cover has been massively devastated. It is aimed to restore the tree cover to that of pre-cyclone period by all out efforts. A massive tree planting drive by Forest Department with help of VSS, local NGO and other organizations will be ensured so as to restore the sanctuary, PRFs, VFs, Coastal belt and all roadside avenues.

B. Conservation & Propagation of Wildlife:

Balukhanda- KonarkSanctuary has been badly devastated during recent Cyclone. The wildlife habitat has been degraded. The Deer and other animal population have been under distress due to cyclonic effect. It will be our endeavor to rehabilitate the wildlife habitat and to enhance the animal population by protection and providing congenial habitat, shelter, fodder and drinking water for faster breeding. The Blackbuck was one of the important species of Balukhanda- Konark sanctuary prior to super cyclone 1999. Now, the species has vanished from the sanctuary. It will be our effort to re-introduce Blackbuck in the Eastern part of the Sanctuary after taking all possible measures for their conservation & propagation through peoples participation.

Olive Ridley sea Turtles are migrating to the Coastline between Devi River Mouth to Chandrabhaga every year for mass nesting. The islands near river mouth are the preferred mass nesting places. Our vision will be to develop it to an ideal nesting ground without any disturbance during mating period in the sea, lying of eggs, hatching and release of hatchlings to sea.

Migratory Birds are visiting the mangrove forests created near Kadua River and Devi River confluence banks and islands. It is aimed to increase the mangrove habitat and riparian vegetation with adequate protection and with expanded base.

Micro habitat for various wild animals seen in pockets all over the division will be recognized and brought to management fold of Forest Department.

C. Secured Forest Boundary & Encroachment.

The Boundary of RF, PRF and Village Forest will be demarcated through DGPS survey; concrete pillars will be posted and maintained perfectly within the plan period. Many Village Forests and PRFs are under encroachment either by individuals / community. It will be our priority to make all forest areas free from encroachment and prevent future encroachment by amicable discussion and settlement with the Revenue Authority concerned and community.

All Forest Blocks after DGPS survey will be depicted on Survey of India Topo Sheet (1:50000 Scale). It will help in future management.

D. Creation of Wind Break / Shelter Belt.

The coast of Bay of Bengal from Satpada to Astaranga – Devi River Mouth will be surveyed through advanced technology. Available area at a width of 500 meters to 1.00 km will be identified and **Green Belt / Wind Break** will be created all along the Sea coast to act as a barrier against Cyclone. Kia (Pandanus) plantation will be taken up in the gaps of sand dunes to arrest saline water insurgence in to hinder land.

E. Peoples Participation:

All Forests of Social Forestry Project and Degraded Forest Area assigned to VSS will be managed through people's participation of highest order. Micro Plans prepared initially will be revisited and integrated village development plan will be incorporated in the micro plan so as to provide alternate livelihood to the rural people and help infrastructure development for building mutual confidence.

Most of the available Revenue Forest will be assigned to VSS and more VSS will be constituted to shoulder responsibility of **Joint Forest Management**. Increase in tree cover through Farm Forestry and Agro Forestry will be ensured. It is aimed to meet the requirement of Casuarina Fire Wood for Jagannath Temple to a substantial quantum i.e. about 75% from Farm Forestry and Agro Forestry on private lands. The local need of fuel wood will also be met from private land. Majority of people around sanctuary & forest will be using cooking gas

instead of fuel wood in their houses through motivation & incentive from forest department. There will be smokeless villages around the sanctuary.

Transfer of technology of Forest management to people will be made faster and expected that by end of 2030, people will be eligible to manage Natural Resource sustainable & effectively.

F. Ecotourism:

The ecological value and aesthetic value of Sea beach, Casuarina forest and wildlife will be realized by each people, bureaucrat, politicians, law makers, stake holders by 2030. They will maintain the destinations in forest with maximum cleanliness and use the land in most disciplined way so that visitors from outside the country will like to repeat their visit to Sea beach, river mouth and forest to witness migratory birds, nesting of Olive Ridley Turtle, Blackbuck, Spotted Deer, wet lands, Sea beach. Forest & wildlife will provide recreational and educational values to the eco-tourist.

In addition to the important tourist places like Sun temple at Konark, Sri Jagannath temple at Puri, Maa Mangala Temple at Kakatpur, there will be Ecotourism places at Nuanai, Jahania and at Muhanmuha to attract more tourist and Nature Lovers to experience wilderness and beauty of the nature.

G. Wet Land Management:

All wet lands more than five hectares area situated within Forest area or Revenue Govt. land will be identified through Satellite imagery interpretation and ground verification. In consultation with the district administration a comprehensive wet land management plan will be prepared and implemented by Forest and Revenue Department through people's participation so that biodiversity in wetland is augmented, recreational value increases, ground water is recharged with sweet water.

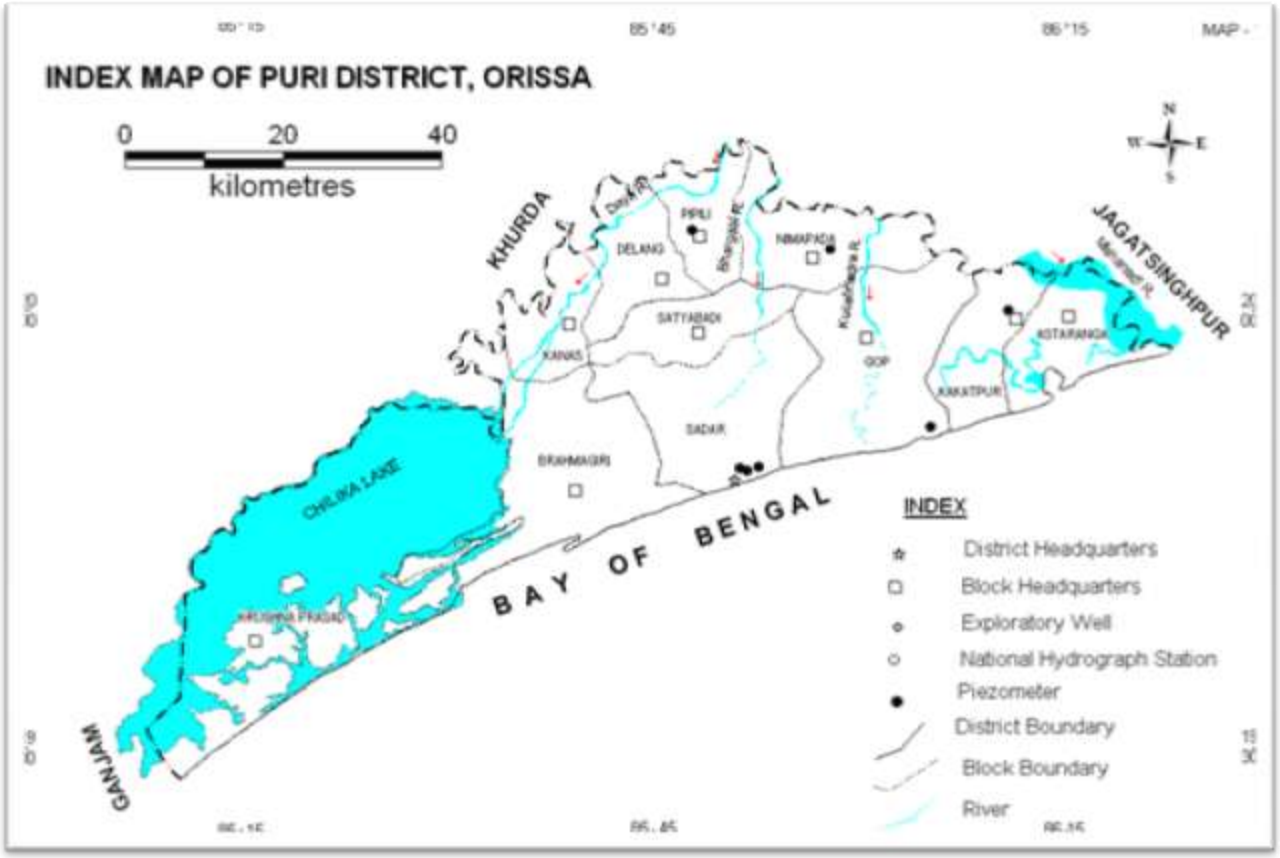
H. Adoption of Modern technology in Forestry:

In order to increase the genetically improved plant species in the Division, Plus trees will be identified and documented in a Register. Clonal Orchard will be developed and maintained near to Mega Nursery. QPM seedlings will be raised through vegetative method and utilized in all plantations of the Division. Root trainer nurseries will replace polypot nursery in mist chamber for production of QPM.

Change of Crop Density and land use pattern will be studied through Satellite imagery. Remedial measures will be promptly taken up. For Fire detection Modis data/ SNPP data are quite helpful. It is aimed to ensure "Zero Fire" incidence in Forests by 2030-31.

I. Climate Change.

Adequate measures will be taken to combat Climate Change and increase Carbon Sequestration through afforestation. Plastic Free environment will be handed over to our future generation. By 2030-31, alternatives to Plastic will be in use and eco friendly materials will be used in each household. Forest Department will be an active agent to reach every household in this matter. Global temperature rise will be checked and reversed to 2010 level by end of 2030-31.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Range Boundary

WORKING PLAN

PURI (WILDLIFE) DIVISION.

PART-I.

CHAPTER-1
THE TRACT DELT WITH

1.1Name and Situation:

Puri (Wildlife) Division with its headquarters at Puri came into existence on 1st October, 2003 after reorganization of Khurdha (T) Division vide Forest & Environment Notification No 1F(A)-100/2003/13228/ F&E dated 8.8.2003**(Annexure-I).** This division is situated within Puri District of the State and lies between 19^0 41' 09" and 20^0 07'38" North latitude and between 85^0 30' 4.7" and 86^0 22' 29" East longitude.The division finds place in Survey of India Toposheet No E 45B9 (74E/9), E45B10(73E/10), E45B13 (73E/13), E45C1 (74 I / 1), E45C5(74 I/ 5) F45T4(73H/4),F45U4 (73L/ 4) and F45U8(73L/8)(Total 8 sheet of 1:50000 Scale). The division is bounded by Bay of Bengal and Devi River -Rajnagar Wildlife Division in the East, Chilika Wildlife Division and Khordha Forest Division in the West, Bay of Bengal in South and Khordha Forest Division and City Forest Division in North. The River Bhargabi is in the North-West side of the division. It has a coast line of 150.40 Km approximately.

Basing on the natural features broadly the Bay of Bengal constitutes the Eastern and Southern boundary, Chilika Lake is in Western boundary and the northern boundary follows the CD Block boundary, which is an artificial boundary like canal, road etc**.**

1.1.1 Geographical Area:

This Puri (Wildlife) Division is a part of Puri District in state of Odisha. The total geographical area of this division is 1771.93 sq.km against total area of the district 3051sq. km. It comprises Puri Sadar, Satyabadi, Nimapada, Gop, Kakatpur, Astaranga, Brahmagiri and part of Krushnaprasad CD Blocks of the district. The division is divided in to Five Ranges for better and effective management. The area of operation of various Ranges covering the CD blocks is as furnished in **Table No-1.1.**

Table No-1.1: Ranges and Civil Jurisdiction, Puri (WL) Division.						
Sl No	Name of The Range	Name of CD Block	Perimeter in KM	Area in Sq. Km	Range Head quarters	Latitude / Longitude.
1	Balukhanda WL Range	Puri sadar, Satyabadi (P).	132.9	479.39	Balukhanda	$19^0$49'27.87" N / $085^0$51'52.67" E
2	Brahmagiri WL Range	Brahmagiri, Krushnaprasad(P)	117.4	391.37	Brahmagiri	$19^0$47'49.9" N / $085^0$38'30.1" E
3	Gop WL Range	Gop (P), Nimapada, Satyabadi (B).	104.7	347.14	Gop	$19^0$58'15.58" N / $086^0$01'27.04" E
4	Konark WL Range	Gop (B),Kakatpur (P), and Astaranga(P)	85.1	208.63	Konark	$19^0$53'20.5" N / $085^0$38'30.3" E
5	Astaranga WL Range	Kakatpur (P), Astaranga (P)	112.5	345.56	Panichhatra.	$20^0$01'29.47" N / $086^0$09'05.46" E
Total	5 Range	7+1(P)	290.16 (Division Perimeter)	1772.09		

1.1.2 Forest Area.

The total forest area is 80.967sq.km (Reserved Forest, Proposed Reserved Forest, and Village Forest) which constitutes about 4.57 percent of the Geographical area of the division. The forest blocks coming within the division are furnished in **Table No 1.2:**

Table No 1.2: Forest Area under Puri (WL) Division.				
Sl No	Category of Forest	Number of Forest blocks	Area in ha	Percentage to total Forest area.
1	Reserved Forests	1	1566.19	19.34
2	Proposed Reserved Forests	19	6205	76.64
3	Village Forests	43	325.582	4.02
	Total	**63 Block**	**8096.772**	**100.00**

1.1.3 Administrative Setup.

For administrative convenience, the division is sub-divided to Ranges, Sections & Beats. The name of Ranges / Sections & Beats are furnished in **Table No 1.3**

Table No 1.3 List of Ranges / Section / Beat of Puri WL Division.						
Name of Range	**Sl No**	**Name / Number of Section**	**Sl No**	**Name / Number of Beat**	**Headquarters**	**Location Details (Lat / Long)**
1	***2***	***3***	***4***	***5***	***6***	***7***
Balukhanda WL Range		**4 Section**		**12 Beat**	**Balukhanda**	
	1	Balukhanda		4 Beat	Balukhanda	$19^0$49’27.87” N / $085^0$51’52.67” E
			1	Balukhanda-I	Balukhanda	$19^0$49’29.13” N / $085^0$51’53.17” E
			2	Phulpatna-I	Phulpatna	$19^0$50’05.11” N / $085^0$53’32.57” E
			3	Phulpatna-II		
			4	Balukhanda Spl.		
	2	Balighai		4Beat	Balighai	$19^0$51’38.86” N / $085^0$56’20.05” E
			5	Bangara	Bangara	$19^0$50’57.11” N / $085^0$58’05.39” E
			6	Haingara	Haingara	$19^0$50’58.44” N / $085^0$57’43.39” E
			7	Balighai	Balighai	$19^0$51’38.86” N / $085^0$56’20.05” E
			8	Beldal	Beldal	$19^0$50’31.86” N / $085^0$54’11.92” E
	3	Satyabadi		2 Beat	Pattanaikia	$19^0$58’37.12” N / $085^0$49’41.04” E
			9	Satyabadi	Pattanaikia	$19^0$58’36.96” N / $085^0$49’41.61” E
			10	Pattanaikia		
	4	Puri Sadar		3 Beat	Puri Town	$19^0$48’01.12” N / $085^0$49’47.12” E
			11	Balukhanda-II	Puri Town	$19^0$48’00.96” N / $085^0$49’46.36” E
			12	Town		
Brahmagiri WL Range		**3 Section**		**7 Beat**	**Brahmagiri**	$19^0$47’49.9” N / $085^0$38’30.1” E
	5	Harachandi		2 Beat	Moto	$19^0$45’9.45” N / $085^0$40’40” E
			13	Kathuaredi	Brahmagiri	$19^0$47’49.9” N / $085^0$38’30.1” E
			14	Palanka	Moto	$19^0$45’9.45” N / $085^0$40’40” E
	6	Brahmagiri		3 Beat	Brahmagiri	$19^0$47’48.5” N / $085^0$38’30.3” E
			15	Brahmagiri-I	Brahmagiri	$19^0$47’49.2” N /

			16	Brahmagiri-II		085^{0}38’30.2” E
			17	Chapamanik	Moto	19^{0}45’9.45” N / 085^{0}40’40” E
	7	Sunamuhin		2 Beat		
			18	Sunamuhin	Panda	19^{0}41’20.76” N / 085^{0}31’18.498” E
			19	Panda		

1	*2*	*3*	*4*	*5*	*6*	*7*
Gop WL Range		**2 Section**		**4 Beat**	**Gop**	19^{0}58’15.58” N / 086^{0}01’27.04” E
	8	Gop		2 Beat	Gop	19^{0}58’15.69” N / 086^{0}01’26.98” E
			20	Gop		19^{0}58’15.39” N / 086^{0}01’25.51” E
			21	Balanga	Balanga	---
	9	Nimapada		2 Beat	Bhiligrama	20^{0}03’56.24” N / 086^{0}02’13.28” E
			22	Nimapada		20^{0}03’56.31” N / 086^{0}02’13.07” E
			23	Haripur		---
Konark WL Range		**3 Section**		**13 Beat**	**Konark**	19^{0}53’20.5” N / 086^{0}05’26.4” E
	10	Balidokan		4 Beat	Balidokan	19^{0}54’19.1” N / 086^{0}08’59.8” E
			24	Nadiamath	Nadiamath	19^{0}53’59.9” N / 086^{0}11’52.6” E
			25	Chitreswari-I	Chitreswari	19^{0}54’36.8” N / 086^{0}10’41.9” E
			26	Chitreswari-II		
			27	Guhalpur		
	11	Konark		4 Beat	**Konark**	19^{0}53’20.5” N / 086^{0}05’26.4” E
			28	Kurujanga	Kurujanga	19^{0}53’57.8” N / 086^{0}07’46.9” E
			29	Isaneswar	Konark	19^{0}53’20.5” N / 086^{0}05’26.4” E
			30	Chandrabhaga	Chandrabhaga	19^{0}51’56.4” N / 086^{0}06’36.8” E
			31	Konark	**Konark**	19^{0}53’20.5” N / 086^{0}05’26.4” E
	12	Ramachandi		5 Beat	Ramachandi	19^{0}51’22.01” N / 086^{0}03’32.73” E

			32	Maguleswar	**Konark**	$19^0$53’20.5” N / $086^0$05’26.4” E
			33	Bhagabati	Beruan	---
			34	Ramachandi	Ramachandi	$19^0$51’22.01” N / $086^0$03’32.73” E
			35	Liakhia	Tikana	$19^0$51’34.2” N / $086^0$01’11.63” E
			36	Kapileswar	Kapileswar	---

1	*2*	*3*	*4*	*5*	*6*	*7*
		3 Section		**9 Beat**	**Panichhatra**	$20^0$01’29.47” N / $086^0$09’05.46” E
	13	Muhanamuha		3 Beat	Muhanamuha	$19^0$57’26.72” N / $086^0$20’09.37” E
			37.	Muhanamuha-I	Muhanamuha	
			38.	Muhanamuha-II		
			39.	Gangadevi	Sahana	$19^0$56’44” N / $086^0$18’05.90” E
	14	Astaranga		4 Beat	Jahania	$19^0$55’56.97” N / $086^0$16’54.58” E
Astaranga WL Range			40.	Gundalaba	Gundalaba	$19^0$56’05.38” N / $086^0$17’04.48” E
			41.	Daluakani	Daluakani	$19^0$55’22.545” N / $086^0$15’55.80” E
			42.	Jahania	Jahania	$19^0$55’56.97” N / $086^0$16’54.58” E
			43.	Sahan	Sahan	$19^0$56’44.52” N / $086^0$18’05.57” E
	15	Panichhatra		2 Beat	Panichhatra	$20^0$01’29.47” N / $086^0$09’05.46” E
			44.	Panichhatra	Panichhatra	$20^0$01’29.47” N / $086^0$09’05.46” E
			45.	Kakatpur		
5 Range		**15 Section**		**45 Beat.**		

1.1.4 Building& Forest Road:

There are 43 Government Buildings inherited from parent division i.e. Khordha Forest Division and Social Forestry Division, Bhubaneswar. Afterwards 60 numbers of Buildings has been constructed till 31st October’2018. The detail of Buildings is at **Annexure-II.** In order to facilitate Protection, Harvesting of Forest Produce and Management of Forests, there are 5 (Five) number of Forest Roads over a length of 15.617 Km. The range wise forest roads

available and its present status is furnished below.The Forest Roads have been notified vide Office Order No 320 dated 18.12.2017**(Table No 1.4)**

Table No 1.4 List of Forest Roads in Puri (WL) Division				
Sl. No.	Name of the Range	Name of the Forest Road	Length in KM	Type of road
1	Astaranga	Sahan- Muhanamuha	4.20	Murrom
2	Konark	Marine drive - Ramchandi Watch tower	0.417	Murrom
3	Balukhanda	Balukhanda- Nuanai	5.00	Murrom
4		Phulpatana entry gate - Sea beach	3.00	Murrom
5		Chidananda ashram- Sea beach	3.00	Murrom
Total			**15.617**	

1.1.5 Forest Rest House (FRH):

There are three Forest Rest Houses in the Division. The Rest Houses are as furnished at **Annexure- III**

1.2 Configuration of the ground:

Physiographically the tract can be broadly divided into three natural divisions, viz,

(i) The Saline marshy tract along the coast.

(ii) The very gently sloping plain.

(iii) Undulating hard rock areas with lateritic capping and isolated hillocks.

The coastal sand dunes occur as a linear strip, running parallel to the shore line, which maintain higher altitude than the immediate interior part. The width of this tract varies from few hundred meters to 7 km. Swamps and tidal flats are also common in this tract. The deltaic plains may be divided into three parts: lower, middle and upper. The lower deltaic plains occur adjacent to the coastal sand dunes, having a width of 5 to 10km. Extensive flood plains, meandering stream curves, swamps; minor ridges etc. characterize this geomorphic unit. The Sar and Samang lake near Puri were important features in this terrain which have been silted up at present. The middle deltaic plains have characteristic parallel to sub-parallel drainage pattern and splitting distributaries. The upper deltaic plains occur along the course of the Daya River with a width of 2 to 3 km. This alluvial plain is characteristically flat. The altitude of the deltaic plain varies from 1 to 10m above mean sea level.

1.3Geology, Rock and Soil:

The Division spreads along the coast line from old Chilika mouth (Arakhakuda) to the Devi-Kadua estuary and the area is almost flat and coastal plains. Geological formations found in this Division are alluvial and sandy etc. raised beaches; older alluvial and laterites of Pleistocene age; and Tertiary beds of Miocene items. Broadly speaking the soil consists of coastal alluvia, forest soils and windblown sand.

1.3.1 Geology & Rocks:

Geologically a small part in the extreme north of the district is represented by Khondalite gneiss of Archaean age and the remaining part is covered by a thick pile of Quaternary sediments ranging in age from Pleistocene to present day. Khondalite gneiss contains garnet, sillimanite, quartz and graphite. The Quaternary sediments are represented by

(i) Bolgarh formation formed by secondary detrital laterite,
(ii) Kaimundi formation consisting of calche bearing hard, sticky sandy to silty clay,
(iii) Upper deltaic sediment comprising sandy clay with little silt
(iv) Lower deltaic sediment made up of variegated clay with little sand
(v) Older beach ridge deposits represented by oxidized medium to fine sand
(vi) Younger beach ridge sediment represented by medium to fine sand with little silt.
(vii) Present day marine and lagoonal sediment consisting of medium sand with heavies and black clay with little sand.

STRATIGRAPHY:

The geological succession in the district is as follows:

Age	Formation	Lithology
Holocene		Medium sand with heavies Residual Black clay with sand Medium to fine sand with little silt Black clay with little silt Greyish sandy clay with little silt
Late Pleistocene to Early Holocene	Kaimundi	Caliche bearing sandy clay
Pleistocene	Bolgarh	Detrital laterite
Archaean to Proterozoic		Feldspar-quartz-sillimaniteSchist

MINERALS:

Heavy minerals:

The beach and sand dune deposit contains heavy minerals like monazite, rutile, illmenite, zircon etc. Such deposits are seen around Paikirapur, Nandala, Brahmandeo, Bajrakot and Udegiri over a length of 91.23km. The total reserve of heavy minerals in these areas has been estimated as 147 million tones and the average grade of the heavies in beach sand is 11.8%.

River Sand deposits:

River sand deposits occur around Bayakuda, Gop, Ganeswarpur, Begunia, Sovanpur, Balanga, Haripur, Dhirapur and Chhenua villages of the district and used as construction material for buildings and roads.

1.3.2 Soil:

There are mainly three types of soils in the area, which are Alfisols, Aridisols and Entisols.

(i) Alfisols:

The deltaic alluvial soils belong to this group and occupy major parts of the area. These deltaic soils are generally deficient in P_2O_5 and Nitrogen. The K_2O are fairly adequate, and pH varies between 6.5 and 7.3. Generally these soils support paddy crops.

(**Alfisols** are a soil order in Soil Taxonomy. Alfisols form in semiarid to humid areas, typically under a hardwood forest cover. They have a clay-enriched subsoil and relatively high native fertility. "Alf" refers to aluminium (Al) and iron (Fe). Because of their productivity and abundance, the Alfisols represent one of the more important soil orders for food and fiber production. They are widely used both in agriculture and forestry, and are generally easier to keep fertile than other humid-climate soils. Those in monsoonal tropical regions, however, have a tendency to acidify when heavily cultivated, especially when nitrogenous fertilizers are used.)

(ii) Aridisols:

These are saline and saline alkali soils found near the coast and are restricted to Krushnaprasad and Astarang blocks. In Astarang block it occurs along the course of the Devi River. These soils are rich in calcium, magnesium and contain half decomposed organic matter.

(Aridisols (or **desert soils**) are a soil order in soil Taxonomy. Aridisols (from the Latin *aridus*, for "dry", and *solum*) form in an arid or semi-arid climate. Aridisols dominate the deserts and xeric shrublands, which occupy about one third of the Earth's land surface. Aridisols have a very low concentration of organic matter, reflecting the paucity of vegetative production on these dry soils. Water deficiency is the major defining characteristic of aridisols. Italso required the sufficient age to exhibit subsoil weathering and development. Limited leaching in aridisols often results in one or more subsurface soil horizons in which suspended or dissolved minerals have been deposited: silicate clays, sodium, calcium carbonate, gypsum or soluble salts. These subsoil horizons can also be cemented by carbonates, gypsum or silica. Accumulation of salts on the surface can result in salinization.)

(iii) Entisols:

These include youngest alluvial soils occurring in the western parts of the district, coastal sandy soils around Chilika lake and in the coastal tract. These soils are deficient in nitrogen, phosphoric acid and humus material, but generally not in potash and lime. The pH values are on the alkaline side. The texture varies from sandy to loamy sand. These are fertile soils and can produce a wide variety of crops, including paddy, wheat, sugarcane, cotton, banana and tobacco.

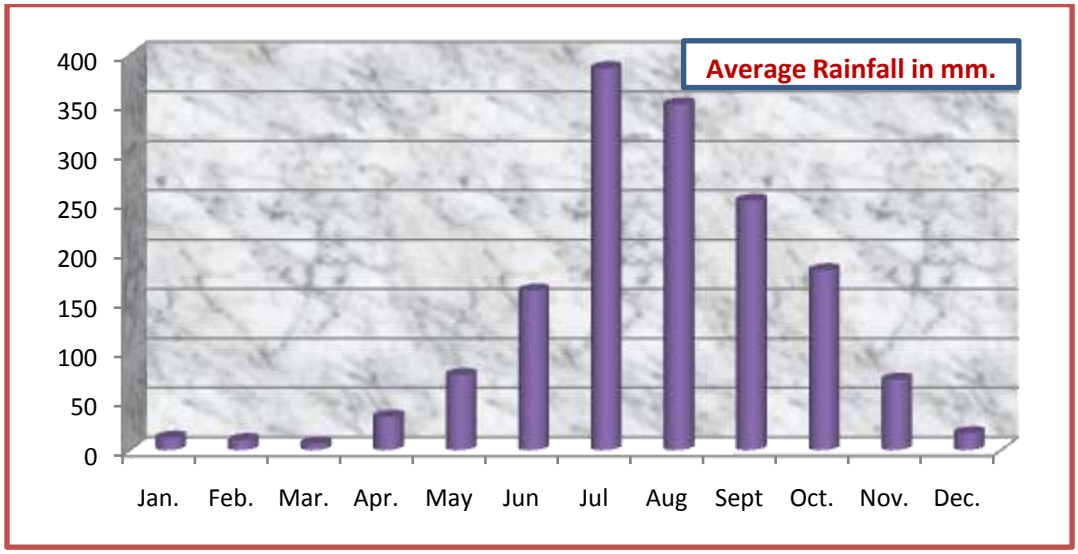
(E**ntisols** are defined as soils that do not show any profile development other than ahorizon. An entisol has no diagnostic horizons, and most are basically unaltered from their parent material, which can be unconsolidated sediment or rock. Entisols are the second most abundant soil order (after inceptisols).

1.4 Climatic Parameters:

1.4.1 Rainfall:

The south-west monsoon is the principal source of rainfall in the district / Division. Average annual rainfall of the district is 1449.1 mm. About 75% of the total rainfall is received during the period from June-September. Floods are quite common in the district. The district mainly receives rainfall from south-west monsoon which is very erratic. Analysis of 10 years of rainfall data from 2006 to 2015 reveals that the rainfall is uneven with maximum rainfall (2086.1mm) in 2007 and minimum (1132.1mm)in 2011. The climate of the district is subtropical with hot and dry summer and pleasant winter. The summer season extends from March to middle of June followed by the rainy season from June to September. The winter season extends from November till the end of February. The Rainfall data collected from IMD Station at Puri is furnished below in **Table no 1.5.**

Table No 1.5 Rainfall in mm (Puri IMD Station)													
Year	Month												
	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug	Sept	Oct.	Nov.	Dec.	Total
2006	7.4	0	23	14.3	120.7	93.7	623.5	861.7	208.8	34	99	0	2086.1
2007	0	26.4	2.8	0.3	82.7	210.7	75.3	477.7	211.3	191.8	11.3	0	1290.3
2008	58.5	46.2	14.8	71.7	7	310.5	367.3	286.3	285.8	109.5	69	0	1626.6
2009	0	0	0	10	74.1	103.2	630.8	250.5	236.4	145	130.3	0	1580.3
2010	4.8	13.5	0	0	152	125.3	133	376.1	265.3	285.2	133.8	87.8	1576.8
2011	0	0.2	0	5	108.2	120.9	335.6	215.9	305.6	39.2	0	1.5	1132.1
2012	1.4	0	0.1	76.7	6.8	162.8	306.1	366.7	153	154.9	192.4	0	1420.9
2013	0	1.9	0	30.5	57.8	337.6	433.4	198.5	257.7	690.4	0	0	2007.8
2014	0	10.4	21.2	4.9	127.3	68.8	738.5	226.8	304.3	122.8	0	10.4	1635.4
2015	51.3	0	1.8	121.4	22	80	220.9	236.2	295.8	45.4	74.8	69.4	1219.0
Total	123.4	98.6	63.7	334.8	758.6	1613.5	3864.4	3496.4	2524	1818.2	710.6	169.1	15575.3
Average	12.34	9.86	6.37	33.48	75.86	161.35	386.44	349.64	252.4	181.82	71.06	16.91	1557.53

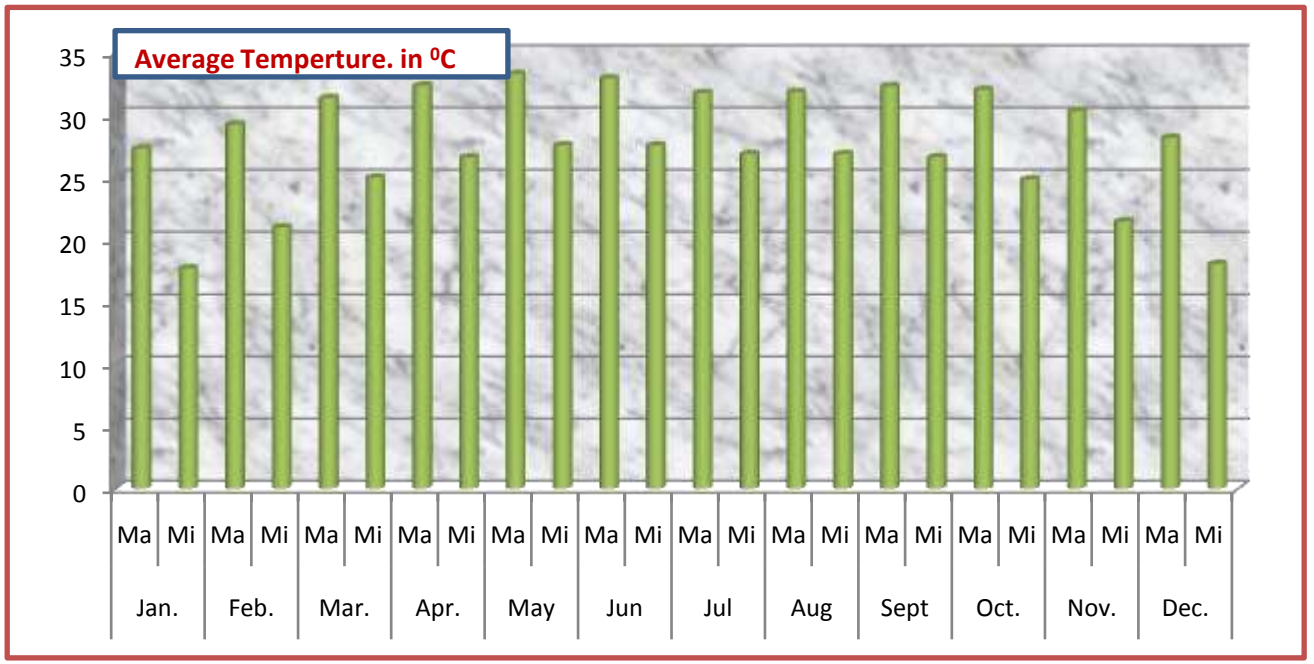


1.4.2 Temperature:

During 2006 to 2015, the highest temperature recorded is 34^0 C during May and lowest temperature is16^0 C during January. The Temperature recorded at IMD Puri Station from 2006 to 2015 (Minimum- Maximum) is furnished in **Table No 1.6** for reference.

Table No:1.6 Temperature Recorded at IMD Puri

Year	Jan.		Feb.		Mar.		Apr.		May		Jun		Jul		Aug		Sept		Oct.		Nov.		Dec.	
	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi	Ma	Mi
2006	28.1	17.3	30.1	21.7	31.3	24.7	31.8	26.9	33	26.5	32.2	26.6	31.6	26.6	30.3	25.9	32.1	26.9	31.9	25.8	30	22	28.7	18.5
2007	27.9	18	29	22	30.9	24.9	31.6	27.2	33.5	27.5	32.1	27.5	31.6	27.6	31.7	27.4	31.3	26.8	32	24.8	30.7	21.4	28.2	17.7
2008	27.4	17.6	27.4	19.8	30.6	25.5	32.3	26.6	33.5	28.2	31.4	26.9	31.5	27	31	26.8	32.1	26.6	32	25.2	30	21.3	28.7	19.4
2009	28.4	19.8	30.5	23.6	31.6	25.2	32.4	27.2	32.9	27.8	33.9	28.2	30.3	26.7	32.4	27.5	32.2	27.2	32.7	24.4	30.3	22.3	28.4	18.5
2010	26.4	17.7	29.4	22.1	31.4	26.6	31.5	27.2	32.6	27.7	32.6	28.4	32.2	27.6	32.3	27.4	32.5	27	31.4	25.4	30.5	23.1	27	16.9
2011	26.8	16	29.1	20	31	24.6	32.2	26	33	27.4	33.4	27.3	32.4	27	32	26.7	32.3	26.4	33.2	25.1	31.1	21.1	28.3	17.7
2012	27.1	18.9	29.7	20.4	32.2	25.7	32.9	26.7	33.6	27.9	33.1	27.9	31.8	26.8	32	26.9	32.7	26.7	32.1	24.4	29.5	21	28.9	18.1
2013	27.3	17.5	29.2	19.4	31.9	24.4	33	26.3	33.8	28.1	33.3	27.7	32.3	27.1	32.5	27.2	33	26.5	30.9	24.9	29.8	20.8	28	17.7
2014	27.1	17.6	28.9	20.3	31.4	24.2	33.4	26.6	33.4	27.3	34.8	28.2	31.6	26.2	31.7	26.9	32.5	26.4	31.6	23.2	30.8	20.8	27.5	16.7
2015	27	16.7	29.6	20.8	31.8	24.3	33	25.8	34.1	27.7	33.1	27.2	32.9	26.4	32.9	26.4	32.9	26	32.9	25.5	30.6	21.1	28.4	19.5
Total	273.5	177.1	292.9	210.1	314.1	250.1	324.1	266.5	333.4	276.1	329.9	275.9	318.2	269	318.8	269.1	323.6	266.5	320.7	248.7	303.3	214.9	282.1	180.7
Avg	27.35	17.71	29.29	21.01	31.41	25.01	32.41	26.65	33.34	27.61	32.99	27.59	31.82	26.9	31.88	26.91	32.36	26.65	32.07	24.87	30.33	21.49	28.21	18.07

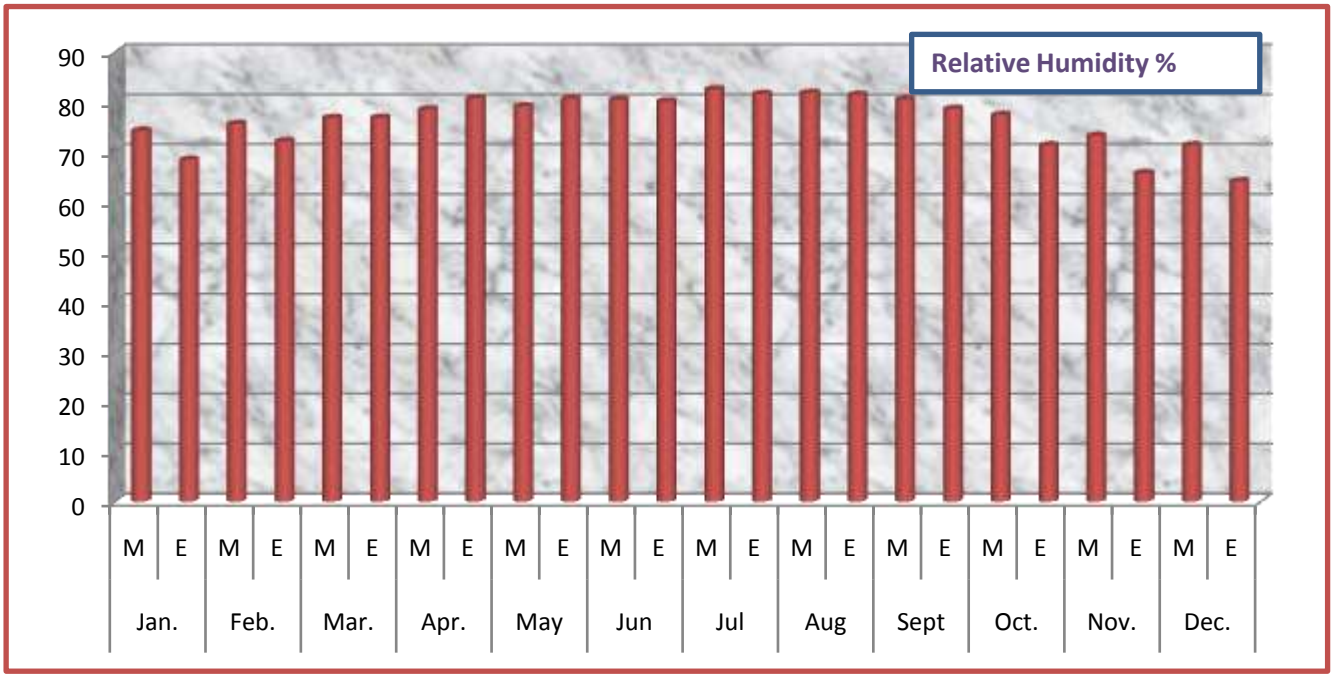


1.4.3 Relative Humidity:

The relative humidity varies from 60 % to 87 %. The minimum Humidity is experienced In December / January and highest during August. The data collected from IDM Puri station is furnished in **Table No 1.7.**

Table No:1.7 Relative Humidity Recorded at IMD Puri

Year	Jan.		Feb.		Mar.		Apr.		May		Jun		Jul		Aug		Sept		Oct.		Nov.		Dec.	
	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
2006	72	69	77	79	78	76	83	84	78	80	84	82	85	84	86	87	82	81	77	71	78	71	70	62
2007	72	67	74	69	77	74	82	83	78	81	84	83	83	82	80	81	84	79	76	65	72	61	68	61
2008	75	71	79	74	81	80	79	81	79	79	83	83	84	83	84	83	80	79	77	71	73	65	80	69
2009	82	71	81	75	77	77	83	81	81	81	78	78	87	86	83	82	81	81	72	63	75	68	75	61
2010	72	65	80	74	83	82	85	85	83	84	83	83	81	80	80	79	81	79	82	78	78	72	71	62
2011	72	68	77	71	76	76	74	77	80	80	79	79	76	79	82	82	80	77	71	64	66	62	68	72
2012	72	70	70	71	77	79	76	80	78	81	80	80	84	81	81	81	80	76	76	69	74	67	71	65
2013	76	69	73	66	74	76	76	79	81	81	77	79	82	79	79	78	79	77	84	79	69	62	69	60
2014	76	69	74	70	75	76	74	81	77	79	77	77	84	83	85	83	80	78	84	82	70	61	67	61
2015	74	66	72	73	71	73	74	77	77	81	80	78	80	80	79	79	79	80	76	72	78	69	75	69
Total	743	685	757	722	769	769	786	808	792	807	805	802	826	817	819	815	806	787	775	714	733	658	714	642
Avg	74.3	68.5	75.7	72.2	76.9	76.9	78.6	80.8	79.2	80.7	80.5	80.2	82.6	81.7	81.9	81.5	80.6	78.7	77.5	71.4	73.3	65.8	71.4	64.2



(M indicates value recorded at 8.30 hr of IST, E indicates value recorded at 17.30 hr of IST)

1.4.4 Wind Speed:

The average Wind Speed varies from 3km/ hr to 19km/hr. The data collected from IDM Puri station is furnished in **Table No 1.8.**

Table No:1.8 Average wind speed Recorded at IMD Puri																								
Year	Jan.		Feb.		Mar.		Apr.		May		Jun		Jul		Aug		Sept		Oct.		Nov.		Dec.	
	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
2006	3	6	3	8	5	11	12	15	14	17	10	14	14	14	15	16	13	15	5	6	5	8	6	9
2007	7	9	9	15	10	14	16	17	11	15	14	17	14	13	9	13	6	7	5	8	6	7	7	8
2008	8	11	7	12	11	14	11	14	12	16	11	12	12	14	17	19	13	16	8	11	8	10	7	11
2009	9	14	9	18	11	19	15	22	20	22	17	22	18	20	10	16	8	15	7	9	8	8	8	9
2010	8	11	7	14	13	17	21	18	15	15	12	14	12	15	9	13	9	13	9	11	9	8	9	8
2011	7	10	7	14	13	18	10	15	14	17	11	15	14	17	14	17	12	14	6	6	6	9	8	7
2012	9	12	6	13	12	18	16	22	12	16	13	16	15	18	12	17	7	13	9	10	6	7	7	9
2013	6	11	5	11	11	15	12	14	17	19	13	15	11	15	9	14	7	12	15	17	6	5	8	8
2014	8	10	8	13	10	13	13	15	14	17	10	15	10	15	8	8	8	13	7	7	8	5	10	7
2015	8	9	9	13	10	14	12	15	14	16	14	16	9	11	9	13	10	14	6	10	8	9	9	9
Total	73	103	70	131	106	153	138	167	143	170	125	156	129	152	112	146	93	132	77	95	70	76	79	85
Average	7.3	10.3	7	13.1	10.6	15.3	13.8	16.7	14.3	17	12.5	15.6	12.9	15.2	11.2	14.6	9.3	13.2	7.7	9.5	7	7.6	7.9	8.5

(M indicates value recorded at 8.30 hr of IST, E indicates value recorded at 17.30 hr of IST)

CHAPTER-2

MAINTENANCE / INCREASE IN THE EXTENT OF FOREST AND TREE COVER.

2.1 Area of Forests under different legal Classes.

The Puri Wildlife Division is covered with 8096.772 ha of Forest which constitutes only 4.57% of total geographical area of the Division. It includes one Reserved Forest (Balukhanda RF) which is within the Balukhanda- Konark wildlife Sanctuary, covering an area of 15.6619 sq. km, there are 19 PRFscovering an area of 62.05 sq. km out of which 6 PRF as indicated below are also within the Sanctuary limit and 43 Village Forests covering an area of 325.582ha(3.25582 sq.km). There is no Protected Forest in the Division.

2.1.1 Reserved Forests:

The list of Reserved Forests / Notification Number and extent of area is furnished at **Table No 2.1** below.

Table No 2.1 : List of Reserved Forests in Puri Wildlife Division, Puri.

Sl No.	Name of Range	Name of Forest Block	Notification No.	Area in Ha.
1	**2**	**3**	**4**	**5**
01	Balukhanda	Balukhanda RF	9013-8F(W)-23/84-FFAH dated 23.04.1984 & No. 15216-8F(W)-65/87-FFAH dated 01.09.1987	1566.19

2.1.2 Proposed Reserved Forests (PRF):

There are 19 PRF (Proposed Reserved Forests) within the Division. The Total area is 6205 ha which constitutes about 76.66% of forest area. The list of PRF along with its notification number is furnished below at **Table No 2.2**

Table No – 2.2: List of Proposed Reserved Forests of Puri (Wildlife) Division.				
Sl No.	Name of Range	Name of Forest Block	Notification No.	Area in Ha.
1	2	3	4	5
1	Balukhanda	Balighai PRF *	No.-FS-233/78-74964 dated 15.11.1978	1190.96
2	Balukhanda	Pattnaikia PRF	No.-FS-234/78-74978/Rdated 15.11.1978	42.00
3	Konark	Liakhia PRF *	No.-FS-221/78-74625 dated 13.11.1978	379.80
4	Konark	Konark West PRF*	No.-143/79 dated 18.01.78	1319.16
5	Konark	Konark East PRF*	No.-278/79 dated 20.01.79	1447.60
6	Konark	Golora PRF *	No.-FS-22/84-58578 dated 29.08.1984	680.00
7	Konark	Nadiamatha PRF*	No.-FS-267/78-88166/R dated 29.12.1978	334.00
8	Konark	Junei PRF	No.-FS-194/78-73198 dated 07.11.1978	7.80
9	Konark	Kuakhai PRF	No.-FS-269/78-88178 dated 29.12.1978	4.80
10	Astaranga	Sahana PRF	No.-FS-369/81-32760 dated 11.05.1984	322.00
11	Astaranga	Nipania PRF	No.-FS-193/78-72397 dated 03.11.1978	10.80
12	Astaranga	Tovagolora PRF	No.-FS-214/8127971 dated 24.04.1984	71.28
13	Bramhagiri	Bada Andhari PRF	No.-FS-216/78-74547 dated 13.11.1978	120.00
14	Bramhagiri	Sana Andhari PRF	No.-FS-219/78-74974 dated 15.11.1978	40.00
15	Bramhagiri	Gopinathpur-I PRF	No.-FS-265/78-88680/R dated 30.12.1978	9.60
16	Bramhagiri	Gopinathpur-III PRF	No.-FS-195/78-74603/R dated 13.11.1978	80.00
17	Bramhagiri	Rameswarpur PRF	No.-FS-281/78-84983/R dated 19.12.1978	20.40
18	Bramhagiri	Siaria PRF	No.-FS-206/78-74599 dated 13.11.1978	32.80
19	Bramhagiri	Manikpatana PRF	No.-FS-259/78-4544 dated 16.11.1978	92.00
	Total	**19 PRF**		**6205 ha**

[(NB: There is no Protected Forests in the Division.) PRF with * mark are in Balukhanda Sanctuary Limit]

2.1.3 Village Forests:

During Social Forestry Project many Village Woodlots were created on Government land and subsequently declared as Village Forest u/s 30 of the Odisha Forest Act,1972. The list of such forests is furnished in **Table No 2.3:** The Notification is eclosed in **Annexure-IV.**

Table No 2.3 : List of Village Forest of Puri (Wildlife) Division.				
Sl no	Name of the Range	Name of the Village Forest	Notification no. and date	Area in ha
1	**2**	**3**	**4**	**5**
1	Balukhanda WL Range	Badagaon	30230/F&E dt. 19.12.1992	6.828
2	Balukhanda WL Range	Mahapur	30230/F&E dt. 19.12.1992	0.4
3	Balukhanda WL Range	Baliguali	30230/F&E dt. 19.12.1992	6.332
4	Balukhanda WL Range	Bhikaripada	30230/F&E dt. 19.12.1992	2.5
5	Balukhanda WL Range	Narsinghpur	30230/F&E dt. 19.12.1992	4
6	Balukhanda WL Range	Paikrapur	2108/F&E dt. 30.01.1992	2.04
7	Bramhagiri WL Range	Kasijharia	30230/F&E dt. 19.12.1992	5.05 (4 plots)
8	Bramhagiri WL Range	Kasijharia	2108/F&E dt. 30.01.1992	5 (9 plots)
9	Bramhagiri WL Range	Bramhagiri	30230/F&E dt. 19.12.1992	11.584(10 Plots)
10	Bramhagiri WL Range	Bhandarikuda	30230/F&E dt. 19.12.1992	0.372
11	Bramhagiri WL Range	Kalikabadi	30230/F&E dt. 19.12.1992	1.5
12	Bramhagiri WL Range	Chandiput	30230/F&E dt. 19.12.1992	0.578
13	Bramhagiri WL Range	Sipasarubali	30230/F&E dt. 19.12.1992	12.9 (2 plots)
14	Bramhagiri WL Range	Rameswar	23069/F&E dt. 28.12.1991	26
15	Bramhagiri WL Range	Samangara	23069/F&E dt. 28.12.1991	11.5 (6 plots)
16	Bramhagiri WL Range	Sahajanpur	23069/F&E dt. 28.12.1991	10 (2 plots)
17	Bramhagiri WL Range	Bhuan	10841/FFAH dt. 16.05.1990	12.4
18	Bramhagiri WL Range	Bhubanpur	2108/F&E dt. 30.01.1992	17.75 (3 plots)
19	Bramhagiri WL Range	Chapamanik	2108/F&E dt. 30.01.1992	8 (10 plots)
20	Bramhagiri WL Range	Gaudakera	2108/F&E dt. 30.01.1992	5
21	Bramhagiri WL Range	Kalikabadi	2108/F&E dt. 30.01.1992	54 (7 plots)
22	Bramhagiri WL Range	Budhisahi	2108/F&E dt. 30.01.1992	1.08 (3 plots)
23	Bramhagiri WL Range	Niazpur	2108/F&E dt. 30.01.1992	2.612(13 plots)
24	Bramhagiri WL Range	Kathuaredy	2108/F&E dt. 30.01.1992	1.44 (2 plots)
25	Bramhagiri WL Range	Tinikudi	2108/F&E dt. 30.01.1992	3 (9 plots)
26	Bramhagiri WL Range	Puba	2108/F&E dt. 30.01.1992	7.22 (2 plots)
27	Bramhagiri WL Range	Bobua	2108/F&E dt. 30.01.1992	1.2
28	Gop WL Range	Nimapada	30230/F&E dt. 19.12.1992	0.496
29	Gop WL Range	Alasankha	10841/FFAH dt. 16.05.1990	5.56 (3 plots)
30	Gop WL Range	Kanti	10841/FFAH dt. 16.05.1990	2.5
31	Gop WL Range	Redhua	10841/FFAH dt. 16.05.1990	3.5 (2 plots)
32	Gop WL Range	Patalia	10841/FFAH dt. 16.05.1990	2.5
33	Gop WL Range	Alanda	10841/FFAH dt. 16.05.1990	15 (3 plots)
34	Gop WL Range	Uchhupur	10841/FFAH dt. 16.05.1990	5.34 (6 plots)

35	Konark WL Range	Santrasa	23069/F&E dt. 28.12.1991	3
36	Konark WL Range	Chheliberua	23069/F&E dt. 28.12.1991	3.6 (3 plots)
37	Konark WL Range	Khandala	23069/F&E dt. 28.12.1991	3 (4 plots)
38	Konark WL Range	Jamara	23069/F&E dt. 28.12.1991	7.5 (3 plots)
39	Konark WL Range	Rahulpatna	10841/FFAH dt. 16.05.1990	0.8
40	Konark WL Range	Tikina	10841/FFAH dt. 16.05.1990	25 (2 plots)
41	Konark WL Range	Khalkata	10841/FFAH dt. 16.05.1990	12.5
42	Konark WL Range	Anasara	10841/FFAH dt. 16.05.1990	4.5 (3 plots)
43	Konark WL Range	Kanpur	10841/FFAH dt. 16.05.1990	10.5
Total	**4 Range**	**43 VF**		**325.582**

2.1.4 Un-classed Forests & Others:

There are areas undercontrol of Forest Department having Buildings, Nursery and roads termed as Un-classed Forests. The Details of Un-classed forests is furnished in **Table No 2.4.**

Table No: 2.4: List of Un-Classed Forests in Puri (Wildlife) Division

Name of the Range	Sl No	Type of the un classed forest	Location	Peripheral area (in sq ft)	Peripheral area (in Ha.)	GPS location (midpoint)
Astaranga WL Range	1	Range Office , Panichatra	Panichhatra	332.75sqft	0.0030	N-20 01’ 29.25” E-86 09’ 05.34”
	2	Panichatra Section , Panichatra	Panichhatra	652sqft	0.0060	N-20 01’ 29.17” E-86 09’ 05.23”
	3	Astaranga Section , Jahania	Jahania	1290.35sqft	0.0119	N-19 56’ 40.87” E-86 16’ 20.55”
	4	Muhanmuha Section, Muhanmuha	Muhanmuha	1701.43sqft	0.0158	N-19 57’ 26.79” E-86 20’ 09.12”
	5	Panichatra Beat , Panichatra	Panichhatra	560sqft	0.0052	N-20 01’ 29.25” E-86 09’ 05.16”
	7	Astaranga Beat, Jahania	Jahania	361 sqft	0.0034	N-19 56’ 40.87” E-86 16’ 20.55”
	8	Gundalaba Beat , Gundalaba	Gundalaba	500 sqft	0.0046	N-19 56’ 40.69” E-86 16’ 20.55”
	9	Daluakani Beat , Daluakani	Daluakani	501.62sqft	0.0047	N-19 55’ 22.43” E-86 15’ 56.26”
	10	Muhanmuha-I Beat , Muhanmuha	Muhanamuha	499.33sqft	0.0046	N-19 57’ 26.70” E-86 20’ 08.78”
	11	Muhanmuha-II Beat , Muhanmuha	Muhanamuha	314.5sqft	0.0029	N-19 57’ 26.44” E-86 20’ 09.19”

	12	Gangadevi Beat , Muhanmuha	Sahan	530sqft	0.0049	N-19 56’ 43.40” E-86 18’ 04.90”
	13	Sahan Beat , Sahan	Sahan	226.31sqft	0.0021	N-19 56’ 44.00” E-86 18’ 05.90”
	14	View Tower , Muhanmuha Complex	Muhanamuha	351.5sqft	0.0033	N-19 57’ 27.02” E-86 20’ 09.39”
	15	Watch Tower , Muhanmuha Sahan PRF	Sahabkuda	162.38sqft	0.0015	N-19 57’ 42.94” E-86 20’ 58.08”
	16	Anti Poaching , Muhanmuha	Muhanamuha	361sqft	0.0034	N-19 57’ 26.44” E-86 20’ 09.23”
	17	Anti poaching , Jahania	Jahania	361sqft	0.0034	N-19 55’ 57.09” E-86 16’ 54.91”
	18	Permanent Nursery, Jahania	Jahania	53820sqft	0.500	N-19 55’ 58.95” E-86 16’ 52.89”
	19	Store House	Inside Mega Nursery			N-20 01’ 47.42” E- 86 09’ 22.29”
	20	Seed Godown	Inside Mega Nursery			N-20 01’ 47.35” E- 86 09’ 22.07”
Astaranga WL Range	21	Labour Shed	Inside Mega Nursery			N-20 01’ 46.05” E- 86 09’ 23.96”
	22	Office Building	Inside Mega Nursery			N-20 01’ 51.65” E- 86 09’ 23.97”
	23	Watch Man Shed	Inside Mega Nursery			N-20 01’ 51.50” E- 86 09’ 22.29”
	24	Compost Godown	Inside Mega Nursery		12.90	N-20 01’ 46.36” E- 86 09’ 28.31”
		S. Total			**13.4807**	
Brahmagiri (WL) Range	1	Forester Quarter, Brahmagiri	Brahmagiri	675sqft (Plinth area)	0.0063	N-19 47’ 48.4” E-085 38’ 30.4”
	2	V.F.W Quarter	Brahmagiri Range Office Premises	683sqft (Plinth area)	0.0063	N-19 47’ 49.0” E-085 38’ 31.0”
	3	Anti Poaching Squad (Old Range Office)	Brahmagiri Range Office Premises	598sqft (Plinth area)	0.0056	N-19 47’ 49.1” E-085 38’ 30.9”
	4	Protection squad shed	Brahmagiri Range Office Premises	730sqft (Plinth area)	0.0067	N-19 47’ 46.9” E-085 38’ 30.7”

	5	Forest guard quarter	Brahmagiri Range Office Premises	500sqft (Plinth area)	0.0046	N-19 47’ 49.2” E-085 38’ 30.6”
	6	Extension room to anti poaching squad	Brahmagiri Range Office Premises	270sqft (Plinth area)	0.0025	N-19 47’ 49.1” E-085 38’ 30.9”
	7	New Range Office	Brahmagiri Range Office Premises	1123.0sqft (Plinth area)	0.0104	N-19 47’ 48.9” E-085 38’ 30.2”
	8	Forester Quarter, Harachandi	Motta	322.91sqft (Plinth area)	0.0030	N-19 45’ 9.45” E-085 40’ 40.00”
	9	Forest guard quarter, Harachandi	Motta	215.27sqft (Plinth area)	0.0020	
	10	Forest guard quarter	Gabakunda	500sqft (Plinth area)	0.0046	N-19 41’ 20.53” E-085 31’ 18.58”
		S. Total			0.052	
Balukhanda WL Range	1	Range Office	Inside Compt. No.II of Balukhanda RF	0.344 km	0.7060	N-19 49’ 29.1” E-85 51’ 51.6”
	2	Old Forester Quarter				
	3	New Forester Quarter-1				
	4	New Forester Quarter-2				
	5	Barrack				
	6	Old Forest Guard Quarter				
	7	New Forest Guard Quarter				
	8	Protection Shed-1				
	9	Protection Camp Shed				
	10	Protection Shed-2				
	11	Balukhanda Beat house				
	12	Malkhana				
	13	Seizure yard				
	14	Cashew nut Go down				
Balukhanda WL Range	15	Range Officer Quarter	Inside Compt. No. II of Balukhand RF	0.0774 km	0.03717	N-19 49’ 29.1” E-85 51’ 51.6”

	16	Permanent Nursery	Inside Compt. No. II of Balukhand RF	0.04 km	0.0096	N- 19 49’ 29.1” E-85 51’ 51.6”
	17	Balighai Section	Near Balighai Square	0.097km	0.036	N-19 51’ 38.8” E-85 56’ 20.1”
	18	Balighai Beat house	Near Balighai Square	0.097km	0.036	N-19 51’ 38.8” E-85 56’ 20.1”
	19	Bangar Beat	Inside Balighai PRF	0.1258 km	0.09815	N-19 50’ 56.9” E-85 58’ 05.0”
	20	Haingora Beat	Inside Balighai PRF	0.0942 km	0.05537	N-19 50’ 57.7” E-85 57’ 43.1”
	21	Phulpatna Beat	Inside Compt. No.VIII of Balukhanda RF	0.046 km	0.013	N-19 50’ 04.9” E-85 53’ 32.7”
	22	FRH, Saikatnivas	Inside Compt. No.VIII of Balukhanda RF	0.191 km	0.196	N-19 50’ 04.9” E-85 53’ 32.7”
	23	Antipoaching Camp	Inside Compt. No.VIII of Balukhanda RF	0.0234km	0.003182	N-19 50’ 04.9” E-85 53’ 32.7”
	24	Beldala Beat	Inside Compt. No. XII of Balukhand RF	0.056 km	0.0195	N- 19 50’ 31.7” E- 85 54’ 11.8”
	25	FRH, Puri (Banani)	Near Puri Club, Puri	0.252 km	0.318	N- 19 48’ 00.6” E – 85 49’ 46.7”
	26	FRH Annexure				
	27	ACF Quarter				
	28	Puri Sadar Section Quarter				
	29	Sadar Beat				
	30	Pattnaikia Section	Inside Pattnaikia Research Garden	0.40 km	0.121	N- 19 58’ 37.1” E- 85 49’ 41.2”
	31	Pattnaikia Beat				
		S.Total			**1.64899**	
Konark WL Range	1	Range Office New	Konark Range Office	3.58 Ac	1.432	N-19 53’ 20.5” E-86 05’ 26.4”

	2	Forester Quarter (ACC)	Campus			N-19 51’ 22.01” E-86 03’ 32.73”
	3	AP Camp shed Konark (RCC)				
	4	FRH Konark				N-19 53’ 19.3” E-86 05’ 25.1”
	5	FRH Kitchen and Store				
	6	Protection Camp shed Konark (Double storied RCC)				N-19 53’ 21.5” E-86 05’ 26.2”
	7	Old wildlife Range office Building-cum-Residence.(RCC)				N-19 53’ 22.52” E-86 05’ 28.47”
	8	Old territorial Range office Building. (ACC)				N-19 53’ 21.50” E-86 05’ 27.19”
	9	Old Range Officers’ Residence (ACC)				N-19 53’ 20.16” E-86 05’ 25.62”
	10	Community toilet inside Range Office campus				N-19 53’ 21.57” E-86 05’ 27.45”
Konark WL Range	11	Cashew Godown (Old)	Konark Range Office Campus			N-19 53’ 20.54” E-86 05’ 26.84”
	12	Cashew Godown (New)				N-19 53’ 21.43” E-86 05’ 26.44”
	13	VFW Quarter (ACC)				
	14	RI Quarter (ACC)				
	15	Forest Guard Quarter (ACC)				
	16	World Food Godown (ACC)				
	17	Ramchandi Section	Ramachandi	0.12 Ac	0.0480	N-19 53’ 23.3” E-86 05’ 28.1”
						N-19 53’ 23.5” E-86 05’ 18.2”
	18	Ramachandi Beat	Ramachandi	0.24 Ac	0.0960	N-19 51’ 22.02” E-86 03’ 33.12”

	19	Chandrabhaga Beat	Chandrabhaga	0.2 Ac	0.0800	N-19 51’ 56.1” E-86 06’ 36.8”
	20	Tikina Beat	Tikana	0.10 Ac	0.0400	N-19 51’ 34.2” E-86 01’ 11.63”
	21	Junei Beat	Junei	0.10 Ac	0.0400	N-19 54’ 12.2” E-86 05’ 09.1”
	22	Kurujanga Beat	Kurujanga	0.54 Ac	0.2160	N-19 53’ 57.8” E-86 07’ 46.9”
	23	Chitreswari Beat	Chitreswari	Inside old Balidokan Section Office campus		N-19 54’ 36.8” E-86 10’ 41.9”
	24	Nadiamatha Beat	Nadiamath	0.10 Ac	0.0400	N-19 53’ 59.9” E-86 11’ 52.6”
	25	Watch tower	Konark FS	0.005 Ac	0.0020	N-19 51’ 52.5” E-86 05’ 39.3”
	26	Protection shed marine drive (Iron Pipe and GCI Sheet)	Konark FS	0.01 Ac	0.0040	N-19 51’ 41.8” E-86 05’ 41.6”
	27	Protection shed Chandrabhaga	Chandrabhaga	0.32 Ac	0.1280	N-19 51’ 56.4” E-86 06’ 36.8”
	28	Protection shed Nadiamatha	Nadiamath	0.32 Ac	0.1280	N-19 53’ 59.9” E-86 11’ 52.6”
Konark WL Range	29	Permanent Nursery Durgabadi	Konark West PRF	2.21 Ac	0.884	N-19 52’ 44.9” E-86 06’ 04.0”
	30	Nursery Labour Shed, Durgabadi.	Konark West PRF			N-19 52’ 44.9” E-86 06’ 04.0”
	31	Balidokan Section office at Balidokan	Darsanibanta	0.027 Ac	0.0108	N-19 54’ 19.17” E-86 08’ 59.81”
	32	Guhalapur Beat House	Chitreswari	0.0114 Ac	0.0046	N-19 54’ 19.19” E-86 08’ 59.67”
		S. Total			**3.1534**	
Gop WL Range	1	New Range Office Gop		0.58 Ac	0.2320	N-19 58’ 15.582” E-86 01’ 27.048”
	2	Old Range Office Gop		0.58 Ac	0.2320	N-19 58’ 15.384” E-86 01’ 2.178”
	3	Forester Quarter Gop		0.58 Ac	0.2320	N-19 58’ 15.690” E-86 01’ 26.980”

	4	Forest Guard Quarter Gop		0.58 Ac	0.2320	N-19 58’ 16.050” E-86 01’ 26.870”
	5	New Forest Guard Quarter Gop		0.58 Ac	0.2320	N-19 58’ 15.396” E-86 01’ 25.518”
	6	Protection Shed Gop		0.58 Ac	0.2320	N-19 58’ 15.2” E-86 01’ 25.8”
	7	Rescue Centre Gop (1)		0.58 Ac	0.2320	N-19 58’ 16.2” E-86 01’ 26.7”
	8	Rescue Centre Gop (2)		0.58 Ac	0.2320	N-19 58’ 16.4” E-86 01’ 26.7”
	9	Forester Quarter, Bhiligram	Inside permanent nursery Bhiligram	14 Ac	5.6	N-20 03’ 55.244” E-86 02’ 13.284”
	10	Forest Guard Quarter, Bhiligram				N-20 03’ 56.310” E-86 02’ 13.074”
	11	Central Nursery, Bhiligram				N-20 03’ 57.02” E-86 02’ 12.7”
	12	Nursery Shed, Bhiligram				N-20 03’ 52.308” E-86 02’ 12.366”
		S. Total			**7.456**	
	109	**Divisional Total**			**25.7911**	

Table No 2.5 : ABSTRACT OF FORESTS IN PURI (WILDLIFE) DIVISION.

Sl No	Name of Range	RF		PRF		VF		UCF		Total	
		No	Area	No	Area	No	Area	No	Area	No	Area
1	Balukhanda WL Range	1	1566.19	2	1232.96	6	22.10	31	1.649	40	2822.899
2	Brahmagiri WL Range	0	0	7	394.8	21	198.186	10	0.052	38	593.038
3	Gop WL Range	0	0	0	0	7	34.896	12	7.456	19	42.352
4	Konark WL Range	0	0	7	4173.16	9	70.4	32	3.153	48	4246.713
5	Astaranga WL Range	0	0	3	404.08	0	0	24	13.481	27	417.561
Total = 5 Range		**1**	**1566.19**	**19**	**6205**	**43**	**325.582**	**109**	**25.7911**	**61**	**8122.563**

2.1.5 DLC FORESTS (As Recorded & Approved by District Level Committee)

District Level Committee (DLC) was constituted during the year 1997 in each district under the Chairmanship of the District Collector as per the Orders passed by the Hon'ble Supreme Court of India in W.P.(C) 202/1995 to identify all forest areas under the administrative control of F&E Department /Revenue Department and Forest land / Plantations belonging to private persons. After necessary scrutiny of the DLC Reports by the State Level Expert Committee, the details of such Forest land were submitted before the Hon'ble Apex Court in shape of an affidavit. All such Forest Lands which found place in the final DLC reports are to be regulated under the provisions of the Forest (Conservation) Act, 1980.

Instruction has been issued by the Government of Odisha, Revenue and Disaster Management Department vide letter No RDM/-LRGEA.POLICY – 0018-23784/ R&DM Dated 30.06.2018 (**Annexure- V**)to enter this DLC Forest land in the BHULEKH DATA BASE. However for ready reference of the Forest staff, it is felt necessary to compile the DLC Report of the Division and annexed to this Working Plan.

There are total 11 Tahasils in Puri district, out of which seven Tahasilsare coming within within the Puri Wildlife Division jurisdiction namely Puri, Satyabadi, Bramhagiri, Nimapada, Gop, Kakatapur and Astaranga Tahasil. The abstract of Tahasil wise DLC area of Puri district is furnished at **Table No 2.6.**

Table No 2.6: Abstract of "DLC Forest" Land in Puri district (In Ha)

Sl No	Name of Tahasil	No of Villages involved	Area recorded under "DLC Forest"			Remark
			As per Revenue Record	Plantations & deemed Forest	Total	
1	Puri		2386.30	3617.99	6004.29	Divided to Puri, Satybadi, Brahmagiri Tahasil
2	Nimapada		149.46	1001.11	1150.57	Divided to Nimapada and Gop Tahasil
3	Kakatpur		698.55	1745.23	2443.78	Divided to Kakatpur and Astarange.
4	Pipili		86.07	283.68	369.75	
5	Krushnaprasad		185.04	2038.70	2223.74	
TOTAL PURI DISTRICT			**3505.42**	**8686.71**	**12192.13**	

The DLC report of the Division has been completed in an exhaustive manner from the available information Tahasil wise and R.I Circle wise and Mouza wise. The DLC report in shape of a Booklet as well as in soft form has been supplied to all the Tahasildar, Sub-collector and Collector Puri District for taking necessary action at their end vide this office Memo No. 4062 Dt. 03.09.2018. The booklet on DLC Forest is enclosed as **Part-III** of the working plan.

2.2 Forest Area under different Working Circle/ Management Plan:

2.2.1 Forest Area covered in the outgoing Plan.

The outgoing Working Plan is of Khordha Forest Division written by Sri Abhiram Das, IFS which was valid up to 2016-17. In the outgoing plan 13 PRF were included covering an area of 853.48ha (GIS computed area 1744.18ha). The range wise PRF included in the Plan is furnished in **Table No 2.7.**

Table No. 2.7: Forest Blocks covered in the Out Going Plan.

Name of Range	Sl No	Name of Block	Status	Area in ha.	GIS area in ha.
Konark WL Range	1	Junei	PRF	7.80	136.76
	2	Kuakhai	PRF	4.80	--
Astarang WL Range	3	Sahana	PRF	322.00	902.08
	4	Nipania	PRF	10.80	5.12
	5	Tavagolara	PRF	71.28	81.39
Balukhanda WL Range	6	Patanaikia	PRF	42.00	105.38
Bramhagir WL Range	7	Gopinathpur-I	PRF	9.60	8.71
	8	Gopinathpur-III	PRF	80.00	20.92
	9	Siaria	PRF	32.80	9.71
	10	Rameswar	PRF	20.40	24.86
	11	Sana Andhari	PRF	40.00	122.49
	12	Bada Andhari	PRF	120.00	303.82
	13	Manikapatana	PRF	92.00	22.94
Total				**853.48**	**1744.18**

2.2.2 Allocation to Different Working Circle & Management Practices:

The Forest Blocks outside the Balukhanda- Konark Sanctuary was included in the Outgoing Plan for management. Depending upon the Crop condition / density, available blank areas, these thirteen blocks as mentioned in Table No 2.7 were managed under

- Rehabilitation Working Circle,
- NTFP (Overlapping) Working Circle,
- Car Timber(Overlapping) Working Circle,
- Wildlife(Overlapping) Working Circle,
- Plantation (Overlapping) Working Circle,
- Forest Protection (Overlapping) Working Circle,
- JFM (Overlapping) Working Circle.

These Forest Blocks were allotted to various Working Circle as furnished in the **Table No 2.8.** Instead of notified area, the GIS computed area has been taken into consideration for Sahana PRF and Kuakhia PRF and allotted accordingly. For rest of the Forest Blocks (11 number), the notified area has been taken in to consideration

Table No:2.8 Allotment to different Working Circles (in Ha) in Outgoing Plan.

Sl no	Name of Forest Block	Area in Ha as per notification	Allotment to different Working Circles (in Ha)						
			RWC	NTFP (O) WC	Car Timber (O) WC	Wildlife (O) WC	Plantation (O) WC	Forest Protection (O) WC	JFM (O) WC
1	Sahana PRF	322.00	902.08	902.08	781.00	902.08	902.08	902.08	902.08
2	Nipania PRF	10.80	10.80	10.80	--	10.80	10.80	10.80	10.80
3	Tavagolora	71.28	71.28	71.28	--	71.28	71.28	71.28	71.28
4	Pattanaikia	42.00	42.00	42.00	--	42.00	42.00	42.00	42.00
5	Junei PRF	7.80	7.80	7.80	--	7.80	7.80	7.80	7.80
6	Kuakhia	4.80	--	--	--	--	--	--	--
7	Badaandhari	120.00	120.00	120.00	--	120.00	120.00	120.00	120.00
8	Gopinathpur-I	9.60	9.60	9.60	--	9.60	9.60	9.60	9.60
9	Gopinathpur - II	80.00	80.00	80.00	--	80.00	80.00	80.00	80.00
10	Manikpatna	92.00	92.00	92.00	--	92.00	92.00	92.00	92.00
11	Sanandhari	40.00	40.00	40.00	--	40.00	40.00	40.00	40.00
12	Siaria	32.80	32.80	32.80	--	32.80	32.80	32.80	32.80
13	Rameswar	20.40	20.40	20.40	--	20.40	20.40	20.40	20.40
Total : 13 Blocks		**853.48**	**1428.76**	**1428.76**	**781**	**1428.76**	**1428.76**	**1428.76**	**1428.76**

On analysis of allocation to different working circle, it is observed that all the forest blocks were under stocked. The prescriptions and present status of crop is as follows.

2.2.3 Rehabilitation Working Circle.

Degraded forest blocks with less than 40% crown density were included in this Working Circle. The operations included regeneration cleaning, soil & moisture conservation, gap planting, block planting along with tending of the crop. Almost all the areas (97.65%) of all the 12 forest blocks PRFs, which are outside the Protected Area of the Division, have been included in this Working Circle. The non-existing Kuakhia PRF has not been taken into consideration. However no ANR or gap planting has been taken up during the plan period.2007-08 to 2017-18.

2.2.4. NTFP (Overlapping) Working Circle:

All the forest blocks of this Division have been allotted to this Working Circle. NTFP potentialities of these forest blocks is very low as three blocks are full of *Casuarina* plantation and most of the forest blocks are in very much degraded condition.

2.2.5 Car Timber (Overlapping) Working Circle.

Out of 902.08 hectare, 781 Ha from Sahan PRF of Astaranga Range have been allotted to this Working Circle with the purpose of supply of firewood to the temple of Lord Jagannath and to *Swargadwar,* the holy cremation ground at Puri. The silvicultural system prescribed was annual clear felling of *Casuarina* plantation with subsequent replanting. The main objective of this Working Circle is to provide / ensure supply of required fire wood to Puri Town especially to Swargadwar and Jagannath Temple for cooking of Mahaprasad. Non-working of the coupes may cause disruption of supply of fire wood for the purpose. As these plantations protect the sea coast against cyclonic storm, a conservative approach should be adopted while allotting area from these blocks to Car Timber Working Circle.

2.2.6 Wildlife Overlapping Working Circle:

All the forest blocks of this Division have been allotted to this Working Circle. The coastal forests under Puri Wildlife Division provide a very good habitat for the spotted deer (*Axisaxis*) with low concentration of other wildlife. The wildlife are more abundant in the forest blocks

under Balukhanda – Konark wildlife sanctuary for which a separate Management Plan is in vogue.

2.2.7 Plantation Overlapping Working Circle.

No area under any forest block has been specifically allotted to this Working Circle in the Division. No block plantation as per the prescription has been taken up during the plan period in any other forest block except replanting of coupe area under Car Timber (Overlapping) Working Circle in Sahan PRF of Astaranga Range.

2.2.8 Forest Protection Overlapping Working Circle.

All the forest blocks of this Division have been allotted to this Working Circle. The prescriptions included silvicultural operations, rigid protection measures, improvement in communication etc.. Most of the activities prescribed for this Working Circle have also been prescribed in other Working Circles. As all the forest blocks are in the costal belt and works as a shelterbelt, its protection has been greatly stressed in the outgoing plan.

2.2.9 JFM (Overlapping) Working Circle.

All the PRFs of the Division have been included under this Working Circle and there are 38 VSSs existing in Puri Wildlife Division who are involved in forest protection in different forest blocks (PRFs and VFs). Out of these total 38 VSS, 22 no of VSS have been registered and a definite forest area has been assigned to all of them for protection (Area allotted: 380.36ha). There is no further scope of formation of new VSS in villages as the total area of most of the forest blocks have already been assigned to VSS.

The details of result / outcome, execution of prescriptions are discussed under **"Past System Of Management"**under **CHAPTER-11.**

2.3 Percentage of Forest with Secured Boundaries:

There are one Reserved Forest, 19 Proposed Reserved Forests and 41 Village Forests. The boundary length / number of pillars etc are furnished in **Table No 2.9**

The Boundary Pillar position has been verified by the Range Staff and the condition of Pillars has been recorded. During verification, the Latitude / Longitude of pillars have been recorded through GPS and a separate register has been maintained in the range for future reference. Their observations have been summarized as **"Good", "Damaged" and "Missing".** The

Boundary length of Balukhanda RF has been computed from the available Map and mentioned here as no record indicating its boundary length is available.

Table No 2.9: LIST OF FOREST BLOCK WITH LENGTH OF BOUNDARY LINE & NO. OF PILLARS.

Sl. No.	Name of Range	Name of RF/ PRF	Area in Ha	Length of boundary (in RKM)	Condition of B. Pillars (No.)			
					Total	Good	Damaged	Missing
1	Balukhanda	Balukhanda RF	1566.19	18.90	60	55	5	0
2	Balukhanda	Balighai PRF	1190.96	25.35	89	72	17	0
3	Balukhanda	Pattnaikia PRF	42	5.67	31	18	13	0
	Sub Total	**3 Block**	**2799.15**	**31.02**	**180**	**145**	**35**	**0**
4	Bramhagiri	Bada Andhari PRF	120.00	5.356	41	0	0	41
5	Bramhagiri	Sana Andhari PRF	40.00	2.78	44	0	0	44
6	Bramhagiri	Gopinathpur-I PRF	9.60	13.02	22	0	0	22
7	Bramhagiri	Gopinathpur-III PRF	80.00	6.09	42	0	0	42
8	Bramhagiri	Rameswarpur PRF	20.40	1.82	22	0	0	22
9	Bramhagiri	Siaria PRF	32.80	2.82	32	0	0	32
10	Bramhagiri	Manikpatana PRF	920	5.5	13	0	0	13
	Sub Total	**7 Block**	**394.8**	**37.386**	**216**	**0**	**0**	**216**
11	Konark	Liakhia PRF	379.80	13.45	45	45	0	0
12	Konark	Konark West PRF	1319.16	16.08	77	77	0	0
13	Konark	Konark East PRF	1447.60	23.15	119	96	0	23
14	Konark	Golora PRF	680.00	3.28	56	22	0	34
15	Konark	Nadiamatha PRF	334.00	13.91	73	56	0	17
16	Konark	Junei PRF	7.80	1.86	21	21	0	0
17	Konark	Kuakhai PRF	4.80	1.2	11	0	0	11
	Sub Total	**7 block**	**4173.16**	**72.93**	**402**	**317**	**0**	**85**
18	Astaranga	Sahana PRF	322.00	17.82	74	6	0	68
19	Astaranga	Nipania PRF	10.80	1.86	18	0	0	18
20	Astaranga	Tovagolora PRF	71.28	3.26	36	3	0	33
	Sub Total	**3 Block**	**404.08**	**22.94**	**128**	**9**	**0**	**119**
	G. Total	**20 Block**	**7771.19**	**164.276**	**926**	**471**	**35**	**420**

The Range Wise Abstract of Boundary pillar position is furnished **Table No 2.10.**

Table No. 2.10: Abstract of Forest Boundary position.							
Name Range	No of Forest Blocks	Total Forest Area in ha	Forest Boundary Length in Km	No of Pillars			
				Total	Good	damaged	Missing
Balukhanda	3 Block	2799.15	31.02	180	145	35	0
Bramhagiri	7 Block	394.8	37.386	216	0	0	216
Gop	0	0	0	0	0	0	0
Konark	7 Block	4173.16	72.93	402	317	0	85
Astaranga	3 Block	404.08	22.94	128	9	0	119
Total	20 Block	7771.19	164.276	926	471	35	420

From the above information & analysis of boundary position, it may be inferred about secured status of Boundary in the division as a whole is “Insecured”.

2.3.1 Boundary Maintainance cycle suggested

The boundary of the forest pillars will be maintain in a cycle of 5 years to improve the boundary condition. Maintainance cycle is furnished below.

Table No. 2.11: Boundary Maintanance cycle suggested.		
Year of Boundary maintainance	Sl no	Name of the forest block
2021-22 &2026-27	1	Balukhanda RF
	2	Sana Andhari PRF
	3	Liakhia PRF
	4	Tovagolora PRF
2022-23& 2027-28	5	Pattnaikia PRF
	6	Bada Andhari PRF
	7	Konark East PRF
	8	Nipania PRF
2023-24 & 2028-29	9	Balighai PRF
	10	Gopinathpur-I PRF
	11	Konark West PRF
	12	Sahana PRF
2024-25 & 2029-30	13	Gopinathpur-III PRF
	14	Golora PRF
	15	Siaria PRF
	16	Kuakhai PRF
2025-26 &2030-31	17	Rameswarpur PRF
	18	Nadiamatha PRF
	19	Manikpatana PRF
	20	Junei PRF

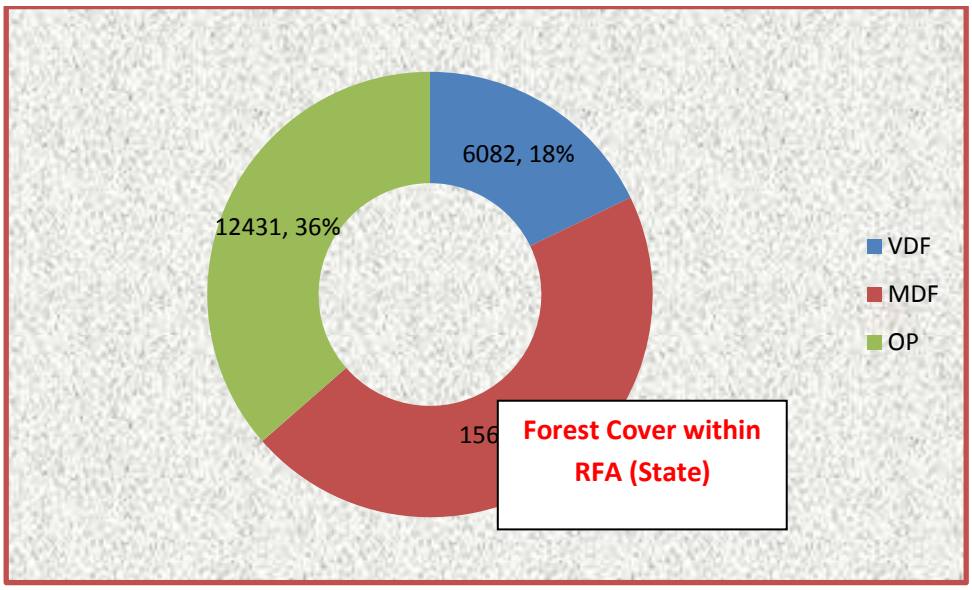
2.4 Land Use, Land Use Change and Forestry (LULUCF):

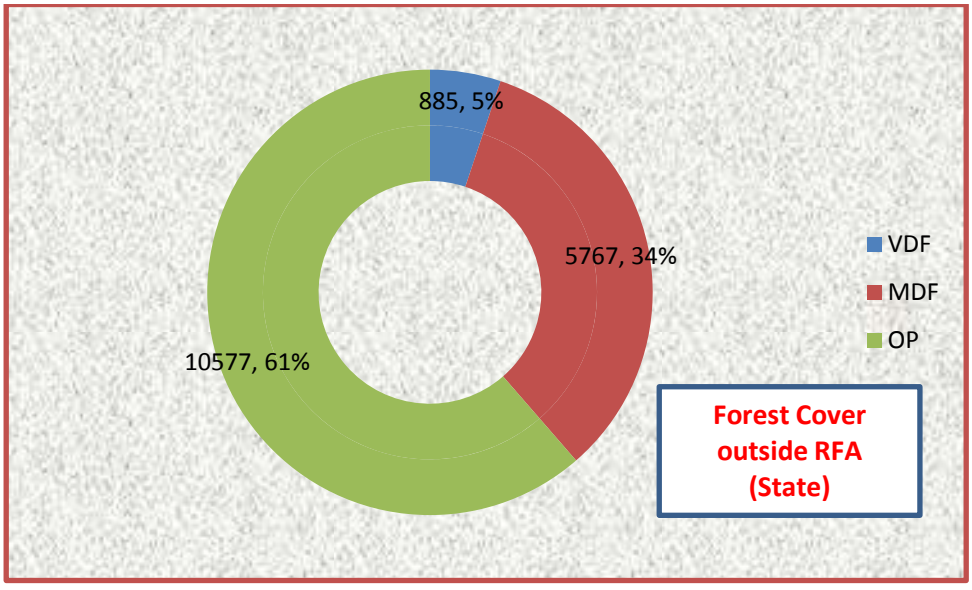
The Forest Survey of India in its Report 2017 indicates change in Forest Cover in the state both within the Recorded Forest area and Outside the Recorded Forest area. The information furnished in the FSI Report for the State and the District Puri is furnished in **Table No 2.12.**

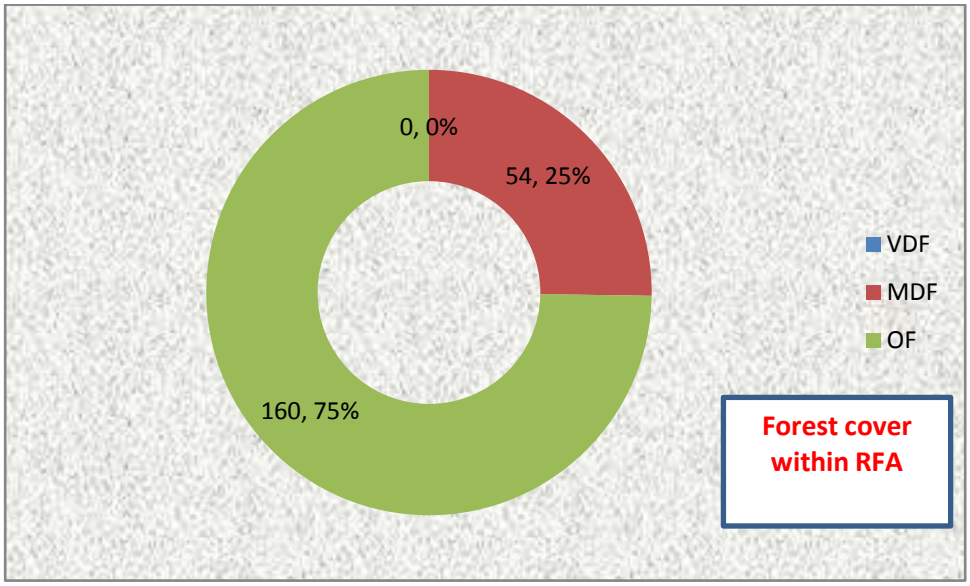
Table No 2.12 Land Use pattern.

Sl No	Land Use Pattern	Area in Sq.km For the State	Percentage	Area in Sq.km For District	Percentage
Forest Cover within Recorded Forest Area (In Sq.Km)					
1	Very Dense Forest (VDF)	6082	17.83	0	0
2	Moderately Dense Forest (MDF)	15603	45.74	54	25.23
3	Open Forest (OF)	12431	36.44	160	74.77
4	Total	34116	100.00	214	100.00
Forest Cover outside Recorded Forest Area (In Sq.Km)					
1	Very Dense Forest (VDF)	885	5.14	NA	
2	Moderately Dense Forest (MDF)	5767	33.47	NA	
3	Open Forest (OF)	10577	61.39	NA	
4	Total	17229	100.00		
5	Total Forest cover (A+B)	51345			
	Tree Cover	3993			
	Total Forest & Tree Cover	55338	35.54		
	%of India's Forest &tree Cover		6.90		
	Per capita Forest & Tree Cover		0.13ha		

(For the Puri District, there is a change in Forest Cover to an extent of 8 sq. km (MDF & OF) and 11 Sq.Km in Scrub Forest.) There is a marginal change in Forest cover which is attributed to Plantations, Increase in crop density due to better protection.


6082, 18%
12431, 36%
156
VDF
MDF
OP
Forest Cover within RFA (State)


885, 5%
5767, 34%
10577, 61%
VDF
MDF
OP
Forest Cover outside RFA (State)



2.5 Threats to the Forest:

The forests of the division are subjected to threat from Natural Calamities as well as from Biotic Factors.

2.5.1 Threat from Natural Calamities:

The threats from Natural Calamities are from

i) Cyclonic Storm,

The Puri (Wildlife) Division is a costal district having about 150 Km of Coast line. The shape of the division is a strip of landmass along the seashore. The maximum width of the land mass in the division is about 34 Km from the Sea coast. In the Bay of Bengal, many low pressure / depression occur during monsoon and it brings heavy rainfall to the State. During October / November Low pressure originating near Andaman Nicobar Island converted to deep depression / Cyclonic Storm / Severe and Very Severe Cyclonic Storm. The Cyclonic Storms are always associated with wind speed of more than 150KM per hour and heavy downpour. During 2013, Cyclonic Storm ***Phailin***, Extremely Severe Cyclonic Storm ***Hudhud*** during October'2014 and Cyclonic storm ***Titli***during October, 2018 followed by heavy rainfall have uprooted young trees, shallow rooted trees and trees with heavy foliage and big old trees of the locality. Casuarina Forests created as shelter belt against wind has also being affected. Frequent cyclonic storms have affected the flora and fauna of the region.

ii) Heavy Flood:

There are many river systems in Puri District. The rivers either drain to Chilika Lake or to the Bay of Bengal. All the river beds have been silted. They have a common characteristic i.e. in summer there is very little or no water streams on it. During rains they receive more water than they can carry. Every year the banks of River are inundated and trees close to bank are seriously affected. As the soil is alluvial and sandy, bank erosion causes loss to fauna & flora of the region.

iii) Shifting of Sand dunes:

A coastal sand dune is a hill of sand built by wind action (eolian process). Dunes are subject to different forms and sizes based on their interaction with the wind. Most kinds of dunes are longer on the windward side where the sand is pushed up the dune, and have a shorter 'slip face' in the leeward side of the wind. The 'valley' or trough between dunes is called a 'slack'. Formation of dunes is through sand accretion. Sand that is brought in by the wind gets trapped by the shrubs, creepers, trees and other obstacles that are found on the coast. This accumulated sand forms mounds of sand that keep growing over the time to form large dunes. Due to formation and shifting of Sand dunes in sea coast, lot of plantations, herbs, shrubs and ground flora are being affected and sometimes buried beyond recovery. Very often the sea changes its coast due to its wave action. it is seen that after a cyclonic storm sea bank erosion takes place at some places and deposition of the sand is noticed in other places by shifting the sand dunes.

iv) Sea Shore Erosion.

Coastal environment is a complex and dynamic eco-system, where there is a constant interaction going on in between land, sea and air culminating in shore line changes. The landward displacement of the shore time caused by the forces of waves and currents is termed as 'Coastal Erosion'. In fact coastal erosion is the wearing away of the land and the removal of beach on dune sediments causing loss of sub-aerial land mass into sea due to natural process like wave action, wave current or drainage. Although coastal erosion is a chronic problem, it is very often considered as inevitable as a natural phenomenon. While the effects of waves, currents, tides and wind are primary natural factors that influence the coast profile, various anthropogenic factors also trigger beach erosion. These include construction of artificial structures along the foreshore, mining of beach sand, off shore dredging on

building dams across river basins. These developments at times are not compatible with the dynamic nature of shoreline.

The Problems of Coastal Ecosystem develops/ persists because of increasing use of coastal region for developmental purposes like industries, fishing, harbors facility and venerability to natural hazards, sea- level rise. The changes along the coast line responsible are Shifting of the shore line, Coastal erosion, Formation of sand bars at the mouth of all rivers of the division. It is noticed that all river bend eastward like hockey stick just before touching the sea at their mouth. The clockwise sea current has not only deposited sand on the mouth, but also obstructed draining of suspended sand coming through rivers, which get deposited on the mouth resulting formation of a sand bar in between river and sea. Such sand bars are called *Nasi* in local language. The shifted river mouth is also not deep enough to discharge river water into the sea. A shallow sand bar at the juncture acts as a barrier for movement of fishing vessels to enter into sea. Therefore most of the time the vessels wait for the high tide to negotiate between harbour in river and sea. Dredging of mouth being cost effective, normally it is not done by any agency.

2.5.2 Threat from Biotic Factors:

The forests are under tremendous pressure due to population rise and increase in demand for land, recreation, Pisciculture, Forest Produce, Grazing etc. The threats from biotic factors are

i) Rapid urbanization and easy access to forests.

The Forest area in the division is only 4.57%. The total population of the Division as per Census 2011 is 13 lakh (2011 census data). The per capita forest land of this tract is only 0.006 ha which is very insignificant from any point of consideration. Land grabbers are encroaching upon the forest land. Most of the PRFs and Village Forests are affected by encroachment.

ii) Illegal collection of timber and firewood.

Casuarina (Jhaun) is the main species mostly planted in Forests of this division. Acacia plantation and Cashew *(Anacardium occidentale)* plantations are also seen in the division especially in Balukhanda and Brahmagiri Range.The nearby villagers depend heavily on these forests for fire wood. The needle of Casuarina is being collected for firewood by poor people.

Lopping of casuarina for fencing purpose is also seen in the area. Lopping of branches for firewood have seriously affected the growth.

iii) Encroachment of forest.

Land grabbers near to many PRF / Village Forest have encroached the forest land. It is of more serious nature in Brahmagiri Range. Though forest cases have been booked, it is not sufficient to deter the land grabbers. It is required to make the forest land free from encroachment and cover under plantation. Lack of Boundary Pillar in many cases facilitates encroachment. The PRFs of Brahmagiri Range are mostly encroached and Cashew plantations have been raised and harvested by the public. The list of Forest Blocks mostly encroached and not available for management are furnished in table no 2.13

Table No 2.13 List of Forest Blocks (PRF /Village Forest) under full encroachment.

Name of Range	Name of Forest Block	Area in Ha
Bramhagiri	Bada Andhari PRF	120.00
Bramhagiri	Sana Andhari PRF	40.00
Bramhagiri	Gopinathpur-I PRF	9.6
Bramhagiri	Gopinathpur-III PRF	80.00
Bramhagiri	Rameswarpur PRF	20.4
Bramhagiri	Siaria PRF	32.8
Bramhagiri	Manikpatana PRF (P)	92.00
Konarka	Kuakhia	4.80
	Total	**399.60**

iv) Grazing.

Cattle, Goat and sheep use the forest land as a grazing ground. No area could be closed to grazing due to public pressure. Due to grazing compaction of soil, damage of plantations and spreading of contagious disease to Sanctuary / wild animals have been observed. Lack of ground flora, invasion of weeds due to heavy grazing pressure affects the maturity of soil and plant succession, expected on sandy river beds, estuaries and wetlands.

v) Forest fire.

Though the matter has been dealt in details under Forest Protection Overlapping Working Circle it needs more emphasis. The implementation of the OrissaForest (Fire protection) Rules 1979 has been very poor and fire continues to be the major threat to forest regeneration and

establishment in Puri Wildlife Division, the coastal forests, i.e. dominated with Casuarinas, become the places of tourist attraction during the winter season. The forest areas being very much accessible, people enter into the forest and do picnic and cook their food in open fire chullahs. Even after the picnic the fire is left in the forest and there is every possibility of spreading forest fire, if it is not attended immediately. Similar situation occurs when the traditional fishermen on river banks lit fire for cooking and warming their body in winter while fishing. Most of the forest blocks experience some fire every year. At present, mitigation measures are undertaken as per the SOP (Standard Operating Procedure) to tackle the forest fire in different forest blocks of the Division.

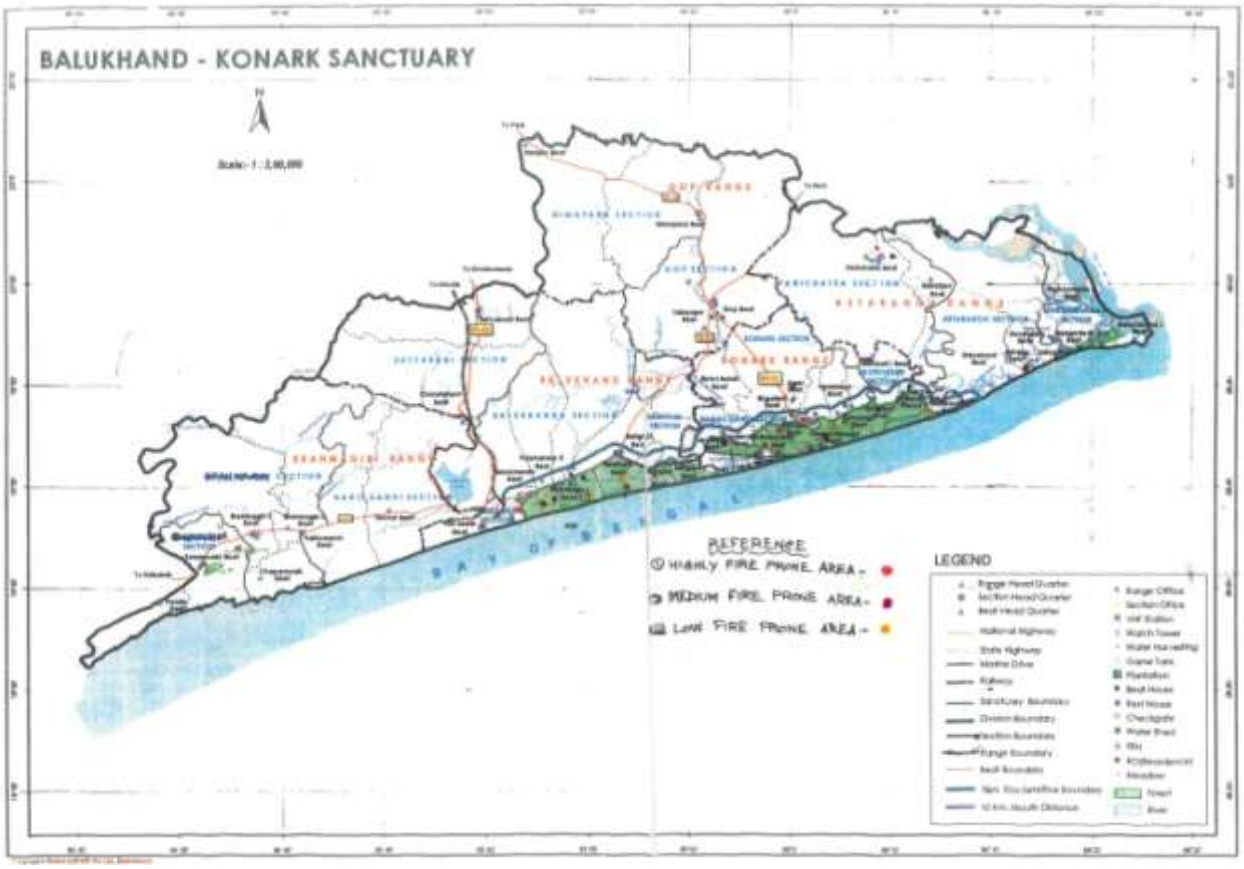
Table No 2.14 Information on Forest Fire incidence incurred during 2012-13 to 2017-18

Year	Name of the Range	Date of fire incident	Total No. of Incidence	Location of the site	Area affected in Ha.	Remarks
1	*2*	*3*	*4*	*5*	*6*	*7*
2012-13	Konark (WL) Range	23.04.2013	02	Kurujanga F/S of Konark East Forest Block	0.5 ha	Forest fire was extinguished by the staff with the help of EDC/VSS members, fire watchers, other deployed watchers and fire service personnel and fire brigade.
	-do-	10.05.2013		Manguleswar F/S of Konark West Forest Block	0.75 ha	
2013-14						
	Konark (WL) Range	17.05.2014	02	Konark F/S Konark West Forest Block	0.75 ha	
	-do-	19.05.2014		Guhalapur F/S of Konark East Forest Block	0.5 ha	

1	2	3	4	5	6	7
2014-15	Konark (WL) Range	09.04.2015	13	Konark F/S of Konark West Forest Block	0.75 ha	Forest fire was extinguished by the staff with the help of EDC/VSS members, fire watchers, other deployed watchers and fire service personnel and fire brigade.
	-do-	15.04.2015		Bhagabati F/S of Konark West Forest Block	0.75 ha	
	-do-	20.04.2015		Liakhia F/S of Konark West Forest Block	0.4 ha	
	Balukhanda (WL) Range	07.01.2014		Balukhanda RF (Compt. XIII)	0.5 ha	
	-do-	22.02.2014		Balighai PRF (Bhuan EDC area)	0.6 ha	
	-do-	17.03.2014		Balighai PRF (Haingora EDC area)	0.3 ha	
	-do-	29.03.2014		Balighai PRF (Bangar EDC area)	1.0 ha	
	-do-	12.04.2014		Balukhanda RF (Compt. V)	0.3 ha	
	-do-	18.05.2014		Balighai PRF (Bangar EDC area)	0.6 ha	
	-do-	28.05.2014		Balukhanda RF (Compt.XIV)	0.3 ha	
	-do-	27.01.2015		Balukhanda RF (Compt. XIII)	0.2 ha	
	-do-	06.03.2015		Balighai PRF (Bangar EDC area)	6.0 ha	
	-do-	07.03.2015		Balighai PRF (Haingora EDC area)	4.0 ha	

1	2	3	4	5	6	7
2015-16	Balukhanda (WL) Range	18.05.2015	04	Balighai PRF (Haingora EDC area)	1.0 ha	Forest fire was extinguished by the staff with the help of EDC/VSS members, fire watchers, other deployed watchers and fire service personnel and fire brigade.
	-do-	23.05.2015		Balighai PRF (Near Beleswar Temple)	0.2 ha	
	-do-	25.12.2015		Balukhanda RF (Compt. XIII)	0.3 ha	
	-do-	27.12.2015		Balukhanda RF (Compt. XIII)	0.1 ha	
2016-17	-do-	19.02.2016	04	Balighai PRF	0.5 ha	
	-do-	20.02.2016		Balighai PRF	0.8 ha	
	-do-	28.01.2017		Balukhanda RF (Compt-VIII)	1.0 ha	
	-do-	04.02.2017		Kushabhadra FS	0.8 ha	
2017-18	-do-	15.02.2018	02	Balukhanda RF (Comp No-IV)	1.8 ha	
	Konark (WL) Range	15.02.2018		Konark East PRF	2.0 ha	

Fire map of the Division



2.6 Distribution of Different Forest Types:

The natural Forests are limited to pockets close to sandy river beds, estuary regularly inundated due to tidal effect. The Forest types of natural vegetation as per Champion & Seth revised Classification is furnished below.

Table No 2.15 Distribution of Different Fortest Type

Group	Sub Group	Type	Name of Forest Block
3- Tropical Moist Deciduous Forests	3C-Nothern Indian Tropical Moist Deciduous Forest.	3C/C3/2S1 – Northern Secondary Moist Deciduous Forest	Tavagolara PRF, Nipania PRF
4-Littoral and Swamp Forest	4A- Littoral Forest	4A/L1 : Littoral forests	River Banks, Islands in Kadua River, Devi River and Confluence area.
	4B- Tidal Swamp Forests	----	----
	4C- Tropical Fresh water Swamp forests:	4C- Tropical Fresh water Swamp forests:	Golara PRF, Nadiamath PRF
5-Tropical Dry Deciduous Forest	5B: Northern Tropical Dry Deciduous Forests	5B/C2- Northern Tropical Dry Mixed Deciduous Forest.	Balukhanda RF
		5B/DS1- Dry Deciduous Scrub Forest.	Sanctuary area.

2.7 Tree Cover outside Forest Area: (TOF).

2.7.1 Tree outside the Forests:

Trees outside forests (TOF) are located on the lands other than forests, including agricultural lands (e.g. agro-forestry systems, farm forestry, industrial plantations, hedgerows, woodlots), built-up areas such as settlements and infrastructure (e.g. street trees, parks and other urban tree systems) and bare lands e.g. sand dunes. As a matter of practice, private people take up tree planting in their land which has proved profitable in comparison to agriculture. Species like Casuarina and Acacia which are more suitable and fast growing in the area are planted in the waste land, water logged areas, back yards, fallow field. They contribute nearly one third of the total growing stock in the coastal areas and more specifically in Puri district. Orchards of Cashew nuts (*Annacardium occidentale)* are very common in the locality of Puri and the

coverage area by cashew plants is on increasing trend. It provides a good source of economic production for community as well as individuals who have raised cashew in their own land. So there is a need to describe and comprehend the dynamics of trees and shrubs on rural and urban land, and their interaction with forest ecosystem. This will lead to a better understanding of off-forest tree management and towards integrated and sustainable management of forests as natural resources.

2.7.2: Mangrove Plantations & Other Plantations:

a) **Mangrove Plantation:**

Under various schemes plantations have been raised in Revenue Forest Lands and fallow lands. Mangroves have been raised in Devi – Kadua estuary i.e. in the revenue land under the Division which covers a considerable area. As per the available record, there is established mangrove forest over 1.08 Sq. Km in Devi – Kadua estuary and 85.00 ha of plantation area till 2015-16 which are yet to be established. The details of mangrove plantations raised during the last plan period are as follows:

Table No 2.16 List of Mangrove Plantation

Year	Name of site	Area planted in ha.	Species planted	Present survival
2007-08	Bank of Kadua river from Sahana to Muhanmuha	30.00	Rai, Guan, Bani, Keruan, Karanja, Banderi etc.	about 60%
2008-09		25.00		80%
2009-10	Belanga	40.00		80%
2012-13	Raiberuhan	35.00		70%
2013-14	Natara	40.00		85%
2014-15	Keutajangha	10.00		85%
2015-16	Nuagarh	10.00		90%
	Total Area planted	**190.00**		

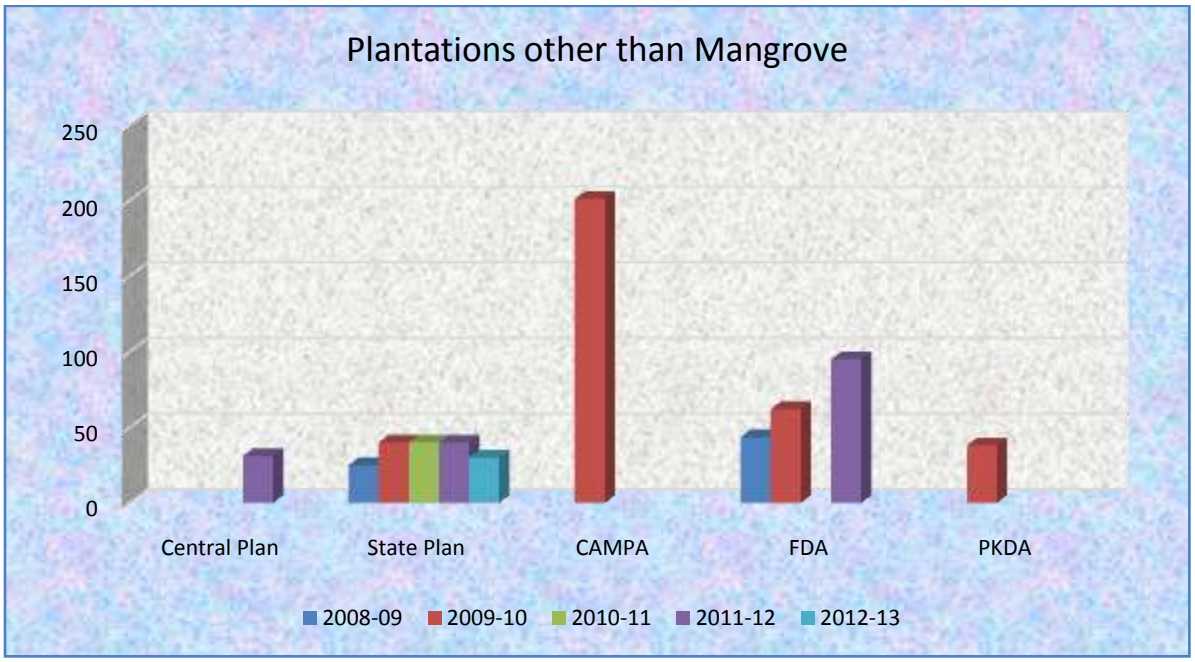
b) **Casuarina / Other Plantation.**

Casuarina & other Plantation is being taken up within Forest area and also outside the recognized forest area (RFA). The plantations raised outside the RFA are enlisted below which contributes towards Tree outside the Forest (TOF) Cover.

Table No 2.17 List Other Plantations (Except Mangrove)

Year	Name of the Scheme	Name of the Range	Name of the sites	Type of plantation	Area in Ha.
1	**2**	**3**	**4**	**5**	**6**
2008-09	State Plan	Astaranga	Sahan, Daluakani	B-Economic Plantation	25.00
2008-09	Forest Development Agency	Brahmagiri	Palanka	FDA Plantation	43.50
2009-10	State Plan	Astaranga	Sahan Forest Block	B-Economic Plantation	40.00
2009-10	Forest Development Agency	Brahmagiri & Balukhanda	Palanka & Balukhanda	FDA Plantation	62.00
2009-10	CAMPA	Brahmagiri, Astaranga, Konark, Gop & Balukhanda	Brahmagiri, Astaranga, Konark, Gop & Balukhanda	Block Plantation	201.00
2009-10	Puri-Konark Development	Balukhanda WL Range	Talabania	Sweet Water Zone Plantation	38.00
2010-11	State Plan	Astaranga WL Range	Sahan PRF	B-Economic Plantation	40.00
2011-12	State Plan	-do-	Sahan PRF	B-Economic Plantation	40.00
2011-12	Forest Development Agency	Gop & Konark WL Range	Jamara, Tailo, Berua , Seura, Tandadhar & Matiapada	FDA Plantation	95.00
2011-12	Central Plan	Balukhanda & Konark WL Range	Balukhanda & Konark	Fodder Plantation	31.00
2012-13	State Plan	Astaranga WL Range	Sahan PRF	Mangrove Plantation	30.00

Table No 2.18 Abstract of Plantations Other than Mangrove.					
Year	Central Plan	State Plan	CAMPA	FDA	PKDA
2008-09		25.00		43.50	
2009-10		40.00	201.00	62.00	38.00
2010-11		40.00			
2011-12	31.00	40.00		95.00	
2012-13		30.00			
Total	31.00	175.00	201.00	200.50	38.00



c) Avenue Plantations:

Avenue Plantations have been taken up along the National Highway/ State Highway/ Major District Roads during last plan period. These plantations also contributetowards TOF. The Year wise avenue plantations raised is furnished in **Annexure- VI.**

d) Seedling Distribution (Farm Forestry / Agro-forestry).

For development of Farm Forestryevery year department is distributing seedlings either free or at a nominal rate. The year wise seedlings distributed and probable coverage of area in Ha (calculated assuming 40% survival rate and 1600 seedlings per ha) is furnished below. **(Table No 2.19)**

Table No 2.19 List of Seedlings distributed			
Year	Scheme	No of Seedlings distributed in lakh	Area of Coverage in Ha (Approximate)
1	2	3	4
2007-08	Nil	Nil	Nil
2008-09	Nil	Nil	Nil
2009-10	Nil	Nil	Nil
2010-11	SP-13th finance commission	3.00	120
	CAMPA	3.00	120
	MGNREGS	1.00	40
2011-12	SP-13th finance commission	3.00	120
2012-13	SP-13th finance commission	3.00	120
2013-14	SP-13th finance commission	3.00	120
	SP-Agro forestry	5.00	200
2014-15	SP-13th finance commission	4.00	160
	SP-Agro forestry	4.00	160
2015-16	SP-Agro forestry	4.00	160
	NP-13th finance commission	4.00	160
2016-17	SP-Agro forestry	6.00	240
	S.S.O-CAMPA	4.00	160
2017-18	Nil	Nil	Nil
	TOTAL	**41.00**	**1640**

2.8 Shifting Cultivation (Jhumming).

The forest area of this division is not affected by shifting cultivation. Hence area under Shifting Cultivation is zero.

CHAPTER-3

MAINTENANCE, CONSERVATION AND ENHANCEMENT OF BIODIVERSITY

3.1 Forest Composition & Distribution:

The Forests of the Division are mostly manmade forest and very little area bears natural forests. The vegetation in natural forest is of pioneer species of Plant succession. There are also species associated with secondary plant succession seen in fresh water wetland, Riparian species on river mouth. Forest composition basing on different Forest Types described under Chapter 2, para 2.6 and area of its distribution is furnished below.

3.1.1 Northern Indian Tropical Moist Deciduous Forest (Type- Secondary Moist Deciduous Forest)

This type of Forest consists of Jamun (Syzizium cumini), Neem (*Azadiracta indica*), Mankada kendu (*Diospyros embryopteries*), Patuli (Lagerstroemis parviflora), Sidha (*Lagrstroemia lanceolata*)and Kanta baunsha (*Babusa bambos*). The under growth consists of grasses, Eupatorium, etc. In the open space heavy Eupatorium affects establishment of natural vegetation and planted species requires uprooting. Kanta baunsha seen in Tavagolara PRF and Nippania PRF covers about 50% of the PRF. Due to non-working of Bamboo, most of the Bamboo clumps became congested. Due to thorny nature, it became non- approachable. Mankada Kendu& Polanga are the main constituent and naturally coming up in Nipania PRF of Astaranga Range.

3.1.2- Littoral Forests (4A/L1)

These littoral forests are seen on the Banks near River mouth. Due to wet and dampening throughout the year, luxuriant growth with better height growth is observed. The species abundantly seen are Guan, Rai, Bani, of Mangrove species. The area covered under mangrove species / forests is about 10 Sq. Km. which is seen all along the confluence of Kadua River with Devi River. Inundation due to tidal waves twice every day and siltation have encouraged this type of vegetation. Patches where the change of land configuration occurred, inundation reduced, the mangrove community is replaced by Casuarina naturally. Nalia grasses are seen all along the strip. Karanja with luxuriant growth is seen on the outer periphery of the mangrove strip. This type of vegetation is observed in Muhanmuha-I beat. The strip width varies from 250m in the north bank and about 100 meters on South Bank of Kadua River. Some patches also seen on the banks of Devi River coming within Puri district/ Division. Since

all the areas are outside the Recorded Forest area it is required to bring them under some legal frame i.e. declaring the areas as PF/ PRF as early as possiblefor their better protection and management.

3.1.3 Tropical Fresh water Swamp forests: (4C).

This type of forest is seen in Golara PRF of Konark range. Main species are Arjun, Jamu, mankada kendu, Kochila, neem and under growth of Beta, Kia. This forest is situated near Prachi River. Due to impounding of water over a large tract, fresh water swamp forest has developed. The dampness is to be maintained to keep its quality / type as such.

3.1.4 Northern Tropical Dry Mixed Deciduous Forest (5B/C2)

Dry mixed Deciduous consists of Arjun, Bamboo, Jamun (Syzizium cumini), Neem (*Azadiracta indica*), Mankada kendu (*Diospyros embryopteries*), Patuli (Lagerstroemis parviflora), Sidha (*Lagrstroemia lanceolata*) and Kanta baunsha (*Babusa bambos*). The under growth consists of grasses, Eupatorium, etc. Now most of the natural species has been replaced by planting of Casuarina. Bamboo occurs in sopme places.

3.1.5 Dry Deciduous Scrub Forest. (5B/DS1)

The thorny vegetations are observed in Golara PRF of Konark WL Range. Due to saline nature of environment salt tolerant species like Firika, Luni Koli, Akhu Koli, Ankula, Bhainch Koli, Khirkoli, Beta (Cane), Vhadoria, Nephada, Sighu (both Leaf and Leaf Less are growing. The average height of the crop is 2m to 4m only. Heavy biotic pressure didn't allow the vegetation towards a climatic climax. The crop remains at an edaphic climax. Due to cyclonic wind the trees remain at a stunted stage.

(Berries of Golara PRF)

(Berries of Golara PRF)

3.2 Plant Species Diversity:

In order to find out plant species diversity no specific study has been taken up by the field staffs of the Division. No other agency has also been engaged to study the plat diversity of both Forests, micro habitat, coastal eco-systems, estuary vegetation etc. But for growing stock estimation, point sampling survey has been taken up in 75 points of 0.1ha area each in different forest locations of this division. The sample point wise plant species diversity is mentioned below (**Table No: 3.1**).

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
01	Tavagolara	Kendu Baunsha Potash	22 38 03	Kendu 35% - Euclaypotash 05%	- - -	- - -	Baunsha 60% - -
02	Sahan PRF	Acacia Jhaun Limba	18 42 16	Acacia 24% - Neem 21%	- - -	- Jhaun 55% -	- - -
03	Muhanamuhan Felling Series	Jhaun Mai	26 03	- Mai 10%	- -	- -	Jhaun 90% -
04	Beleswar Felling Sereies	Jhaun Acacia	29 03	- Acacia 09%	- -	- -	Jhaun 91% -
05	Muhanamuhan Felling Series	Jhaun Acacia	24 04	- Acacia 14%	- -	- -	Jhaun 86% -
06	Muhanamuhan Felling Series	Jhaun	15	-	-	-	Jhaun 100%
07	Muhanamuhan Felling Series	Jhaun Mai	24 03	- Mai 11%	- -	- -	Jhaun 89% -
08	Muhanamuhan Felling Series	Jhaun	22	-	-	-	Jhaun 100%
09	Muhanamuhan Felling Series	Jhaun Acacia	20 05	- Acacia 20%	- -	- -	Jhaun 80% -
10	Golara PRF	Jamu Kochila Ara Jari Bara	15 10 02 01 01	- Kochila 35% Ara 07% Jari 03% Bara 03%	- - - - -	Jamu 52% - - - -	- - - - -
11	Golara PRF	Captera Telakua	10 18	Captera 22% -	- Telakua	- -	- -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		Khirakoli Jamu Kendu	10 03 04	Khirakoli 22% Jamu 07% Kendu 09%	40% - - -	- - -	- - -
12	Golara PRF	Giringa Katha Panasa Cashew Kendu Jamu Kochila	11 10 06 11 10 08	Giringa 20% Katha Panasa 18% Cashew 10% Kendu 20% Jamu 18% Kochila 14%	- - - - - -	- - - - - -	- - - - - -
13	Golara PRF	Casuarina Cashew Acacia Neem	07 04 04 05	Casuarina 35% Cashew 20% Acacia 20% Neem 25%	- - - -	- - - -	- - - -
14	Golara PRF	Jari Bara Kendu Acacia Khirakoli	08 02 10 08 10	Jari 21% Bara 06% Kendu 26% Acacia 21% Khirakoli 26%	- - - - -	- - - - -	- - - - -
15	Guhalapur FS	Casuarina Jamu Gravelia	08 03 04	- Jamu 20% Gravelia 27%	- - -	Casuarina 53% - -	- - -
16	Ishaneswar FS	Gravelia	16	-	-	-	Gravelia 100%
17	Guhalapur FS	Eucalyptus Acacia Gravelia	06 05 29	Eucalyptus 15% Acacia 13% -	- - -	- - -	- - Gravelia 72%
18	Kurujanga FS	Acacia Jhaun Cashew	12 04 04	- Casuarina20% Cashew 20%	- - -	- - -	Acacia 60% - -
19	Guhalapur FS	Jhaun Cashew Acacia Jamu	29 04 03 01	- Cashew 11% Acacia 08% Jamu 03%	- - - -	- - - -	Casuarina78 % - - -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
20	Ishaneswar FS	Casuarina Eucalyptus Gravelia	14 07 01	- Eucalyptus 32% Gravelia 04%	- - -	- - -	Casuarina64 % - -
21	Guhalapur FS	Casuarina Jamu Acacia	10 05 07	- Jamu 23% Acacia 32%	Casuarina 45% - -	- - -	- - -
22	Chandrabhaga FS	Acacia Casuarina	06 03	- Casuarina33 %	- -	- -	Acacia 67% -
23	Guhalapur FS	Jamu	20	-	-	-	Jamu 100%
24	Chandrabhaga FS	Casuarina Cashew	06 02	- Cashew 25%	- -	- -	Casuarina75% -
25	Chandrabhaga FS	Casuarina Cashew	04 05	- -	Casuarina 44% -	- Cashew 56%	- -
26	Nadiamatha PRF	Casuarina Jari Mai Achhu Cashew	08 04 03 04 04	Casuarina35% Jari 17% Mai 14% Achhu 17% Cashew 17%	- - - - -	- - - - -	- - - - -
27	Nadiamatha PRF	Casuarina Neem Jamu Achhu Cashew Bara	29 09 03 03 03 01	- Neem 20% Jamu 06% Achhu 06% Cashew 06% Bara 02%	- - - - - -	- - - - - -	Casuarina60 % - - - -
28	Nadiamatha PRF	Casuarina Neem Cashew	04 10 02	Casuarina25 % - Cashew 12%	- - -	- - -	- Neem 63% -
29	Nadiamatha PRF	Acacia Casuarina Neem Cashew Eucalyptus	10 13 08 03 01	Acacia 29% Casuarina37% Neem 23% Cashew 08% Eucalyptus03 %	- - - - -	- - - - -	- - - - -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
30	Nadiamatha PRF	Casuarina Jari Achhu Kaniara Khirakoli cashew Neem	02 01 01 01 01 04 05	Casuarina13% Jari 07% Achhu 07% Kaniara 07% Khirakoli 07% cashew 26% Neem 33%	- - - - - - -	- - - - - - -	- - - - - - -
31	Manguleswar FS	Casuarina Cashew Acacia	30 01 08	- Cashew 03% Acacia 20%	- - -	- - -	Casuarina77% - -
32	Manguleswar FS	Casuarina Acacia	46 02	- Acacia 04%	- -	- -	Casuarina96% -
33	Manguleswar FS	Casuarina Acacia	03 02	- -	- Acacia 40%	- -	Casuarina60%
34	Manguleswar FS	Acacia Neem Cashew Casuarina	07 02 03 25	Acacia 19% Neem 05% Cashew 08% -	- - - -	- - - -	- - - Casuarina68%
35	Manguleswar FS	Casuarina Cashew Acacia Jamu	03 01 01 01	- Cashew 17% Acacia 17% Jamu 16%	- - - -	Casuarina 50% - -	- - - -
36	Ramachandi FS	Acacia Cashew Casuarina	01 01 25	Acacia 04% Cashew 04% -	- - -	- - -	- - Casuarina92%
37	Manguleswar FS	Casuarina Acacia	09 05	- Acacia 36%	- -	- -	Casuarina64%
38	Manguleswar FS	Casuarina	10	-	-	-	Casuarina100%
39	Manguleswar FS	Acacia Casuarina	14 06	- Casuarina30%	- -	- -	Acacia 70% -
40	Ramachandi FS	Cashew Eucalyptus Casuarina	05 08 16	Cashew 17% Eucalyptus 28% -	- - -	- - Casuarina 55%	- - -

Table No: 3.1 Frequency of Species as recorded during Point sampling							
Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
41	Liakhia FS	Casuarina Cashew Acacia	21 06 01	- Cashew 21% Acacia 04%	- - -	- - -	Casuarina75 % -
42	Liakhia FS	Casuarina Cashew Acacia	13 02 01	- Cashew 13% Acacia 06%	- - -	- - -	Casuarina81 % -
43	Liakhia FS	Casuarina Cashew	30 01	- Cashew 03%	- -	- -	Casuarina97 %
44	Balighai PRF	Cashew Casuarina Bara Neem	01 01 01 01	Cashew 25% Casuarina25% Bara 25% Neem 25%	- - - -	- - - -	- - - -
45	Balighai PRF	Casuarina Cashew Neem Gravelia	01 01 01 01	Casuarina25% Cashew25% Neem 25% Gravelia 25%	- - - -	- - - -	- - - -
46	Balighai PRF	Acacia Casuarina Cashew	01 01 01	Acacia 33% Casuarina34% Cashew 33%	- - -	- - -	- - -
47	Balighai PRF	Cashew Casuarina Acacia	01 01 01	Cashew 33% Casuarina34 % Acacia 33%	- - -	- - -	- - -
48	Balighai PRF	Acacia Casuarina Cashew	01 01 01	Acacia 33% Casuarina34% Cashew 33%	- - -	- - -	- - -
49	Balighai PRF	Acacia Casuarina Cashew Bara	01 01 01 01	Acacia 25% Casuarina25% Cashew 25% Bara 25%	- - - -	- - - -	- - - -
50	Balighai PRF	Eucalyptus Casuarina Acacia Jamu	01 01 01 01	Eucalyptus 25% Casuarina25% Acacia 25% Jamu 25%	- - - -	- - - -	- - - -
51	Balighai PRF	Casuarina Neem Cashew	01 01 01	Casuarina34% Neem 33% Cashew 33%	- - -	- - -	- - -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
52	Compt-13 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34 % Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
53	Compt-13 of Balukhanda RF	Eucalyptus Cashew Acacia Casuarina Jammu	01 01 01 01 01	Eucalyptus 20% Cashew 20% Acacia 20% Casuarina20 % Jamu 20%	- - - - -	- - - - -	- - - - -
54	Compt-12 of Balukhanda RF	Casuarina Acacia Cashew	01 01 01	Casuarina34% Acacia 33% Cashew 33%	- - -	- - -	- - -
55	Compt-12 of Balukhanda RF	Casuarina Eucalyptus Cashew Achhu	07 03 05 01	- Eucalyptus 19% Cashew 31% Achhu 06%	Casuarina 44% - - -	- - - -	- - - -
56	Compt-08 of Balukhanda RF	Cashew Acacia Jammu Casuarina	01 01 01 01	Cashew 25% Acacia 25% Jammu 25% Casuarina25%	- - - -	- - - -	- - - -
57	Compt-14 of Balukhanda RF	Casuarina Cashew Eucalyptus	06 03 03	- Cashew 25% Eucalyptus 25%	- - -	Casuarina 50% -	- - -
58	Compt-14 of Balukhanda RF	Casuarina Cashew	09 01	- Cashew 10%	- -	- -	Casuarina90 % -
59	Balighai PRF	Cashew Casuarina Eucalyptus	01 01 01	Cashew 33% Casuarina34% Eucalyptus 33%	- - -	- - -	- - -
60	Compt-6 of Balukhanda RF	Acacia Casuarina Cashew Bara	01 01 01 01	Acacia 25% Casuarina25% Cashew 25% Bara 25%	- - - -	- - - -	- - - -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
61	Compt-9 of Balukhanda RF	Eucalyptus Cashew Casuarina Acacia Jammu Khirikoli	10 05 03 01 01 01	- Cashew 24% Casuarina14 % Acacia 05% Jammu 05% Khirikoli 05%	Eucalyptus 47% - - - - -	- - - - - -	- - - - - -
62	Compt-11 of Balukhanda RF	Casuarina Cashew Acacia	04 02 01	- Cashew 29% Acacia 14%	- - -	Casuarina 57% - -	- - -
63	Compt-04 of Balukhanda RF	Casuarina Cashew Eucalyptus Acacia Bara Tala	01 01 01 01 01 01	Casuarina17% Cashew 17% Eucalyptus 17% Acacia 17% Bara 16% Tala 16%	- - - - - -	- - - - - -	- - - - - -
64	Compt-02 of Balukhanda RF	Casuarina Acacia Cashew	01 01 01	Casuarina34% Acacia 33% Cashew 33%	- - -	- - -	- - -
65	Compt-07 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34% Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
66	Compt-07 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34% Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
67	Compt-05 of Balukhanda RF	Casuarina Eucalyptus Cashew Bara	01 01 01 01	Casuarina25% Eucalyptus 25% Cashew 25% Bara 25%	- - - -	- - - -	- - - -
68	Compt-03 of Balukhanda RF	Acacia Casuarina Cashew Eucalyptus	01 01 01 01	Acacia 25% Casuarina25 % Cashew 25% Eucalyptus 25%	- - - -	- - - -	- - - -

Table No: 3.1 Frequency of Species as recorded during Point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
69	Village Natia	Neem Mango Acacia Kendu Khirakoli Cashew Kochila	01 01 03 01 01 02 01	Neem 10% Mango 10% Acacia 30% Kendu 10% Khirakoli 10% Cashew 20% Kochila 10%	- - - - - - -	- - - - - - -	- - - - - - -
70	Village Bhubanapur Mouza	Acacia Cashew Khirakoli Asadhua	03 03 01 01	Acacia 38% Cashew 38% Khirakoli 12% Asadhia 12%	- - - -	- - - -	- - - -
71	Village Budhisahi Mouza	Cashew Neem Orange Coconut Jackfruit Mango Acacia Polanga	01 01 01 01 01 01 01 01	Cashew 12.5% Neem 12.5% Orange 12.5% Coconut 12.5% Jackfruit 12.5% Mango 12.5% Acacia 12.5% Polanga 12.5%	- - - - - - - -	- - - - - - - -	- - - - - - - -
72	Village Jenapur	Acacia Casuarina Cashew	02 03 08	Acacia 15% Casuarina23 % -	- - -	- - -	- - Cashew 62%
73	Village Hasinpur	Neem Cashew Casuarina	01 09 02	Neem 08% - Casuarina17%	- - -	- - -	- Cashew 75% -
74	Village Hasinpur	Cashew Acacia Casuarina	08 05 02	- Acacia 33% Casuarina14%	- - -	Cashew 53% - -	- - -

3.2.1 Principles of Biodiversity Index Calculation:

A **diversity index** (also called **phylogenetic or Simpson's Diversity Index**) is a quantitative measure that reflects how many different types (such as species) there are in a dataset (a community) and that can simultaneously take into account the phylogenetic relations among the individuals distributed among those types, such as *richness*, *divergence* or*evenness*. These indices are statistically representations of biodiversity in different aspects (richness, evenness and dominance).

Richness *R* simply quantifies how many different types the dataset of interest contains. For example, species richness (usually noted *S*) of a dataset is the number of different species in the corresponding species list. Richness is a simple measure, so it has been a popular diversity index in ecology, where abundance data are often not available for the datasets of interest. Because richness does not take the abundances of the types into account, it is not the same thing as diversity, which does take abundances into account. However, if true diversity is calculated with $q = 0$, the effective number of types (^0D) equals the actual number of types (R).

3.2.2 Shannon Index:

The Shannon index has been a popular diversity index in the ecological literature, where it is also known as Shannon's diversity index, the Shannon–Wiener index, the Shannon–Weaver index and the Shannon entropy. The measure was originally proposed by Claude Shannon to quantify the entropy (uncertainty or information content) in strings of text. The idea is that the more different letters there are, and the more equal their proportional abundances in the string of interest, the more difficult it is to correctly predict which letter will be the next one in the string. The Shannon entropy quantifies the uncertainty (entropy or degree of surprise) associated with this prediction. It is most often calculated as follows:

$$H' = - \Sigma\, p_i \ln p_i$$

Where p_i is the proportion of characters belonging to the i^{th}type of letter in the string of interest. In ecology, p_i is often the proportion of individuals belonging to the i^{th} species in the dataset of interest. Then the Shannon entropy quantifies the uncertainty in predicting the species identity of an individual that is taken at random from the dataset.

Although the equation is here written with natural logarithms, the base of the logarithm used when calculating the Shannon entropy can be chosen freely. Shannon himself discussed

logarithm bases 2, 10 and *e*, and these have since become the most popular bases in applications that use the Shannon entropy. Each log base corresponds to a different measurement unit, which have been called binary digits (bits), decimal digits (decits) and natural digits (nats) for the bases 2, 10 and *e*, respectively. Comparing Shannon entropyvalues that were originally calculated with different log bases requires converting them to the same log base: change from the base *a* to base *b* is obtained with multiplication by $\log_b a$.

It has been shown that the Shannon index is based on the weighted geometric mean of the proportional abundances of the types, and that it equals the logarithm of true diversity as calculated with $q = 1$:

$$H' = -\sum_{i=1}^{R} p_i \ln p_i = -\sum_{i=1}^{R} \ln p_i^{p_i}$$

This can also be written

$$H' = -(\ln p_1^{p_1} + \ln p_2^{p_2} + \ln p_3^{p_3} + \cdots + \ln p_R^{p_R})$$

which equals

$$H' = -\ln p_1^{p_1} p_2^{p_2} p_3^{p_3} \cdots p_R^{p_R} = \ln\left(\frac{1}{p_1^{p_1} p_2^{p_2} p_3^{p_3} \cdots p_R^{p_R}}\right) = \ln\left(\frac{1}{\prod_{i=1}^{R} p_i^{p_i}}\right)$$

Since the sum of the p_i values equals unity by definition, the denominator equals the weighted geometric mean of the p_i values, with the p_i values themselves being used as the weights (exponents in the equation). The term within the parentheses hence equals true diversity ${}^1D$, and H' equals ln (${}^1D$).

When all types in the dataset of interest are equally common, all p_i values equal to $1 / R$, and the Shannon index hence takes the value ln(R). The more unequal the abundances of the types, the larger isthe weighted geometric mean of the p_i values, and the smaller the corresponding Shannon entropy. If practically all abundance is concentrated to one type, and the other types are very rare (even if there are many of them), Shannon entropy approaches zero. When there is only one type in the dataset, Shannon entropy exactly equals zero (there is no uncertainty in predicting the type of the next randomly chosen entity).

3.2.3 Rényi entropy:

The Rényi entropy is a generalization of the Shannon entropy to other values of *q* than unity. It can be expressed:

$$ {}^{q}H = \frac{1}{1-q} \ln\left(\sum_{i=1}^{R} p_i^q\right) $$

which equals

$$ {}^{q}H = \ln\left(\frac{1}{\sqrt[q-1]{\sum_{i=1}^{R} p_i p_i^{q-1}}}\right) = \ln({}^{q}D) $$

This means that taking the logarithm of true diversity based on any value of *q* gives the Rényi entropy corresponding to the same value of *q*.

3.2.4 Simpson Index:

The Simpson index was introduced in 1949 by Edward H. Simpson to measure the degree of concentration when individuals are classified into types. The same index was rediscovered by Orris C. Herfindahl in 1950.The square root of the index had already been introduced in 1945 by the economist Albert O. Hirschman.As a result, the same measure is usually known as the Simpson index in ecology, and as the Herfindahl index or the Herfindahl–Hirschman index (HHI) in economics.

The measure equals the probability that two entities taken at random from the dataset of interest represent the same type. It equals:

$$ \lambda = \sum_{i=1}^{R} p_i^2, $$

Where *R* is the richness i.e. the total number of types in the dataset. This equation is also equal to the weighted arithmetic mean of the proportional abundances p_i of the types of interest, with the proportional abundances themselves being used as the weights. Proportional abundances are by definition constrained to values between zero and unity, but it is a weighted arithmetic means, hence $\lambda \geq 1/R$, which is reached when all types are equally abundant.

By comparing the equation used to calculate λ with the equations used to calculate true diversity, it can be seen that 1/λ equals ${}^2D$, i.e. true diversity as calculated with $q = 2$. The original Simpson's index hence equals the corresponding basic sum.

The interpretation of λ as the probability that two entities taken at random from the dataset of interest represent the same type assumes that the first entity is replaced to the dataset before taking the second entity. If the dataset is very large, sampling without replacement gives approximately the same result, but in small datasets the difference can be substantial. If the dataset is small, and sampling without replacement is assumed, the probability of obtaining the same type with both random draws is:

$$\ell = \frac{\sum_{i=1}^{R} n_i(n_i - 1)}{N(N-1)}$$

where n_i is the number of entities belonging to the ith type and N is the total number of entities in the dataset. This form of the Simpson index is also known as the Hunter–Gaston index in microbiology.

Since mean proportional abundance of the type's increases with decreasing number of types and increasing abundance of the most abundant type, λ obtains small values in datasets of high diversity and large values in datasets of low diversity. This is counterintuitive behavior for a diversity index, so often such transformations of λ that increase with increasing diversity have been used instead. The most popular of such indices have been the inverse Simpson index (1/λ) and the Gini–Simpson index (1 − λ).[Both of these have also been called the Simpson index in the ecological literature, so care is needed to avoid accidentally comparing the different indices as if they were the same.

3.2.5 Inverse Simpson index

The inverse Simpson index equals:

$$\frac{1}{\lambda} = \frac{1}{\sum_{i=1}^{R} p_i^2} = {}^2D$$

This simply equals true diversity of order 2, i.e. the effective number of types that is obtained when the weighted arithmetic mean is used to quantify average proportional abundance of types in the dataset of interest.

The index is also as a measure of the effective number of parties.

3.2.6 Gini–Simpson index:

The original Simpson index λ equals the probability that two entities taken at random from the dataset of interest (with replacement) represent the same type. Its transformation 1 − λ therefore equals the probability that the two entities represent different types. This measure is also known in ecology as the probability of inter-specific encounter (*PIE*) and the Gini–Simpson index. It can be expressed as a transformation of true diversity of order 2:

The Gibbs–Martin index of sociology, psychology and management studies,which is also known as the Blau index, is the same measure as the Gini–Simpson index.

The quantity is also known as the expected heterozygosity in population genetics.

3.2.7 Berger- Parker Index:

The Berger–Parkerindex equals the maximum p_i value in the dataset, i.e. the proportional abundance of the most abundant type. This corresponds to the weighted generalized mean of the p_i values when q approaches infinity, and hence equals the inverse of true diversity of order infinity ($1/^{\infty}D$).

3.2.8 Effective number of Species or Hill numbers:

When diversity indices are used in ecology, the types of interest are usually species, but they can also be other categories, such as genera, families, functional types or haplotypes. The entities of interest are usually individual plants or animals, and the measure of abundance can be, for example, number of individuals, biomass or coverage. In demography, the entities of interest can be people, and the types of interest various demographic groups. In information science, the entities can be characters and the types the different letters of the alphabet. The most commonly used diversity indices are simple transformations of the effective number of types (also known as 'true diversity'), but each diversity index can also be interpreted in its own right as a measure corresponding to some real phenomenon (but a different one for each diversity index).

Many indices only account for categorical diversity between subjects or entities. Such indices however do not account for the total variation (diversity) that can be held between subjects or entities which occurs only when both categorical and qualitative diversity are calculated.

True diversity, or the effective number of types, refers to the number of equally abundant types needed for the average proportional abundance of the types to equal that observed in

the dataset of interest (where all types may not be equally abundant). The true diversity in a dataset is calculated by first taking the weighted generalized mean M_{q-1} of the proportional abundances of the types in the dataset, and then taking the reciprocal of this. The equation is:

$$ {}^{q}D = \frac{1}{M_{q-1}} = \frac{1}{\sqrt[q-1]{\sum_{i=1}^{R} p_i p_i^{q-1}}} = \left(\sum_{i=1}^{R} p_i^q \right)^{1/(1-q)} $$

The denominator M_{q-1} equals the average proportional abundance of the types in the dataset as calculated with the weighted generalized mean with exponent q-1. In the equation, R is richness (the total number of types in the dataset), and the proportional abundance of the ith type is p_i. The proportional abundances themselves are used as thenominal weights. The numbers are called **Hill numbers of order q** or **effective number of species**.

When q =1, the above equation is undefined. However, the mathematical limit as q approaches 1 is well defined and the corresponding diversity is calculated with the following equation:

$$ {}^{1}D = \frac{1}{\prod_{i=1}^{R} p_i^{p_i}} = \exp\left(-\sum_{i=1}^{R} p_i \ln(p_i) \right) $$

Which is the exponential of the Shannon entropy calculated with natural logarithms (see above). In other domains, this statistic is also known as the *perplexity*.

The value of q is often referred to as the order of the diversity. It defines the sensitivity of the diversity value to rare vs. abundant species by modifying how the weighted mean of the species proportional abundances is calculated. With some values of the parameter q, the value of M_{q-1} assumes familiar kinds of weighted mean as special cases. In particular, q = 0 corresponds to the weighted harmonic mean, q = 1 to the weighted geometric mean and q = 2 to the weighted arithmetic mean. As q approaches infinity, the weighted generalized mean with exponent $q-1$ approaches the maximum p_i value, which is the proportional abundance of the most abundant species in the dataset. Generally, increasing

the value of q increases the effective weight given to the most abundant species. This leads to obtaining a larger M_{q-1} value and a smaller true diversity (^qD) value with increasing q.

When q = 1, the weighted geometric mean of the p_i values is used, and each species is exactly weighted by its proportional abundance (in the weighted geometric mean, the weights are the exponents). When q > 1, the weight given to abundant species is exaggerated, and when q < 1, the weightis given to rare species. At q = 0, the species weights exactly cancel out the species proportional abundances, such that the weighted mean of the p_i values equals 1 / R even when all species are not equally abundant. At q = 0, the effective number of species, ^0D, hence equals the actual number of species R. In the context of diversity, q is generally limited to non-negative values. This is because negative values of q would give rare species so much more weight than abundant ones that ^qD would exceed R.

The general equation of diversity is often written in the form

$$^qD = \left(\sum_{i=1}^{R} p_i^q \right)^{1/(1-q)}$$

3.2.9 Methods adopted to calculate Bio diversity:

There are four Ranges in the division. Each Range is taken as strata. There are 264 Sample plots of 0.1 ha (31.62 m Sq) in each range. Three Sample plot of Binka Range, Six points from Sonepur Range, five points from Ullunda Range and three points from Birmaharajpur Range (total -17 sample point) data have been analyzed for Bio Diversity index) to find out Shannon-Weiner Species Diversity Index, Evenness Index, Index of Dominance using the formula furnished below.

A) **Shannon-Weiner Species Diversity Index** has been calculated as per the following expression:

$$\overline{H} = -\sum \frac{n}{N} \log_e \frac{n}{N}$$

where,

$\overline{H}$ = Shannon-Weiner Species Diversity Index

n = No. of individuals per species

N = Total number of individuals of all species

B) Evenness Index has been calculated by the following expression:

$$\mathbf{e} = \frac{\overline{H}}{\log_e S}$$

where,

e = Evenness Index

$\overline{H}$ = Shannon Weiner Species Diversity Index

S = No. of species

C) Index of Dominance has been calculated by the following expression

$$\mathbf{c} = \sum\left(\frac{n}{N}\right)^2$$

where,

c = Index of Dominance

n = No. of individuals per species

N = Total number of individuals of all species

As most of the blocks under management are of plantation / man made forest, Bio Diversity Index has not been calculated.

3.3 Status of Biodiversity Conservation in Forests:

No systematic scientific study on species wise strata of this division has been carried out in the past. Biodiversity assessment in terms of density, frequency, total basal cover, dominance, etc. has been assessed during Sample plot enumeration. Assessment of biodiversity in different habitats i.e. micro-habitats covering the forests and coastal eco-systems adjacent to the beach, estuary and part of marine habitats requires to be studied in

detail. Though specific mention has been made in the PWPR, no exercise could be taken up due to paucity of funds.

3.3.1 Special Objectives:

The special objectives of forest management to address biodiversity conservation are:

i. To improve the cover and food value of forests,
ii. To create favorable conditions for wildlife,
iii. To develop the forest blocks near villages through rehabilitation and afforestation measures and to create recreational opportunity,
iv. To develop the ground flora and middle story even in plantation in order to attract more wild animals,
v. To increase species diversity by creating favorable conditions for them,
vi. To assess and recommend prescriptions for sustenance of biodiversity,
vii. To identify and map the water resources of the Division.

3.3.2 Past Efforts on Biodiversity Conservation:

During the preparation of outgoing plan, the information on vegetation type, vegetation indices and landscape level biodiversity characteristics had been used for the biodiversity assessment with reference to forest vegetation of Puri (Wildlife) division. The division wise vegetation type delineation and phyto-sociological analysis was done using satellite remote sensing and ground based sample points generated as part of the DOS–DBT project of NRSA on *"Biodiversity Characterization at Landscape Level"* The analysis has been done using sample points available as a part of the biodiversity assessment project and are also exclusively collected for the purpose where ever required.

3.3.3: Present efforts / proposals for Bio- Diversity Conservation:

Presently there is no harvesting practice of forest produce to ensure restoration and conservation of biodiversity. However, harvestable trees planted in Govt. land under various schemes shall be harvested scientifically & keeping in mind to avoid over exploitation followed by replanting the gaps. This will be in such manner and at such rate that it will not lead to the long term decline of the biological diversity thereby maintaining its potential to meet the needs and aspirations of present and future generations, fair and equitable sharing of the benefits arising out of use of biological resources.

3.4 Status of Species prone to over exploitation:

During outgoing plan under Car Timber Working Circle (Overlapping), Casuarina was harvested to supply fuelwood to *ShriJagannath Temple* and *Swargadwar. Casuarinas, Acacia, Cashew* werepreferably planted in this locality, exploitation of these species has no adverse effect on Bio- Diversity.

Outside the forest area, *Borassus flabellifer*, (Palm/tala tree) is abundantly found in the past and associated with Jagannath culture. It's leaves are used for thatching, mats, baskets, fans, hats, umbrellas, and as writing material. All the literature of the old Sanskrit / Odia was written in preserved Palm leaves also known as Palm-leaf manuscript "*Pothi*" (*Tala patra granthas*).The trunk of the tree is used as a timber in construction of building and used as stair steps to the chariots of rath yatra. Though the tree has multifarious uses, its population is decreasing in the locality. This "Tala Gachha"is also a good habitat of weaver birds *(Baiya Chadei)*. Number of weaver birds is also reducing day by day. Plantation of Tala requires to be promoted to save its habitat.

Due to expansion of Road network, many road side trees of age old time have been sacrificed. The main species are Country Mango, Jamun, Bara *(Ficus bengalensis),* Ostha *(Ficus religiosa)*. Now there number in the township, Rural area is reducing. It needs special attention for propagation of these species.

3.5 Conservation of Genetic Resource:

The indigenous species like Kewda/ Kia (Pandanus sp), cane(Calamus), patal garuda (rauwolfia serpentina), etc have been conserved as genetic resources in the past working plan under Protection working circle. However over exploitation of Sagada batua (Combredtum) shrub from natural forests for preparation of incense stick have been noticed. The nuts of Sagada batua shrub are edible by birds and squirrels. Hence conservation of genetic quality of these plant species which are much required for sustenance of the animal kingdom needs to be focused in the revision.

3.6 Fauna and their habitats:

3.6.1 Balukhanda- Konark Wildlife sanctuary:

Balukhanda- Konark Wildlife sanctuary of this division is situated very close to Puri town, the district headquarters. The sanctuary has an area of 87 km² and is located along the Bay of Bengal coast, between the towns of Puri and Konark. The Forest Blocks included in the Sanctuary are Balukhanda RF, Balighai PRF, Liakhia PRF, Konark West PRF, Konark East PRF,

Golora PRF , Nadiamatha PRF. The Forest blocks cover an area of 6917.71 ha or (69.177 Sq. Km). The sanctuary includes sandy beaches, coastal dunes, groves of introduced *Casuarina* treesand cashew plantations. Little of the native flora remains. Other natural floras are Neem (Azadirachta indica), Ghanta (Abutilon sp.), Guakoli, Khirkoli (Monilkra hexandra). A portion of Golara proposed reserved Forest Block of this Sanctuary situated on the mouth of Prachi river supports Mangrove vegetation like Keruan, Rai, Guan along with associates like Mankadkendu, Barakoli, Jamun (Syzigium cummini), Jhumpuri, Canes and Bamboos. The sanctuary was designated in 1984 vide Government notification No.9013/FFAH dated 23rd April, 1984 and the notification was amended vide Government notification No.15261/FFAH dated the 1st September, 1987, in which 70.40 Acres of the Government land in one patch was excluded from the Sanctuary (**Annexure VII& VIII**). The sanctuary was home to Black Buck (Antilope cervicapra) which is not found since 1999. Now spotted deer (Axi axis) is the flagship species of this sanctuary. Other species seen are Hyena (Hyaena sp.), Jungle Cat (Felis chaus), Jackal (Canis aureus), Fox (Vulpes vulpes), Monkey (Macaca sp.), Hare (Lepus sp.), and Monitor Lizard (Varanus sp.). The Eco- Sensitive Zone (ESZ) has been notified vide No S.O.1654(E) dated 19th May, 2017 (**Annexure IX**) covering an area of 21.50sq. km.The ESZ includes 30 villages / towns. The Eco-sensitive Zone is bounded by 19º54’03.5"N latitude and 86º13’34.2”E longitude towards east; 19º48’14.4"N latitude and 85º51’35.0"E longitude towards west-south; 19º52’45.0"N latitude and 86º01’01.8”E longitude towards north and 19º51’15.3"N latitude and 86º04’33.9"E longitude towards south.

The management of the sanctuary mainly focused on development of meadows, plantation of fodder trees on the bunds of water bodies, creation of water bodies, salt licks, eradication of invasive weeds as measures to habitat improvement. Protection measures included fire protection, foot patrolling, camping of anti -poaching and anti-smuggling squads at vulnerable places and check gates. Monitoring of staff movement have been done by GPS PDA. Patrolling has been strengthened by engagement of vehicles in the sanctuary. Maintenance of infrastructure includes roads, buildings and VHF network. List of Flora and Fauna is placed in **Annexure-X.**

3.6.2 Wildlife outside the Sanctuary:

a) **Olive Ridley Sea Turtles:**Olive Ridley Sea Turtles *(Lepidochelys olivacea)* nest on the beaches especially at Mouth of Devi River. Every Year they come to specified area for mass nesting during January, February. There are sandy islands where such nesting

takes place. Every year about 5000 to 8000 Olive Ridley turtles are coming to the beach for lying of eggs.

b) Spotted Deer *(Axis axis*), Hyena (Hyaena sp.), Jungle Cat (Felis chaus), Fishing Cat (Prionailurus viverrinus).Jackal (Canis aureus), Fox (Vulpes vulpes), Monkey (Macaca sp.), Hare (Lepus sp.), Monitor Lizard (Varanus sp.), Mongoose (*Herpestes edwardsi)* are also seen outside the protected area. Crop raid by spotted deer are comely seen in villages far away from the sanctuary.

c) **Snakes (Reptiles):** Various Snakes are observed on sea coast.

d) **Red crabs or horseshoe crabs:** Red crabs or horseshoe crabs have been seen in large numbers in Chilika, Nuanai, Ramchandi and Devi estuaries along the Puri coastline with around one crore alone at the Devi river estuary on the Devi island during January,2016. While the real reason behind this unnatural phenomenon is being examined, researchers have said that red crabs, native of Christmas Island in Australia are migrating to other shores around the world.Nearlyafter 30 years these red crabs have returned to Devi river estuary. Red crabs search for their food in river estuaries, mangrove forests and vegetation growing on saline marshy lands along the coast. The sudden appearance of red crabs in such large numbers is a special attraction both for the tourists and the locals.

e) **Avifauna (Birds):**

Due to proximity to Sea, presence of many water bodies and rivers, many birds' species are observed in the division. The species available are white bellied Sea Eagle, Peregrine falcon, Kites, Owls, Bats, Baya weavers, King Fishers, Indian Rollers, Barbets, Gulls, Darter, Sand piper, Snipes, Great Cormorant, Herons, Egrets, Asian open bill, Ducks, Lapwings etc. Heavy birds population is noticed on the patha (small Island)within Kadua River are of tourist attraction. During winter, bird's population in this Muhanmuha area goes up to Fifty thousand.

3.7 Threats and Challenges to wildlife:

Threats and challenges to wildlife of this region is mostly from biotic pressure, tourists, pollutions etc. The threats are summarized as follows.

3.7.1. Threats to Wildlife and Birds:

a. **Fast expansion of urbanized area:** Shrinkage of Habitat due to land grabbers, heavy movement of human beings in the forests is the most threat to animals.

b. **Natural calamity:** Cyclonic Storm in the Bay of Bengal always poses a threat to animals / birds even to human beings. Black Buck considered being the flagship species of Balukhanda- Konark Sanctuary became extinct during 1999 super cyclone. Subsequent cyclone also deters the management to implant this species again.

c. Heavy Traffic on National Highway /State Highway and Marine drive close to Sanctuary:

Location of Sanctuary nearer to marine drive and National High ways which run through the Division and having good networks of roads inside the Division with heavy traffic affecting the tranquility of sanctuary. Tourist attraction spots like Sun temple of Konark, Sri Jagannath Temple, Puri, Ramchandi, Baliharchandi, Gangadevi , Beleswar, Balikapileswar etc attract a lot of tourists to the area. Speeding vehicles on the well built road network pose a threat to the free movement of wildlife in the area. About 8 to 10 spotted deer and many small mammals die due to road accident.

d. **Picnic in Forest near to Sea shore:** Large numbers of tourists travel through the Marine drive from Puri to Konark and on the way get into the forest area for picnicking or sightseeing and leave a lot of garbage in the forest. Dumping of garbage in the area poses threat to the sanitation and health of wildlife. Polythene, plastics and thermo cool is a real serious issue to wildlife. Aesthetic beauty of the area is also being badly affected due to the unwaist garbage. Fire sometimes spreads to forest from the picnic spots.

e. **Forest Fire:**A lot of visitors come to the forest areas in the coastal belt for picnicking during winter. Although efforts are taken to prevent entry of people deep into the forest, still cases of open fire in the forest are noticed. In some cases, forest fire due to such picnickers becomes a cause of concern for the protection of wildlife. Traditional fishermen cook food on river banks close to the forest and sanctuary area. Make accidental fire spreads from the cooking sites to the nearby forest posing threat to the terrestrial animals.

f. **Pollution:** Tourist inflows, High vehicle exhaust, use of polythene have affected the pollution level on soil, Air and water. It is seriously affecting the health of animals, birds. Now Government has banned use of Polythene in Puri Township with effect from 2nd October'2018. Contamination of water body, toxic substance from sewerage,

increase acidity of soil and water, remnants of insecticides from agricultural fields is affecting the marine life of this division.

g. Poaching of animals / Birds:

Thought it is not much common in this area still incidence of poaching is noticed.

3.8 Protection & Management of Fauna:

The Sanctuary is being managed as per "Sanctuary Management Plan". Besides the provisions embodied in the Sanctuary Management Plan, the following steps are being taken to augment Protection & Management of Fauna of this region.11

- Steps are taken to improve / create water body in forest areas to make sweet water available to animals.
- Expansion & Improvement of Habitat through plantations and help establishment of natural regeneration through silvicultural practices.
- Protect & improve ground flora by reducing Forest Fire and regulating grazing.
- Creation of Meadows artificially with intensive cultivation of Humidicola grass (Tully grass) with sprinkler irrigation and fencing to meet the fodder requirement of the herbivores of the sanctuary.
- Fruit bearing and fodder plantations are taken up on bunds of water bodies created
- Fencing of sanctuary is done with construction of compound wall to prevent encroachment.
- Anti-poaching and anti-smuggling camps have been established at vulnerable places to protect wild animals and their habitat.
- Regular patrolling is taken up to check illegal activities inside forest area.
- Maintain Mouth of Devi Nasi to receive Olive Ridley Turtles during mass nesting.
- To educate people on wildlife, against use of insecticides specially near to water body, river banks and sea shore.
- People's participation has been ensured through formation of Eco Development Committees in the villages around the sanctuary.
- Steps are being undertaken to re-introduce Black buck into the sanctuary by bringing few of them from Bhetnoi and Buguda area of Ganjam district.

CHAPTER-4

MAINTENANCE AND ENHANCEMENT OF FOREST HEALTH & VITALITY

4.1 Status of Regeneration

During enumeration of trees on Point Sampling basis, regeneration survey has been taken up in accordance with Para -74 of the National Working Plan Code-2014. The following steps has been followed for regeneration status assessment.

4.1.1 Regeneration of Tree species:

Young plants of tree species up to 10 cm diameter are taken into consideration for assessmentof regeneration status of a particular species as practiced in National Forest Inventory by FSI.Data collected from the square plots of 3x3m for saplings (2cm to 10 cm collar diameter) andfrom the square plots of 1x1m for seedlings has been taken to assess the regenerationstatus of species in the management unit (compartment, village or any other unit). Based on the phyto-sociological data from plot level enumeration, the regeneration status of the sampledspecies is assessed in the following categories:

Table No 4.1 Regeneration Assessment Criteria

Category	Criteria	Observation / Forest Block/Species wise
Good regeneration	Seedlings are more in numbers than the saplings and likewise saplings is more than that of adults. (Number of Seedlings > Saplings> Adult	NIL
Fair regeneration:	Seedlings are more in numbers than the saplings but the saplings are equal or less than that of adults. Number of Seedlings > Saplings = or < Adults	Tavagolara PRF and PRFs under Cashew plantations.
Poor regeneration	Species survives in only sapling stage, but not as seedlings (though sapling may be less, more or equal to adults).Seedlings absent; Saplings < or = or > Adults.	Nil
No regeneration	Species is absent both in sapling and seedling stage, but present as adult.	Nil
New regeneration	Species has no adults but only sapling and/or seedlings	All plantations.

4.1.2 Assessment of Bamboo / Rattans (Cane):

All culms occurring in the clump has been enumerated as per different classes of National Forest Inventory and these data has been used to assess the availability of bamboo/rattan using post stratification for a management unit as per the methodology adopted by FSI. Data from plotenumeration has been used to estimate the number of clumps per management unit (compartment, village or any other unit) and inference has been derived basing on the following criteria.

Table No 4.2 Bamboo Clump Status Criteria

Inference	Condition of Bamboo / Rattans	Observation Forest / Village wise
Luxuriant	All healthy, un-congested, undamaged and in good condition	Tavagolara PRF, Nipania PRF and Junei PRF
Degraded	Not capable of being rehabilitated and of attaining normal productivity	Nil
Cultivable	Not included in above category.	Nil
Non-clump forming bamboos	Single Culm	Nil

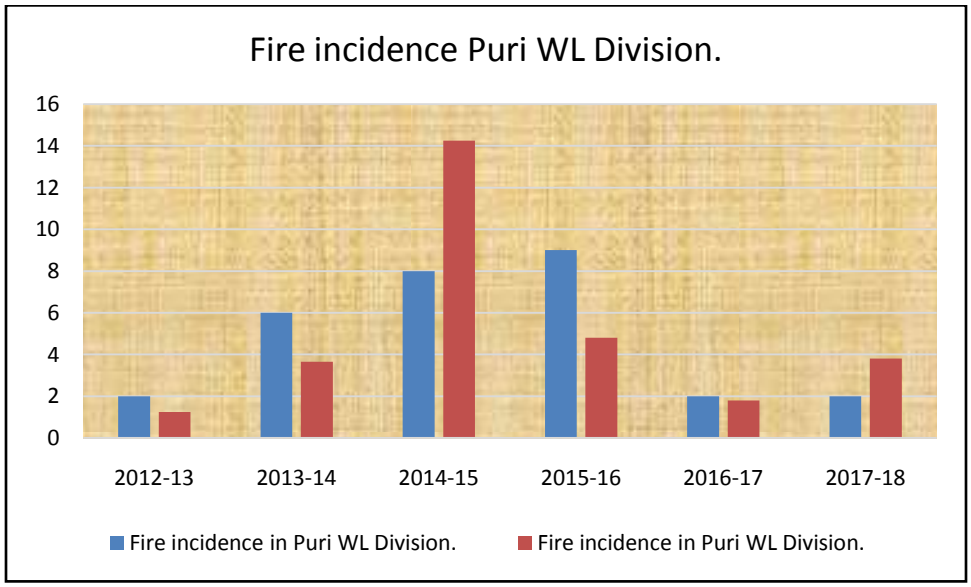
4.2 Area affected by Forest Fire:

Forest Fire continues to be the major threat to forest regeneration and establishment in Puri (Wildlife) Division, the coastal forests, i.e. dominated with Casuarinas, become the places of tourist attraction during the winter season. The forest areas being very much accessible, people enter into the forest and do picnic and cook their food in open fire chullahs. Even after the picnic the fire is left in the forest and there is every possibility of spread of forest fire, if it is not attended immediately. Most of the forest blocks experience some fire every year. At present, mitigation measures are undertaken as per the SOP (Standard Operating Procedure) to tackle the forest fire in different forest blocks of the Division. Fire Watcher system needs to be strengthened with provision of modern fire fighting equipments. The forest fringe village where the vulnerability of fire is more are to be identified. In these villages the VSS need to be motivated and incentive should be given (for seven months i.e. from November to May every year) to prevent forest fire. The local officials of other departments should also be involved so that information regarding forest fire is obtained early for needful action. On experimental basis some NGO's may be entrusted to motivate to

forest fringe villagers to prevent forest fire on payment reasonable remuneration. However the advance technology of remote sensing may be facilitated for check of regular fire occurrence. As per the available records, the occurrence of forest fire during last 3 years is furnished below.

Table No 4.3 Fire Incidence in Puri WL Division

Year	Total no of incidences	Total area covered in ha	Remarks
2012-13	02	1.25	Forest fire was extinguished by the staff with help from local EDC /VSS members and Fire service.
2013-14	6	3.65	
2014-15	8	14.25	
2015-16	9	4.8	
2016-17	2	1.8	
2017-18	2	3.8	



The state government has formulated a standard operating procedure to check forest fire. The basic principles of SOP for firefighting are furnished below.

a) **Fire Line / Fire Break to be created & maintained**: It may come into existence naturally or be man-made. Rivers, lakes or canyon are natural firebreaks, while roads, four-wheel drive trails or highways act as man-made firebreaks in the forests.

b) **Use of Satellite Imagery:**Steps are being taken to take photographs of forest fire through satellites, and accordingly, inform the respective forest officials immediately through short message service (SMS) to contain it.

c) **Exchange /Communication of Information:** Information on forest fire is being exchanged between the control room in the state forest headquarters and those set up in the forest divisions. Alerts are to be sent to the concerned officials and also feedbacks on the follow-up actions to be ensured.

d) **Deployment of Fire Fighting Squad with Vehicles**. Fire fighting squads in ranges has been deployed. During fire season vehicles have been provided for speedy movement of the squad.

e) **Use of Fire Brigade:**Assistance of nearby fire brigades is also being taken considering the intensity of fire. Fire extinguishers are also being provided to Ranges. Fire Fighting persons are being engaged in ranges prone to Forest fire.

f) **Incentives to VSS / EDC:** Involvement of VSS / EDC are ensured for forest fire management. In order to encourage them incentives to VSS / EDC for firefightingis being practiced.

4.3 Area damaged by Natural Calamities:

Damage due to fire is not conspicuous because it is ground fire and doused at its first sight. Shifting of sand dunes sand bars in the river bed and sea beach are common phenomenon. Hactares of such area are washed away causing serious damage to nesting sites of sea turtle and casuarina plantations raised on coast line. Super cyclones at regular intervals have wiped out the Blackbuck population from the division and uprooted many valuable trees. Although exact extent of area has not been assessed the damage has been noticed in all forests, but the damage are being replenished by plantations.

4.4 Area Protected from Grazing:

No forest block has been declared as “Close to Grazing”. However all plantations are closed for 1st three years to grazing in order to avoid damage to plantations. Area under natural regeneration is also required protection against grazing for establishment of regeneration.

4.5 Lopping Practices:

Collection of fire woods from forest by local villagers are seen in *Casuarina* plantations. People collect twigs / branches for fire woods. These people sometimes resort to lopping / pruning of branches more than permissible limits which hinders the growth of plants.

Plants like Casuarina, *Samania saman (Bada Chakunda), Dalbergia sisoo (Bali Sisoo), Artocarpus hetrophyllus (Jack fruit), Zyziphus jujuba (Barakoli), Bamboo*e usually lopped by

people for fodder purpose. Lopping is considered as one of the management practice for these species.

4.6 Area infested by invasive weed species in Forests:

Forest area where the canopy is opened with permanent gaps, the area is infested with weeds like Eupatorium, Lantana and unpalatable grasses. The forest blocks infested with weeds and extent thereof is furnished below.

Table No4.4 Forest Blocks invaded by weeds.

Sl No.	Name of the Forest Blocks	Invading weeds	Extent of area in Ha (Approximate)
1	2	3	4
1	Sahana PRF	Nagahiri(Lantena), Pokasunga, Gharapodia	100
2	Tavagolara	Nagahiri(Lantena), Pokasunga, Bhaincha,Dudhukoli.	10
3	Nipania	Nagahiri(Lantena), Pokasunga, Bhaincha,Dudhukoli.	
4	Nadiamatha	Nagahiri(Lantena), Pokasunga, Gharapodia	150
5	Golara	Nagahiri(Lantena), Pokasunga, Gharapodia	150
6	Konark East	Nagahiri(Lantena), Pokasunga, Gharapodia, Pabanapyari.	350
7	Konark West	Nagahiri(Lantena), Pokasunga, Gharapodia, Gila, Kanteikoli.	200
8	Liakhia	Nagahiri(Lantena), Pokasunga, Gharapodia	150
9	Junei	Nagahiri(Lantena), Pokasunga,	2.5
10	Balighai PRF	Nagahiri(Lantena), Pokasunga, Gharapodia	150
11	Balukhanda RF	Nagahiri(Lantena), Pokasunga, Gharapodia	200
12	Pattanaikia	Nagahiri(Lantena), Pokasunga.	10
13	Manikapatana	Nagahiri(Lantena), Pokasunga, Gharapodia	25

4.6.1 Practices to Control the weeds:

Controlling of weeds is of paramount importance to allow natural regeneration to establish and check invasion. It may be of Physical method, Chemical method or combination of both.

4.6.1 (a) Physical Method: Controlling the weeds can be possible by uprooting the weeds when it is green (in case of weeds those dies in summer and reappear during rains i.e. annual weeds). Cutting of weeds in green stage / before flowering is also practiced under which no seed formation or seed dispersal is allowed. There are weeds like lantana, those can be controlled / eradicated by cutting followed by controlled burning and uprooting the species. After uprooting, the area must be covered under plantation with extra weeding in first two years. Under tree cover the weeds growth will be substantially checked. Normally the uprooting by manual method is adopted during rainy season when the soil is wet to facilitate proper uprooting and the weed like Eupatorium is not in flowering.

4.6.1(b) Chemical Method: There are Chemicals / Weedicides available in the market which suppress the weeds to a greater extent. Application of such chemicals at pre-monsoon period is more effective. These chemicals trade name along with its main constituents (Components) and application practices are furnished below.

i) Glyphosate 41% SL: It is an Amino Acid synthesis inhibiter. It inhibits the EPSP synthase enzyme, which leads to depletion of key amino acids that are necessary for protein synthesis and plant growth. This should be applied @0.5 Kg active ingredient+200 liters water/acre or 1.2 Ltr formulation+ 200 ltr water/acre during growth phase. The plant can be pruned and applied with this solution after first rain. The soil must remain moist. Avoid inhalation, skin or oral contact with the weedicide. Do not chew tobacco, eat food or smoke during spraying. Follow normal precautions – keep away from food stuff containers and animal food; avoid contact with mouth, eyes and skin; avoid inhalation of the spray mist; spray in the direction of wind; wash thoroughly the contaminated cloths and parts of body after spraying; do not smoke, drink, eat or chew while mixing and spraying; and wear full protective clothing while mixing and spraying.

ii) 2,4-D Dimethyl Amine salt 58% SL: It affects weeds by causing uncontrolled cell division in vascular tissue. This should be applied @1 Kg active ingredient+120 ltr water/acre or 1.8 Ltr formulation+ 120 ltr water/acre during growth phase. The plant can be pruned and applied with this solution after first rain i.e. during active growth phase. Follow normal precautions – keep away from food stuff containers and animal food; avoid contact with mouth, eyes and skin; avoid inhalation of the spray mist; spray in the direction of wind; wash thoroughly the contaminated cloths and parts of body after spraying; do not smoke, drink, eat or chew while mixing and spraying; and wear full protective clothing while mixing and spraying.

Precautions: Chemical weedicides are poisons and it should not be used in wildlife concentrated area, near to water source where it is likely to be leached / washed to water body. This chemical method may be applied to area where physical control is difficult and not supported by financial provision.

4.7 Incidence of pest & Diseases:

No incidence of Pest & Diseases is noticed in forest blocks of this division.*Casuarina equisetifolia*, a fast growing exotic tree of multiple end uses, has been planted extensively in this division. Although various limiting factors affect its successful cultivation, incidence of diseases is most important especially in the wet tropics. Fungal pathogens attack all stages of the tree growth -seedlings, saplings and young trees. *Rhizoctonia solani, Thanatephorus cucumehs*are the major pathogen causing high mortality of seedlings in nurseries. In plantations, trees are vulnerable to stem canker, die-back; pink disease, root infection and blister bark disease, etc. *Trichosporium vesiculosum,* blister bark disease pathogen and *Phomopsis casuarinae*, causing stem canker and dieback resulting in between 10 to 15 per cent mortality in coastal plantations.

i) Damping-off in Casuarina:

It is a most prevalent disease in Casuarina nurseries, highly destructive & cause heavy loss of seedlings.

Causative organisms: *Pythium, Phytophthora, Fusarium* and *Rhizoctonia.*

Causes:

1) High soil temperature,
2) Excessive soil moisture,
3) High soil pH (alkaline),
4) High nitrogen content,
5) Low light intensity due to shading,
6) Hard or clayey soil with poor drainage,
7) Dense sowing.

ii) Major diseases in Casuarina plantations:

The Casuarina plantation are found vulnerable to various diseases viz., stem canker and die back, pink disease, root infection and die back and wilt. The stem canker and die back can be controlled by the application of Bavistan at 0.01 per cent active ingredients.

Wilt disease caused by *Trichosporium* is a serious disease and could be managed with proper soil and water management. Severely damaged trees have to be uprooted immediately to avoid further spreading.

Table No 4.5 Common Diseases of Casuarina Species.

S.No.	Common disease	Control Measure
1.	Damping off	Providing proper drainage in nursery, Seed treatment with Captan or Thiram @ 4g/kg. Soil drenching with Carbendazim @ 0.1 %
2.	Stem canker	Spray with Mancozeb @ 0.25 %
3.	Die back	Removal of infected plant parts and spray with Mancozeb @ 0.25 % or copper oxy chloride@ 0.25 %.
4.	Pink disease	Removal of severely affected plant parts or Scrap the infected portions and apply with Bordeaux Paste.
5.	Wilt disease	Remove the infected trees immediately. Digging the trenches around the infected tree. Scrap the infected portion and spray with Copper oxy chloride @ 0.25 %.

4.8 Forest degradation & its drivers:

Forest degradation is caused mainly due to illegal removal of Forest Produce i.e. timber & Fire wood. Due to Biotic pressure & interference like heavy grazing, ground fire and above all pressure from increasing population which exert pressure on land resulting encroachment. The nature of degradation & its driver are summarized below.

Table No 4.6 Drivers of Forest Degradation		
Forest degradation:	Drivers of Degradation.	Remedial measures.
Loss of Tree cover	Collection of Firewood and timber for local consumption	To provide alternate fuel, timber substitute. To have strict enforcement of protection & legal action.
Loss of Ground Flora	Forest fire.	Regulating Picnic party entering in to Forest / Plantations. Maintaining Fire Lines, Strict vigilance on Forest Fire detection & combating. Taking help of nearby Fire stations / brigades.
	Heavy Grazing.	Regulating Grazing, Practicing Rotational grazing. Development of Grass lands.
	Shifting of sand dunes.	Planting of Grasses, Creepers on sand dunes. Creation of Wind break / Shelter belt
Reduction in Forest area.	River Bank erosion/ Sea Coast erosion.	Planting of Soil binding species on River banks / Sea coast. Rapid stabilization of unsettled sand banks with grass planting. Resorting to construction of structures to prevent bank erosion in extreme cases of importance.
	Land grabbers / Encroachers.	Appropriate legal action, Motivate the encroachers to resort to Agro Forestry.
Bio diversity.	Loss of Bio diversity.	Introduce / protect less known species. Educate students / villagers importance of Bio Diversity. Control use of pesticides in agriculture. Protect Riverine plant succession.

4.9 Pollution Control and Protection of Environment:

4.9.1 Pollution due to Tourism:

Puri, Ramchandi, Chandrabhaga, Konark, Baliharachandi, Brahmagir, Kakatpur, Jahania are some of the important places of tourist interest in this division. Bay of Bengal and its Sea beach are of point of attraction. Every year lakhs of people visit these sites. Tourist related

pollution i.e. dumping of solid wastes, thermocol, plastic and polythene are the major source of pollution.

Negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope up with this use within the acceptable limits of change. Uncontrolled conventional tourism poses potential threats to many natural areas around the tract. It can put enormous pressure on an area and lead to impacts such as soil erosion, increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts a strain on water resources, and it can force local populations to compete for the use of critical resources.

i) DEPLETION OF NATURAL RESOURCES.

Tourism development can put pressure on natural resources when it increases consumption in areas where resources are already scarce.

a- Water resources.

Water, especially fresh water, is one of the most critical natural resources. The tourism industry generally overuses water resources for hotels, swimming pools, golf courses and personal use of water by tourists. This can result in water shortages and degradation of water supplies, as well as generating a greater volume of waste water.

b- **Local resources**.

Tourism can create great pressure on local resources like energy, food, and other raw materials that may already be in short supply. Greater extraction and transport of these resources exacerbates the physical impacts associated with their exploitation. Because of the seasonal character of the industry, many destinations have ten times more inhabitants in the peak season in comparison to the lean season. A high demand is placed upon these resources to meet the high expectations of tourists often they have.

c- Land degradation.

Important land resources include minerals, fossil fuels, fertile soil, forests, wetland and wildlife. Increased construction of tourism and recreational facilities has increased the

pressure on these resources and on scenic landscapes. Direct impact on natural resources, both renewable and nonrenewable, in the provision of tourist facilities can be caused by the use of land for accommodation and other infrastructure provision, and the use of building materials.

Forests often suffer from negative impacts of tourism in the form of deforestation caused by fuel wood collection and land clearing.

ii) POLLUTION.

Tourism can cause the same forms of pollution as any other industry: air emissions, noise, solid waste and littering, releases of sewage, oil and chemicals, even architectural/visual pollution.

a- Air pollution and noise.

Transport by air, road, and rail is continuously increasing in response to the rising number. One consequence of this increase in air transport is that tourism now accounts for more than 60% of air travel and is therefore responsible for an important share of air emissions. Transport emissions and emissions from energy production and use are linked to acid rain, global warming and photochemical pollution. Air pollution from tourist transportation has impacts on the global level, especially from carbon dioxide (CO_2) emissions related to transportation energy use. And it can contribute to severe local air pollution. Some of these impacts are quite specific to tourist activities. For example, especially in very hot weather tour buses often leave their motors running for hours while the tourists go out for an excursion because they want to return to a comfortably air-conditioned bus.

Noise pollution from airplanes, cars, and buses, as well as recreational vehicles is an ever-growing problem of modern life. In addition to causing annoyance, stress, and even hearing loss for its humans, it causes distress to wildlife, especially in sensitive areas. For instance, noise generated by vehicles can cause animals to alter their natural activity patterns.

b- Solid waste and littering

In areas with high concentrations of tourist activities and appealing natural attractions, waste disposal is a serious problem and improper disposal can be a major despoiler of the natural environment - rivers, scenic areas, Sea beach and roadsides. Solid waste and littering can

degrade the physical appearance of the water and shoreline and cause the death of marine animals.

c- Sewage.

Construction of hotels, recreation and other facilities often leads to increased sewage pollution. Wastewater has polluted seas and Rivers surrounding tourist attractions, damaging the flora and fauna. Sewage runoff causes serious damage to marine Changes in salinity and siltation can have wide-ranging impacts on coastal environments and sewage pollution can threaten the health of humans and animals.

d- Aesthetic Pollution.

Often tourism fails to integrate its structures with the natural features and indigenous architectural of the destination. Large, dominating resorts of disparate design can look out of place in any natural environment and may clash with the indigenous structural design.A lack of land-use planning and building regulations in many destinations has facilitated sprawling developments along coastlines, valleys and scenic routes. The sprawl includes tourism facilities themselves and supporting infrastructure such as roads, employee housing, parking, service areas, and waste disposal. In spite of Coastal Zone Regulation many unplanned constructions have come up reducing the aesthetic value of the locality.

iii) PHYSICAL IMPACTS.

Attractive landscape sites, such as sandy beaches, lakes, riversides, Devi River mouth and Puri- Konark marine drive are often transitional zones, characterized by species-rich ecosystems. Typical physical impacts include the degradation of such ecosystems.An ecosystem is a geographic area including all the living organisms (people, plants, animals, and micro-organisms), their physical surroundings (such as soil, water, and air), and the natural cycles that sustain them. The ecosystems most threatened with degradation are ecologically fragile areas such as wetlands, mangroves, Sand dunes, Sanctuary and sea grass beds. The threats to and pressures on these ecosystems are often severe because such places are very attractive to both tourists and developers.Physical impacts are caused not only by tourism-related land clearing and construction, but by continuing tourist activities and long-term changes in local economies and ecologies.

Physical impacts of tourism development can be summarized as follows:

a- Construction activities and infrastructure development.

The development of tourism facilities such as accommodation, water supplies, restaurants and recreation facilities can involve sand mining, beach and sand dune erosion, soil erosion and extensive paving. In addition, road and other related construction can lead to land degradation and loss of wildlife habitats and deterioration of scenery.

b- Deforestation and intensified or unsustainable use of land.

Construction of luxurious resort accommodation and facilities frequently requires clearing forested land. Coastal wetlands are often drained and filled due to lack of more suitable sites for construction of tourism facilities and infrastructure. These activities can cause severe disturbance and erosion of the local ecosystem, even destruction in the long term.

c- Marina development.

Overbuilding and extensive paving of shorelines can result in destruction of habitats and disruption of land-sea connections (such as sea-turtle nesting spots). Evidence suggests a variety of impacts to marine life's from shoreline development, increased sediments in the water, trampling by tourists and divers, pollution from sewage, overfishing.

4.9.2 Regulating Activities:

Considering the importance and fragile nature of the marine eco system, Wildlife Sanctuary, presence of Mangrove habitat, Mass nesting site of River Devi Mouth and adjacent to Bay of Bengal, govt. have placed many regulation to protect the environment. These regulations / Notifications are

a- Coastal Zone Regulation:

Under the Environment Protection Act, 1986 of India, notification was issued in 18th January,2019 for regulation of activities in the coastal area by the Ministry of Environment and Forests (MoEF). As per the notification, the coastal land up to 500m from the High Tide Line (HTL) and a width of 50m along banks of tidal influenced creeks, estuaries, backwater and rivers and water area of such creeks and rivershaving tidal fluctuations, is called the **Coastal Regulation Zone**(CRZ). CRZ has been placed in four categories. The above CRZ zone also includes the inter-tidal zone and land part of the coastal area and the ocean water upto 12 Nautical Miles besides ecologically sensitive areas. The notification imposed restriction on the setting up and expansion of industries or processing plants etc. in the said CRZ. Coastal Regulation Zones (CRZ) are notified by the Govt. of India in 1991 for the first

time. Under this coastal areas have been classified as CRZ-I A, CRZ-I B, CRZ-II, CRZ-IIIA,CRZ-III B, CRZ-IV A, CRZ-IV B.

- CRZ-I A: These are ecologically sensitive areas, which are essential in maintaining the ecosystem of the coast. Those include mangroves, turtle nesting sites sand dunes mud flats etc.
- CRZ-I B: The intertidal zoneinbetween low and high tide line.
- CRZ-II: This zone constitutes the developed land areas form up to the shoreline of the coast within the existing Muncipality or designated urban area.
- CRZ-III A: The areas are having population density more than 2161 per sq km as per 2011 census. the shore line upto 50 mts from HTL is the No Development Zone.
- CRZ-III B: Rural areas having population density less than 2161 per sq km are included in this zone, where upto 200 mts land from HTL is the No Development Zone. Land area upto 50 mts or equal to the width of the creek whichever is less on either sides of the creek are included in this zone and are No Development zone.
- CRZ-IV A: The water area and the sea bed area between the LTL upto 12 NM on the seaward side comes under this zone.
- CRZ-IV B: This zone includes water area and bed area between LTL of both banks of the same tidal influenced water body.

b- Balukhanda- Konark Wildlife sanctuary:

The **Balukhand-Konark Wildlife Sanctuary** is a wildlife sanctuary located in Puri Division / district comprising Balukhanda Reserved Forest, and Six Proposed Reserved Forests (Balighai PRF,Liakhia PRF, Konark West PRF, Konark East PRF, Golora PRF and Nadiamatha PRF).The sanctuary has an area of 87 km², and is located along the Bay of Bengal coast, covering the towns of Puri and Konark. The sanctuary includes sandy beaches, coastal dunes, groves of introduced *Casuarina* treesand native flora. The sanctuary was designated in 1984.

c- Eco- sensitive Zone around the Sanctuary:

In accordance with the provisions of the Environment (Protection) Act, 1986 and Environment (Protection) Rules, 1986, the Central Government declared an extent of 0 metres to 500 metres on the landward side of the Balukhanda-Konark Wildlife Sanctuary in the State of Odisha as the Balukhanda-Konark Wildlife Sanctuary Eco-sensitive Zone covering

an area of 21.50 Sq.Km and bounded by 19º54’03.5"N latitude and 86º13’34.2”E longitude towards east; 19º48’14.4"N latitude and 85º51’35.0"E longitude towards west-south; 19º52’45.0"N latitude and 86º01’01.8”E longitude towards north and 19º51’15.3"N latitude and 86º04’33.9"E longitude towards south.

d- Ban on use of polythene of specified thickness.

The Government of Odisha, Forest & Environment Department has issued notification banning use of polythene , thermocool etc within the municipal limits or as the case may be within the Municipal Corporation Limits of Bhubaneswar, Cuttack, Berhampur, Rourkela, Sambalpur and Puri, namely:-

(i) Polythene carry bags of any shape, thickness and size (excluding compostable);
(ii) Bottled drinking water Polyethylene Terephthalate (PET/PETE) bottles of less than 200 ml. capacity;
(iii) Single use disposable cutleries made up of thermocol (polystyrene) or plastic such as dish, spoon, cup, plate, glass, fork, bowl, straw, pouch to store liquid and container etc. of any size and shape &
(iv) Thermocol decorative materials (flowers and the like)

(Note: Compostable plastics shall conform to the Indian Standard: IS 17088:2008. The manufacturers or seller of compostable plastic carry bags shall obtain a certificate from the Central Pollution Control Board before marketing or selling.)

CHAPTER-5
CONSERVATION & MAINTENANCE OF SOIL AND WATER RESOURCES:

5.1 Area treated under Soil & Water Conservation Measures:

The tract under Puri (Wildlife) Division is mostly plain to gentle slope. The soil is mostly Sandy to sandy loam. Water holding capacity is poor to moderate. Considering the nature of the tract and with an aim to recharge ground aquifer, percolation pits of Size 10 mt X 10 mt have been taken up in Sanctuary area and in 4 PRF.

5.2 Duration of Water flow in Selected Seasonal streams

5.2.1 Rivers within the District / Division.

All the rivers of Puri district have similar characteristics. In the hot weather they are beds of sand interspersed with tiny streams or none at all, while in the rains they receive more water than they can carry. Mostly, all rivers are distributaries of Mahanadi River system. The Rivers are

1) Kushabhadra River- A branch of *Kuakhai* River originates from Balianta and meets the **Bay of Bengal** near the shrine of Ramachandi, located 15 miles (24 Km) east of Puri. Its tributary *Mugei* joins with *Kushabhadra*.

2) Daya River- A branch of *Kuakhai* River drains into the **Chilika** Lake. Two small rivers join with Daya River i.e. the *Gangua* and the *Managuni* below Kanas. Daya River has been attributed with problem of causing silt build-up in **Chilika Lake**.

3) Bhargavi River- A branch of *Kuakhai* meets the **Bay of Bengal** after breaking up into numerous distributaries in the last two and half miles of its course. There are four main branches all branching off from the left bank viz. *Kanchi*, the *East Kania*, the *Naya Nadi* and the *South Kanchi* (which drains into Sar Lake); and by various channel the first three are interconnected and finally join the *Sunamunhi R*iver which falls into **Bali Harchandi** and ultimately drains to the Bay of Bengal sea via the mouth of Chilika. The *South Kania* gets lost in the marshes on the western shore of Chilika.

4) Kadua River- It is a monsoon fed river that drains into *Devi* River.

5) Prachi River- It is a branch of Devi River. It has its origin near Kantapara on Cuttack-Gop road and passes through the village of Kakatpur before draining into the sea of Bay of Bengal.

6) Devi River- It is a branch of *Kathajori*. It runs into Puri district near the extreme east forming numerous branches.

There are also a few small rivers worth mention, chiefly *Ratnachira* and *Luna*, which drain into *Bhargabi River* and *Daya River*respectively.

5.2.2 Seasonal Streams of the Division:

Besides the prominent rivers flowing in the District / Division, there are nalas / rivulets within and outside the forest blocks / sanctuary. These nalas are of Seasonal in nature. The Location of Rivers / Seasonal streams are indicated in the drainage map of the division.

5.3 Wetlands in Forest Areas:

There are few wetlands / marshy places within the Forest area. The location & extent of such marshy places / wet lands are furnished in **Table No: 5.3.** Besides, marshy places in Forest Area, there are also wet lands outside the Forest Blocks but of importance from Conservation Point Of View. Sar Lake was the largest sweet water wetland in Puri district. It was proving drinking water to the Puri town. But gradually the lake has been silted; flow of water has been obstructed due to several civil constructions. The present Talabania sweet water zone used to get recharged from Sar lake underground. The wetland needs revival by desilting. Several wetlands are seen in Brahmagiri range close to Chilika lake. The wetlands in Golara PRF are being used as nesting ground of lesser whistling ducks. The list of Natural water bodies are given in tab 5.1.

Table No 5.1 List of Natural Water bodies and Wetlands of the Division			
Name of the Range	Location	GPS Co-ordination	
		North	East
1	2	3	4
Astaranga WL Range	Devi Nashi to Gandakula	19 57’ 41.69”	86 22’ 26.06”
	Golara to Pata Sundarpur (Prachi River)	20 00’ 36.91”	86 10’ 48.01”
	Beleswar to Keluni Muhan	19 54’ 36.68”	86 14’ 22.69”
	Natara to Keutajanga	19 55’ 01.59”	86 14’ 22.59”
	Kanamana to Gangadevi	19 56’ 38.89”	86 16’ 24.05”
Gop WL Range	Baiakuda Sara	19 58’ 59.4”	86 00’ 54.2”
	Kushabhadra Bridge	20 3’ 39.29”	86 00’ 23.25”
	Kushabhadra River (Nimapada)	20 03’ 39.3”	86 00’ 22.9”
	Dhanua River (Bada Naiguan)	19 59’ 40.2”	85 56’ 35.5”
	Villi deuli Sara	20 4’ 39.2”	86 02’ 19.81”
Brahmagiri WL Range	Kapileswarpur to Patharpada	19 48’ 41.4”	85 44’ 26.9”
	Sunamuhin to Barakudi	19 46’ 10.5”	85 35’ 55.6”
	Dhaba Chhak to Golara	19 47’ 55.7”	85 38’ 45.4”
Konark WL Range	Keluni Mouth	19 54’ 06.7”	86 13’ 26.9”
	Kadua River (Near Chitreswari)	19 54’ 45.0”	86 10’ 11.8”
	Belari Nala	19 54’ 35.7”	86 10’ 18.3”
	Kadua river (Near Tikarapada)	19 56’ 31.66”	86 10’ 51.53”
	Otanga bridge (Kadua River)	19 56’ 50.3”	86 07’ 2.8”
	Ambligaon Jora	19 53’ 54.4”	86 04’ 55.8”
	Patharbasa Nala	19 55’ 59.6”	86 6’ 55.7”
	Ramachandi river mouth	19 51’ 22.7”	86 3’ 32.7”
	Gada Gadia Nala (Near Khalakata patna)	19 52’ 10.2”	86 05’ 35.8”
	Sutan Sara	19 54’ 44.3”	86 02’ 22.1”
Balukhanda WL Range	Kushabhadra Mouth	19 51’ 7.89”	86 03’ 14.46”
	Nuanai Mouth	19 49’ 17.1”	85 55’ 21.2”
	Sara Lake	19 50’ 55.6”	85 52’ 57.1”
	Ratnachira River	19 54’ 0.45”	85 46’ 42.24”

5.3.1 Wetland Classification System:

Modified National Wetland Classification system is used for wetland delineation and mapping comprising of 19 wetland classes which are organized under a Level III hierarchical system. Level one has two classes: Inland and coastal, these are further bifurcated into two categories as: natural and man-made under which the 19 wetland classes are suitably placed. Two date data pertaining to pre- monsoon and post monsoon was used to confirm the classes.

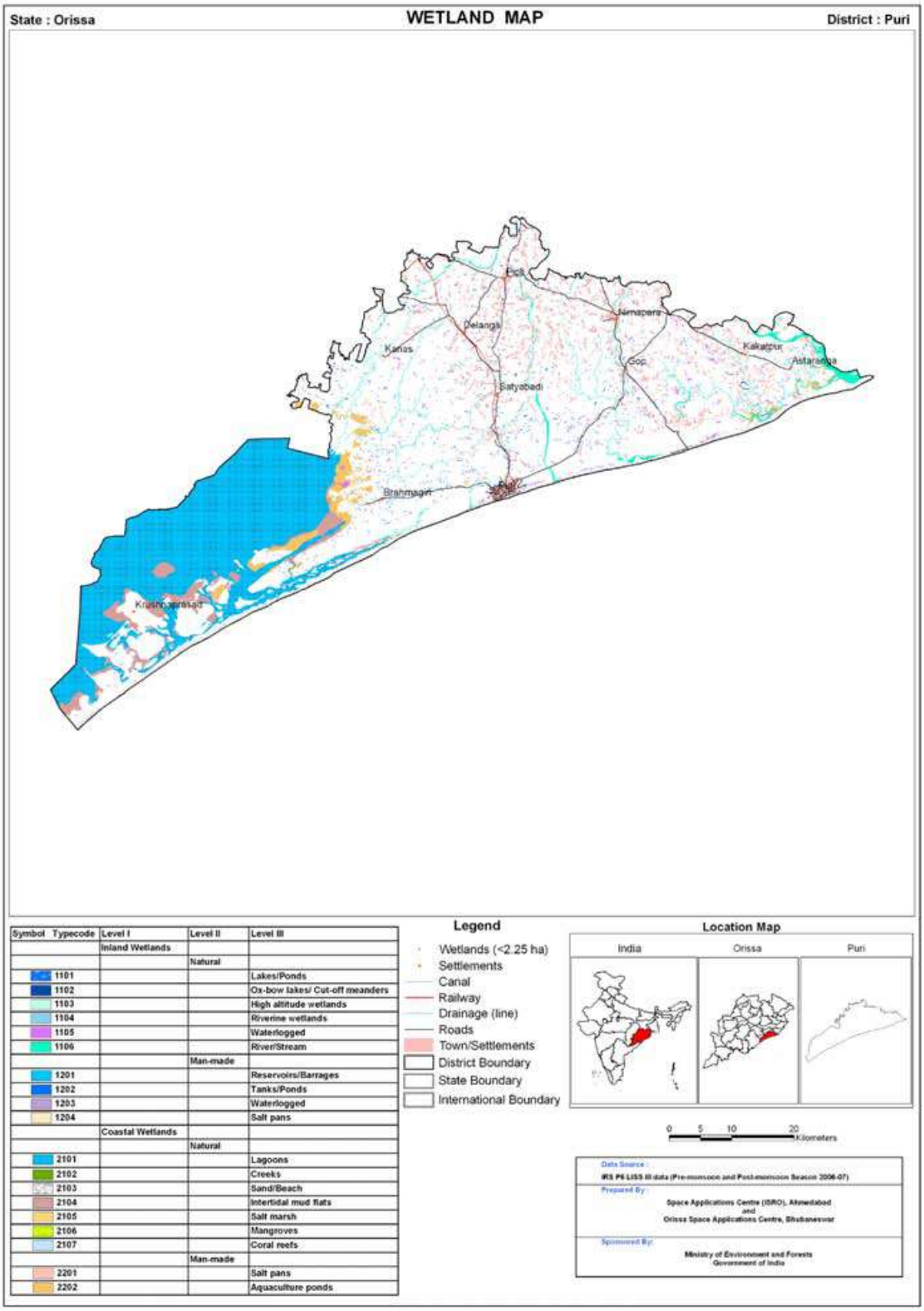
Wetlands put to agriculture use in any of the two dates are not included as wetland class. Definitions of wetland categories used in general is as follows

5.2 Wetland Classification System and coding			
WettCode	Level-I	Level-II	Level-III
1000	Inland Wet Lands		
1100		Natural	
1101			Lakes
1102			Ox- Bow lakes / Cut-Off Meanders
1103			High altitude wet lands
1104			Riverine Wet Lands
1105			Waterlogged
1106			River / Stream
1200		Manmade	
1201			Reservoirs / Barrages
1202			Tanks / Ponds
1203			Waterlogged
1204			Saltpans
2000	Coastal Wetlands		
2100		Natural	
2101			Lagoons
2102			Creeks
2103			Sand / Brach
2104			Intertidal Mud flats
2105			Salt marsh
2106			Mangroves
2107			Coral Reefs
2200		Man- made	
2201			Salt Pans
2202			Aquaculture Ponds

The district data on wetland is furnished below

Name	Geographical Area in (km^2)	Wetland in ha	% of Wet land area	% of Geographic area	Open Water in ha		Seasonal reduction in open water extent (%)
					Post Monsoon	Pre Monsoon	
Puri	3055	98096	14	1.96	59427	65593	9.4

Table No 5.3 Wetland in Puri District							
Sl No	Wett Code	Wetland Category	No of Wetlands	Total Wetland area (in ha)	% of Wetland	Open Water in ha	
						Post Monsoon	Pre Monsoon
	1100	**Indian Wetlands - Natural**					
1	1101	Lakes / Ponds	-	-	-	-	-
2	1102	Ox-bow lakes / Cut-off meanders	6	69	0.07	57	57
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetland	4	36	0.04	36	36
5	1105	Waterlogged	71	659	0.67	449	449
6	1106	River / Stream	40	6637	6.77	6627	6465
	1200	**Inland Wetlands- Man made**					
7	1201	Reservoirs / Barrages	-	-	-	-	-
8	1202	Tanks / Ponds	62	259	0.26	175	175
9	1203	Waterlogged	-	-			
10	1204	Salt pans	-	-	-	-	-
		Total inland	183	7660	7.81	7344	7182
	2100	Coastal Wetlands- Natural					
11	2101	Lagoons	4	72759	74.17	52275	46271
12	2102	Crerks	-	-	-	-	-
13	2103	Sand / Beach	18	1649	1.68	-	-
14	2104	Intertidal Mud flats	70	8565	8.73	-	-
15	2105	Salt march	-	-	-	-	-
16	2106	Mangroves	-	-	-	-	-
17	2107	Coral reefs	-	-	-	-	-
	2200	Coastal Wetlands- Manmade					
18	2201	Salt pans	-	-	-	-	-
19	2202	Acquaculture ponds	107	5974	6.09	5974	5974
		Total Coastal	199	88947	90.67	58249	52245
		Sub Total	382	96607	98.48	65593	59427
		Wetlands <2.25 ha	1489	1489	1.52	-	-
		Total	**1871**	**98096**	**100.00**	**65593**	**59427**
	Area under aquatic vegetation					**21573**	**28255**
	Area under Turbidity Level						
	Low					**41778**	**46869**
	Moderate					**23815**	**12558**
	High					**--**	**--**



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

5.4 Water level in the Wells in the vicinity (Up to 5km) of Forest area:

5.4.1 Groundwater Exploration:

In Puri district Central Ground Water Board has drilled 13 exploratory wells, 9 deposit wells, 5 deep piezometers, and 7 slim holes. The depth of the borehole varies from 54.57m at Santrapur to 602m at Agricultural farm, Puri. The hard crystalline basement complex was encountered at several places at different depths, shallowest in Delang (119.8m) and deepest at Jagannathballabh in Puri Sadar block (556m). In the central part of the district basement was encountered at 208m depth at Rupadeipur, 282m at Sakshigopal. Athgarh sandstone was encountered in the borehole of Pipili at 56m depth. The yield of the exploratory bore wells varied from 36.32 m3/hr to 221.4 m3/hr. The transmissivity values ranges from 34.10 m2/day at Sakshigopal to 8189 m2/day at Tompalo. The storativity values vary from 6.7×10^{-2} to 2.8×10^{-5}. The static water level in deeper aquifer varies from 0.05 to 9.97 mbgl. Some of the deeper aquifer are auto-flow in nature.

a) **Auto flow zones:** In the southern sector of the area, adjoining Chilika lake a numbers of auto flow wells are found which have been constructed by PHED and DANIDA. Auto-flow wells are located in Krishnaprasad, Brahmagiri blocks and partly in Kanas, Delang, Puri Sadar and Satyabadi block. The zones tapped vary from 150m to 250 mbgl. At Sadanandapur and Birgobindapur (74 E/13) two auto flow wells have been constructed by Danida. The piezometric head at Birgobindapur has been found to be 2.64 magl and at Sadanandapur it is about 0.45 magl. The temperature of water from auto flow wells varies from 29^0C at Sadanandapur to 35^0C at Bengama. The temperature of the auto flow wells around Chilika varies from 32^0C to35^0C. The quality of water varies from fresh at Sanabandha to saline at Sadanandapur. The well at Birgobindapur was fresh at the beginning but with time at present it has turned into saline well.

b) **Depth to Water Level (Pre-monsoon and Post-monsoon, 2011)** The depth to water level is measured from the National Hydrograph Stations situated in different blocks of the Puri district. The Pre monsoon, 2011 water level data varies from 0.16 mbgl (Pratap-ramchandrapur) to 5.96 mbgl (Satapada). The depth to water level map of pre - monsoon, 2011 is displayed in Plate 5.1. The depth to water level data of Post-monsoon, 2011 represents 0.08 mbgl (Sadanandapur) to 5.13 mbgl (Ramchandi). Plate 5.2 represents depth to water level map of post –monsoon, 2011.

c) **Seasonal Fluctuation** The fluctuation of depth to water level in 2011 between pre-monsoon and post-monsoon varies from 0.1 m (Juinti) to 3.51 m (Chandanpur).

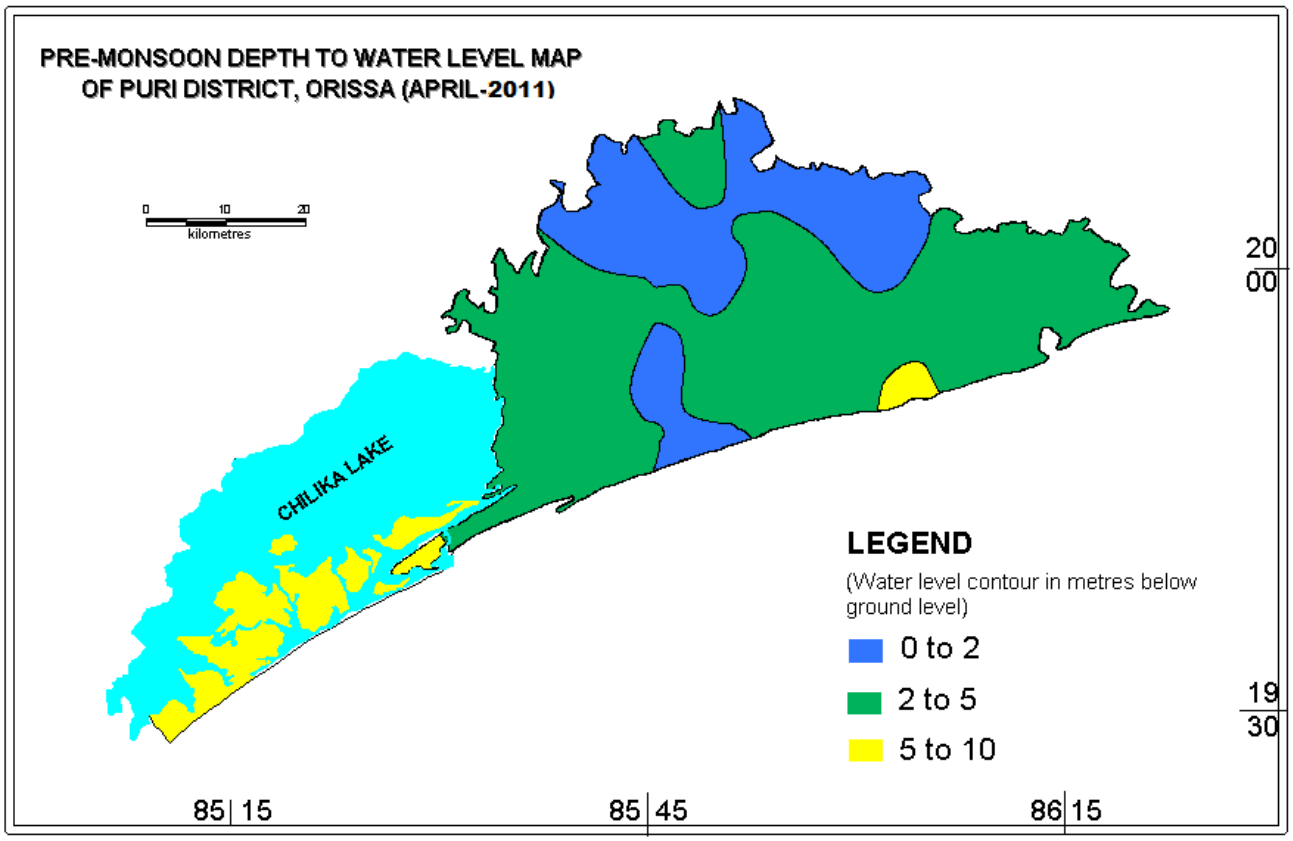
d) Long Term Water Level Trend in last 10 years in Ground Water Monitoring wells The long term trend of (10 years) in water level for the **pre-monsoon** shows rise from 0.001 to 0.303m/yr. Fall in water level is restricted within 0.0 to 0.554 m/yr. 63.6% of the wells show rising trend and 36.4 % of the wells show falling trend. The long term trend of (10 years) in water level for **post monsoon** season shows rise in water level from 0.004 to 0.302m/yr. The fall in water level is in the range of 0.0 to 0.183 m/yr. 63.4% of the wells show rising trend and 36.6 % of the wells show falling trend.

5.4.2 Ground Water Resources:

The Ground Water Resources of the district has been assessed adopting the methodology recommended by the Groundwater Estimation Committee (1997), constituted by Govt. of India. The task was jointly carried out by the Central Ground Water Board and Ground water Survey & Investigation, Department of Water Resources, Govt. of Orissa. The block wise computation of ground water resources in the district has been presented in Table 5.4. The Annual Replenish able ground water resources in the district are computed as 58806 HaM, out of which the existing Ground Water Draft for irrigation is 7246 HaM. The ground water draft for irrigation is through dug wells shallow tube wells and tube wells. So far ground water development in the district has been meager, and all the blocks fall under the safe category. The stage of ground water development varies from 4.83% (Krushnaprasas) to

29.45% (Puri) in different blocks. The overall Stage of Groundwater development of the district is 17.77%. There is ample scope for stepping up ground water development in the district.

Map :- 2


PRE-MONSOON DEPTH TO WATER LEVEL MAP
OF PURI DISTRICT, ORISSA (APRIL-2011)
0
10
20
kilometres
CHILIKA LAKE
LEGEND
(Water level contour in metres below ground level)
0 to 2
2 to 5
5 to 10
20 00
19 30
85 15
85 45
86 15

Map :-3

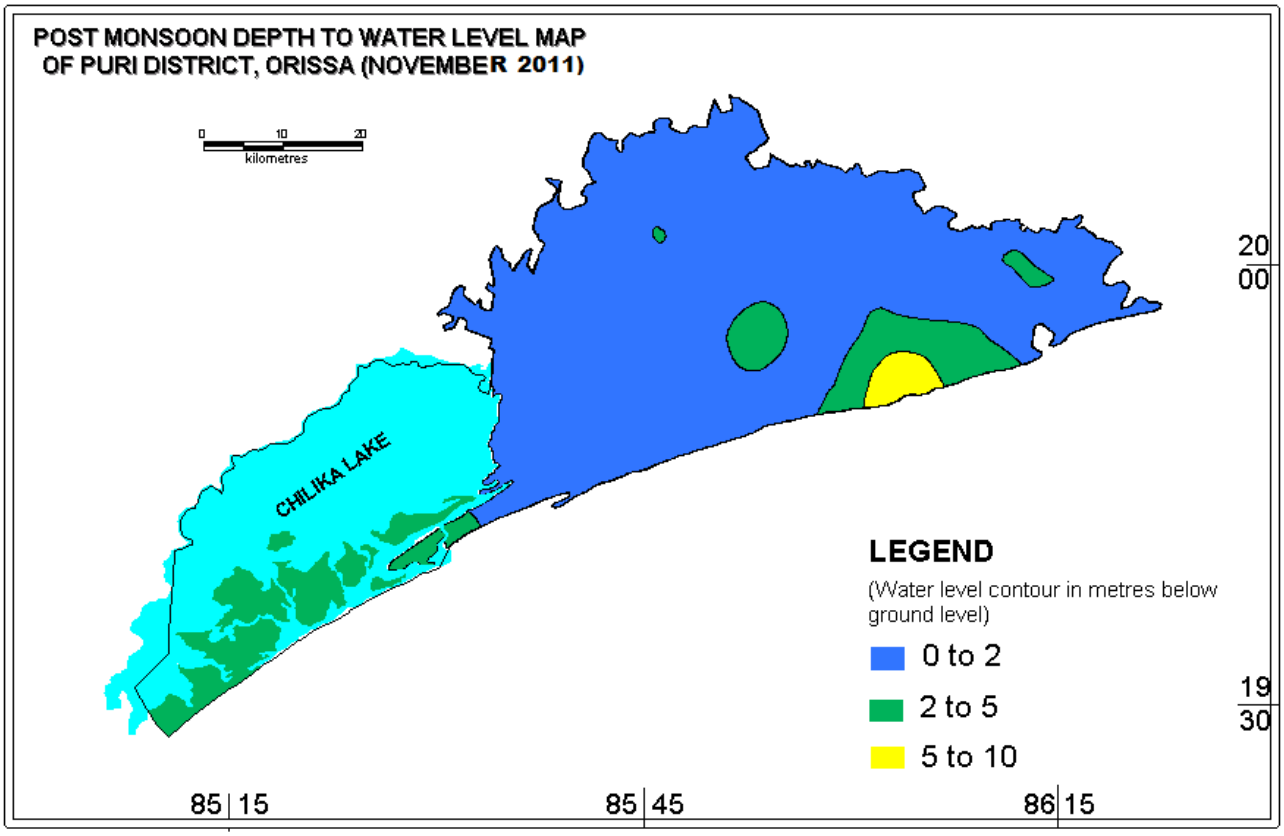

POST MONSOON DEPTH TO WATER LEVEL MAP
OF PURI DISTRICT, ORISSA (NOVEMBER 2011)
0
10
20
kilometres
CHILIKA LAKE
LEGEND
(Water level contour in metres below ground level)
0 to 2
2 to 5
5 to 10
20 00
19 30
85 15
85 45
86 15

Table No 5.4Ground Water Resources.								
Sl No	Assessment Unit/ District	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Gross Ground Water draft for domentic and industrial Water Supply	Existing Gross Ground water draft for all uses (4+5)	Allocation for domestic and industrial requirement supply upto next 25 years	Net Ground Water availability for future irrigation Development (3-4-7)	Stage of Ground Water Development {(6/3)*100}%
1	2	3	4	5	6	7	8	9
	PURI							
1	Astaranga	2496.00	382.00	138.82	521.00	177.00	1937.00	20.87
2	Brahmagiri	7515.00	1070.00	232.25	1302.00	312.00	6133.00	17.33
3	Delanga	4024.00	782.00	245.13	1026.00	330.00	2913.00	25.50
4	Gop	6346.00	622.00	293.86	916.00	399.00	5325.00	14.43
5	Kakatpur	3379.00	675.00	186.07	860.00	241.00	2463.00	25.45
6	Kanas	4498.00	263.00	262.99	526.00	336.00	3898.00	11.69
7	Krushnaprasad	11418.00	381.00	170.00	551.00	251.00	10786.00	4.83
8	Nimapada	5882.00	1122.00	398.44	1520.00	535.00	4225.00	25.84
9	Pipli	5337.00	840.00	340.51	1181.00	435.00	4062.00	22.13
10	Puri	4742.00	721.00	680.65	1401.00	768.00	3254.00	29.54
11	Satyabadi	3169.00	388.00	256.51	644.00	318.00	2463.00	20.32
	District Total	58806.00	7246.00	3205.00	10448.00	4102.00	47459.00	17.77

(Source: Govt. of India Ministry of Water Resources Central Ground Water Board, Publication for Puri District.)

5.4.3 Ground Water Table near Forest Blocks:

During Field exercise, the water table in various wells has been studied. The water Table during summer, rain and winter season have been recorded and furnished at **Table No 5.5**

Table No. 5.5 Ground water table position near Forest blocks

Name of the Range	Name of the Forest	Name of the Village	Name of the owner of the well	GPS location of well	Depth of water in well			Remarks
					Summer Season	Rainy Season	Winter Season	
1	2	3	4	5	6	7	8	9
Brahmagiri WL Range	Sahajanpur VSS Kalabanta	Sahajanpur	Gopinathdev Temple	N-19 45' 00.8" E-085 37' 27.5"	1'.0"	8'.0"	5'.0"	7'
do	Gabakunda VSS Manika PRF	Gabakunda	Bhabakundal eswar Temple	N-19 41' 23.7" E-085 31' 27.89"	3'.0"	8'.0"	6'.0"	5'
do	Gabakunda VSS Manika PRF	Gabakunda	Raghunathde v Temple	N-19 41' 9.48" E-085 30' 55.63"	3'.0"	8'.0"	6'.0"	5'
do	Brahmapada VSS Manika PRF	Brahmapa da	Villagrers of Brahmapada	N-19 41' 51.72" E-085 31' 11.65"	2'.0"	8'.0"	6'.0"	6'
do	Brahmapada VSS Manika PRF	Brahmapa da	Brahmapada Matha	N-19 41' 56.26" E-085 31' 9.43"	2'.0"	8'.0"	6'.0"	6'
do	Kalikabadi PFR	Brahmagiri	Padukae thakurani Brahmagiri Village	N-19 47'38.016" E-085 38' 26.424"	4'.0"	9'.0"	5'.0"	6'
do	Kalikabadi PFR	Brahmagiri	Sahadev Temple Brahmagiri	N-19 47' 32.172" E-085 38' 28.908"	4'.0"	10'.0"	6'.0"	6'
do	Kalikabadi PFR	Brahmagiri	Sub-Registar office Brahmagiri	N-19 47' 46.020" E-085 38' 39.174"	3'.0"	9'.0"	6'.0"	6'
do	Kalikabadi PFR	Brahmagiri	Esaneswar Temple Brahmagiri	N-19 47' 45.966" E-085 38' 45.714"	5'.0"	10'.0"	5'.0"	5'
do	Palank VSS	Palank	Baliharachan di Temple	N-19 45' 27.6" E-085 41' 41.0"	4'.0"	14'.0"	8'.0"	10'

do	Palank Gramya Jungle	Palank	Mahadev Temple Palank	N-19 46' 29.2" E-085 41' 07.8"	2'.0"	10'.0"	7'.0"	8'
do	Narsinghapatna VSS	Narsinghapatna	Mukteswar Temple Narasinghapatna	N-19 45' 41.9" E-085 42' 07.8"	3'.0"	10'.0"	5'.0"	7'
do	Matamatapur VSS	Matamatapur	Matamatapur Village	N-19 45' 40.2" E-085 39' 07.3"	2'.0"	7'.0"	5'.0"	5'
do	Chapamanika VSS	Chapamanika	Chapamanika Village	N-19 45' 33.2" E-085 38' 50.3"	2'.0"	10'.0"	6'.0"	8'
do	Chapamanika VSS	Chapamanika	Bhimeswar Temple Chapamanika	N-19 45' 55.6" E-085 38' 38.5"	2'.0"	9'.0"	5'.0"	7'
Balukhanda WL Range	Balukhanda-Konark WL Sanctuary	Nagapatna	Rameswar temple	N-19 50' 20.1" E-85 52' 41.1"	5'0"	15'0"	9'0"	10'
do		Balipatna	Mahaveer temple	N-19 50' 20.9" E-85 52' 30.9"	3'6"	12'0"	7'0"	8' 6"
do		Balighai Section Office Campus	Forester, Balighai Wildlife Section	N-19 51' 38.64" E-85 56' 20.8"	3'6"	14'0"	7'0"	10' 6"
do	Pattnaikia PRF	Mahabalpada	Sri Jatia Bhoi	N-19 58' 37.0" E-85 49' 45.0"	5'0"	12'0"	7'0"	7'
Konark WL Range	R.L adjoining to Liakhia PRF	Khalakatapatna	Near Jageswari temple	N-19 51' 20.10" E-86 02' 37.49"	6'.00"	15'.00"	10'.0"	9'
do	R.L adjoining to Liakhia PRF	Tikana	Inside Khanduali temple	N-19 51' 13.27" E-86 01' 01.20"	3'.00"	18'.00"	8'.0"	15'
do	R.L adjoining to Liakhia PRF	Tikana	Near Radhakrishna temple	N-19 51' 33.46" E-86 01' 20.16"	3'.00"	15'.00"	11'.0"	12'
do	R.L adjoining to Liakhia PRF	Tarakor	Near Balikapileswar temple	N-19 52' 37.22" E-86 01' 28.89"	5'.00"	35'.00"	15'.0"	30'
do	R.L adjoining to Ramachandi F.S	Ramachandi	Inside Ramachandi temple	N-19 51' 17.57" E-86 03' 34.20"	2'.00"	12'.00"	6'.0"	10'
do	Adjoining to Kurujanga F.S	Jamara	Padmanabha Khatoi	N-19 54' 27.55" E-86 08' 35.04"	3'.00"	15'.00"	6'.0"	12'
do	Adjoining to Kurujanga F.S	Kurujanga	Jugal Charan Jena	N-19 53' 43.5" E-86 07' 42.14"	3'.00"	16'.00"	10'.0"	13'

do	Adjoining to Kurujanga F.S	Kurujanga	Chandramani Patra	N-19 53' 53.24" E-86 07' 39.75"	4'.00"	17'.00"	12'.0"	13'
do	Adjoining to Konark F.S	Karamanga	Inside Rama Mandir of Karamanga village	N-19 53' 37.76" E-86 05' 44.86"	5'.00"	17'.00"	10'.0"	12'
do	Adjoining to Manguleswar F.S	Madipur	Inside Tribeniswar temple of Madipur village	N-19 53' 45.12" E-86 05' 29.11"	4'.00"	15'.00"	9'.0"	11'
do	Adjoining to Nadiamatha PFR	Kanharpur	Bhaskara Pujahari	N-19 53' 42.82" E-86 12' 9.91"	1'.6"	16'.00"	12'.0"	14' 6"
do	Adjoining to Nadiamatha PFR	Kanharpur	Kanharpur U.P school campus	N-19 53' 46.48" E-86 12' .16.49"	2'.00"	14'.00"	11'.0"	12'
do	Adjoining to Nadiamatha PFR	Tandahar	Near Cyclone rescue Centre	N-19 54' 8.52" E-86 13' .11.21"	3'.00"	17'.00"	10'.0"	14'
do	Adjoining to Nadiamatha PFR	Tandahar	Gopal Sahoo	N-19 54' 13.65" E-86 13' .17.20"	2'.00"	12'.00"	8'.0"	10'
do	Adjoining to Nadiamatha PFR	Tandahar	Near Tandahar Mahadev temple	N-19 54' 15.27" E-86 13' .14.61"	2'.00"	14'.00"	10'.0"	12'
Astaranga WL Range	Sahana PRF	Sahana	Sahan Beat	N-19 56' 43.84" E-86 18' 06.37"	3'2"	7'2"	4'1"	4'
do	Sahana PRF	Sudhikeswar	Sudhikeswar Gadi Kiar house near	N-19 56' 36.36" E-86 17' 32.10"	1'0"	5'0"	2'10"	4'
do	Sahana PRF	Sudhikeswar	Sudhikeswar Mahadev Nilakantheswar	N-19 56' 22.70" E-86 17' 22.48"	2'6"	6'6"	4'0"	4'
do	Sahana PRF	Sudhikeswar	Sudhikeswar School	N-19 56' 48.75" E-86 17' 22.43"	2'0"	8'6"	5'0"	6'
do	Sahana PRF	Balabhadrapur	Balabhadarpur Tada Alekha Mahima tungi	N-19 56' 24.89" E-86 16' 54.86"	2'0"	7'0"	3'8"	5'
do	Tavagolara PRF	Tavagolara Gada	Hemanta Kumar Routray	N-20 01' 23.57" E-86 10' 00.79"	18'0"	26'0"	20'0"	8'

do	Tavagolara PRF	Tavagolara Gada	Madhusudan Paikray	N-20 01' 23.07" E-86 10' 02.95"	8'0"	20'0"	10'0"	12'
do	Tavagolara PRF	Tavagolara Gada	Surendra Nath Ray	N-20 01' 23.72" E-86 10' 03.27"	13'0"	23'0"	15'0"	10'
do	Tavagolara PRF	Bodala	Near Rameswar Temple	N-20 02' 00.24" E-86 09' 21.56"	19'0"	30'0"	20'5"	11'
do	Tavagolara PRF	Barjisahi	Jalandra Singh	N-20 02' 06.86" E-86 10' 11.28"	9'4"	17'0"	8'0"	7'8"
do	Nipania PRF	Jangalbori	Prachi Guru Dharma Matha	N-20 01' 56.80" E-86 08' 36.71"	15'0"	22'0"	17'0"	7'
do	Nipania PRF	Jangalbori	Parsuram Ray	N-20 02' 07.03" E-86 09' 03.53"	25'0"	34'5"	28'0"	9' 5"
do	Nipania PRF	Jangalbori	Mihir Kumar Ray	N-20 02' 15.70" E-86 08' 53.49"	10'0"	15'0"	12'0"	5'
do	Sahana PRF	Gundalaba	Narayana Biswal	N-19 56' 11.06" E-86 17' 01.61"	4'0"	10'0"	7'0"	6'
do	Sahana PRF	Gundalaba	Gundalaba Beat	N-19 56' 05.32" E-86 17' 04.75"	4'0"	10'0"	6'0"	6'
Gop WL Range	Non Forest Area	Bishnupur	Ajaya Ku. Mishra	N-20 3' 45.10" E-86 00' 46.08"	4'	16'	10'	12'
do	do	Patapur	Rudrabadan Mohanty	N-20 02' 56.82" E-86 00' 9.72"	Dried	15'	7'	15'
do	do	Amaranga	Naba Pradhan	N-20 01' 59.01" E-85 59' 29.38"	Dried	10'	5'	10'
do	do	Taradapara	Bhakta Charan Mohanty	N-20 01' 39.04" E-85 58' 35.68"	2'	15'	5'	13'
do	do	Nuagaon	Debendra Swain	N-20 03' 28.85" E-86 04' 15.25"	Dried	15'	10'	15'

From the above it is fairly can be inferred that the Ground Water Table fluctuation is in between 4 ft to 15 ft.

5.5 Status of Aquifers:

5.5.1 Hydrogeology:

The geological formation in the district is aged from Archean to Recent (Quaternary). The Tertiary and Quaternary formations occur over major parts of the district while the Archeans occupy the hilly areas under higher altitudes in the west. The Quaternary deposits consist of laterites and alluvium. While the laterite occurs only in the western and northwestern parts,

major parts of the district are covered by alluvium of varying thickness. The average thickness of laterite is around 8 to 10m.The older alluvium is generally exposed in the northwestern parts including a sequence of sand, clay and kankars of grey to brown in colour. The younger alluvium, which covers nearly 90% of the area, occurs as flood plain deposits along the course of major rivers and streams. These sediments consist of an admixture of silt, sand, gravel and pebble in varying proportions. These layers increase in thickness towards the sea, showing a gentle dip. Discontinuous ridges of sand dunes occur along the coast and are formed due to wind action.

(i) Areas underlain by alluvium.

(ii) Areas underlain by fractured, fissured and consolidated basement rock formations.

5.5.2 Water bearing properties of the consolidated formations:

The aquifer system in the district may be broadly divided into

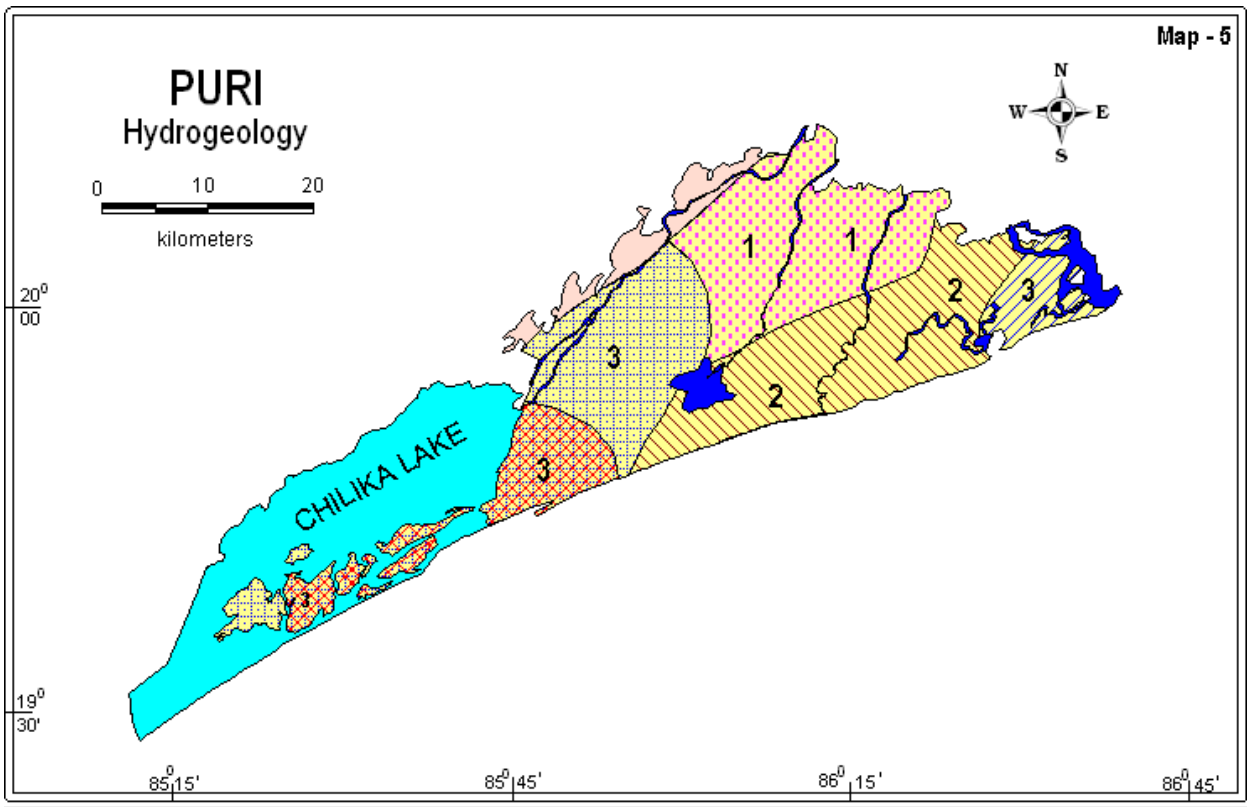
(i) Shallow aquifers
(ii) Deeper aquifers.

(a) Shallow Aquifer:

The thickness of shallow aquifers (near surface aquifer) varies widely due to salinity problem. The geological setup as discussed earlier controls the occurrence and movement of ground water. The crystalline Archeans are devoid of primary porosity. They possess secondary porosity on being weathered and fractured. However, the unconsolidated sand and gravel layers of Tertiary and Quaternary age form the main repository of ground water. Groundwater occurs under water table conditions in shallow aquifers. All the hydrogeological formations can be broadly divided into three sub groups viz. (a) Crystalline formations (b) Sedimentary formations and (c) Laterites. The unconsolidated or porous formations comprising of Tertiary and Quaternary sediments, encountered in the major parts of the district. The sand and gravel layers form the main repository of ground water in this area. The groundwater in near surface shallow aquifers occurs under phreatic conditions, even down to a depth of even 135 m below ground level. The laterites occurring as capping over the country rocks are vesicular, ferruginous and highly porous, which support large number of domestic wells.

(b) Deeper aquifers:

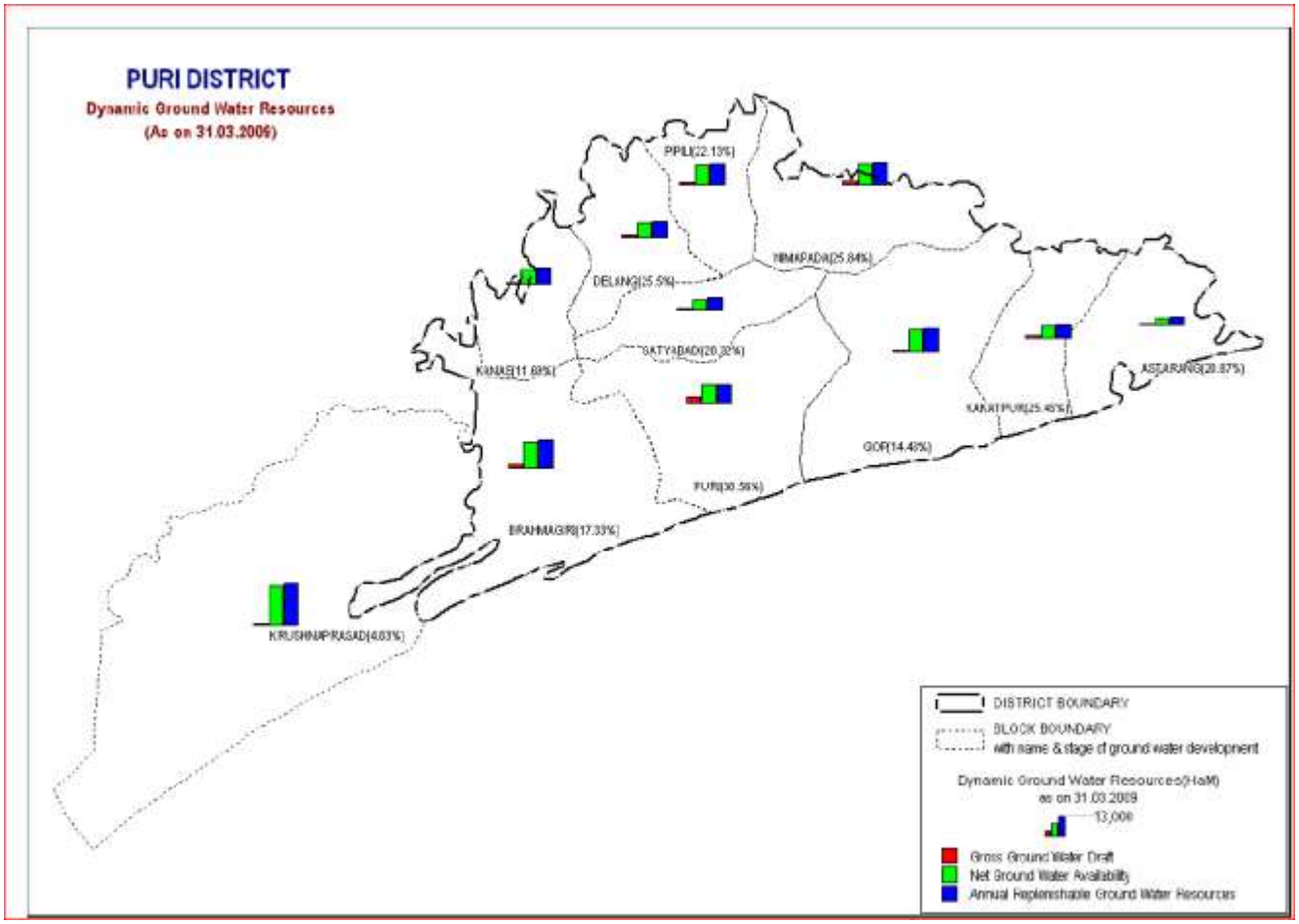
The occurrence of fresh water bearing deeper aquifers are identified from available borehole data down to a maximum depth of 602m in Puri town. The available information indicate that in general the deeper fresh water bearing zones are sandwitched between saline water bearing zones. The fresh water bearing zones are composed of sand, silt, clay, gravel and among these materials sand and gravel horizondeeper aquifers occur under semi confined and confined conditions. The aquifers areextensive, interconnected and have prolific yield potentials (up to 65 lps). The thickness of aquifer materials down to a depth of 250m varies from 10 to 79m. The common groundwater abstraction structures are dug wells, shallow tube wells, deep tube wells and filter points.



LEGEND

AGE GROUP	LITHOLOGY	HYDROGEOLOGICAL CONDITIONS (POROUS FORMATION)	GROUND WATER POTENTIALS
QUATERNARY	Recent Alluvium, clay, silt, sand, gravel, pebbles, etc.	Fairly thick, regionally extensive unconfined / confined aquifer down to 300m.	Large yield prospect more than 40 lps — 1
UPPER TERTIARY	Older Alluvium and laterite, silt, sand, ferruginous/ calcareous concretion, lithomargic clay.	Moderately thick and regionally extensive confined/unconfined aquifer down to 150m	Moderate yield prospects 15 to 40 lps — 2
			Low yield prospects less than 15 lps — 3

HYDROGEOLOGICAL FEATURES	HYDROCHEMICAL FEATURES
Artesian flow	Area where fresh ground water is overlain by saline ground water
Rivers / Streams/ lakes	Area where saline ground water is overlain by fresh ground water
	Area where ground water is saline at all levels except in local patches.



5.5.3 Ground Water Quality.

The chemical quality of ground water in the district has been assessed on the basis of ground water samples collected during ground water monitoring, hydrogeological surveys and ground water exploration. The range of different chemical constituents in shallow and deeper aquifers is given inTable **No5.6**

Table No 5.6 Range of Chemical Constituents in Different Aquifers.				
	Shallow aquifer		Deeper aquifer	
Chemical constituents	Range	Average	Range	Average
E.C. (µs/cm at 250c)	155-4882	353-2829	159-8920	524-4086
pH	-	-	7.1-8.2	7.13-8.1
Bicarbonate (mg/l)	-	-	20-439	116-390
Chloride(mg/l)	14-1389	57-695	3-3332	46-1536
Nitrate(mg/l)	0-164	2.54-8.61	0-13	0.5-10
Fluoride(mg/l)	0.34-12	0.48-2.65	0.07-1.9	0.2-1.3
Total Hardness (mg/l)	40-940	90-580	25-1640	70-351
Calcium(mg/l)	-	-	8-409	14-84
Magnesium(mg/l)	-	-	4.9-151	8.5-40
Sodium(mg/l)	-	-	7.2-1449	53-463
Potassium(mg/l)	-	-	4-36	7.7-33
Carbonate(mg/l)	-	-	-	-
Sulphate(mg/l)	-	-	0-448	11-240
Iron(mg/l)	0.07-8.63	0.51-2.47	0.01-9.93	0.25-0.89
Silica(mg/l)	-	-	18-66	18-29

(Source: Govt. of India, Ministry of Water Resources Central Ground Water Board, Publication for Puri District.)

As it is a coastal district salinity hazard is very common in both shallow and deeper aquifer and electrical conductivity reaches as high as 8920 mg/l. High value of chloride, sodium and sulphate is reported in deeper aquifer. High fluoride is reported sporadically in shallow aquifer but so far no health hazard is reported. The suitability of ground water for irrigation in the district has been assessed by use of US salinity diagram prepared on the basis of sodium absorption ratio (SAR) and specific conductance. The classification of water in the district is given in **Table No: 5.7**

Table No: 5.7 Classification of Water in the district.			
Classification based on Salinity diagram	Grade	No. of Samples	
		Deeper aquifer (Total-19)	Deeper aquifer (%)
C1S1	Good	2	10.52
C1S2	Moderately Good	-	-
C1S3	Unsuitable	-	-
C1S4	Highly Unsuitable	-	-
C2S1	Good	5	26.31
C2S2	Moderately Good	1	5.26
C2S3	Unsuitable	--	-
C3S1	Moderately Good	1	5.26
C3S2	Unsuitable	1	5.26
C4S1	Unsuitable	4	21.05
C4S3	Unsuitable	3	15.79
C4S4	Unsuitable	2	10.52

(Source: Govt. of India, Ministry of Water Resources Central Ground Water Board, Publication for Puri District.)

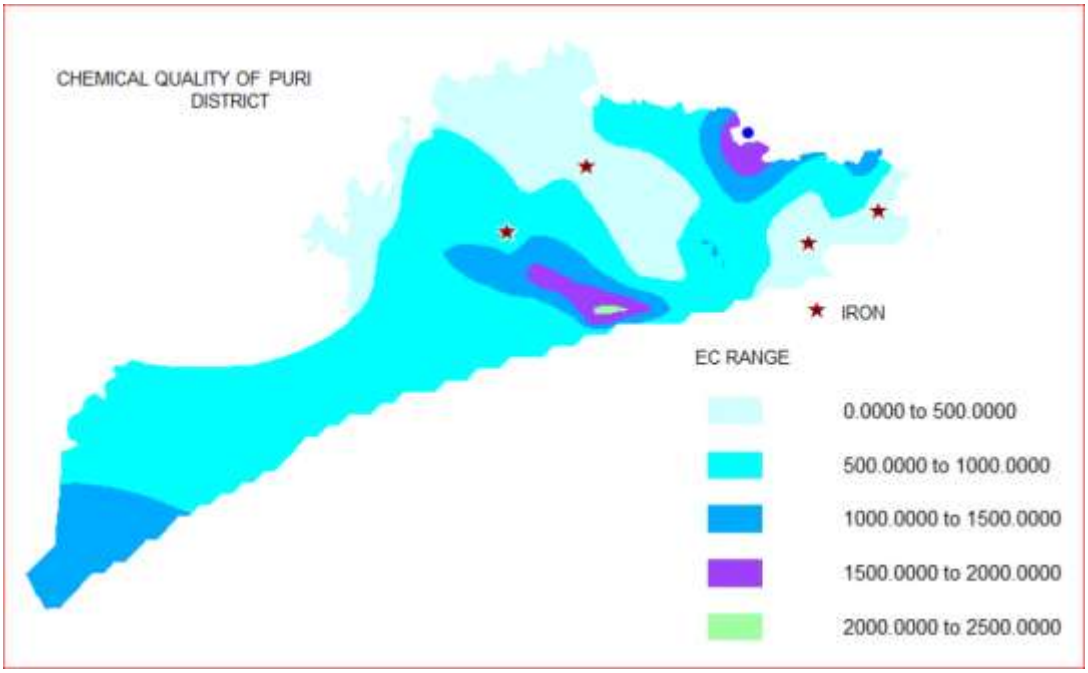
It may be noted that about 50% of the groundwater samples collected from deeper aquifers are not suitable for irrigation purposes as it is a coastal area and suffers from salinity hazard. From Piper diagram it is interpreted that in deeper aquifer the water type is (Na+K) + Ca – (Cl + NO3)+ HCO3 .

5.5.4 Status of Ground Water Development:

Ground water development in the district is mainly through dug wells, shallow tube wells and deep tube wells. Ground water is mainly used for domestic and irrigation purpose and in limited scale for industrial purposes. The stage of development of ground water in the district is low. So far only 10.51% of its resources has been exploited. Hence a strategy for detailed ground water development is required. Depth range, probable thickness of aquifers and yield of different groundwater structures in Puri district is given in Table No 5.8.

Table No. 5.8Depth range, probable thickness of aquifers and yield of different groundwater structures in Puri district						
Sl. No.	Type of structure	Depth range	Probable thickness or aquifer	Probable yield (LPS)	Approx command area (Ha)	Hydrogeological setting
1	Dugwell	9-12	4.5-6	<3	1	Crystalline and alluvial area
2	Borewell	60-150	-	<5	3	Crystalline area
3	Filter point and shallow tubewells	25-60	10-15	<10		Alluvial area
4	Medium deep tubewell	60-100	20-30	15-40	25	Tertiary and alluvial area
5	Deep tubewell	135-290	30-40	>40	40	Alluvial area

(Source: Govt. of India, Ministry of Water Resources Central Ground Water Board, Publication for Puri District.)



CHAPTER-6

MAINTENANCE & ENHANCEMENT OF FOREST RESOURCE PRODUCTIVITY:

6.1 Growing Stock of Wood:

The Total Forest area of the division is 8094.622 ha out of which 1566.19ha is Reserved Forest, 6205 ha is PRF (Proposed Reserved Forests) and 323.432ha is of Village Forests. The Reserved Forest and 6 PRF comes under Balukhanada – Konark Sanctuary. For estimation of Growing stock, the forest area coming under Sanctuary i.e.6917.71 ha has been excluded.The Forest Blocks excluded are in the Sanctuary i.e. Balukhanda RF, Balighai PRF, Liakhia PRF, Konark West PRF, Konark East PRF, Golora PRF , Nadiamatha PRF. Stratifying the forest blocks and selecting Sample points for tree enumeration i.e. Growing Stock Estimation, Forest Blocks outside the Sanctuary has been considered.

6.1.1 Sample plots & size:

In the Process of Growing Stock Estimation, the sampling points have been provided by the Orissa Space Application Centre (ORSAC), Bhubaneswar. All total 75 sample points have been provided considering the forest area, crop density and percentage of sampling for Growing Stock Estimation. The Points coming within various PRF of the Division is furnished at **Table No: 6.1.**Each Sample plot is layout in the Survey of India Topo sheet and in the Ground following the guidelines contained in the National Working Plan Code- 2014. Each Sample Plot is of 0.1 ha area Size 31.62mx31.62m, keeping the Provided Sample Point at the Centre.

Table No 6.1 Sample Points analysed/ Data Recorded				
Sl. No. of S. points	Name of the Range	Name of forest Block	GPS co ordination	
			Latitude N	Longitude E
1	Astaranga Wildlife Range	Tavagolara PRF	20.0255940	86.1581087
2	Astaranga Wildlife Range	Sahan PRF	19.9545352	86.32346317
3	Astaranga Wildlife Range	Sahan PRF	19.94979767	86.32346317
4	Astaranga Wildlife Range	DLC Plantatation	19.9306248	86.2809285
5	Astaranga Wildlife Range	Sahan PRF	19.9598710	86.3498737
6	Astaranga Wildlife Range	Sahan PRF	19.9516657	86.3323558
7	Astaranga Wildlife Range	Sahan PRF	19.9400215	86.2976568
8	Astaranga Wildlife Range	Sahan PRF	19.9503065	86.3408568
9	Astaranga Wildlife Range	Sahan PRF	19.9549883	86.3460458
10	Konark Wildlife Range	Golara PRF	19.8947050	86.1767383
11	Konark Wildlife Range	Golara PRF	19.894766	86.170097
12	Konark Wildlife Range	Golara PRF	19.9015467	86.1911017
13	Konark Wildlife Range	Golara PRF	19.889293	86.170084
14	Konark Wildlife Range	Golara PRF	19.90082	86.17323
15	Konark Wildlife Range	Konark East PRF	19.8973142	86.1547120
16	Konark Wildlife Range	Konark East PRF	19.884265	86.132109
17	Konark Wildlife Range	Konark East PRF	19.8970600	86.1580185
18	Konark Wildlife Range	Konark East PRF	19.890529	86.142515
19	Konark Wildlife Range	Konark East PRF	19.8941570	86.1627152
20	Konark Wildlife Range	Konark East PRF	19.89143	86.129713
21	Konark Wildlife Range	Konark East PRF	19.8986032	86.1647927
22	Konark Wildlife Range	Konark East PRF	19.879134	86.10439
23	Konark Wildlife Range	Konark East PRF	19.8835308	86.1555275
24	Konark Wildlife Range	Konark East PRF	19.878428	86.11534
25	Konark Wildlife Range	Konark East PRF	19.879951	86.119269
26	Konark Wildlife Range	Nadiamatha PRF	19.8840567	86.1712117
27	Konark Wildlife Range	Nadiamatha PRF	19.8957345	86.1977243
28	Konark Wildlife Range	Nadiamatha PRF	19.8900517	86.1830883
29	Konark Wildlife Range	Nadiamatha PRF	19.8877617	86.1815567
30	Konark Wildlife Range	Nadiamatha PRF	19.8937617	86.1921950
31	Konark Wildlife Range	Konark West PRF	19.8614	86.080674
32	Konark Wildlife Range	Konark West PRF	19.860834	86.073073
33	Konark Wildlife Range	Konark West PRF	19.884476	86.076719
34	Konark Wildlife Range	Konark West PRF	19.861832	86.08406
35	Konark Wildlife Range	Konark West PRF	19.883813	86.087366
36	Konark Wildlife Range	Konark West PRF	19.877749	86.05489

Table No 6.1 Sample Points analysed/ Data Recorded				
Sl. No. of S. points	Name of the Range	Name of forest Block	GPS co ordination	
			Latitude N	Longitude E
37	Konark Wildlife Range	Konark West PRF	19.877119	86.0918
38	Konark Wildlife Range	Konark West PRF	19.877341	86.08644
39	Konark Wildlife Range	Konark West PRF	19.87219	86.092643
40	Konark Wildlife Range	Konark West PRF	19.878091	86.067157
41	Konark Wildlife Range	Liakhia PRF	19.869506	86.024465
42	Konark Wildlife Range	Liakhia PRF	19.863555	86.033522
43	Konark Wildlife Range	Liakhia PRF	19.867239	86.019186
44	Balukhanda WL Range	Balighai PRF	19.8514360	85.9963680
45	Balukhanda WL Range	Balighai PRF	19.8358880	85.9644430
46	Balukhanda WL Range	Compt-6 of Balukhanda RF	19.8411700	85.9622040
47	Balukhanda WL Range	Balighai PRF	19.8459990	85.9742540
48	Balukhanda WL Range	Balighai PRF	19.8362800	85.9485700
49	Balukhanda WL Range	Balighai PRF	19.8327540	85.9471590
50	Balukhanda WL Range	Balighai PRF	19.8405720	85.9567060
51	Balukhanda WL Range	Balighai PRF	19.8383490	85.9897160
52	Balukhanda WL Range	Compt-14 of Balukhanda RF	19.8388780	85.9154190
53	Balukhanda WL Range	Compt-13 of Balukhanda RF	19.8423150	85.9171900
54	Balukhanda WL Range	Compt-12 of Balukhanda RF	19.8368390	85.9050350
55	Balukhanda WL Range	Compt-12 of Balukhanda RF	19.8350510	85.9117517
56	Balukhanda WL Range	Compt-08 of Balukhanda RF	19.8327120	85.8907020
57	Balukhanda WL Range	Compt-14 of Balukhanda RF	19.8311300	85.9170180
58	Balukhanda WL Range	Compt-14 of Balukhanda RF	19.8274470	85.9128150
59	Balukhanda WL Range	Balighai PRF	19.8273450	85.8767580
60	Balukhanda WL Range	Compt-6 of Balukhanda RF	19.8260650	85.8837820
61	Balukhanda WL Range	Compt-9 of Balukhanda RF	19.8218250	85.8945100
62	Balukhanda WL Range	Compt-11 of Balukhanda RF	19.8211110	85.8970870

Table No 6.1 Sample Points analysed/ Data Recorded				
Sl. No. of S. points	Name of the Range	Name of forest Block	GPS co ordination	
			Latitude N	Longitude E
63	Balukhanda WL Range	Compt-04 of Balukhanda RF	19.8225940	85.8668420
64	Balukhanda WL Range	Compt-02 of Balukhanda RF	19.8219970	85.8614580
65	Balukhanda WL Range	Compt-07 of Balukhanda RF	19.8350510	85.9117517
66	Balukhanda WL Range	Compt-07 of Balukhanda RF	19.8199640	85.8804160
67	Balukhanda WL Range	Balighai PRF	19.8120840	85.8726250
68	Balukhanda WL Range	Compt-03 of Balukhanda RF	19.8175430	85.8673180
69	Brahmagiri WL Range	Village Natia (Private Forest)	19 46' 16.65"	85 36' 36.39"
70	Brahmagiri WL Range	Village Bhubanapur (Private Forest)	19 45' 52.67"	85 36' 52.90"
71	Brahmagiri WL Range	Village Budhisahi (Private Forest)	19 45' 57.42"	85 37' 28.52"
72	Brahmagiri WL Range	Village Jenapur (Private Forest)	19.731278	85.601052
73	Brahmagiri WL Range	Village Hasinpur (Private Forest)	19 44' 0.18"	85 37' 19.93"
74	Brahmagiri WL Range	Village Hasinpur (Private Forest)	19 44' 12.57"	85 37' 09.82"

Frequency of Species recorded in point sampling

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
01	Tavagolara	Kendu Baunsha Potash	22 38 03	Kendu 35% - Potash 05%	- - -	- - -	Baunsha 60% - -
02	Sahan PRF	Acacia Casuarina Limba	18 42 16	Acacia 24% - Limba 21%	- - -	- Casuarina5 5% -	- - -
03	Muhanamuhan Felling Series	Casuarina Mai	26 03	- Mai 10%	- -	- -	Casuarina90 % -
04	Beleswar Felling Sereies	Casuarina Acacia	29 03	- Acacia 09%	- -	- -	Casuarina91 % -
05	Muhanamuhan Felling Series	Casuarina Acacia	24 04	- Acacia 14%	- -	- -	Casuarina86 % -
06	Muhanamuhan Felling Series	Casuarina	15	-	-	-	Casuarina100 %
07	Muhanamuhan Felling Series	Casuarina Mai	24 03	- Mai 11%	- -	- -	Casuarina89 % -
08	Muhanamuhan Felling Series	Casuarina	22	-	-	-	Casuarina100 %
09	Muhanamuhan Felling Series	Casuarina Acacia	20 05	- Acacia 20%	- -	- -	Casuarina80 % -
10	Golara PRF	Jamu Kochila Ara Jari Bara	15 10 02 01 01	- Kochila 35% Ara 07% Jari 03% Bara 03%	- - - - -	Jamu 52% - - - -	- - - - -
11	Golara PRF	Captera Telakua Khirakoli Jamu Kendu	10 18 10 03 04	Captera 22% - Khirakoli 22% Jamu 07% Kendu 09%	- Telakua 40% - - -	- - - - -	- - - - -
12	Golara PRF	Giringa Katha	11 10	Giringa 20% Katha Panasa	- -	- -	- -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		Panasa Cashew Kendu Jamu Kochila	06 11 10 08	18% Cashew 10% Kendu 20% Jamu 18% Kochila 14%	- - - -	- - - -	- - - -
13	Golara PRF	Casuarina Cashew Acacia Neem	07 04 04 05	Casuarina35 % Cashew 20% Acacia 20% Neem 25%	- - - -	- - - -	- - - -
14	Golara PRF	Jari Bara Kendu Acacia Khirakoli	08 02 10 08 10	Jari 21% Bara 06% Kendu 26% Acacia 21% Khirakoli 26%	- - - - -	- - - - -	- - - - -
15	Guhalapur FS	Casuarina Jamu Gravelia	08 03 04	- Jamu 20% Gravelia 27%	- - -	Casuarina5 3% - -	- - -
16	Ishaneswar FS	Gravelia	16	-	-	-	Gravelia 100%
17	Guhalapur FS	Eucalyptus Acacia Gravelia	06 05 29	Eucalyptus 15% Acacia 13% -	- - -	- - -	- - Gravelia 72%
18	Kurujanga FS	Acacia Casuarina Cashew	12 04 04	- Casuarina20 % Cashew 20%	- - -	- - -	Acacia 60% - -
19	Guhalapur FS	Casuarina Cashew Acacia Jamu	29 04 03 01	- Cashew 11% Acacia 08% Jamu 03%	- - - -	- - - -	Casuarina78 % - - -
20	Ishaneswar FS	Casuarina Eucalyptus Gravelia	14 07 01	- Eucalyptus 32% Gravelia 04%	- - -	- - -	Casuarina64 % - -
21	Guhalapur FS	Casuarina Jamu	10 05	- Jamu 23%	Casuarina45 %	- -	- -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		Acacia	07	Acacia 32%	- -	-	-
22	Chandrabhaga FS	Acacia Casuarina	06 03	- Casuarina33 %	- -	- -	Acacia 67% -
23	Guhalapur FS	Jamu	20	-	-	-	Jamu 100%
24	Chandrabhaga FS	Casuarina Cashew	06 02	- Cashew 25%	- -	- -	Casuarina75 % -
25	Chandrabhaga FS	Casuarina Cashew	04 05	- -	Casuarina44 % -	- Cashew 56%	- -
26	Nadiamatha PRF	Casuarina Jari Mai Achhu Cashew	08 04 03 04 04	Casuarina35 % Jari 17% Mai 14% Achhu 17% Cashew 17%	- - - - -	- - - - -	- - - - -
27	Nadiamatha PRF	Casuarina Neem Jamu Achhu Cashew Bara	29 09 03 03 03 01	- Neem 20% Jamu 06% Achhu 06% Cashew 06% Bara 02%	- - - - - -	- - - - - -	Casuarina60 % - - - - -
28	Nadiamatha PRF	Casuarina Neem Cashew	04 10 02	Casuarina25 % - Cashew 12%	- - -	- - -	- Neem 63% -
29	Nadiamatha PRF	Acacia Casuarina Neem Cashew Eucalyptus	10 13 08 03 01	Acacia 29% Casuarina37 % Neem 23% Cashew 08% Eucalyptus03 %	- - - - -	- - - - -	- - - - -
30	Nadiamatha PRF	Casuarina Jari Achhu Kaniara Khirakoli	02 01 01 01 01	Casuarina13 % Jari 07% Achhu 07% Kaniara 07%	- - - - -	- - - - -	- - - - -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		cashew Neem	04 05	Khirakoli 07% cashew 26% Neem 33%	- -	- -	- -
31	Manguleswar FS	Casuarina Cashew Acacia	30 01 08	- Cashew 03% Acacia 20%	- - -	- - -	Casuarina77% - -
32	Manguleswar FS	Casuarina Acacia	46 02	- Acacia 04%	- -	- -	Casuarina96% -
33	Manguleswar FS	Casuarina Acacia	03 02	- -	- Acacia 40%	- -	Casuarina60% -
34	Manguleswar FS	Acacia Neem Cashew Casuarina	07 02 03 25	Acacia 19% Neem 05% Cashew 08% -	- - - -	- - - -	- - - Casuarina68%
35	Manguleswar FS	Casuarina Cashew Acacia Jamu	03 01 01 01	- Cashew 17% Acacia 17% Jamu 16%	- - - -	Casuarina50% - - -	- - - -
36	Ramachandi FS	Acacia Cashew Casuarina	01 01 25	Acacia 04% Cashew 04% -	- - -	- - -	- - Casuarina92%
37	Manguleswar FS	Casuarina Acacia	09 05	- Acacia 36%	- -	- -	Casuarina64% -
38	Manguleswar FS	Casuarina	10	-	-	-	Casuarina100%
39	Manguleswar FS	Acacia Casuarina	14 06	- Casuarina30%	- -	- -	Acacia 70% -
40	Ramachandi FS	Cashew Eucalyptus Casuarina	05 08 16	Cashew 17% Eucalyptus 28% -	- - -	- - Casuarina55%	- - -
41	Liakhia FS	Casuarina Cashew	21 06	- Cashew 21%	- -	- -	Casuarina75%

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		Acacia	01	Acacia 04%	-	-	-
42	Liakhia FS	Casuarina Cashew Acacia	13 02 01	- Cashew 13% Acacia 06%	- - -	- - -	Casuarina81 % - -
43	Liakhia FS	Casuarina Cashew	30 01	- Cashew 03%	- -	- -	Casuarina97 % -
44	Balighai PRF	Cashew Casuarina Bara Neem	01 01 01 01	Cashew 25% Casuarina25 % Bara 25% Neem 25%	- - - -	- - - -	- - - -
45	Balighai PRF	Casuarina Cashew Neem Gravelia	01 01 01 01	Casuarina25 % Cashew25% Neem 25% Gravelia 25%	- - - -	- - - -	- - - -
46	Balighai PRF	Acacia Casuarina Cashew	01 01 01	Acacia 33% Casuarina34 % Cashew 33%	- - -	- - -	- - -
47	Balighai PRF	Cashew Casuarina Acacia	01 01 01	Cashew 33% Casuarina34 % Acacia 33%	- - -	- - -	- - -
48	Balighai PRF	Acacia Casuarina Cashew	01 01 01	Acacia 33% Casuarina34 % Cashew 33%	- - -	- - -	- - -
49	Balighai PRF	Acacia Casuarina Cashew Bara	01 01 01 01	Acacia 25% Casuarina25 % Cashew 25% Bara 25%	- - - -	- - - -	- - - -
50	Balighai PRF	Eucalyptus Casuarina Acacia Jamu	01 01 01 01	Eucalyptus 25% Casuarina25 % Acacia 25%	- - - -	- - - -	- - - -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
				Jamu 25%			
51	Balighai PRF	Casuarina Neem Cashew	01 01 01	Casuarina34 % Neem 33% Cashew 33%	- - -	- - -	- - -
52	Compt-13 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34 % Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
53	Compt-13 of Balukhanda RF	Eucalyptus Cashew Acacia Casuarina Jammu	01 01 01 01 01	Eucalyptus 20% Cashew 20% Acacia 20% Casuarina20% Jamu 20%	- - - - -	- - - - -	- - - - -
54	Compt-12 of Balukhanda RF	Casuarina Acacia Cashew	01 01 01	Casuarina34 % Acacia 33% Cashew 33%	- - -	- - -	- - -
55	Compt-12 of Balukhanda RF	Casuarina Eucalyptus Cashew Achhu	07 03 05 01	- Eucalyptus 19% Cashew 31% Achhu 06%	Casuarina44 % - - -	- - - -	- - - -
56	Compt-08 of Balukhanda RF	Cashew Acacia Jammu Casuarina	01 01 01 01	Cashew 25% Acacia 25% Jammu 25% Casuarina25%	- - - -	- - - -	- - - -
57	Compt-14 of Balukhanda RF	Casuarina Cashew Eucalyptus	06 03 03	- Cashew 25% Eucalyptus 25%	- - -	Casuarina50% - -	- - -
58	Compt-14 of Balukhanda RF	Casuarina Cashew	09 01	- Cashew 10%	- -	- -	Casuarina90 % -
59	Balighai PRF	Cashew Casuarina Eucalyptus	01 01 01	Cashew 33% Casuarina34 % Eucalyptus 33%	- - -	- - -	- - -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
60	Compt-6 of Balukhanda RF	Acacia Casuarina Cashew Bara	01 01 01 01	Acacia 25% Casuarina25% Cashew 25% Bara 25%	- - - -	- - - -	- - - -
61	Compt-9 of Balukhanda RF	Eucalyptus Cashew Casuarina Acacia Jammu Khirikoli	10 05 03 01 01 01	- Cashew 24% Casuarina14% Acacia 05% Jammu 05% Khirikoli 05%	Eucalyptus 47% - - - - -	- - - - - -	- - - - - -
62	Compt-11 of Balukhanda RF	Casuarina Cashew Acacia	04 02 01	- Cashew 29% Acacia 14%	- - -	Casuarina57% - -	- - -
63	Compt-04 of Balukhanda RF	Casuarina Cashew Eucalyptus Acacia Bara Tala	01 01 01 01 01 01	Casuarina17% Cashew 17% Eucalyptus 17% Acacia 17% Bara 16% Tala 16%	- - - - - -	- - - - - -	- - - - - -
64	Compt-02 of Balukhanda RF	Casuarina Acacia Cashew	01 01 01	Casuarina34% Acacia 33% Cashew 33%	- - -	- - -	- - -
65	Compt-07 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34% Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
66	Compt-07 of Balukhanda RF	Casuarina Eucalyptus Cashew	01 01 01	Casuarina34% Eucalyptus 33% Cashew 33%	- - -	- - -	- - -
67	Compt-05 of Balukhanda RF	Casuarina Eucalyptus	01 01 01	Casuarina25% Eucalyptus	- - -	- - -	- - -

Table No 6.2 Frequency of Species recorded in point sampling

Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
		Cashew Bara	01	25% Cashew 25% Bara 25%	-	-	-
68	Compt-03 of Balukhanda RF	Acacia Casuarina Cashew Eucalyptus	01 01 01 01	Acacia 25% Casuarina25% Cashew 25% Eucalyptus 25%	- - - -	- - - -	- - - -
69	Village Natia	Neem Mango Acacia Kendu Khirakoli Cashew Kochila	01 01 03 01 01 02 01	Neem 10% Mango 10% Acacia 30% Kendu 10% Khirakoli 10% Cashew 20% Kochila 10%	- - - - - - -	- - - - - - -	- - - - - - -
70	Village Bhubanapur Mouza	Acacia Cashew Khirakoli Asadhua	03 03 01 01	Acacia 38% Cashew 38% Khirakoli 12% Asadhia 12%	- - - -	- - - -	- - - -
71	Village Budhisahi Mouza	Cashew Neem Orange Coconut Jackfruit Mango Acacia Polanga	01 01 01 01 01 01 01 01	Cashew 12.5% Neem 12.5% Orange 12.5% Coconut 12.5% Jackfruit 12.5% Mango 12.5% Acacia 12.5% Polanga 12.5%	- - - - - - - -	- - - - - - - -	- - - - - - - -
72	Village Jenapur	Acacia Casuarina Cashew	02 03 08	Acacia 15% Casuarina23% -	- - -	- - -	- - Cashew 62%
73	Village Hasinpur	Neem Cashew Casuarina	01 09 02	Neem 08% - Casuarina17%	- - -	- - -	- Cashew 75% -

Table No 6.2 Frequency of Species recorded in point sampling							
Sample Point No	Forest Block	Name of Species recorded	No of Species counted	Frequency of species			
				above20%-<40%	Above 40%-<50%	Above 50%-<60%	Above 60%
74	Village Hasinpur	Cashew Acacia Casuarina	08 05 02	- Acacia 33% Casuarina14 %	- - -	Cashew 53% - -	- - -

Table No 6.3 Forest Block & Sample point Intensity.			
Sl No	Name of Forest Block	Area of the Forest Block in Ha	Number of Sample Points
1	Sahana PRF	322.00	8
2	Nipania PRF	10.80	0
3	Tavagolora	71.28	1
4	Pattanaikia	42.00	0
5	Junei PRF	7.80	0
6	Kuakhia	4.80	0
7	Badaandhari	120.00	0
8	Gopinathpur-I	9.60	0
9	Gopinathpur - II	80.00	0
10	Manikpatna	92.00	0
11	Sanandhari	40.00	0
12	Siaria	32.80	0
13	Rameswar	20.40	0
	Total	853.48	

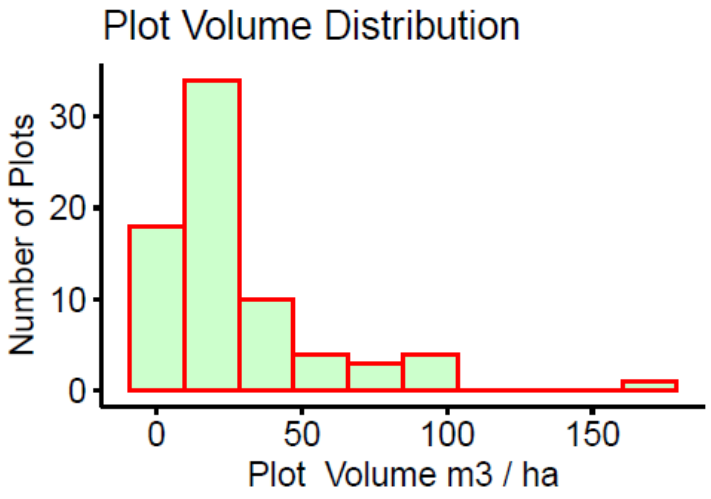
The sample enumeration data has been provided to ORSAC to analyses to calculate the Basal Area, Growing stock and crop density of various forest blocks. Reproduced below.

6.1.2 Growing Stock of the Division:

Basing on Sample Points, the National Institute of Remote Sensing has estimated the growing stock. The basic information on growing stock is furnished below.

Table No 6.4 Stand volume parameters – Puri WL Division.						
Criteria						
No of trees / ha	Basal Area per ha (M^2)	Volume per Ha (in M^3)	Mean Volume (in M^3)	Standard Error	LB (in M^3)	UB (in M^3)
160.27	4.81	27.44	22.7	0.15	16.2	29.19

The volume distribution is graphically represented as

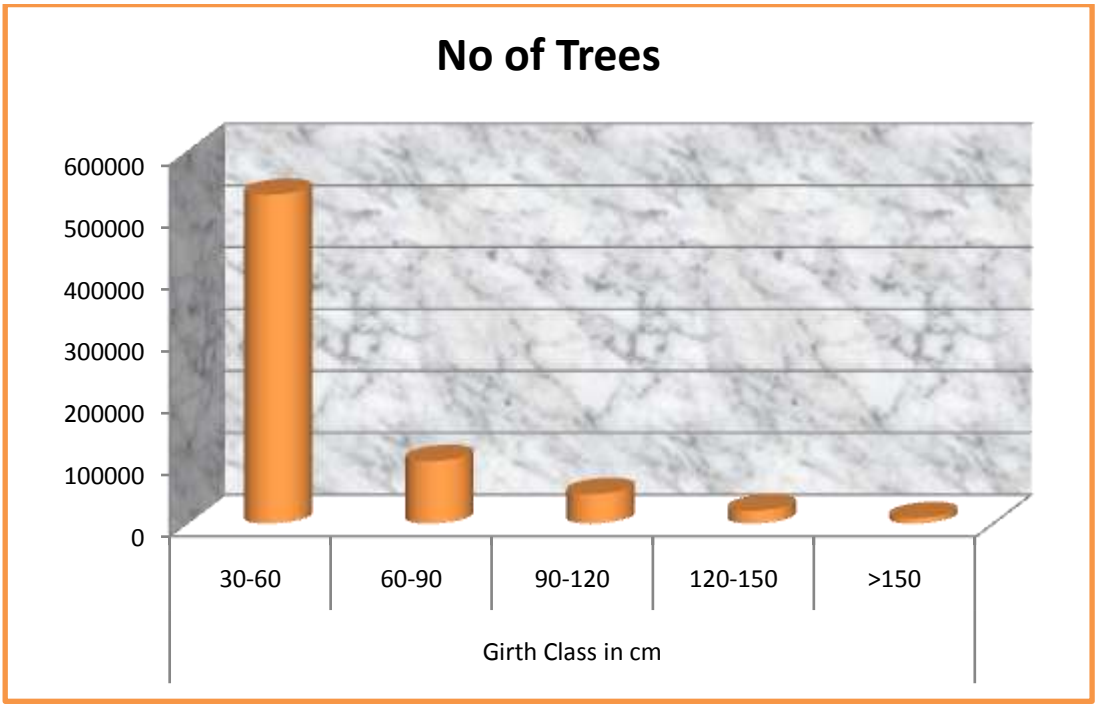


Econsps	Mean	SE
Ano lat	0.0	NA
Misc	22.7	0.15
Sho rob	0.0	NA
Ter tom	0.0	NA
Dio mel	0.0	NA

The girth class wise distribution of available stems is gurnished below.

The Girth Class wise distribution has also been indicated by ORSAC. It is reproduced below.

Table No 6.5 Number of trees in different girth Class as per ORSAC Analysis Report.						
Range	Girth Class in cm					
	30-60	60-90	90-120	120-150	>150	Total
Astaranga / Gopa	1863	316	162	70	18	2429
Astaranga	61389	12097	6276	2976	1207	83945
Balukhanda	135138	32872	14650	7669	6048	196377
Brahmagiri	26122	4520	2382	1004	318	34346
Konark	307060	50942	24032	8968	1011	392013
Div. Total	531572	100747	47502	20687	8602	709110
Percentage	74.96	14.21	6.70	2.92	1.21	100.00

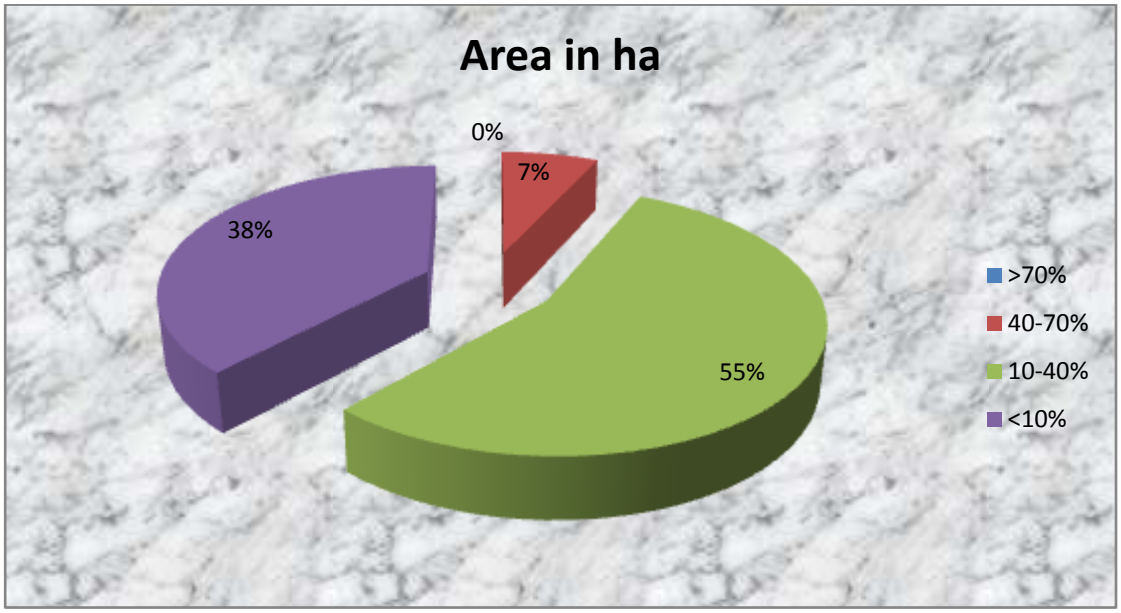


6.1.3. Crop Density:

From crom density table as given below, it is observed that 6.87 percent of area is under moderate density, 54.95% area under degraded forest category and 38.18% area under open category.

Table No 6.6 Distribution of Forest area vis – vis density class.

Crop Density	Area in ha	Percentage of Forest area	Remark
>70%	0	0	Dense Forest
40-70%	587.5	6.87	Moderately Dense Forest
10-40%	4700.5	54.95	Degraded forest
<10%	3265.9	38.18	Open Forest.
Total	8553.83	100.00	



6.2 Growing Stock of Bamboo:

Bamboo (*Bambusa arundinacea* – Kanta baunsha) and (*Bambusa nutans* – Bari Baunsha) are available in three forest blocks of this division. No systematic assessment of Bamboo stock has been made. During visit to these forest blocks for preparation of working plan it is observed that the presence / density of bamboo (Forest Block Wise) assessed as follows.

a) Tavagolora PRF:
b) Junei PRF
c) Nipania PRF
d) Patanaikia PRF

6.3 Increment in Volume of Identified Timber Species:

There are plantations of *Casuarina* and *Acacia auriculiformis*. Casuarina is commercially harvested for Fire wood purpose through Odisha Forest Development Corporation Ltd. Annually 50ha of Casuarina plantation is being harvested and the fire wood is supplied to Jagannath South Gate Depot and Swargadwar Depot.

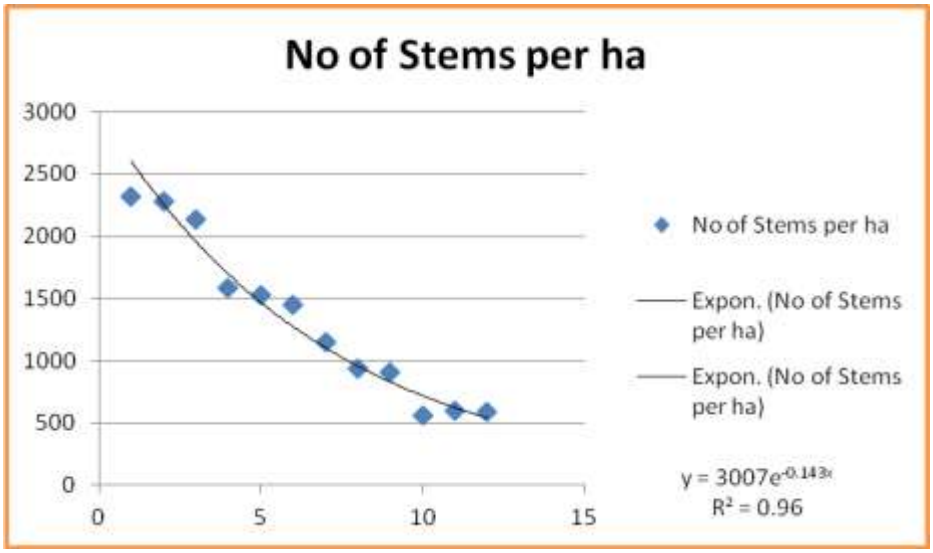
Usually *Casuarina* Plantation is taken up at a spacing of 2.0m x2.0m i.e. 2500 plants per hectare. At the time of harvesting (after 10 years), the number of stem available is 450 no to 500 per hectare.

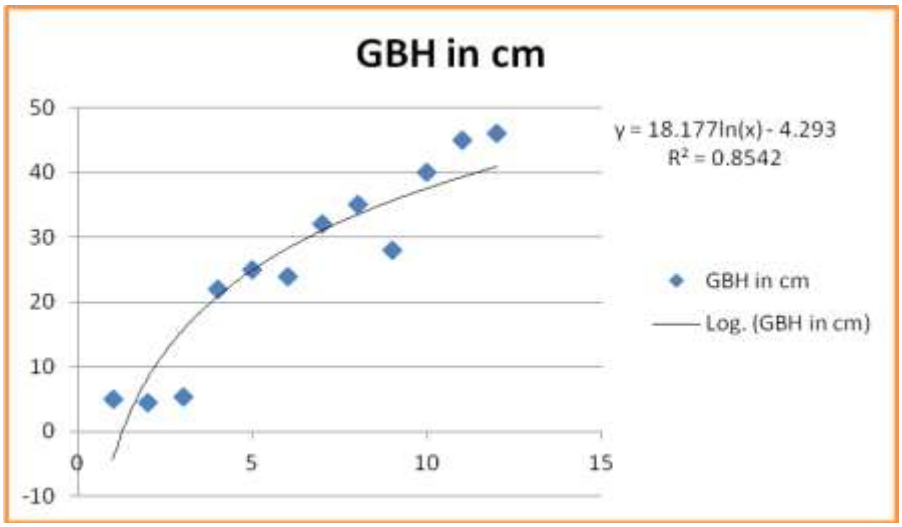
During field exercise, plantation of 2nd year, 5th year and 8th year were inspected and growth & survival statistics are recorded. The observations are furnished at **Table No: 6.7**

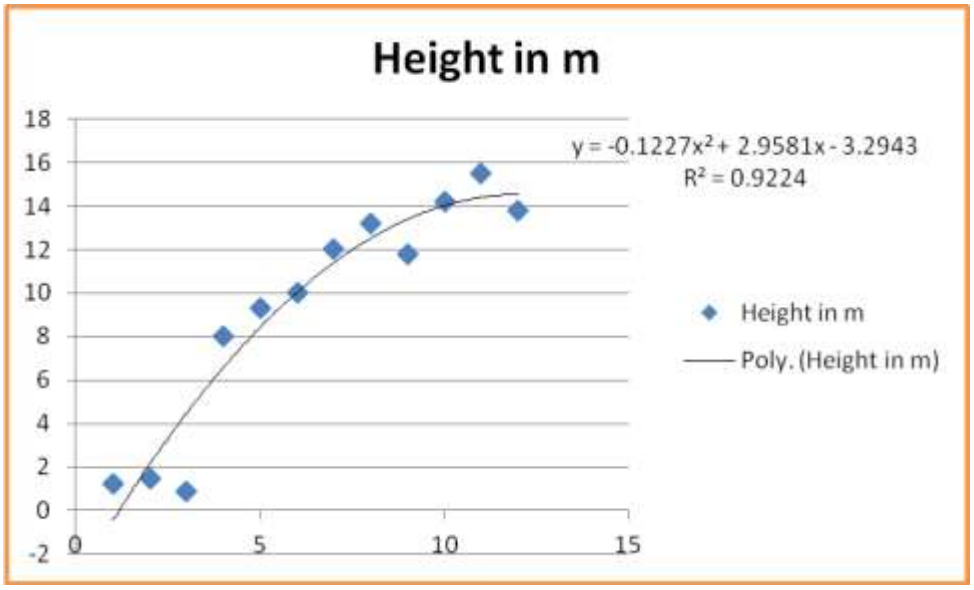
Table No : 6.7 Growth Statistics (Casuarina Plantation)

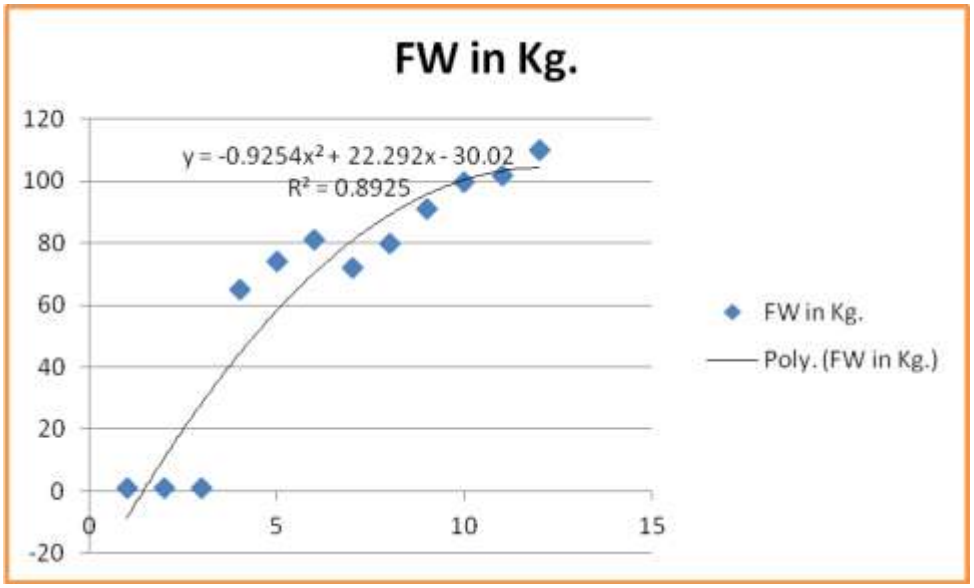
Sl No	Name of Plantation	Year of Growth	No of stems available / Ha	Average Growth		
				GBH in cm	Top Height in M	Weight/ plant.
1	Sahana PRF	2nd	1824	5	1.25	0.9
2			1785	4.5	1.5	1.1
3			1743	5.3	0.9	0.85
4		5th	1348	22	8	65
5			1406	25	9.3	74
6			1379	24	10	81
7		8th	947	32	12	72
8			869	35	13.2	80
9			994	28	11.8	91
11		10th	564	40	14.2	99.52
12			601	45	15.5	101.77
13			590	46	13.8	109.93

(NB: 10th year data recoded from coupe enumeration list and weight obtained after harvesting)


No of Stems per ha
3000
2500
2000
1500
1000
500
0
0
5
10
15
No of Stems per ha
Expon. (No of Stems per ha)
Expon. (No of Stems per ha)
y = 3007e-0.143x
R² = 0.96


GBH in cm
50
40
30
20
10
0
-10
0
5
10
15
y = 18.177ln(x) - 4.293
R² = 0.8542
GBH in cm
Log. (GBH in cm)





6.4 Effects towards enhancement of Forest Productivity through Quality Plantation activities:

In Puri (Wildlife) Division, the forest is mostly miscellaneous forest with low to moderate productivity. As the soil is mostly sandy and saline to some extent Casuarina plantation is most effective way to enrich forests, to create Shelter Belt and Wind Break. As it is a first growing species and easy to establish, it is being planted in almost all plantation sites at a spacing of 2mx2m i.e. @2500 plants per hectare. The annual productivity of Forest under

Casuarina plantation in an average is 72 tons per ha per annum. Only drawback of Casuarina plantation is the clear felling silvicultural system followed by plantation. It is not a coppicer at all. Moreover natural regeneration of casuarinas is hardly seen. Hence recurring expenditure is required in every 10 years Cycle. Planting capacity of the Division is to be increased to cover more area in a year. As Casuarina is being planted by private individuals, people may be motivated to have Farm forestry for better tree cover.

6.5 Carbon Stock:

For calculation of Carbon Stock of trees / Herbs / Leaf litters on forest floor, it is required to enumerate them as per procedures led out in the National Working Plan Code-2014. No systematic study has been taken up due to funds constrain. The Forest Survey of India has been requested to provide available information on Carbon Stock of Casuarina plantations being raised in coastal belt.

6.5.1 Principle:

The rate of carbon sequestration depends on the growth characteristics of the tree species,the conditions for growth where the tree is planted, and the density of the tree's wood. Itis greatest in the younger stages of tree growth, between 20 to 50 years. Furthercomplicating the issue is the fact that far less research has been done on tropical treespecies as compared to temperate tree species.

1. Determine the total (green) weight of the Growing Stock.
2. Determine the dry weight of the Growing Stock.
3. Determine the weight of carbon in the Growing Stock.
4. Determine the weight of carbon dioxide sequestered in the Growing Stock.

6.5.2 General approach.

As per thump Rule & taking Wood Empirical Formula $C_nH_{2n}O_n$, 30 gms of Wood contains 12 gms of carbon. Considering the Ash content i.e. Metals and its oxides in plants 15 % reduction of Carbon may be safely considered.

Hence 30 Tons of Wood may contain (12T-0.3T) 11.70 Ton of Carbon. Hence 1 Ton of Wood (Dry mass) may contain 0.39 Tons of fixed Carbon. For Conversion of mass of Wood from Cum to Ton, the density factors for various species recorded in Tropical forests are furnished below.

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
1	*Acacia arabica*	0.70 *	31	*Amoora aherniana*	0.58
2	*Acacia catechu*	0.88	32	*Amoora macrocarpa*	0.55
3	*Acacia confusa*	0.75	33	*Amoora spp.*	0.6
4	*Acacia leucophloea*	0.76	34	*Anisophyllea zeylanica*	0.46 *
5	*Acacia richii*	0.69	35	*Anisoptera aurea*	0.53
6	*Adina cordifolia*	0.58, 0.59 +	36	*Anisoptera spp.*	0.54
7	*Aegle marmelo*	0.75	37	*Anisoptera thurifera*	0.54
8	*Agathis dammara*	0.41	38	*Anogeissus latifolia*	0.78, 0.79 +
9	*Agathis spp.*	0.44	39	*Anthocephalus chinensis*	0.36, 0.33 +
10	*Agathis vitiensis*	0.45	40	*Antidesma pleuricum*	0.59
11	*Aglaia diffusa*	0.7	41	*Aphanamixis cumingiana*	0.58
12	*Aglaia iloilo*	0.53	42	*Aphanamixis perrottetiana*	0.52
13	*Aglaia llanosiana*	0.89	43	*Araucaria bidwillii*	0.43
14	*Alangium longiflorum*	0.65	44	*Artocarpus blancoi*	0.43
15	*Alangium meyeri*	0.63	45	*Artocarpus heterophylla*	0.6
16	*Albizzia amara*	0.70 *	46	*Artocarpus lakoocha*	0.53 *
17	*Albizzia falcataria*	0.25	47	*Artocarpus ovata*	0.47
18	*Albizzia lebbek*	0.55, 0.66 +	48	*Artocarpus spp.*	0.58
19	*Albizzia odoratissima*	0.76	49	*Azadirachta indica*	0.69
20	*Albizzia procera*	0.52 *, 0.59 +	50	*Azadirachta spp.*	0.52
21	*Aleurites moluccana*	0.25	51	*Balanocarpus spp.*	0.76
22	*Aleurites trisperma*	0.43	52	*Barringtonia edulis*	0.48
23	*Alnus japonica*	0.43	53	*Bauhinia spp.*	0.67
24	*Alphitonia philippinensis*	0.4	54	*Beilschmiedia tawa*	0.58
25	*Alphitonia zizyphoides*	0.5	55	*Berrya cordifolia*	0.78 *
26	*Alphonsea arborea*	0.69	56	*Bischofia javanica*	0.54, 0.58, 0.62 +
27	*Alseodaphne longipes*	0.49	57	*Bleasdalea vitiensis*	0.43
28	*Alstonia macrophylla*	0.62	58	*Bombax ceiba*	0.33
29	*Alstonia scholaris*	0.36	59	*Bombycidendron vidalianum*	0.53

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
30	*Alstonia spp.*	0.37	60	*Boswellia serrata*	0.5
31	*Bridelia retusa*	0.5	91	*Cedrela spp.*	0.42
32	*Bridelia squamosa*	0.5	92	*Cedrela toona*	0.43
33	*Buchanania lanzan*	0.45	93	*Ceiba pentandra*	0.23
34	*Buchanania latifolia*	0.45	94	*Celtis luzonica*	0.49
35	*Bursera serrata*	0.59	95	*Chisocheton cumingianus*	0.52
36	*Butea monosperma*	0.48	96	*Chisocheton pentandrus*	0.52
37	*Calophyllum blancoi*	0.51	97	*Chloroxylon swietenia*	0.76, 0.79, 0.80 +
38	*Calophyllum inophyllum*	0.57	98	*Chukrassia tabularis*	0.57
39	*Calophyllum neo-ebudicum*	0.5	99	*Cinnamomum mercadoi*	0.65
40	*Calophyllum obliquinervium*	0.58	100	*Cinnamomum spp.*	0.43
41	*Calophyllum spp.*	0.53	101	*Citrus grandis*	0.59
42	*Calophyllum vitiense*	0.5	102	*Cleidion speciflorum*	0.5
43	*Calycarpa arborea*	0.53	103	*Cleistanthus collinus*	0.88
44	*Cananga odorata*	0.29	104	*Cleistocalyx operculatus*	0.66
45	*Canarium asperum var. asperum*	0.50, 0.60 +	105	*Cleistocalyx spp.*	0.76
46	*Canarium hirsutum forma scabrum*	0.4	106	*Cochlospermum gossypium + religiosum*	0.27
47	*Canarium luzonicum*	0.51	107	*Cocos nucifera*	0.5
48	*Canarium spp.*	0.44	108	*Colona serratifolia*	0.33
49	*Canarium vanikoroense*	0.54	109	*Combretodendron quadrialatum*	0.57
50	*Canarium vitiense*	0.54	110	*Cordia spp.*	0.53
51	*Canarium vrieseanum forma stenophyllum*	0.56	111	*Cotylelobium spp.*	0.69
52	*Canthium monstrosum*	0.42	112	*Crataeva religiosa*	0.53 *
53	*Carallia calycina*	0.66 *	113	*Cratoxylon arborescens*	0.4

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
54	*Cassia fistula*	0.71	114	*Cryptocarya spp.*	0.59
55	*Cassia javanica*	0.69	115	*Cubilia cubili*	0.49
56	*Cassia spectabilis*	0.48	116	*Cullenia excelsa*	0.53
55	*Castanopsis philippensis*	0.51	117	*Cynometra insularis*	0.76, 0.91 +
56	*Casuarina equisetifolia*	0.83	118	*Cynometra ramiflora*	0.7
57	*Casuarina nodiflora*	0.85	119	*Cynometra spp.*	0.8
58	*Cedrela odorata*	0.38	120	*Dacrycarpus imbricatus*	0.45, 0.47 +
59					
60	*Dacrydium elatum*	0.48	151	*Dipterocarpus gracilis*	0.61
61	*Dacrydium nausoriensis*	0.52	152	*Dipterocarpus grandiflorus*	0.62
62	*Dacrydium nidulum*	0.52	153	*Dipterocarpus kerrii*	0.56
63	*Dacrydium spp.*	0.46	154	*Dipterocarpus kunstlerii*	0.57
64	*Dacryodes spp.*	0.61	155	*Dipterocarpus spp.*	0.61
65	*Dalbergia latifolia*	0.75	156	*Dipterocarpus warburgii*	0.52
66	*Dalbergia paniculata*	0.64	157	*Dracontomelon dao*	0.52
67	*Decussocarpus philippinensis*	0.5	158	*Dracontomelon edule*	0.46
68	*Decussocarpus vitiensis*	0.37	159	*Dracontomelon spp.*	0.5
69	*Degeneria vitiensis*	0.35	160	*Dryobalanops spp.*	0.61
70	*Dehaasia triandra*	0.64	161	*Drypetes bordenii*	0.75
71	*Dialium spp.*	0.8	162	*Durio spp.*	0.53
72	*Dillenia luzoniensis*	0.69	163	*Durio zibethinus*	0.44, 0.53 +
73	*Dillenia megalantha*	0.69	164	*Dyera costulata*	0.36
74	*Dillenia pentagyna*	0.53	165	*Dysoxylum altissimum*	0.42
75	*Dillenia philippinensis*	0.61	166	*Dysoxylum decandrum*	0.51
76	*Dillenia spp.*	0.59	167	*Dysoxylum euphlebium*	0.63
77	*Diospyros embryopteris*	0.63 *	168	*Dysoxylum quercifolium*	0.49
78	*Diospyros inclusa*	0.68	169	*Dysoxylum richii*	0.49
79	*Diospyros melanoxylon*	0.68	170	*Elaeocarpus serratus*	0.40 *
80	*Diospyros*	0.69	171	*Emblica officinalis*	0.8

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
	mindanaensis				
81	*Diospyros nitida*	0.71	172	*Endiandra laxiflora*	0.54
82	*Diospyros philippensis*	0.81	173	*Endospermum macrophyllum*	0.4
83	*Diospyros pilosanthera*	0.8	174	*Endospermum peltatum*	0.31
84	*Diospyros poncei*	0.81	175	*Endospermum spp.*	0.38
85	*Diospyros pyrrhocarpa*	0.6	176	*Enterolobium cyclocarpum*	0.35
86	*Diospyros spp.*	0.7	177	*Epicharis cumingiana*	0.73
87	*Diplodiscus paniculatus*	0.63	178	*Erythrina fusca*	0.25
88	*Dipterocarpus caudatus*	0.61	179	*Erythrina suberosa*	0.32
89	*Dipterocarpus eurynchus*	0.56	180	*Erythrina subumbrans*	0.24
90					
91	*Erythrophloeum densiflorum*	0.65	211	*Heritiera sylvatica*	0.77
92	*Eucalyptus citriodora*	0.64	212	*Hevea brasiliensis*	0.53
93	*Eucalyptus deglupta*	0.34	213	*Hibiscus tiliaceus*	0.57
94	*Eugenia spp.*	0.65	214	*Homalanthus populneus*	0.38
95	*Fagraea gracilipes*	0.84	215	*Homalium spp.*	0.76
96	*Fagraea spp.*	0.73	216	*Hopea acuminata*	0.62
97	*Ficus benjamina*	0.65	217	*Hopea foxworthyi*	0.64
98	*Ficus botryocarpa*	0.43	218	*Hopea plagata*	0.88
99	*Ficus minahassae*	0.42	219	*Hopea spp.*	0.64
100	*Ficus spp.*	0.39	220	*Intsia bijuga*	0.61, 0.68,0.74
101	*Ficus variegata*	0.28	221	*Intsia palembanica*	0.68
102	*Ganua obovatifolia*	0.59	222	*Kayea garciae*	0.53
103	*Garcinia myrtifolia*	0.65	223	*Kingiodendron alternifolium*	0.48
104	*Garcinia spp.*	0.75	224	*Kleinhovia hospita*	0.36
105	*Gardenia latifolia*	0.64	225	*Knema spp.*	0.53
106	*Gardenia turgida*	0.64	226	*Koompassia excelsa*	0.63
107	*Garuga pinnata*	0.51	227	*Koompassia malaccensis*	0.72

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
108	*Gluta spp.*	0.63	228	*Koordersiodendron pinnatum*	0.65, 0.69 +
109	*Gmelina arborea*	0.41, 0.45 +	229	*Kydia calycina*	0.72
110	*Gmelina vitiensis*	0.54	230	*Lagerstroemia parviflora*	0.62
111	*Gonocaryum calleryanum*	0.64	231	*Lagerstroemia piriformis*	0.5
112	*Gonystylus bancanus*	0.52	232	*Lagerstroemia speciosa*	0.53
113	*Gonystylus macrophyllus*	0.52	233	*Lagerstroemia spp.*	0.55
114	*Gonystylus punctatus*	0.57	234	*Lannea coromandelica*	0.54
115	*Grewia multiflora*	0.46	235	*Lannea grandis*	0.5
116	*Grewia tiliaefolia*	0.68	236	*Leucaena leucocephala*	0.64
117	*Hardwickia binata*	0.73	237	*Litchi chinensis var. philippinensis*	0.88
118	*Harpullia arborea*	0.62	238	*Lithocarpus celebica*	0.68
119	*Heritiera ornithocephala*	0.68	239	*Lithocarpus llanosii*	0.63
120	*Heritiera spp.*	0.56	240	*Lithocarpus soleriana*	0.63
121					
122	*Litsea garciae*	0.34	271	*Milliusa velutina*	0.63
123	*Litsea leytensis*	0.35	272	*Mimusops elengi*	0.72 *
124	*Litsea perrottetii*	0.45	273	*Mitragyna parviflora*	0.56
125	*Litsea spp.*	0.4	274	*Myristica castaneifolia*	0.49
126	*Lophopetalum spp.*	0.46	275	*Myristica chartacea*	0.49
127	*Macaranga bicolor*	0.29	276	*Myristica gillespieana*	0.49
128	*Macaranga denticulata*	0.53	277	*Myristica spp.*	0.53
129	*Madhuca fulva*	0.53	278	*Neesia spp.*	0.53
130	*Madhuca longifolia var. latifolia*	0.74	279	*Neonauclea bernardoi*	0.62
131	*Madhuca oblongifolia*	0.53	280	*Neotrewia cumingii*	0.55
132	*Mallotus multiglandulosus*	0.42	281	*Ochna foxworthyi*	0.86
133	*Mallotus philippensis*	0.64	282	*Ochroma pyramidale*	0.3
134	*Mangifera altissima*	0.55	283	*Octomeles sumatrana*	0.27, 0.32 +
135	*Mangifera indica*	0.52, 0.59 +	284	*Oroxylon indicum*	0.32

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
136	*Mangifera merrillii*	0.52	285	*Ougenia dalbergiodes*	0.7
137	*Mangifera spp.*	0.52	286	*Palaquium fidjiense*	0.48
138	*Maniltoa grandiflora*	0.76	287	*Palaquium hornei*	0.7
139	*Maniltoa minor*	0.76	288	*Palaquium lanceolatum*	0.55
140	*Mastixia philippinensis*	0.47	289	*Palaquium luzoniense*	0.45
141	*Melanorrhea spp.*	0.63	290	*Palaquium philippense*	0.41
142	*Melia dubia*	0.4	291	*Palaquium spp.*	0.55
143	*Melicope triphylla*	0.37	292	*Palaquium tenuipetiolatum*	0.5
144	*Meliosma macrophylla*	0.27	293	*Palaquium vitilevuense*	0.48
145	*Melochia umbellata*	0.25	294	*Pangium edule*	0.5
146	*Mesua ferrea*	0.83, 0.85 +	295	*Parashorea malaanonan*	0.51
147	*Metrosideros collina*	0.70, 0.76 +	296	*Parashorea spp.*	0.44
148	*Michelia platyphylla*	0.51	297	*Parashorea stellata*	0.59
149	*Michelia spp.*	0.43	298	*Paratrophis glabra*	0.77
150	*Microcos stylocarpa*	0.4	299	*Parinari corymbosa*	0.76
151	*Micromelum compressum*	0.64	300	*Parinari insularum*	0.65
152					
153	*Parinari spp.*	0.68	331	*Salmalia malabarica*	0.32, 0.33 +
154	*Parkia roxburghii*	0.34	332	*Samanea saman*	0.45, 0.46 4
155	*Payena spp.*	0.55	333	*Sandoricum koetjape*	0.44
156	*Peltophorum pterocarpum*	0.62	334	*Sandoricum vidalii*	0.43
157	*Pentace spp.*	0.56	335	*Sapindus saponaria*	0.58
158	*Phaeanthus ebracteolatus*	0.56	336	*Sapium luzonicum*	0.4
159	*Phyllocladus hypophyllus*	0.53	337	*Schleichera oleosa*	0.96
160	*Pinus caribaea*	0.48	338	*Schrebera swietenoides*	0.82
161	*Pinus insularis*	0.47, 0.48 +	339	*Semicarpus anacardium*	0.64
162	*Pinus merkusii*	0.54	340	*Serialbizia acle*	0.57
163	*Pisonia umbellifera*	0.21	341	*Serianthes melanesica*	0.48

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
164	*Pittosporum pentandrum*	0.51	342	*Sesbania grandiflora*	0.4
165	*Planchonella vitiensis*	0.77	343	*Shorea agsaboensis*	0.35
166	*Planchonia spectabilis*	0.58	344	*Shorea almon*	0.42
167	*Planchonia spp.*	0.59	345	*Shorea assamica forma philippinensis*	0.41
168	*Podocarpus neriifolius*	0.52	346	*Shorea astylosa*	0.73
169	*Podocarpus spp.*	0.43	347	*Shorea ciliata*	0.75
170	*Polyalthia flava*	0.51	348	*Shorea contorta*	0.44
171	*Polyscias nodosa*	0.38	349	*Shorea gisok*	0.76
172	*Pometia pinnata forma pinnata*	0.58	350	*Shorea guiso*	0.68
173	*Pometia spp.*	0.54	351	*Shorea hopeifolia*	0.44
174	*Pouteria villamilii*	0.47	352	*Shorea malibato*	0.78
175	*Premna tomentosa*	0.96	353	*Shorea negrosensis*	0.44
176	*Pterocarpus indicus*	0.52	354	*Shorea palosapis*	0.39
177	*Pterocarpus marsupium*	0.67	355	*Shorea plagata*	0.7
178	*Pterocymbium macrorater*	0.47	356	*Shorea polita*	0.47
179	*Pterocymbium tinctorium*	0.28	357	*Shorea polysperma*	0.47
180	*Pygeum vulgare*	0.57	358	*Shorea robusta*	0.72
181	*Quercus spp.*	0.7	359	*Shorea spp. balau group*	0.7
182	*Radermachera pinnata*	0.51	360	*Shorea spp. dark red meranti*	0.55
183					
184	*Shorea spp. light red meranti*	0.4	391	*Terminalia chebula*	0.96
185	*Shorea spp. white meranti*	0.48	392	*Terminalia citrina*	0.71
186	*Shorea spp. yellow meranti*	0.46	393	*Terminalia copelandii*	0.46
187	*Shorea virescens*	0.42	394	*Terminalia foetidissima*	0.55
188	*Sloanea javanica*	0.53	395	*Terminalia microcarpa*	0.53

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
189	*Soymida febrifuga*	0.97	396	*Terminalia nitens*	0.58
190	*Spathodea campanulata*	0.25	397	*Terminalia pterocarpa*	0.48
191	*Stemonurus luzoniensis*	0.37	398	*Terminalia tomentosa*	0.73, 0.76, 0.77 +
192	*Sterculia ceramica*	0.27	399	*Ternstroemia megacarpa*	0.53
193	*Sterculia foetida*	0.47 *	400	*Tetrameles nudiflora*	0.3
194	*Sterculia urens*	0.67	401	*Tetramerista glabra*	0.61
195	*Sterculia vitiensis*	0.31	402	*Thespesia populnea*	0.52
196	*Stereospermum suaveolens*	0.62	403	*Toona calantas*	0.29
197	*Strombosia philippinensis*	0.71	404	*Trema orientalis*	0.31
198	*Strychnos potatorum*	0.88	405	*Trichospermum richii*	0.32
199	*Swietenia macrophylla*	0.49, 0.53 +	406	*Tristania decorticata*	0.91
200	*Swintonia foxworthyi*	0.62	407	*Tristania micrantha*	0.89
201	*Swintonia spp.*	0.61	408	*Tristania spp.*	0.8
202	*Sycopsis dunni*	0.63	409	*Turpinia ovalifolia*	0.36
203	*Syzygium cumini*	0.7	410	*Vateria indica*	0.47 *
204	*Syzygium luzoniense*	0.63	411	*Vatica mangachapoi*	0.65
205	*Syzygium nitidum*	0.74	412	*Vatica obscura*	1.04 *
206	*Syzygium simile*	0.56	413	*Vatica pachyphylla*	0.78
207	*Syzygium spp.*	0.69, 0.76 +	414	*Vatica spp.*	0.69
208	*Tamarindus indica*	0.75	415	*Vitex parviflora*	0.7
209	*Tectona grandis*	0 50, 0.55 +	416	*Vitex peduncularis*	0.96
210	*Teijsmanniodendron ahernianum*	0.9	417	*Vitex spp.*	0.65
211	*Terminalia arjuna*	0.68	418	*Vitex turczaninowii*	0.49
212	*Terminalia belerica*	0.72	419	*Wallaceodendron celebicum*	0.55, 0.57 +
213	*Terminalia catappa*	0.52	420	*Weinmannia luzoniensis*	0.49
214					
215	*Wrightia tinctorea*	0.75	425	*Zanthoxylum rhetsa*	0.33
216	*Xanthophyllum excelsum*	0.63	426	*Zizyphus spp.*	0.76

Table No 6.8 Density of Wood					
Sl No	Species	Wood density	Sl No	Species	Wood density
	Tropical Asia				
217	*Xanthostemon verdugonianus*	1.04	427	*Zizyphus talanai*	0.53
218	*Xylia xylocarpa*	0.73, 0.81 +	428	*Zizyphus xylopyra*	0.85

6.6 Carbon Sequestration& Mitigation:

6.6.1 Carbon sequestration:

Carbon sequestrationis the process involved in carbon capture and the long-term storage of atmospheric carbon dioxide or other forms of carbon to mitigate or defer global warming. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels.

Carbon dioxide (CO_2) is naturally captured from the atmosphere through biological, chemical, and physical processes.Carbon dioxide may be captured as a pure by-product in processes related to petroleum refining or from flue gases from power generation. CO_2 sequestration includes the storage part of carbon capture and storage, which refers to large-scale, artificial capture and sequestration of industrially produced CO_2 using subsurface saline aquifers, reservoirs, ocean water, aging oil fields, or other carbon sinks.

Increasing yields and efficiency generally reduces emissions as well, since more food results from the same or less effort. Techniques include more accurate use of fertilizers, less soil disturbance, better irrigation, and crop strains bred for locally beneficial traits and increased yields.

Replacing more energy intensive farming operations can also reduce emissions. Reduced or no-till farming requires less machine use and burns correspondingly less fuel per acre. However, no-till usually increases use of weed-control chemicals and the residue now left on the soil surface is more likely to release its CO_2 to the atmosphere as it decays, reducing the net carbon reduction.

In practice, most farming operations that incorporate post-harvest crop residues, wastes and byproducts back into the soil provide a carbon storage benefit.This is particularly the case for practices such as field burning of stubble – rather than releasing almost all of the stored CO_2 to the atmosphere; tillage incorporates the biomass back into the soil.

Carbon Sequestration as it relates to Forestry, the following steps are suggested:

- Planting of Species having long Rotation period in order to enhance carbon storage for a longer period.
- The crop should not be harvested when the bio mass growth is faster i.e. first growing species to be favoured to slow growing species. When growth is retired the species may be harvested.
- The timber should be utilized in structures / house hold articles than use as fuel.
- Leaf litters, Twigs may be allowed to convert to compost and go back to soil than use as fuel which immediately releases $CO_2$to atmosphere.
- Steps to be taken to improve soil organic content than losing carbon to atmosphere as CO_2.

Enhancing carbon removal.

All crops absorb CO_2 during growth and release it after harvest. The goal of agricultural carbon removal is to use the crop and its relation to the carbon cycle to permanently sequester carbon within the soil. This is done by selecting farming methods that return biomass to the soil and enhance the conditions in which the carbon within the plants will be reduced to its elemental nature and stored in a stable state. Methods for accomplishing this include:

- Use cover crops such as grasses and weeds as temporary cover between planting seasons
- Concentrate livestock in small paddocks for days at a time so they graze lightly but evenly. This encourages roots to grow deeper into the soil. Stock also till the soil with their hooves, grinding old grass and manures into the soil.
- Cover bare paddocks with hay or dead vegetation. This protects soil from the sun and allows the soil to hold more water and be more attractive to carbon-capturing microbes.
- Restore degraded land, which slows carbon release while returning the land to agriculture or other use.

Agricultural sequestration practices may have positive effects on soil, air, and water quality, be beneficial to wildlife, and expand food production. On degraded croplands, an increase of 1 ton of soil carbon pool may increase crop yield by 20 to 40 kilograms per hectare of wheat, 10 to 20 kg/ ha for maize, and 0.5 to 1 kg/ha for cowpeas.

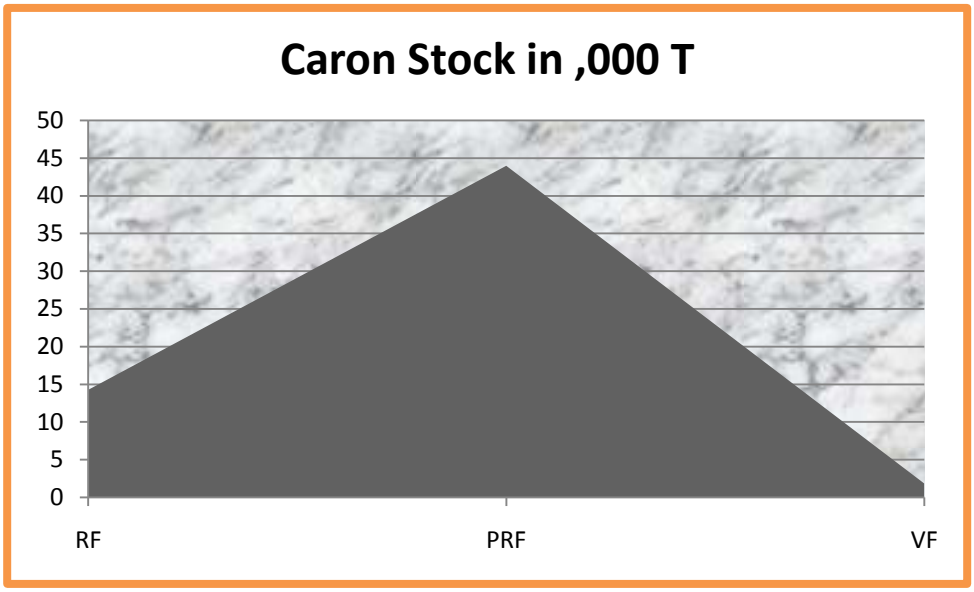
The effects of soil sequestration can be reversed. If the soil is disrupted or tillage practices are abandoned, the soil becomes a net source of greenhouse gases. Typically after 15 to 30 years

of sequestration, soil becomes saturated and ceases to absorb carbon. This implies that there is a global limit to the amount of carbon that soil can hold.

Many factors affect the costs of carbon sequestration including soil quality, transaction costs and various externalities such as leakage and unforeseen environmental damage. Because reduction of atmospheric $CO_2$is a long-term concern, farmers can be reluctant to adopt more expensive agricultural techniques when there is not a clear crop, soil, or economic benefit.

6.6.2 Carbon Stock in Forests:

Sl No	Forest	Total Forest area in Ha	Growing Stoch Cum/ Ha	Wood density T/ Cum	Total Biomass $x10^3$ T	Carbon stock $x10^3$	Carbon Dioxide equivalent $x10^3$
1	RF	1566.19	27.44	0.85	36.53	14.25	52.24
2	PRF	6205	22.70	0.80	112.68	43.95	161.13
3	VF	325.582	22.70	0.64	4.73	1.84	6.76
	Total	**8096.772**	**72.84**	**2.29**	**153.94**	**60.04**	**220.13**

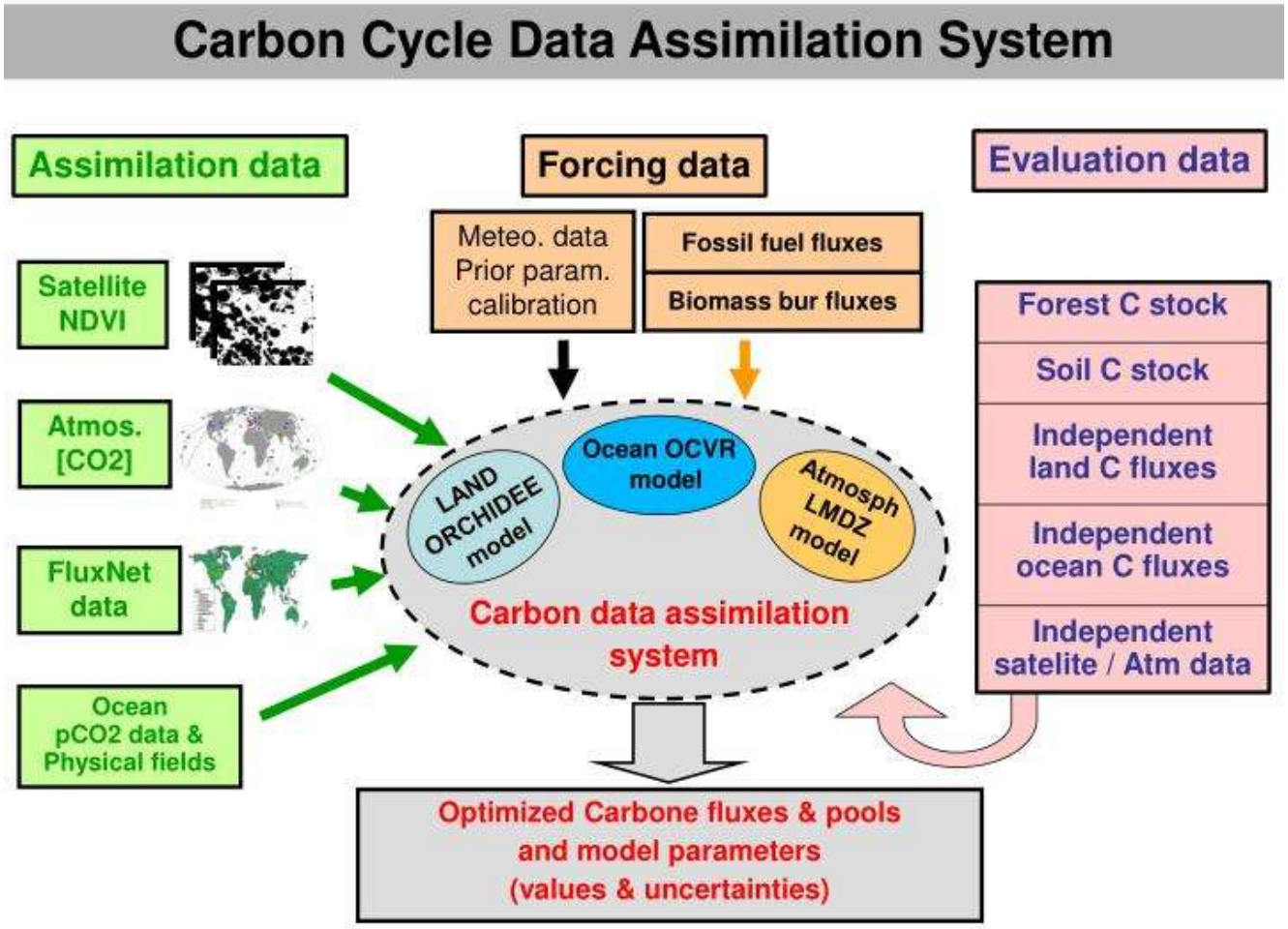


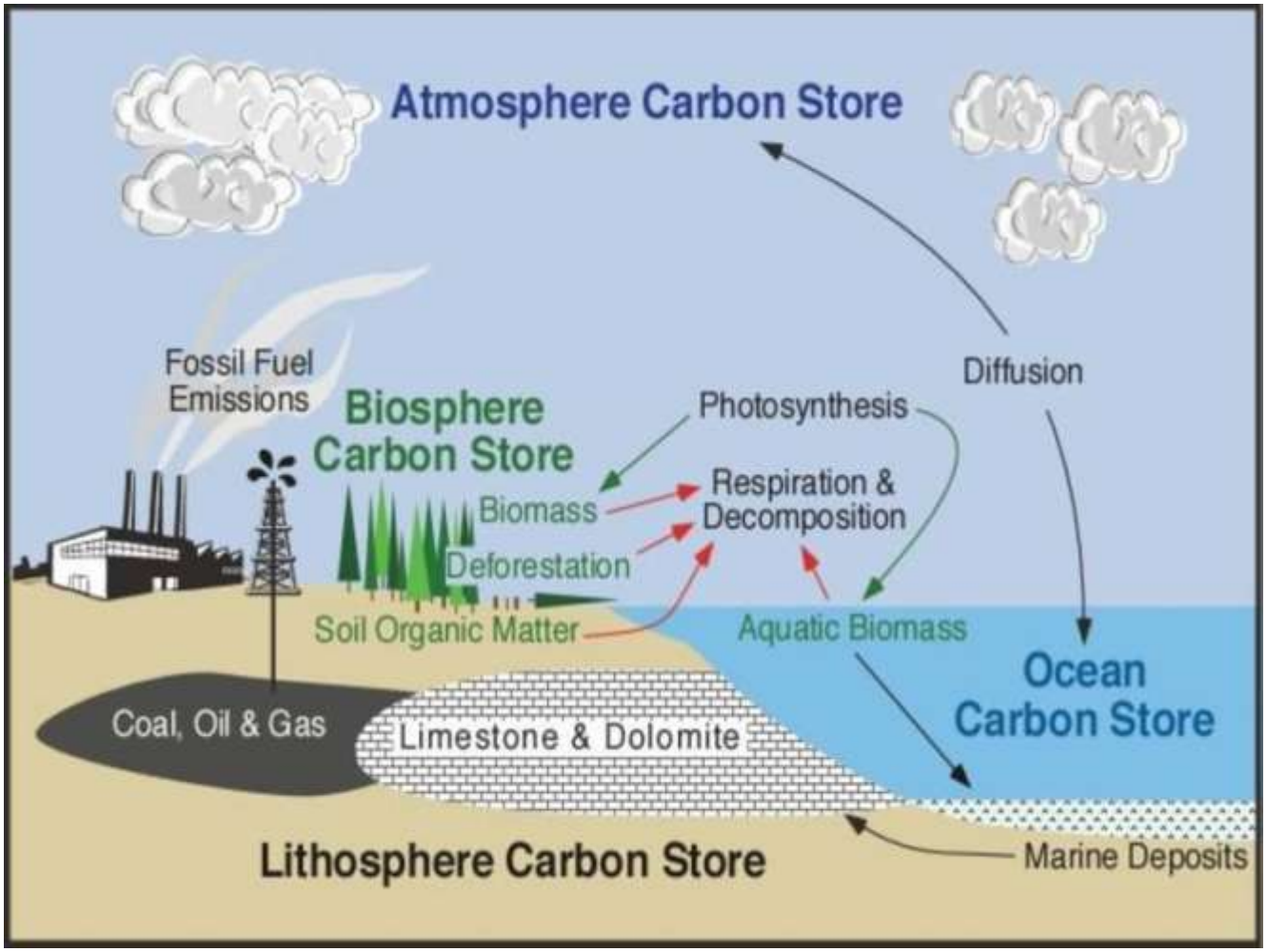
6.6.3 Mitigation Measures:

It is a common knowledge that Green House Gases are the cause of Global Warming. The entire world is greatly concerned to increase of GHG specially the CO_2. Photosynthesis is the

simplest method to reduce the GHG in the atmosphere. The mitigation measures that can be practiced by a Forester are

- Increase tree cover by woody vegetation on Blank Areas.
- Enrich the existing forest by plantation and crop density may be maintained above 70%
- Allow Ground Flora to cover the Forest Floor.
- Long term Rotation to be adopted than a short term rotation.
- Reduce Forest Fire and release of CO_2.
- Allow a good humus cover to retain soil fertility and vigour.
- Reduce Fire wood consumption in rural areasthrough improved chulla / Fire Place.
- Increase life of wooden materials through seasoning & treatment.




Atmosphere Carbon Store
Fossil Fuel Emissions
Biosphere Carbon Store
Photosynthesis
Diffusion
Respiration & Decomposition
Biomass
Deforestation
Soil Organic Matter
Aquatic Biomass
Ocean Carbon Store
Coal, Oil & Gas
Limestone & Dolomite
Lithosphere Carbon Store
Marine Deposits

CHAPTER-7

OPTIMIZATION OF FOREST RESOURCE UTILIZATION:

7.1 Recorded Removal of Timber:

In the outgoing plan there is coupe working in Sahana PRF under Car Timber (Overlapping) Working Circle. The Rotation period is 10 years andthe out turn is mostly firewood billets. The timber harvested is virtually nil during last 10 years. Some poles are obtained as per demand during coupe working. The year wise poles obtained is furnished in **Table No: 7.1**

Table No: 7.1 Year Wise Target & Achievement of Timber Coupe Working of Last Plan Period.

Year of Allotment	Coupe No.	Year of actual working	Composition of Coupe				Timber obtained		Achievement
			Block	Year of Plantation	Area allotted in ha.	Worked in Ha	No of Poles	Timber in Cum	
1	2	3	4	5	6	7	8	9	10
2007-08	I	2010-11	Sahana PRF	1997-98	14.00	14.00	50	--	Working of Coupe No.-I,II,III,IV , V, VI, VII and VIII (P) is completed .
2008-09	II	2010-11	-do-	1998-99	50.00	50.00	0	-	
2009-10	III	2010-11	-do-	1999-2000	40.00	10.00	0	-	
2010-11	IV	2010-11	-do-	2000-01	60.00	14.00	0	-	
2011-12	V	2012-13	-do-	2001-02	50.00	25.00	0	-	
2011-12	V	2013-14	-do-	2001-02	0	25.00	152	-	
2012-13	VI	2016-17	-do-	2001-02	50.00	50.00	0	-	
2013-14	VII	2014-15	-do-	2001-02	150.00	50.00	0	-	
2013-14	VII	2015-16	-do-	2001-02		50.00	0	-	
2013-14	VII	2015-16	-do-	2001-02		50.00		-	
2014-15	VIII	2017-18	-do-	2001-02	152.00	50.00	0	-	
2014-15	VIII	2017-18	-do-	2001-02		50.00	70	-	
2015-16	IX		-do-	2001-02	115.00		Not worked		
2016-17	X		-do-	2001-02	100.00				

The pole and timber obtained is insignificant as the aim and objectives were production of Fire wood to supply to Jagannath Temple Depot and Swargadwar Depot.

7.2 Recorded Removal of Fuel wood:

The coupes are being worked through Odisha Forest Development Corporation Ltd. The coupe / year of delivery & working, number of trees marked for felling and fire wood obtained are furnished in **Table No 7.2**

Table No: 7.2 Year Wise Target & Achievement of Timber Coupe Working & Firewood production.

Year of Allotment	Coupe No.	Year of actual working	Composition of Coupe						
			Area allotted in ha.	Worked in Ha	Trees marked / felled	FW Casuarina #		FW Misc#	
						Garinda	Twigs	Garinda	Twigs
1	2	3	6	7	8	9	10	11	12
2007-08	I	2010-11	14.00	14.00	11564	387	20	6	0
2008-09	II	2010-11	50.00	50.00	40529	1626.5	155	28.5	0
2009-10	III	2010-11	40.00	10.00	4677	199	48	20	7
2010-11	IV	2010-11	60.00	14.00	44635	1559.5	126	3	0
2011-12	V	2012-13	50.00	25.00	16059	794	20	02	0
2011-12	V	2013-14	0	25.00	10508	483.5	15	47.5	0
2012-13	VI	2016-17	50.00	50.00	24741 / 24671	1326	192	25	2
2013-14	VII	2014-15	150.00	50.00	28222	1382.5	46	1.5	0
2013-14	VII	2015-16		50.00	33616/ 30070	1379	35	3.5	0
2013-14	VII	2015-16		50.00	32231/ 29506	1305	224	35	0
2014-15	VIII	2017-18	152.00	50.00	32374	1644	286	64	0
2014-15	VIII	2017-18		50.00	27108/ 25998	1338	260	175.5	0
2015-16	IX		115.00						
2016-17	X		100.00						

 # In Stacks of 12'x3'x3'

The year wise area worked out & Firewood obtained in MT vis- a- vis productivity per ha per year is furnished in Table No 7.3

Table No 7.3
Yield Data Analysis of Harvested Casuarina Crop from 2010-11 to 2016-17

Year of Working	Area Worked in Ha.	Production in stacks		Production in MT		Total Production in MT.	Yield in MT/Ha.
		Garinda Firewood 12x3x3	Twigs Firewood12x3x3	Garinda	Twigs		
2010-11	14	387	20	640.485	16.55	657.035	46.93
2010-11	50	1626.50	155	2691.85	128.26	2820.11	56.4
2010-11	10	199	48	329.345	39.72	369.06	36.90
2010-11	14	1559.5	126	2580.97	104.26	2685.23	191.80
2011-12	25	794	20	1314.07	16.55	1330.62	53.22
2011-12	25	483.5	15	800.19	12.41	812.60	32.50
2014-15	50	1382.50	46	2288.03	38.06	2326.09	46.52
2015-16	50	1379	35	2282.24	28.96	2311.20	46.22
2015-16	50	1305	224	2159.77	185.36	2345.13	46.90
2016-17	50	1326	192	2194.53	158.88	2353.41	47.06
2017-18	50	1644	286	2720.82	236.66	2957.48	59.14
2017-18	50	1338	260	2214.39	215.15	2429.54	48.59
							59.35/ha/yr

[Weight of Green Garinda Casuarina Firewood- 12'x3'x3' stack = 1.655 Mt. One stack Twig firewood= Half stack Garinda firewood]

7.3 Recorded Removal of Bamboo / Rattans:

Bamboo occurs in three forest blocks. No prescription on Bamboo harvest was given in the outgoing plan. There is no harvest of Bamboo from any Forest Block.The forest areas of the Division are not rich in NTFP. Bambusa Nutans (Sundarakani) is available in Tavagolora PRF and Bambusa arundinasia (kanta baunsa) is available in Pattanaikia PRF and Junei PRF. Calamus viminalis (Beta) is available in littoral swampy forest area of Golara PRF.

7.4 Recorded removal of locally important NTFPs including MAPs:

This tract is poor in NTFP. No record is available on Collection of NTFP from Forest Blocks. Local people collect various berries from Forest to a very insignificant quantity and use. It is

not found in a commercial scale. However, this different type of Berry like Mankada kendu, Jamu, Khirikoli, Guakoli, Sagadabatua Koli, Akhukoli , Biluakoli,kar koli,mehenga koli,Sahadakoli,Asadhua, Kochila,Mendhi, chun chunka, luni lunika, penthi, beta, chauladhua, aambada etc. are plently available in Golara PRF. It is being used by the local villagers. No effort has been made ever to collect these berries commercially.Cashew nuts are abundantly available in sanctuary area of Konark Range and Balukhanda Range. Calophylum inophylum (Polanga) is profusely available in Brahmagiri Range area in private lands. Pandanus panden (Kia) is available in all most all area of the Division. In Golora PRF. Kia is profusely available. In the past, Kia flowers were being collected for preparation of perfume.

7.4.1 Grasses:

Wild grasses like Nala grass (*Arundo karka*), Beruan, Juna grass are collected and used for providing shed in *Pana Baraja*(Betel vine garden).Though no record is available it is estimated to be around 2000 MT of grasses grown in marshy / dry places are being collectedand mostly found outside the Forest area.

7.4.2 Cashew Nut:

Cashew plantations are taken up in forest & non forest area. Many private cashew plantations are also seen in this division. The approximate area covered under Cashew plantation might be around 40sq.km. Cashew is also found in PRF in Brahmagiri Range, Konarka Range and Balukhanda Range. Plantations in Balukhanada- Konarka Sanctuary have been taken up. As per the orders of Supreme Court, Cashew nut is sold in situ through auction. The quantum of Cashew obtained and sale value is given in **Table No 7.4.**

Table No. 7.4 Cashew production and sale value

Crop Year	Quantity of cashew nuts collected in quintal	Sale value realized (in Rs.)
1	2	3
2003	953.37	18,79,242/-
2004	515.75	17,76,051/-
2005	703.22	22,86,798/-
2006	1,701.00	34,83,663/-
2007	905.69	23,12,659/-
2008	1,200.59	56,33,834/-
2009	1,629.80	52,29,766/-
2010	850.70	31,58,028/-

2011	1,134.72	49,62,199/-
2012	806.90	26,28,877/-
2013	1,388.13	54,16,065/-
2014	1,228.17	72,51,832/-
2015	1,209.13	1,14,49,730/-
2016	775.32	91,50,977/-

7.4.3 Palm Leaf:

Tala Patra (Palm Leaf)is an important NTFP. Tender leaves are collected, processed and used for making Dala (basket), Chata (mat), Pakhia(rain coat) etc. Previously this leaf was used for writing *pothi, grantha* when paper was not available or of limited assess. Now palm leaf is used for making dala used for offering "Dry Prasad" to God / Goddess/ and in Jagannath temple. This is also used as packing materials for "Maha Prasad".

Many paintings / arts are also being carved / painted on Palm leaf and are famous in Puri District.

7.5 Demand & Supply of Timber and important Non- Timber Forest Produce:

7.5.1 Firewood

The forests of this division are managed under Rehabilitation Working Circle. Species normally grown and harvested are Casuarina, Acacia and Eucalyptus. In Car Timber (Overlapping) Working Circle, mostly Casuarina is harvested as firewood. The Odisha Forest Development Corporation Ltd is the Harvesting & Marketing Agency in Forest Produce. They only supply Firewood to Jagannath Temple for preparation of *"Mahaprasad"* in the temple. The requirement of Fire wood for the sacred kitchen of Lord Jagannath temple is estimated as 2000 MT per year. Only 25% of the above requirement is supplied by by the OFDC and 75% of the requirement is supplied by private farmers. Now it is planned in this working plan to supply total requirement of 4400 metric ton of firewood from the Casuarina Working Circle which covers 746.717 hectare of area. based on the last 10 years data it is ascertained that 59.35 MT of a Firewood have been harvested per hectare per year and accordingly we will be able to supply above annual requirements of 4400 MT firewood from the coupe area of Casuarina working circle.As it is learnt, the supply of Firewood from coupe area is about 25% of the requirement of Temple administration. Local people grow Casuarina as Farm Forestry and they use to supply firewood to Temple administration to bridge the gap.

Puri Swargadwar is a "Smasan Ghat" where dead bodies are cremeted every day (70-80dead bodies per day in an average). Casuarina Firewood required @1.50 qts per body. It is ascertained that for cremation of dead bodies' at *Swargadwar* 20 truckloads of firewood are required per month. So the annual requirement of Fire wood at *Swargadwara* is 2400 MT per year, which is largely met from cutting of casuaruna plantation from Sahana PRF.This firewood is being sold from *Swargadwar* Depot @ Rs 750/ Qntl. This requirement is fully met by OFDC Ltd as an obligation.

Local people use firewood mostly harvested from trees grown in their homestead land. There are also licensed Firewood depots selling firewood to public. Now most of the people have assess to alternate fuel i.e. LPG and demand of Firewood is in a declining trend.

7.5.2 Timber.

The timber requirement is mainly managed by local people from timbers like Mango, Bada Chakunda, Panasa (Jack Fruit) usually available in their court yard. There is no licensed Saw Mill in the Division. There are licensed Timber depots in the division. They usually purchase

timber from OFDC Ltd and sale to people to meet the building construction demand. These depot owners are also trade in Permit free species like Acacia, Eucalyptus, Bada Chakunda and meet timber demand for building construction. As centering materials, poles of Acacia, casuarinas, Eucalyptus and bamboo are being used.

7.5.3 Bamboo.

"Pana Baraja" (Betel vine garden) is being planted and managed in Asaranga / Kakatpur area of the Division. They require Bamboo to a huge quantity annually. There are more than 35000 *Pana Baraja*in this locality. Each *Baraj* requires around 300 bamboo culmsin every 3 years. Hence the average requirement of Bamboo is 3, 50,000 culms per annum. Bamboo is not sufficiently available in this zone. It is being procured from Nayagard, Keonjhar, Balasore and few are grown bamboo in home stead land.

7.6 Import & Export of Wood & Wood Products:

There is virtually no Import & Export of timber in this division. Teak wood, Sal, Bija and other timbers are being sold in the division in licensed depots being procured from OFDC Ltd. There are furniture shops / carpentary units, who carry out their trade obtaining timber from OFDC Ltd and Raipur state.

7.7 Import & Export of NTFPs:

There is no records of import & export of NTFP products.

7.8 Removal of Fodder:

Grazing is a regular phenomenon in forests of this division. Cattle/ Goat / Sheep are used to graze in forests. Sometimes lopping of fodder trees noticed. No record of removal of fodder is available as collection of fodder is allowed in forests.

7.9 Valuation of Products:

Removal of Firewood, Poles has been documented. Sale of Cashew nut is also documented. No systematic study on removal of NTFP has been made. However an attempt has been made to value the produce.

7.9.1 Removal of Forest produce from RF/ PRF.

The Forest Produce (Timber, Firewood, NTFP) removed from Forest has notbeen quantified or valuated except for cashewnuts, the oquantinty of collection and sale have been indicated above

7.9.2 Removal of Forest produces from Outside the Forest Area.

The collection of NTFP from outside the Forest area has not been assessed.

CHAPTER-8
MAINTENANCE & ENHANCEMENT OF SOCIAL, ECONOMIC, CULTURAL AND SPIRITUAL BENEFITS:

8.1 Number of JFM Committees and areas protected by them:

8.1.1 VSS / EDC Constituted:

In accordance with the National Forest Policy, 1988 and Government of Odisha resolution on the Joint Forest Management (JFM) community participation for protection, regeneration and management of the forest wealth has been sought for. JFM has not only been a tool for forest regeneration, but also a means of employment generation and social empowerment of the forest-fringe dwellers. Joint Forest Management Committees have been constituted as per JFM resolution 1993 and subsequently brought over to the fold of JFM Resolution 2011. The VSS / EDC have been allotted with Area from Proposed Reserved Forests and Revenue Forests of the Division. The List of VSS / EDC constituted and functioning are furnished in **Table No 8.1.** JFM Resolution 2011 and subsequent amendment in 2015 and in 2018 are at **Annexure- XI(a) & XI(b).**

Table No 8.1: List of VSS Constituted in Puri (Wildlife) Division under JFM Resolution.

Sl. No.	Name of the Range	Name of the Section	Name of the VSS	Name of the Village	Type Forest land alloted & Area in ha		Registered with		Remark
					PRF	**Rev. Forest**	**RCCF**	**DFO**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Astaranga WL Range	Panichhatra	Nipania	Gada Nipania	10.00	0.00		Yes	VSS
2	Astaranga WL Range	Astaranga	Daluakani	Daluakani	10.00	0.00		Yes	VSS
3	Astaranga WL Range	Astaranga	Balipatana	Balipatana		10.00		Yes	VSS
4	Astaranga WL Range	Astaranga	Baghamunda	Baghamunda		15.00		Yes	VSS
5	Astaranga WL Range	Astaranga	Baradiha	Baradiha		7.50		Yes	VSS
6	Astaranga WL Range	Astaranga	Aisinia	Aisinia	15.00			Yes	VSS

Table No 8.1: List of VSS Constituted in Puri (Wildlife) Division under JFM Resolution.									
Sl. No.	Name of the Range	Name of the Section	Name of the VSS	Name of the Village	Type Forest land alloted & Area in ha		Registered with		Remark
					PRF	**Rev. Forest**	**RCCF**	**DFO**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	Astaranga WL Range	Astaranga	Gundalva	Gundalva	20.00			Yes	VSS
8	Astaranga WL Range	Astaranga	Anakana	Anakana	20.00			Yes	VSS
9	Brahmagiri WL Range	Harachandi	Palanka	Palanka	40.00		Yes		VSS
10	Brahmagiri WL Range	Harachandi	Narasingh patna	Narasingh patna		10.00	Yes		VSS
11	Brahmagiri WL Range	Brahmagiri	Kasijharia	Kasijharia		10.00		Yes	VSS
12	Brahmagiri WL Range	Harachandi	Matamatpur	Matamatpur		5.00	Yes		VSS
13	Brahmagiri WL Range	Brahmagiri	Bedhasundar	Bedhasundar		5.00	Yes		VSS
14	Brahmagiri WL Range	Brahmagiri	Sahajanpur	Sahajanpur		20.00	Yes		VSS
15	Brahmagiri WL Range	Brahmagiri	Budhisahi	Budhisahi		3.00		Yes	VSS
16	Brahmagiri WL Range	Brahmagiri	Kalikabadi	Kalikabadi		40.00		Yes	VSS
17	Brahmagiri WL Range	Brahmagiri	Moto	Moto		34.00		Yes	VSS
18	Brahmagiri WL Range	Brahmagiri	Chapamanika	Chapamanika		5.00		Yes	VSS
19	Brahmagiri WL Range	Brahmagiri	Gabakund	Gabakund		26.00		Yes	VSS
20	Brahmagiri WL Range	Brahmagiri	Brahmapada	Brahmapada		17.00		Yes	VSS
21	Brahmagiri WL Range	Brahmagiri	Bhaba kundaleswar	Bhaba kundaleswar		0.00		Yes	VSS
22	Konark WL Range	Konark	Junei	Junei	6.00			Yes	VSS
23	Konark WL Range	Konark	Beruhan	Beruhan		6.00		Yes	VSS

Table No 8.1: List of VSS Constituted in Puri (Wildlife) Division under JFM Resolution.									
Sl. No.	Name of the Range	Name of the Section	Name of the VSS	Name of the Village	Type Forest land alloted & Area in ha		Registered with		Remark
					PRF	**Rev. Forest**	**RCCF**	**DFO**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
24	Konark WL Range	Ramchandi	Bangara barapada	Bangara barapada		12.00	Yes		VSS
25	Konark WL Range	Konark	Tailo	Tailo		3.00		Yes	VSS
26	Konark WL Range	Konark	Jamara	Jamara	4.00		Yes		VSS
27	Konark WL Range	Konark	Tandhar	Tandhar	2.00		Yes		VSS
28	Konark WL Range	Ramachandi	Kharagam	Kharagam		3.00		Yes	VSS
29	Konark WL Range	Balidokan	Kantimala	Kantimala		0.00	Yes		VSS
30	Konark WL Range	Konark	Matiapada	Matiapada		0.00		Yes	VSS
31	Konark WL Range	Balidokan	Suaro	Suaro		0.00	Yes		VSS
32	Gop WL Range	Nimapada	Davara	Davara		3.00	Yes		VSS
33	Gop WL Range	Nimapada	Rench sasan	Rench sasan		3.00	Yes		VSS
34	Gop WL Range	Nimapada	Amarang	Amarang		2.00	Yes		VSS
35	Gop WL Range	Nimapada	Kholana	Kholana		3.00	Yes		VSS
36	Gop WL Range	Nimapada	Dakhinara das	Dakhinara das		3.00	Yes		VSS
37	Gop WL Range	Nimapada	Kanarpur	kanarpur		3.00	Yes		VSS
38	Balukhanda WL Range		Kabirajpur	Kabirajpur	4.86		Yes		EDC
Total					**131.86**	**248.50**			

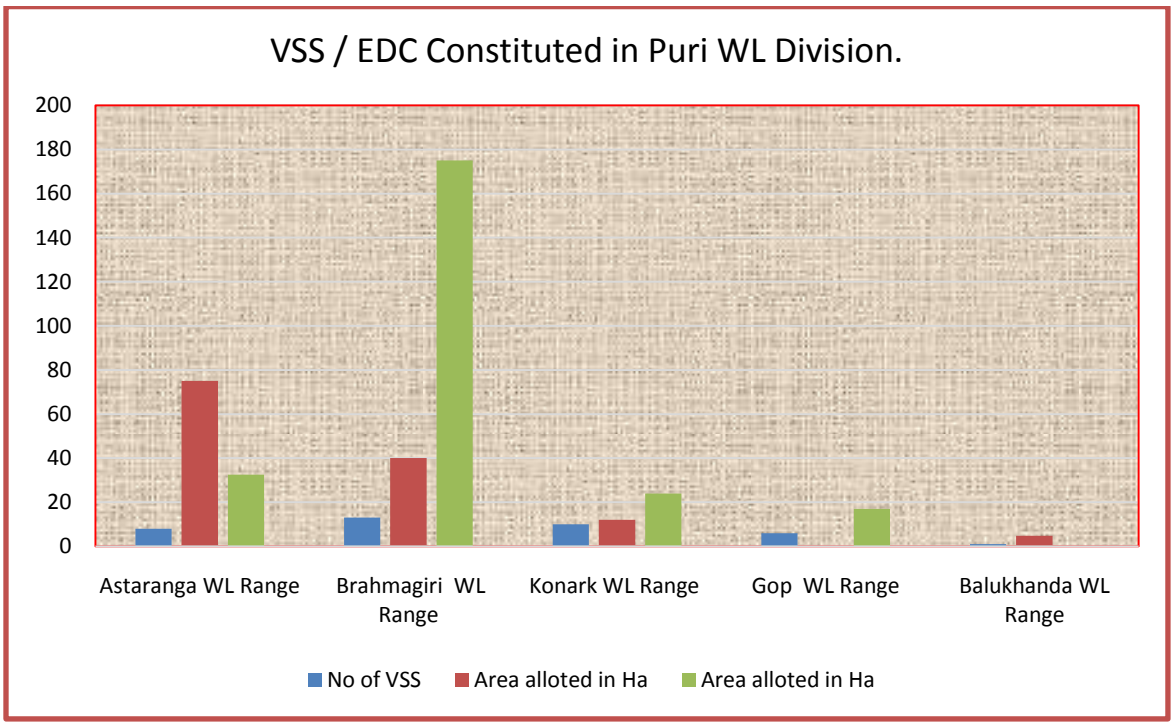
Table No 8.2 List of EDC of Puri Wildlife Division

Sl. No.	Name of the Range	Name of Section	Name of EDC	Name of village	Type of forest land allotted within the Balukhand sanctaury	Area Alloted (in ha)	Regd. No. of D.F.O
1	2	3	4	5	6	7	8
1	Balukhanda Wildlife Range	Balukhanda	Gopaljee EDC	Gopalpur	Balukhanda RF	261.06 Ha.	PWL201/EDC/2015
2		-do-	Baliguali EDC	Baliguali	-do-	235.28 Ha.	PWL202/EDC/2015
3		-do-	Maa Jagulai EDC, Samagara	Samagara	-do-	262.80 Ha.	PWL203/EDC/2015
4		-do-	Nagapatna EDC	Nagapatna	-do-	152.60 Ha.	PWL204/EDC/2015
5		-do-	Beleswarpatna EDC	Beleswarpatna	-do-	235.60 Ha.	PWL205/EDC/2015
6		Balighai	Maa Jagulai EDC, Beldal	Beldal	-do-	234.40 Ha.	PWL206/EDC/2015
7		-do-	Maa Duladei EDC	Haingra	-do-	92.00 Ha	PWL207/EDC/2015
8		-do-	Maa Solapua EDC	Bhuan	-do-	381.74 Ha.	PWL208/EDC/2015
9		-do-	Panchamukhi EDC	Gada Bangar	-do-	608.72 Ha.	PWL209/EDC/2015
10	Konark Wildlife Range	Ramachandi	Balikapileswar EDC,	Khalakatapatna	Kapileswar & Liakhia FS	519.46 Ha.	PWL210/EDC/2015
11		-do-	Maa Sidheswari EDC	Mankaragoradi	Bhagabati FS	218.90 Ha.	PWL211/EDC/2015
12		-do-	Arakuda EDC	Arakuda	Bhagabati FS	125.10 Ha.	PWL212/EDC/2015
13		Konark	Nalakana Ganthiasahi EDC	Nalakana Ganthiasahi	Manguleswar FS	196.60 Ha.	PWL213/EDC/2015
14		-do-	Madhipur EDC	Madhipur	Manguleswar FS	67.00 Ha.	PWL214/EDC/2015
15		-do-	Mulisahi EDC	Mulisahi	Manguleswar FS	67.01 Ha.	PWL215/EDC/2015
16		Konark	Karamanga/ Srikanthapur EDC	Karamanga/ Srikanthapur	Konark(W) FS	360.40 Ha.	PWL216/EDC/2015
17		-do-	Maa Jageswari EDC	Banapada & Dalimbagoradi	Chandrabhaga FS	192.60 Ha.	PWL217/EDC/2015
18		-do-	Raulapatna EDC	Raulapatna	Chandrabhaga FS	184.50 Ha.	PWL218/EDC/2015

Table No 8.2 List of EDC of Puri Wildlife Division							
Sl. No.	Name of the Range	Name of Section	Name of EDC	Name of village	Type of forest land allotted within the Balukhand sanctaury	Area Alloted (in ha)	Regd. No. of D.F.O
1	2	3	4	5	6	7	8
19		-do-	Kunjamatha EDC	Kunjamatha	Isaneswar FS	138.00 Ha.	PWL219/EDC/2015
20		-do-	Baba Isaneswar EDC	Bhanapur, Santhapur	Isaneswar FS	166.16 Ha.	PWL220/EDC/2015
21		-do-	Baba Dhakhineswar EDC	Kurujanga	Kurujanga FS	473.80 Ha.	PWL221/EDC/2015
22		Balidokan	Maa Damunei EDC	Golaragarh	Golara PRF	264.00 Ha.	PWL222/EDC/2015
23		Konark	Maa Duladei EDC	Jamara	Kurujanga FS	264.80 Ha.	PWL223/EDC/2015
24		Balidokan	Gadibrahma EDC	Guhalpur/Nuagaon	Guhalpur FS	300.8 Ha.	PWL224/EDC/2015
25		-do-	Chitreswari EDC	Chitreswari	Golara PRF	212.0 Ha.	PWL225/EDC/2015
26		-do-	Maa Jageswari EDC	Musapada	Golara PRF	212.60 Ha.	PWL226/EDC/2015
27		-do-	Baba Banambar EDC	Nadiamatha	Nadiamatha FS	159.00 Ha.	PWL227/EDC/2015
28		-do-	Maa Khanduali EDC	Kanarpur	Nadiamatha FS	115..00 Ha.	PWL228/EDC/2015

As per Division office record, there are 38 VSS and 28 EDC functioning in the Division. The abstract of VSS / EDC constituted in various Ranges and area allotted is at **Table No 8.2**

Table No 8.3 VSS Constituted in Puri WL Division.				
Abstract				
Sl No	Name of Range	No of VSS	Area allotted in Ha	
			PRF	Rev Forest
1	Astaranga WL Range	8	75	32.5
2	Brahmagiri WL Range	13	40	175
3	Konark WL Range	10	12	24
4	Gop WL Range	6	0	17
5	Balukhanda WL Range	1	4.86	0
	Total	**38**	**131.86**	**248.5**



Out of 38 VSS & 28 EDC, 19 VSS & 3 EDChave been involved in National Afforestation Programand brought under Forest Development Agency (FDA).

The list of VSS / EDC functioning in the Division is al **Annexure XII.**

8.1.2 Forest Development Agency:

To achive the objectives of National Forest Policy-1988 of Govt of India, Puri Wildlife Division in the district of Puri, Odisha has implimeted participectory forest management under National Afforestation Program (NAP), supported by National Afforestation and Eco development Board (NAEB) through 22 VSS/EDC. Forest Development Agency (FDA) for Puri Wildlife Division has been constituted and registered under Society Registration Act, 1860. This FDA started functioning from the year 2008-09 to 2010-11. About 145.5 ha Govt land has been brought under Green cover through community participation involving 21 villages. The aim of the policy was to generate livelihood of the forest dependant communities, check soil erosion, conservation of bio-diversity and wildlife. The VSS functioning under FDA are either registered with the Regional Chief Conservator of Forests, Bhubaneswar or with the Divisional Forest officer, Puri Wildlife division.Regional Chief Conservator of Forestsis the Chairman of the Society whereas the Divisional Forest Officer is the Chief Executive Officer and Member

Secretary of The FDA. The Members of the Executive Committee is at **Annexure-XIII**. The year wise activities taken up by the FDA is at **Table No 8.4**

Table No 8.4: Plantations taken up under FDA Activities.

Sl No.	Name of the VSS/EDC	Name of the Range	Year of Plantation				EPA in brief
			2008-09	2009-10	2010-11	Total in ha	
1	Palanka	Brahmagiri	10	20	5	35	Depending upon the demand of the village community attempts have been made to take up the following EPA activities. i- Distribution of Pressure Cooker ii- Erection of Hand pump iii- Digging of Ponds iv- Distribution of Electrical Fan v- Distribution of Utensils vi- Repair of Morrum Road vii- Repair of Pindi
2	Sahajahanpur		10	-	5	10	
3	Narasinghapatana		5	-	5	10	
4	Matamatapur		5	-	-	05	
5	Bedhasundara		5	-	-	05	
6	Kashijharia		5	-	5	10	
7	Dovar	Gop	3.5	-	-	3.5	
8	Kolhana		-	1.5	-	1.5	
9	Jamara	Konark	-	4	-	4	
10	Beruhan		-	5	-	5	
11	Tandahar		-	3	-	3	
12	Tailo		-	3	-	3	
13	Balipatana	Astaranga	-	10	-	10	
14	Baghamunda		-	5	-	5	
15	Baradiha						
16	Rench sasan	Gop	-	1.5	-	1.5	
17	Amaranga		-	2	-	2	
18	Gopalapur EDC	Balukhanda	-	2	-	2	
19	Samangra EDC		-	5	-	5	
20	Kharagaon	Konark	-	-	3	3	
21	Bangara / Barapada		-	-	12	12	
22	Beldal EDC	Balukhanda	-	-	5	5	
	Total		43.50	62.00	40.00	145.5	
Total Expenditure in lakh.			2.18	11.20	10.90	24.28	

8.2 Status of empowerment of JFMCs:

The JFMCs functioning under National Afforestation Program have been directly funded by the Government of India through DFO i.e. Member Secretary of the FDA. The Bank account maintained for VSS is jointly operated by President and Secretary of the respective JFM committee. The funds is usually drawn & utilized by the committee as per the resolution of the Executive Committee. The execution and expenditure pattern is made as per Microplan

prepared by the VSS and approved by the DFO, Puri WL Division. The level of participation is evaluated as 4 out of 5 in the scale of five (0 being the lowest and 5 is the highest level of participation)

8.3 Labour welfare:

8.3.1 Entry Point Activities:

During implementation of National Afforestation Program, various village developmental / welfare activities have been implemented. The details of EPA taken up are furnished in **Table No 8.3.** Twenty eight EDC are there in Balukhanda Range and Konark Range surrounding the Balukhanda-Konark sanctyary. Although those two Ranges are managed as per the prescription of wildlife management plan as those are coming under Balukhanda-Konark Wildlife Sanctuary but labour welfare activities are the topmost priority. Those two Ranges are having profuse Cashewnut trees in the jungle. As per the direction of Cental Empowered Committee of Honourable Suprem Court of India Cashew collection from forest floor are being taken up by the Eco-development committee. The usufructs are largely spent on labour welfare as per the machanisim framed by the Government. The year wise sale proceeds generated from chashew are furnished in Table 8.5 Sale Proceeds generated by the EDC from Cashew collection.

Table 8.5 Sale Proceeds generated by the EDC from Cashew collection

Crop Year	Quantity of Cashew nuts collected in quintal	Sale value realized (in Rs.)
1	2	3
2003	953.37	18,79,242/-
2004	515.75	17,76,051/-
2005	703.22	22,86,798/-
2006	1,701.00	34,83,663/-
2007	905.69	23,12,659/-
2008	1,200.59	56,33,834/-
2009	1,629.80	52,29,766/-
2010	850.70	31,58,028/-
2011	1,134.72	49,62,199/-
2012	806.90	26,28,877/-
2013	1,388.13	54,16,065/-
2014	1,228.17	72,51,832/-
2015	1,209.13	1,14,49,730/-
2016	775.32	91,50,977/-
2017	1354.60	1,04,42,674/-
2018	1135.90	70,82,380/-

8.3.1 Other Welfare activities.

During Plan period i.e. 2007-08 to-2017-18 Health Checkup Camp and Cattle immunization programs have been taken up. The details are furnished below.

Table No 8.6 Other Welfare activities in the Division

Range	Year	Scheme	Place		No. of cattle treated
			Immunization	Health camp	
1	2	3	4	5	6
Konark	2007-08	Central Plan	Tikana,Khalakatapatana,Barapada, Beruhan, Arakuda, Nagamath, Nalakan, Golara, Nadiamath, Chitreswari, Muasapada, Guhalpur, Nuagaon	-	5000
Konark	2008-09	Central Plan	Golara, Khalkatapatna, Beruhan	-	6100
Konark	2009-10	Central Plan	Tikana	Tikana, Golaragarh	1818
Balukhanda	2009-10	State Plan	Baliguali, Beladal & Samagara		635
		State Plan		Penthakata	25
		State Plan		Beldala	20
Balukhanda	2010-11	State Plan		Penthakata	15
Konark	2010-11	Central Plan	Golara, Nadiamath, Telikuda, Kanharpur & Tandahar	-	3900
Balukhanda	2010-11	State Plan	Baliguali, Beladal & Samagara		550
Konark	2011-12	-	-	-	-
Konark	2012-13	-	-	-	-
Balukhanda	2012-13	State Plan	Haingora, Bangar, Chhaitana and Samagara		1000
Konark	2013-14	-	-	-	-
Konark	2014-15	Central Plan	Tikana, Sutan & halkatapatna	Khalkatapatna & Sutan	10121
Balukhanda	2014-15	State Plan	Bhuan, Nagapatna		699
Konark	2015-16	Central Plan	-	Chitreswari & Barapada	432
Balukhanda	2015-16	State Plan	Beldala & Bhaun		330
		CAMPA (W)	Bangar		232
Gop	2016	StatePlan-02-2313	Davar, Nenti Bali basta		500

Konark	2016-17	Central Plan	Barapada, Kanharpu, Tikana, Balikapileswar, Khalkatapatna, Siripur, Ambiligaon, Jagannathpur, Paikarapur, Raulpatna, Nalakan, Junei, Anasara & Achyutpur	Barapada, Khalkatapatna & Raulpatna	3708
Balukhanda	2016-17	State Plan	Bhuan		362
		State Plan	Beldala		341
		State Plan	Beleswarpatna		167
Balukhanda	2017-18	CAMPA (W)	Haingora		184
		CAMPA (W)	Bhuan		207
Astaranga	2017-18	State Plan	Bodala,Barjisahi, Tavagolara Gada		1086
Konark	2017-18	Central Plan	Barapada, Kanharapur & Khalakatapatna	Barapada, Kanharapur, Tikana & Khalakatapatna	800
Konark	2018-19	State Plan	-	Tikana & Khalakatapatna	250

The local peole have been egaged as daily waged watchers as Anti poaching squad and and anti depredation squad and also fire watchers. They are getting their salary through service providers. Besides their monthly remuneration at minimum wage rate, they are being paid ESI @ 4.75%, EPF 13 % as emploer's contribution towards social security and health care.

Year wise number of local youth engaged as watchers in different Ranges.

Table No 8.7 Year wise number of local youth engaged as watchers in different Ranges.

Name of the Range	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Astaranga	06	07	07	09	10	12	12	12	12	12
Gop	05	05	05	05	05	05	05	05	05	05
Konark	09	09	09	09	12	12	12	13	15	15
Balukhanda	05	08	08	08	13	14	14	14	16	19
Brahmagiri	03	04	04	04	06	05	07	07	07	07
Total	28	33	33	35	46	48	50	51	55	58

8.3.2 Socio Econimic Study:

No Socio Econimic study has been conducted by the Forest department to as certain economic staus of villages and effect of Forest on improvement of Socio Economic status. The

Economic study conducted in the State during 2014-15 by Planning and coordination department is is at **Annexure- XIV.**

8.4 Use of indigenous knowledge:

Most of the community depend on fishing activity and have traditional knowledge on catching various marine life forms like fish, prawn and crabs. Besides that due to huge requirement of pottery utensils for Jagannath temple large section are engaged in making specific clay utensils utilizing their indigenous khowlege. Village women utilizing their native skill use to weave baskets with palm leaf and stilt root of pandanus.

8.5 Extent of Cultural / Sacred groves:

There is no sacred grove in the division worth find place in this plan.

8.6 Eco-tourism areas and activities:

Eco tourism is being run inside Balukhanda- Konark sanctuary at Nuanai river bank, where 10 tented accommodations have been provided for night stay of the tourists to experience wilderness of the sanctuary. Local communities have been involved in day to day management. Boating, swing, slide, cycling, battery Operated Vehicles, volley ball and badminton facilities are provided there besides the nature trail and bird watching. Wildlife books are provided in the library alongwithh leaflets and coffee table books to enrich the wildlife knowledge of the visitors. Wildlife film show is also organized in the evening. Food is complementary in the package.

A new Eco touirism destination at Jahania is being developed under ICZMP project involving the VSS members of Gundalaba village to provide night stay facilities to the visitors inside the casuarinas forest on sea shore. Boat ride in river Kadua from Sahana to Devi river mouth is another ecotourism site to provide experience of Mangrove forest, migratory birds and riverine ecosystem.

8.7 Social Customs (As relates to Forests):

There is no tribe in Puri district. General people though depend on forests there is no specific social custom noticed in forest area.

8.8 Status of Compliance of Forest Right Act (FRA):

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 &itsRules arebeing implemented since 2006. There are FRC in villages. SDLC and DLC is holding its meeting as and when required. Till to date no application under individual category / community category has been settled in this division due to want of evidence in support of their continuous occupation of forest land prior to the specified date. However, u/s 3 (2) of the Act, sanctuary land has been provide to OSWALI of Home Department to establish a Skill Development infrastructure for providing training to local community on river diving, swimmimg and rescue operation. Besides, permission has been given to Electricity department to treem the branches of trees to lay transmissioin lines from Sutan to Konark within sanctuary.

8.9 Other Rights and Concessions:

There is no rights and concession given to the people relating to Forest & tradition except those are allowed under FRA,2006.

8.10 Dependency of Local People on NTFPs:

NTFP availability in forest is limited. Outside the Forest Area Grasses on marshy places i.e. Nalia grass. Beruhan, Juna is highly utilized by people. Tala Patra (Palm Leaf) is used for making Dala, chata, pakhia, Pankha etc. Some SHG group / specific traditional group are preparing these articles. The dependency on NTFP is extremely limited.

8.11 Other aspects:

8.11.1 Search of Daru (Neem Tree for making of Idol of Lord Jagannath, Balabhadra and Devi Subhadra and Sudarshan):

Nabakalebara (Odia: ନବକଳେବର) is a symbolic recreation of the wooden forms of four Hindu deities (Jagannath, Balabhadra, Subhadra, and Sudarshana) at Jagannath Temple, Puri. In the cult of Jagannath, the ritual is performed during the 8^{th} , 12^{th} , or 19^{th} year after the previous Nabakalebara in which year the full moon occurs twice during the month of Ashadha. The most recent ceremony was in 2015, 19 years after the 1996 ceremony. Huge Neem Trees (Commonly called as Daru) were being searched by Daitapati. They visit to Goddess Mangala at Kakatpur in Astaranga Range. They stay at “Deuli Matha” on the bank of River Prachi for a period of about 15 days in search of such Daru for Nabakalebara of LordJagannath, Balabhadra, Subhadra, and Sudarshana. The Deuli Math is associated with

traditional custom and required to be maintained with good tree cover. Planting of Neem Tree in the division is highly required to make it available for Daru for thousand years to come.

8.11.2 Tala bania:

There is a place called "Tala bania" means a place having Tala (Palm tree) in large number. Every year Tala planks are required for Car festival to have Chara mala, the stairs to chariots of Lord Jagannath, Balabdhadra & Subhadra. Day by day its density is reducing for many reasons. It is required to plant Tala i.e. palm in the area to keep its importance in the mind of people for above auspicious purpose.

8.11.3 Bakulabana:

Bakulabana (Forests of Baula species) is seen at Satyabadi. Satyabadi Bidyapitha is also associated with our age old educational system. Every year logs of Baula are being collected for the Car festival. This timber is used as "Senapata" which is being tied to the deities for easy and convenient Pahandi without any pressure on the deities.

8.11.4 Development of Picnic Spot:

The Sea coast at Brahmagiri, Puri, Ramachandi, Konark, Astaranga, Jahana, near Sanctuary is vastly visited by tourists of both outsiders and local. During winter, picnic teams visit these places, cook their food, and have fun and go back in evening. It is required to maintain good tree cover, hygienic surroundings and minimum regulation to keep its environment pro conservation. Sometimes forest fire originates from left over fire by these teams. This aspect needs regulation as it relates to forest. Picnic spots need to be developed to provide minimum facility for the picnickers like pindi, tube well, dust bin, toilets for gents and ladies separately with water supply and utensil on hire. The VSS or EDC of the concerned site required to be motivated to collect user's fee from the party to keep the site clean and maintained properly.

CHAPTER-9

ADEQUACY OF POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

9.1 Existing policy and legal framework and their compliance:

The Forest & Environment Department, Government of Odisah is framing rules in accordance with various Acts, Rules and policy of the State as well as that of Central Govt. The important Acts, Rules and policies those affect / guide and help in forest Management are

i. The Odisha Forest Act,1972 and rules there under;
ii. The Wildlife (Protection) Act, 1972 and Rules thereof;
iii. The Environment (Protection) Act, 1986 and Rule 1986,
iv. The Forest (Conservation) Act, 1980 & Rules.
v. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 & Rules,
vi. The Coastal Zone Regulation, 1991
vii. EIA, Notification, 2006
viii. NTFP Collection Policy-2000
ix. ESZ Notification for Balukhanada- Konark Sanctuary.
x. The Sawmill & Sawpit (Control) Act, 1991 and Rules thereunder
xi. Joint Forest Management Resolution, 2011

These Acts / Rules are adequate to have a sustainable management of forests & Environment of the tract / Division. Thefield functionaries are discharging their duty within the legal frame work of the department for sustainable management of the forest resources.Improvement intervention are also been made at the time of requirement for betterment of the forest as per the prescription of the plan.

9.2 Status of approved working plan and compliance:

9.2.1 Outgoing Working Plan:

The Outgoing Working Plan written by Sri Abhiram Das, IFS was valid for the period 2007-08 to 2016-17. The Working plan was for the erstwhile Puri Division,now reorganized to Khordha Division, Chilika Wildlife Division, Puri Wildlife Division and City Forest Division. Nothing was specifically prescribed for the present Puri wild life Division except working of Car Timber working circle.

9.2.2 Annual Working Schemes:

After expiry of the approved working plan, in order to continue forest working, there after Annual Working Schemes have been prepared and approved by the competent authority.

(i) Annual Working scheme for the year 2017-18: Approved vide Letter no 8(31)35/2016-FCE dated 22.11.2017 of Regional MoEF&CC, Bhubaneswar (**Annexure-XV**)

(ii) Annual Working scheme for the year 2018-19: Approved vide Letter no 8(31)7/2017-FCE-II dated 05.10.2018 of Regional MoEF&CC, Bhubaneswar (**Annexure-XVI**)

(iii) The PWPR for preparation of revised working plan has been approved by Standing Consultative Committee meeting held on 15-12-2016 under the chairmanship of PCCF, Odisha, Bhubaneswar (**Annexure-XVII**)& communicated to DFO, Puri Wildlife Division vide Memo 1145 Dated 17.01.2017 of the PCCF, Odisha, Bhubaneswar.

9.3 Number of forest offences:

The Forest Offences are mainly classified into three category i.e.

(i) For Violation of the Odisha Forest Act, 1972 & Rules framed thereof.
(ii) For Violation of the Wildlife (Protection) Act, 1972 & Rules framed thereof.
(iii) For the Forest (Conservation) Act,1980.
(iv) Environment (Protection)Act,1986

9.3.1 Forest Offence for Violation of the Odisha Forest Act, 1972 & Rules framed thereof.

a) Number of Cases Booked & Present Status:

The offence booked for violation of Odisha Forest Act, 1972 and Rules framed thereof from 2003-04 to 2018-19 is furnished at **Annexure-XVIII**

b) **Number of cases booked / quantum of Forest Produce involved:**

The number of cases booked for violation of Odisha Forest Act, 1972 and Rules framed thereof and quantity of forest produced seized from 2003-04 to 2018-19 is furnished at **Annexure-XIX**

c) **Numbers of Cases sends to court / To Authorized Officer & disposal position:**

Numbers of Cases send to court / To Authorized Officer & disposal position is furnished at **Table No 9.1**

Table No 9.1 Numbers of Cases send to court / To Authorized Officer & disposal position

Year	Number of OR Cases	Cases send to		Disposal position	
		Judicial Court	Authorized Court	Judicial Court	Authorized Court
1	2	3	4	5	6
2007-08	21	07	20		19
2008-09	20	03	19		19
2009-10	07	03	07		07
2010-11	35	19	25		23
2011-12	09	09	09		07
2012-13	06	05	05		03
2013-14	13	10	10		06
2014-15	09	07	07		06
2015-16	26	23	23		12
2016-17	11	10	10		08
2017-18	11	09	08		04
Total	168	105	123		94

9.3.2 Forest Offence for Violation of the Wildlife Protection Act, 1972 & Rules thereof.

The number of cases involved in violation of Wildlife Protection Act, 1972 & Rules thereof and its disposal is furnished in Table No 9.2

Table No 9.2 Cases Booked under Wildlife Protection Act,1972			
Year	Number of OR Cases Booked	Send to Judicial Court	Disposal by the Court.
1	2	3	4
2007-08	263	17	Information Not available
2008-09	229	17	
2009-10	439	38	
2010-11	374	49	
2011-12	255	46	Information Not available
2012-13	205	22	
2013-14	238	43	
2014-15	166	24	
2015-16	223	49	
2016-17	108	12	
2017-18	116	12	
Total	2616	329	

9.3.3 Cases booked for Violation of Forest (Conservation) Act, 1980

There is no case of violation under Forest (Conservation) Act, 1980.

9.4 Status of research and development:

Five studies conducted in the Balukhanda- Konark sanctuary have been reported.

9.4.1 Study by Mrs Sweta Mishra.

This case study has been written by Sweta Mishra, Vasundhara, in 2007 on Management of the sanctuary in participation with the local communities. The conclusion of the study is given below:

The forest department acknowledges the role and efforts of the local people in the protection ofthe forests of the area and is hence supportive of their activities. The case of Balukhand–KonarkSanctuary stands out to as an exemplary case towards co-management in protected areas.In Orissa, Balukhand-Konark sanctuary stands out as an exemplary case, where the communities have got their rights of cashew collection and, more important, the FD hassupported them in their struggle. The FD acknowledges the fact that communities have

been actively protecting the forest in and around the sanctuary and there has not yet been any incidence of poaching or man-animal conflict. The activities undertaken for sanctuary development are carried out in consultation with the respective villages. Thus it definitely reflects a case of co-management, but there still is space left where both FD and the communities can coordinate and work together for better management of the sanctuary.
The detail study report is enclosed as **Aneexure-XX.**

9.4.2 Report by Basundhara:

Draft report of Vasundhara on "Issues related to protected area governance, local livelihood rights and concessions of Balukhanda- konark sanctuary" published in 2006. The salient points of the report are as follows:

"The decision for any sort of village developmental activity is taken in the village meeting. Generally each village has various committees like Harijan Sahi committee, Youth committee, Puja committee etc, which putforth their requirements and demands in the village meeting and it is with the common consensus of all the villagers, the activity to be taken up is decided. If the villagers feel that there is no need of development of common asset in the particular year then the amount is equally divided among all the villagers or kept in the community fund as per the decision taken in the village meeting."
The detailed draft report is eclosed in Annexure**-XXI.**

9.4.3 Study by North Orissa University, Baripada, Odisha:

A research paper on Sexual Size and Shape Dimorphism in an Agamid LizardSitana Ponticeriana (Sauria: Agamidae) written by Tinamauni Puthal, Gunanidhi Sahoo,Department of Zoology, North Orissa University, Baripada, Odisha, was published in Advances in Zoology and Botany 2(1): 15-20, 2014. the abstract of which is as follows:

"The fan-throated lizard, Sitana ponticeriana, is a medium-sized ground living agamid distributed throughout India, preferably in dry and more or less open country habitats. A total of each of 80 males and females were collected from Konark-Balukhand Wildlife Sanctuary area and subjected to various morphometric measurements to investigate the sexual size and shape dimorphism of the species. Sexually immature individuals were much less dimorphic than the adults. All body parts of males were larger than those of females. Both the sexes also differ in allometry of all head characters with body size, with males showing a disproportionate increase of head size and dimensions and head shape changed with

*increasing head size. Similarly, the foot (front and hind) of both sexes differs in length. The hind foot was double in length than that of the front. Males had larger hind foot (1.68cm) than females (1.56cm). A strong positive relatioship (r =0.8) was observed between SVL and HFL in females. Analysis of variance at p<0.05 level of significance was done for several variables. The head was twice longer than width. The HL and HW showed positive allometry in males and females."*The complete report is placed at **Annexure-XXII.**

9.4.4 Publication by Zoological Survey of India:

Status survey reporton status of Balck buck (Anelope cervicarpa) in Odisha written by Atindra Murmu, Arun Kumar Roy Mahato, Subir Guha, and Phakir Chandra Saren, published by Zoological Survey of India, Kolkata in January,2013, ISBN: 987-81-8171-317-9. The extract of the report says that*, "the population of blackbuck in Orissa was distributed in several coastal areas like Konark, Balukhand in Puri districts and Chilika, Purusottampur, Aska, Buguda, Kodala and Balipadar in Ganjam district, (Patnaik and Acharjyo, 1985). In past, blackbuck populations were distributed in Balasore, Purl, Bolangir and Kalahandi districts and some coastal dunes of Bhitarkanika and Kujang areas (Kar, 2004). Few captive individuals of blackbuck from Nandankanan Zoological Park were also released in Bhitarkanika Wildlife Sanctuary in 1985 and 1987 but they could not survive in the new habitat and died within couple of months (Kar, 2004). Present study recorded healthy populations in the various agricultural, bushes and grasslands habitats of Ganjam district. Some indirect evidences of the survivality of blackbuck in Balukhand-Konark Wildlife Sanctuary were observed however evidences and direct sighting of blackbuck in Bhitarkanika Wildlife Sanctuary were not found.*

Earlier the population of blackbuck in Orissa was recorded from time to time by various workers. Notably amongst them, Ranjitsingh (1982) found the populations of black buck in Orissa (700). Prasad (1982) described about 140+ populations in Orissa, while Rahmani (1990) found 485 blackbucks in Ganjam district alone. Several surveys were conducted in between 1973 to 2004 by forest department authorities, Govt. of Orissa, in Balipadar-Bhetnoi area and observed that the population of blackbuck was 523 in 1973,485 in 1980, 551 in 1998 and 786 in 2004. During the present study, three surveys were conducted in the entire Ganjam district alone in between 2007 to 2009 and recorded 788 individuals in monsoon 2008,902 in summer 2009 and 852 in winters 2009. As per the data of present study on the population it is found that about 860+ individuals of blackbuck were found in Ganjam district alone." The complete report is placed as **Annexure-XXIII.**

9.4.5 Study by Nimai Charan Palei & others:

A study on Survey Status of White Bellied Sea Eagle (*Haliaeetus leucogaster*) in Balukhanda-Konark wildlife sanctuary has been carried out by Nimai Charan Palei and Bhakta Padarabinda Rath, o/o PCCF (wildlife) & Chief Wildlife Warden, Odisha. In their interim report they have reported that during study period a total of 25 White bellied sea eagles were found in the Balukhanda-Konark sanctaury, out of which 8 were recorded in Balukhanda block, 6 in Nuanai area, 6 in Nadiamatha PRF, 4 in Ramachandi block and one in Konark block. Adults are generally sedentary whereas the immatured birdsare capable of travelling long distances upto 5 to 10 kms in search of food.

9.5 Human Resource Capacity Building Efforts:

In all development program Human Resource Capacity Building is an integral part. New technologies are being introduced for better management. Every year training programs for Staffs / VSS Members are being organized atRange level/ Divisional Level / Regional Level. Training programs organized atRange level/ Divisional level are furnished at **Table No 9.3**

Table No 9.3 Human Resource Development Program. (Staff)

Range	Year	Scheme	Type of training conducted	Place of training	No. of Participants
1	2	3	4	5	6
Balukhanda	2008-09	State plan	Black buck census	Saikatnivas	35
	2009-10	State plan	Capacity building	Toshali	39
			Capacity building	Saikatnivas	26
			Capacity building	Saikatnivas	33
			Case Matter	Saikatnivas	11
			Sensitization workshop on legal matter	Saikatnivas	20
			GPS Training	Balukhanda	25
			Black buck Census	Penthakata	100
	2010-11	State Plan	Tiger and other carnivorous census	Saikatnivas	13
	2011-12	State plan	Black buck Census	Saikatnivas	25
	2012-13	State Plan	Capacity building	Saikatnivas	33
	2013-14	State Plan	Black buck Census	Saikatnivas	100
	2014-15	CAMPA (G)	Forest Law & Management	Balukhanda	21
			Forest Law & Management	Balukhanda	30

Table No 9.3 Human Resource Development Program. (Staff)					
Range	Year	Scheme	Type of training conducted	Place of training	No. of Participants
1	2	3	4	5	6
		State Plan	Water fowl census	Balukhanda	43
			GPS training	Saikatnivas	35
	2015-16	CAMPA (G)	Forestry Training to Newly Recruited	Balukhanda	59
			Forest Law	Balukhanda	19
			Arm & Ammunition	Khurdha	10
		State Plan	Water fowl census	Balukhanda	48
			Black buck Census	Balukhanda	53
	2016-17	State Plan	GPS PDA	Balukhanda	31
			Water fowl census	Balukhanda	26
			Black buck Census	Balukhanda	19
			Boi- divercity	Balukhanda	28
	2017-18	State Plan	Water fowl census	Balukhanda	41
			Tiger & co-predator estimation survey	Balukhanda	50
			Black buck Census	Balukhanda	19
			GPS PDA	Balukhanda	21
			World day combat Desertification	Balukhanda	24
Gop	2018	State-plan	Training on rescue technique of snakes	Gop Range Office Campus	50 no
		Campa wildlife (Capacity Building)			60 no
Astaranga	2011-12	State Plan	Tourist Guide Training	Jahania	40 no
	2012-13	-do-	-do-	-do-	30 no
	2015-16	-do-	Use of GPS	Mega nursery	40 no
Konark	2007-08	-	-	-	-
	2008-09	-	-	-	-
	2009-10	-	-	-	-
	2010-11	-	-	-	-
	2011-12	-	-	-	-
	2012-13	Central Plan	Estimation of deer and black-buck	FRH, Konark	35
	2013-14	Central Plan	Training on forest law, forestry operation, conservation,	Konark WL Range office campus	21

Table No 9.3 Human Resource Development Program. (Staff)					
Range	Year	Scheme	Type of training conducted	Place of training	No. of Participants
1	2	3	4	5	6
			silviculture and protection		
			Training on forest law, forestry operation, conservation, silviculture and protection	Konark WL Range office campus	30
	2014-15	Central Plan	Estimation of Dolphin	Konark WL Range office campus	24
			Estimation of deer and black-buck	Konark WL Range office campus	42
			G.P.S Training	Konark WL Range office campus	26
	2015-16	Central Plan	Protection, conservation & forestry operation.	Konark WL Range office campus	21
			Estimation of deer and black-buck	Konark WL Range office campus	40
			G.P.S Training	Konark WL Range office campus	22
	2016-17	Central Plan	Asia water fowl census	Konark WL Range office campus	31
			Census of Black-buck and other animals	Konark WL Range office campus	46
			GPS-PDA, forest management & forest law	Konark WL Range office campus	30
	2017-18	Central Plan	Dolphin census	Yatri Niwas, Konark	21
			Extinguishing forest fire	OSWALI, Ramachandi	55
			Training programme on swimming, diving and sea patrolling	OSWALI, Ramachandi	61

9.6 Forest Resource Accounting:

No Specific steps have been taken for accounting the Forest Resource (Standing Crop) during outgoing plan period. On analysis of Sample point data, ORSAC has furnished comprehensive information for all blocks. The details have been mentioned under Chapter-6 of this Plan.

9.7 Budgetary allocations to the forestry sector:

The Budgetary allocation under State Plan, Central Plan, CAMPA and other District level schemes for last ten years is furnished at Table No 9.4

Table No 9.4 Budgetary Allocations for Puri Wildlife Division.											
Year	Allotment in Lakh Rs										
	Non-Plan		State plan	Central Plan	OEMF	ICZMP	FDA	CAMPA		Eco-Club	Total
	salary	contigency						wildlife	General		
2008-09	156.70	0	17.50	6.0	-	-	3.0	-	-	-	183.2
2009-10	197.82	0	53.01	27.53	-	--	7.27	73.745	68.57	4.01	432.0
2010-11	217.66	0.01	108.29	15.57	-	-	4.96	54.25	40.416	6.5	447.7
2011-12	199.90	0.01	126.88	17.87	-	-	2.83	79.25	66.963	10.075	503.8
2012-13	205.81	0.01	136.96	36.56	-	-	-	73.0	153.74	9.88	616.0
2013-14	222.40	0.01	163.89	46.80	-	-	-	199.05	198.58	9.98	840.7
2014-15	247.87	0	142.58	50.38	-	-	-	132.638	165.42	-	738.9
2015-16	284.210	0	233.0	56.22	-	-	-	174.996	169.61	-	918.0
2016-17	308.94	0	240.06	51.46	48.83754	-	-	177.124	93.184	9.88	929.5
2017-18	340.71	0	130.12	66.95	62.17531	24.22506	-	-	-	11.89	636.1

9.8 Existence of Monitoring, Assessment And Reporting Mechanism:

Monitoring & Evaluation is an important mechanism to have sustainable progress in execution of various programs. Many Monthly Information Systems have been developed either at State Level or at Department level. The monitoring applications now in use are as follows.

For implementation of developmental works, staffs have been deployed at different strategic locations maintaing the hierarchy. All the plantation works are monitored through Range Officer, ACF, & DFO at Division level and record building is done depicting the details of expenditure and work done in the plantation journal prescribe in the plantation manual of Forest Department. All the construction activities are done through approved estimate. All other ancillary activities like, boundary clearance, fireline tracing, digging of water body, maintance of forest road etc. are monitored at different levels and records are built up accordingly.

Regular felling in car timber overlapping circle in Sahana PRF is going on to cater the need of firewood of Jagannath temple, Puri and Swargadwar, Puri. Control forms for marking of trees, felling of trees, subsidiary cultural operation and its disposal to OFDC Ltd. are being mainted at Range level as per the prescribe format in the National Working Plan Code,2014. No individual rights have been settled under FRA, 2006 because no applications have been received at this end from anyone. No lands have been allotted to any community for enjoying the rights.

There is no reserved forest covered under working plan. However silvicultural cleaning and thinning are being taken up in PRFs for which records are being built up at Range levels. In no cases burning operation are being taken up.

The entire forest of the Division comprises of plantations. The forest areas of the Division are not rich in NTFP. Bambusa nutans (Sundarakani) is available in Tavagolora PRF and Bambusa aurundinasia (kanta baunsa) is available in Pattanaikia PRF and Junei PRF. Calamus viminalis (cane) is available in littoral swamp forest area of Golara PRF. Beside this different type of Berries like Mankada kendu, Jamu, Khirikoli, Guakoli, Sagadabatua Koli, Akhukoli , Biluakoli,kar koli,mehenga koli,Sahadakoli,Asadhua, Kochila,Mendhi, chun chunka, luni lunika, penthi, beta, chauladhua, aambada etc. are plently available in Golara PRF. It is being used by the local villagers. No effort has been made ever to collect these berries commercially. Cashew nuts are abundantly available in sanctuary area of Konark Range and Balukhanda

Range. Calophyllum inophyllum (Polanga) is profusely available in Brahmagiri Range area in private lands. Pandanus panden (Kia/ Kewda) is available in all most all area of the Division. In Golora PRF Kia is profusely available. In the past, Kia flowers were being collected for preparation of perfume. Bumper Cashew nuts are being harvested from the forest area of the sanctuary through Eco-Development Committee with a perfect *modus operand*i fixed by the Govt. since 2005. No specific records except collection of Cashew and its disposal are being mainted.

All other records and registers of fire, boundary pillar, nursery, reserved forest, lease, FC Act, FRA Act, soil and water conservation work, grass land management, wildlife management, eradication of invasive weed, human wildlife conflict, human casuality and injury due to wildlife, loss of domestic animal and crop damage and compensation paid, register of licence gun holders, places of religious significance and water table at various places of the division are being maintained at Range level as well as Division level.

9.9 Public awareness and education:

Success of any program depends on public awareness and education. Regular Public Awareness Camps for public / Children/ VSS members have been organized on the occasion of International / National / State level days of importance. Attempts have been made to expose the VSS/ EDC members to the activities taken up in other Division areas through exposure visits. Children of different schools have been taken to forest areas to expose themselves to forest and creat enthusiasim amont themselves. The Important days observed / celebrated are

a. World Wetlands Day (2nd February).
b. World Forestry Day (21st March)
c. Earth Day (22nd April)
d. World Environment Day (5th June)
e. Vanamahotchhava Week (1st -7th July)
f. World Day to Combat Desertification (WDCD) (17th June)
g. World Elephant Day (12th August))
h. Wildlife Week (2nd October – 8th October)

Details of Public Awareness camps organized in the Division during last 5 years is given at Table No 9.5

Table No 9.5 Public Awareness camps organized in the Division				
Range	Year	Scheme	Place	Theme of the camp
Balukhanda	2008-09	State Plan	Saikatnivas	Vanamahotsav
			Saikatnivas	Development of Bamboo Mission
	2009-10	State Plan	Kabirajpur	Development of Bamboo Mission
			FRH, Puri	Oyster merchant awareness camp
			Penthakata	Oyster merchant awareness camp
			FRH, Puri	55th Wildlife Week celebration
			Saikatnivas	55th Wildlife Week celebration
			Penthakata	Protection of Sea turtle
			Penthakata	Protection of Sea turtle
			Penthakata	Protection of Sea turtle
	2010-11	State Plan	Penthakata	Protection of Sea turtle
			Compt. No.III	Protection of Sea turtle
			Saikatnivas	Protection of Sea turtle
			Compt. No.V	Protection of Sea turtle
	2011-12	State Plan	Beldala	57th Wildlife Week celebration
	2012-13	State Plan	Gopalpur	58th Wildlife Week celebration
			Gopalpur	58th Wildlife Week celebration
			Saikatnivas	Protection of Sea turtle
			Saikatnivas	Protection of Sea turtle
	2013-14	State Plan	Saikatnivas	Protection of Sea turtle
	2014-15	State Plan	Puri Zilla School	Vana Mahotsav 2014
			Balukhanda	Wildlife Week
			Balukhanda	Forest Protection
	2015-16	State Plan	Balukhanda	Vana Mahotsav
			Balukhanda	Wildlife Week
			Balukhanda	Award for plantation
	2016-17	State Plan	Govt. ITI Campus	Vana Mahotsav
			DRDA, Puri	Wildlife Week
	2017-18	State Plan	Puri Zilla School	World Earth day
			Saikatnivas	World Day to combat desertification
			Satkosia	Exposure visit of EDC members
			Balukhanda	Vana Mahotsav
		CAMPA (W)	Balukhanda	World Environment day
Gop	2018	General (GMM)	Nuharkiri to Daleisahi	To aware the people about GMM
			All Range of Puri WL Division	
Astaranga	2011-12	Turtle Protection	National Museum,Bhubaneswar	Protection & Conservation of Olive Ridley Sea Turtle

	2012-13	-do-	Bhubaneswar	-do-
	2013-14	-do-	Muhanamuha	-do-
	2017-18	-do-	Kaliakana	-do-
			Konark Wildlife Sanctuary	Forest Conservation, Eco Tourism & Wildlife Management.
Konark	2007-08	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2008-09	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2009-10	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2010-11	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2011-12	Central Plan	Tikana & Chandrabhaga	Public awareness through Ghodanacha about the protection and conservation of wildlife and forest.
			Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
			Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2012-13	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2013-14	Central Plan	In the premises of Garudeswar Temple	Awareness programme to protect the forest and wild animals
	2014-15	Central Plan	Konark Range Office Campus	Forest and wildlife management with 2011 resolution.
	2015-16	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2016-17	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle
	2017-18	Central Plan	Chandrabhaga Nolia sahi	Awareness meeting on Olive ridley Sea Turtle

9.10 Adequate manpower in forest division:

The Cadre Strength (Sanctioned & in Position as on 31.10.2018 is furnished at Table No 9.6

Table No. 9.6 Sanctioned cadre strength and present position (As on 31.10.2018)

Sl No.	Name of cadre	Sanctioned Strength	Present Position	Remarks (Vacant)
1	Divisional Forest Officer	1	1	-
2	Assistant Conservator of Forests	3	3	-
3	Forest Ranger	5	4	1
4	Forest Extension Supervisor	1	1	-
5	Deputy Ranger	4	2	2
6	Forester	28	22	6
7	Forest Guard	55	34	21
8	Head Clerk	1	1	-
9	Junior Accountant	5	2	3
10	Junior Stenographer	1	-	1
11	Junior Clerk	7	5	2
12	Driver (L.V)	1	1	-
13	Amin	1	1	-
14	Office Peon	2	2	-
15	Chowkidar-cum-Sweeper	1	1	-
16	Bunglow Chowkidar	2	1	1
17	Mali	2	2	-
	Total	120	83	37
18	Temporary status	-	05	-

The division has been constituted since 1st October,2003. The Divisional Forest Officers and their period on incumbency is furnished at **Annexure-XXIV**

CHAPTER-10
Five Year Plans

10. Five Year Plans:

From 1947 to 2017, the Indian economy was premised on the concept of planning. This was carried through the **Five-Year Plans**, developed, executed, and monitored by the Planning Commission (1951-2014) and the NITI Aayog (2015-2017). With the prime minister as the ex-officio chairman, the commission has a nominated deputy chairman, who holds the rank of a cabinet minister. The Twelfth Plan completed its term in March 2017. Prior to the Fourth Plan, the allocation of state resources was based on schematic patterns rather than a transparent and objective mechanism, which led to the adoption of the Gadgil formula in 1969. Revised versions of the formula have been used since then to determine the allocation of central assistance for state plans. The new government elected in 2014, has announced the dissolution of the Planning Commission, and its replacement by a think tank called the NITI Aayog (an acronym for National Institution for Transforming India).

10.1 First Five year Plan: (1951-1956)

The First Five-Year Plan was one of the most important, because it had a great role in the launching of Indian development after Independence. Thus, it strongly supported agriculture production and also launched the industrialization of the country (but less than the Second Plan, which focused on heavy industries). It built a particular system of mixed economy, with a great role for the public sector (with an emerging welfare state), as well as a growing private sector.

The first Indian Prime Minister, Jawaharlal Nehru, presented the First Five-Year Plan to the Parliament of India and needed urgent attention. The First Five-year Plan was launched in 1951 which mainly focused in development of the primary sector. The First Five-Year Plan was based on the Harrod–Domar model with few modifications.

The total planned budget of Rs.2069 crore (2378 crore later) was allocated to seven broad areas:

i. Irrigation and energy (27.2%),
ii. Agriculture and community development (17.4%),
iii. Transport and communications (24%),
iv. Industry (8.4%),

v. Social services (16.6%),
vi. Rehabilitation of landless farmers (4.1%),
vii. Other sectors and services (2.5%).

The most important feature of this phase was active role of state in all economic sectors. Such a role was justified at that time because immediately after independence, India was facing basic problems—deficiency of capital and low capacity to save.

The target growth rate was 2.1% annual gross domestic product (GDP) growth; the achieved growth rate was 3.6% the net domestic product went up by 15%. The monsoon was good and there were relatively high crop yields, boosting exchange reserves and the per capita income, which increased by 8%. National income increased more than the per capita income due to rapid population growth. Many irrigation projects were initiated during this period, including the Bhakra, Hirakud, Mettur Dam and Damodar Valley dams. The World Health Organization (WHO), with the Indian government, addressed children's health and reduced infant mortality, indirectly contributing to population growth.

At the end of the plan period in 1956, five Indian Institutes of Technology (IITs) were started as major technical institutions. The University Grants Commission (UGC) was set up to take care of funding and take measures to strengthen the higher education in the country. Contracts were signed to start five steel plants, which came into existence in the middle of the Second Five-Year Plan. The plan was quasi-successful for the government.

10.2 Second Five Year Plan: (1956-1961)

The Second Plan focused on the development of the public sector and "rapid Industrialisation". The plan followed the Mahalanobis model, an economic developmentmodel developed by the Indian statistician Prasanta Chandra Mahalanobis in 1953. The plan attempted to determine the optimal allocation of investment between productive sectors in order to maximise long-run economic growth. It used the prevalent state-of-the-art techniques of operations research and optimization as well as the novel applications of statistical models developed at the Indian Statistical Institute. The plan assumed a closed economy in which the main trading activity would be centred on importing capital goods.

Hydroelectric power projects and five steel plants at Bhilai, Durgapur, and Rourkela were established with the help of Russia, Britain (the U.K) and West Germany respectively. Coal production was increased. More railway lines were added in the north east.

The Tata Institute of Fundamental Research and Atomic Energy Commission of India were established as research institutes. In 1957, a talent search and scholarship program was begun to find talented young students to train for work in nuclear power.

The total amount allocated under the Second Five-Year Plan in India was Rs.48 billion. This amount was allocated among various sectors: power and irrigation, social services, communications and transport, and miscellaneous. The second plan was a period of rising prices. The country also faced foreign exchange crisis. The rapid growth in population slowed down the growth in the per capita income.

The target growth rate was 4.5% and the actual growth rate was 4.27%.

The plan was criticized by classical liberal economist B.R. Shenoy who noted that the plan's "dependence on deficit financing to promote heavy industrialization was a recipe for trouble". Shenoy argued that state control of the economy would undermine a young democracy. India faced an external payments crisis in 1957, which is viewed as confirmation of Shenoy's argument.

On Forestry Sector, in this two 5 year plan the focus was on the rehabilitation of the degraded forests and the creation of plantations of economically important species. In the second plan, the stress was also on the conservation of Wild Life.

10.3 Third Five Year Plan (1961-1966)

The Third Five-year Plan stressed agriculture and improvement in the production of wheat, but the brief Sino-Indian War of 1962 exposed weaknesses in the economy and shifted the focus towards the defence industry and the Indian Army. In 1965–1966, India fought a War with Pakistan. There was also a severe drought in 1965. The war led to inflation and the priority was shifted to price stabilisation. The construction of dams continued. Many cement and fertilizer plants were also built. Punjab began producing an abundance of wheat.

Many primary schools were started in rural areas. In an effort to bring democracy to the grass-root level, Panchayat elections were started and the states were given more development responsibilities.

State electricity boards and state secondary education boards were formed. States were made responsible for secondary and higher education. State road transportation corporations were formed and local road building became a state responsibility.

The target growth rate was 5.6%, but the actual growth rate was 2.4%.

On Forestry Sector, the third five year plan laid special emphasis on measures to meet the long term requirements of the country and to ensure more economic and efficient utilization of the valuable forest products. The immediate objective was to increase the output from the existing forests through better techniques of timber extraction, improvement of communications and popularizing the use of less commonly known secondary Indian timber after proper seasoning and preservative treatment. Various schemes implemented during the third five year plan were oriented towards attaining self sufficiency in industrial timbers, fuel wood and other forest products. In order to encourage State Governments to undertake plantations of quick growing species, particularly to meet the requirement of pulp and paper, a new centrally sponsored scheme "Plantation of Quick Growing Species" was introduced. It was accepted as a matter of policy that in order to obtain higher timber yields from the forest areas under exploitation and to reduce the wastage, improved logging tools have to be used. Training of forest officers and field executives in the State Governments and of lessees and forest contractors in logging planning and efficiency studies were started with the establishment of logging training centers set up with the assistance of the United Nations Special Fund.

10.4 Plan Holiday (1966-1969)

Due to miserable failure of the Third Plan the government was forced to declare "plan holidays" (from 1966–67, 1967–68, and 1968–69). Three annual plans were drawn during this intervening period. During 1966–67 there was again the problem of drought. Equal priority was given to agriculture, its allied activities, and industrial sector. The government of India declared "Devaluation of Rupee" to increase the exports of the country. The main reasons for plan holidays were the war, lack of resources and increase in inflation.

10.5 Fourth Five Year Plan (1969-1974):

At this time Indira Gandhi was the prime minister. The government nationalised 14 major Indian banks and the Green Revolution in India advanced agriculture. In addition, the situation in East Pakistan (now Bangladesh) was becoming dire as the Indo-Pakistan War of 1971 and Bangladesh Liberation War took funds earmarked for industrial development. India also performed the Smiling Buddha underground nuclear test (Pokhran-1) in Rajasthan on May 18, 1974, partially in response to the United States deployment of the Seventh Fleet in the Bay of Bengal. The fleet had been deployed to warn India against attacking West

Pakistan and extending the war.The target growth rate was 5.6%, but the actual growth rate was 3.3%.

During this plan period, three main objectives laid down in this plan are:

- To increase the productivity of forests,
- To link up forestry development with various forest based industries and
- To develop forests as a support to rural economy.

Emphasis was laid on measures to meet the immediate and long term agricultural and industrial requirements. Further efforts were made at creating large scale plantation of valuable quick growing species and species of economic and industrial importance. Concerted efforts at regenerating areas, where forest produce was removed for industrial uses, were taken. The object was to achieve self sufficiency in forest products as early as possible, specially for major forest based industries such as pulp, paper newsprint, wood panel products and matches so that the imports of these items may be replaced and some sizeable exports of pulp and wood panel products built up. In the last two years of the Plan period several important developments have taken polace like promulgation of Wild Life (Protection) act, 1972, and launching of Project Tiger in 1973.

10.6 Fifth Five Year Plan (1974-1978)

The Fifth Five-Year Plan laid stress on employment, poverty alleviation and justice. The plan also focused on self-reliance in agricultural production and defence. In 1978 the newly elected Morarji Desai government rejected the plan. The Electricity Supply Act was amended in 1975, which enabled the central government to enter into power generation and transmission.

The Indian national highway system was introduced and many roads were widened to accommodate the increasing traffic. Tourism also expanded. The twenty-point programme was launched in 1975. It was followed from 1974 to 1979.

The Minimum Needs Programme (MNP) was introduced in the first year of the Fifth Five-Year Plan (1974–78). The objective of the programme is to provide certain basic minimum needs and thereby improve the living standards of the people. It is prepared and launched by D.P.Dhar.The target growth rate was 4.4% and the actual growth rate was 4.8%.

In Forestry Sector, the primary objective was

- To take up a dynamic programme of production forestry, aiming at clear felling and creating large scale man made forests with the help of institutional financing.
- To develop farm forestry and to improve degraded forests so as to increase the fuel and timber supply in the rural areas. A network of State Forest Corporations was proposed to be created for the establishment and management of man-made forests and cater to needs of forest based industries.
- Special efforts were proposed to be made to prepare a number of projects in various States, for immediate and long term benefits in terms of increased raw materials for industries and additional revenues at different levels of investment.

10.7 Rolling Plan (1978-1980):

The Janata Party government rejected the Fifth Five-Year Plan and introduced a new Sixth Five-Year Plan (1978–1980). This plan was again rejected by the Indian National Congress government in 1980 and a new Sixth Plan was made. The Rolling Plan consisted of three kinds of plans that were proposed. The First Plan was for the present year which comprised the annual budget and the Second was a plan for a fixed number of years, which may be 3, 4 or 5 years.The Second Plan kept changing as per the requirements of the Indian economy. The Third Plan was a perspective plan for long terms i.e. for 10, 15 or 20 years. Hence there was no fixation of dates for the commencement and termination of the plan in the rolling plans. The main advantage of the rolling plans was that they were flexible and were able to overcome the rigidity of fixed Five-Year Plans by mending targets, the object of the exercise, projections and allocations as per the changing conditions in the country's economy. The main disadvantage of this plan was that if the targets were revised each year, it became difficult to achieve the targets laid down in the five-year period and it turned out to be a complex plan. Also, the frequent revisions resulted in the lack of stability in the economy.

10.8 Sixth five year Plan (1980-1985):

The Sixth Five-Year Plan marked the beginning of economic liberalisation. Price controls were eliminated and ration shops were closed. This led to an increase in food prices and an increase in the cost of living. This was the end of Nehruvian socialism. The National Bank for Agriculture and Rural Development was established for development of rural areas on 12 July 1982 by recommendation of the Shivaraman Committee. Family planning was also expanded in order to prevent overpopulation. More prosperous areas of India adopted family planning more rapidly than less prosperous areas, which continued to have a high birth rate. Military

Five-Year Plans became coterminous with Planning Commission's plans from this plan onwards.

The Sixth Five-Year Plan was a great success to the Indian economy. The target growth rate was 5.2% and the actual growth rate was 5.7%.

In this plan period, the emphasis was on increasing the productivity through proper land and water management**.** It was also felt that the preservation of the genetic and species diversity is essential for the management of the ecosystem and for the sustainable utilization of the resources. This would help in a big way in the future survival and development of the people. The necessity for constitution the Biosphere Reserves was also felt.

10.9 Seventh Five Year Plan (1985-1990)

The Seventh Five-Year Plan was led by the Congress Party with Rajiv Gandhi as the prime minister. The plan laid stress on improving the productivity level of industries by upgrading of technology.

The main objectives of the Seventh Five-Year Plan were to establish growth in areas of increasing economic productivity, production of food grains, and generating employment through "Social Justice".

As an outcome of the Sixth Five-Year Plan, there had been steady growth in agriculture, controls on the rate of inflation, and favourable balance of payments which had provided a strong base for the Seventh Five-Year Plan to build on the need for further economic growth. The Seventh Plan had strived towards socialism and energy production at large. The thrust areas of the Seventh Five-Year Plan were: social justice, removal of oppression of the weak, using modern technology, agricultural development, anti-poverty programmes, full supply of food, clothing, and shelter, increasing productivity of small- and large-scale farmers, and making India an independent economy.

Based on a 15-year period of striving towards steady growth, the Seventh Plan was focused on achieving the prerequisites of self-sustaining growth by the year 2000. The plan expected the labour force to grow by 39 million people and employment was expected to grow at the rate of 4% per year.

Under the Seventh Five-Year Plan, India strove to bring about a self-sustained economy in the country with valuable contributions from voluntary agencies and the general populace.

The target growth rate was 5.0% and the actual growth rate was 6.01% and the growth rate of per capita income was 3.7%.

On Forestry sector, the basic approach was sustainable development in harmony with the environment. Most of the programmes for environmental management dealt with planning for eliminating or at least minimizing environmental degradation. One of the major objectives of the Eco-development programme was the restoration of already degraded eco-systems through practical field schemes such as land reclamation, afforestation, cleaning of water bodies, etc. The programme is also geared towards arresting further damage to eco-systems and the promotion of a conservation based development strategy

Further emphasis on Research and Training was stressed. Botanical Survey of India (BSI), Zoological Survey of India (ZSI) was reoriented to deal with the lower forms of the life like fungi, bacteria, invertebrates, etc. Man and Biosphere Programme were also oriented towards the ecosystem development.

Implementation of the Biosphere Reserves Programme started in the Seventh Plan with the Department of Environment acting as the nodal agency. The conservation programmes in the Reserves was to be supplemented by a strong component of research studies on the living and non-living resources, rare and endangered species, socio-economic interactions with local/ surrounding populations and ethnobiological relationships

Eco-development programme like restoration of already degraded eco-systems through practical field schemes such as land reclamation, afforestation, cleaning of water bodies, etc. was to be strengthened in this Plan Period.

10.10 Annual Plan (1990-1992)

The Eighth Plan could not take off in 1990 due to the fast changing economic situation at the centre and the years 1990–91 and 1991–92 were treated as Annual Plans. The Eighth Plan was finally formulated for the period 1992–1997.

10.11 Eighth Five Year Plan (1992-97)

1989–91 was a period of economic instability in India and hence no Five-Year Plan was implemented. Between 1990 and 1992, there were only Annual Plans. In 1991, India faced a crisis in foreign exchange (forex) reserves, left with reserves of only about US$1 billion. Thus, under pressure, the country took the risk of reforming the socialist economy. P.V. Narasimha Rao was the ninth prime minister of the Republic of India and head of Congress Party, and led

one of the most important administrations in India's modern history, overseeing a major economic transformation and several incidents affecting national security. At that time Dr. Manmohan Singh (later prime minister of India) launched India's free market reforms that brought the nearly bankrupt nation back from the edge. It was the beginning of liberalization, privatisation and globalization (LPG) in India.

Modernization of industries was a major highlight of the Eighth Plan. Under this plan, the gradual opening of the Indian economy was undertaken to correct the burgeoning deficit and foreign debt. Meanwhile, India became a member of the World Trade Organization on 1 January 1995. The major objectives included, controlling population growth, poverty reduction, employment generation, strengthening the infrastructure, institutional building, tourism management, human resource development, involvement of Panchayati rajs, Nagar Palikas, NGOs, decentralisation and people's participation.

Energy was given priority with 26.6% of the outlay.

The target growth rate was 5.6% and the actual growth rate was 6.8%.

To achieve the target of an average of 5.6% per annum, investment of 23.2% of the gross domestic product was required. The incremental capital ratio is 4.1. The saving for investment was to come from domestic sources and foreign sources, with the rate of domestic saving at 21.6% of gross domestic production and of foreign saving at 1.6% of gross domestic production.

The major objectives for this Plan were:

a) To protect the natural environment;
b) To regenerate and restore degraded ecosystems and increase their productivity and to generate employment through these activities;
c) To decentralise control over nature and natural resources;
d) To develop and share an understanding of nature and natural processes;
e) To formulate a national policy for environment and an appropriate institutional and legal framework in support of the policy;
f) To ensure co-ordinated and integrated Governmental action aimed at conserving nature and sustainable use of natural resources;
g) To make individuals and institutions more accountable to the people for their actions impinging on environment and ecosystem; and
h) To monitor the state of environment

10.12 Nineth Five year Plan (1997-2002)

The Ninth Five-Year Plan came after 50 years of Indian Independence. Atal Bihari Vajpayee was the prime minister of India during the Ninth Plan. The Ninth Plan tried primarily to use the latent and unexplored economic potential of the country to promote economic and social growth. It offered strong support to the social spheres of the country in an effort to achieve the complete elimination of poverty. The satisfactory implementation of the Eighth Five-Year Plan also ensured the states' ability to proceed on the path of faster development. The Ninth Five-Year Plan also saw joint efforts from the public and the private sectors in ensuring economic development of the country. In addition, the Ninth Five-Year Plan saw contributions towards development from the general public as well as governmental agencies in both the rural and urban areas of the country. New implementation measures in the form of Special Action Plans (SAPs) were evolved during the Ninth Plan to fulfill targets within the stipulated time with adequate resources. The SAPs covered the areas of social infrastructure, agriculture, information technology and Water policy.

Budget

The Ninth Five-Year Plan had a total public sector plan outlay of 859,200 crore (US$120 billion). The Ninth Five-Year Plan also saw a hike of 48% in terms of plan expenditure and 33% in terms of the plan outlay in comparison to that of the Eighth Five-Year Plan. In the total outlay, the share of the center was approximately 57% while it was 43% for the states and the union territories.

The Ninth Five-Year Plan focused on the relationship between the rapid economic growth and the quality of life for the people of the country. The prime focus of this plan was to increase growth in the country with an emphasis on social justice and equity. The Ninth Five-Year Plan placed considerable importance on combining growth oriented policies with the mission of achieving the desired objective of improving policies which would work towards the improvement of the poor in the country. The Ninth Plan also aimed at correcting the historical inequalities which were still prevalent in the society.

Objectives

The main objective of the Ninth Five-Year Plan was to correct historical inequalities and increase the economic growth in the country. Other aspects which constituted the Ninth Five-Year Plan were:

- Population control.

- Generating employment by giving priority to agriculture and rural development.
- Reduction of poverty.
- Ensuring proper availability of food and water for the poor.
- Availability of primary health care facilities and other basic necessities.
- Primary education to all children in the country.
- Empowering the socially disadvantaged classes like Scheduled castes, Scheduled tribes and other backward classes.
- Developing self-reliance in terms of agriculture.
- Acceleration in the growth rate of the economy with the help of stable prices.

Strategies

- Structural transformations and developments in the Indian economy.
- New initiatives and initiation of corrective steps to meet the challenges in the economy of the country.
- Efficient use of scarce resources to ensure rapid growth.
- Combination of public and private support to increase employment.
- Enhancing high rates of export to achieve self-reliance.
- Providing services like electricity, telecommunication, railways etc.
- Special plans to empower the socially disadvantaged classes of the country.
- Involvement and participation of Panchayati Raj institutions/bodies and Nagar Palikas in the development process.

Performance

- The Ninth Five-Year Plan achieved a GDP growth rate of 5.4% against a target of 6.5%
- The agriculture industry grew at a rate of 2.1% against the target of 4.2%
- The industrial growth in the country was 4.5% which was higher than that of the target of 3%
- The service industry had a growth rate of 7.8%.
- An average annual growth rate of 6.7% was reached.

The Ninth Five-Year Plan looks through the past weaknesses in order to frame the new measures for the overall socio-economic development of the country. However, for a well-planned economy of any country, there should be a combined participation of the governmental agencies along with the general population of that nation. A combined effort of public, private, and all levels of government is essential for ensuring the growth of India's economy.

The target growth was 7.1% and the actual growth was 6.8%.

In Forestry sector, the objectives were

- Empowering the people through information generation, dissemination and access
- Involving the Industry in both the private and the public sector.
- Integrating environment with decision making through valuation of environmental impacts; evolving market based economic instruments as an alternative to the command and control form of environmental regulation; appropriate pricing of natural resources based on their long-term marginal cost of supply; appropriate fiscal reforms and natural resource accounting.
- Evolving the rights for common property resources.
- Inter-sectoral coordination and cooperation.
- Ensuring scientific and technological inputs.
- Participation of people (particularly women) in the management and sharing of usufruct through Joint Forest Management.
- Involvement of NGOs for awareness building and as an interface between forest department and the people would be encouraged during the Ninth Plan.

10.12 Tenth Five year Plan (2002-2007)

The main objectives of the Tenth Five-Year Plan:

- Attain 8% GDP growth per year.
- Reduction of poverty rate by 5% by 2007.
- Providing gainful and high-quality employment at least to the addition to the labour force.
- Reduction in gender gaps in literacy and wage rates by at least 50% by 2007.
- 20-point program was introduced.
- Target growth: 8.1% – growth achieved: 7.7%.
- The Tenth Plan was expected to follow a regional approach rather than sectoral approach to bring down regional inequalities.
- Expenditure of 43,825 crore (US$6.1 billion) for tenth five years.

Out of total plan outlay, 921,291 crore (US$130 billion) (57.9%) was for central government and 691,009 crore (US$97 billion) (42.1%) was for states and union territories.

The main objectives of this plan are:

- Bringing one third geographical area under the forest cover.
- Adopting watershed approach to develop and maintain the forest cover.

- The livelihood needs of the people living adjoining to the forests would be addressed.
- JFM would be given more thrust for the regeneration of the degraded forests.
- Efforts would be taken to reduce the import of the timber and the timber requirement would be met from the community lands, private farm lands and degraded lands.
- Food for work programme would be extensively implemented in the forest pockets to ensure food security and productive employment.
- Efforts would be taken on protecting the natural forests to have a better carbon trading potential to increase the market avenues for forest protection and management.
- The conservation and protection of the medicinal plants is given priority.
- The bio-diesels coming from plants like Jatropa, pongamia etc., would be promoted to encourage the livelihood opportunities of the rural masses.
- It was also decided to merge all Afforestation programmes under National Afforestation and Eco-development Board (NAEB) into one scheme called 'National Afforestation Programme' and it would be implemented through Forest Development Agency (FDA)

10.13 Eleventh Five year Plan (2007-2012)

- It was in the period of Manmohan Singh as a prime minister.
- It aimed to increase the enrolment in higher education of 18–23 years of age group by 2011–12.
- It focused on distant education, convergence of formal, non-formal, distant and IT education institutions.
- Rapid and inclusive growth (poverty reduction).
- Emphasis on social sector and delivery of service therein.
- Empowerment through education and skill development.
- Reduction of gender inequality.
- Environmental sustainability.
- To increase the growth rate in agriculture, industry and services to 4%, 10% and 9% respectively.
- Reduce total fertility rate to 2.1.
- Provide clean drinking water for all by 2009.

- Increase agriculture growth to 4%.

10.14 Twelveth Five year Plan (2012-2017)

The Twelfth Five-Year Plan of the Government of India has been decided to achieve a growth rate of 8.2% but the National Development Council (NDC) on 27 December 2012 approved a growth rate of 8% for the Twelfth Plan.

With the deteriorating global situation, the Deputy Chairman of the Planning Commission Montek Singh Ahluwalia has said that achieving an average growth rate of 9 percent in the next five years is not possible. The Final growth target has been set at 8% by the endorsement of the plan at the National Development Council meeting held in New Delhi.

The objectives of the Twelfth Five-Year Plan were:

- To create 50 million new work opportunities in the non farm sector.
- To remove gender and social gap in school enrolment.
- To enhance access to higher education.
- To reduce malnutrition among children aged 0–3 years.
- To provide electricity to all villages.
- To ensure that 50% of the rural population have accesses to proper drinking water.
- **To increase green cover by 1 million hectare every year.**
- To provide access to banking services to 90% of households.

10.14 Financial Achievements Upto Fourth Five Year Plans:

During 1951-69, 23 percent of total allocation to Forestry has been spent on economic plantations for industrial and commercial uses. The same percentage was maintained in the fourth plan period. The scheme on Farm forestry-cum—fuel wood plantations accounted for 2.2 percent of the total expenditure for the period 1951-69.

CHAPTER-11
Past System of Management

11.1 General History of the Forests:

Right from Pre-British period to Post-Independence period, covering 1st five year plan period to the 10th five year plan period, the forest have undergone various changes. Normally, forests are scientifically managed as per the prescriptions made in the Working Plan. The impact of a Working Plan is evaluated usually at an interval of 10 years. During the past 100 years the main focus has been on sustaining and augmenting natural regeneration through manipulation of overhead light, regulation of felling intensity of trees in different canopies.

The following factors had greatly influenced the forest crop in the past years:

1. Introduction of scientific forest management by the British around 1850.
2. Two World Wars.
3. Independence in 1947.
4. Acquisition of private forests – 1956.
5. Recommendations of National Commission on Agriculture – 1976.
6. Environmental Awakening – 1985.
7. Ban of green felling introduced in the state in 1988.

For a rational and intelligible ecological impact assessment, the entire history of forest management is divided into six distinct periods:

1. Pre –British Period
2. Early British Period (1750-1900)
3. Late British Period (1900-1947)
4. Post-Independence Period (1947-1975)
5. Post-Independence Period (1975-1985) 1st Five Year Plan period to 10th Five Year Plan.
6. Post-Independence Period (1985-todate)

The changes witnessed by forest managers during the last 150 years can be represented as follows:

a. Conservation (Up to 1900)
b. Production (1900-1985)
c. Poeples participation and Ecological and Environmental protection (1988-today)

Odisha was ruled by Hindu Kings for centuries until 1568 when the Afghans conquered the country and ruled till 1592. In 1592, Odisha came under Mughal Rule and remained under them till 1751, when the State was passed to Marathas, who made a way for the British Rule, In Pre-British period; the forest was being managed in an un-scientific manner. It appears that the people were allowed to cut and clear the forest whenever they required. Certain stretches of jungles were reserved in the neighborhood of forest for security point of view and games were preserved by the Kings. The historian Mr. Sterling in 1592 mentioned that there were 31 Zamindars under the Ruler of Khurda.

Under British Rule.

King of Khurda rebelled in 1804,as a result his estate was forfeited and brought under British Rule directly. Subsequently at the time of quinquennial settlement of 1823-24 or 1836, the Settlement Officer Mr. Wilkinsion liberally encouraged Rayats for doing cultivation by clearing forests. Forest Conservation had never been thought of. That detrimental practice continued till 1870. It was in 1870 that, Mr. W.C. Taylor, who was appointed as Deputy Collector thought of putting some checks on unrestricted felling and taila cultivation. The system of permits and passes was first time introduced by him and some regulations were framed. Extract of the letter of Mr. Taylor of Collector, Puri No. 49 dated the 4th June 1872, will explain the condition of forests of Khurda at that time, which is quoted below:

“When I came to Khurda I found the question of jungle and forest conservancy had been entirely neglected ever since the estate came into the hands of Government in the beginning of the present century, i.e. 1805”

In former years, timber, bamboos, fire wood were sometimes allowed by the Sarbarakars to be taken on receiving some trifling royalty to which they had no right whatsoever.

Subsequently the Government of India Vide letter No.- 402-T dated. 9.6.1879 appointed Mr. E.E. Wylly as Forest Officer @ Rs. 100/- per month under the Collector “with provision that forest be visited by and reported on by Conservator or some other Forest Officer”. Following further representations made by Mr. Taylor, the Local Government issued a notification

dated 9.8.1880 declaring all the unsettled lands in the Khurda estate to be Protected Forests under the Chapter IV of the Indian Forest Act this was a land mark development in the history of Forest legislation.

Control by the Forest Department under British Rule.

In 1883, the forest areas of Khurda Estate were placed under the control of forest department through the administrative unit known as Khurda Forest Sub-Division with headquarter at Khurda under Orissa Forest Division with headquarters at Cuttack. Another sub-Division was Angul. This arrangement continued till 1891 when Puri Forest Division was constituted. Most of the buildings were erected and roads were constructed and survey and demarcation of the forest areas was undertaken during 1833 to 1895. There being no mature stock, main object of Forest Officers had been to preserve and improve left over stock and consequently no considerable felling were undertaken. The Forests were carefully protected from fire, important experimental thinning was taken up in Class II forests and plantations in classed I and II were raised. The first ever regular plan was prepared by Mr. C.C. Hatt based on the lines indicated in the unofficial note prepared by Mr. Ribbentrop, the then Inspector of General of Forests and the forests were worked under the said plan from 1896-97. Most of the Forests of Puri Division except those, Balukhand and Ranpur Ranges were notified Reserved between 1885 to 1911.

11.2 Past system of Management and their results:

11.2.1 HATT'S PLAN 1896-97 to 1905-06 (1st Plan):

Basing on the policy draft by Mr. Ribbebtrop, the then Inspector General of Forests, Mr. C.C. Hatt prepared the First Working Plan of Puri Forest Division. It is significant to note that even in 1896, forests of Puri Division were classified into five classes.

Those days management was not Revenue Oriented as Revenue was limited to 30% of Expenditure incurred on development of Forests. The felling were very light and limited to removal of diseased and badly grown trees.

11.2.2 MONTEATH'S PLAN 1905-06 to 1919-20 (2nd Plan):

Owing to the improvement of the demand of the forest produces, a revised method of working was introduced from 1905-06 by this Plan. The second Working Plan period was from 1919-20.

11.2.3 DERRY'S WORKING PLAN (1926) (3rd Plan):

The third plan brought up radical change in the management of high forests.

11.2.4 MOONEY'S PLAN OF 1931-32 to 1954-55 (4th Plan):

In 1931, Mr. Derry's Plan was revised due to its failure in respect of Sal Conversion Working Circle and 4th revised Plan was made by Dr. Mooney which came into force from 1st April 1931. In this plan emphasis was given for management of casuarina forest for which one casuarina working was prescribed.

Casuarina Working Circle

Whole of the Balukhand block covering 3355 acres was divided in to 12 compartments, and was allocated to Casuarina Working Circle. This Working Circle was first time introduced in the Working Plan. **Casuarina Plantation was raised for the first time during 1916-17 around Puri near Balukhand** to check and control shifting of sand and minimize the damage due to cyclone. This was started by Mr. J.P. Haslett, extra Deputy Conservator of Forest. Two felling series, namely Northern Felling Series and Southern Felling Series were constituted. Existing crop in the Northern Felling Series was to be clear felled within a period of 12 years keeping in view **rotation of 15 years**. Intermediate thinning were prescribed in the 9th year in better quality areas wherein 1/5th no. of stands were to be removed. In Southern Felling Series low lying areas, river beds and sand dunes were included and felling of dead, dying trees was prescribed. Healthy casuarinas tree were to be pruned in 6th year up to 6'- height and crop to be thinned in 9th and 10th years. The prescriptions for Southern Felling Series were amended in 1936, when removal of dead, dying trees along with the trees of and above 10" diameter was prescribed on 3 year cycle. It was observed by subsequent Working Plan Officers that deepening of Surlake Cut in 1940-41 caused extensive dying off owing to lowering of water table. As the demand was less, instead of working over whole area, clear felling and planting on small scale, leaving 3 chain width of wind belt on seaward side was experimented. The plantations raised in 1941 came up successfully.

11.2.5 DASH'S PLAN OF 1944-45 to 1953-54 (5th Plan)

Mr. G.C Dash revised the plan prepared by Dr. Mooney. This plan came into effect from 1st July, 1944 for 10 years. Under this plan one working circle for management of casuarina forest was also there.

Casuarina Working Circle

Casuarina Working Circle covered an area of 3235.6 acres extending over Balukhand block. 222 acres of Casuarina forests of Balukhand block lying along the sea coast was taken to miscellaneous Working Circle as the area was likely to be extended by gradual shifting of the sea coast. Two felling series 'A' and 'B' were constituted corresponding to North and South Felling Series of Mooney's Plan with a difference that only 'A' felling series was to be worked and 'B' felling series (which was comprising of the mortality zone) was prescribed for tending and plantation operations only. Thinning at 6th and 12th year was prescribed. **Rotation was fixed at 20 years**. In 1958, sudden mortality over 2280 acres of plantation occurred and a separate scheme for felling with 15 years rotation was prepared in 1962 after planting up of the mortality areas.

11.2.6 MITRA'S PLAN 1965-66 to 1984-85 (6th Plan):

After expiry of Sri G.C Dash's plan for the parent Puri Division in 1954 and Sri G.N Mathur's plan for Ranpur ex-state in 1955, no further plan was written by anybody except one Working Scheme prepared by C.L Mohapatra (1959) for exploitation of Old Teak Plantations of Puri District (though it covered only Puri Division area) covering an area of 031.20 acres planted up to 1931, which was succeeded by Working Plan prepared by Mr. M.N Mitra for the period from 1965-66 to 1984-85. The general objects of the management under this plan remained more or less the same as any other Working Plan in the county i.e. conservation of soil and water resources by maintaining vegetative cover on hill slopes and eroded land, meeting the growing needs of the local population, maintenance and improvement of the growing stock by proper scientific management and consistent with the above, to obtain maximum financial return on a sustained basis. To attain the above objectives out of10 Working Circles casuarina working circle was one of them.

Casuarina Working Circle

This Working Circle covered an area of 3870 acres of Balukhanda Reserved Forest and included old Casuarina plantation and areas fit for raising its new plantations. 2 Felling Series were originally constituted namely: Northern Felling Series and Southern Felling Series. Subsequently Government vide their letter No. 10F (N)-158-77-29752 dated 3.11.1977, reconstituted Southern Felling Series into 3 felling series namely; Indradyumna Felling Series, Phulpatna Felling Series and Beldal Felling Series. The silvicultural system prescribed was clear felling followed by artificial regeneration through planting of potted seedlings of Casuarina at the spacement of 2.5m x 2.5m except the sea-shore sides where the spacement was prescribed to be 4'x4'. Regular watering of plantations for initial 2 years and prunning up to 6' height in the fourth year and thinning in the 7th year was prescribed. **Casuality replacement was suggested to be done by Cashew and Eucalyptus seedlings** and subsidiary silvicultural operations prescribed for protection from grazing and stoppage of litter removal.

For Southern Felling Series i.e. Indradyumna, Beldal and Phulpatna Felling Series retention of all trees except dead, dying diseased and wind-broken which were unlikely to survive for 7 years or more was prescribed. It was also suggested that no tree from wind belt area should be removed unless it is dead. It was left to the discretion of the Divisional Forest Officer to decide whether an area is inside the wind belt or not.

Coupes were suggested to be worked departmentally which were later worked through Orissa Forest Corporation Ltd. It has been learnt that during 1980-82 large scale drying of Casuarina took place in this Working Circle and dead trees were uprooted and removed departmentally. During 1984, Balukhand Reserved Forest has been included inside Balukhand-Konark Wildlife Sanctuary vide Notification No. 8F (W) 23/84, 9013/FFAH dated. 23.04.1984. Subsequently this notification has been amended to be Notification No. 8F (W) 65/87, 16216/FFAH dated. 1.9.1987. Therefore, since 1985 onward felling inside Balukhand Reserved Forest has been completely stopped at the instance of the Chief Minister, Orissa as learnt from the Divisional Forester Officer, Puri Division. No official communication in this regard is available. As observed in the field, whole Balukhand Reserved Forest bears a look of bushy Casuarina forests of Uniform age. Plantations raised in past have been cut and removed by the people at the stump height of 9" to 22" and shoots from leftover stumps have emerged giving a look of bushy growth. Density of the survived growth varies from 0.3 to 0.6 and height is abound 4' to 6'. Gaps caused due to illicit felling and removals of drying plants have been filled by way of gap filling (though called plantation) in haphazard manner

for which no proper record has been maintained. Acacia and Eucalyptus, which were planted in a few patches, during Social Forestry Project time have also been repeatedly felled by smugglers and coppice shoots are occupying the space. However, Acacia and Cashew-nut have been somehow able to withstand the smugglers' pressure and doing reasonably well due to their ability for natural regeneration through seed dispersal.

11.2.7 J D Sharma's Plan 1989-90 to 1998-99 (7th Plan):

Keeping in view the National Forest Policy 1988, the then working plan officer, Sri J.D Sharma, Bhanjanagar revised the working plan for the R.F, DPF Blocks of erstwhile Puri Division for the period 1989-90 to 1998-99. The gap period from 1985-86 to 1988-89 was managed through working schemes. More emphasis was given on ecological balance and environment stability rather than commercial exploitation of the forest wealth. This plan was approved vide Forest, Fishery and Animal Husbandry Department memo no. 10F (cons) 43/90-FFAH. Dt 13.07.1990.

In this plan it was described that inadequate availability of timbers as per the Demand of the market. Railway was asked to use concrete sleeper instead of timber sleepers. Govt. encouraged use of steel, concrete door and window frames. To meet the demand of small timbers and firewood of the people Plantation under social forestry project was undertaken to reduce pressure on natural forest. Ban on felling could not fulfil the expectation, rather immense and indiscriminate damage to the forest took place due to heavy illicit felling.

In this plan Mr. Sharma had prescribed 09 working circles, out of which Car Timber (overlapping) working circle was one of them. This working circle was prescribed for the first time to cater the timber requirement of Chariots of Lord Jagannath as per Ratha Yatra Code, 1983 from Nayagarh and Khurda (T) Divisions. But there was no prescription to meet the demand of firewood to the kitchen of Lord Jagannath or to Swargadwar. Nothing was prescribed specifically for management of Casuarina Plantations in the coastal tract of present Puri Wildlife Division.

11.2.8 Abhiram Das Plan (2007-2008 to 2016-2017) (8th Plan):

The last revision of working plan of the erstwhile Puri Forest Division was made by J.D Sharm which was valid till 1998-99. No working plan/ scheme was prepared after its expiry as implimenation of working plan became a low priority job after imposition of blanket ban on green felling by State Govt. in 1992. After a lot of debate on the issue of need for scientific forest management and the directive of the apex court for execution of all forestry

operations only as per the prescription of scientific management plan, then state Govt. decided to prepare the working plan where ever expired.

The working plan for erstwhile Puri Division was prepared by Abhiram Das, WPO, Bhubaneswar for the period 2007-08 to 2016-17 as per the National Working Plan code 2004.

In this plan there were 09 working circles out of which Car Timber (Over lapping) working circle was one of them. The major area of the Division comes under Balukhanda and Konark Range being a part of Balukhanda-Konark Notified Wildlife Sanctuary. The forests of the sanctuary are managed as per the approved Management Plan prepared separately.

Khordha (T) Division, Nayagarh (T) Division and Boudh (T)Division are supplying different types of Timber annually for manufacturing of Chariots of the deities worshipped at Jagannath Temple, Puri as per the Ratha yatra code 1983. But Puri (WL) Division supplies only the firewood for the sacred kitchen of the Temple and to the Swargadwar, the crematorium.

The monthly consumption of firewood in Puri town was estimated at 10,000 quintals keeping in view the requirement for cooking of sacred food at Jagannath Temple, Funeral at Swargadwar and other domestic needs of the town. Most of the requirement has been met from Department plantations. In this working circle Sahana felling series comprising of 10 coupes was prescribed to meet the firewood requirement of Puri. It was prescribed that the annual clear felling of coupes will be followed by restoring the area by planting casuarinas plants. Out of 10 prescribed annual coupes, Only 7 coupes and part of 8^{th} coupe could be felled by 31-3-2018. The delay in annual prescribed coupes felling is due to some legal constraints and field problems. However the remaining un-worked coupes will be allotted in the present working plan prescription and priority will be given to allot those in the initial year of felling. As per the prescription plantation following felling have been taken up in immediate subsequent year. The felling has been taken up in accordance with the prescription. The felling, conversion and subsequent disposal has been done through the Odisha Forest Development Corporation Ltd.

In last plan, one wildlife (overlapping) working circle was prescribed. There was a specific Wildlife Management Plan for Balukhanda-Konark Sanctuary for the period 2007-08 to 2016-17 written by Sarat Kumar Mishra. After expiry of the same a fresh management plan has been prepared for the period 2017-2018 to2026-2027 by Chitaranjan Mishra. The wildlife management is being taken up as per the management plan in vogue.

Forest protection is the paramount important for scientific management of forests. This working circle covers all those blocks require special protection measures. Due to intense biotic pressure of human and cattle, large number of forest of the division are under threat at various stages of degradation. Protection measures coupled with soil and moisture conservation measures have been taken in all those prescribed areas. Joint forest management has been adopted involving the local community for better management of the forests. Social forestry plantations have been declared as village forest. There are 43 no. village forests in Puri wildlife Division. No such eye catching initiatives have been taken for the management of those village forests. Strong initiatives have been taken to protect the forest from fire, illicit felling, grazing theft and smuggling. Although encroachment is a major problem in the division, some areas under encroachment have been evicted and the lands encroached have been retained back by the Forest Department. Modern fire fighting methods have been adopted for combating the forest fire. Public awareness campaign on various forest and environment issues have been taken up in the past. In this plan period two major natural calamities were faced i.e. Phailine in 2013 and Hud-Hud in 2014. Immense loss was noticed in shape of uprooting of trees and breaking of branches. In 2015 due to extreme heat in summer large number established casuarinas trees were died, some wilted dueto lowering of the water table. There was no specific plantation circle for this division. Block plantations have been taken up in car timber (over lapping) working circle. Some block plantations have been taken up during 2009-2010 under CAMPA scheme in different PRFs of the division. Some block plantations under National Afforestation Programme through Forest Development Agency have been raised in government lands as per the guidelines of the JFM Resolution, 2011.Besides these, attempts have been made to take up large chunk of areas of Devi- Kadua Estuary under Mangrove plantation which can act as an shock absorber against the Oceanic hazard. Amidst the excess biotic interference in the thickly populated areas a number of roads have been covered through Avenue plantation. Due to the geographic location of the division it is a tourist paradise. Lakhs of tourists pay visit to the different tourism destinations of the division round the year. Intensive logistic arrangements have been made at Kapileswar, Garudeswar,and Polanga orchard at Beleswar, Ramachandi, Chandrabhaaga, Isaneswar, Gangadevi, Sakshigopal, Baliharachandi and Bhabakundeleswar. After creation of the new division number infrastructures have been created. Communication network has been strengthened using modern electronic equipment.

11.2.9 Annual Working Scheme:

The outgoing plan was expired from 2016-17. The forest working is being carried out by annual working schemes. The Divisional Forest Officer has submitted Annual Plan (Working scheme) for three years i.e. 2017-18, 2018-19 and 2019-20. Approval orders has been communicated year wise vide letter no 8(31)35/2016-FCE dated 22.11.2017 & Letter No -8 (31)7/2017-FCE-II dated 05.10.2018. (Annexure-XV& XVI).

11.2.9.1 Objectives of Working Schemes:

- The proposals of the present Working Scheme for 2017-18 & 2018-19 aims at scientific management of the forest and wildlife in Puri Wildlife Division without contradicting the genuine interest of the people in absence of the prescriptions of Working Plan which has expired in March 2017.
- The general objectives proposed to be prescribed for better management of Forests and Wildlife during this period are:
- To conserve and improve the existing vegetative-cover for soil and water conservation with a view to ensure ecological and environmental stability.
- To endeavor to meet the requirements of people for agricultural small timbers, firewood, bamboos and other forest produces.
- To enhance the production of raw materials required for forest based industries consistent with ecological requirement.
- To protect, manage and enrich the flora and fauna of the division.
- To generate and uphold public interest and awareness on Protection of Forests and Wildlife.
- To promote development of sustainable and non-destructive livelihood opportunities for local communities and eco-tourism.
- To supply timbers for making chariots for the annual Car Festival of Lord Jagannath at Puri, as specified in the Puri Car Festival Code 1983.

11.2.9.2 Method of Treatment to be adopted.

To achieve the objectives mentioned above, the management prescriptions are to be made for various blocks and will be based on the local field realities, analysis of the forest crop by enumeration, regeneration, biodiversity survey, soil testing, detailed stock mapping, treatment required and other factors.

11.2.9.3 Constitution of Working Circles.

Considering the above mention ground realities, the forests of Puri Wildlife Division was proposed to be managed under the following Working Circles:

(1) Rehabilitation Working Circle,

(2) Car Timber (Overlapping)Working Circle,

(3) Plantation (Overlapping)Working Circle &

(4) Joint Forest Management (Overlapping) Working Circle

The target & achievement on different Working circle is furnished below.

Working Circle	Year 2017-18		Year 2018-19		Year 2019-20		Year 2020-21	
	Target	Acheivement	Target	Acheivement	Target	Acheivement	Target	Acheivement
RWC	Nil	Nil	Nil	20.0	Nil	18	Nil	Work is in progress
Car Timber (O) WC	102.0	Nil	150.0	48.0	215	50	165.0	
Pl (O) WC	50.0	85.0	0	50.0	50.0	50.0	Nil	
JFM (O) WC		No add. VSS constituted		No add. VSS constituted		No add. VSS constituted		

From the above target and achievement under Car timber Working Circle the implementation of coupe working is progressing slow. In case of Plantation Working Circle, more area has been taken up than targeted.

In 2017-18 coupe area 23694 numbers of trees marked over 48 ha and after felling 3408.9 Ton of Fire wood obtained. No subsidiary silvicultural operation was taken up.

The implementation of working scheme is considered to be satisfactory.

11.3 Special works of improvement undertaken

Beyond the working plan prescription some improvement works like, Mangrove Plantation, Avenue Plantation, FDA Plantation, Sweet Water Zone Plantation, Creation of Water body, Development of Infrastructures, Enhancement of Mobility, Improvement of communication network, Protection of Olive Ridley sea Turtle, Engagement of Anti-Poaching, Anti-Depredation, Protection Squad, Fire Protection Squad, Development of Eco-tourism Spots & Fixation Signage have been taken up during last plan period.

To protect the life and property of the people of the hinter land from oceanic hazards tremendous efforts have been made to bring available marshy areas of Devi-Kadua estuary under green cover by way of raising of mangrove plantations. A good eco-fragile coastal marine eco system has been created in Astaranga Range. 255 ha of land outside the plan areahave been brought under green cover by planting 6.375lakhs mangrove seedlings.

Abundant fallow land is not available within the Division Limit for plantation purpose. A timely action has been taken by way of raising avenue plantations by the roadsides of 194.26 RKMs. Different types of ornamental and shade bearing species about 48,565 nos. have been planted in different type of roads like, village road, other district road, PWD roads, RD roads and National Highway covering five Ranges of the Division.

Attempts have been made to create green belt or city lungs near urban areas for a healthy and eco- friendly environment. 27,553 nos. of seedlings have been planted in the vacant lands of different institutions, fallow wasteland of the urban local bodies of Puri, Konark, Nimapada and Kakatapur.

To strengthen the people's participation and cover the Govt. Waste land under greenery, plantations under National afforestation Programme (NAP) through Forest Development Agency (FDA) have been done over 145.5 ha area involving Vana Surakhya Samiti (VSS) under the guideline of joint forest management resolution. 3,63,750 seedlings have been planted to cater the need of fuel wood and small timber of the village community.

Special emphasis has been given to create a healthy and conducive atmosphere in the heritage city of Puri. To protect the ground water, plantations in the available sweet water zone of Puri town at Talabania and Baliapanda have been done covering an area of 154 ha. 3,85,000 Casuarina(Casuarina equisetifolia) and Acacia seedlings have been planted. To bring the planted areas under the clutch of forest laws, draft proposal for notification U/s-4 of

Odisha Forest Act, 1972 has been submitted to the Collector, Puri. The proposed reserved forest notification of the sweet water zone plantation area is pending at Govt. lavel (Revenue & Disaster Management Department) for publication of notification.

During last plan period attempts have been made to boost up plantations in private lands within the Divisional Jurisdiction. 41 lakhs seedlings of timber and firewood value have been distributed free of cost from different nurseries located within 5 Ranges of the Division. Ocularly 1600 ha of land in private sector either in shape of patch block plantation, small backyard plantation and multiple rows plantation in the available land have been raised.

Division has very good potentiality for tourism purpose. There are a number of old mythological places spread throughout the division. During last plan period attempt have been made to provide logistic facilities like drinking water, tubewell, toilet, sit out, dustbins and pindi at important places like, Gangadevi, Ishaneswar, Chandrabhaga, Ramachandi, Garudeswar, Balikapileswar, Beleswar, Bhabakundaleswar, Baliharachandi and Jahania have been constructed for the tourist.

Besides the presciptions in the plan,Small water bodies have been created in the car timber working circle area and other forest blocks within plan area to provide drinking water to wild animals especially to spotted deer.

The division was created during 2003. The infrastructure was very poor. Lot of new infrastructures like Range Office, Range Officer's residence, Forester Quarter, Forest Guard Quarter, Anti-Poaching Shed, Protection Shed, watch tower, Mega nursery have been constructed. Now the division is almost self sufficient in infrastructure.

To strengthen the protection activities emphasis has been given to provide easy mobility to field functionaries. One bolero vehicle equipped with a squad of 10 persons has been engaged on out-sourcing basis at the disposal of each Range Officer. Besides that, several squads have been deployed at strategic locationsto combat any untoward happenings like illicit felling, poaching and fire. Communication network has been strengthened by installing more VHF towers, replacing the old, damaged equipments of the VHF with new ones. Each field functionary has been provided with an android mobile phone as an auxiliary mode of communication.

To provide quality planting material to the public and for departmental consumptions, 4 permanent nursery and 1 mega nursery have been established in 4 different Ranges.

The entire division is a thickly populated area. To protect forest resources awareness among the people plays a vital role. Signage has been fixed at different eye catching locations to create awareness among the public for protection of Forest and wildlife.

To protect the Olive Redley Sea Turtles from the date of their arrival in coastal waters in the month of November to the date of emergence of their hatchlings in the month of June of succeding year strong protection measures either at offshore or onshore along the coast line of the division are being done annually. Protection camp sheds equipped with daily waged labourers headed by either a Forest Guard or a Forester are being setup at an average distance of 5 kms. along the coast line. Temporary hatcheries are being made at important locations to incubate the collected eggs from sporadic nesting places. One hired trawler is engaged in conducting patrolling in the sea by a Turtle Protection Team comprising staffs from forest, marine fishery, marine police and one section of armed police reserve. Mechanised fishing vessels are being either driven out from the 'No fishing zone' or seized and handed over to marine fisheries authority to take action under OMFRA Act.

11.4 Past yield, revenue and expenditure.

Table No 11.1 Past yield , revenue and expenditure										
Year	Yield in Regular Coupe (Physical)	Out turn in irregular lots (physical)	Royalty from regular and Irregular lot.	Rent on FRH.	Entry Fees	C. fees realized	License fees realized	Total	Expenditure	
									Drift & Waif wood	Deptt. Working of Timber
1	2	3	4	5	6	7	8	9	10	11
2007-08	-	Timber = 15.30 Cum. C.Fw = Q.262.80 Kgs. Misc. Fw = Q.78.85 Kgs.	-	-	-	2,96,662	62,633	3,59,295	6,000	-
2008-09	-	Timber & sizes= 11.81 Cum. C.Fw = Q.765.25 Kgs. Misc. Fw = Q.58.00 Kgs.	1,39,201	26,925	10,890	2,89,797	68,314	5,35,127	-	-
2009-10		Timber = 21.02 Cum. C.Fw = Q.2046.75 Kgs. Misc. Fw = Q.14.30 Kgs.	2,08,518	60,840	12,438	2,05,852	85,877	5,73,525	-	10,000
2010-11	4185.5 Stk	Timber = 24.93 Cum. C & M Fw = Q.537.60 Kgs. Misc. Fw = 7 Stk. Pole = 844 Nos.	-	72,900	12,079	1,81,373	82,599	3,48,951	-	15,000
2011-12	1360.2 Stk	Timber = 14.72 Cum. C Fw= Q.122.90 Kgs.	6,41,928	56,200	11,949	1,04,974	84,842	8,99,893	10,000	10,000
2012-13	-	Timber = 15.65 Cum. C. Fw = Q.183 Stk. Misc. Fw = Q.76.70 Kgs. Pole = 163 Nos.	57,289	37,050	10,655	32,525	79,427	2,16,946	-	-
2013-14	-	Timber = 9.19 Cum.	1,25,048	48,900	8,384	1,70,165	72,119	4,24,616	-	2,35,000

		C. Fw = 183 Stk. C & Misc. Fw = 3267.91 Stk Pole = 102 Nos.								
2014-15	1430 Stk	Timber = 9.92 Cum. C. Fw = Q.330.00 Sizes = 7.48 Cum.	9,013	48,500	10,555	43,411	74,124	1,85,603	50,000	1,00,000
2015-16	2981.5 Stk	C.Fw = Q.757.00	1,25,27,222	54,400	11,455	4,33,243	80,209	1,31,06,529	-	-
2016-17	1743 Stk	Timber = 1.95 Cum. M. Fw = Q.238.00 Poles = 254 Nos.	43,43,889	59,500	7,525	9,70,760	76,880	54,58,554	20,000	1,00,000
2017-18	1436.5 Stk	Timber = 6.06 Cum. C. Fw = Q.307.85 M. Fw = Q.70.75.	22,73,247	74,250	11,415	94,337	83,554	25,36,803	2,000	1,50,000

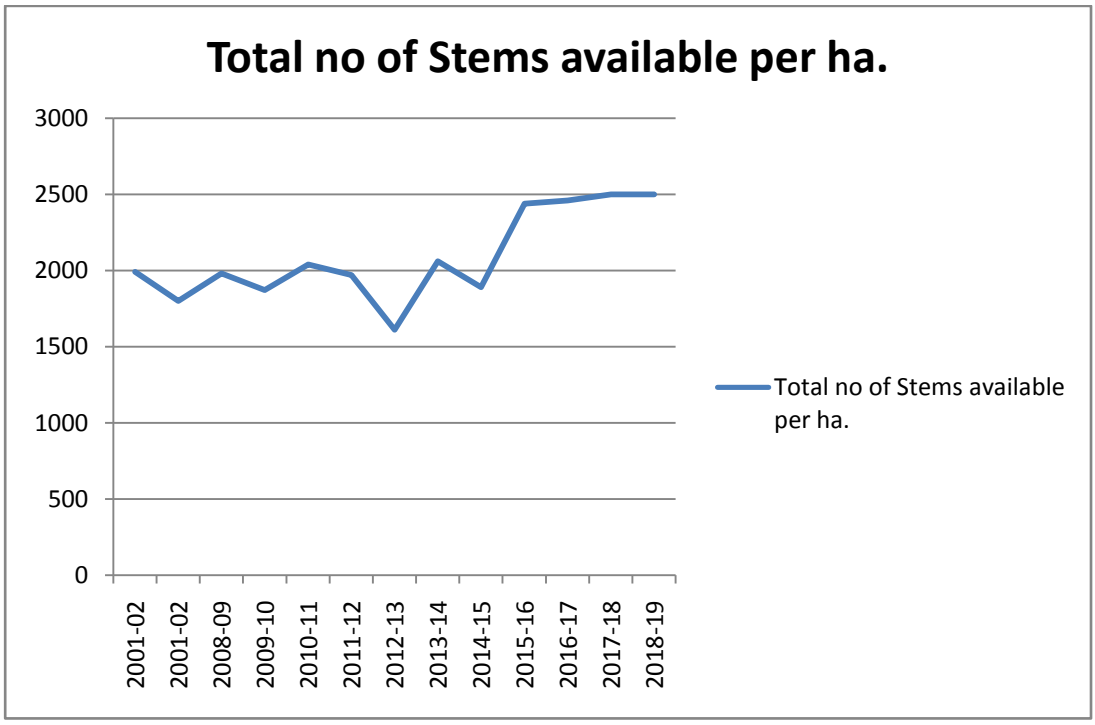
CHAPTER-12
STATISTICS OF GROWTH AND YIELD

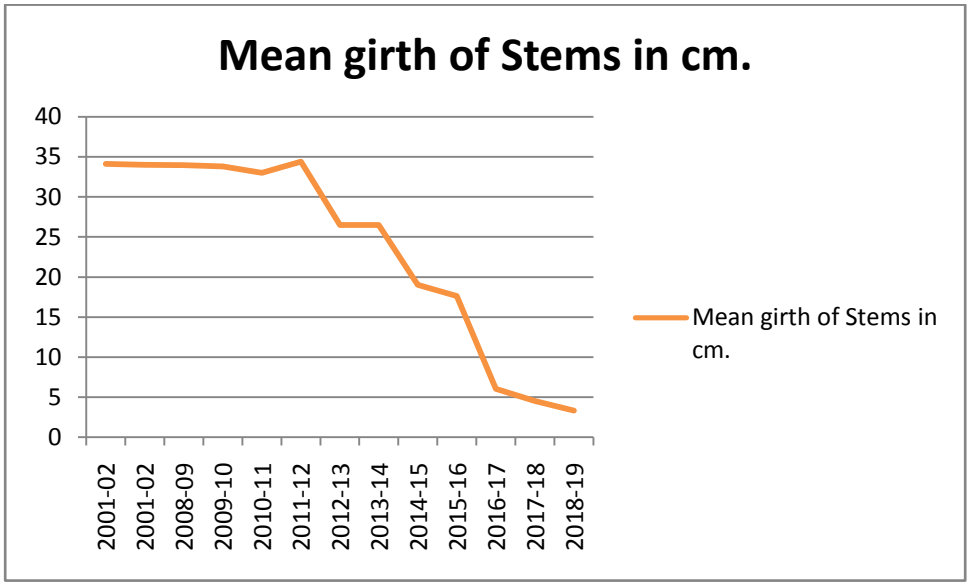
12.1 Statistics of forest carbon stock.

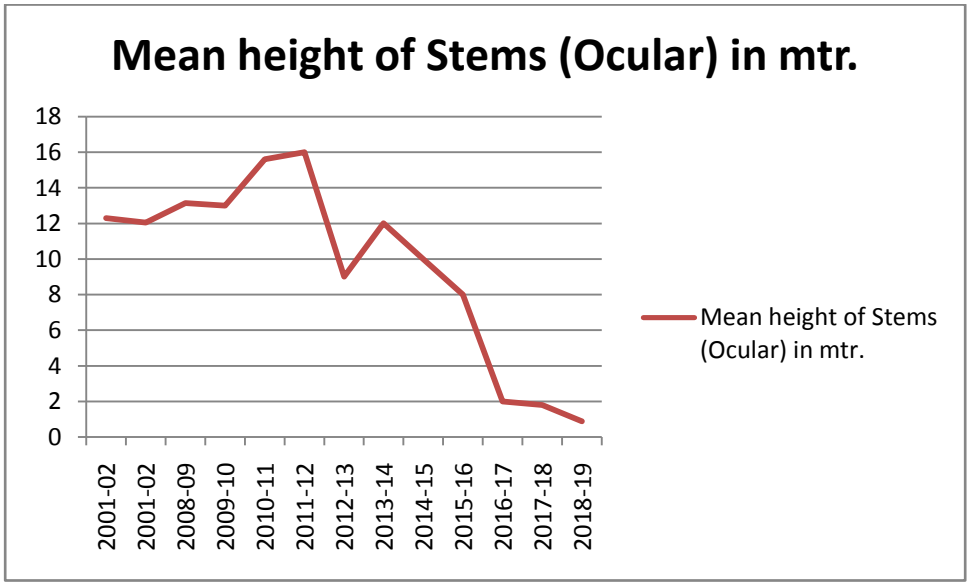
In this plan attempt has been made to access the growth rate of Casuarina species planted in different financial year starting from 2001 – 2002 to till 2018-19 by sampling method. Sample plots of 0.1 ha. has been laid in each year plantation without any prejudice. The average girth and average height of trees, plantation wise, has been calculated. The average no. of trees felled in comparison to the no. of seedlings planted per ha. has been calculated from the last 10 years harvesting figure. The average weight of Casuarina tree in maturity at the time of felling has been calculated from the last 10 years harvesting figure. It was estimated that 32.58% of planted seedlings got matured and available for felling. Similarly average weight of single Casuarina tree felled comes to 0.79 Qntl. Basing on these available yield datas from last 10 years harvesting, the production of firewood of different years available plantation has been outlaid.

Sahana felling series comprises Casuarina plantation in Sahana PRF as well as plantations in Govt. permissive land. The motto of the plantation is to supply firewood to Jagannath Temple for preparation sacred food and to Swargadwar for funeral of dead bodies in perpetuity. Since its formation, annual felling is followed by annual plantation. The car timber working circle plantations are raised along the bare coastal sand dunes along Astaranga coast. The growth rate as well as production of Casuarina is low as compared to cultivated Casuarina in different parts of the Division. Keeping all these factors in view and previous production figure for last 10 years, forecast of yield has been made and tabulated below.

Table No 12.1 Growth Statistics			
Year of Plantation	Total no of Stems available per ha.	Mean girth of Stems in cm.	Mean height of Stems (Ocular) in mtr.
2001-02	1990	34.13	12.29
2001-02	1800	34.02	12.05
2008-09	1980	33.95	13.15
2009-10	1870	33.80	13.00
2010-11	2040	33.0	15.6
2011-12	1970	34.4	16.0
2012-13	1610	26.5	09.0
2013-14	2060	26.5	12.0
2014-15	1890	19.0	10.0
2015-16	2440	17.6	08.0
2016-17	2460	06.0	02.0
2017-18	2500	04.5	01.8
2018-19	2500	03.3	0.88







12.2 Past Yield:

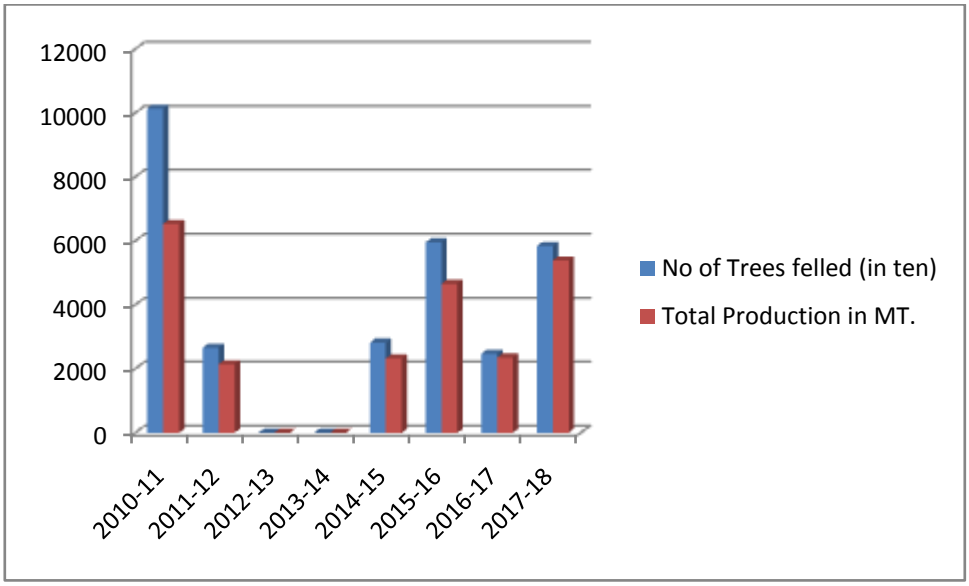
Felling in Sahana felling series of car timber (O) working circle for production of firewood was prescribed from the year 2007-08 to 2016-17 in the working plan of erstwhile Puri Division, Khordha, prepared for the period 2007-08 to 2016-17. Felling of 14ha, 50ha & 40 ha was prescribed for working during 2007-08, 2008-09 & 2009-10 respectively. But due to some technical problem firewood working could not be done from 2007-08 to 2009-10. However, the working of coupe began from 2010-11where the backlog coupe area for last 3years

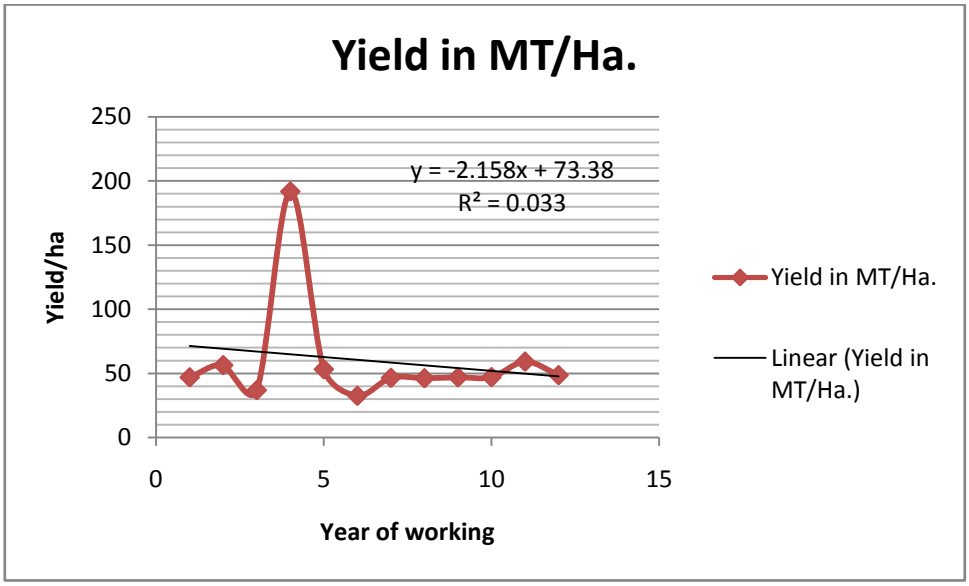
including the coupe area assigned for 2010-11 were worked as per the availability in the field. The allotted area for 2011-12 has been worked completely. Govt. imposed ban on felling for some technical ground during the period 2012-13 & 2013-14. Again the coupe working started from 2014-15 and continued till date. Due to 2 years break the assigned areas in the working plan could not be worked out as per prescription. The prescribed coupe no IX &X scheduled to be worked during 2015-16 & 2016-17 respectively have not yet been worked. The balance 2 coupes of the previous plan will be rescheduled as priority in the present plan for working. The coupes prescribed from I to X in the outgoing working plan correspond to the plantations raised from period 1997-98 to 2001-02 of Sahana PRF. Due to coastal erosion some plantations situated near Devi river mouth and Prachi river mouth have been washed away resulting reduction in production.

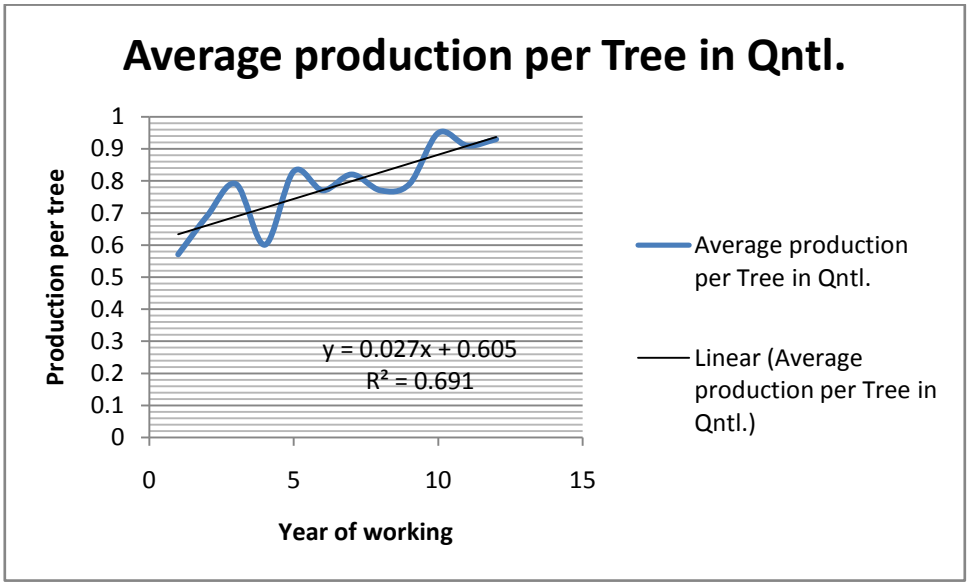
Table No 12.2 Yield Data Analysis of Harvested Casuarina Crop from 2010-11 to 2016-17											
Year of Working	Area Worked in Ha.	No. of seedlings Planted	No of Trees felled.	Percentage of Trees felled against Planting	Production in stacks		Production in MT		Total Production in MT.	Yield in MT/Ha.	Average production per Tree in Qntl.
					Garinda F.W 12x3x3	Twigs F.W. 12x3x3	Garinda	Twigs			
2010-11	14	35,000	11,564	33	387	20	640.485	16.55	657.035	46.93	0.57
2010-11	50	1,25,000	40,529	32.4	1626.50	155	2691.85	128.26	2820.11	56.4	0.69
2010-11	10	25,000	4,677	18.7	199	48	329.345	39.72	369.06	36.90	0.79
2010-11	14	35,000	44,635	127.50	1559.5	126	2580.97	104.26	2685.23	191.80	0.60
Total	**88**	**2,20,000**	**1,01,405**	**46.00**	**3772**	**349**	**6242.65**	**288.79**	**6531.44**	**74.22**	**0.64**
2011-12	25	62,500	16,059	25.69	794	20	1314.07	16.55	1330.62	53.22	0.83
2011-12	25	62,500	10,508	16.81	483.5	15	800.19	12.41	812.60	32.50	0.77
Total	**50**	**1,25,000**	**26,567**	**21.25**	**1277.5**	**35**	**2114.26**	**28.96**	**2143.22**	**42.86**	**0.80**
2014-15	50	1,25,000	28,222	22.57	1382.50	46	2288.03	38.06	2326.09	46.52	0.82
2015-16	50	1,25,000	30,070	24.05	1379	35	2282.24	28.96	2311.20	46.22	0.77
2015-16	50	1,25,000	29`,506	23.60	1305	224	2159.77	185.36	2345.13	46.90	0.79
Total	**100**	**2,50,000**	**59,576**	**23.83**	**2684**	**259**	**4442.01**	**214.32**	**4656.33**	**46.56**	**0.78**
2016-17	50	1,25,000	24,671	19.73	1326	192	2194.53	158.88	2353.41	47.06	0.95
2017-18	50	1,25,000	32,374	25.89	1644	286	2720.82	236.66	2957.48	59.14	0.91
2017-18	50	1,25,000	25,998	20.79	1338	260	2214.39	215.15	2429.54	48.59	0.93
Total	**100**	**2,50,000**	**58,372**	**23.34**	**2982**	**546**	**4935.21**	**451.81**	**5387.02**	**53.87**	**0.92**

Weight of Green Garinda Casuarina Firewood- 12'x3'x3' stack = 1.655 Mt.One stack Twig firewood= Half stack Garinda firewood

Yearwise harvesting of casuarinas trees (in No.) and outturn obtained (in MT)







Requirement of Firewood for Puri town:

The primary data have been obtained from Jagannath Temple firewood Depot (Both OFDC & Private), Swargadwar depot, Gundichabadi Depot and other private Depot for domestic consumption operated in the Puri town. The monthly consumption of firewood in Puri town is 5500 quintals, the breakup of which is given below.

1. Kitchen of Jagannath Temple : 1500 Qntl per month
2. Swargadwar (for pyre) : 3000 Qntl per month
3. For domestic and other Commercial consumption : 1000 Qntl per month

The annual requirement of Firewood for Puri town comes to 66000 Qntls= 6600 MT
After increase of Road, Rail and other transport connectivity population of devotees to have a Darshana to Lord Jagannath has incrased in manifold. After lunching of “Harischandra Yojana ” by State Govt. people are rushing from different corners of the state for cremating the dead bodies of their near and dear with an aspiration of getting salvation. The demand of firewood has crossed all the limits. At times it is extremely difficult to find a place at Swargadwar to keep the dead body for cremation. The use of firewood by domestic stake holders has reduced to maximum after introduction of ‘UJJALA’ yojana by Govt. Keeping all these factors

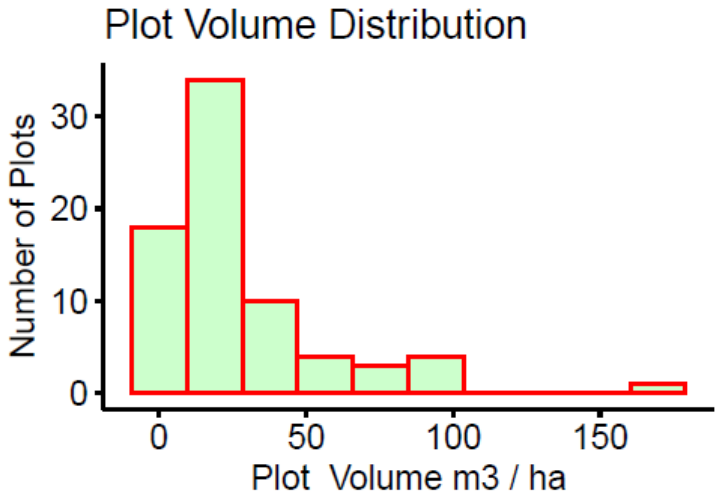
into consideration the requirement of firewood is estimated to give 10% rise over the previous years.

Gap in supply and Demand:

As against the annual demand of 6600 MT of firewood for Puri town, the car timber working circle is capable to meet only 250 MT, which is supplied to swargadwar only for cremation of dead bodies. The balance is met out of private plantations in and around Puri town.

12.3 Statistics of forest carbon stock:

During Working Plan preparatory phase enumeration of trees on Sample point basis was conducted. The data has been analysed through various modeling by Odisha Space Application Centre, Bhubaneswar. The growing stock has been assessed. The relevant portion is furnished below to indicate the growing stock position in Puri Division.



Econsps	Mean	SE
Ano lat	0.0	NA
Misc	22.7	0.15
Sho rob	0.0	NA
Ter tom	0.0	NA
Dio mel	0.0	NA

The crop density of forest area has been observed after analysis as follows.

Table No 12.3 Stand volume parameters – Puri WL Division.						
Criteria						
No of trees / ha	Basal Area per ha (M^2)	Volume per Ha (in M^3)	Mean Volume (in M^3)	Standard Error	LB (in M^3)	UB (in M^3)
160.27	4.81	27.44	22.7	0.15	16.2	29.19

The Overall crop density and area under each density class has been furnished by ORSAC. The details are as given below.

Table No 12.4 Distribution of Forest area vis – vis density class.			
Crop Density	Area in ha	Percentage of Forest area	Remark
>70%	0	0	Dense Forest
40-70%	587.5	6.87	Moderately Dense Forest
10-40%	4700.5	54.95	Degraded forest
<10%	3265.9	38.18	Open Forest.
Total	8553.83	100.00	

The Girth Class wise distribution has also been indicated by ORSAC. It is reproduced below.

Table No 12.5 Number of trees in different girth Class as per ORSAC Analysis Report.						
Range	Girth Class in cm					
	30-60	60-90	90-120	120-150	>150	Total
Astaranga / Gopa	1863	316	162	70	18	2429
Astaranga	61389	12097	6276	2976	1207	83945
Balukhanda	135138	32872	14650	7669	6048	196377
Brahmagiri	26122	4520	2382	1004	318	34346
Konark	307060	50942	24032	8968	1011	392013
Div. Total	531572	100747	47502	20687	8602	709110
Percentage	74.96	14.21	6.70	2.92	1.21	100.00

From the obtained data it is very clear that the forest is at a young stage. The crop is mostly of short rotation. The young trees mostly of coppice origin is attaining a growth up to 60cm GBH in 74.96% cases beyond 60 cm GBH, only 25.04% trees grow and attain a higher girth class.

12.4 Annual Increment:

From various growth data volume equation for some important species has been derived, this is quite close to ground reality.The increment varies in different age classes. The Species og short rotation i.e. Eucalyptus, Acacia and Casuarina are showing promising growth in young stage. The Giomas production is very encouraging.

The Forest is the greatest Carbon sink. It is associated with bio mass production and retention over a long period. No systematic carbon sequestration has been assessed, as attempt has been made to predict the carbon stock of Puri Wildlife Division.

The available Biomass over one hectare of Forest is projected at 22.7cum (Leaves / braches etc not included)

The forest area (RF/ PRF) of the Division is 8096.772 ha. The total Growing Stock of the division is projected at 183796.7 cum or say 1.84 lakh Cum. Taking average wood density at 0.83 T/ cum and 30 ton of Bio Mass contains 11.7 T carbon, the forest of Puri WL Division may contain 0.5956 lakh Tons of carbon. Taking average age of forest as 15 years, the rate of annual carbon sequestration is 59560/15= 3970.667 tons. Taking 12 ton of Carbon equivalent to 44 tons of CO_2 the annual assimilation of CO_2 in Forests of Puri Division Division comes to 14599.11 Ton. All steps will be initiated to induce growth through silvicultural operation to enhance the carbon sink to grow 3-4% every year.

Table No 12.6 Yield Data Analysis of Harvested Casuarina Crop from 2010-11 to 2016-17

Year of Working	Area Worked in Ha.	No. of seedlings Planted	No of Trees felled.	Percentage of Trees felled as compared to Planting	Production in stacks		Production in MT		Total Production in MT.	Yield in MT/Ha.	Average production per Tree in Qntl.
					Garinda Firewood 12x3x3	Twigs Firewood12x3x3	Garinda	Twigs			
2010-11	14	35,000	11,564	33	387	20	640.485	16.55	657.035	46.93	0.57
2010-11	50	1,25,000	40,529	32.4	1626.50	155	2691.85	128.26	2820.11	56.4	0.69
2010-11	10	25,000	4,677	18.7	199	48	329.345	39.72	369.06	36.90	0.79
2010-11	14	35,000	44,635	127.50	1559.5	126	2580.97	104.26	2685.23	191.80	0.60
2011-12	25	62,500	16,059	25.69	794	20	1314.07	16.55	1330.62	53.22	0.83
2011-12	25	62,500	10,508	16.81	483.5	15	800.19	12.41	812.60	32.50	0.77
2014-15	50	1,25,000	28,222	22.57	1382.50	46	2288.03	38.06	2326.09	46.52	0.82
2015-16	50	1,25,000	30,070	24.05	1379	35	2282.24	28.96	2311.20	46.22	0.77
2015-16	50	1,25,000	29,506	23.60	1305	224	2159.77	185.36	2345.13	46.90	0.79
2016-17	50	1,25,000	24,671	19.73	1326	192	2194.53	158.88	2353.41	47.06	0.95
2017-18	50	1,25,000	32,374	25.89	1644	286	2720.82	236.66	2957.48	59.14	0.91
2017-18	50	1,25,000	25,998	20.79	1338	260	2214.39	215.15	2429.54	48.59	0.93
				391/12							**9.42/12**
				32.58							**0.79**
					Weight of Green Garinda Casuarina Firewood- 12'x3'x3' stack = 1.655 Mt.						
					One stack Twig firewood= Half stack Garinda firewood						

Production outlay of Casuarina of different year plantation.

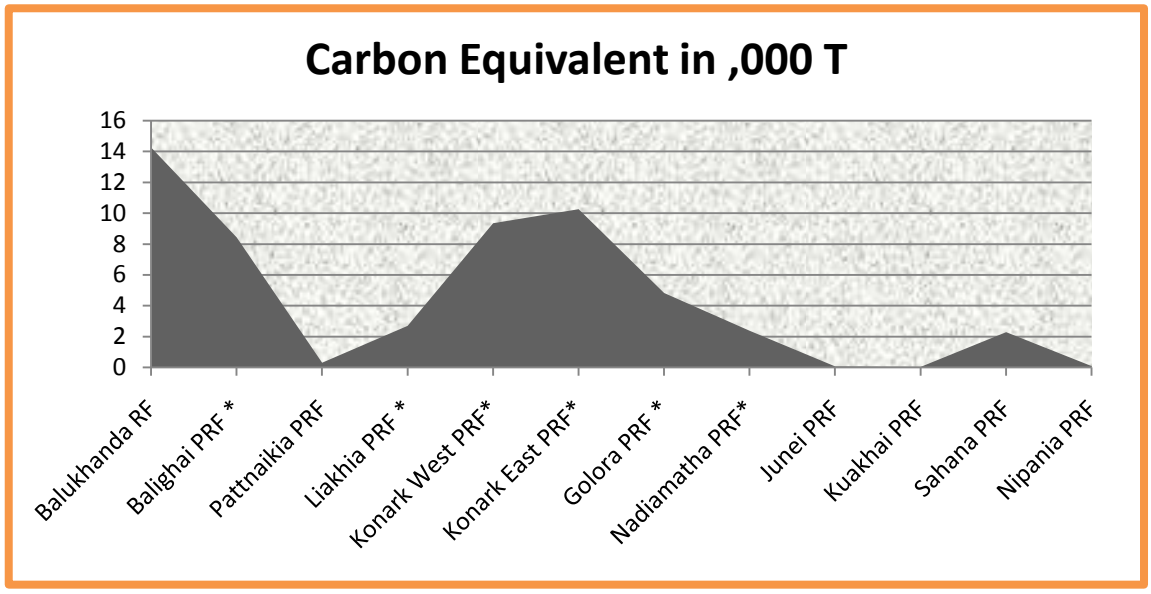
Table No 12.7 Production outlay of Casuarina of different year plantation.									
Year of Plantation	Total Area of Plantation in ha.	Name of the Species	No. of Stems available per sample plots of size 0.1 ha.	Total no of Stems available per ha.	Mean girth of Stems in cm.	Mean height of Stems (Ocular) in mtr.	Total no of Stems available in Plantation	Estimated no. of Trees to be felled @ 32.58% of Planting Seedlings	Production of firewood on estimated no of tree felled @0.79 Qntl. per Tree.
1	2	3	4	5	6	7	8	9	10
2001-02	115 (Cope-ix)	Casuarina	199	1990	34.13	12.29	2,28,850	2,28,850	1,80,791.5
2001-02	100 (Cope-x)	Casuarina	180	1800	34.02	12.05	1,80,000	1,80,000	1,42,200.0
2008-09	40	Casuarina	198	1980	33.95	13.15	79,200	32,580	25,738.2
2009-10	40	Casuarina	187	1870	33.80	13.00	74,800	32,580	25,738.2
2010-11	40	Casuarina	204	2040	33.0	15.6	81,600	32,580	25,738.2
2011-12	40	Casuarina	197	1970	34.4	16.0	78,800	32,580	25,738.2
2012-13	35	Casuarina	161	1610	26.5	09.0	56,350	28,507	22,520.5
2013-14	40	Casuarina	206	2060	26.5	12.0	82,400	32,580	25,738.2
2014-15	50	Casuarina	189	1890	19.0	10.0	94,500	40,725	31,172.7
2015-16	50	Casuarina	244	2440	17.6	08.0	1,22,000	40,725	31,172.7
2016-17	68	Casuarina	246	2460	06.0	02.0	1,67,280	55,386	43,754.9
2017-18	82	Casuarina	250	2500	04.5	01.8	2,05,000	66,789	52,763.3
2018-19	50	Casuarina	250	2500	03.3	0.88	1,25,000	40,725	31,172.7
							Total -	544,619	464,251.3

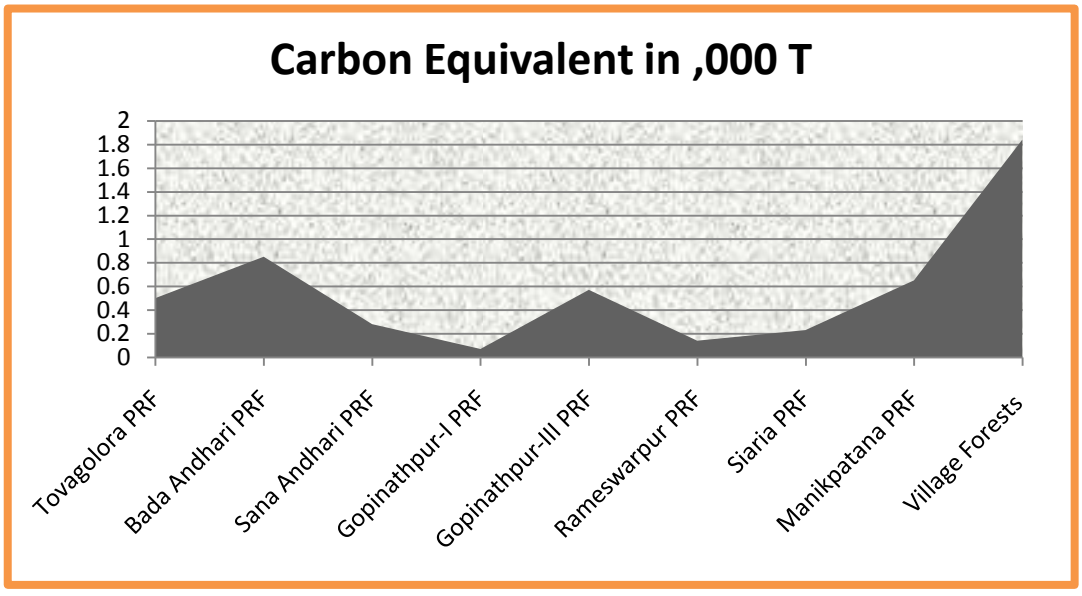
12.4.1 Cabon Stock (Forest Block wise)

The available biomass in forest blocks have been calculated by NRSC, Hyderabad. Basing on the available Biomass / Growing stock the carbon stock in forests of Puri Wildlife Division is estimated as follows.

Sl No	Name of Forest	Area in ha	Growing Stck in Cum /ha	Wood Density (T/ Cum)	Growing Stock in 10^3 Ton	Carbon Equivalent in 10^3 T	Carbon Dioxide Equivalent in 10^3 T
	Reserved forest						
1	Balukhanda RF*	1566.19	27.44	0.85	36.53	14.25	52.24
	PRF						
2	Balighai PRF *	1190.96	22.70	0.80	21.63	8.43	30.93
3	Pattnaikia PRF	42.00	22.70	0.80	0.76	0.30	1.09
4	Liakhia PRF *	379.80	22.70	0.80	6.90	2.69	9.86
5	Konark West PRF*	1319.16	22.70	0.80	23.96	9.34	34.26
6	Konark East PRF*	1447.60	22.70	0.80	26.29	10.25	37.59
7	Golora PRF *	680.00	22.70	0.80	12.35	4.82	17.66
8	Nadiamatha PRF*	334.00	22.70	0.80	6.07	2.37	8.67
9	Junei PRF	7.80	22.70	0.80	0.14	0.06	0.20
10	Kuakhai PRF	4.80	22.70	0.80	0.09	0.03	0.12
11	Sahana PRF	322.00	22.70	0.80	5.85	2.28	8.36
12	Nipania PRF	10.80	22.70	0.80	0.20	0.08	0.28
13	Tovagolora PRF	71.28	22.70	0.80	1.29	0.50	1.85
14	Bada Andhari PRF	120.00	22.70	0.80	2.18	0.85	3.12
15	Sana Andhari PRF	40.00	22.70	0.80	0.73	0.28	1.04
16	Gopinathpur-I PRF	9.60	22.70	0.80	0.17	0.07	0.25
17	Gopinathpur-III PRF	80.00	22.70	0.80	1.45	0.57	2.08
18	Rameswarpur PRF	20.40	22.70	0.80	0.37	0.14	0.53
19	Siaria PRF	32.80	22.70	0.80	0.60	0.23	0.85
20	Manikpatana PRF	92.00	22.70	0.80	1.67	0.65	2.39
21	Village Forests	325.582	22.70	0.64	4.73	1.84	6.76
	Total	**8096.772**			**153.96**	**60.03**	**220.13**

NB: Blocks marked with * are in Balukhanda Sanctuary.


Carbon Equivalent in ,000 T
16
14
12
10
8
6
4
2
0
Balukhanda RF
Balighai PRF *
Pattnaikia PRF
Liakhia PRF *
Konark West PRF*
Konark East PRF*
Golora PRF *
Nadiamatha PRF*
Junei PRF
Kuakhai PRF
Sahana PRF
Nipania PRF


Carbon Equivalent in ,000 T
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Tovagolora PRF
Bada Andhari PRF
Sana Andhari PRF
Gopinathpur-I PRF
Gopinathpur-III PRF
Rameswarpur PRF
Siaria PRF
Manikpatana PRF
Village Forests

12.4.2 Cabon Stock (TOF area)

Forest cover has been created by planting outside the forest land. An attempt has been made to estimate the carbon stock in plantation areas so created (over 438.50 ha + 600.592 RKM Avenue plantation equivalent to 93.84 ha. The biomass has been estimated on visit to plantations and observing the growth status.

Sl No	Name of plantation site	Area planted in ha.	Growing stock in cum /ha	Wood Density (T/ Cum)	Growing Stock in 10^3 Ton	Carbon Equivalent in 10^3 T	Carbon Dioxide Equivalent in 10^3 T
1	Bank of Kadua river from Sahana to Muhanmuha	30.00	40	0.7	0.84	0.33	1.20
2		25.00	40	0.7	0.70	0.27	1.00
3	Belanga	40.00	35	0.7	0.98	0.38	1.40
4	Raiberuhan	35.00	35	0.7	0.86	0.33	1.23
5	Natara	40.00	35	0.7	0.98	0.38	1.40
6	Keutajangha	10.00	30	0.7	0.21	0.08	0.30
7	Nuagarh	10.00	30	0.7	0.21	0.08	0.30
8	Palanka	35.00	55	0.7	1.35	0.53	1.93
9	Sahajahanpur	15.00	60	0.7	0.63	0.25	0.90
10	Narasinghapatana	10.00	65	0.7	0.46	0.18	0.65
11	Matamatapur	5.00	65	0.7	0.23	0.09	0.33
12	Bedhasundara	5.00	70	0.7	0.25	0.10	0.35
13	Kashijharia	10.00	70	0.7	0.49	0.19	0.70
14	Dovar	3.50	70	0.7	0.17	0.07	0.25
15	Kolhana	1.50	65	0.7	0.07	0.03	0.10
16	Jamara	4.00	60	0.7	0.17	0.07	0.24
17	Beruhan	5.00	75	0.7	0.26	0.10	0.38
18	Tandahar	3.00	55	0.7	0.12	0.05	0.17
19	Tailo	3.00	45	0.7	0.09	0.04	0.14
20	Balipatana	10.00	56	0.7	0.39	0.15	0.56
21	Baghamunda	5.00	55	0.7	0.19	0.08	0.28
22	Rench sasan	1.50	60	0.7	0.06	0.02	0.09
23	Amaranga	2.00	60	0.7	0.08	0.03	0.12

24	Gopalapur EDC	2.00	55	0.7	0.08	0.03	0.11
25	Samangra EDC	5.00	45	0.7	0.16	0.06	0.23
26	Kharagaon	3.00	65	0.7	0.14	0.05	0.20
27	Bangara / Barapada	12.00	65	0.7	0.55	0.21	0.78
28	Beldal EDC	5.00	50	0.7	0.18	0.07	0.25
29	Muhanmuha	16.00	40	0.7	0.45	0.17	0.64
30	Tavagolara	15.00	45	0.7	0.47	0.18	0.68
31	Bhabakundaleswar	34.00	55	0.7	1.31	0.51	1.87
32	Talabania	38.00	55	0.7	1.46	0.57	2.09
33	Avenue Plantation 600.592 RKM= 93.84 ha	93.84	60	0.7	3.94	1.54	5.64
	Total Carbon stock in TOF					7.22	26.47
	G. Total Carbon stock in division					**67.25**	**246.60**

END OF PART-I

Working Plan, Part-II
Puri (Wildlife) Division, Puri.

For the Period 2021 to 2031

By

Sri Harsha Bardhan Udgata, OFS-A (SB).

Divisional Forest Officer, Puri (Wildlife) Division, Puri.

CHAPTER- 13
BASIS OF PROPOSALS

13.1: Objectives of Management.

The objective of this working plan is to provide a basic approach for sustainable management of forests and preserve itsbiodiversity in light of the National Forest Policy, encompassing the ecological(environmental), economic (production) and social (including cultural) dimensions. Theobjectives for attaining this goal include conservation of forests and reducing forestdegradation, maintenance and enhancement of ecosystem services including ecotourism,enhancement of forest productivity together withestablishment of regeneration to improveforest health and vitality as per ecological and silvicultural requirements of the species,progressively increasing the growing stock and carbon sequestration potential, maintenance ofbiological diversity, sustainable yield of forest produce, prevention of soil erosion andstabilization of the terrain, improvement and regulation of hydrological regime, people'sinvolvement in planning and management of forests fulfilling socio-economic and livelihoodneeds of the people. The sector wise objectives are precisely enumerated in following paragraphs.

13.1(I): Dynamics of Forests and Stands.

Forest is a living dynamic entity and changes its species composition, growth pattern, bio diversity in passage of time. This plan aims

- To enhance species composition towards a climatic climax comprising species of more importance and of values.
- To ensure Annual Biomass Production sustainably throughout the plan period so as to ensure a specific quantum of carbon sequestration.
- To enhance Bio-Diversity of a Forest through adoption of various management practices & proper documentation.
- To ensure sustainable & dependable production of timber / fuel wood and other available forest produce.
- To enhance area under mangrove species through artificial and natural regeneration.

13.1(II): Forests and Soil:

The Forest and soil condition especially its fertility are like two sides of a coin. Forest enriches the soil organic content and as the soil marches forward, the forest luxuriance also marches forward. When the soil is degraded for many reasons, gradually the forest

condition & vegetation get degraded. The soil condition & forest cover move hand in hand. In casuarina forests / plantations of Konark Range, Balukhanda Range where soil organic matters is higher to certain extent shows prominent coppice behaviour where as in Sahana PRF and Sahana extension area where soil is mostly sandy with no organic content, casuarinasdoes not show its coppicing behaviour and therefore after harvesting, artificial regeneration (Plantation method) is being followed. In order to keep the soil healthy this plan sets the following objectives to be achieved.

- To follow appropriate management practices to protect the sea coast against Seashore erosion.
- To create & maintain Wind Break along the sea coast.
- To create shelter belt to protect against shifting of Sand Dune.
- To Protect River banks against tidal erosion and save riparian forests.
- To protect forests against drivers of forest degradation with special importance to Soil conservation.
- To check soil erosion in forest floor – Sheet erosion, Rill erosion, Splash erosion, Gully and ravine formation.
- To maintain Soil cover of any form – mostly of vegetative / grass cover in forests i.e. enriched undergrowth.
- To maintain adequate humus layer on forest floor.
- To reduce the grazing pressure on forest.

13.1(III) Forests and Water:

The forests are the store house of water. All the rivulets / springs are originating from forests. The flow of water in springs and rivulets depends upon water holding capacity of Forest floor. Recharge of ground water table mostly depends upon runoff time, soil permeability for percolation of surface water. Reduced time of collection of runoff water enhances the flood menace in rivers. Availability of surface water also decides the carrying capacity of wildlife of any forest. The composition of forests mostly depends on water regime of forest floor. The objectives set out for this plan are

- To protect and maintain thick vegetation at the origin of rivers, springs and rivulets.
- To treat the catchment area of nallas within the forest block or outside to enhance water holding capacity and enhance sustainable flow of water in Rivers, springs and rivulets.
- To create new water body within the forest blocks and preserves the existing wet land inside the forests.
- To prevent inundation of forest by tidal wave / tidal water.

- To allow inundation of Mangrove forests created on Banks of Kadua River & Devi River Mouth area.

13.1(IV): Forest Biodiversity.

The natural forests of this division are confined to few blocks of Astaranga WL Range, Konark WL Range and Balukhanda WL Range. The vegetation is of mixed dry deciduous & moist deciduous, dry scrub forests with riparian vegetation along the river banks. Mangrove forests have been created in the confluence of Kadua River & Devi River. Major Blocks are of plantation origin with species like Casuarina, Cashew, Acacia and Eucalyptus. Whatever floral bio diversity is seen requires to be protected.Convertion to pure plantation is not desirable. This plan aims

- To preserve bio diversity of natural forests,
- To take appropriate steps to prepare Bio- Diversity Register of the locality.
- To prevent mono culture practices in plantations excepton economic consideration.
- To encourage natural regeneration in mangrove forests / forest blocks.

13.1(V): Climate and Forests:

The relation between climate and forests is complementary to each other. The climate influences the forest composition and forest ameliorates the climate of an area in a larger context. During recent past, loss of forests has its effect of climate and a change in climatic behaviour is being experienced. Extreme climatic conditions like high rainfall, less rainy days, Cyclonic storm, merging of seasons to summer and rain only are experienced. Duration of other seasons likes Autumn, Dew, winter and Spring has been marginalized and sometimes not felt. In order to combat climate change the following objectives has been outlined for this plan. These are

- To improve the crop density of forest vegetations.
- To increase tree cover outside the conventional forest land i.e. TOF.
- To reduce emission of Green House Gases at source through public cooperation and create new carbon sink through Farm Forestry.
- To bring Village woodlots of erstwhile **Social Forestry Project** to the management fold and enhance forest cover & carbon sequestration.
- To reduce fuel wood dependency by introducing alternate / renewable source of energy through VSS / EDC constituted under JFM Resolution.

13.1(VI): Socioeconomic Considerations and generation of forest based employment opportunities and livelihood options:

Forest Management is not confined to departmental personals only. It has encompassed community participatory management practices since 1985 and more effectively thereafter. JFM resolution - 1993 has brought revolutionary changes in **Participatory Forest Management** which has been further fortified in JFM Resolution 2011. This resolution (2011) provided a wider scope for participatory forest management, encompassing the Revenue Forests for joint management with villagers. The Committee is designated as Vana Surakshya Samiti (VSS) for forests and Eco- Development Committee (EDC) for Sanctuary, National Park and other Protected Areas. EDC are actively involved in management of Eco- Tourism, Nature Camps and Day Tourist visitors to protected areas. The Panchyat Raj Institutions (PRI) are also involved in the process of Joint Forest Management in accordance with the JFM Resolution 2011. The objectives intended to be fulfilled / achieved in this plan are as follows.

- To involve VSS in forest management by assigning **Forest Fringe Areas**.
- To enhance / support various forests based livelihood and employment opportunity.
- To strengthen usufruct sharing mechanism for interim / final harvested forest produce from the assigned area.
- To organise Skill Development Training camps for VSS on Value addition to NTFP and other Forest Produce.
- To support the VSS to change from use of traditional fuel wood use to renewable energy resources.
- To protect traditional knowledge / cultural practices and help in documentation of traditional knowledge related to Forest, NTFP and herbal therapy/practices.

13.1(VII): Tool for Integrated Development:

For overall development of Forest resources / TOF in the division dovetailing of various developmental schemes, make use of modern technology in forest management, Nursery raising, tissue culture etc are required to be implemented / used by Forest personnel. The department is to work hand in hand with the District Administration. Development in Veterinary & Animal Husbandry Sector, Soil Conservation and Water Resource Department are to be integrated with forest activities to make it more scientific, effective and more acceptable for the developing situation. This plan aims to

- To develop Forest Resources through various Schemes like MGNREGA.
- To improve Planting stock through Tissue Culture, other vegetative propagation.
- To identify and protect 'plus trees' and create genetic pool.

- To imbibe knowledge on modern scientific technology in Agriculture / Soil Conservation to improve forest growing stock.
- To use Satellite imagery output for forest management with the help of ORSAC, FSI, National Institutes of Remote Sensing& Space Application Centre / Forest Research Institute etc.

13.1(VIII) Performance Indicators for different objectives of management (PI):

In order to assess the performance on above outlined broad objectives, a set of performance indicators (PI) has been indicated below. It is required to evaluate / assess the performance in a periodical basis. First year of the Plan (2020-21) may be taken as base value and subsequent results may be compared to evaluate the achievements. The measurable / assessable parameters / attributes are furnished in **Table No 13.1** below.

Table No 13.1: Performance Indicators for different objectives of management.

Sl No	Objectives	Parameters to be assessed.	Frequency	Remark
1	**Dynamics of Forests and Stands.**	Species Composition	1st Yr, 6th Yr & 10 Yr	Sample Survey Method.
		Annual Biomass Production		Basal area Method. (M^2 / Ha)
		Bio Diversity of a Forest		Bio Diversity Index – Sample Survey
		Sustainable & Dependable Production of timber / fuel wood		Annual Production in Cum Per annum or / MT per annum
		Area under mangrove species		Interpretation of Satellite Imagery.
2	**Forests and Soil:**	Sea shore erosion.	1st Yr, 6th Yr & 10 Yr	Interpretation of Satellite Imagery / Local Observation.
		Create& maintained Wind Break.		
		Create Shelter Belt to protect against shifting of Sand Dune		
		Gully and Ravine formation / Silt in Run Off		Analysis of Runoff Water & Local observation.
		Humus Layer on forest floor		Study of Soil Profile.
		Grazing Pressure on forest.		Random assessment in a particular Forest Block in Nov-Dec.
3	**Forests and Water.**	Thick vegetation at the origin of rivers, springs and rivulets	1st Yr, 6th Yr & 10 Yr	Interpretation of Satellite Imagery / Local Observation
		Flow of water in Rivers, springs and rivulets.		Observation – Recording the quantum of flow of water and Period of Flow.

		Inundation of Mangrove forests created on Banks of Kadua River & Devi River Mouth area.		Local observation, Period of tidal submersion in Mangrove area.
4	**Forest Biodiversity**	Bio- Diversity Register.	1st Yr, 6th Yr & 10 Yr	Bio- Diversity Register to be prepared in each Gram Panchayat& compare.
		Natural regeneration in mangrove forests / forest blocks.		Regeneration Survey.
5	**Climate and Forests**	Crop density of forest vegetations.	1st Yr, 6th Yr & 10 Yr	FSI Report on Forest cover.
		Tree Outside the Forest.		
		Fuel wood dependency and changing over to alternate / renewable source of energy.		Participatory Rural Appraisal. Economic survey Report
6	**Socioeconomic Considerations and generation of forest based employment opportunities and livelihood options**	Forests based livelihood and employment opportunity.	1st Yr, 6th Yr & 10 Yr	Survey on Self employment on Forest Produce/ Value addition.
		Usufruct sharing mechanism for interim / final harvested forest produce.	Annual	Records of Forest produce harvest in JFM area & distribution- Manner / Conflict if any.
		Skill Development Training camps for VSS on Value addition to NTFP.	Annual	Survey on Self employment on Forest Produce/ Value addition.
		Documentation of traditional knowledge related to Forest.	1st Yr, 6th Yr & 10 Yr	Documentation and analysis.
7	**Tool for integrated development**:	To develop Forest resources through various Schemes like MGNREGA	Annual	Funds flow from other agencies.
		To improve Planting stock through Tissue Culture, other vegetative propagation.		Plantation / Nursery through modern techniques.
		Identify and Protect plus trees and create improved genetic pool.		Creation of Genetic Pool.
		First growing technology in Agriculture / Soil Conservation to improve forest growing stock.	Annual	Application of Modern technology & Result evaluation.
		Use Satellite related output for forest management		Self assessment.

13.2: Method of treatment to be adopted:

The forests of Puri Wildlife Division are broadly categorised in to six categories i.e.

i) Casuarina Plantation in Sahana PRF and Sahana Extension.
ii) Natural vegetations of Nipania PRF, Pattanaikia PRF, Junei PRF, Tavagolora PRF.
iii) Cashew Plantations in Bada Andhari PRF, Gopinathpur-I PRF, Gopinathpur – III PRF, Manikpatna PRF, San Andhari PRF, Siaria PRF, Rameswarpur PRF.
iv) Eucalyptus / Acacia plantation within PRF / Village Forest and outside the forest area.
v) Kanta bausha *(Bambusa arundinasia)*, Sundarkani bausha *(Bambusa vulgaris)* in Nipania PRF, Tavagolora PRF.
vi) Mangrove forests (Planted) in Kadua – Devi River Mouth area- Outside the Forest.

13.2.1 Natural vegetations having Crop Density <40%.

The Forest Blocks having natural vegetation and crop density less than 40% is proposed to be treated for **Rehabilitation of Degraded Forests** with the help of VSS. The treatment for these forest blocks to enhance the regeneration of natural species in normal silvicultural practices i.e. **High Forest System mixed with Aided Natural Regeneration**, Soil & Moisture Conservation, and Strict protection against fire and closed to grazing.

13.2.2 Casuarina Plantation in Sahana PRF and Sahana Extension.

Sahana PRF and Sahana Extension have been covered under Casuarina Plantation. The species is quick growing and ease to establish by Artificial Regeneration (Plantation). Casuarina fuelwood is exclusively required for Lord Jagannath Temple for preparation of ***"Mahaprasad".***Fuel wood is also required for funeral rites at ***"Swargadwar"***, Puri. It becomesa social responsibility of Forest Department / Forest Development Corporationto provide Fuel wood on sustainable basis. Casuarina Plantations raised in Sahana PRF & Sahana Extension will be managed under **Clear Felling System**followed by Replanting.

13.2.3 Plantations Raised in Other Forest Blocks:

Besides Casuarina Plantations, Acacia auriculiformis, Eucalyptus, have been planted under various schemes in other PRF and Village Forests under SIDA Assisted Social Forestry Project. The crop is now mostly irregular. It is required to manage the old plantations on regular basis. The Crop will be harvested and replanted. In some sites, the crop is at juvenile stage and species are of coppicing nature. In those cases both coppice system supplemented by plantation will be adopted. It aims to make the plantation return back the capital to some extent and VFC (Village Forest Committee) involved in Social Forestry Project are benefited either in shape of Forest Produce or its market value.

13.2.4 Plantations along the sea shore:

There are casuarinaplantations / other vegetations like Kia *(Pandanus)*along the sea shore. These plantations / vegetations of 40m width (2 Chain) will be maintained as Wind Break against cyclone and tidal wave.

13.2.5 Participatory Forest Management:

Forest Fringe Villages have been assigned with responsibility of Protection and management of Forests and Wildlife under provisions of Joint Forest Management Resolution -2011 and subsequent amendment -2015 and 2019. Similarly Village Forests created under SIDA Assisted Social Forestry Project is being managed by Village Forest Committee constituted under provisions of Village Forest Rule-1985. These forests will be managed under Participatory Forest Management in JFM Mode. These JFM forests will be managed under Overlapping working Circle.

13.2.6 Management of Wildlife:

In Balukhanda Wildlife Sanctuary, Spotted deer (*Axis axis)* is flagship species. Other species seen are Hyena (Hyaena sp.), Jungle Cat (*Felis chaus*), Jackal (*Canis aureus*), Fox (*Vulpes bengalensis*), Monkey (*Macaca* sp.), Hare (*Lepus* sp.), and Monitor Lizard (*Varanus* sp.). During Cyclonic Storm (Phani) on 3rd May'2019, the sanctuary has been devastated to a greater extent. The Sanctuary is being managed as per prescriptions of Sanctuary Management Plan. Besides the sanctuary there is wildlife throughout the division. Marine life, Olive Ridley turtles, Birds and Reptiles are required to be managed. These aspects will be managed / regulated under overlapping management prescriptions. Hence general management practices for wildlife seen outside the Sanctuary are to be prescribed in Wildlife (Overlapping) Working circle.

13.2.7 Management of Forest resource outside the Forest area:

Tree Outside the forest (ToF) has been enriched through various plantation programs under different schemes (State plan, Central Plan, Special Schemes). Road side Plantations / Avenue Plantation has been created for aesthetic value. There is a high level meeting / discussion to constitute a Working Circle namely "Development Working Circle" communicated vide letter no 3628/ 11F (SFM)-15 / 2018 dated 26.02.2019. **(Annexure-XXV).** After discussion / deliberations, it is decided to constitute a working Circle to manage Forest Resource outside the Forest area. This working circle will comprise the forests created outside the forest area including Avenue Plantations, other plantations of first growing species, other need based plantations like Fuel wood and Fodder Plantations, National Afforestation Program i.e. Plantations taken up under FDA Program.

13.2.8 Miscellaneous Working Circle:

Infrastructures have been created by the Forest Department for better management of Forest & Wildlife. It is observed that Forest Nursery, Eco- Tourism Complex, Recreational infrastructures, Research Plots have been created within the PRF. These areas are not available for normal forest management under any Working Circles enumerated above. It is felt necessary to frame a set of regulatory mechanism to manage these infrastructures / Resources. Hence a Miscellaneous Working Circle is proposed to be constituted in this plan.

13.3: Constitution of Working Circles.

With the guiding factors as stated above are taken in to consideration.It is felt to have the following Working Circles for scientific management of available forest resources.

i. Rehabilitation Working Circle – (Area assigned -77.90 Ha)
ii. Casuarina Working Circle – (Area assigned –746.717 Ha)
iii. Plantation Working Circle-(Area assigned –386.382 Ha)
iv. Protection Working Circle- (Area assigned- 54.187Ha) + Area under Encroachment 380.358 ha) Total area under PrWC-434.545 ha
v. Miscellaneous Working Circle (Area assigned - 42.188 Ha)

Total area of above 5 Stand alone WCs- 1687.732 Ha

vi. Wildlife (Overlapping) Working Circle- (Area assigned –981.792 Ha)
vii. Joint Forest Management (Overlapping) Working Circle-(Area assigned – 388.636Ha)
viii. TOF Working Circle (Area- 438.50ha &600.592 RKM Avenue Plantation)

There areFiveStand alone Working Circles(i to v) having independent area where as there is proposal to constitute Two Working Circles with overlapping jurisdiction (vi to vii). The TOF (Tree outside the Forest Area) Working Circle (viii) does not cover any RF/ PRF or VF, hence its management area is outside plan area.

NB: Total area of PRF & VF- 1687.732 Ha, No Forest land from PRF/ VF is diverted under FC Act'1980 and No land is assigned to individuals under FRA, 2006. So Area available for Managementis 1687.732 Ha. Area under Encroachment (380.358 ha) has been included in the Plan area.

The area assigned to various Working circle is furnished at **Table No 13.2** below.

13.4: Period of Working Plan and necessity for intermediate revision:

The period of this working Plan is from **1st April 2021 to 31st March 2031.** The implementation and probable impact of various prescriptions may be reviewed after five years of working, if it is so required.

Table No 13.2 Area under Management & Distribution to various Working Circle (PRF)														
Sl No	Name of Forest Block	Area in Ha	Area diverted under		Under Encroachment in ha	Area available for Management in ha	Area under different Working Circles (in Ha)							
			FC Act 1980	FRA,2006			RWC	Casuarina WC	Plantation WC	WL(O) WC	Protection WC	JFM(O) WC	TOF WC	Misc Use.
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Proposed Reserved Forest.														
Konark WL Range														
1	Junei	7.800	0.000	0.000	0.000	7.800	7.800			7.800		7.800		
2	Kuakhai	4.800	0.000	0.000	3.800	4.800	1.000			1.000	3.800			
Astaranga WL Range														
3	Sahana	322.000	0.000	0.000	8.378	322.000		305.617		313.622	8.378			8.005
3A	Sahana Extension(Revenue forest)	508.670	0.000	0.000	0.000	508.670		441.100		508.670	54.187	6.394		13.383
4	Nipania	10.800	0.000	0.000	0.000	10.800	10.800			10.800		10.000		
5	Tavagolara	71.280	0.000	0.000	7.380	71.280	39.400		10.00	63.900	7.380			14.5
Balukhanda WL Range														
6	Patanaikia	42.00	0.000	0.000	0.000	42.00	18.90		16.800	42.00		4.860		6.30
Bramhagiri WL Range														
7	Gopinathpur-I	9.600	0.000	0.000	9.600	9.600				0.000	9.600			
8	Gopinathpur - III	80.000	0.000	0.000	80.000	80.000				0.000	80.000			
9	Siaria	32.800	0.000	0.000	32.800	32.800				0.000	32.800			
10	Rameswarpur	20.400	0.000	0.000	20.400	20.400				0.000	20.400			
11	Sana Andhari	40.000	0.000	0.000	40.000	40.000				0.000	40.000			
12	Bada Andhari	120.000	0.000	0.000	120.000	120.000				0.000	120.000			

Table No 13.2 Area under Management & Distribution to various Working Circle (PRF)

Sl No	Name of Forest Block	Area in Ha	Area diverted under		Under Encroachment in ha	Area available for Management in ha	Area under different Working Circles (in Ha)							
			FC Act 1980	FRA,2006			RWC	Casuarina WC	Plantation WC	WL(O) WC	Protection WC	JFM(O) WC	TOF WC	Misc Use.
13	Manika Patana	92.000	0.000	0.000	58.000	92.000			34.000	34.000	58.000	34.000		
	Total	**1362.15**	**0**	**0**	**380.358**	**1362.15**	**77.90**	**746.717**	**60.8**	**981.792**	**434.545**	**63.054**		**42.188**

NB: Sahana Extension is neither a PRF nor a VF nor a DPF but new land created by accumulation of Sand near Sahana PRF and Planted up for stabilizing the Sand / Sea Coast. This was included in last working plan under Sahana PRF.

The Divisional Area statement is at **Annexure-XXVI.**

Table No 13.3 Area under Management & Distribution to various Working Circle (Village Forest)

Sl No	Name of Forest Block	Area in Ha	Area diverted under		Under Encroachment in ha	Area available for Management in ha	Area under different Working Circles (in Ha)							
			FC Act 1980	FRA,2006			RWC	Casuarina WC	Plantation WC	WL(O) WC	Protection WC	JFM(O) WC	TOF WC	Misc Use.
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Village Forest														
Astaranga WLRrange														
1	Chheliberua	3.600				3.600			3.600			3.600		
2	Kanti	2.500				2.500			2.500			2.500		
3	Santrasa	3.000				3.000			3.000			3.000		
Balukhanda WL Range														
4	Alanda	15.000				15.000			15.000			15.000		
5	Alasankha	5.560				5.560			5.560			5.560		
6	Badagaon	6.828				6.828			6.828			6.828		
7	Baliguali	6.332				6.332			6.332			6.332		
8	Bhikaripada	2.500				2.500			2.500			2.500		
9	Bhuan	12.400				12.400			12.400			12.400		
10	Mahapur	0.400				0.400			0.400			0.400		
11	Narasinghpur	4.000				4.000			4.000			4.000		
12	Paikerapur	2.040				2.040			2.040			2.040		
13	Samangarh	11.500				11.500			11.500			11.500		
14	Uchhpur	5.340				5.340			5.340			5.340		
Brahmagiri WL Range														
15	Bhandarikuda	0.372				0.372			0.372			0.372		
16	Bhubanpur	17.750				17.750			17.750			17.750		
17	Brahmagiri	11.584				11.584			11.584			11.584		

Table No 13.3 Area under Management & Distribution to various Working Circle (Village Forest)

Sl No	Name of Forest Block	Area in Ha	Area diverted under		Under Encroachment in ha	Area available for Management in ha	Area under different Working Circles (in Ha)							
			FC Act 1980	FRA,2006			RWC	Casuarina WC	Plantation WC	WL(O) WC	Protection WC	JFM(O) WC	TOF WC	Misc Use.
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
18	Budhisahi	1.080				1.080			1.080			1.080		
19	Chandiput	0.578				0.578			0.578			0.578		
20	Chapamanik	8.000				8.000			8.000			8.000		
21	Gaudakera	5.000				5.000			5.000			5.000		
22	Kalikabadi	1.500				1.500			1.500			1.500		
23	Kalikabadi	54.000				54.000			54.000			54.000		
24	Kashijharia	5.000				5.000			5.000			5.000		
25	Kasijharia	5.050				5.050			5.050			5.050		
26	Kathuaredi	1.440				1.440			1.440			1.440		
27	Niajpur	2.612				2.612			2.612			2.612		
28	Rameswarpur	26.000				26.000			26.000			26.000		
29	Sahajanpur	10.000				10.000			10.000			10.000		
30	Sipasarubali	12.900				12.900			12.900			12.900		
31	Tinikudi	3.000				3.000			3.000			3.000		
	Gop WL Range													
32	Nimapada	0.496				0.496			0.496			0.496		
	Konark WL Range													
33	Anasara	4.500				4.500			4.500			4.500		
34	Bobua	1.200				1.200			1.200			1.200		
35	Jamara	7.500				7.500			7.500			7.500		
36	Kanpur	10.500				10.500			10.500			10.500		
37	Khalakata	12.500				12.500			12.500			12.500		

Table No 13.3 Area under Management & Distribution to various Working Circle (Village Forest)

Sl No	Name of Forest Block	Area in Ha	Area diverted under		Under Encroachment in ha	Area available for Management in ha	Area under different Working Circles (in Ha)							
			FC Act 1980	FRA,2006			RWC	Casuarina WC	Plantation WC	WL(O) WC	Protection WC	JFM(O) WC	TOF WC	Misc Use.
1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***	***15***
38	Khandala	3.000				3.000			3.000			3.000		
39	Patalia	2.500				2.500			2.500			2.500		
40	Puba	7.220				7.220			7.220			7.220		
41	Raulpatna	0.800				0.800			0.800			0.800		
42	Redhua	3.500				3.500			3.500			3.500		
43	Tikina	25.000				25.000			25.000			25.000		
	Total	**325.582**				**325.582**			**325.582**			**325.582**		
G. Total	**(Table 13.2+ 13.3)**	**1687.732**	**0**	**0**	**380.358**	**1687.732**	**77.90**	**746.717**	**386.382**	**981.792**	**434.545**	**388.636**	**0**	**42.188**

(NB: Area under Encroachment indicated under column6 will be treated under Protection Working Circle for Future Management.)

CHAPTER- 14

REHABILITATION WORKING CIRCLE

14.1: Rehabilitation 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 having crop density less than 40% are included on this Rehabilitation working circle. There are scattered tree growths which serve the purpose of mother trees and helps in natural regeneration of forest. Establishment of regeneration from seed origin is difficult. The Ground Flora is mostly covered with thorny species, weeds and hence hinders the establishment of recruits / seedlings from seed origin. This Working Circle i.e. **"Rehabilitation Working Circle"** is constituted covering 77.90 ha of PRF of the Division.

14.2: General Constitution of Working Circle:

The forest blocks included in this working Circle are as follows. **(Table No 14.1)**

Sl No	Name of Forest Block	Total Area (in Ha)		Area allotted to RWC (in Ha)	Location – SOI Topo Sheet no
	Proposed Reserved Forest.				
Konark WL Range					
1	Junei	7.800		7.800	E45C1
2	Kuakhai	4.800		1.000	E45C1
Astaranga WL Range					
4	Nipania	10.800		10.800	F45U4
5	Tavagolara	71.280		39.400	F45U4
Balukhanda WL Range					
6	Patanaikia	42.00		18.90	E45B10
	Total	**136.68**		**77.900**	

Table No 14.2 : Abstract of Area allotted to Rehabilitation Working Circle.			
Name of Range	No of forest Blocks	Area in Ha	Remark
Konark WL Range	2	8.80	
Astaranga WL Range	2	50.20	
Balukhanda WL Range	1	18.90	
Total – 3 Range	**5 Blocks**	**77.90**	

14.3: General Characteristics of vegetation:

All the Forest blocks included in this working circle are of Natural vegetation. The extent of area is very small. The main species in Nipania PRF and Tavagolora PRF consistsof Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Mankad kendu (*Diospyrs embryopteris*), Kendu (*Diospyros melanoxylon*),Patuli (*Lagerstroemia parviflora*), Sidha (*Lagerstroemia lanceolata*)and *Bambusa bamboo* (Kanta baunsha), Sundarkani Baunsa (*Bambusa vulgaris*). The under growth consists of grasses, Eupatorium, etc. There are heavy climbers. In the open space heavy eupatorium affects establishment of natural vegetation and planted species. Kanta baunsha seen in Tavagolara PRF and Nipania PRF covers about 50% of the PRF. Due to non-working of Bamboo, most of the Bamboo clumps became congested. Due to thorny in nature, it became non- approachable. Mankada Kendu is one of the main constituent and naturally coming up species in Nipania PRF of Astaranga WL Range. Its establishment is hindered due to bamboo and othersuppressing the species.

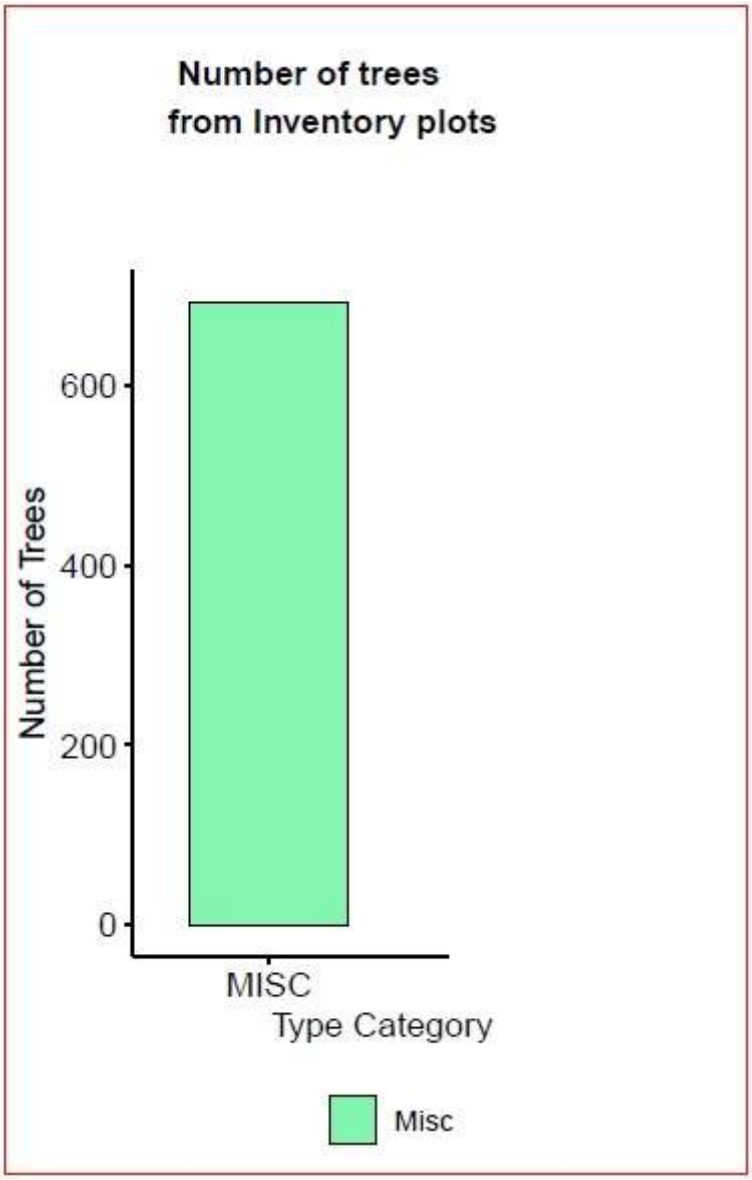
The sample point data provided to ORSAC has been analysed and its report has been received. As per the report the number of trees per ha is 160.27 number the relevant data is furnished below.

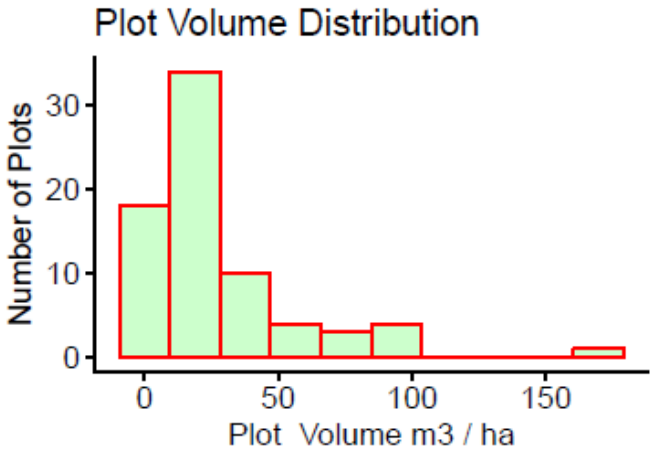
No of Sample Points taken	No of Points data analyzed	D1 (>70%)	D2 (40%-70%	D3 (10%-40%)	D4 (<10%)
74	74	0	22	42	10

No of Trees per Ha	BA per ha	Volume per Ha (Cum)	Mean Volume per ha (Cum)	Standard Error	LB (Lower Bound)	UN (Upper Bound)
160.27	4.81	27.44	22.7	0.15	16.2	29.19

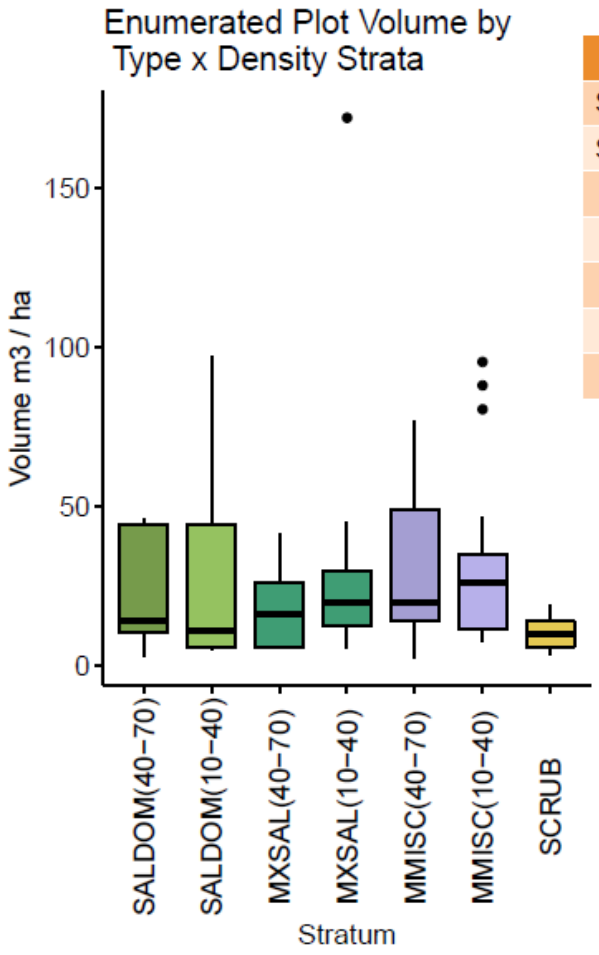
Plot Distribution

RANGE	D3	D1	D2	D4
ASTARANGA	1	0	0	0
ASTARANGA(WL)	4	0	4	0
BALUKHANDA(WL)	19	0	4	2
BRAHMAGIRI	3	0	1	2
KONARK(WL)	15	0	13	6





Econsps	Mean	SE
Ano lat	0.0	NA
Misc	22.7	0.15
Sho rob	0.0	NA
Ter tom	0.0	NA
Dio mel	0.0	NA



Stratum	Numpt	MeanPerHa
SALDOM(40−70)	5	23.47
SALDOM(10−40)	15	29.27
MXSAL(40−70)	5	18.85
MXSAL(10−40)	8	38.63
MMISC(40−70)	12	29.68
MMISC(10−40)	19	32.29
SCRUB	10	10.12

TreesPerHa	BAPerHa	VolPerHa
160.27	4.81	27.44

14.4: Treatment Series, Treatment Sections and JFM areas:

The total area of77.90 ha is coming within threeRanges i.e. Konark, Astaranga and Balukhanda WL Range. Due to its nature, Location & biotic interference from land grabbers and grazing, intensive working is required to improve the vegetation to a fully stocked forest. Only one Treatment series is constituted namely **"Konark- Astaranga Rehabilitation Series".** The area is proposed to be treated within the plan period of 10 Years. As the area is small, it is proposed to treat the forests within three years and repeat the operations in 5 year cycle.

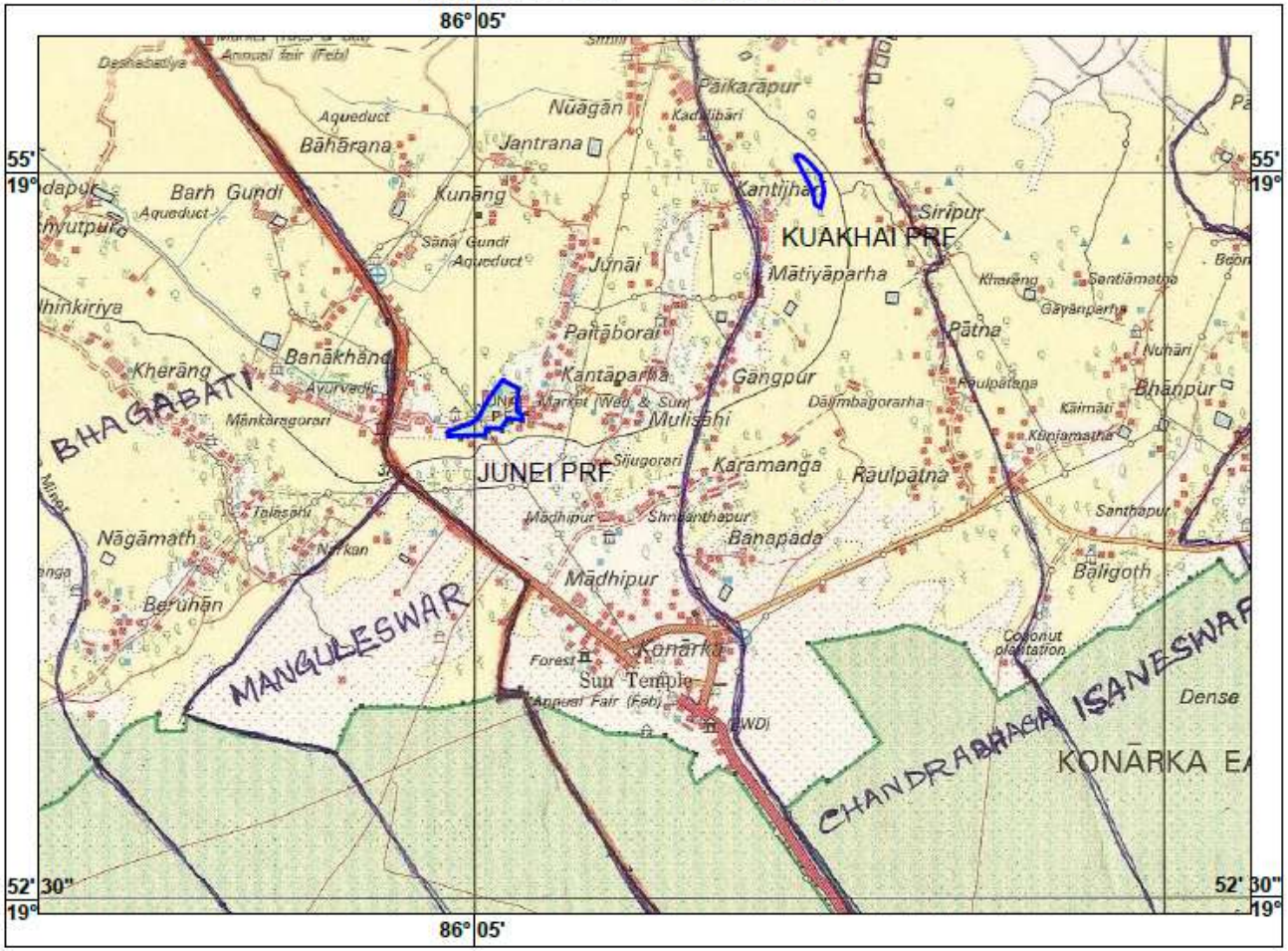
14.4.1: Allotment of area to different Treatment Series.

The entire area covered in this Working Circle is allotted to this **"Konark- Astaranga Rehabilitation Series".** The detail is as at **Table 14.3.**

Table No-14.3 Allotment of Area to Different Rehabilitation Series.					
Sl No	Name of Rehabilitation Series.	Range	Forest blocks allotted	Total area of the Forest block in Ha	Area allotted to this Rehabilitation Series.
1	**Konark- Astaranga Rehabilitation Series**	Konark WL Range	Junei	7.800	7.800
			Kuakhai	4.800	1.00
		Astaranga WL Range	Nipania	10.800	10.800
			Tavagolara	71.280	39.400
		Balukhanda WL Range	Patnaikia	42.00	18.90
	Total – 1 Series	3 Range	**5 Blocks**	**136.680**	**77.900**

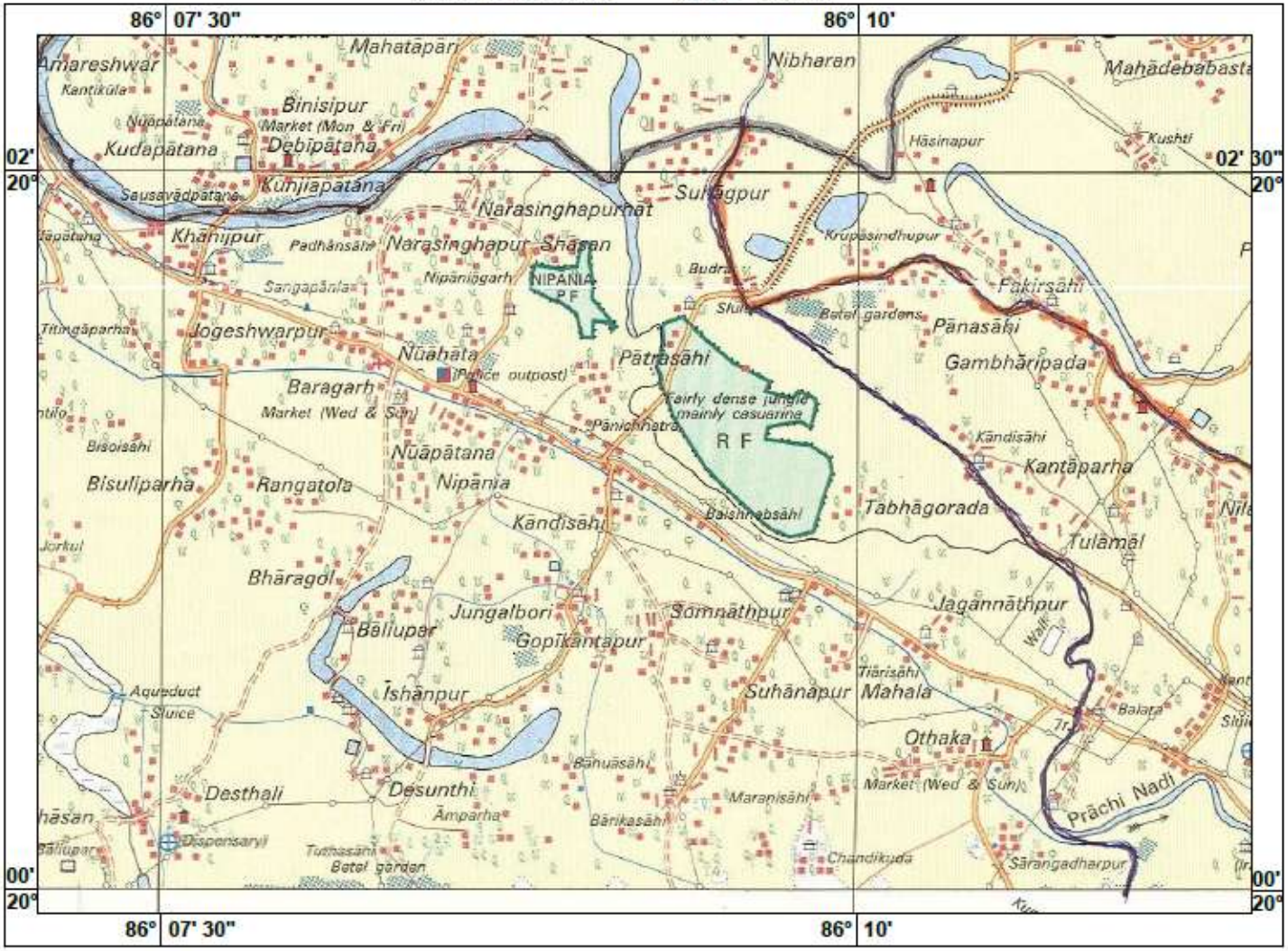
MAP SHOWING LOCATION OF JUNEI & KUKHAI PRF IN KONARK WILDLIFE RANGE

TOPO SHEET : F45C1 SCALE 1:20,000



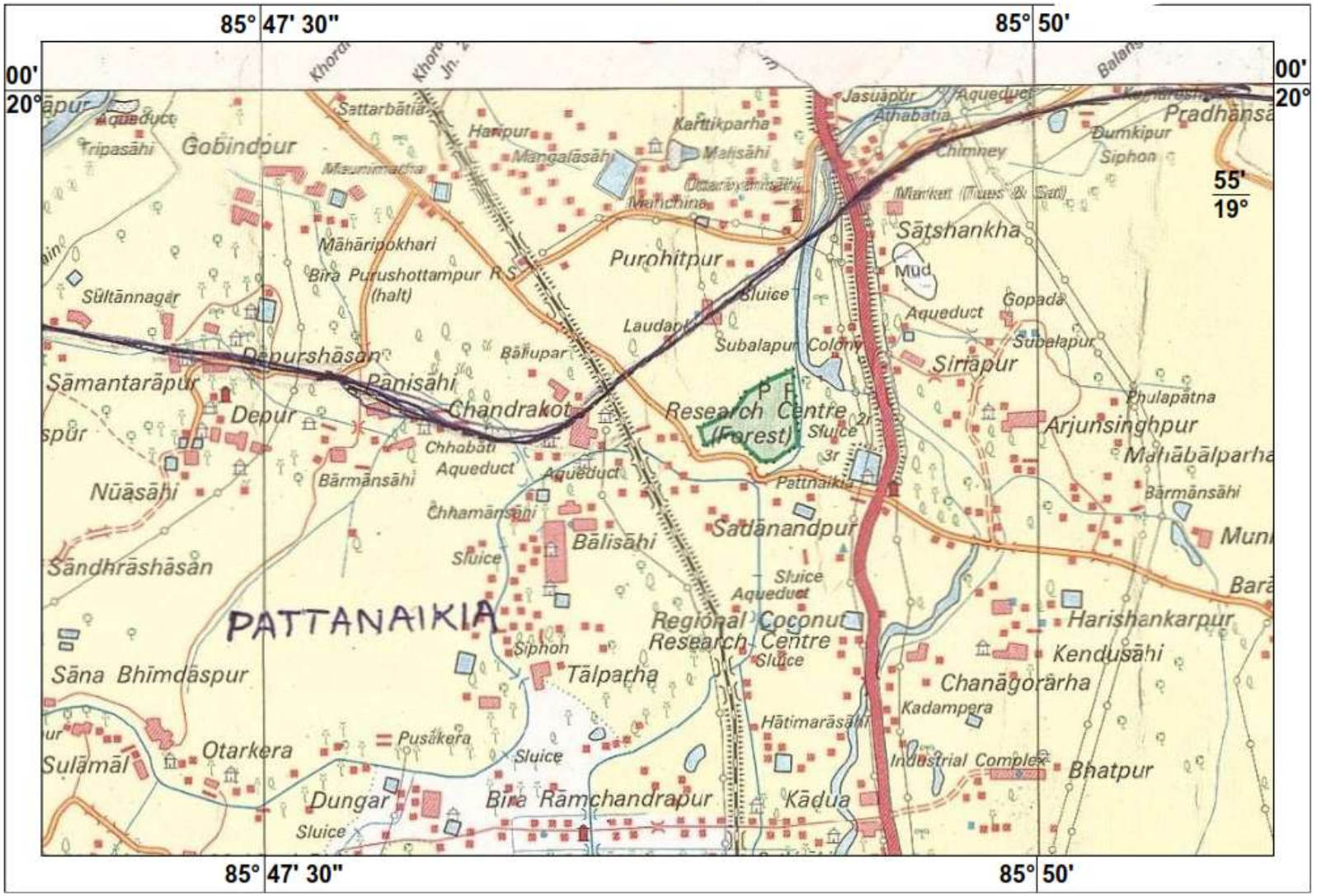
MAP SHOWING LOCATION OF NIPANIA & TOVAGOLARA PRF IN ASTARANGA WILDLIFE RANGE

TOPO SHEET : F45U4 SCALE 1:35,000



MAP SHOWING LOCATION OF PATTNAIKIA PRF

TOPO SHEET : E45B10 SCALE 1:35,000



14.4.2: Area allotted to different Treatment sections:

It is proposed to cover the entire area within 10 Years i.e. within the Plan Period. As the area is small it is proposed to cover the area in 1st three years and repeat the operation in a 5 year cycle i.e. in 6th, 7th& 8thyear of the plan. Hence the area is divided in to three(3) treatment Sections as in **Table No 14.4**.

Table No 14.4: Allotment of Area to different Treatment Section.					
Name of Treatment Series.	**Range**	**Treatment sections (TS)**	**Name of forest block allotted**	**Area in Ha**	**Year of Operation**
Konark-Astaranga Rehabilitation Series	Astaranga WL Range	TS-I	Tavagolara PRF	30.00	2021-22 & 2026-27
	Balukhanda WL Range	TS-II	Patnaikia PRF	18.90	2022-23& 2027-28
	Konark WL Range	TS-III	Junei PRF	7.80	2023-24 & 2028-29
			Kuakhai PRF	1.00	
	Astaranga WL Range	TS-III	Nipania PRF	10.80	
			Tavagolara PRF	9.40	
		Total TS-III		29.00	
Total – 1 Series	**3 Range**	**3 Section**	**5 Forest Block**	**77.90**	

14.4.3 Allotment of area to JFM (VSS Committee):

In accordance with the JFM Resolution, 1993 and subsequent modification to the Resolution, twonumbers of VSS has been constituted for the Forest Blocks included in this Working circle. The VSS & area allotted is listed below in **Table No 14.4 A**

Table No 14.4 A: List of VSS Constituted in Puri (Wildlife) Division under JFM Resolution							
Sl. No.	Name of the Range	Name of the Section	Name of the VSS	Name of the Village	Type Forest land allotted& Area in ha		Name of Forest Block.
					PRF	Rev. Forest	
1	2	3	4	5	6	7	
1	Astaranga WL Range	Panichhatra	Nipania	Gada Nipania	10.00	0.00	Nipania PRF
2	Konark WL Range	Konark	Junei	Junei	7.80	0.00	Junei PRF
3	Balukhanda WL Range	Satyabadi	Patnaikia	Patnaikia	4.86	0	Patnaikia PRF
Total					**22.66**	**0**	

14.4.4: Blocks / Compartments/ JFM Area depicted on GIS Maps.

The forest Blocks included in this Working Circle are without subdivision in to Compartments. The Forest Blocks and JFM Area allotted to the VSS are shown in the GIS Map (Management Map 1: 50000 Scale / 1: 25000 Scales)

14.5: Special Objectives of Management:

The following special objectives of management are set for this working circle within the ambit of the general objectives of management.

(i) To induce natural regeneration & improve the condition of existing forests through protection against encroachment, grazing, fires and illicit felling.
(ii) To Improve the crop density to more than 50% from the present position through protection and Silvicultural practices.
(iii) To enhance soil enrichment through Soil & Moisture conservation measures.
(iv) To regulate the surface water runoff to enhance percolation and water availability down the streams.
(v) To protect the River Bank / Stream Bank against erosion through vegetative measures.
(vi) To restock barren areas through artificial regeneration with most desirable indigenous species.
(vii) To have partnership with the local community in protection and management of the forests.
(viii) To increase the water retention capacity of the soil.
(ix) To improve the health of Bamboo clumps occurring in the Forests.
(x) To Control / eradicate the weeds and check its invasion.
(xi) To restore and improve the microclimate and micro edaphic condition of forests.
(xii) To increase the biodiversity and heterogeneity in the forest crop by encouraging natural regeneration

14.5.1 Analysis of the Crop:

The enumeration has been taken up by **"Point Sampling Method".** The sample Points coming within the Forest Blocks are furnished at Annexure- XXVII. The data has been uploaded on the web site for analysis by ORSAC, Bhubaneswar / NRSC, Hyderabad. The analysis result has been obtained; the same has been annexed to this Plan.

On field visit the observation by the Working Plan Officer / DFO, Puri Wildlife Division is summarized below.

The vegetation of the Forest Blocks allotted to this working circle is degraded and the open space found to be covered with weeds like eupatorium, lantena and annual soft stem climbers. The Kanta Baunsha clumps (*Bambusa bambos*) are highly congested due to non working in past years. Some rehabilitation work has been taken up in the past but the vegetation needs further treatment supplemented with Silvicultural Cleaning followed by adequate care to seed origin saplings.

14.5.2 Silvicultural System:

The Silvicultural System to be adopted for this working Circle is ***"Silvicultural Cleaning, Tending followed by Aided Natural Regeneration supplemented with enrichment Plantation"***

a) Silvicultural Cleaning:

Silvicultural Cleaning operation includes

- Removal/uprooting of Soft stem Weeds (Annual in nature).
- Singling of Shoots.
- The species / plant if considered to be a good coppicer and in malformed, it may be cut flush tothe ground. This will induce a good promising shoot with high probability of **"Established Regeneration"**.
- Cut back the living high stumps to produce good coppice shoot.
- The annual climbers which hinders with the establishment of regeneration to be removed.
- Woody Climbers interlinking the trees above 10m height may not be removed as it will help to sustain wind pressure during Cyclone.

b) Silvicultural Tending.

Silvicultural Tending involves

- Thinning of natural growth in a congested patch (Above Sapling Stage i.e. in a pole crop to enhance diameter growth.)
- Advance growth / Natural growth are to be retained.
- Pruning in heavily branched individuals to allow faster height growth. Pruning should be restricted to one third height of the individual plant. ($1/3^{rd}$ of the Plant height)
- Woody climbers affecting poles below 5m height required to be cut down.
- Least disturbance to Ground Flora.

c) Aided Natural Regeneration.

Besides Silvicultural Cleaning the following activities are prescribed for the Aided Natural Regeneration (ANR)

- Regeneration from Seed Origin (Recruits, Seedlings and Saplings) to be aided with weeding, Soil Working and application of Bio-fertilizer to enhance growth & speedy establishment.
- Extensive Soil & Moisture Conservation measures to be taken. Besides Contour trenches, contour bunding, gully plugging, Vegetative check dams, percolation pits are required to be taken up to improve soil moisture regime. Individual plants of Natural origin need to be provided with Half Moon Trench, Soil Mulching etc.

d) Enrichment Plantation

- In Blanks seedlings of indigenous species matching with the natural seedlings / saplings / vegetation available to be planted. Planting of teak Acacia, Chakunda inside natural forest will be avoided.

14.5.3 Rotation Period:

The objective of this Working Circle isnot to harvest any Forest Produce within this Plan period. There are few NTFP species seen within the forest blocks. Bamboo is the main species forming congested clumps need to be managed. The treatment period is made coterminous with the Plan period i.e. 10 years. As the area is small, the treatment is restricted within two years and repetition after 5 year i.e. a five year cycle is followed.

14.5.4 Harvestable Diameters:

There is no proposal to harvest tree from the allotted area. No harvestable diameter / Girth are prescribed. Bamboo clumps will be treated / de- congested during silvicultural cleaning process. Old bamboo clumps above 4 years will be removed departmentally following the Bamboo Cutting Rules.

14.5.5 Reducing factors and reduced areas:

As there is no timber harvest, no yield forecast / no yield regulation / no calculation of reduced area / reducing factor is proposed for this working circle.

14.5.6 Treatment Cycle:

A treatment Cycle of 5 (Five) years is prescribed. For management of available Bamboo, a cutting Cycle of 5 (Five) years is also prescribed. For other NTFP like Fruits / Berries / Grasses / fodders an Annual Cycle is to be followed. Within the plan period two cycles will be completed.

14.5.7 Division in to periods and allotment to Periodic Blocks:

Not applicable for prescribed Silvicultural System.

14.5.8 Calculation of Yield:

No harvest is prescribed for this Working Circle. Hence Calculation of Yield / Safety measures and Yield Regulation is not prescribed for this Working Circle / Forest Blocks.

14.5.9 Table of Felling / Treatment:

The allotted area has been sub divided to three Treatment section under One Treatment Series. For improvement of Tree crop and bamboo a five year cycle has been proposed. The year of treatment, area assigned is furnished below at **Table No 14.5**

Table No 14.5: Area allotted & year of Treatment (General)

Year	Name of Range	Treatment Section No	Forest Block	Area in Ha	Total
2021-22	Astaranga WL Range	TS-I	Tavagolara PRF	30.00	30.0 ha
2022-23	Balukhanda WL Range	TS-II	Patnaikia PRF	18.90	18.9 ha
2023-24	Konark WL Range	TS-III	Junei PRF	7.80	29.00 ha
			Kuakhai PRF	1.00	
	Astaranga WL Range	TS-III	Nipania PRF	10.80	
			Tavagolara PRF	9.40	
2024-25 2025-26			No Forest land allotted		
2026-27	Astaranga WL Range	TS-I	Tavagolara PRF	30.00	30.0 ha
2027-28	Balukhanda WL Range	TS-II	Patnaikia PRF	18.90	18.9 ha
2028-29	Konark WL Range	TS-III	Junei PRF	7.80	29.00ha
			Kuakhai PRF	1.00	
	Astaranga WL Range	TS-III	Nipania PRF	10.80	
			Tavagolara PRF	9.40	
2029-30 to 2030-31		No Forest area assigned			
Total		**3 section / 2 cycle**	**5 Blocks.**	**77.90 ha**	**77.90 ha**

Table No 14.5A Area allotted & year of Treatment (for Bamboo)					
Year	Name of Range	Treatment Section No	Forest Block	Area in Ha	Total
2021-22& 2026-27	Astaranga WL Range	TS-I	Tavagolara PRF	30.00	30.0 ha
2022-23& 2027-28	Balukhanda WL Range	TS-II	Patnaikia PRF	18.90	18.9 ha
2023-24& 2028-29	Konark WL Range	TS-III	Junei PRF	7.80	29.00 ha
			Kuakhai PRF	1.00	
	Astaranga WL Range	TS-III	Nipania PRF	10.80	
			Tavagolara PRF	9.40	
2024-25 2025-26			No Forest land allotted		
Total		3 Section/ 2 Cycle	5 Blocks.	77.90	77.90

(NB: The treatment section for Bamboo and Rehabilitation is same and a five year treatment cycle is followed in each case as the area available for treatment is quite small. its distribution over 10 years is felt not required.)

14.5.10 Method of Executing Felling / Treatment:

14.5.10.1 Demarcation of Annual Rehabilitation Area:

The Annual Rehabilitation Area (Treatment Area) has been depicted on Topo map (1: 50000 Scale) with marking like TS-I, TS-II& TS-III. The area assigned for the year is to be surveyed, Pillars Posted well marked on the Ground. This will be done in following manner.

(i) For identifying and locating the annual rehabilitation areas for respective rehabilitation series a preliminary reconnaissance survey will be carried out in the month of October.

(ii) As the area is very susceptible to land encroachment / heavy Biotic Pressure, the Boundary of the Forest Block is to be clearly demarcated/ concrete pillars posted as per the guidelines of PCCF, Odisha.

(iii) In the situation when the Treatment Section line is not coinciding with the block or Compartment lines, it is to be demarcated by cleaning a strip of 1.50 meter width and stone cairns of size 90 cmX60 cm are to be erected at the corners at visible intervals along the line. While clearing 1.50 meter strip, all trees below

20 cm GBH are to be felled .Trees of larger girth occurring along coupe line at visible distances are to be given with two Black Paint rings at breast height.

(iv) When Treatment Section Line is co-terminus with block or compartment line then the latter will be maintained as per prevailing practice.

(v) When the Treatment Section line is coterminous with compartment line and the same has not been demarcated earlier, then two white paint rings at breast height are to be given in the trees standing along the Compartment line.

(vi) The sign boards exhibiting the serial number of the Treatment Section and extent of rehabilitation area, name of rehabilitation series and year of working etc. shall be posted at prominent places preferably at the points where Treatment Section line meets the road.

14.5.10.2 PREPARATION OF TREATMENT MAP & TREATMENT PLAN.

(a) TREATMENT MAP

Once the annual rehabilitation areas has been identified, delineated and demarcated in the field then an officer not below the rank of Range Officer, shall inspect and examine such area and prepare a treatment map. The treatment map so prepared should exhibit measures to be taken for different patches within the annual rehabilitation area. The areas included under this Working Circle are in different stage of degradation and require different type of site-specific treatment. While preparing treatment map following three types of areas will be distinguished.

Type "A"

Area to be taken for Silvicultural Cleaning which includes singling out of coppice shoot, pruning, climber cutting removal of high stumps and other tending operations.Area for eradication of weeds is to be marked on the map.Area with congested advance growth, if required thinning is also to be marked.

Type "B"

Seedlings / Recruits of seed origin available in the area are to be specifically noted & its approximate number / species to be mentioned. An available Blank Area which needs to be planted up is to be marked. The suitable species are also to be mentioned in the Treatment Plan.

Type "C"

Bamboo bearing area which needs to be treated / harvested / de congested is also to be marked on map with approximate number of clumps.

(b) TREATMENT PLAN:

The treatment Plan shall include

i) Site identification i.e. Forest Block/ Compartment No. / Treatment series No

ii) Area and Treatment map.
iii) Site characteristics (terrain, slope, drainage, soil type and depth).
iv) Vegetation and extent of regeneration.
v) Extent of degradation.
vi) Year of operations (including maintenance if any).
vii) Major operation to be undertaken**.**
viii) Cost norms and calendar of operations.

The treatment Plan is to be prepared by the Range Officer, checked by the Asst. Conservator of Forests and to be approved by the DFO Puri Wildlife Division for execution.

(c) EXECUTION OF REHABILITATION METHOD.

After approval of the Treatment map & plan, the same is to be executed in the assigned year. The sequences of Operations are

i. Fencing of the Area:
ii. Silvicultural Cleaning.
iii. Silvicultural thinning,
iv. Eradication of weeds,
v. Treatment of bamboo clumps including Harvest / De-congestion)
vi. Soil & Moisture Conservation.
vii. Treatment of Natural seedlings available,
viii. Restocking of Area by Planting (Artificial Regeneration) & Post-care operation.
ix. Subsidiary Silvicultural Operation for bamboo.
x. Control of Grazing,
xi. Fire Protection Measures.
xii. Disposal of Forest Produce

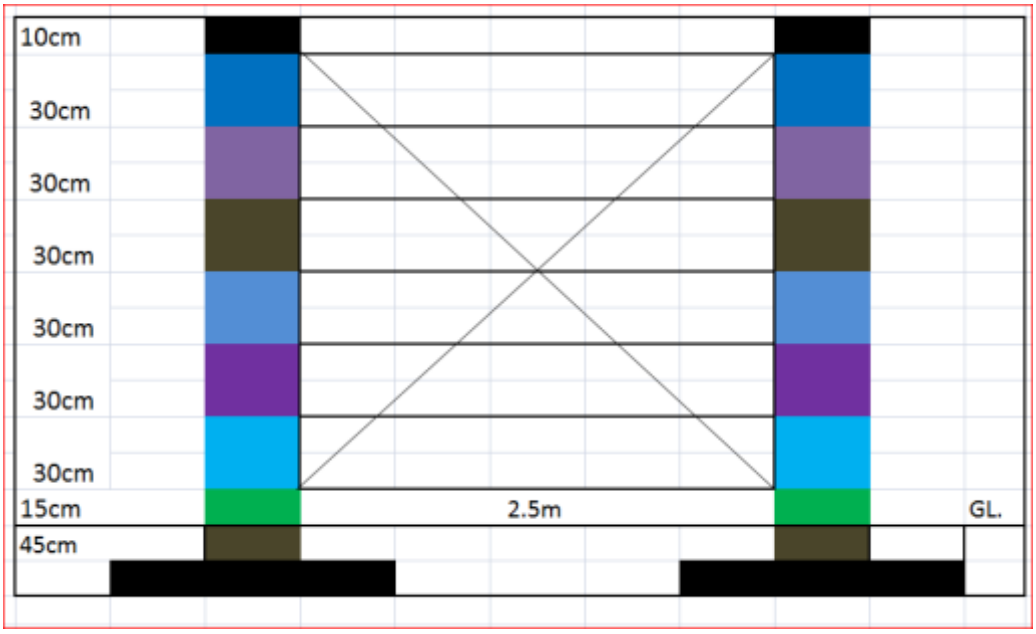
14.5.11 Description of Operations:

i) Fencing of the Area:

The area is susceptible to encroachment and other biotic interferences. The area is also comparatively of smaller size and near to densely populated habitations. To keep the area intact and to have a successful regeneration it is strongly required to fence the area with barbed wire.

Description of Barbed Wire Fencing:
It is suggested to put inverted "T" shaped pillars at an interval of 2.5m. The length of such pillar is 2.40 m. (2.05m above the ground & 0.45m below the ground.) cross section size: 15cmx15cm at bottom and 10cm x10cm at top. The Lower bar of inverted "T" is of 30cm

including the width of the pillar. There will be 7 strands of two ply barbed wire to be placed at a height of 15cm, 45cm, 75cm, 105cm, 135cm, 165cm and 195cm. Two strands will be put diagonally (connecting 15cm point to 195 cm point & 195cm point to 15cm point of adjacent pillar).



Barbed wire fencing Design.

The approved Cost norm for barbed wire fencing based on wage rate of Rs280/- per Persondays is at **Annexure XXVIII.**

ii) Silvicultural Cleaning.

The silvicultural cleaning is intended to achieve healthy growth of existing seedlings / saplings / coppice shoots of favoured species. The operation includes

- Cutting back of high stumps with preference to living stumps and having a good coppicing power.
- Cutting of climbers those are of annual nature and uprooting them wherever possible. The woody climbers those are interlocking the existing trees should not be cutback as it gives enforcement to trees during Cyclone / heavy wind.
- Singling out of multiple coppice shoots and retaining most promising ones.

iii) Silvicultural thinning.

In cases of having congested advance growth at a pole stage, it is required to take up light thinning of**"C grade intensity"**. It is required to undertake removal of dead, moribund, diseased, suppressed, dominated and defective trees without creating a permanent gap

in canopy. Some defective trees around five trees per hectare having cankers / holes should be retained for wildlife habitation.

iv) Eradication of weeds:

The present Blank area included in this Working Circle is heavily infested with Eupatorium, Lantena and other thorny weeds. These weeds are hindering with the growth of natural seed origin seedlings and planted seedlings. Before taking up plantation in these areas its eradication is essential. The details of eradication process have been described in Part-I of this plan. Methods like repeated uprooting at tender stage, uprooting of weeds by tractors or mechanical means at older age of the bush and immediate covering the area with plantations / grass land creation may be practised.

v) Treatment of bamboo clumps (Harvesting / De-congestion)

Bamboo clumps are very dense and at a congested stage due to non-working for a long period. The Bamboo clumps are to be worked following Bamboo cutting Rules.

Bamboo Cutting Rules:

The following cutting Rule of Salia and Daba Bamboo have been prescribed for systematic working of Bamboos in all the Division of the State of Odisha.

Silvicultural System: The silvicultural System prescribed is

- Culm Selection-cum-Clump-improvement Combined with simultaneous cleaning and cultural operation for Saila Bamboos. &
- Clump Improvement combined with simultaneous cleaning and cultural operation for Daba Bamboos.

Felling Cycles: A felling Cycle of 5 years is adopted both for Saila as well as DabaBamboos.
Cutting Rules for Salia Bamboos: Salia Bamboo (*Dendrocalamus strictus)* will be worked as per the following prescriptions.

Rules, which are uniformly applicable to all the Treatment Types:

Regulation of the Yield: Yield will be regulated entirely by area. As it is in small areas the yield regulation is not strictly to be adhered to.

Agency of Working: It is to be workedout departmentally.

Estimation of the yield for fixation of Target: As this operation is intended to improve the clumps and de-congestion is the basic aim, no yield estimation is required.
Sequence of Felling: A definite sequence of felling in Bamboo bearing area is essential. The Coupe should be divided into four Sections running along the contours. The Sections from

the uphill side should be worked first and the first section should be completed in all respects before the work commences in the second Section and soon. Having completed the demarcation of Bamboo Coupes and before taking it up for working, a Treatment Map will be prepared by the department / Agency for working on a copy of the available Management Map in 1:25, 000 scale indicating Salia and Daba bamboos area separately.

Treatment types to be distinguished shall be based on the assessment of the standard Salia bamboo quality classes and actual clump condition.

Treatment Types of Salia Bamboos: The following Treatment Types have been identified / standardized for Salia Bamboo areas. Salia Bamboo forest will be categorized for different Treatment as described below:

Treatment TypeA: Areas with healthy and well-stocked Bamboo clumps consisting of Clump Quality- I: Culm height of Bamboos: 9 m and up.

Clump Quality- II: Culm height of Bamboos: between 6 to 9 m.

Clump Quality- III: Culm height of Bamboos: below 6 m.

Treatment Type B: Areas with well-stocked but degraded, damaged, congested and / or fire burnt clumps.

Treatment Type C: Areas wherein bamboo clumps are sparse and scattered. If necessary, these Treatment Type B & C may be further classified into the above three clump quality classes.

Cutting Rules for Salia Bamboos: Salia Bamboo (*Dendrocalamus strictus)* will be worked as per the following prescriptions.

Rules, which are uniformly applicable to all the Treatment Types:

- Karadi (culms upto one year of age) and the bamboo culms over one year but fewer than two years of age will not be cut under any circumstances.
- Bamboos more than one year old culms and the culms which are older than 2 years but less than 3 years of age are to be retained in the clump and their number should not be less than number of Karadi.
- The minimum number of culms to be retained in a clump is fixed on the basis of quality of the clump and it is as follows :

Clump Quality- I: 20 Culms

Clump Quality-II: 15 culms.

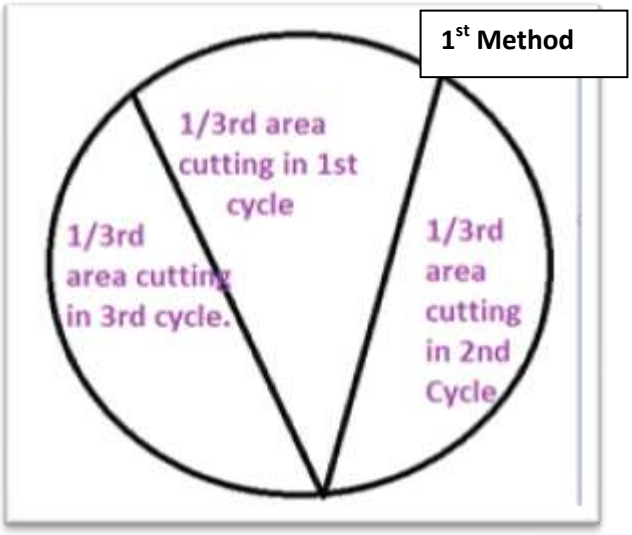
Clump Quality- III: 10 culms.

Clumps having the minimum or less than minimum prescribed number of culms shall not be commercially exploited. Only broken, dead, dry, badly damaged and malformed bamboos will be felled.

Methods for de-congestion:

The bamboo clumps are extremely de-congested and further improvement is hindered. It is required to de-congest the clumps in the following manner.

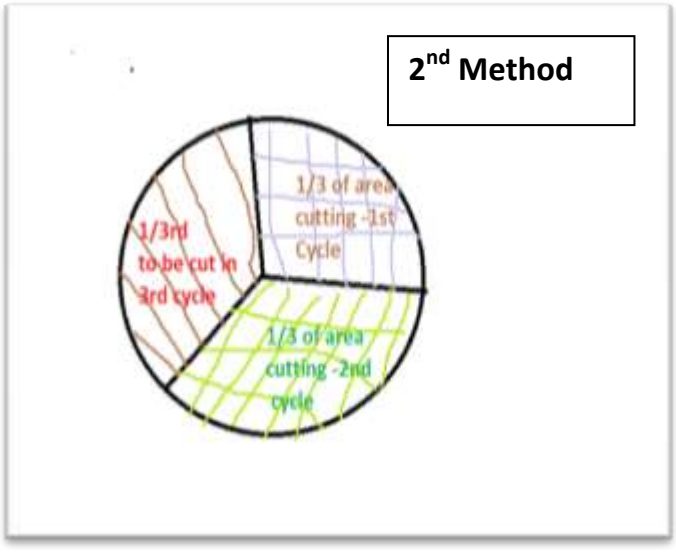
First Method: The congested bamboo clumps are to be cut from one side up to 1/3rd of the total clump irrespective of its age i.e. 1st yr, 2nd yr etc. the design is furnished below.



In 1st method, the cutting of various segments meets at the center of the Bamboo clump.

2nd Method:

In the second method, the cutting segments meet at the periphery of the bamboo clump. Execution is comparatively ease in 2nd method than the 1st method.



The congested clumps are designed to completely de-congest in three cycles. While working in the 2nd cycle, the matured bamboo of the 1st cycle segment also needs to be harvested as per cutting rule otherwise they will again form a congested clump.

Miscellaneous prescription:

(i) A clump will be distinguished, as an independent clump where its periphery is easily discernible from others. Only where such a distinction is not possible, two clumps within one-mater distance will be regarded as one.

(ii) While retaining culms against felling in a clump they should remain well spaced and preferably at the periphery and in the order of preference as follows :

(a) Karadi Bamboos

(b) Kasi Bamboos (older than one year but less than 2 years)

(c) Pakala Bamboos (Young green Bamboos)

(d) Older live Bamboos.

(e) Others as may be available.

(iii) Rhizomes will not be dugout.

(iv) The height above which culms are cut shall not be less than 15 cm or more than 45 cm from the ground level and in no case below the first prominent node from the ground.

(v) The cut shall be made with a sharp instrument to ensure that the stump remains intact without splitting.

(vi) Lops and tops of bamboos will be simultaneously cleared to avoid fire hazard at least to a distance of one meter away from the periphery of the worked clumps.

(vii) Climbers shall be cut from all the Bamboo clumps during working of the coupe.

(viii) Bamboo strips will not be used in tying bamboo bundles.

(ix) Bamboo felling will not be done from 1stJuly to 30thSeptember each year. However, all fellings and transport of Bamboos in the Sanctuaries shall be completed by the end of April positively. In case of gregarious flowering in Sanctuary areas, working period will be extended up to end of June.

(x) If sporadic flowering of Bamboo clumps is observed, such clumps will be clear felled once the seeds from such clumps have fallen.

(xi) In case of gregarious flowering of bamboos, on the shedding of ripe seeds, the clumps will be clear felled and extracted early so that bamboos may not dry or deteriorate or become prone to fire damage. Disposal of such bamboos should be expeditiously arranged to prevent deterioration in quality and the prescribed treatment as mentioned below shall be adopted in the gregariously flowered areas.

(xii) Lopping of bamboos either for feeding livestock or otherwise is strictly prohibited.

(xiii) As far as possible, bamboo felling should be completed by the end of May (except in Sanctuaries where it should be completed by April.)

(xiv) Bamboo forests should be rigidly protected from fires and in any case forest fires should not occur during the year of working and the year following it.

(xv) No grazing is permitted during rains in bamboo forests, which have been worked in the previous season.

Rules applicable to Specific Treatment Types:

Treatment Type- A :

Commercial felling will be done in those clumps which have more than the prescribed minimum number of culms. Cultural operations will be carried out in clumps having less than the prescribed minimum number of culms. In such clumps commercial felling will not be done.

Treatment Type-B:

There will be no commercial felling in any clump.Only cultural operation will be carried out which will include:

(i) Felling of all dead, dried, over-mature, burnt, broken and grossly damaged bamboos.

(ii) Broken or cut bamboos or high stumps in green condition having length of 2.5 meters or more may be retained, if necessary, to maintain size of the clumps.

(iii) The minimum number of clump, as prescribed in foregoing Para for various quality classes may not be strictly followed if necessary so arises.

(iv) The congested bamboo clumps should be clear felled by forming segments. The maximum number of segments, under which a congested clump should be worked, will be three and at each working not more than one segment will be cut. Where three segments are found, the middle segments will be in the shape of triangle having apex at the periphery. Only this middle segment should be felled at the first working. In subsequent cycles, side segments should be felled. Diagram showing divisions of the clump in these segments is given above.

Treatment Type - C:

Only cultural operations will be carried out in the existing bamboo clumps. The bamboo potentiality of such forests will be augmented by raising bamboo plantation. The minimum areas to be planted annually will be 10 hectares or one third of the area under this type.Tending and cultural operations in the area planted with the bamboos will be done as per the standard practice.

Cutting Rules for Daba Bamboos (*Bambusa arundinacea*)& of Sundarkani bamboo:

All bamboo culms in a clump which are more than 3 years old shall be harvested on Culm selection basis provided the number of culms left uniformly distributed in a clump shall not less than 10.In case of congested clumps where Culm selection is not possible the clump should be carefully felled by forming segments as per any of two diagrams given above and depending on the interlocking of the bamboos with a view to provide support to the remaining segments against wind damage. The maximum number of segments under which a congested clump should be worked will be three and at each working not more than one segment will be cut. Stumps higher than 50 cm or more than two internodes should not be left un cut. Where three segments are formed, the middle segment will be in the shape of a triangle. Only the middle segment should be felled at the first working. Two Diagrams showing divisions of the clump in three segments are given above.

Simultaneous Silvicultural Operations: (SSO)

All cutting debris shall be removed from the clump and the clump shall be left cleaned. Where possible, the exposed rhizomes shall be covered with soil scrapped from the surrounding in plain areas and preferably from the uphill side of a hilly or undulating terrain. Both these operations shall have to be done along with the main cutting operation.No damage shall be caused to rhizomes and rootstock.

Treatment of gregariously flowered areas:

- Bamboo seedlings at a spacing of about 4 m x 4 m are to be adopted and retained and the rest are to be thinned out.
- Cleaning, soil working and weeding is to be done around the adopted bamboo seedlings upto a radius of 50 cm.
- To maintain the continuity, planting up of bamboo rhizomes is also to be resorted to especially in big gaps.
- All the flowered clumps are to be worked out following the prescription of the working plan.
- The area should be closed for grazing.
- Elaborate fire protection measures are also to be taken.

A comparison Statement on Sporadic Flowering / Gregarious Flowering is furnished below for academic interest.

Sporadic Flowering	Gregarious Flowering
Scattered nature of flowing only Few clumps are involved in flowering.	Flowering occurs almost in the entire areas.
Only few culms flower in a clump	It involves almost all or some proportion Flowering takes place in all the culms in clump.
The culm may or may not die after flowering	All the culms of a clump die after flowering.
The clump does not die.	Flowering is followed by the death of the clump
It takes place usually irregularly almost every alternate year.	If follows a cycle of long interval 20 to 65 years.
	It progress in a definite direction like an epidemic wave.
	It takes 2 to 4 years to complete the flowering in the area.

In Selection forest, the age of clump varies and accordingly varies the intensity of gregarious / sporadic flowering. The delay in flowering in poor sites is due to the effect of site quality, which is related with the growth, and storage of starch, sugar and other substances in the clump, which help flowering. In a well-managed forest intensity of flowering is less in comparison to a un-worked forest consisting congested clumps. Intensity of flowering is more in area having more biotic interference in form of grazing and fire in comparison to protected area. It is important to identify the characters of flowering in Salia Bamboo to decide appropriate management technique.

Distinguishing Morphological characters of the Culms of different age:

Culm age	**Morphological Character**
Karadi (the first year clum)	Culm sheath present on lower half of Culm. Branches present throughout the length of Culm. Green uniformly, bloom is abundantly present and comes off easily on finger. A fresh cut just under the node shows the same fresh coloration even after one or two minutes
Kasi (the second year clum)	Culm sheath mostly absent except some remnants. Culm dark in colour. Branches present practically at all nodes. Bloom is patchy, grayish-white in colour and comes off less easily on finger. A fresh cut just under the node shows the same fresh coloration even after one or two minutes
Pakala (the 3rd & 4th year clum)	Culm sheath absent. White bloom absent. Blackish gray or dark blotches appear which come off on finger slightly on rubbing. A fresh cut under the node shows reddish-brown coloration after one or two minutes.

The main threats to the bamboo forest are:

- Indiscriminate cutting of bamboo by tenants and artisans.
- Annual forest fire.
- Excessive grazing and
- Clear felling of Daba bamboos.

These factors require to be checked on one hand and techniques are to be developed to improve the quality and quantity of the clumps in order to conserve the deteriorating Bamboo forests. Decreasing trend in production of Bamboo has already indicated the deterioration of Bamboo forest. Appropriate silvicultural techniques to manage the Bamboo forest will, therefore, be essential in restoring the valuable Bamboo forests of the state.

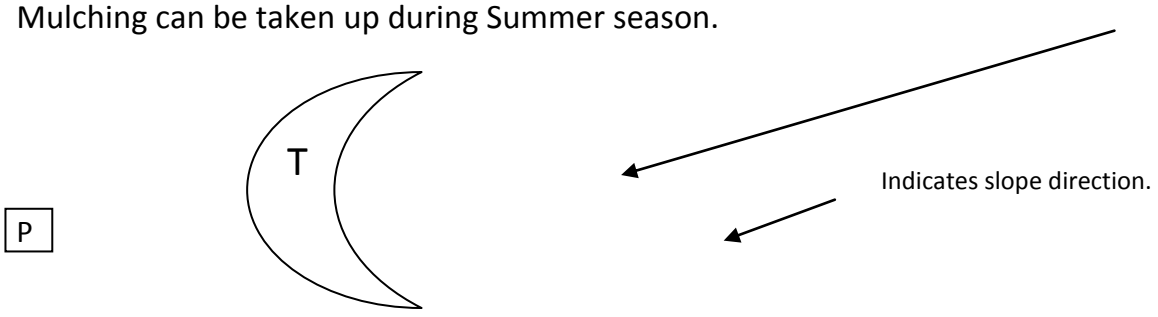
vi) Soil & Moisture Conservation.

The area included in this working circle is mostly plain to gentle slope. Percolation pits of 2mx 1mx1m with gentle side slopes, Contour bunding within 200meters from water body/ River bank are only prescribed. Areas close to lose sand stretches measures will be taken up to check advancement of sand dunes. Maintaining thick leaf litters / Casuarina needles in humus form coupled with fire protection measures will also help in moisture conservation.

vii) Treatment of Natural seedlings available,

The natural seedlings available in the treatment area are to be given appropriate attention to ensure its establishment.
The following measures are prescribed.

- Deep Soil Working around the seedlings at a width of 0.50 m with application of fertilizer.
- Weeds to be removed / uprooted at a radius of 1 meter.
- In case of sloppy location Half Moon trench to be provided.
- Mulching can be taken up during Summer season.



- T : Half Moon Trench
- P: Plant position.

viii) Restocking of Area by Planting (Artificial Regeneration) &Post-care operation.

Plantation of indigenous species matching with the local species is required to be planted following the cost norm of Plantations approved by Forest department. The species suggested are Bali sissoo*(Dalbergia sisoo)*, Khaira (*Acacia catechu)*, Bela (*Aegle marmelos)*, Phasi (*Anogeissus acuminata),* Dhaura*(Anogeissus latifolia)*, Kaintha (*Limonia acidissima)*, Casuarina*(Casuarina equisetifolia),* Acacia*(Acacia auriculiformis)*, Neem*(Azadirachta indica)*, Jamun*(Syzygium cumini)*and Bamboo (*Bambusa vularis*).

ix) Subsidiary Silvicultural Operation for bamboo.

It has already described under Bamboo Cutting Rules furnished above.

x) Control of Grazing.

The assigned area for a particular year is required to be closed to grazing at least for three years. During that period, VSS members, villagers may be allowed to collect grasses by cutting. After three years controlled grazing may be allowed considering the quantum of grass growth in the protected area.

xi) Fire Protection Measures.

The area is to be protected against fire. Fire line is required to be maintained along the periphery and internal lines. Controlled burning of weeds may be taken up under strict supervision of section forester.

xii) Disposal of Forest Produce:

During Cleaning / thinning operation if any utilizable forest produce is obtained, it will be disposed up as per the guidelines of Forest Department.

14.5.12 Associated Regulations and Measures:

Besides the above prescriptions, the following associated regulations are prescribed to be followed. These are

- The encroached area is to be recovered through legal / motivation methods.
- No lopping is allowed within 5 years of treatment.
- Boundary maintenance in a cycle of 3 years is to be ensured.
- VSS is to be strengthened and regular interaction with villagers / VSS members to be maintained.

There is no degraded forest land being maintend under this working circle to be allotted for under Compensatory Afforestation purpose shence no land /Forest block is suggested for including in land bank for Compensatory afforestation purpose.

14.5.13 Coupe Control Form

The activities are to be closely monitored to have the desired result. A set of Coupe control form is prescribed below to be filled up and submitted to DFO by the Range officer at the end of the year.

Table No 14.7 Coupe Control Form (Form No-1)

Name of Treatment Series	Coupe No	Year of Assigned	Area in ha	Areas treated Under (in Ha)					Deviation
				Cleaning	Thinning	Planting	Seed sowing	SMC	

CHAPTER-15
CASUARINA WORKING CIRCLE

15.1: Casuarina Working Circle:

The Casuarina Plantations raised in Sahana PRF and Sahana Extension (Revenue forest) of Astaranga Wildlife Range were previously covered under **"Car Timber Working Circle"** in the outgoing plan and worked out to meet the fuelwood requirement of Swargadwar (Cremation ground) and sacred kitchen of Shree Mandir of Puri. Now it is proposed to rename it as **"Casuarina Working Circle"** as the sole species found is *Casuarina equisetifolia*and there is no timber production.The assigned area will be worked out for Fuel wood production only. The area allotted to this working Circle is **746.717 ha.**

15.2: General Constitution of Casuarina Working Circle.

The Sahana PRF and Sahana Extension (Revenue Forest) are sand dunessituated very close to sea shore and formed due to deposit of Sand. The Organic content of Soil is very poor for which the coppicing power of Casuarina tree is poor in this locality. There are few trees of *Acacia auriculiformis*and Banyan also seen here and there within the plantations. The entire area is under casuarina plantation of different age classes depending upon year of Plantation asit varies from 1 year to 10 years age class. Some plantations are of more than 10 years old which couldn't be harvested in the allotted year during outgoing plan period. The casuarina plantations are forming good shelter belt on the Sea beach with aesthetic value, recreational value and protective function against wind and tidal effect.

One Eco Tourism Spot is being developed in Sahana Extension (Revenue Forest)at Jahania under Astaranga WL Range over an area of 13.383ha., which was earlier covered under erstwhile 'Car Timber Working Circle' of outgoing plan. Looking into the present land use and growing demand for ecotourism and picnic at Jahania this area is now excluded from proposed 'Casuarina Working Circle' and included under "Miscellaneous working circle". To manage the crowd and to keep the sea beach clean, one VSS has been constituted in the name of Gundalaba VSS, who has been assigned with 6.394 ha area out of excluded area of 13.383 ha. The VSS area of 6.394 ha is now covered under JFM (O) working circle.

Similarly, old casuarina plantations along the coast line covering a length of 13.546 kms and width of 40 meterover an area of 54.187 ha, which was under 'Car Timber Working circle' of outgoing plan, is now covered under "Protection Working Circle" to act as a wind break to protect hinter land and plantations from the cyclones now prevailing regularly on coast of Puri district.

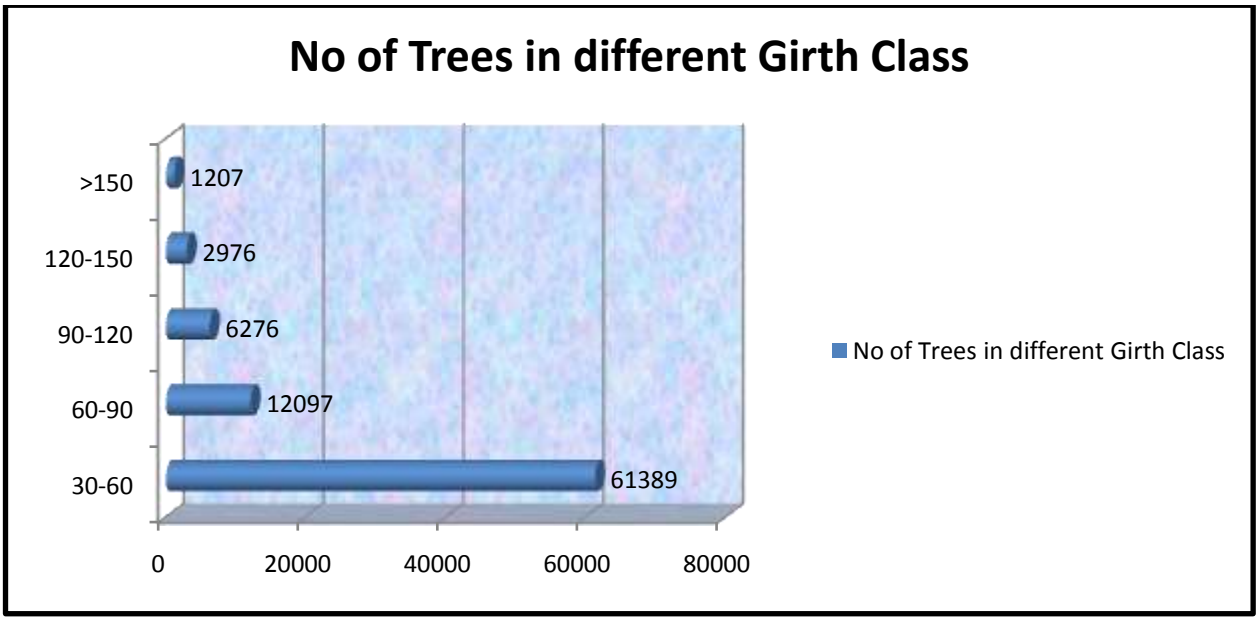
Hence after allocation of above areas to Miscellaneous working circle and Protection working circle, balance 746.717 ha is kept for Casuarina working circle.

15.3: General Characteristics of vegetation:

The vegetation is a manmade forest of Casuarina. All are of Plantation origin. Coppice shoots are not coming up though the species is a poor coppicer. The reason is mainly attributed to lack of soil organic matter and other soil nutrients. This aspect needs to be further observed by State Silviculturist. The vegetation is of different age class and of mosaic in nature. Growth varies from stunted growth towards Sea shore and of prominent towards land ward side. This may be attributed to self management of trees to stand against wind pressure and maturity of Soil.

In the ORSAC Report, the Girth Class wise distribution of trees has been furnished. The result for Astaranga WL Range is as follows.

Range	Species	No of trees in dfifferent Girth Class in cm					
		30-60	60-90	90-120	120-150	>150	Total
Astaranga WL Range	Misc	61389	12097	6276	2976	1207	83946
Percentage		**73.13**	**14.41**	**7.48**	**3.55**	**1.44**	**100.00**



15.4: Felling Series, Cutting Sections and JFM areas:

Two Forest blocks i.e. Sahana PRF and Sahana Extension have been included in this working Circle. A strip of 40 meter (2 Chain) wide along the Sea coast from Sahana Extension has been set aside and proposed to be managed under Protection Working Circle. As the location is very adjacent to Sea beach clear felling in a bigger area is not preferred and advisable. Therefore it is proposed to have two **Felling Series** i.e. **Sahana Felling Series** and **Muhanmuha Felling series**. Each Felling series is divided in to ten Cutting sections i.e. Annual Coupe for Systematic Working on Small area.

15.4.1: Allotment of area to different Felling Series.

The entire Sahana PRF is allotted to **Sahana Felling Series** and after excluding the strip of plantation from Sahana extension which is allotted to Protection Working Circle, the balance area is allotted to **Muhanmuha Felling series**. The details are furnished in the following **Table No 15.1:**

Table No 15.1 Allotment of Area to Felling series.

Sl No	Name of the Felling series	Name of the Forest Block	Area allotted in ha
1	Sahana Felling series	Sahana PRF	305.617
2	Mundamuhan Felling series	Sahana Extension	441.100
	2 Felling series		**746.717**

15.4.2: Area allotted to different Cutting Sections:

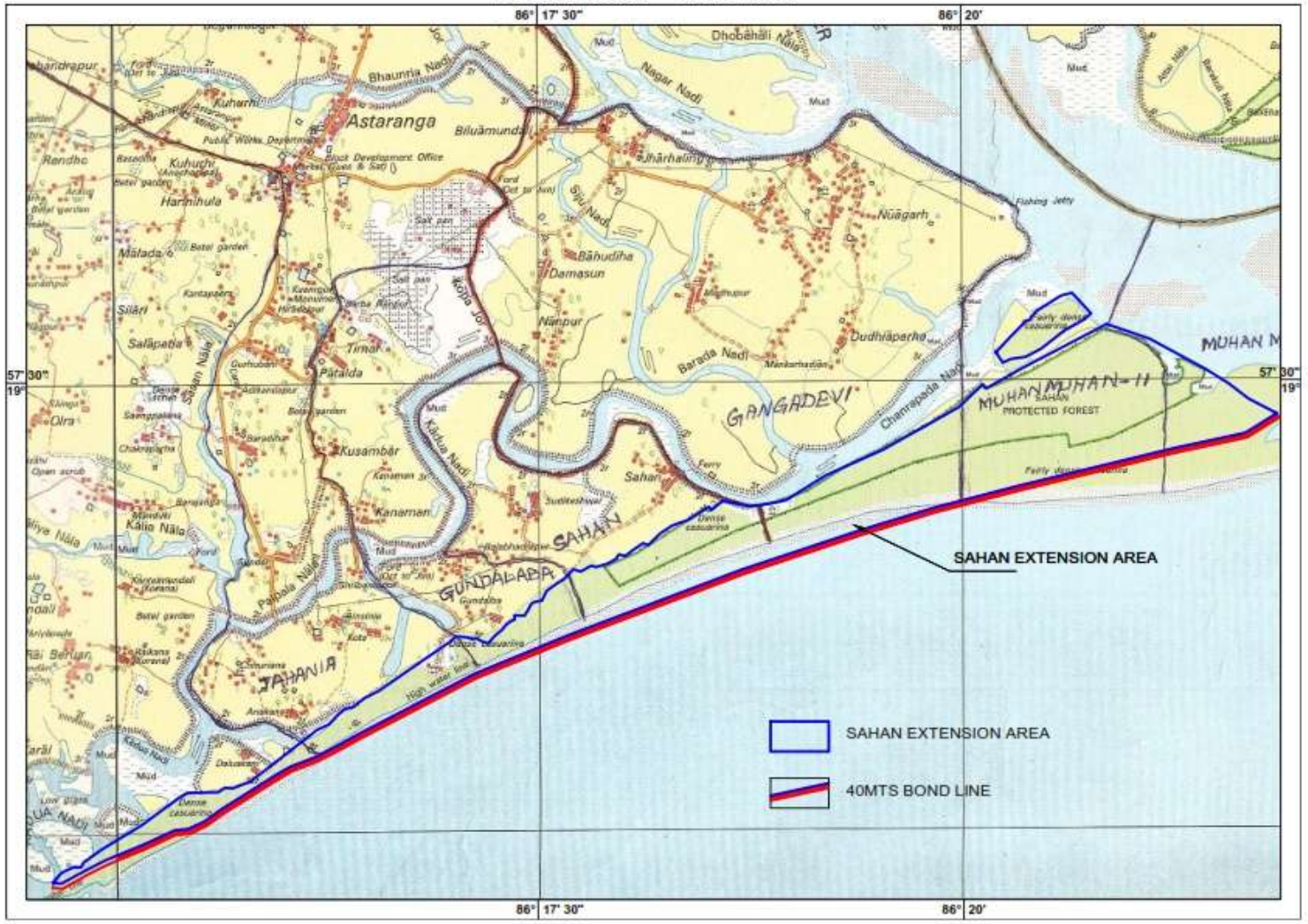
Area allotted to different felling series is sub divided in to ten annual coupes. Area allotted to each coupe, year of working is furnished in **Table No- 15.2:**

Table No 15.2 Area of allotment to different Felling Series / Cutting Section.					
Sl No	Felling series	Name of Forest block	Annual Coupe No	Area in Ha	Year of Working
1	Sahana Felling series	Sahana PRF	SFS-I	31.00	2021-22
			SFS-II	30.00	2022-23
			SFS-III	31.00	2023-24
			SFS-IV	30.00	2024-25
		Sahana PRF	SFS-V	31.00	2025-26
			SFS-VI	30.00	2026-27
			SFS-VII	31.00	2027-28
			SFS-VIII	30.00	2028-29
			SFS-IX	31.617	2029-30
			SFS-X	30.00	2030-31
	Total of SFS			**305.617**	
2	Muhanmuha FS (MFS)	Sahana Ext.	MFS-I	44.00	2021-22
			MFS-II	44.00	2022-23
			MFS-III	44.00	2023-24
			MFS-IV	44.00	2024-25
			MFS-V	44.00	2025-26
			MFS-VI	44.00	2026-27
			MFS-VII	44.00	2027-28
			MFS-VIII	44.50	2028-29
			MFS-IX	44.60	2029-30
			MFS-X	44.00	2030-31
	Total of MFS			**441.10**	

Areas worked out will be replanted after one year gap to facilitate cleaning of area and doing advance work. For example, if an Area is worked out during 2021-22 will be surrendered to department by end of June, 2022. Then unlifted debris, branches etc will be cleaned, water holes will be dug; decentralised nurseries will be raised on the planting site. Hence the same area will be planted in 2023-24 (July 2023). The Annual Coupe area has been marked on Management map i.e. Survey of India Topo Sheet 74 I/5 NW (1: 25000 scale)

MAP SHOWING LOCATION OF SAHAN EXTENSION PRF IN ASTRANGA WILDLIFE RANGE

TOPO SHEET : E45C5 SCALE 1:35,000



15.4.3 Allotment of area to JFM (VSS Committee):

No area from this Casuarina Working Circle has been assigned to any VSS. However, 6.394 ha from excluded Sahana Extension revenue forest under erstwhile Car Timber working Circle, has been assigned to Miscellaneous Working Circle for Ecotourism and has been covered under JFM (O) Working Circle.

15.5: Blocks & Annual Coupe Area depicted on GIS Maps.

The Annual Coupe area has been marked on Management map i.e. Survey of India Topo Sheet 74 I/5 NW (1: 25000 scale)

15.6: Special Objectives of Management:

The special objectives of management set out for this working circle are within the Basic objectives of the Working Plan. These are as follows.

i. To provide Firewood to Puri Jagannath Temple for preparation of ***"Abhada"*** and other "M***ahaprasad"*** for different rituals.
ii. To Provide Firewood for Funeral rites at ***Swargadwar, Puri.***
iii. To Produce renewable energy by fast growing plantations i.e. Casuarina.
iv. To maintain a good Carbon sink near the Sea beach.
v. To Provide an Aesthetic / Green look to the landscape.
vi. To provide recreational facilities to urban population.
vii. To provide a strong Wind Break against cyclonic storm.
viii. To check shifting of Sand Dune towards habitation.
ix. To stabilize the shifting unconsolidated sand mass near to Sea.
x. To provide shelter to wild animals in the vicinity.
xi. To provide employment to local people through forest activities.

15.6.1 Analysis of the Crop:

The crop is of uniform in nature (patch wise). The overall crop looks like a mosaic of casuarinas trees with patches of **"Different Age Class".**The productivity is more or less equal. The detail of growth pattern with different age has been furnished in Chapter 12. As per ORSAC analysis data, the crop density is above 70%.

15.6.2 Silvicultural System:

The prescribed Silvicultural System is **"Clear Felling followed by Artificial regeneration".**To induce coppice shoots the area after main felling is to be controlburned during February. The area is to be planted up subsequently as furnished in Table No -2.

15.6.3 Rotation Period:

The Rotation period is fixed to 10 years from the year of planting which is co-terminus with the plan period.

15.6.4 Harvestable Diameters:

As the area is to be worked under **"Clear Felling followed by Plantation"** no harvestable diameter is prescribed for Casuarina. Harvest will take place after completion of rotational period.

15.6.5 Reducing factors and reduced areas:

As the yield will be regulated by "Area under working" no reducing factors / reduced area is applicable. More or less the entire area in the working Circle is well stocked. Hence the reducing factor is 1 (One).

15.6.6 Felling Cycle:

A felling Cycle of 10 years is followed for this working circle i.e. **Casuarina Working Circle**.

15.6.7 Calculation of Yield:

The yield will be regulated by area. The approximate yield is expected 60 T/ ha/ yr i.e. at the felling time it is expected to obtain 600 Qntl. per hectare per year (Final harvest). This will be considered as standard for the working circle.

15.6.8 Table of Felling / Treatment:

The year wise area allotted for felling and calendar of operation is furnished below. The assigned area should be taken for harvesting in the prescribed year and steps to be taken to follow the time schedule for a smooth working & restocking of the area. Any deviation from the time schedule may be reported as deviation from the working plan prescription and necessary deviation statement may be approved from competent authority i.e. CCF/ Add. PCCF (Protection & Sustainable Management), Odisha.

15.6.8.1 Table of Felling:

The table of felling is furnished at **Table No 15.3**

Table No 15.3 Area of allotment to different Felling Series / Cutting Section.					
Sl No	Felling series	Name of Forest block	Annual Coupe No	Area in Ha	Year of Working
1	Sahana Felling series	Sahana PRF	SFS-I	31.00	2021-22
			SFS-II	30.00	2022-23
			SFS-III	31.00	2023-24
			SFS-IV	30.00	2024-25
			SFS-V	31.00	2025-26
			SFS-VI	30.00	2026-27
			SFS-VII	31.00	2027-28
			SFS-VIII	30.00	2028-29
			SFS-IX	31.617	2029-30
			SFS-X	30.00	2030-31
	Total of SFS			**305.617**	
2	Muhanmuha FS (MFS)	Sahana Ext.	MFS-I	44.00	2021-22
			MFS-II	44.00	2022-23
			MFS-III	44.00	2023-24
			MFS-IV	44.00	2024-25
			MFS-V	44.00	2025-26
			MFS-VI	44.00	2026-27
			MFS-VII	44.00	2027-28
			MFS-VIII	44.50	2028-29
			MFS-IX	44.60	2029-30
			MFS-X	44.00	2030-31
	Total of MFS			**441.10**	

15.6.8.2 Table of Treatment Sequence.

The calendar of Treatment for the assigned area is furnished below. **(Table No: 15.4)**

Table No:15.4 Table of Treatment Sequence (Calendar of Operation)			
Sl No	Description of Work	Time Frame	Remark
1	Demarcation of Coupe Area	January of assigned Year	Forest department.
2	Marking of Trees/ Preparation of Marking List & Yield estimation.	February- March of Assigned Year	Forest department.
3	Verification of Area / Marking List & yield estimation.	April of Assigned year	Verification by Officer not below the rank of Asst. Conservator of Forests.
4	Sharing of Marking List with OFDC Ltd	April – May of Assigned year	To Divisional Manager,(C) Bhubaneswar
5	Co-ordination Meeting between DFO Puri WL Division & DM Bhubaneswar. Fixation of Royalty	June- August of Assigned year	DFO, Puri WL Division to convey the meeting.
6	Offer for delivery of Coupes for working	September of Assigned Year	DFO Puri WL Division.
7	Delivery of Coupes & Agreement thereof.	1st week of October of the assigned year	By Range officer, Astaranga WL Range.
8	Felling / Conversion / Passing & Removal of Produce	9 (Nine Working months) or Completion of working or 30th June whichever is earlier.	OFDC Ltd.
9	Surrender of Coupe Area	30th June, of the assigned year.	Any deviation / extension of working period to be governed by Lease Rule / OFD Code.
10	Analysis of Yield / Cleaning of the coupe area / removal of left out trees / fallen materials.	October- November of the Assigned year	Forest department.
11	Collection of debris / grasses	December of the Assigned Year	Forest department.
12	Control Burning of Grasses / Debris & Casuarina needles if any.	February of the subsequent year	Forest department under supervision of not below the rank of Forester.
13	Observation of Area & assessment of Coppice Shoots concentration & Report.	March- April of the subsequent year	By Range Officer concerned / Cross checked by Asst. Conservator of Forests.
14	Restocking of worked out areaby collection of seedlings from nursery, Planting & Post-care operation.	May to onwards	As prescribed in Standard Planting Cost norm

Table No:15.4 Table of Treatment Sequence (Calendar of Operation)			
Sl No	Description of Work	Time Frame	Remark
15	Maintenance of Journals / inspection note etc	May to onwards	As per administrative instruction.
16	Maintaining the Compartment History file	Periodical / Quarterly	To be periodically checked by Asst. Conservator of Forests

(NB: Though the above prescription is mandatory, minor variation may be accepted as decided by the Divisional Forest Officer, Puri Wildlife Division. In case of Year of Working / year of restocking by plantations is deviated, the same may be recorded in the Compartment History and necessary deviation statement may get approval from competent authority.)

15.6.9 Method of Executing Felling / Treatment:

The various important steps in coupe working and subsequent working procedures are described below for needful guidance.

15.6.9.1 Demarcation of Coupe Area:

The Coupe area is to be demarcated by the Section Forester as per the management map provided, with the help of GPS. The Coordinates (Latitude / Longitude) of Cardinal points of a coupe is furnishedon the Management Map (1:25000 Scale). The Forester is required to fix up the points accurately as far as possible by ordinary GPS. The same is to be cross checked with reference to nearby land mark shown on the management map (1:25000). The identified points are to be marked with stone cairns of 75 cm base diameter and 60 cm height or preferable with RCC Pillars of 20cm x 20cm with 120cm height. The pillar numbers to be marked clock wise with Lat / long on it. The pillar to Pillar distance is to be decided so that the nest pillar is at a visible distance. Each corner pillars must be marked with a black double band on it at Base (30 cm above the Ground Level) and Top position (30 cm below the top of the pillar). Interim pillars are to be marked with single band at top only (30 cm below the top of the pillar). The line connecting adjacent pillars is to be cleared at a width of 90 cm. Any tree coming within the Coupe line should not be felled but to be provided with a double black ring at Breast Height. If the Coupe line coincides with PRF boundary line, then a width of 10m to be maintained as per Boundary maintenance guidelines.

15.6.9.2 Marking of Trees/ Preparation of Marking List & Yield estimation.

Just after demarcation of Coupe and boundary verified by the Range Office or any officer above the Rank of Forest Ranger, Casuarina glacial trees above 30cm GBH are to be

marked and tree enumeration list to be prepared as per standard practice. The marking Officer shall assess the availability of tree growth below 30cm GBH and probable Firewood likely to be obtained from these tree growth below 30cm GBH. Marking list is to be prepared in triplicate. Marking list is required to be cross checked by the Range Officer before transmitting the same to DFO, Puri WL Division. For harvesting of Produce, the Coupe may be delivered to OFDC Ltd for working with specific working period. There should not be any coupe working during 1st July to 30th September.

15.6.9.3 Felling / Conversion / Passing & Removal of Produce:

The felling will be carried out by the OFDC Ltd and taking over the coupe. All trees except trees of wildlife importance on the coupe area are to be felled. As the aim of this working circle is to provide Fire wood to Jagannath Temple / Swargadwar, all felled trees to be converted to Firewood billets of 3 ft long (90cm) and stacked in a size of 12'x3'x3' for passing. The Conversion list is to be prepared in triplicate and submitted to the DFO through Range Officer for passing of Converted firewood. The ACF may pass the produce as authorised by the DFO for passing. The Fire woods are to be removed from the coupe to Sahana depot under the strength of Coupe Permit issued to OFDC Ltd. After removal of Forest Produce the coupe is to be surrendered back by OFDC Ltd. As the coupe is a small area, it should be endeavour by OFDC Ltd / Forest department to complete working in the same season without extension as the area is near to sea shore and prone to wind and cyclone.

15.6.9.4 Control Burning of Grasses / Debris & Casuarina needles if any:

After received back the coupe area, the debris/ casuarinas branches found in the coupe area i.e. timbers / logs/ twigs may be piled in small heaps and completely burnt by "Control Burning" in presence of Section Forester. This operation is to be taken up during January / February. Precautionary measures required to be taken to see that

- The fire is not prolonged beyond more than half an hour in a particular spot.
- The flame should not rise more than one meter.
- The debris is well dried for a good burning in a short duration.
- Firing should not be in a windy period / day.
- Spreading to nearby area is prevented / checked.
- No smoking un-burnt timbers / logs/ twigs left in the field.
- If necessary, the water / sands may be used to extinguish left out fire smoking un-burnt timbers / logs/ twigs.
- This operation may be taken up segment wise. Segment may be of size 200mtx200mt so as to control the fire.

This operation should find place in journals / Compartment history.

15.6.9.5 Observation of Area & assessment for Planting:

As per present situation, no significant coppice shoots may come up. Hence the area is to be planted up as per approved cost norm for Casuarina plantation (with waterhole based watering system) vide letter no 1335/ 12F-25/2018 dated 18th December, 2018 **(Annexure-XXIX),** it is prescribed to plant 2500 seedlings per hectare at a spacing of 2mx2m with 6 months of seedlings raised on the proposed plantation sites.

15.6.9.6 Restocking of by Planting & Post-care operation:

The clear felled area is to be restocked by planting following the standard procedure during the assigned year. The prescribed cost norm should be followed. The area is prone to invasion of weeds like eupatorium Lantana. All precautionary steps are to be taken to uproot the weeds during post-care operation. Application of organic fertilizer is recommended than chemical fertiliser as the area is close to sea shore and leaching of chemical fertilizer / insecticides may affect the marine life near sea shore. If required Bio-insecticides (Neem cake) may be used in a limited manner. Mulching by dried grasses & weeds partly covered with sand at the base of the seedling will help in enriching &developing soil organic content and moisture conservation by reducing transpiration.

15.6.9.7 Maintenance of Journals / inspection note etc:

The nursery journal and plantation Journals are required to be maintained. The cultural operations taken up from surrender of coupe area from OFDC Ltd to 4th year of plantation are to be meticulously maintained. The essential features that must find place in the Plantation Journals are listed below.

- Taking of Coupe area from OFDC Ltd. (date)
- General observation of Coupe area / OFDC Ltd working.
- Availability of debris & control burning.
- Assessment of Coppice shoots & its vigour.
- Number of plants to be planted per hectare.
- Inspection notes with photographs.
- Deviations if any.

15.6.9.8 Maintaining the Compartment History file:

The compartment History File is required to be newly created with given format and filled up / regularly updated with General remarks. In addition to information stated under

para15.6.9 &15.6.10, the following information are required to be recorded when it happens.

a. Number of trees marked & Yield.
b. Natural calamities like Cyclone / flood / tidal inundation and damage caused.
c. Fire hazards / diseases/ sighting of wild animals etc.

15.6.10 Subsidiary Silvicultural Operations:

After main felling in a coupe, subsidiary silvicultural operation is required to be taken up to obtain a healthy crop in second and subsequent rotation. The operation requires to be taken up are as follows.

15.6.10(a) Cleaning:

Silvicultural cleaning after main felling (clear felling) is highly required. In this operation, all un-marked trees are to be removed. Control burning as elaborated above is also to be carried out. The stumps ofabove 15cm height are to be cut back before control burning. In the places where coppice shoots are coming up naturally singling of shoots are to be taken up. As production of firewood is the objectives, two – three coppice shoots per stump are to be retained and balance shoots are required to be removed by sharp cutting instrument. It should be singled out before it attains a height of one meter so that the remaining shoots will have a vigorous start and may attain a height of 2m in first year. Grasses those come up after control burning and removed coppice shoots may be allowed to burry under sand to increase soil organic content.

Many times it is seen that the leading shoot of the seedlings/ sapling of plantation are browsed by spotted deer or die back due to insect attack or drought and ultimately the seedling turns into a bush having several branches/ coppice shoots coming from the base of sapling. Such a condition will never allow the sapling to grow as a tree with clear bole. If such condition prevails, side branches or coppice shoots will be removed by a sharp cutter (SECATEURS)leaving the leading shoot intact, which will grow into the tree with clear bole.

15.6.10(b) Thinning:

As the objective is only to get firewood, no thinning is prescribed which would have induced diameter growth. The rotation is also only 10 years, hence no thinning regime is prescribed. However, the broken, diseased or damaged trees can be removed under silvicultural thinning.

15.6.11 Regeneration:

After assessment of coppice shoots, the area is to be planted up with seedlings as per the allotted year furnished under **Table No 15.3.** At present, seedlings are being raised from seeds collected from mother trees retained within the locality. Steps may be initiated to produce seedlings through vegetative propagations in MegaNursery as well.

Vegetative reproduction (also known as vegetative propagation, vegetative multiplication, tissue cultureor vegetative cloning) is a form of asexual reproduction occurring in plants in which a new plant grows from a fragment of the parent plant i.e. branches or 10 inch long growing tip.

Many plants are naturally reproduced in this way, but it can also be induced artificially. Horticulturalists have developed asexual propagation techniques that use vegetative plant parts to replicate plants. However seed origin seedlings are easier to raise if seeds (cones) are collected from better provinces.

15.6.11.1 Advantages:

There are several advantages of vegetative reproduction, mainly that the produced offspring are clones of their parent plants. If a plant has favorable traits, it can continue to pass down its advantageous genetic information to its offspring. It can be economically beneficial for commercial growers to clone a certain plant to ensure consistency throughout their crops. Vegetative reproduction offers research advantages in several areas of biology and has practical usage when it comes to afforestation. The most common use made of vegetative propagation by forest geneticists and tree breeders has been to move genes from selected trees to some convenient location, usually designated a gene bank, clone bank, clone-holding orchard, or seed orchard where their genes can be recombined in pedigreedoffspring.

For Casuarina, cuttings of young shoots of one year old seedling has been used to reproduce superior seedlings in Raygada district. It is giving a good yield and able to meet the raw material requirement of paper mills. In this method asmall branch of 10 inch length is cut off and planted in poly pots. Adventitious roots grow from cuttings and a new plant eventually develops. Usually those cuttings are treated with **roothormones** before being planted to induce growth. It is required to create a gene bank of Casuarina in Puri WL Division as these species are the most favoured forest species for “Artificial Regeneration”. The details of gene bank and methods are described in Chapter “Application of Modern Technology to Forest Management”.

15.6.11.2 Disadvantages:

A major disadvantage of vegetative propagation is that it prevents species genetic diversity which can lead to reductions in crop yields. The plants are genetically identical and are all, therefore, susceptible to pathogenic plant viruses, bacteria and fungi that can wipe out entire crops.

In spite of disadvantage as narrated above, it is strongly recommended to have vegetative propagation for casuarinas plantation in Puri Wildlife division.

15.6.11.3 Associated Regulations and Measures:

The Puri Sea coast is vulnerable to Cyclone which is becoming an annual phenomenon in the State. Regulations for **Coastal Regulated Zone** (CRZ) are to be followed as it is applicable to the plantations / working areas of the chapter.

15.6.11.4 Coupe Control Form

After coupe working is over, the Range Officer is required to provide the information to DFO in the following control form.

Table No 15.5 : Control Form No-2

Name of Felling Series	Coupe No	Year of Felling	Area covered	No of Trees Marked	Unit calculated	Timber in Cum	Fire wood in stacks (12x3'x3')	Trees retained, if any	Deviation, if any

CHAPTER-16
PLANTATION WORKING CIRCLE

16.1: Plantation Working Circle:

Besides the area covered under **"Casuarina Working Circle",** there are many plantations of Eucalyptus, Acacia, Casuarina and Cashew *(Anacardium occidentale)*taken up by Forest Department in other areas. During Social Forestry Project period i.e. 1985-1993, Plantations have been raised at various villages and declared as village forest u/s 30 of the Odisha Forest Act, 1972. Similarly under "National Afforestation Program" through Forest Development Agency plantations have been raised in various villages. All the areas covered up under various plantation schemes (within the administrative control of Forest Department) are to be managed under this Working Circle.

16.2: General Constitution of Working Circle:

The area covered under this "Plantation Working Circle" is386.382 hectare. Plantations raised in Protected Forests, Village Forests (Declared Under Section 30 of the Odisha Forest Act'1972) are included for management. The Forest blocks covered in this working circle is furnished at **Table No 16.1**

Table No 16.1 Area / Forest Blocks included in Plantation Working Circle

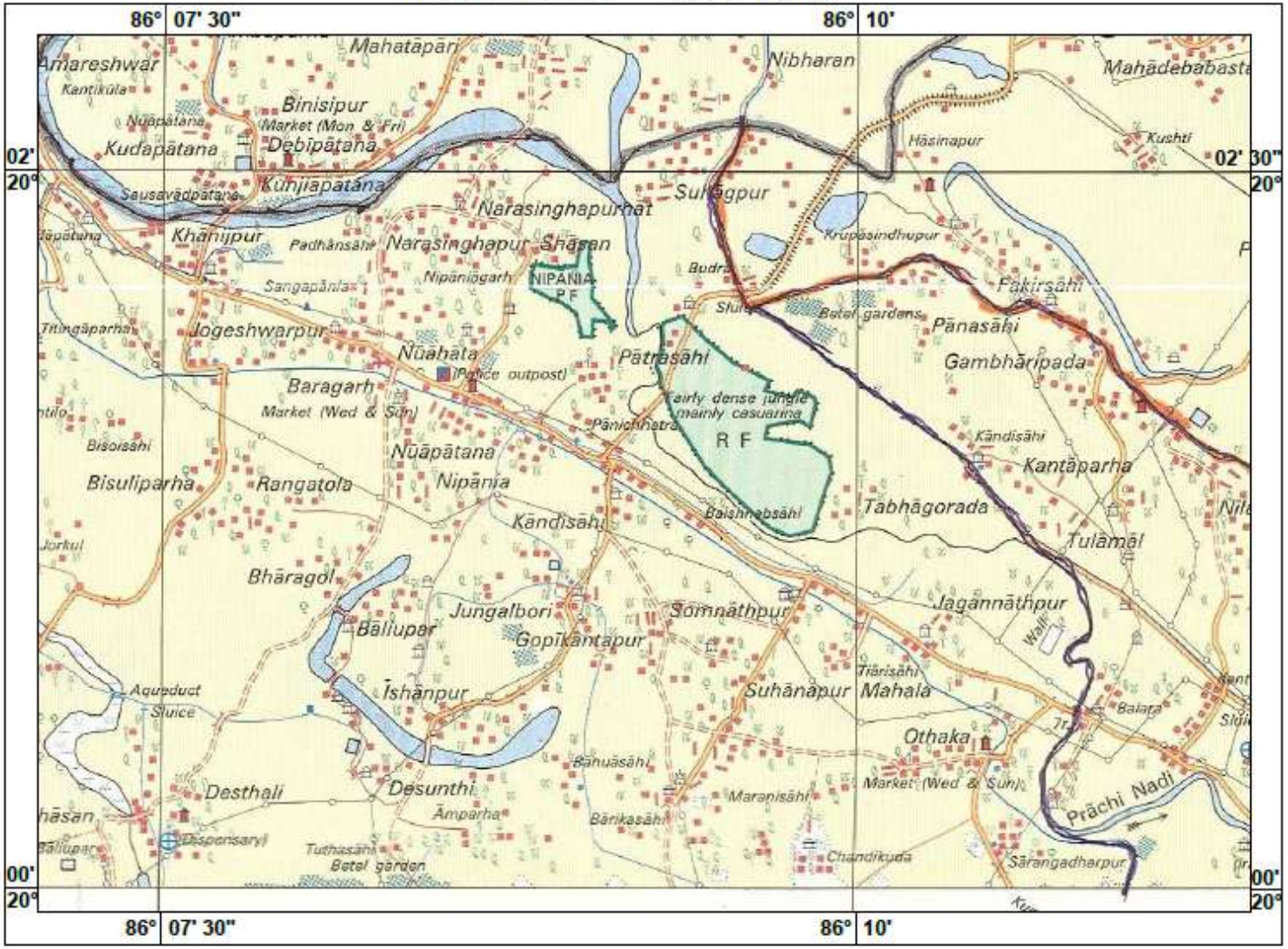
Sl No	WL Range	No of PRF	Area allotted in Ha	No of VF	Area allotted in Ha	Total area under Plantation WC.
1	Astaranga	1	10.00	3	9.100	19.100
2	Balukhanda	1	16.80	11	71.900	88.700
3	Brahmagiri	1	34.00	17	165.866	199.866
4	Konark	0	0.00	11	78.220	78.220
5	Gop	0	0.00	1	0.496	0.496
	Total	3	60.800	43	325.582	386.382

16.3: General Characteristics of Vegetation:

The area included in this Working Circle consists of old plantations of Eucalyptus, Acacia andCasuarinamostly in mixed form. Cashew plantations have also been created in many blocks partly in Village Forests. The trees available are in scattered manner with average crop density of 45-65%. The average height of the crop is 15-20 meters and GBH is about 90 cm. No regeneration is visible. Sporadic Acacia seedlings are observed in Acacia plantations but not established due to non opening of canopy. The Ground flora is mostly of grasses,weeds and eupatorium.

MAP SHOWING LOCATION OF NIPANIA & TOVAGOLARA PRF IN ASTARANGA WILDLIFE RANGE

TOPO SHEET : F45U4 SCALE 1:35,000



MAP SHOWING LOCATION OF MANIKAPATANA PRF IN BRAHMAGIRI WILDLIFE RANGE

TOPO SHEET : E45B10 SCALE 1:35,000

16.4: Planting Series, Planting Section and JFM areas:

16.4.1 Constitution of Planting series:

A- The planting area coming within PRF of this Division is allotted to Tavagolara-Manikapatna Planting series. Area under this planting series is 60.800 ha as detailed below. **(Table No 16.2)**

Table No 16.2: Constitution of Planting series. (for PRF)			
Name of Planting Series	Name of Range	Name of PRF	Area allotted in Ha
Tavagolara-Manikapatna Planting series	Astaranga WL Range	Tavagolara	10.000
	Balukhanda WL Range	Patanaikia	16.800
	Bramhagiri WL Range	Manika Patana	34.000
Total	**3 Range**	**3 PRF**	**60.800**

B- The area coming under Village Forest is allotted to two Planting series as detailed below **(Table No 16.3)**

Table No 16.3: Constitution of Planting series. (For Village Forest)			
Name of Planting Series	Name of WL Range	No of Village Forest Block	Area allotted in Ha
Kushabhadra Planting Series (KBPS)	Astaranga	3	9.100
	Balukhanda	11	71.900
	Konark	11	78.220
	Gop	1	0.496
Total	**4 Range**	**26**	**159.716**
Alarnath Planting Series (ALP)	Brahmagiri WL Range	17	165.866
G. Total	**5 Range**	**43 Blocks**	**325.582**

16.4.2: Area allotted to different Planting Sections:

The area allotted to Tavagolara- Manikapatna Planting Series is 60.800 ha, which spreads over three PRF in three ranges. As the area is comparatively small, it is proposed to cover the allotted land under plantation in **Four years**. Hence it is divided in to ***Four Planting Sections*** as follows.

Table No 16.4 Planting section & area assigned. (A) [for PRF]				
Name of Planting Series	Planting section	Name of PRF	Area allotted in ha	Year of Harvesting followed by Planting
Tavagolara-Manikapatna Planting series	TMPS-I	Tavagolara	10.000	2021-22
	TMPS-II	Patanaikia	16.80	2022-23
	TMPS-III	Manika Patana	17.00	2023-24
	TMPS-IV	Manika Patana	17.00	2024-25
1 Series	**4 Section**	**3 Blocks**	**60.800**	

Table No 16.4 Planting section & area assigned. (B) [for VF]					
Name of Planting Series	Planting section	Name of PRF	Area allotted in ha		Year of Harvesting followed by Planting
Kushabhadra Planting Series (KPS)	KPS-I	Kanti	2.500	17.500	2021-22
		Santrasa	3.000		
		Alanda (P)	7.500		
		Anasara	4.500		
	KPS-II	Alanda (B)	7.500	13.000	2022-23
		Khandala	3.000		
		Patalia	2.500		
	KPS-III	Badagaon	6.828	17.328	2023-24
		Kanpur	10.500		
	KPS-IV	Bhuan	12.400	15.900	2024-25
		Redhua	3.500		
	KPS-V	Baliguali	6.332	16.852	2025-26
		Bhikaripada	2.500		
		Raulpatna	0.800		
		Puba	7.220		
	KPS-VI	Samangarh	11.500	15.140	2026-27
		Bobua	1.200		
		Mahapur	0.400		
		Paikerapur	2.040		
	KPS-VII	Narasinghpur	4.000	16.500	2027-28
		Khalakata	12.500		
	KPS-VIII	Tikina (P)	12.500	17.840	2028-29
		Uchhpur	5.340		
	KPS-IX	Tikina (B)	12.500	12.500	2029-30
	KPS-X	Chheliberua	3.600	17.156	2030-31
		Alasankha	5.560		
		Nimapada	0.496		
		Jamara	7.500		
Total	**KPS**		**159.716**	**159.716**	

Table No 16.4 Planting section & area assigned. (C)					
Name of Planting Series	Planting section	Name of PRF	Area allotted in ha		Year of Harvesting / Planting
Alarnath Planting series	A.L.P.-I	Bhubanpur	17.750	17.75	2021-22
	A.L.P.-II	Bramhagiri	11.584	14.742	2022-23
		Chandiput	0.578		
		Budhisahi	1.08		
		Kalikabadi	1.50		
	A.L.P.-III	Gaudakera	5.000	14.44	2023-24
		Tinikudi	3.00		
		Kathuaredy	1.44		
		Kasijharia	5.000		
	A.L.P.-IV	Kalikabadi (P1)	18.000	18.00	2024-25
	A.L.P.- V	Kalikabadi(P2)	18.000	18.00	2025-26
	A.L.P.-VI	Kalikabadi (B)	18.000	18.00	2026-27
	A.L.P.-VII	Rameswar (P)	13.000	15.612	2027-28
		Niazpur	2.612		
	A.L.P.-VIII	Rameswar(B)	13.000	19.90	2028-29
		Sipasarubali (P)	6.900		
	A.L.P.-IX	Sipasarubali(B)	6.000	16.00	2029-30
		Sahajahanpur	10.00		
	A.L.P.-X	Bhandarikuda	0.372	13.422	2030-31
		Kashijharia	5.05		
		Chapamanik	8.000		
	Total			**165.866**	

16.4.3 Allotment of area to JFM (VSS Committee):

The area covered under Tavagolara- Manikapatna Planting Series has not been assigned to any VSS for protection & management.

The area coming under Village Forests and assigned to both the Felling series i.e.**Konark Planting Series (KPS) and Alarnath Planting Series (AlP)**have been assigned to concerned Village Forest Committee (VFC) constituted under Rule-3 of the Village Forest Rules, 1985. The entire area (325.582 ha) under village forest has been assigned to VFC for management under JFM Mode. The provisions of Village Forest Rules, 1985 regarding sharing of forest produce i.e. Rule 9 will be applicable. This matter required to be discussed and resolution passed in VFC before taking up plantation / harvesting etc.

16.5: Blocks / Compartments/ JFM Area depicted on GIS Maps.

The location map of PRF has been depicted on Management Map (1:50000 Scale) attached to this Working Plan. The location of Village Forest and area assigned to VFC / VSS are depicted on Cadastral map (16"= 1 mile).

16.6: Special Objectives of Management:

The objectives of management envisaged for this working circle are within the broad objectives of this working plan. The special objectives are

(i) To bring the plantations raised here and there to a single management fold and scientifically managed to optimize the yield.
(ii) To encourage participatory management of erstwhile Social Forestry Plantations and activate the VFC.
(iii) To Increase availability of Firewood and timbers in the locality and reduce pressure on forests for fuel wood.
(iv) To cover up the vacant lands in PRF / VF with fast growing species and to meet industrial as well as local demand on Forest Produce mainly Fire wood.
(v) To increase the crop density of forests and improve the Carbon Sequestration.
(vi) To develop a healthy usufruct benefit sharing mechanism in the villages and encourage natural resource management with a community approach method.

16.6.1 Analysis of the Crop:

The crop is a mixed crop of planted seedlings of Casuarina, Eucalyptus, Acacia, and Cashew etc. The age class depends upon year of planting. The crop is more or less irregular and partly damaged due to cyclone **"Phani".**

16.6.2 Silvicultural System:

Silvicultural System **"Clear felling with standard followed by Artificial Regenerationthrough planting"**will be adopted. Where ever promising coppice shoots will be developed / come up, the same will also be retained to reduce the replanting cost. The number of standards per hectare will depend upon proximity to Sea, Biotic interference, possibility of dispersal of seeds for a high forest system, fruit bearing species, having timber value at a higher girth class especially required for Construction of Chariots for ***Lord Jagannath, Lord Balabhadra and Devi Subhadra.*** The minimum number of trees prescribed for retention is 25 number and maximum 75 numbers per hectare.

16.6.3 Rotation Period:

The normal rotation period is Ten years which is co-terminus with the plan period. The standard trees those will be retained are required to be removed when they will either achieve their objectives or attain utilizable girth. The standard trees those are likely to be retained are Acacia, Neem, Simal, Phasi, Cashew and fruit bearing species. The exploitable girth prescribed to be followed in the next plan period is furnished below in Table No 16.5. The trees planted under Jagannath Van Prakalpa (JVP)in Tavagolera PRF and Patnaika PRF will be harvested on attaining exploitable diameter as per Table 16.5 to supply timber for construction of chariots for Lord Jagananath, Lord Balabhadra and Devi Subhadra of Puri temple. Consequent upon harvesting of exploitable trees if opening is created plantation (AR /ANR) can be taken up there.

Table no 16.5Exploitable Diameter / Girth of Standard trees

Sl No	Species Retained as standard	Exploitable diameter / Girth in Cm		Remark.
		GBH	Diameter	
1	*Acacia auriculiformis (Sunajhari)*	90& above	29	
2	*Anacardiumoccidentale (Cashew)*			As long as Fruiting continues.
3	*Anogeissus acuminata (Phashi)*	180& above	57	
4	Anthocephalus cadamba (Kadamba)	150& above	48	
5	*Azadirecta indica (Neem)*	180& above	57	
6	*Bomax ceiba (Simili)*	150& above	48	
7	Erythrina variegata *(Paladhua)*	150& above	48	
8	*Gmelina arborea (gambhari)*	150& above	48	
9	Melia azedarach (Mahaneema)	120& above	38	
10	Fruit bearing species			As long as Fruiting continues.

16.6.4 Harvestable Diameters:

All trees available in the assigned area will be felled except the Standards to be retained. The standards and JVP plantation will be harvested when attained harvestable diameter / Girth (GBH) as prescribed at **Table No 16.5** above.

16.6.5 Reducing factors and reduced areas:

Reduction factor is not applicable.

16.6.6 Felling Cycle:

The felling cycle is ten years which is coterminous with the plan period.

16.6.7 Calculation of Yield:

No previous data / statistics is available to calculate the yield from this type of plantations. The yield will be regulated by "Area only". On visit to plantations included in this working circle, it is observed that the crop density is about 50%. As the standing crop will be harvested as firewood, the probable yield will be around 70 Ton per hectare.

16.6.8 Table of Harvesting (Felling) /Planting:

The Village Forests / PRF assigned to this Working Circle have been divided to three felling / planting series namely ***Tavagolara- Manikapatna Planting Series***, ***KushabhadraPlanting series*** and ***Alarnath Planting Series***. The year wise area assigned for felling and subsequent planting have been provided in **Table No 16.4 (A), 16.4 (B) and 16.4 (C) .**

16.6.9 Method of Executing Harvesting (Felling) / Planting:

16.6.9.1 Method of Executing Harvesting (Felling):

(a) Consultation with VSS / VFC:

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 Area:

In case of PRF, the area is to be demarcated on ground by putting RCC pillars, if the demarcating line coincides with the PRF Boundary. In other cases, putting of Stone Cairns at a visible distance will be sufficient.

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 most of the cases, the entire block is assigned for working in a single year, in that case only boundary line is of importance. In few cases the area is to be worked in two consecutive years. In that case Boundary line and a tie line dividing the area in to two equal half are to be maintained as depicted in the village sheet (16"= 1 Mile). 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 Standard Trees:

As the system to be followed is "**Clear Felling with Standard",** it is required to mark the standardsinitially. The criteria for selection of standards in general are furnished below.

- Timber species of greater importance,
- Timbers species required for construction of Chariots of Lord Jagannath and at present below the required girth,
- Fruit bearing trees like Mango, Jack Fruit, Barkoli (Zyziphus), Palm, Cashew,
- Any Plus tree suitable for seed collection for raising plantations,
- Any trees associated with sentiments of local villagers areto 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.

<u>Suggested format:</u>

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.

List of Standard Trees selected for retention					
Sl No	Name of Species	GBH in cm	Latitude / Longitude	Crown diameter in meter	Remark
				Signature of Marking Officer.	

(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 / sea shore to a width of 40m measured from High Flood level / High tide line 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 are to be retained.
iv) Trees on rocky surface / above 30^0slope / high erosion prone area are not to be marked for felling.
v) The trees suitable for construction of Chariot of ***Load Jagannath / Balabhadra / Subhadra*** are to be marked and listed separately.

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 trees suitable for Chariot construction is required to be felled & converted as per requirement of Jagannath Temple administration. 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.

(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 saw do not produce coppice shoots. As most of the species are good coppicer, it is suggested to fell the trees with axe only. Subsequent logging may be taken up by saw or as convenient to OFDC Ltd 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, managed by VFC 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.

16.6.10 Subsidiary Silvicultural Operations:

Subsidiary Silvicultural Operation (SSO) after main felling in any coupe is essential to maintain the hygiene of any forest. It involves Cleaning of the debris and thinning of the advance growth if any retained during marking.

16.6.10(a) Cleaning:

As the silvicultural system adopted is clear felling, the cleaning operation involves

- 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.
- Fell & Remove the marked trees, if not removed by the OFDC Ltd.
- Remove all weeds by uprooting mechanically.
- Make the coupe area suitable for taking up plantation.

16.6.10(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.

16.6.11 Regeneration:

The Coupe area is to be restocked through artificial regeneration i.e. by planting of seedlings with adequate Soil & Moisture Conservation measures. The standard planting technique has been enumerated in approved cost norm. To refresh the steps involved, the procedure is summarized in brief.

16.6.11.1 Survey,demarcation, site preparation, alignment & stacking:

The coupe area has been well demarcated and pillars posted during coupe marking and described under **Para 16.6.9.1(b).** In case of Block plantation @1600 trees per hectare at a spacing of 2.5mx2.5m is to be adopted. In case of Casuarina Plantation a spacing of 2mx2m will be adopted.

16.6.11.2 Pitting:

The areas under consideration are mostly sandy alluvial soil / sandy soil. A pit size of 30cmx30cmx30cm is recommended. Though pitting is generally carried out during January- March, there is every possibility of filling of pits during pre-monsoon as the soil is soft & loose. Hence pitting may be carried out towards middle of May and allow weathering at least for one month before planting.

16.6.11.3 Choice of Species & Nursery:

In Tavagolara- Manikapatna Planting series (TMPS), forest blocks assigned are of Natural vegetation. It is recommended to plant species matching to the vegetation of the forest. The species recommended are

i. *Dalbegia Sisoo (Bali Sisoo),*
ii. *Anogeissus acuminata (Phasi)*
iii. *Bombax ceiba (Simili)*
iv. *Terminalia tomentosa (Asan)*
v. *Anogeissus latifolia (Dhaura)*
vi. *Erythrina indica / suberosa (Paladhua)*
vii. *Acacia catechu (Khair)*
viii. *Melia azadiracht (mahaneema).*
ix. *Samania saman (Bada chakunda)*
x. *Terminalia belerica (Bahada)*
xi. *Syzygium cumini* (*Jamu)etc.*

Nursery for required species and number may be raised in permanent nursery or in a temporary nursery as convenient. The standard nursery technique found in any silviculture text or standard practices may be followed. The recommended height of seedling before planting is 60cm to 75cm in case of six month old seedlings and 100 cm in case of one year old seedlings. For seed collection, plus trees available in the locality or brought from known source of origin may only be utilised. Unknown source should be strictly avoided to have a better plantation.

16.6.11.4 Planting:

Planting of seedlings shall be taken up during last week of June / 1st week of July. During planting, application of Chemical fertilizer is recommended at sites away from water sources / near to Sea shore as there is possibility of leaching and subsequent contamination of water bodies. In that case application of FYM / Organic fertilizer is recommended. In no case chemical fertiliser and insecticides should be applied.

After planting following Post care is recommended.

a) **Causality Replacement**.

After planting, some planted seedlings may get damaged. These dead / defective seedlings are required to be replaced within 15 days of planting or as soon as possible with better seedlings.

b) **Weeding &Soil Working:**

After 30 days of planting, the planted seedlings start bearing new leaf. From 30 days to 45 days soil working around the plant along with application of organic fertilizer is recommended. Weeding around the plant i.e. patch weeding is to be taken up. In case of area with heavy weeds / grasses strip weeding proves beneficial. Number of weeding in a year may be decided as per cost norm provisions. Two weeding in 1st year is always prescribed.

c) **Mulching:**

In sandy soil, mulching by dried grasses from February to June helps in retaining soil moisture. Hence it is recommended in case of sandy soil with complete open areas.

d) **Watering:**

In case of Casuarina plantations, watering provisions are inbuilt with the cost norm. Hence watering is to be provided during summer for first year and second year.

e) **Fire Protection / watch & ward:**

Fire protection measures and watch & ward against grazing are strictly to be implemented.

16.6.12 Associated Regulations and Measures:

In case of plantations the plantation journal and Nursery journal are to be maintained. The details of operation, yield, year of working etc along with the photographs are to be recorded / placed in the Compartment history.

16.6.12.1 Eviction of Encroachments & planting:

There are PRFs which has been partly or fully encroached either by individual / group or community. It will be the prime endeavour to get the area vacated and make the area free from encroachment. The area free from encroachment is to be brought under plantation of 380.358ha PRF has found to be under encroachment (as per area statement chapter 13). It is proposed to evict at least 40 ha of land and bring it to management fold every year. It is programmed to plant the evicted area as per suitability. Either Agro Forestry Model or Block Plantation model may be adopted depending upon situation. A target of 40 ha plantation every year is planned in this plan.

The prescriptions for eviction and acquire of the encroached forest area is covered under Protection Working Circle.

16.6.12.2 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 Working Plan prescription.

Table No 16.11 Plantation Control Form No-3

Name of Planting Series	Year of Working	Area assigned in ha	No of Standard Trees marked	Quantum of Timber / F.W obtained	Area actually planted up	Reason of Deviation if any.

CHAPTER-17
PROTECTION WORKING CIRCLE

17.1: Protection Working Circle:

Cyclonic Storm hits the Puri Coast frequently. In the near past Cyclone is experienced in every alternate years. Forests adjacent to sea shore are required to be managed so as to put a check to wind speed. It is also required to create more wind break all along the coast line at a width of 50m to 500 m depending upon availability of land.

Areas from 10 PRFs are under encroachment to an extent of 380.358ha. This area is required to be made encroachment free and bring under vegetative cover either by planting departmentally or through VSS in a joint management modeto resume its original vegetative cover. This area is also assigned to Protection Working Circle for effective action.

17.2: General Constitution of Working Circle:

Category-I: Sahana Extension is the extension of the Sahana PRF built up due to accumulation of Sand by River / Sea. The land has been stabilized by planting Casuarina since long. It was included in the outgoing working plan and managed under **"Car Timber Working Circle"**which has been covered with Casuarina Plantation. Though the objective of plantation is to harvest the crop regularly for fuel wood purpose for Lord Jagannath temple and Swargadwar, but experiencing the frequent cyclone at Odisha Sea Coast particularly in Puri District, it is proposed to retain a strip of 2 chain width (40m) from the sea shore outer line as wind break and will be managed under **"Protection Working Circle".**The area calculated to be 54.187 ha covering a length of 13.546 Km along the sea shore.

Category-II: Besides that, the areas under encroachment in PRF blocks aggregating to 380.358 ha are also assigned to this Working Circle for effective management. The details of area assigned to this Working Circle are furnished below. Total area under this protection Working Circles comes to **434.545 ha**.

Table No 17.1 : Total area under Protection Working circle					
Sl No	Range	Name of Forest Block	Total area in Ha	Area assigned to Protection WC in ha	Remark
Category-I					
1	Astaranga WL	Sahana Ext. (Revenue Forest)	508.670	54.187	Casuarina Plantation within 2 chains along the Sea shore.
Category-II					
2	Konark WL	Kuakhai PRF	4.800	3.800	Under Encroachment
3	Astaranga WL	Sahana PRF	322.000	8.378	Nolia Sahi Basti (Encroached)
4	Astaranga WL	Tavagolara PRF	71.280	7.380	Under Encroachment
5	Bramhagiri WL	Gopinathpur –I PRF	9.600	9.600	Under Encroachment
6	Bramhagiri WL	Gopinathpur –III PRF	80.00	80.00	Under Encroachment
7	Bramhagiri WL	Siaria PRF	32.800	32.800	Under Encroachment
8	Bramhagiri WL	Rameswarpur PRF	20.400	20.400	Under Encroachment
9	Bramhagiri WL	Sana Andhari PRF	40.00	40.00	Under Encroachment
10	Bramhagiri WL	Bada Andhari PRF	120.00	120.00	Under Encroachment
11	Bramhagiri WL	Manika Patana	92.00	58.00	Under Encroachment
	Total (Category-I & II)		**1301.55**	**434.545**	

17.3: General Characteristics of vegetation:

The vegetation is of Casuarina plantation starting from 2 years old to 10 years old. It is in pure crop. Due to wind pressure the tree growth is stunted towards coast line. The height varies from 1m to 10m. The crown density is about 80%. Due to its crown system and close spacing, it acts as a good wind break / Shelter belt. It has the capacity to reduce the wind speed up to 20% within 2-3 km in the lee ward side.

The area under encroachment is either under habitation / agriculture/ Cashew Plantation by Community.

17.4: Felling Series, Cutting Sections and JFM areas:

Category-I: The assigned area is to be protected against theft, fire etc. No felling is permitted within the Plan period. No area from this working circle is assigned to any VSS.

Category-II: The area under encroachment is assigned to **Encroachment Removal Series** to put thrust on bringing back into administration fold of Forest Department.

Table No 17.2 : Felling series, cutting section and JFM area

Name of the Series	Forest block assigned	Area in Ha	Year of Operation	Remark
Sea coast Protection Series	Sahana Extension	54.187	Entire Plan Period i.e. 2021-22 to 2030-31	Under strict Protection as a shelter belt / wind break
Encroachment Removal Series	Sahana PRF	8.378	2021-22	Eviction drive to free the encroachment may be initiated in the assigned year or prior to it as the work may take more time than a year. It may be attempted in the subsequent years if the eviction is not completed
	Tavagolara PRF	7.380	2022-23	
	Gopinathpur –I PRF	9.600	2023-24	
	Gopinathpur –III PRF	80.00	2024-25	
	Siaria PRF	32.800	2025-26	
	Rameswarpur PRF	20.400	2026-27	
	Sana Andhari PRF	40.00	2027-28	
	Bada Andhari PRF	120.00	2028-29	
	Manika Patana	58.00	2029-30	
	Kuakhai PRF	3.800	2030-31	
	S. Total	380.358		
	G. Total	**434.545**		

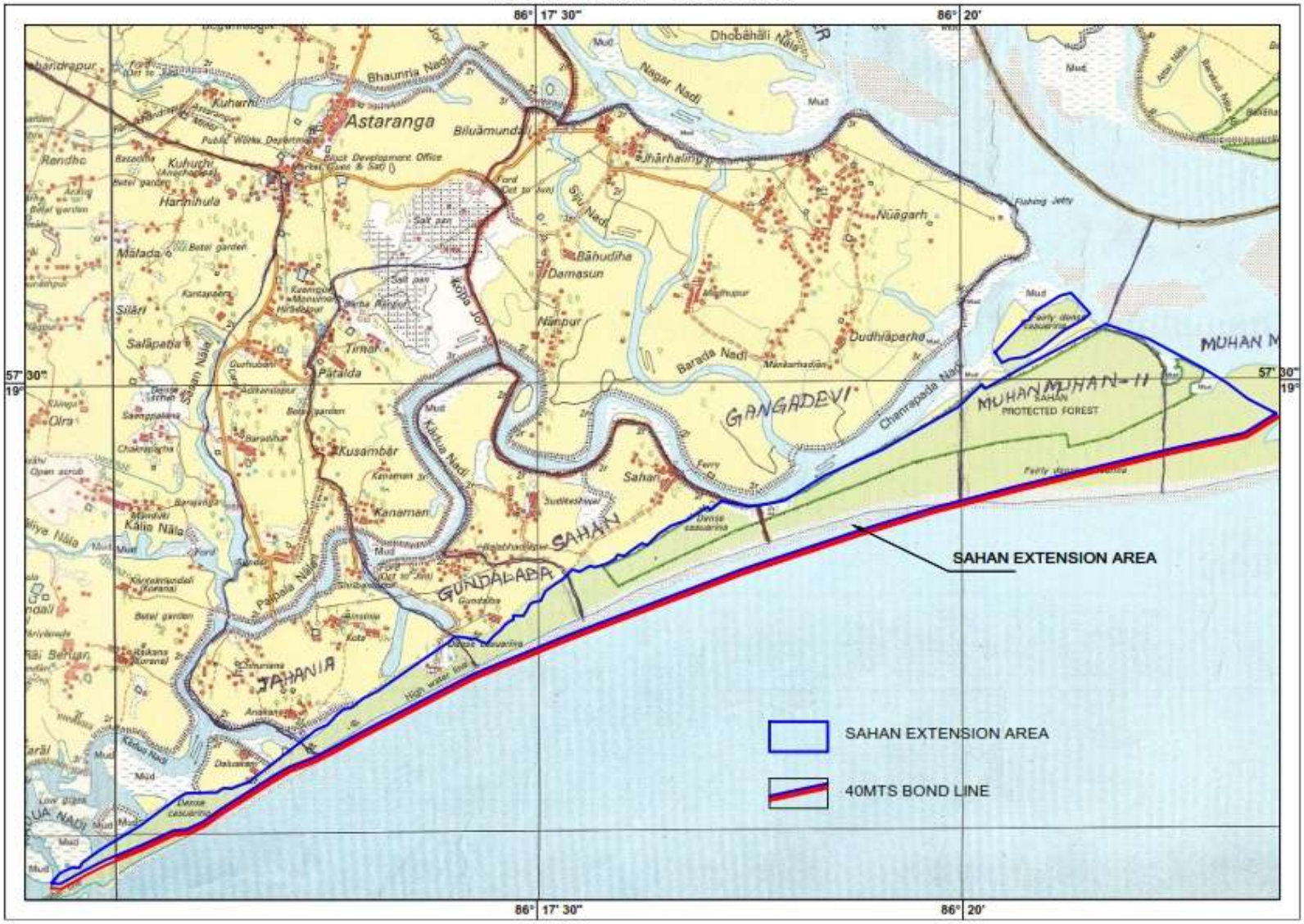
17.5: Blocks / Compartments area depicted on GIS Maps.

The casuarina plantation area of 54.187 ha from Sahana Extension is depicted on Survey of India Topo sheet No 74I/5 (NW) map (1:25000 Scale). The same is also furnished below for reference.

The encroachment area as indicated in the above table has been depicted on Survey of India Topo map (1: 50000 Scale) for reference.

MAP SHOWING LOCATION OF SAHAN EXTENSION PRF IN ASTRANGA WILDLIFE RANGE

TOPO SHEET : E45C5 SCALE 1:35,000



17.6: Special Objectives of Management:

The special objectives of management are as follows.

- To maintain tree cover all along the sea shore.
- To stand against cyclonic storm frequently meeting the land mass in Puri Coast.
- To reduce the wind velocity / speed within 2-3 km in the lee ward side.
- To check the shifting of sand dunes towards landmass.
- To protect the plantations against sand cover and wind fall.
- To provide a good recreational venue along the sea shore.
- To act a shelter belt and prevent sea shore erosion due to tidal waves.
- To remove encroachment and bring the land to administrative control of the department.
- To plant up the encroachment area with suitable planting model.

17.6.1 Silvicultural System:

The assigned area is to be completely protected and maintained as tree cover. Hence no silvicultural system is prescribed.

In case of Category-II land, it is proposed to cover the area under Plantation Program & strict protection against land grabbers.

17.6.2 Rotation Period:

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

The encroached area is to be made free within the Plan period and planted up. Hence a ten year cycle is prescribed.

17.6.3 Harvestable Diameters& Principle thereof:

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

17.6.4 Reducing factors and reduced areas:

There is no yield prescribed. Crop density is taken as 1 (One). No reducing factor is prescribed to regulate yield.

17.6.5 Felling Cycle:

No felling Cycle is prescribed except salvage of timer / firewood depending upon occurrence of natural calamity like cyclone resulting uprooting of trees. Cycle of Salvage depends upon occurrence of Cyclonic storm.

17.6.6 Calculation of Yield:

No yield is calculated as the vegetation is retained for protection against wind, tidal effect and shifting of sand.

17.6.7 Table of Felling / Treatment:

The entire area is treated as a single unit and any treatment to be taken up will be applicable to total area under this working circle.

17.6.8 Method of Executing Felling / Treatment:

17.6.8.1: For removal of wind fallen trees, the following method is to be adopted.

a) Marking of Wind fallen trees:

Just after the natural calamity resulting uprooting of trees, the fallen trees is to be enumerated along with the GBH at 1.37m above the collar zone of the tree. The marking list is required to be cross checked by the Forest Range Officer. The marking list is to be accepted by the Divisional Forest Officer and returned to Range Officer for conversion and stacking.

b) Conversion:

After receipt of marking list from Divisional Forest Officer, the Range Officer is to take steps for its conversion to Firewood and stack it outside the area to prevent further damage to existing tree growth. The firewood is required to be stacked in size 12'x3'x3'. The conversion list is required to be submitted to DFO, Puri WL Division for disposal order.

c) Disposal:

As per the convention the converted materials are to be delivered to OFDC Ltd for needful marketing. The prevailing royalty is to be raised from OFDC Ltd. In case of unwillingness of OFDC Ltd for taking delivery for any reason, the material could be disposed of by local sale / auction.

17.6.8.2: Although 380.358 ha of forest land have been encroached for homestead purpose and cultivation purpose, there is no individual claim or community claim settled in favour of encroachers under the provision of Forest Right Act, 2005 (Odisha Schedule Tribe & other Traditional Forest Dweller's Recognition to Forest Rights Act, 2005). As per Hon'ble Supreme Court's order re-verification of rejected claims has been completed and it is found that nobody is found eligible to get forest right patta under the Act. Now the next step is to evict them from the forest land by the help of District Administration and Police. Eviction drive to free the encroachment may be initiated in the assigned year or prior to it as the work may take more time than a year. It may be attempted in the subsequent years if the eviction is not completed.

If then District Administration wants to settle the encroachment instead of eviction the Revenue Authority may follow the provision of diversion of forest land under Forest Conservation Act by identifying suitable non-forest land for alienation in favour of Forest Department for raising compensatory afforestation.

To make encroached land free from encroachment and Rehabilitation of the area the following steps may also be taken up.

- Discussion with VSS / Villagers and convincing them the need to make it encroachment free.
- Adopt Legal means if so warranted.
- To convince the individual encroacher to adopt agro forestry model for few years and brought area under vegetation (Rehabilitation).
- In case of Community encroachment, VSS may be strengthened & regulated to manage the PRF under Joint management practices.
- If required the area may be adopted under AJY (Aama Jungal Yojana) or FDA or ICZMP. Villagers may be motivated through EPA / JFM Provisions etc.

17.6.9 Subsidiary Silvicultural Operations:

17.6.9(a) Cleaning:

Just after cyclonic storm and after removal of the fallen trees, broken up / hanging branches are to be removed. The debris if in little quantum, it may be allowed to form humus and enrich soil organic condition. If the leaf litters, branches fallen on the ground is more than 10-15cm thick, then it is required to be partly removed and buried on the sand / soil away from the area. It is required to maintain the soil hygiene and reduce fire hazard.

17.6.9(b) Thinning:

No thinning is prescribed in the stand coming within the Protection Working Circle. However if dead trees are noticed in groups of 5-10 trees, it may be removed along with the wind fallen / up rooted trees. This operation can only be taken up if, any such removal warranted after cyclonic storm. Only thinning operation for dead trees are not recommended.

17.6.10 Regeneration:

The area under this working circle is always to be maintained at a stage of "Closed Canopy". If any permanent gap is noticed due to cyclonic effect or some other reasons, the area shall be brought under tree cover by planting at first opportunity. The species to be planted is casuarinas, Neem, Banyan or any species suitable to site and for wind break.

17.6.11 Associated Regulations and Measures:

The area under this Working Circle is along the sea shore covering a distance of 13.54 km. During November – January, many tourists / local people used to visit the site and make picnic. Sometimes it may cause fire hazard. Leftover food, solid waste scattered all around gives an ugly look to the site. It is required to keep the site hygienic. Following adequate steps required to be taken for

- Prevention of fire hazards,
- Management of Solid waste,
- Removal of waste food from the site,
- To keep / maintain tranquillity of the area,
- No damage to vegetation,
- No fire wood collection from the plantation / forest area.

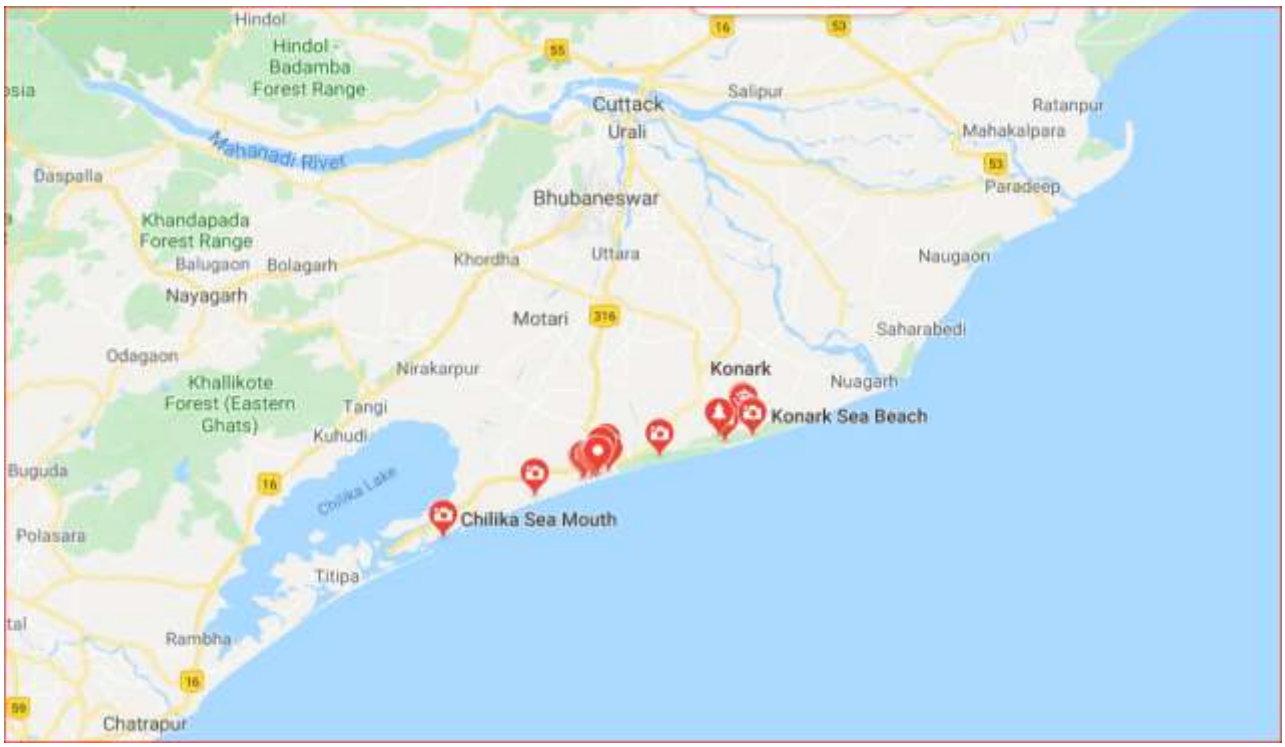
CHAPTER-18
WILDLIFE (OVERLAPPING) WORKING CIRCLE.

18.1: Wildlife (Overlapping) Working Circle:

Puri Wildlife Division comprises One reserved forest, Nineteen Proposed Reserved Forest and Forty three Village Forest as declared under provisions of Odisha Forest Act,1972. Out of the above forest blocks, theonly Reserved Forest of the division and six PRF constitute the Balukhanda Sanctuary. Besides the forest blocks under administrative control of the Forest Department, there are revenue forests / mangrove forests over 121.9 sq. Km. the wild animals are seen throughout the division. For the management of wild animals, the entire area is taken as an entity. For physical interventions besides the wildlife Sanctuary, the forest blocks under administrative control of Forest department is taken in to consideration and this Wildlife (Overlapping) Working Circle is constituted. The total area under this Overlapping Working Circle is **981.792 ha**.

18.2: General Constitution of Working Circle.

The rich varied **Fauna** of this division are due to existence of Coast line covering 85 Km (Total sea coast of Puri district-150.40 Km), Mangrove forests along the River Devi and Kadua confluence and mouth region, extensive Casuarina man made forests, Cashew plantations and various water bodies along the coast of Bay of Bengal and different type of natural wildlife habitat in the coastal plane.



Presence of considerable number of spotted deer, hyena, jungle cat, fishing cat, water monitor lizards, snakes are noticed in the sanctuary and all the PRFs , Village Forests, Revenue Forests and along sea coast. Olive Ridley Sea Turtle nest on the sea beach near Devi River Mouth and along the coast of Puri district during January to March every year are seen. Other marine life like Conch (Sankha), Snail (Samuka), varied types of fishes, substantial population of small animals like monkeys are seen all over the Division, i.e. both in the forest as well as rural / urban areas. Many birds are normally seen in the coastal zone throughout the year. Migratory birds are seen in mangrove forest of Devi River / Kadua River confluence and mouth. All the Forest Blocks – Except those within Balukhanda Sanctuary are included in this Overlapping Working Circle. Besides the Forest blocks, the sea coast, Water body River confluence & mouth are included for general consideration.The Forest Blocks included in this working circle are furnished below.

Table No: 18.1 Area allotted to Wildlife (Overlapping) Working Circle.

Sl No	Name of Forest Block	Area in Ha	Area under encroachment in ha	Area under WL(O) WC
Proposed Reserved Forest.				
Konark WL Range				
1	Junei	7.800	0	7.800
2	Kuakhai	4.800	3.800	1.000
Astaranga WL Range				
3	Sahana	322.000	8.378	313.622
3A	Sahana Extention	508.670	0	508.670
4	Nipania	10.800	0	10.800
5	Tavagolara	71.280	7.380	63.900
Balukhanda WL Range				
6	Patanaikia	42.00	0	42.00
Bramhagiri WL Range				
7	Manika Patana	92.000	58.000	34.000
	Total	**1059.35**	**77.558**	**981.792**

18.3: General Characteristics of Fauna:

The Fauna / Avifauna / Marine live normally observed throughout the year and migratory birds, Sea turtle are the general constituents and the target species for holistic management. The thrust species & their brief characteristics are described below.

(a) Spotted Deer (Axis axis):

The spotted deer a species of deer that is native in the Indian subcontinent and main species of Balukhanad sanctuary. A moderate-sized deer, male chital reach nearly 90 cm and females 70 cm at the shoulder. While males weigh 30–75 kg, the lighter females weigh 25–45 kg. The species is sexually dimorphic; males are larger than females, and antlers are present only on males. The upper parts are golden to rufous, completely covered in white spots. The abdomen, rump, throat, insides of legs, ears, and tail are all white. The antlers, three-pronged, are nearly 1 m long.The underparts are white or creamy in color. The tail is short, with white underparts. They have white furs on the lower lip and chin.

They breed throughout the year, but peak in April to August. Sexually active males follow these groups during the mating season while less active males form bachelor herds. The pair will do several bouts of chasing and mutual licking before copulation. Females usually give birth to a single young, sometimes 2 fawns are born, after a gestation period of 7 to 8 months.

(ii) Bali Harina (Black Buck -*Antilope cervicapra*)

The blackbuck (*Antilope cervicapra*), also known as the Indian antelope, is an antelope found in India, Nepal, and Pakistan. The blackbuck is the sole extant member of the genus *Antilope*. It stands up to 74 to 84 cm (29 to 33 in) high at the shoulder. Males weigh 20–57 kg (44–126 lb), an average of 38 kilograms (84 lb). Females are lighter, weighing 20–33 kg (44–73 lb) or 27 kg (60 lb) on average. The long, ringed horns, 35–75 cm (14–30 in) long, are generally present only on males, though females may develop horns, as well. The white fur on the chin and around the eyes is in sharp contrast with the black stripes on the face. The coats of males show two-tone coloration; while the upper parts and outsides of the legs are dark brown to black, the underparts and the insides of the legs are all white. However, females and juveniles are yellowish fawn to tan.

The blackbuck is a diurnal antelope (active mainly during the day). Three kinds of groups, typically small, are the female, male, and bachelor herds. Males often adopt licking as a strategy to garner females for mating. While other males are not allowed into these territories, females often visit these places to forage. The male can thus attempt mating with her. As herbivores, blackbuck graze on low grasses, occasionally browsing, as well. Females become sexually mature at 8 months old, but mate no earlier than 2 years. Males mature later, at 1 1/2 years. Mating takes place throughout the year. Gestation is typically 6 months long, after which a single calf is born. The lifespan is typically 10 to 15 years.

The blackbuck inhabits grassy plains and slightly forested areas. Due to their regular need of water, they prefer areas where water is perennially available. Hunting of blackbuck is

prohibited under Schedule I of the Wildlife Protection Act of 1972. The blackbuck has significance in Hinduism; Indian and Nepali villagers do not harm the antelope.

(v) Hyena

Hyenas or **hyaenas** are any feliform carnivoran mammals of the family **Hyaenidae** With only four extant species (in three genera), it is the fifth-smallest biological family in the Carnivora, and one of the smallest in the class Mammalia. Despite their low diversity, hyenas are unique and vital components of our ecosystems.

Although phylogenetically they are closer to felines and viverrids, and belong to the feliform category, hyenas are behaviorally and morphologically similar to canines in several elements of convergent evolution; both hyenas and canines are non-arboreal, cursorial hunters that catch prey with their teeth rather than claws. Both eat food quickly and may store it, and their calloused feet with large, blunt, no retractable claws are adapted for running and making sharp turns. However, the hyenas' grooming, scent marking, defecating habits, mating and parental behavior are consistent with the behavior of other feliforms.

Spotted hyenas may kill as many as 95% of the animals they eat, while striped hyenas are largely scavengers. Generally, hyenas are known to drive off larger predators, like lions, from their kills, despite having a reputation in popular culture for being cowardly.Hyenas are primarily nocturnal animals, but sometimes venture from their lairs in the early-morning hours. With the exception of the highly social spotted hyena, hyenas are generally not gregarious animals, though they may live in family groups and congregate at kills.

(vi) Rhesus Monkey

The rhesus macaque (*Macaca mulatta*) is one of the best-known species of Old World monkeys. It is 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.The rhesus macaque is brown or grey in color and has a pink face, which is bereft of fur. It has, on average, 50 vertebrae, a dorsal scapulae and a wide rib cage. Its tail averages between 20.7 and 22.9 cm. Adult males measure about 53 cm on average and weigh about 7.7 kg. Females are smaller, averaging 47 cm in length and 5.3 kg in weight. The ratio of arm length to leg length is 89%.Rhesus macaques are native to India, Bangladesh, Pakistan, Nepal, Burma, Thailand, Afghanistan, Vietnam, southern China, and some neighbouring areas. They have the widest geographic ranges of any non-human primate, occupying a great diversity of altitudes throughout Central, South, and Southeast Asia. Inhabiting arid, open areas, rhesus macaques may be found in grasslands, woodlands, and in mountainous regions up to 2,500 m in elevation. They are

regular swimmers. Babies as young as a few days old can swim, and adults are known to swim over a half mile between islands, but are often found drowned in small groups where their drinking waters lie. Rhesus macaques are noted for their tendency to move from rural to urban areas, coming to rely on handouts or refuse from humans.They adapt well to human presence, and form larger troops in human-dominated landscapes than in forests.

(vii) Pangolin

Pangolins under scaly anteaters are mammals of the order Pholidota. The one extant family, Manidae, has three genera: Manis, which comprises four species living in Asia; Pangolins have large, protective keratin scales covering their skin; they are the only known mammals with this feature. They live in hollow trees or burrows, depending on the species. Pangolins are nocturnal, and their diet consists of mainly ants and termites, which they capture using their long tongues. They tend to be solitary animals, meeting only to mate and produce a litter of one to three offspring, which are raised for about two years.

Pangolins are threatened by poaching (for their meat and scales) and heavy deforestation of their natural habitats, and are the most trafficked mammals in the world.Of the eight species of pangolin, four (Phataginus tetradactyla, P. tricuspis, Smutsia gigantea, and S. temminckii) are listed as vulnerable, two (Manis crassicaudata and M. culionensis) are listed as endangered, and two (M. pentadactyla and M. javanica) are listed as critically endangered on the International Union for Conservation of Nature Red List of Threatened Species.

The physical appearance of a pangolin is marked by large hardened overlapping plate-like scales, which are soft on newborn pangolins, but harden as the animal matures.They are made of keratin, the same material from which human fingernails and tetrapod claws are made, and are structurally and compositionally very different from the scales of reptiles.The pangolin's scaled body is comparable in appearance to a pine cone. It can curl up into a ball when threatened, with its overlapping scales acting as armor, while it protects its face by tucking it under its tail. The scales are sharp, providing extra defense from predators.

Pangolins can emit a noxious-smelling chemical from glands near the anus, similar to the spray of a skunk.They have short legs, with sharp claws which they use for burrowing into ant and termite mounds, and climbing.

The tongues of pangolins are extremely long and – like those of the giant anteater and the tube-lipped nectar bat – the root of the tongue is not attached to the hyoid bone, but is in the thorax between the sternum and the trachea.Large pangolins can extend their tongues as much as 40 cm, with a diameter of only 0.5 cm.

(viii) Porcupine.

Porcupines are large rodents with coats of sharp spines, or quills that protect them against predators. The term covers two families of animals: the Old World porcupines of family Hystricidae, and the New World porcupines of family Erethizontidae. Both families belong to the infraorder Hystricognathi within the profoundly diverse order Rodentia and display superficially similar coats of quills: despite this, the two groups are distinct from each other and are not closely related to each other within the Hystricognathi.

The Old World porcupines live in southern Europe, Asia (western and southern), and most of Africa. They are large, terrestrial, and strictly nocturnal. In taxonomic terms, they form the family Hystricidae.Most porcupines are about 60–90 cm long, with a 20–25 cm long tail. Weighing 5–16 kg, they are rounded, large, and slow, and use aposematic strategy of defense. Porcupines occur in various shades of brown, gray, and white. Porcupines' spiny protection resembles that of the munrelated erinaceomorph hedge hogs and Australian monotreme echidnas.Porcupines occupy a short range of habitats in tropical and temperate parts of Asia, Southern Europe, Africa, and North and South America. They live in forests and deserts, and on rocky outcrops and hillsides.They are generally nocturnal, but are occasionally active during daylight.

(ix) Otter

Otters are carnivorous mammals in the subfamily Lutrinae. The 13 extant otter species are all semiaquatic, aquatic or marine, with diets based on fish and invertebrates. *Lutrinae* is a branch of the Mustelidae family, which also includes weasels, badgers, honey badgers, martens, minks, polecats, and wolverines.

Otters have long, slim bodies and relatively short limbs. Their most striking anatomical features are the powerful webbed feet used to swim, and their seal-like abilities holding breath underwater. Most have sharp claws on their feet and all except the sea otter have long, muscular tails. The 13 species range in adult size from 0.6 to 1.8 m in length and 1 to 45 kg in weight. The Asian small-clawed otter is the smallest otter species and the giant otter and sea otter are the largest. They have very soft, insulated underfur, which is protected by an outer layer of long guard hairs. This traps a layer of air which keeps them dry, warm, and somewhat buoyant under water.

Several Otter species live in cold waters and have high metabolic rates to help keep them warm. European otters must eat 15% of their body weight each day, and sea otters 20 to 25%, depending on the temperature. In water as warm as 10 °C (50 °F), an otter needs to catch 100 g of fish per hour to survive. Most species hunt for three to five hours each day and nursing mothers up to eight hours each day.

(x) Olive Ridley Turtles.

Olive Ridley Turtle is also known as Pacific Ridley. The Carapace length varies from 60 to 77cm. In Gahirmatha of Odisha it is found to be 67.5 to 77cm. Female length varies from 66 to 76.5cm. The Carapace is heart shaped which is characterized by four pairs by pore-bearing infra-marginal scutes on the bridge, two pairs of pre-frontals and upto nine lateral scutes per side. Olive Ridley has uniqueness to have variable and asymmetrical lateral scute count varying from five to nine plates on each side.Each side of the carapace has 12-14 marginal.Carapace is flattened dorsally and highest anterior to the bridge.Head is medium size, broad, appearing triangular in planar view. They have paddle like forelimbs, each with two anterior claws. Hatchlings are dark gray with pale yolk scar but when length of Carapace ranges from 37-50m they appear black.Matured males have longer & thicker tail from females used for mating.Males have longer, tapered carapace than females who around dome like carapace.

Life History

For the purpose of breeding, Olive Riddles also migrate from 100kms to 1000kms i.e Srilanka.Courtship and mating occur in offshore waters of the breeding ground.Eggs lay once or twice during a nesting season.Incubation is favoured by metabolic heat & Sun where moisture level is maintained by six hourly high tides.Sex is determined by incubation temperature where higher temperature produces females.Incubation period is dependent on temperature.Hatchlings emerge after 50 to 70 days of incubation.Hatchlings find their way to Sea using visual cues.The seaward side is brightly illuminated during night than land ward side which helps the hatchlings to orient their movement towards sea direction.Many hatchlings face predation by carnivorous fishes before they reach sea. Percentage of adult head is very less.

Life on Land:

Lying of eggs & hatchlings coming out of eggs are two phenomena related to land life. The hatchlings return to land after several years for nesting as adults.

Life in water:

So far the information goes as on date, hatchlings emerge from their nest & more so natal beach & spread a brief period crawling there with orientation towards sea. After several years they become adult and the adult gravid female sea turtle spend time on natal beach for a couple of hours for reproduction & laying eggs. Except this period they spend most of the time in sea & Oceans.

(xi) Conch (Sea Snail)

This shell is from a sea snail species Turbinella pyrum in the family Turbinellidae. This species is found living in the Indian Ocean and surrounding seas. The shell is porcelaneous (i.e. the surface of the shell is strong, hard, shiny, and somewhat translucent, like porcelain)

The overall shape of the main body of the shell is oblong or conical. In the oblong form, it has a protuberance in the middle, but tapers at each end. The upper portion (the siphonal canal) is corkscrew-shaped, while the lower end (the spire) is twisted and tapering. Its colour is dull, and the surface is hard, brittle and translucent. Like all snail shells, the interior is hollow. The inner surfaces of the shell are very shiny, but the outer surface exhibits high tuberculation. In Hinduism, the shiny, white, soft shankha with pointed ends and heavy is the most sought after.

A **conch** develops into an adult after about 4 years, and as it matures the mantle (body) of the snail pushes on the growing shell, making the opening flare out. This allows the mature snail to move along with lagoon floor the shell opening flat against the bottom. The **conch's** rapid **growth** slows after the snail matures.

(xii) White belliedSea Eagle.

The white-bellied sea eagle (*Haliaeetus leucogaster*), also known as the white-breasted sea eagle, is a large diurnal bird of prey in the family Accipitridae. A distinctive bird, the adult white-bellied sea eagle has a white head, breast, under-wing coverts and tail. The upper parts are grey and the black under-wing flight feathers contrast with the white coverts. The tail is short and wedge-shaped as in all Haliaeetus species. Like many raptors, the female is slightly larger than the male, and can measure up to 90 cm long with a wingspan of up to 2.2 m, and weigh 4.5 kg. Immature birds have brown plumage, which is gradually replaced by white until the age of five or six years. The call is a loud goose-like honking.The white-bellied sea eagle has a white head, rump and underparts, and dark or slate-grey back and wings. In flight, the black flight feathers on the wings are easily seen when the bird is viewed from below. The large, hooked bill is a leaden blue-grey with a darker tip, and the irides are dark brown. The legs and feet are yellow or grey, with long black talons (claws). Unlike those of eagles of the genus *Aquila*, the legs are not feathered. The sexes are similar. Males are 66–80 cm long and weigh 1.8–3 kg. Females are slightly larger, at 80–90 cm and 2.5–4.5 kg . The wingspan ranges from 1.78 to 2.2 m. There is no seasonal variation in plumage.The moulting pattern of the white-bellied sea eagle is poorly known. It appears to take longer than a year to complete, and can be interrupted and later resumed from the point of interruption.

A young white-bellied sea eagle in its first year is predominantly brown,with pale cream-streaked plumage on their head, neck, nape and rump areas.The plumage becomes more

infiltrated with white until it acquires the complete adult plumage by the fourth or fifth year.The species breeds from around six years of age onwards. The lifespan is thought to be around 30 years.

The loud goose-like honking call is a familiar sound, particularly during the breeding season; pairs often honk in unison, and often carry on for some time when perched. The male's call is higher-pitched and more rapid than that of the female.

Adult white-bellied sea eagles are unmistakable and unlikely to be confused with any other bird. Immature birds can be confused with wedge-tailed eagles. However, the plumage of the latter is darker, the tail longer, and the legs feathered. They might also be confused with the black-breasted buzzard (*Hamirostra melanosternon*), but this species is much smaller, has white patches on the wings, and has a more undulating flight.In India, the Egyptian vulture has white plumage, but is smaller and has a whiter back and wings. The white tail of the white-bellied sea eagle in flight distinguishes it from other species of large eagles.

(xiii) Sea gulls.

Gulls or seagulls are seabirds of the family Laridae in the suborder Lari. They are most closely related to the terns (family Sternidae) and only distantly related to auks, skimmers, and more distantly to the waders.

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 crabs and small fish. 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 large species take up to four years to attain full adult plumage, but two years is typical for small gulls. Large white-headed gulls are typically long-lived birds, with a maximum age of 49 years recorded for the herring gull.

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 behavior, attacking and harassing predators and other intruders.Certain species have exhibited tool-use behavior, such as the herring gull, using pieces of bread as bait with which to catch goldfish, for example.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. Gulls have been observed preying on live whales, landing on the whale as it surfaces to peck out pieces of flesh.

The gulls have a worldwide cosmopolitan distribution. They breed on every continent, including the margins of Antarctica, and are found in the high Arctic, as well. They are less common on tropical islands, although a few species do live on islands such as the Galapagos and New Caledonia. Many species breed in coastal colonies, with a preference for islands, and one species, the grey gull, breeds in the interior of dry deserts far from water. Considerable variety exists in the family and species may breed and feed in marine, freshwater, or terrestrial habitats.

Most gull species are migratory, with birds moving to warmer habitats during the winter, but the extent to which they migrate varies by species. Some migrate long distances, like Franklin's gull, which migrates from Canada to wintering grounds in the south of South America. Other species move much shorter distances and may simply disperse along the coasts near their breeding sites

(xiv) Cormorants

Phalacrocoracidae is a family of approximately 40 species of aquatic birds commonly known as **cormorants** and **shags**. Several different classifications of the family have been proposed recently, and the number of genera is disputed. Cormorants and shags are medium-to-large birds, with body weight in the range of 0.35–5 kilograms and wing span of 45–100 centimeters. The majority of species have dark feathers. The bill is long, thin and hooked. Their feet have webbing between all four toes. All species are fish-eaters, catching the prey by diving from the surface. They are excellent divers, and under water they propel themselves with their feet with help from their wings; some cormorant species have been found to dive as deep as 45 meters. They have relatively short wings due to their need for economical movement underwater, and consequently have the highest flight costs of any flying bird.

The majority, including nearly all Northern Hemisphere species, has mainly dark plumage, but some Southern Hemisphere species are black and white. Many species have areas of coloured skin on the face (the lores and the gular skin) which can be bright blue, orange, red or yellow, typically becoming more brightly coloured in the breeding season. The bill is long, thin, and sharply hooked. Their feet have webbing between all four toes, as in their relatives.

(xv) Burmese Python:

Burmese python (*Python bivittatus*) is one of the five largest species of snakes in the world (about the fourth-largest as measured either by length or weight). It is native to a large area of Southeast Asia but is found as an invasive species elsewhere. Until 2009, it was considered a subspecies of Python molurus, but now is recognized as belonging to a distinct species.

Burmese pythons are dark-colored snakes with many brown blotches bordered in black down the back. The perceived attractiveness of their skin pattern contributes to their popularity with both reptile keepers and the leather industry. The pattern is similar in colour, but different in actual pattern from the African rock python (*Python sebae*), sometimes resulting in confusion of the two species outside of their natural habitats. The African rock python can generally be distinguished by its tighter pattern of markings, compared to the Burmese python, which has bolder patterns, similar to those seen on a giraffe.

In the wild, Burmese pythons typically grow to 5 m while specimens of more than 7 m are uncommon. This species is sexually dimorphic in size; females average only slightly longer, but are considerably heavier and bulkier than the males.

(Xvi) Star Tortoise:

The Indian star tortoise (*Geochelone elegans*) is a threatened species of tortoise found in dry areas and scrub forest in India, Pakistan and Sri Lanka. This species is quite popular in the exotic pet trade, which is the main reason it is endangered.The Indian star tortoise was upgraded to CITES Appendix I in 2019 (threatened with extinction).

18.4: Management unit:

The wild animals are observed in all the area of the Division. The animal concentration is higher in Forest areas, near to Sea shore and water bodies. For management purpose the each Range is taken as a Management Unit. For Balukhanda Range, The sanctuary part is excluded from the purview of this Working Plan as it is being managed under “Management Plan for the Sanctuary”.

18.4.1: Allotment of area to different Management Unit:

The area / Forest Blocks allotted to different Management unit is furnished below. The management Unit is named after the Range.

Table No 18.2 Area assigned to various Management Unit.				
Sl No	Name of Management Unit / Range	Number of RF	Number of PRF	Area in Ha
1	Balukhanda Unit	0	1	42.00
2	Brahmagiri Unit	0	1	34.00
3	Konark Unit	0	2	8.80
4	Astaranga Unit	0	3	896.992
	Total	**0**	**7**	**981.792**

Though the Range is divided into Sections and Beats for administrative convenience, for management of wildlife no further sub units are prescribed.

18.4.2 Allotment of area to JFM (VSS Committee):

As per record, there are 29 EDCs and 37 VSSs in Puri wildlife Division. All the 29 EDCs are coming within the Balukhanda-Konark Wildlife sanctuary, for which they are not included in the working plan. Out of 37 VSSs, only 5 VSSs have been constituted in 5 PRFs and assigned with 63.054 ha, the details of which are given in Table No. 18.3 below. Balance 32 VSSs are constituted over Revenue forest. Revenue forests are not included in this plan area as they are not designated forests (RF/PRF/VF). Although 325.582 ha of43 Village Forests of erstwhile Social Forestry Project are designated forests, they are not included in this Wildlife (Overlapping) Working Circle as these are very small areas distributed scatteredly within the populous villages where chance of wild animals living is remote.

Table No: 18.3 Area allotted to VSS in Wildlife (Overlapping) Working Circle.				
Sl No	Name of Forest Block	Area in Ha	Area under WL(O) WC	Area assigned to VSS
Proposed Reserved Forest.				
Konark WL Range				
1	Junei	7.800	7.800	7.800
2	Kuakhai	4.800	1.000	0
Astaranga WL Range				
3	Sahana	322.000	313.622	0
3A	Sahana Extention	508.670	508.670	6.394
4	Nipania	10.800	10.800	10.000
5	Tavagolara	71.280	63.900	0
Balukhanda WL Range				
6	Patanaikia	42.00	42.00	4.860
Bramhagiri WL Range				
7	Manika Patana	92.000	34.000	34.000
	Total	**1059.35**	**981.792**	**63.054**

As per the provisions of JFM Resolution 2011 the Para- 6 Reads as follows.

"6. Duties and responsibilities of VSS / EDC:

(i) The members of the VSS / EDC shall individually and collectively protect the forest, wildlife and biodiversity."

18.5: Special Objectives of Management:

The Special objectives of Management are

- To provide improved habitat for peaceful living and a conducive atmosphere for their reproduction.
- To conserve and protect the wildlife habitat with special emphasis on special habitat of flagship species of the locality & migratory fauna.
- To create a niche for migratory birds by protecting the wet lands.
- To improve mangrove habitat for marine life and mass nesting area of Olive riddle turtles.
- To restore habitat after any natural calamity.
- To maintain grassland for herbibores specially in proximity to Protected areas- Balukhanda Sanctuary.
- To improve eco- tourism along the available Sea shore & marine life interface.
- To promote wildlife in general and endangered species in particular.
- To create awareness among the people regarding the necessity to conserve and protect the wildlife and their habitat.
- To protect the wildlife against poaching & from transmitted diseases.
- To improve Bio Diversity.
- To enhance Food & Shelter for the animals / Birds / reptiles etc.
- To develop skill and human resource to protect the animals against flood and cyclone.

18.5.1 Analysis of available fauna & mapping there up.

An attempt has been made to show the abundance of specific wild animals in a particular locality. The list of such locality and species are listed below.

Table No: 18.4 Lists of avifauna and their locality			
Sl No	Species	Locality	Remark
1	Spotted deer	Balukhanda Sanctuary and Nearby area.	Sever damage has been caused due to "Phani" Cyclone during 2nd May'2019
2	Olive Ridley Turtles	Mouth of Devi Nadi & Sandy islands nearby.	Mass nesting observed on islands.
3	Migratory Birds	Mangrove Forests at Kadua and Devi nadi confluence & Brahmagiri block adjoining to Chilika	Usually observed during August to November every year.
4	Fox / Jackel	Balukhanda Sanctuary / Sahana PRF	Frequently observed
5	Bats.	Brahmigiri Range	Abundantly observed
6	Burmese Python	Chandanpur area	Abundantly observed
7	Otters	Mangrove Forests of Muhanmuha Beat	Frequently seen in Morning & evening.
8	Sea Snail, molluscs	All along the Sea Coast.	Abundantly observed

18.5.2 Management Practices:

The general management practices involves

a) Improvement of existing habitat and Development of new habitat for any species found in the locality.
b) Preservation of existing wetlands.
c) Providing a conducive and safe breeding zone in and around Devi River mouth including nearby Zone in Bay of Bengal for Olive Ridley Turtles.
d) Maintain the islands on Devi River Mouth for safe & smooth egg laying phenomena (Mass nesting) of Olive Ridley Turtles & safe hatching of eggs till young's released to Sea.
e) Protect mangroves forest and nesting of migratory Birds.
f) Maintain creeks for allowing tidal water for inundation of river banks.
g) Maintain Sea beach in Jahana Peer Area for recreational avenue.
h) Provide safe shelter to animals during cyclones.
i) Restore habitat of Birds / animals after cyclonic disturbances.
j) Provide sweet water to animals during summer.
k) Create & maintain grass lands.

18.5.3 Method of Treatment.

18.5.3 (i) Improvement of Habitats:

Special habitats are biological in origin and provide habitat functions for small Wild animals. They include snags, snag recruits, den trees, down wood, isolated large old trees, trees with fluting boles, buttresses, lianas, some significant species of fruit bearing trees and shrubs. These special habitats have been neglected in the past. Care should be taken while implementing the prescription of the Plan to maintain these special habitats.

a) Snags:

As a rule of the thumb, maintain at least the 5 tallest and largest diameter snags per hectare, in a well distributed design in all silvicultural treatments. Retained snags need to appear in the compartment history. These are vital for a variety of primary hole-nesting birds like Woodpeckers and Barbets, which are colonized by secondary hole-nesters like Hill Mynas, Rollers, and Owlets etc during subsequent years.

Snag Recruits

Likewise maintain 5 snag recruits per hectare. These are dying trees, mostly affected by heart rot fungus but not quite dead. They can be recognized by their external symptoms. All such trees, which are being retained, need to be reflected in the compartment histories. These, along with snags provide a very good substrate for epiphytic orchids, birds and insects.

b) Down Wood:

Many species require or use down wood (fine and coarse woody debris) as habitat. Where forestry has been practiced for several rotations large proportions of these species are considered threatened. Key attributes determining the suitability of down wood as habitat are decay stage, tree species, and size, specifically diameter. Both quantity and distribution of suitable down wood influence species' presence and abundance.

In felling operations, among the rejects, apart from lops and tops, large size irregular shaped hollow logs often feature. Being uneconomical they usually remain on site, or are converted into fuel wood. Such large sized woody material provides critical ecological functions in support of maintenance of vegetation and animal diversity, besides serving the functions of cover and microhabitat for several species. The largest size hollow logs, or rejects for any reason need to be maintained at the rate of at least three logs per ectare, and as far as practicable evenly distributed. These should suitably find place in the compartment history.

c) Large Old Trees

These would naturally occur in low densities. The Ficus species should not be counted among these, since Ficus is not felled even otherwise. Large old trees of different species as and when encountered need to be reserved in any felling or tending operation. These retained trees (2 to 4 per ha) need to be entered in the compartment histories and serve as daytime roosts or nesting sites for birds, large owls of Bubo species.

d) Trees with Fluting Boles, Buttresses and Holes:

These are expected to occur in very low densities represented by a small number of species. They provide significant microhabitat functions for small mammals like the Mouse Deer and reptiles. One such tree at least, the largest possible, needs to be retained per hectare and entered on the compartment history.

e) Lianas and Tangled Climbers:

Climber cutting operation is a standard practice, which has been prescribed in all Working Circles. However lianas provide significant habitat functions in support of mobility of arboreal animals, and depending on animal species, serve as resting and escape cover for primates. They are equally important for arboreal small carnivores, some rodents and lizards. A climber with tangles is especially important. It is recommended that woody well distributed all over the area may be retained & entered in the compartment histories.

f) Fruit Bearing Trees and Shrubs:

In all operations keeping fruit bearing tree species in felling or tending operations is the standard practice. Species providing fruits to local human inhabitants and Wild Life are to be retained / nursed and propagated. The information on human use is probably complete but the same cannot be said to Wild Life. The species liked by animals/ birds needs to be elaborately listed by local observation and distribution needs to be recorded.

g) Roosting or Nesting Trees:

All trees which are known to support nesting colonies of water birds or roosting congregations of raptors or other birds need to be retained. This is crucial especially with reference to vultures, which are critically endangered along with Pallas's Fishing Eagle and White-bellied Sea Eagle, which have become very rare in this tract. It helps migratory birds along Rivers / creks etc.

h) Maintenance of Creeks:

Creeks near Kadua River and Devi Nadi are the life line of mangrove forests and very good habitat. The tidal water flows towards land mass through these creaks. Due to deposit of

silts / mud, it creates a good habitat for otters, Turtles, Snakes, Snails, and Crabs etc. Its maintenance is of great importance for wildlife management. The creeks required to be identified, mapped and maintained at least in a three years cycle.

i) Maintenance of Wet lands:

Wetlands are breeding grounds of reptiles, birds etc. Day by day wetlands are vanishing due to land filling / construction etc. Many wetlands are under administrative control of Revenue department. Initiative is to be taken by the forest department to map the wetlands through Satellite imagery and GPS. The list of such wetlands needs to be approved by the District administration and maintenance of such wetlands may be regulated by the Forest department. The maintenance involves

- Demarcate extent of wetland.
- Partial de-silting of wetland.
- Allow growth of submerged weeds palatable to birds to some extent.
- Allow fish fauna / snails/ crabs to breed & grow naturally.
- Prevent fishing, poaching of birds in the designated wetland.

j) Maintenance of Kia (Pandanus odoratissimus).

P. odoratissimus (Kia) plants are found growing along seashores, banks of rivers, ponds, canals, and so forth. It grows in tropical climate, where it can withstand drought salty spray and strong wind. It propagates readily from seed but it is also propagated from branch cutting for farm or for garden. It grows fairly quickly.The tree begins to flower 3 to 4 years after planting. The flowering period is rainy season (July–October). The flowers are harvested early in the morning, and the spa dices take a fortnight to mature, depending upon the weather conditions. In India male flowers are valued for their fragrance and some kia products. Pandanus plant has the tradition of alternative therapies.

Kia bushes are very good habitat for Fox, Jackal, Mongoose, Lizards, Rabits and largely found in Puri Division. Its conservation & propagation is highly required from wildlife point of view. Now the kia bushes are facing destruction due to Road widening, filling up water bodies and marshy places.

K) Creation & Maintenance of Grass Land:

The common wildlife species available in the division are herbivorous. Day by day grass lands are reducing posing a stress time for herbivorous. It is highly required to create and maintain grass lands inside forest blocks, Village forests, river banks, near wetlands and swampy areas. This will boost the concentration of food base for herbivorous vis a vis carnivores.

l) Providing Sweet water to animals:

The underground water available is normally saline in nature. Available water is mostly saline. It is required to harvest / store more and more rain water through creating water body by impounding rain water through check dams inside forests.

18.5.3 (ii) Providing Protection:

It is of paramount importance to provide adequate protection to available fauna / migratory birds and Olive Ridley turtles. During mass nesting period protection against accidental death by fishing boats / nets and eggs from pray animals. During mass emerging turtles against light / crows/ dogs etc.

18.5.3(iii) Detail study of Animal behaviour & scientific Documentation:

Detail study of various animal behaviours / life cycle, reason for dwindling population and effect of increase in human interface is required in depth with a scientific approach. Periodical documentation is also stressed upon.

18.5.3(iv)Creation of Public awareness & public participation in management:

For better management and co-habitation with animals, required public awareness is required. It is proposed to conduct awareness camps with villagers, School Children and other functionaries including voluntary organizations.

18.5.4 Threat to wild animals &Suggested mechanism:

Various threats to animals / birds / reptiles and marine life as anticipated for this tract and probable steps prescribed/ suggested are as follows.

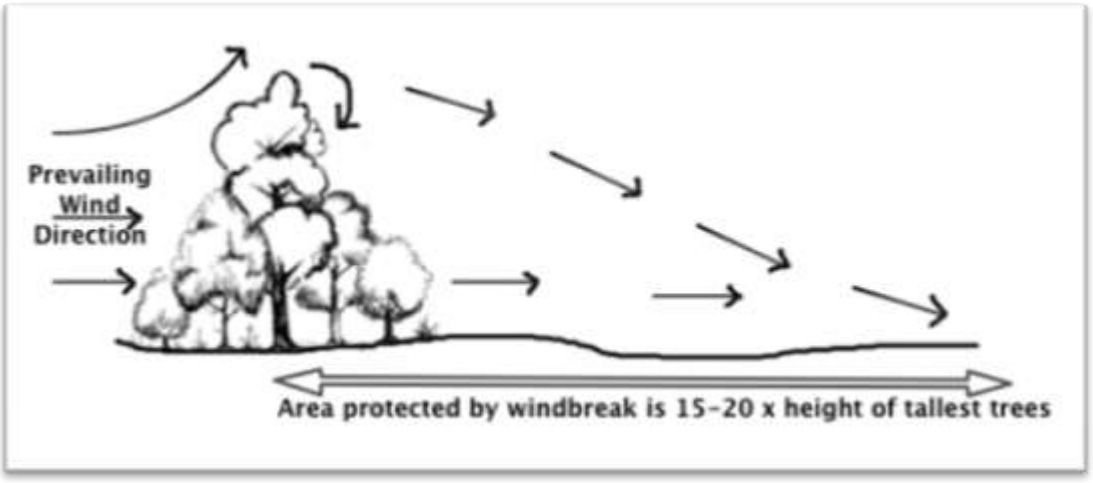
18.5.4.1 Inundation by Flood& High Tidal wave:

The Division is prone to flood & Sea coast is prone to high tidal wave. Areas near to river banks, Sea shore are inundated due to flood and tidal waves. If a sudden rise of water occurs, it may sweep away the young animals. It is recommended to create high land (Kuda) near river banks / away from Sea shore with moderate gradient and bushes / grasses planted to provide a camouflage.

18.5.4.2 Cyclonic Storm:

During recent cyclone i.e. “Phani” many animals like deer and avifauna were affected. Similarly during super cyclone 1999, the Black bucks available in Balukhanda Sanctuary were completely vanished. As cyclone became a regular phenomenon in Odisha coast specially Puri district, animals / birds are likely to be affected before they recouped from past damage. It is essential to provide protection to animals against storms and immediate fallouts. The following measures are recommended.

(a) **Creation of Shelter belt all along the Sanctuary Boundary / PRF Boundary adjacent to Sea.**



(b) **Shelter Shed required to be constructed in highly animal concentrated zone**.

It is recommended to construct some dome shaped structure with maximum 2.5 meter height to provide shelter to animals during cyclone. The alignment of the dome is across the wind direction. The entrance will be designed across the wind. The dome shaped roof will

help in deflecting the wind upward and reduce wind pressure on wall and roof and protect against blowing away of roof.

18.5.4.3 Fire Hazard:

All possible steps are required to be taken against fire hazards and protecting the animals against fire.

- Maintaining Fire Line along the Forest Blocks,
- Control burning of dry grasses and dry leaf litters before fire season.
- Early fire detection system to be followed.
- In case of fire from all sides of a patch of forest- escape route / path should be immediately cleared to save from fire burnt.

18.5.4.4 Illegal Collection of eggs and Birds hunting:

Illegal collection of Turtle eggs, Birds egg by local people is normally seen in many parts of the district / State. It can only be checked by patrolling / deploying squad members. It should be ensured. In case of Olive Ridley turtles, eggs are being collected by staffs and being hatched at temporary hatching area. This may be carefully taken up. Public awareness before birds' nesting in probable areas will also help in reducing the damage due to collection of eggs.

18.5.4.5 Fishing during mass nesting of Olive Ridley Turtles:

Mass mating of Olive Ridley Turtles prior to mass nesting is observed in the fishing zone of Bay of Bengal, Devi Nadi mouth. The turtles get entangled in fishing nets and cause death. To overcome this danger, the Govt. declares no fishing periodand no fishing zone for certain months & compensation to fisherman.

18.5.4.6 Scarcity of Forage:

During Flood and Cyclone fodders are not available to animals for days together. In shelter shed they have to be provided with fodders / grasses etc. It is required to make necessary provisions in management fold to have fodders at stock after getting Flood / Cyclone Warning. Captive grass land / cultivation of grass may be a practice in this division. Such grass lands may be opened periodically to animals.

18.5.4.7 Illegal trade in wild animals and articles:

Illegal trade of wild animals like soft shell turtles, monitor lizards, snakes etc. / animal parts / meat / venom is frequently encountered in the state. The origin is not always tracked up.

Constant patrolling, collection of intelligence, deployment of squad in vulnerable areas is recommended.

18.5.4.8 Road kills:

Two major roads like Puri-Konark marine drive and Puri- Bhubaneswar NH posethreat for the wild animals while crossing road. Puri-Konark marine drive road passes through the Balukhanada Wildlife Sanctuary where large number of spotted deer inhabits. During night hours the vehicles run with speed more than the limit of 40 Km/hr. When the spotted deer cross the road for forage they meet road accident @ 8-10 numbers per year. The injured deer succumb to injury ultimately or attacked subsequently by pack of feral dogs.

Although lots of signages are in place to create awareness among public to limit the vehicle speed and to be more watchful for the wild animals, it is not practically possible. The NH Executive Engineer should be impressed upon to erect movable barriers with florescent coloured signage's to check the speed.

Similarly, Burmese python when cross the Puri-Bhubaneswar NH from one wetland to other habitat near Chandanpur, get killed or injured by the vehicular movement on the road. The habitat has not yet been declared as any conservation reserveor sanctuary for the protection of Burmesepython.

18.5.5 Associated Regulations and Measures:

Wildlife are not only confined to forest blocks / boundaries but also seen in rivers, sea and habitations, agricultural fields. The public as a whole has a responsibility towards protection & conservation of wild animals. The administrative instructions on Mass nesting of Olive Ridley Turtles, Compensation to Fishermen due to declaration no fishing period, no fishing zone, Costal Regulated Zone (CZR), Orders banning Polythene in the State, maintaining recreational zone along the sea shore are required to be followed for better management of wildlife. The fishing trawlers should be forced to use Turtle Exclusion Device (TED) without fail while passing through the no fishing zone. The fishing laws need to be amended accordingly. Enforcement will be strengthened with deployment of APR force, forest staff equipped with speed boats to apprehend the trawlers fishing in no fishing zone. The fishing law may be amended to enhance compounding fees and to empower the DFO/ ACF of Puri (WL) Division as the AdjudicatingOfficer under OMFR Act. The identified nesting beaches will be protected by implementing CRZ regulation strictly.

For management of wetland situated outside the forest area requires to be regulated by the district administration. A concentrated effort is required to be initiated and some

instructions to regulating officials need to be promulgated. Wetlands should be identified and renovated by de-silting with mechanical means to harvest sweet water. The Sar lake needs to be restored by de-silting its original area after eviction of encroachment.

A continuous wind break all along the Sea shore at a width of 40m at least required to be created to protect the animals / vegetation and habitation against cyclonic storm. This matter needs to be discussed with district administration.

CHAPTER-19
JOINT FOREST MANAGEMENT (OVERLAPPING) WORKING CIRCLE [JFM (O) Working Circle]

19.1 Joint Forest Management (Overlapping) Working Circle:

19.1.1 General:

Joint Forest Management often abbreviated as **JFM** is the official and popular term in India for partnerships in forest management involving both the state forest departments and local communities. The policies and objectives of Joint Forest management are detailed in the Indian comprehensive National Forest Policy of 1988 and the Joint Forest Management Guidelines of 1990 of the Government of India.

Joint forest management is a concept of developing relationships between fringe forest dwellers and forest department on the basis of mutual trust and jointly defined roles and responsibilities for forest protection and development. Odisha remains the pioneer to pass the first resolution for JFM. At present, the JFM Resolution 2011 is the basis on which forests are assigned as follows.

"The forests of the State to be covered under this Resolution shall be grouped intothe following two categories:
(a) Reserved Forests, Protected forests, Village forests, Revenue forests etc. Notcovered under Protected Areas.
(b) Protected Areas (National Park and Sanctuaries) excluding Core Areas, andMangrove Wetlands.
The Committee constituted for the first category of forests will be known as **VanaSurakshya Samiti (VSS)** while the Committee constituted for the second category will beknown as **Eco-Development Committee (EDC)".**

19.1.2 Salient Features of Joint Forest Management:

Joint Forest Managementencourages the development of partnerships between local people and forest department to manage forest resource jointly. It provides a communication structure for consultation and negotiation between forest Department and forest users and provides legalized access for the local communities to forest lands.JFM encourages local people to protect forest areas in order to prevent free grazing of livestock and to assist in preventing illegal activities by outsiders. JFM assures local people that a certain proportion of the intermediate and final harvests from forest lands will accrue to them.

19.2:General Constitution of Working Circle:

The main principle of JFM is to motivate the forest communities to protect the forest from over exploitation so that it meets the subsistence needs of the rural poor. JFM represents a significant shift in India's forest policy that balances community and government interest while remaining sensitive to local conditions, institutions and forest dependence. With this background, the JFM Resolution has outlined the category of Forests that has been assigned or to be assigned to VSS / EDC. The scope is spelt out as follows.

"Area that can be assigned to VSS may be Reserved Forests, Protected forests, Village forests, Revenue forests etc. not covered under Protected Areas."

"Area that can be assigned to EDC may be Protected Areas (National Park and Sanctuaries) excluding Core Areas, and Mangrove Wetlands."

As per record, there are 29 EDCs and 37 VSSs in Puri wildlife Division. All the 29 EDCs are coming within the Balukhanda-Konark Wildlife sanctuary, for which they are not included in the working plan. Out of 37 VSSs, only 5 VSSs have been constituted in 5 PRFs and assigned with 63.054 ha, the details of which are given in Table No. 19.2 below. Balance 32 VSSs are constituted over Revenue forest. Revenue forests are not included in this plan area as they are not designated forests (RF/PRF/VF). The area under JFM (Overlapping) working circle includes area assigned to VSS i.e.63.054 ha from PRF and 325.582 ha of43 Village Forests of erstwhile Social Forestry Project. The total area assigned to JFM (Overlapping) Working Circle is **388.636 ha (VSS from PRF- 63.054 ha and VFC from VF- 325.582 ha)**

19.3: General Characteristics of vegetation:

The areas allotted to VSS are mostly degraded PRF and Village forests. The vegetation comprises of natural growth and plantations of previous plan period. The crop density is less than 40% in most of the cases. The characteristics of vegetation are as follows.

19.3.1 Northern Tropical Moist Deciduous Forests:

The vegetation consists of Jamun (*Syzizium cumini*), Neem (*Azadiracta indica*), Mankada kendu (*Diospyros embryopteries*), Patuli (*Lagerstroemis parviflora*), Sidha (*Lagrstroemia lanceolata*)and Kanta baunsha (*Babusa bambos*). The under growth consists of grasses, Eupatorium, etc. In the open space heavy Eupatorium affects establishment of natural vegetation and planted species requires repeated weeding. Kanta baunsha seen in Tavagolara PRF and Nippania PRF covers about 50% of the PRF. Due to non-working of Bamboo, most of the Bamboo clumps became congested. Due to thorny nature, it became

non- approachable. Mankada Kendu is one of the main constituent and naturally coming up in Nipania PRF of Astaranga Range.

19.3.2 Northern Tropical dry deciduous Forests:

The vegetation consists of Dhaura, Sunari, Simili, Neema, Bahada, Cashew etc. The under-wood consists of climbers, bushes of Zyziphus occasionally mixed with bamboo.

19.3.3 Northern Tropical thorny Forests:

The thorny forests are due to very sandy soil and heavy biotic interference. The vegetation is liked by local people due to most of bushes are of berry and collected for consumption.

19.3.4 Dry bamboo Forest:

The vegetation consists of "Bari Bamboo" (Bambusa nutans) and in a congested stage due to non-working for a long period.

19.3.5 Plantations under various schemes:

The area assigned to VSS / VFC contains plantations raised under Jagannath Vana Prakalpa, National Afforestation programme through Forest Development Agency, State plan, MGNREGA etc.

19.3.6 Plantations raised under Social Forestry Project:

Social Forestry Project was being implemented in the State from 1985 to 2003. The plantations so raised consist of planted trees of Eucalyptus, Acacia, Cassia, Neem etc.

The crop density in most of the cases is near about 40-50%.

19.4:Felling Series, Cutting Sections and JFM areas:

19.4.1: Allotment of area to different Felling Series / Treatment Series:

As per record, there are 29 EDCs and 37 VSSs in Puri wildlife Division. All the 29 EDCs are coming within the Balukhanda-Konark Wildlife sanctuary, for which they are not included in the working plan. Out of 37 VSSs, only 5 VSSs have been constituted in 5 PRFs and assigned with 63.054 ha, the details of which are given in Table No. 19.2 below. Balance 32 VSSs are constituted over Revenue forest.Revenue forests are not included in this plan area as they are not designated forests (RF/PRF/VF). The area under JFM (Overlapping) working circle includes area assigned to VSS i.e.63.054 ha from PRF and 325.582 ha of43 Village Forests of erstwhile Social Forestry Project.Total area assigned to this working circle is **388.636 ha**. The range wise area assigned to VSS /VFC is as follows.

Table No 19.1 VSS / VFC area assigned.			
Sl No	Name of range	No of Forest block (PRF)	Area assigned to JFM (O) WC
1	Astaranga WL Range	2	16.394
2	Brahmagiri WL Range	1	34.00
3	Konark WL Range	1	7.800
	Balukhanda WL	1	4.860
4	Gop WL Range	0	0
	Total	**5**	**63.054**
For VFC (During Social Forestry Project)		No of VF Blocks	Area assigned to JDM (O) WC
1	Astaranga WL Range	3	9.100
2	Balukhanda WL Range	11	71.900
3	Brahmagiri WL Range	17	165.866
4	Konark WL Range	11	78.220
5	Gop WL Range	1	0.496
	Total	**43**	**325.582**
	G. Total	**48**	**388.636**

The details of area assigned to VSS and VFC are furnished in Table no 19.2& 19.3

Table No 19.2 Name of VSS and area assigned in PRF			
Name of Range	Name of PRF	Name of VSS	Area assigned in Ha
Konark WL	Junei PRF	Junei	7.800
Astaranga WL	Sahana Extension	Gundalaba	6.394
	Nipania	Gada Nipania	10.00
Balukhanda WL	Patnaikia	Patnaikia	4.860
Bramhagiri WL	Manikapatna	Manikapatna	34.00
	S. Total		**63.054**

Table No 19.3 Name of VFC and area assigned in Village Forest.			
Name of Range	**Name of Forest block (VF)**	**Name of VFC**	**Area assigned in ha**
Astaranga WL	Chheliberua	Chheliberua	3.600
	Kanti	Kanti	2.500
	Santrasa	Santrasa	3.000
Balukhanda WL	Alanda	Alanda	15.000
	Alasankha	Alasankha	5.560
	Badagaon	Badagaon	6.828
	Baliguali	Baliguali	6.332
	Bhikaripada	Bhikaripada	2.500
	Bhuan	Bhuan	12.400
	Mahapur	Mahapur	0.400
	Narasinghpur	Narasinghpur	4.000
	Paikerapur	Paikerapur	2.040
	Samangarh	Samangarh	11.500
	Uchhpur	Uchhpur	5.340
Brahmagiri WL	Bhandarikuda	Bhandarikuda	0.372
	Bhubanpur	Bhubanpur	17.750
	Brahmagiri	Brahmagiri	11.584
	Budhisahi	Budhisahi	1.080
	Chandiput	Chandiput	0.578
	Chapamanik	Chapamanik	8.000
	Gaudakera	Gaudakera	5.000
	Kalikabadi	Kalikabadi	1.500
	Kalikabadi	Kalikabadi	54.000
	Kashijharia	Kashijharia	5.000
	Kasijharia	Kasijharia	5.050
	Kathuaredi	Kathuaredi	1.440
	Niajpur	Niajpur	2.612
	Rameswarpur	Rameswarpur	26.000
	Sahajanpur	Sahajanpur	10.000
	Sipasarubali	Sipasarubali	12.900
	Tinikudi	Tinikudi	3.000
Gopa WL	Nimapada	Nimapada	0.496
Konark WL	Anasara	Anasara	4.500
	Bobua	Bobua	1.200
	Jamara	Jamara	7.500
	Kanpur	Kanpur	10.500
	Khalakata	Khalakata	12.500
	Khandala	Khandala	3.000

	Patalia	Patalia	2.500
	Puba	Puba	7.220
	Raulpatna	Raulpatna	0.800
	Redhua	Redhua	3.500
	Tikina	Tikina	25.000
Total			**325.582**

19.4.2: Blocks / Compartments/ JFM Area depicted on GIS Maps:

The area allotted to different VSS are depicted on the Management Map (Topo Map of 1:50000 Scale). The list of VSS / EDC and area assigned is furnished in Table No 19.2 and 19.3.

19.5: Special Objectives of Management:

The special objectives of Management of this Working Circle are as follows.

i) To restock the degraded Forests through community participation,
ii) To ensure protection, regeneration and management of the forest wealth through a participatory approach.
iii) Mass Awareness campaign and motivation to the villagers is to be spread to every forest fringe village.
iv) To make the people and Forest Department equal partners in management process.
v) Reconstitution of all VSS as per recent JFM Resolution, assigning conflict free areas to VSS and registration at DFO office.
vi) Demarcation and Survey of the area allotted under V.S.S.
vii) Artificial regeneration in the degraded forest area is to be taken up to restore the barren and blank area.
viii) Soil and Moisture Conservation Measures have to be adopted in the VSS assigned area and preparation of micro-plan to each VSS.
ix) To reduce the dependency on forest, alternate income generating activities are to be created.
x) The other lines Departments like Agriculture, Horticulture, Fishery, Soil Conservation, veterinary; Health, mass education etc. have to be involved to achieve all-round socio-economic development of the village.
xi) To develop VSS as an institution at local level to manage **"Natural Resource".**
xii) To have special thrust on **"Fringe Forest Management."**

19.6.1 Analysis of the Crop:

The Forests assigned to VSS are mostly degraded in nature except plantations under various schemes like Jagannath Bana Prakalpa, Forest Development Agency and Social Forestry Project Plantations. Crop varies from natural forest to monoculture like Eucalyptus. Crop Density also varies from 30% in case of natural forest to 70% in plantations.

19.6.2 Silvicultural System:

The VSS area is under overlapping working circle. It overlaps with Rehabilitation Working Circle and Plantation Working Circle. The silvicultural system prescribed to these working circles will be followed as applicable. The Micro Plan of VSS is required to be revisited after approval of this working plan so as to accommodate the prescriptions of the working plan. The overall prescription of Micro plan shall be in line with prescriptions of this working Plan. In case of any contradictory prescription in micro plan is made by any VSS, the working plan prescription will supersede the micro plan prescription.

19.6.3 Method of Execution:-

1. Demarcation of VSS Area:-

Demarcation of area assigned to VSS is very important task. The demarcation of area is to be done with pillar posting. It helps to give a specific identity to the VSS and to motivate them to protect and to avoid dispute between the villages. A uniform system may be adopted over the entire division while demarcating the VSS area. The Village forests of erstwhile Social Forestry Project needs special thrust as village forests have remained unattended since 2003. 2 feet tall RCC pillars with cross section 6”X6” may be posted.

2. Preparation of Micro-plan:-

Micro-plans should be prepared for each VSS irrespective of whether money for implementation is available or not. The micro-plan should be prepared keeping in view the overall prescription of the concerned Working Circle. Prescription like prescribed exploitable girth class of different species of the final harvest, specific marking rules, limiting the final yield with due emphasis on conservation measures and biotic pressure etc. should be followed while preparing the micro-plan. The yield in the area assigned to the VSS should be calculated with due consideration to safeguard against erosion, illicit felling and other biotic pressure. The Plantation along with Soil and Moisture Conservation measures are to be undertaken and effort should be taken to obtain funds from different sources and while preparing the Micro-plans, PRA exercise are to be followed. Other tools like GIS and MIS can also be taken in to account. The detail process has been provided in the JFM Resolution-2011 Para -10. The same should be followed. In case of village forest,

the management plan shall be prepared as per Rule 11 of the Odisha Village Forest Rule,1985 (as amended vide F.F. and A.H. Deptt. Notification No. 27109 Dt. 17.11.1989).

3. Plantation & Choice of Species.

In many of the VSS assigned area due to protection by villagers bamboo, and other species have attended harvestable growth. After harvesting, the area may be re-afforested. The Choice of Species may be carefully decided to suit the soil condition.

Whenever plantation exist in VSS allotted area, these plantation should be thinned and pruned as per requirements. (Prescription under Plantation Working Circle may be the guiding principle) Sweeping of floor of the plantations should be avoided since it affects the cycling of soil nutrients. Grazing and fire protection should be provided to all plantations. In natural vegetation area where crop is approaching established stage regulated grazing may be allowed after discussion in the VSS. These prescriptions should serve as a guideline while preparing the micro-plan in these areas.

4. Incentive Schemes for the VSS

The following incentive based activities shall be introduced under the JointForest Management(JFM) in order to increase village participation.

(i) **Entry Point Activities (E.P.A.)** in other words is called Community Development Works (CDW) which includes small community infrastructures such as water tanks, rural roads/community halls as desired by the villagers which attract people's attention for trust building with forest staff to the forest development activities. Forest/water conservation related activities as well as non-forest activities can also be selected for CDW based on the needs of each VSS. CDW shall be selected based on the Rapid Rural Appraisal (RRA)/Participatory Rural Appraisal (PRA) and incorporated in the Micro Plan prepared by the VSS. The implementers of these activities should start preferably before the plantation and other activities take place. The JFM Committee is required to collect user's fee for the assets provided by the CDW. EPAs are part of the community mobilization process taken up in the respective villages at the initial stage of project implementation. EPA will be selected in a well facilitated participator manner.

(ii) **Income Generation Activities (I.G.A.)** shall be identified at the micro planning stage. However, the local NGOs shall be required to provide inputs with regards to the marketable potential of the goods to undertake the IGAs by Self Help Groups (SHG) existing within a VSS. It is confirmed that IGA are not restricted in the forest related activities but any potential IGA activities are to be encouraged

based on the agricultural, horticultural, fishery, poultry and MFP etc. produces are concerned. The value addition in the produces may be encouraged with handholding, capacity building and market linkage supports provided by the NGOs. Each Self Help Groups (SHG) may be provided with Revolving Fund supports from JFM Committee on loan basis to undertake the Income Generation Activities. Prior to beginning of IGAs a market research will be undertaken by the group of specialists from specialized market research organization. It will look at a macro level market environment as well as field level situations in close collaboration with the NGOs assigned to the community. A final shortlist of potential options of project areas based IGAs for forest dependents and other poor communities will be assessed through the market research study for implementation to the IGAs. IGA will be implemented by the Self Help Groups through the help of Revolving Fund loans provided to the JFM Committee.

(iii) The Basic Livelihood Improvement Activities: Under such component, the fulfilment of basic human needs to make the local people capable for participating in JFM activities are to be prioritized during the micro planning process in the community. The provision of incentives to the local people towards the information dissemination on environmental protection and basic livelihood improvement activities. The following activities may be facilitated in the community on priority basis.

a) Medical & Health Camps in convergence with the Govt. PHC/Hospitals.
b) Prevention and Control of Vector & Water Borne Diseases.
c) Reproductive and Child Health Care through providing seeds to VSS for kitchen garden.
d) Non Formal Education Centres in the VSS for drop outs to school going.
e) Promotion of Fuel Efficient Devices in convergence with OREDA.
f) Incentives to get cooking gas connections to each household to make VSS a smokeless village.

(iv) Capacity Building Programmes: To enable VSS to manage the respective JFM areas, organizations and forests a standard JFM Management Manual in Odia will be prepared, different training modules also to be prepared by the consultant agencies for imparting trainings to the JFM Committee in the following thematic areas.

(a.) Maintenance and submission of records, reports and bills to forest departments at VSS level.
(b.) Financial management, budgeting and book keeping.
(c.) Duties and responsibilities of the General Body and Executive Body

(d.) Conflict resolution mechanism.

(e.) Forest protection and management arrangements.

(f.) Sustainable harvesting and equitable sharing of different forest products.

(g.) Beneficiary management within the community.

(h.) Exposure trips/ exchange visits.

(v) VFDF (Village Forest Development Fund): A financial establishment is essential for the VSS activities to be sustained. Provisions of budget for EPA, Revolving Fund for Income Generation Activities and Basic Livelihood Improvement Activities should be made under the Forest Department for implementation of a scheme. VSS will contribute to a Village Forest Development Fund by raising money from user fees for the asset created under EPA, penalty for illegal actions, a portion of usufruct sharing,interest from bank savings and sales for the forest products. The budget provided by the Forest Department for EPA, IGA & Livelihood Improvement Activities should be utilized only for the original designed objectives of a scheme while VFDF could be flexibly used according to the needs of the VSS. Provision of Corpus Fund may also be arranged under a scheme for strengthening of the JFM, VFDF. It suggested that at least 50% of thesavings of the VFDF should be allocated for maintenance of the forest area after completion of the scheme.

(vi) Formulation of Micro Planning: A Micro Planning is a comprehensive document to guide the VSS in pursuing all forest management for its JFM area, community development and institutional development and other intervention under a scheme designe. The VSS will be responsible for formulation of their Micro Plan which will be assisted by the contracted NGOs/Experts and the forest division concerned. PRA for resource assessment for analysis will be conducted for this purpose. Micro Planning is vital for any JFM Committee for ensuring their participation at different levels of implementation of a scheme.

(vii) Engagement of specialized agencies for input support to JFM

1. For Micro Planning Preparation- Local NGOs
2. For capacity building of JFMC- Local NGOs
3. For IGAs- Specialized IGA Support Agencies

(viii) Training camps for VSS Members.

The JFM resolution-2011, Para-9, the role of Forest department has been defined. The role includes

- To assist in capacity building of VSS / EDC members on different aspects offorest management, planning, silviculture, nursery technology, forest laws,

accounting,book keeping, micro-enterprise development, value addition and processing of NTFPs etc.

- To provide technical help to the VSS / EDCs in preparation andimplementation of the Micro plan/ annual work programme.

To fulfil the responsibility in this aspect, it is recommended that the DFO, may arrange training camps for 2/3 days duration for VSS members where plantations/ Rehabilitation and harvesting operation is likely to be taken during the same year / coming year. It may be made an annual feature and included in the work schedule of the division.

19.6.4 Usufruct Sharing Mechanism:

The Joint Forest Management Resolution 2011 para 11 elaborately deals with usufruct sharing. The para is reproduced for immediate reference.

11. Usufruct sharing:

(i) The VSS / EDC shall be entitled to the usufructuary benefits from the assignedforests as under:—

(a) Usufructs like fallen leaves, fodder grasses, thatch grass, broom grass,fencing materials, brushwood, fallen lops, tops and twigs to be used as fuelshall be available to the members free of cost.

(b) All intermediate yields in the shape of small wood, poles, firewood etc as maybe obtained as a result of silvicultural operations and bamboo harvested inVSS / EDC assigned area shall be made available to the VSS / EDC membersin a manner as may be decided by EC. If sold at a price, the funds so obtainedshall be deposited in the VSS / EDC account.

(c) In case of Kendu leaves and specified forest produce other than bamboo, ifany, the VSS will have the right to collect the same from the assigned forestbut these items will be disposed of as per the prevailing provisions ofGovernment and practices.

(d) While maintaining the forest cover in perpetuity, if any major harvest or final felling occurs in the assigned forest, the same shall be taken up by the forestdepartment as per the prescription of the working plan/ duly approved microplan. In case of natural calamities, harvesting of wind-fallen trees shall betreated as final harvest. Priority will be given to the members of the VSS /EDCfor salvaging and harvesting work. Valuation of the produce so obtained shallbe done and information shared with the VSS /EDC and the produce will besold / disposed of by the forest department or by agents of the forestdepartment. The VSS / EDC will receive 50% share of the sale price afterdeduction of

proportionate harvesting cost and this will be deposited in the “VSS account". The VSS may also opt for 50% of the forest produce soharvested if it is for their bonafide domestic use and they agree to pay theproportionate cost of harvesting.

(e) In case of village woodlots created and maintained by the VSS / EDC on non-forest land, all usufructs including interim and rotational harvests shall go to theVSS / EDC.

(f) In the event of a natural calamity occurring in the village there may be ademand for house building materials and other forest produce from theassigned forest. In such cases, the VSS / EDC may go for harvesting therequired quantity of timber or other forest produce as a deviation to the MicroPlan, with due approval of the Divisional Forest Officer concerned.

(ii) The EC shall be responsible for the distribution of the usufructuary benefitsequitably among the members of the VSS. Need of the group or community, who do nothave any livelihood support other than depending on the forests, should be speciallyconsidered.

(iii) In cases where member/ a group of members of the VSS /EDC play a major role inthe collection of intelligence, detection and seizure of illegal forest produce in transit theconcerned VSS/EDC shall be entitled to the prescribed percentage of the sale price of theforest produce as per Rule 4 (3) of the Orissa Rewards for Detection of Forest OffencesRules, 2004. Such amount shall be deposited by the DFO in the “VSS account/EDCaccount" after disposal of the seized produce following due procedure of law.

In case of Village Forest created during Social Forestry Project, the sharing mechanism will be as per Rule -9 of the village forest Rule, 1985. The rule reads as follows.

“9. Sharing of Forest Produce:

(1) The beneficiaries shall on payment, asprescribed under Rule13, be entitled to the collect forest produce from the village forest fortheir bona fide use or consumption. The beneficiaries shall obtain necessary permitunder Rule 8 in case of their bona fide use of consumption. The Committee will beentitled to sell part of the forest produce for generating funds for management andregeneration of the village forests and the buyer shall obtain necessary permit underthe Rule 8 for transportation of the village forest produce.

(2) The Committee shall be responsible for the proper distribution of all availableforest produce from the village forest amongst the beneficiaries for their bona fide useor consumption on the basis of one equal share for each kitchen as far as possible. TheCommittee shall maintain a record of distribution of the forest produce and all

thedistributions made before a particular meeting shall be reviewed in the said meeting ofthe Committee.

19.6.4 Rights and Concessions:

Rights and Concessions in this Working circle shall be regulated in accordance with the provision of the relevant gazette notification of the respective forest blocks and the Government of Odisha policy with regard to JFM. Community rights as allowed under The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 will also be honoured. The Executive Committee (EC) of the VSS will act as a subcommittee for protection and conservation of forest, wildlife, biodiversity and environment of the Gram sabha or Palli sabha under the ambit of Forest Right Act, 2000. The provisions of the Odisha Village Forest Rule, 1985 will also be followed for allowing the rights and concession to villagers.

19.6.5 Scope of expanding JFM Working Circle:

(i) There are many PRF under encroachment by individual / community. All-out effort will be taken up by the Forest Department / Staff to make the area free from encroachment and bring them in to the management fold. These areas may be brought within the purview of JFM for mutual cooperation & better relation with the people.

(ii) There are many forested area under the administrative control of Revenue department. The JFM resolution 2011 has extended its purview to manage Revenue Forests in a joint Forest management approach. Where PRI (Panchyat Raj Institutes) are interested in management of such forests, the same may be taken for management under VSS.

(iii) After Cyclone “Phani” on 3rd May, 2019 the Government expressed its intention to create Green belt all along the Sea Coast at a width of 1KM to protect the Coastal area from effect of Cyclone. It is expected that the Forest Department will play a key Role in “Greening the coastal area”. The planted areascoming under a revenue village may be assigned to the same village and a VSS may be constituted for management & sharing of forest produce in a long run. Different plantation schemes can be implemented through the VSS.

(iv) There are many natural forest protection committees in this division who are protecting the forest adjoining to their villages, but they have not yet been formally constituted under the recent JFM resolution. Steps may be taken to constitute new VSSs if there is no conflict with other villages. The conflicts may also be resolved by the range level committee before VSSs are constituted. As per record there are 37 VSSs in Puri (WL) division, those were

constituted before reorganisation of the Odisha forest department in 2003, when the areas were under the control of erstwhile Puri Territorial division. The relevant records, documents and maps showing assigned area, plot nos. are not traceable at present due to which it becomes difficult to resolve the conflicts between VSSs. Therefore it is required to revisit each and every existing VSS, re-determine the conflict free assigned areas, demarcate the areas VSS wise and then reconstitute the VSS and register them afresh proving a new registration no.

19.6.6 Evaluation of Performance & Incentive:

The incentive to VSS / VFC or any other group is always drive the group in a positive direction. It encourages the villagers for better participation. The Principal Chief Conservator of Forests, Odisha Bhubaneswar has formulated a set of parameters for evaluation of performance of VSS. The Government also rewards the best VSS every year either on "World Forest day" or "Vana Mahostav Week" in state level functions. The evaluation is being carried out on ten important criteria and each point is evaluated out of 10 mark scale. The criteria's are

a. Extent of Forest area under effective control, Protection and management of VSS.
b. Regularity & frequency of holding meetings of General Body and Executive committee of the VSS, proper attendance in those meetings, deliberation of vital issue and record keeping.
c. Improved status of Forest Protection.
d. Quality of control exercised by the VSS on day- to- day management of the forest.
e. Resolution of conflict.
f. Sustainable collection of NTFP.
g. Effective preservation & control of Forest Fire.
h. Reduction of day- to- day dependency on Forest Produce.
i. Effectiveness in implementation of afforestation, soil moisture conservation measures and silvicultural operation.
j. Equity and gender equity.

Similarly the Divisional Forest Officer shall undertake motivation cum evaluation camps and reward to the VSS / NGO/ Staffs for their contribution for Joint Forest Management.

19.6.7 Associated Regulations and Measures:

(i) The JFM area is mostly covered either plantations or degraded forest area intended to regenerate the area through Aided Natural Regeneration. Plantation area will be managed through clear felling with Standard followed by planting. During planting period till its establishment, control of Grazing is of paramount importance. In the Village Forest Rule,

1985, elaborate provisions have been made for Control of Grazing. Rule 10 of the Odisha Village Forest Rule is reproduced below for reference and guidance.

"Rule 10. (1) The Committee shall regulate grazing in the village forest by alternateclosing and opening of areas for such period as it may deem proper and by suchmethods as it may adopt. Provided that the provisions in the Orissa Forest (Grazing of Cattle) Rules, 1980,shall, as far as may be, regulate such grazing.

(2) The Committee shall have the power to impound the cattle that enter thevillage forest contrary to these rules.

(3) Pasture development and fodder cultivation in Gochar lands within thelimits of the village may be taken up by the Committee in accordance with schemesdrawn up by the Sub-Collector or the Divisional Forest Officer, or the Soil ConservationOfficer in that regard, For implementing the schemes, the Committee shall ensure thatevery household owning cattle has access to the benefit of the scheme."The same principle may be extended to the VSS area / area worked out under National Afforestation Schemes by Forest Development Agency. The Divisional Forest Officer shall declare the plantation area, Regeneration area closed to Grazing for at least for three years from year of plantation. After third year Rotational Grazing may be allowed depending upon growth Pattern of plantations.

(ii) Auditing / accounting of VSS Account.

The accounting procedure for VSS has been well defined in the JFM Resolution. The accounts of VSS involved in FDA program, Ama Jungle Yojana (AJY) are regularly maintained and audited. In case of other VSS, the Secretary of VSS (FG or Forester) shall make it a point to update the Account and get audited annually. It will increase the interest of VSS and transparency in VSS Executive Committee activities.

In VFC constituted during Social Forestry Project,may not have their own account. The Secretary of VFC may open an account jointly as in line of Rule 12 of the Odisha Village Forest Rules-1985 and in line of JFM Resolution-2011 & up to date amendments.

(iii) Regular Meeting of EC/ General body:

In many VSS / VFC monthly meeting of EC and Annual Meeting of General body is found to be irregular. The Secretary of VFC / VSS shall make a point to convey / conduct regular meeting of VSS / VFC in his jurisdiction.

CHAPTER-20
MISCELLANEOUS WORKING CIRCLE

20.1: Miscellaneous Working Circle:

The Forest land coming within PRF / VF under administrative control of Forest department is utilized for ancillary forest & wildlife management practices like construction of Permanent Nursery, Eco Tourism Centres, Forest Rest House and Silvicultural Research Plot. The management of these infrastructures do not fit to the prescriptions of any previous Working Circles constituted basing on Sivicultural Principle. It is felt to constitute "Miscellaneous Working Circle" and formulate guiding principles for management of these miscellaneous units.

20.2: General Constitution of Working Circle.

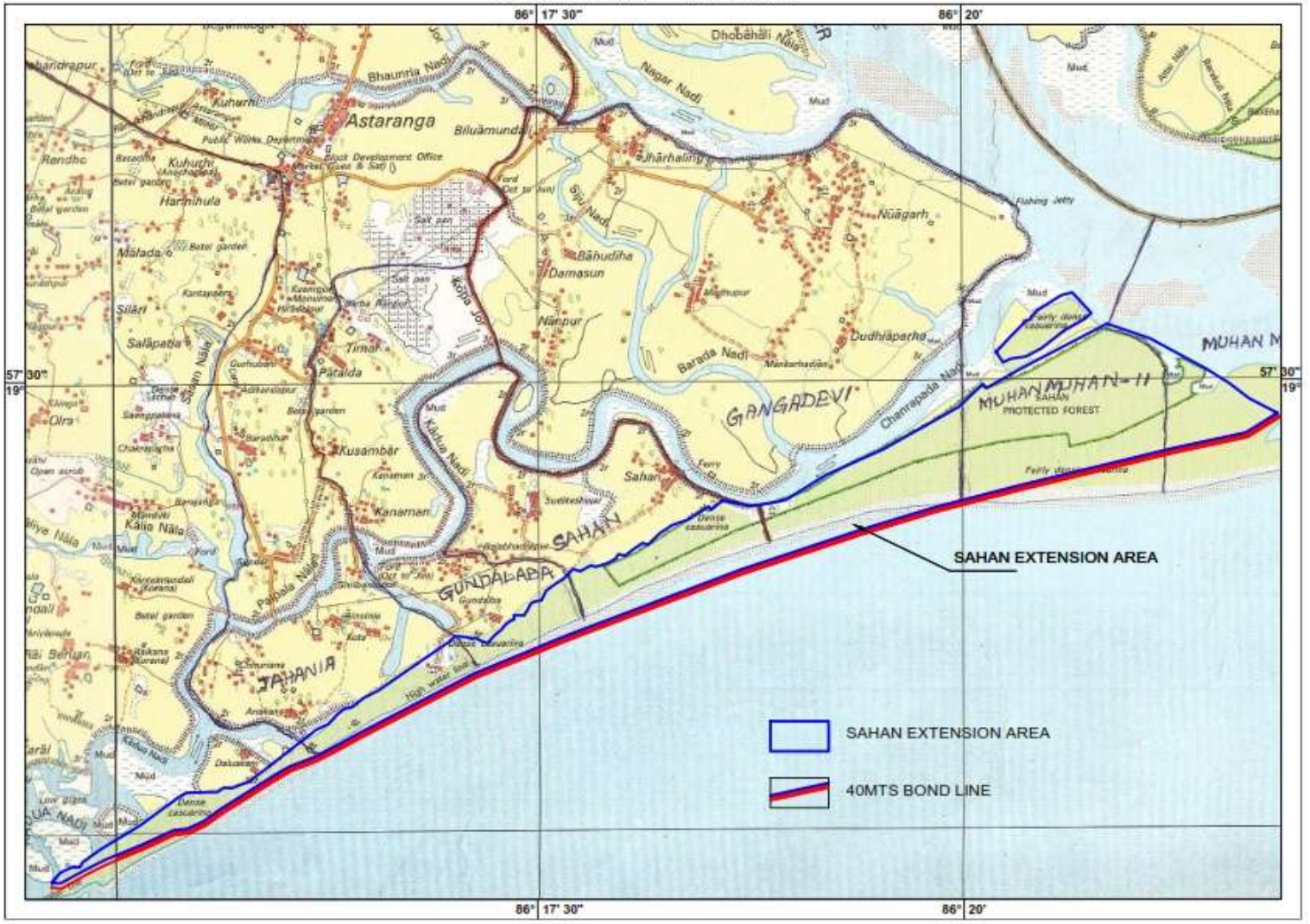
The **"Miscellaneous Working Circle"** is constituted consisting of Forest Rest House &Protection Camp in Sahan PRH at Muhanamuha, Eco Tourism Complex at Jahania Peer in Sahana Extension, Mega Nursery in Tavagolora PRF and Silvicultural Research Plot at Patnaikia PRF. An area of **42.188hectare** has been assigned to this "Miscellaneous Working Circle". The Range wise allocation / area is as follows.

Table No. 20.1: Allotment of area to Miscellaneous Working Circle

Sl No	Name of Forest Block	Total Area in Ha	Area allotted to Misc WC (in Ha)	Land Use Pattern
Astaranga WL Range				
1	Sahana PRF	322.000	8.005	Mangrove Retreat Centre & Protection camp Complex at Muhanamuha
1A	Sahana Extension (Revenue Forest)	508.670	13.383	Eco Tourist Complex at Peer Jahania
2	Tavagolara PRF	71.280	14.50	Mega Nursery at Panichhatra
Balukhanda WL Range				
3	Patanaikia PRF	42.000	6.30	Silvicultural Research Garden at Patnaikia
	Total	**943.95**	**42.188**	

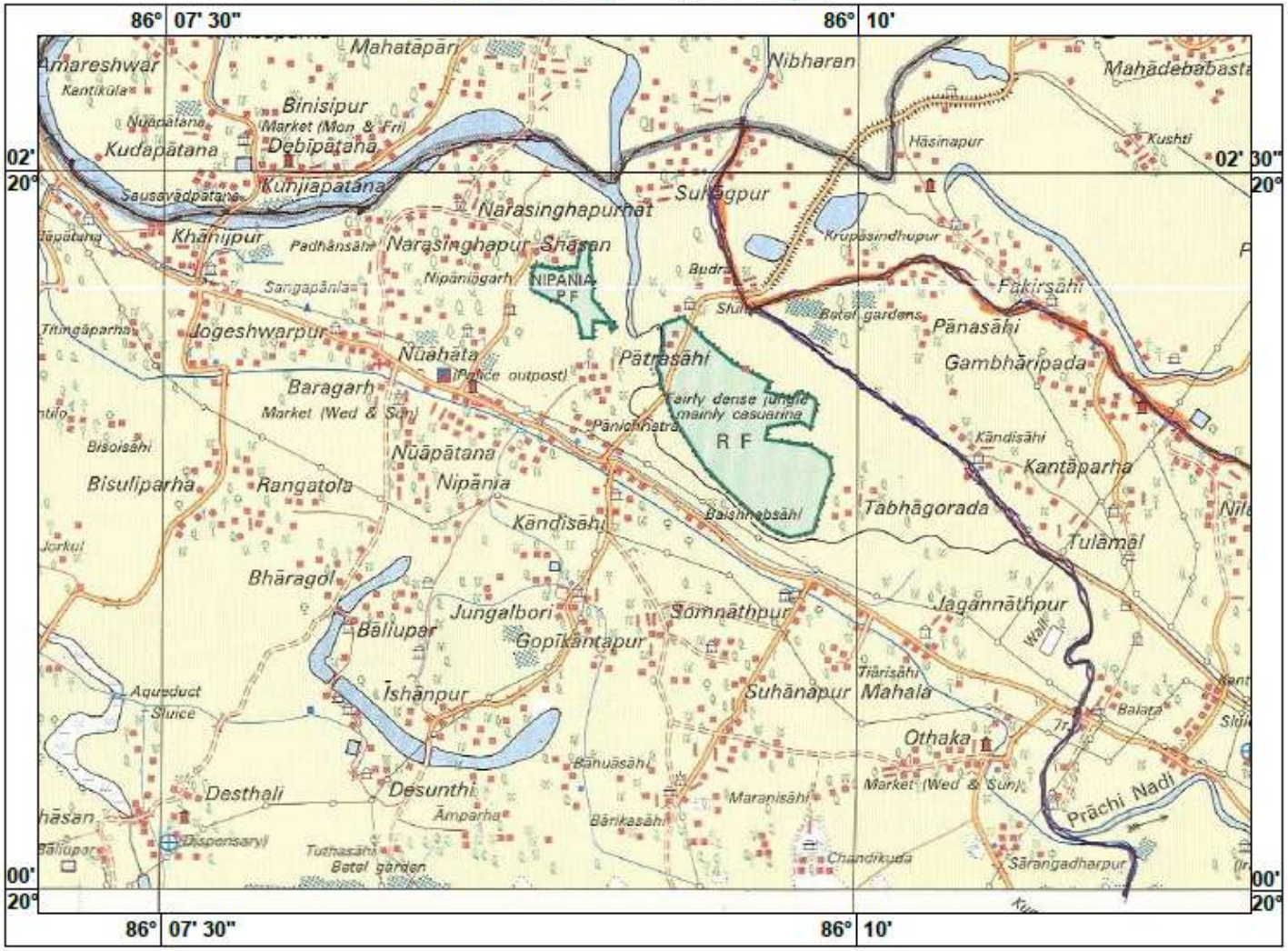
MAP SHOWING LOCATION OF SAHAN EXTENSION PRF IN ASTRANGA WILDLIFE RANGE

TOPO SHEET : E45C5 SCALE 1:35,000



MAP SHOWING LOCATION OF NIPANIA & TOVAGOLARA PRF IN ASTARANGA WILDLIFE RANGE

TOPO SHEET : F45U4 SCALE 1:35,000



20.3.0 Nature of Use of area:

20.3.1 Mangrove Retreat Centre:

There is a Mangrove Retreat Centre (MRC) and Protection camp at Muhanmuha in Sahana PRF over an area of 8.005 Ha. This MRC has been constructed to facilitate Forest Inspection, monitor Mangrove plantations, and monitor mass nesting of Olive Ridley Turtles and Migratory Birds in Devi river mouth and river bed.

Mangrove Retreat Centre at Muhanmuha

Protection Camp at Muhanamuha

20.3.2 Eco Tourism Complex:

One Eco Tourism Spot is developing in Sahana Extension (Revenue Forest)at Jahania under Astaranga WL Range over an area of 13.383ha., which was earlier covered under erstwhile Car Timber Working Circle of outgoing plan. Looking into the present land use and demand for ecotourism and picnic at Jahania this area is now included under Miscellaneous working circle. Many People are coming to the spot to enjoy the beauty of Sea Beach and Casuarina Forest throughout the year except the Rainy Season. The peak visiting period is from November to March. There is also a Peer temple named “Jahania Peer” after which the place is named. To manage the crowd and keep the sea shore clean, one VSS has been constituted in the name of Gundalaba VSS, which has been assigned 6.394 ha area out of 13.383 ha. One administrative complex has been developed by Forest Department. It is in process of further development. District administration is also developing the Road network, Parking place and common utility centre. A Nature camp with tented accommodations can be developed there to facilitate night stay of the tourists.

20.3.3 Mega Nursery:

One Mega Nursery is being maintained at Panichhatra in Tavagorala PRF over an area of 14.50ha. At present Seed Storage house, Seed treatment yard, Forest Guard House and watcher shed have been constructed. At present one Deep Bore well with overhead water tank facility is available for watering of seedlings. About three lakh seedlings can be produced at a time and can handle the requirement of seedlings for plantation and distribution in the nearby Ranges. Root trainer technique can be adopted to raise Quality Planting Material (QPM). The root trainer cups with stand can be procured from CIPET or any other reputed firm. Mist chamber can be constructed to facilitate proper seedling growth under regulated temperature and humidity.

Labourer Shed

Entrance gate of Mega nursery with watcher shed

Seed Godown

Entrance gate

20.3.4 Silvicultural Research Plot:

There is "Silvicutural Research Plot" in Patnaikia PRF over an area of 6.30ha. Silvicultural Research is being carried out by the State Silviculturist, Bhubaneswar. One Range Officer under administrative control of State Silviculture Division, Bhubaneswar is looking after Research programs. The research programmes are approved by the PCCF, Odisha and implemented by State Silviculturist under guidance of CCF (T & D). The ongoing research activities carried out by Siliviculturalist of Odisha is at **Annexure-XXX**

20.4: Constitution of Management Unit:

The area is used for different purpose. Category of land use is assigned to three different unit depending upon land use pattern. The management units are classified as follows.

Table No 20.2 Constitution of Management Units

Sl No	Use	Name of Forest Bock	Extent of Area in ha	Remark
1	Accommodation Facility			
	a) Mangrove Retreat Centre	Sahana PRF	8.005	Management Supporting Unit
	b) Eco Tourism	Sahana Extension	13.383	Eco- Tourism.
2	Nursery	Tavagolora PRF	14.50	Propagation of Forest Species.
3	Research	Patnaikia PRF	6.30	Research and Development
			42.188	

20.5 Management Practices & Recommendation:

20.5.1 Accommodation Facilities:

(i) Mangrove Retreat Centre (MRC): The Forest Officials / Other Govt. Officials on duty are allowed to visit the MRC and may make night halt on prior permission of the DFO, Puri WL Division. General catering facilities are not available. Besides the MRC with two suites of rooms, two additional rooms are available for occupation on prior permission. There is no electric supply facility to the complex. It is now being powered by generators and solar energy.

(ii) Jahania Peer Ecotourism Complex:

The Ecotourism Complex at Jahania Peer is at its initial stage. There is one Forester's Office, VHF Centre for looking after the Casuarina Forest created in Sahana PRF and Sahana Extension. Due to "Phani" Cyclone massive damage has been caused to the complex. One interpretation centre is available for the public. Gundalaba VSS will run Ecotourism, Nature camp and picnic spots in the complex as their livelihood. User fees

are to be collected by them to develop the infrastructure. Tented accommodation can be created and managed by the VSS.

20.5.2 Nursery.

The Mega Nursery at Panichhatra in Tavagolora PRF has immense potential. Now, there is no regular seedling production in the nursery. There is a vermi compost unit, but it is not in running condition due to non availability of organic matters. It has watering facilities, seed treatment yard, watcher's shed, management unit and minimum equipment's to run the nursery. Local VSS may be engaged to run the vermi compost unit by utilizing the plant & vegetable products.

20.5.3 Silvicultural Research Plot.

The Research Plot is managed by State Silviculturist. There is no ongoing research activity in the plot. However, there is ample scope to run research activities by the State Silviculturist, Bhubaneswar under the guidance of Chief Conservator of Forests (Transit & Development).

20.6.0 Recommendations:

20.6.1 Accommodation.

(i) **MRC**: Following improvements are recommended in MRC.
The MRC with addition of two suits with Solar lighting arrangements is strongly suggested. A watch tower nearing to Kadua River is also suggested to facilitate viewing of mangrove forest and heronry.

(ii) **Eco Complex Jahania Peer:** It is suggested to construct tented accommodation facilities at least for twenty persons. The catering facilities may also be developed by engaging local VSS members. They may also be assigned to run the catering / housekeeping and ancillary maintenance.

Existing interpretation centre to be modernized to encompass details on marine life especially on Olive Ridley Turtles, Sea beach management, Effect of Shelter belt / wind break may be constructed and managed for education of local people / School Children and tourists.

One watch Tower near the Eco Complex is recommended. Some hoarding depicting message on environment / wildlife may be placed in a safer place considering cyclonic effect.

20.6.2 Mega Nursery.

At mega nursery annual seedling production of one lakh shall be arranged for plantation, Farm Forestry and supply to public on cost plus basis throughout the year. To modernise the facilities and encourage clonally propagation, a clonal orchard may be developed at different sites of the Range. To facilitate vegetative propagation a mistchamber, Spinker irrigation system may be developed in a phased manner.

20.6.3 Research:

As the research activities being managed by State Silviculturist, no recommendation is suggested.

20.7 Associated Regulations and Measures:

It is expected that more and more people will visit Jahania Peer site in recent future. Regulatory mechanism, deployment of additional staff from November to March is required. Now, collection & disposal of solid waste is managed through putting dust bins. The provisions are not adequate. More dust bins are required to be provided with a tie up with local Panchyat Raj Institute (Block authority) for solid waste collection & disposal with priority. One Micro Composting Centre (MCC) may be established to manage the waste.

Coordination with District administration is highly recommended to develop the beach and provide adequate protection to tourists.

CHAPTER-21
TOF WORKING CIRCLE
(Tree outside the Forest Working Circle- 438.50 ha &600.592 RKM)

21.1: Tree outside the Forest Working Circle: (ToF WC):

The Forest area in Puri WL Division is about 4.57% of Geographical area. Besides the forests, under administrative control of Forest department about 121 Sq.KM of Revenue forests (7% of the Geographical area) remain outside the management purview. Plantations are being raised under various schemes like Coastal Shelter Belt Plantation, Forest Development Agency, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Farm Forestry, Avenue Plantations, Urban Tree Plantation, GMM, IGC etc. These Forests cover more area than the traditional forest area. Hence its management is of equal importance. In order to provide a management strategy for these plantations / natural forests, it is proposed to constitute ToF Working Circle.

21.2: General Constitution of Working Circle.

This working Circle encompass the forest outside the conventional forest land. The plantations raised by Forest Department under various schemes outside RF / PRF/ VF will be the major components under this Working Circle. For other plantations like Farm Forestry, Avenue Plantations, CSR (Corporate Social Responsibility) Plantations, FFRP and other plantations raised during Social Forestry Project but not declared as village Forest will be considered in general. The Total area under this working circle for detail management Practice is 438.50 ha. The details are as follows. Moreover, during outgoing plan period **600.592 RKM** avenue plantations have been taken up, details of which has been given at Annexure- VIof Part-I of Working Plan.

21.2.1 Plantation under FDA.

The Plantations raised under National Afforestation Program (NAP) through Forest Development Agency VSS during last plan period is furnished below (Table No 21.1). Plantations over 145.5 ha have been taken up during 2008-09 to 2010-11 (in three years). No plantations thereafter have been taken up under this program.

Table No-21.1 FDA Plantation included in TOF WC.						
Sl No.	Name of the VSS/EDC	Name of the Range	Year of Plantation			
			2008-09	2009-10	2010-11	Total
1	Palanka	Brahmagiri	10.00	20.00	5.00	35.00
2	Sahajahanpur		10.00	-	5.00	15.00
3	Narasinghapatana		5.00	-	5.00	10.00
4	Matamatapur		5.00	-	-	5.00
5	Bedhasundara		5.00	-	-	5.00
6	Kashijharia		5.00	-	5.00	10.00
7	Dovar	Gop	3.50	-	-	3.50
8	Kolhana		-	1.50	-	1.50
9	Jamara	Konark	-	4.00	-	4.00
10	Beruhan		-	5.00	-	5.00
11	Tandahar		-	3.00	-	3.00
12	Tailo		-	3.00	-	3.00
13	Balipatana	Astaranga	-	10.00	-	10.00
14	Baghamunda		-	5.00	-	5.00
15	Baradiha					
16	Rench sasan	Gop	-	1.50	-	1.50
17	Amaranga		-	2.00	-	2.00
18	Gopalapur EDC	Balukhanda	-	2.00	-	2.00
19	Samangra EDC		-	5.00	-	5.00
20	Kharagaon	Konark	-	-	3.00	3.00
21	Bangara / Barapada		-	-	12.00	12.00
22	Beldal EDC	Balukhanda	-	-	5.00	5.00
	Total		43.5 ha	62ha	40ha	145.5ha
Total Expenditure in lakh.			2.18	11.20	10.90	24.28

The Range wise abstract is as given below (Table No21.2)

Table No: 21.2 Abstract of FDA Plantations.				
Sl No	Name of the range	No of VSS/ EDC	Area in Ha	Remark
1	Balukhanda	3	12.00	EDC / Out of Sanctuary Limitation
2	Astaranga	2	15.00	VSS
3	Brahmagiri	6	80.00	VSS
4	Gop	4	8.50	VSS
5	Konarak	6	30.00	VSS
	Total	**21**	**145.50**	

21.2.2 Mangrove Plantations.

Table No: 21.3 Mangrove Plantations included in TOF WC.				
Year	Name of site	Area planted in ha.	Species planted	Present survival
2007-08	Bank of Kadua river from Sahana to Muhanmuha	30.00	Rai, Guan, Bani, Keruan, Karanja , Sundari etc.	about 60%
2008-09		25.00		80%
2009-10	Belanga	40.00		80%
2012-13	Raiberuhan	35.00		70%
2013-14	Natara	40.00		85%
2014-15	Keutajangha	10.00		85%
2015-16	Nuagarh	10.00		90%
	Total Area planted	**190.00**		

(All Mangrove plantations are in Astaranga Wildlife Range)

21.2.3 Plantations under Other Plans:

Table No 21.4 Plantations raised under other Plans & included in TOF WC.					
Year	Name of the Scheme	Name of the Range	Name of the sites	Type of plantation	Area in Ha.
1	2	3	4	5	6
2009-10	CAMPA	Astaranga	Muhanmuha	Block Plantation	16.00
2009-10	CAMPA	Astaranga	Tavagolara	Block Plantation	15.00
2010-11	CAMPA	Brahmagiri	Bhabakundaleswar	Block Plantation	34.00
2009-10	Puri-Konark Development	Balukhanda WL Range	Talabania	Sweet Water Zone Plantation	38.00
	Total				103.0

Table No 21.5: Abstract of Plantations covered under TOF.					
Year	FDA	Mangrove	CAMPA	PKDA	Total
2007-08	0	30.0	0	0	30.0
2008-09	43.50	25.0			68.50
2009-10	62.00	40.0	31.00	38.00	171.0
2010-11	40.00	0	34.00		74.0
2011-12	0	0	0	0	0.0
2012-13	0	35.0	0	0	35.0
2013-14	0	40.0	0	0	40.0
2014-15	0	10.0	0	0	10.0
2015-16	0	10.0	0	0	10.0
Total	145.50	190.00	65.00	38.00	438.50

21.3: General Characteristics of vegetation:

The plantations raised are manmade forests. Characteristics of vegetations vary according to the species planted. As the crop is not natural describing its characteristics in general is difficult. However an attempt is being made to describe the characteristic basing on plantation category.

21.3.1 Characteristic of Plantation raised under NAP (FDA activities):

Plantations raised under FDA are AR Plantations (Block Plantations @ 1100 plants per Hectare). The plantations are mostly of Casuarina mixed with Acacia. The crop density is about 60-70%. The crop is not yet matured for harvest. Due to Cyclone" Phani" in May, 2019, most of the trees have been uprooted. Some of the uprooted trees have been removed by villagers. The available trees are required to be harvested as per provisions of **"Joint Forest management Resolution, 2011 (As amended till 2019)"**

21.3.2 Mangrove Plantations:

The mangrove plantations have been raised on the banks of Kadua River & near to mouth of Devi River. The plantations are established mostly. The species planted are Rai, Guan, Bani, Keruan, Karanja , Bandari etc. The growth is satisfactory. The crop density is above 75%. The objectives of plantations are to protect the river bank from tidal erosion and stabilize the silt deposited on River banks carried during flood. At the present stage the plantations are required to be nurtured and allowed to grow without any interventions except maintaining the inundation of banks and maintaining salinity of soil.

21.3.3 Plantations under Other Plans.

Plantations raised under various Plan / Schemes are of mixed species of Casuarina and Acacia. The plantations are inter mixer of various species of fast growing species mostly Casuarina and Acacia (Rotation age- 10 years) and long term species (Rotation age- 40-60 years). The plantations are with about 75% survival. The crop is not uniform. The crop height also varies depending upon the species growth pattern. Some plantations have been severely damaged due to Cyclone "Phani" during May,2019.

21.3.4 Plantations raised under PKDA grant.

The Ground water is mostly saline due to proximity to Bay of Bengal. There are some pockets ofunderground Sweet Water Reserves at Talabania and Baliapanda of Puri Municipality. In order to protect the sweet water reserve, plantation has been taken up in and around the Sweet Water Zone. The plantations are mostly of Casuarina and Acacia species and maintained as soil cover to allow percolation of rain water to recharge the ground water. The plantation is of 10 years old with crop density of 70%. It is felt to allow the stand to grow, accumulate humus with silvicultural treatment / intervention. During Cyclone "Phani" on 3rd May,2019 most of the trees have been up rooted and are mostly removed by the local people for use. Now the area requires to be restocked by Gap planting. However, a private agency voluntarily planted 2.5 lakh seedlings of 9" height of Acacia and casuarina species although the planting technique was not scientifically sound.

21.3.5 Avenue Plantations.

During outgoing plan period 600.592 RKM avenue plantations have been taken up. (Details of plantations is at Annexure- VI of part-I). The survival of plantation is about 60%. The species are mostly shade bearing, flowering and of Aesthetic value. The growth is not uniform. Most of the avenue plantations have been badly damaged due to Cyclone "Phani". Now it is required to restock the plantations afresh to bring greenery to the area.

21.4: Treatment Series, Treatment Sections and JFM areas:

The category of Plantations and crop condition indicates that plantations raised are of short rotation mostly of fire wood species and mangrove plantations. Except mangrove plantations, other plantations are mostly raised with different objectives. The treatment series / sections are constituted basing on objectives for which the plantations are raised.

21.4.1 Astaranga Mangrove Treatment Series:

All plantations raised under Mangrove Plantation head i.e. 190 ha are included in this Series. The entire area is sub dividedin to 10 treatment section as follows.

Table No 21.6 Mangrove Treatment Section.

Range	Name of Treatment series	Year of Plantation	Treatment section	Area in ha	Year of Treatment	Remark / location.
Astaranga WL Range	**Astaranga Mangrove Treatment Series**	2007-08	Mangrove -I	30.00	2020-21	Bank of Kadua river
		2008-09	Mangrove-II	25.00	2021-22	
		2009-10 (P)	Mangrove -III	20.00	2022-23	Belanga
		2009-10 (B)	Mangrove -IV	20.00	2023-24	
		2012-13 (P)	Mangrove -V	20.00	2024-25	Raiberuhan
		2012-13 (B)	Mangrove-VI	15.00	2025-26	
		2013-14 (P)	Mangrove -VII	20.00	2026-27	Natara
		2013-14(B)	Mangrove -VIII	20.00	2027-28	
		2014-15	Mangrove-IX	10.00	2028-29	Keutajangha
		2015-16	Mangrove-X	10.00	2029-30	Nuagarh
	Total			**190.00**		

21.4.2 FDA Treatment Series:

The entire Plantation raised under NAP through FDA –VSS are included in this treatment series named “FDA Treatment Series”. For Phased treatment it is sub divided in to 10 treatment sections as given below.

Table No 21.7 FDA Treatment series

Name of Series.	Range	Treatment Section	Village / VSS	Area in ha	Year of Plantation	Year of Treatment
FDA Treatment Series	Brahmagiri	FDA-I	Palanka	10.00	2008-09	2021-22
			Narasinghapatana	5.00		
		FDA-II	Sahajahanpur	10.00	2008-09	2022-23
			Matamatapur	5.00		
		FDA-III	Bedhasundara	5.00	2008-09	2023-24
			Kashijharia	5.00		
	Gop	FDA-III	Dovar	3.50	2008-09	
			Kolhana	1.50	2009-10	
FDA Treatment Series	Konark	FDA-IV	Jamara	4.00	2009-10	2024-25
			Beruhan	5.00		
			Tandahar	3.00		
			Tailo	3.00		
	Astaranga	FDA-V	Balipatana	10.00	2009-10	2025-26
			Baghamunda / Baradiha	5.00		
	Gop	FDA-VI	Rench sasan	1.50	2009-10	2026-27

Table No 21.7 FDA Treatment series						
Name of Series.	Range	Treatment Section	Village / VSS	Area in ha	Year of Plantation	Year of Treatment
			Amaranga	2.00		
	Balukhanda	FDA-VI	Gopalapur EDC	2.00	2009-10	
			Samangra EDC	5.00		
			Beldal EDC	5.00	2010-11	
FDA Treatment Series	Brahmagiri	FDA-VII	Palanka	20.00	2009-10	2027-28
	Brahmagiri	FDA-VIII	Palanka	5.00	2010-11	2028-29
			Narasinghapatana	5.00		
			Sahajahanpur	5.00		
	Brahmagiri	FDA-IX	Kashijharia	5.00	2010-11	2029-30
	Konark		Kharagaon	3.00		
	Konark	FDA-X	Bangara / Barapada	12.00	2010-11	2030-31
	Total			**145.50**		

21.4.3 CAMPA & PKDA Treatment Series:

The Plantations raised under CAMPA & PKDA (Puri- Konark Development Authority) assistance covering 103.00ha of Plantation are included in this Series. It is proposed to be treated in 5 years Cycle.

The Section constituted and year of treatment is furnished below.

Table No 21.8: CAMPA -PKDA series (C-PKDA)					
Name of Series	Name of Section	Location	Area assigned in Ha	Year of Plantation	Year of Treatment.
C-PKDA Series	C-PKDA-I	PKDA Plantation	20.00	2008-09	2021-22
	C-PKDA-II	PKDA Plantation	18.00	2009-10 & 10-11	2022-23
	C-PKDA-III	CAMPA-Bhabakundnaleswar	34.00	2010-11	2023-24
	C-PKDA-IV	Muhanmuha	16.00	2009-10	2024-25
	C-PKDA-V	Tavagolara	15.00	2009-10	2025-26
		Total	**103.00**		

21.4.4 Allotment of area to JFM (VSS Committee):

The plantations raised under FDA and covered under FDA Treatment Series are assigned to the VSS as noted against the plantations raised in the village. Other plantations are not assigned to any VSS.

21.5: Blocks / Compartments/ JFM Area depicted on GIS Maps.

The plantation area has been surveyed by GPS and data recorded in the Plantation journals. An attempt has been made through GIS Cell of "Aranya bhaban" and depicted on corresponding Topo map.

21.6: Special Objectives of Management:

The objectives of management are varied and depending upon category of plantations the special objectives TOF management & specific objectives are furnished as follows.

General Objectives:

i. To increase tree cover of the district through planting outside the forest land.
ii. To create wind break / shelter belt to protect against cyclone.
iii. To increase bio mass production by planting quick growing species.
iv. To stabilize the sand / loose soil through planting.
v. To improve the aesthetic value along sea coast and along road network.

Specific Objectives:

a) Of Mangrove Plantations:
   - To improve bio diversity of coastal area.
   - To stabilize the river banks & prevent bank erosion.
   - To provide home to migratory birds especially at Kadua / Devi River confluence.
   - To provide a good habitat to animals / reptiles those requires both marshy land and saline water interface

b) Of FDA Plantations:
   - To meet the timber, firewood and other minor forest produce requirement of villages,
   - To enhance participatory forest & natural resource management among villagers.
   - To allow dissemination of knowledge and technology of Forest management to villagers / common man and percolate down the responsibility of protection of forest & wildlife.
   - To develop a common resource sharing mechanism with fraternity.

c) Of PKDA Plantation:
   - To protect the underground sweet water reserve,
   - To allow rain water percolation by tree planting,
   - To cover the area under tree cover and preventing dumping of garbage and contamination of ground water.
   - To maintain its present land use.

d) Of Avenue Plantations:
   - To improve the aesthetic value of the land scape,
   - To ameliorate the climate,
   - To provide shade to passer-by,
   - To provide habitat to birds / reptiles/ rodents.
   - To add tree cover to bring the area within the standard norm i.e. 33% tree cover of the total geographical area.

21.6.1 Analysis of the Crop:

The crop has been devastated due to cyclone 'Phani' occurred on 3rd May, 2019. Most of the plantations have been uprooted and fallen materials / timbers havebeen removed by villagers as a garbage cleaning operation after cyclone. The available crop is mostly of top damaged and requires to be tended for future crop.

21.6.2 Silvicultural System:

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

21.6.3 Rotation Period:

The species planted is mostly Casuarina and *Acacia auriculiformis*. The rotation period is coterminous with the Plan period i.e. 10 years. In case of Mangrove species, it has not yet reached harvestable stage and its objectives are to protect the river banks from tidal erosion. No rotation age is prescribed for mangrove species.

21.6.4 Harvestable Diameters:

The harvestable diameter has been defined at Para 16.6.3. The same is furnished below for ready reference. At the present situation only uprooted trees will be removed irrespective of its diameter. All top broken trees will be retained and allowed to rejuvenate naturally. While removing the wind fallen trees prescription for retention of some wind fallen / stag trees as per wildlife management requirement described above under Wildlife (Overlapping) Working Circle to be followed.

Table no 21.9 Exploitable Diameter / Girth of Standard trees				
Sl No	Species Retained as standard	Exploitable diameter / Girth in Cm		Remark.
		GBH	Diameter	
1	*Acacia auriculiformis (Sunajhari)*	90	29	
2	*Anacardium occidentale (Cashew)*			As long as Fruiting continues.
3	*Anogeissus acuminata (Phashi)*	180	57	
4	Anthocephalus cadamba (Kadamba)	150	48	
5	*Azadirecta indica (Neem)*	180	57	
6	*Bomax ceiba (Simili)*	150	48	
7	Erythrina variegata *(Paladhua)*	150	48	
8	*Gmelina arborea (gambhari)*	150	48	
9	Melia azedarach (Mahaneema)	120	38	
10	Fruit bearing species			As long as Fruiting continues.

21.6.5 Reducing factors and reduced areas:

The objective is not harvesting of timber and regulating yield for any purpose. Hence no reducing factor has been defined.

21.6.6 Treatment Cycle:

A treatment Cycle of 10 Years has been prescribed / adopted for this working circle.

21.6.7 Division in to periods and allotment to Periodic Blocks:

The silvicultural system adopted does not requires consideration of Periodic Block and allotment thereof. Hence it is not prescribed for this Working Circle.

21.6.8 Calculation of Yield:

No yield is calculated as only uprooted trees will be removed. The removal depends on event of any damage due to natural calamity like Cyclone, Flood or dead due to sever drought or illicit felling.

21.6.9 Table of Treatment:

The table of treatment and year of treatment is furnished under Para21.4. The same may be referred.

21.6.10 Method of Executing Felling / Treatment:

For executing the prescription the sequence of operation is as follows.

a) Demarcation of Area:

The area / forest block or part thereof is assigned for working in a particular year. It is desired to demarcate the area in the previous year at least six months prior to working. After demarcation the demarcating line may be marked by placing stone cairns (size: 60Cm dia at top, 100cm dia at bottom & height- 60cm i.e. (100+60)/2 x60 cm) or by putting demarcating pillars (size: 15cmx15cmx120cm) with numbers on it given clock wise. 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 the Map of the assigned area. On preliminary recognisance survey of the assigned area, if no exploitable trees are available, still then the assigned area is to be demarcated as the area is very much prone to encroachment. After demarcation, a signboard depicting Name of Treatment Series, Name of Section/ Coupe, area of the coupe and year of operation is to be placed at a conspicuous place near to coupe.

b) Marking of Trees:

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

i. All dead and uprooted trees / poles to be marked.
ii. Two / three fallen trees / dead but standing trees are to be left per hectare from wildlife management point of view.
iii. No green tree marking is permissible on any consideration except threat to life & properly due to positional hazards.
iv. No woody interlinking climbers to be cut during marking.

Marking is to be taken up by trained foresters and to be cross checked by the concerned Range Officer. Marking list is required to be prepared in quadruplicate along with the position of marking pillars and map. It is to be submitted to DFO for consideration.

c) Removal of trees:

The felling / conversion of marked trees is to be taken up departmentally or through OFDC Ltd depending on quantum of produce and profitability. In case of FDA Plantations, the VSS may be given priority for felling / conversion etc. 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 and amendment till date.

d) Restocking of area:

Restocking of assigned area after coupe working is of paramount importance. In most of the cases, restocking of assigned area by "Artificial Regeneration" i.e. by planting is required. . Funds for such plantations may be arranged from District administration or from State / Central Plan. In case of VSS assigned area i.e. FDA plantations, participation of VSS by contribution of labour may be explored.

e) Mangrove Series:

In case of Mangrove series, no marking is prescribed. No removal of trees is desirable. The blank areas / new adjacent areas may be planted up with suitable species like Rai, Guan, Bani, Keruan, Karanja , Sundari etc. The creaks help in inundation and maintain salinity for mangrove species. It is to be regularly maintained by desilting the mouth of creaks and channels.

21.6.11 Subsidiary Silvicultural Operations:

After coupe working, subsidiary silvicultural operation is to be taken up to maintain hygiene of the forest area.

21.6.11(a) Cleaning:

As most of the assigned area is of plantation origin and natural regeneration is scanty, silvicultural cleaning is limited to removal of debris, cutting of succulent annual climbers and maintaining the natural saplings of Acacia seen here and there. The debris is to be buried under sand / soil to allow decomposition and enrich the soil organic content.

21.6.11(b) Thinning:

As the crop is already damaged and very thinly populated, no thinning is prescribed during this plan period.

21.6.12 Restocking the area:

21.6.12.1 Restocking of Block Plantations:

The assigned area is required to be restocked by planting. The soil is suitable for planting of the following species.

i) *Dalbergia sisoo* (Bali Sisoo)
ii) *Acacia catechue* (Khair),
iii) *Bombax ceiba* (Simili)
iv) *Zyziphus maurutiana* (Barakoli)
v) *Anogeissus acuminata*(Phasi)
vi) Casuarina equisetifolia,
vii) Acacia auriculuiformis.
viii) *Saccharrum munja* (Grass)
ix) *Azadirachta indica*

Planting of *Saccharrum munja* grass on boundary line will prevent advancement of shifting sand, protect seedlings and also act as demarcating line for future.

21.6.12.2 Restocking of Mangrove areas:

Mangrove areas included in the series are within fragile eco- system of Devi- Kadua River confluence. Deposit of mud / silt on the river beds &banks due to flood creates new avenue for plantations. The existing plantations need restocking and improvement. The following prescriptions are suggested:

i) Blank patchy areas are to be restocked by planting seedlings or collected germinated seeds to be collected from mangrove forests / Hypocotyls collected from existing mangrove areas.
ii) Species those are surviving well in this area are to be tried. Favoured species are (a) Rai (*Rhizophora stylosa), (b) Bani (Avicennia alba (c) Sundari (Heritiera fomes) (d) Keruan (Sonneratia apetala)*
iii) The mud flats are suitable sites for raising Mangrove plantations. At some places these mud flats get inundated by the tidal water everyday, but there are certain patches which do not submerge with tidal water but found to be suitable for mangrove plantation. In such cases fish bone channels are required to be dug manually or by the help of JCB/ Hitachi to create fish bone

channels of cross section 1 meter X 1 meter spreading from one end to other, so that the river water passes through the channel. Similar channels parallel to each other are required to be dug at an interval of 4 meters.Plantations can be taken up inside the channel for successful establishment of the seedlings. If the area is large enough a main channel of 2 meter X 2 meter cross section can be excavated to supply abundant amount of saline water into the mud flat patch and small parallel channels of 1 meter X 1 meter cross sections can be excavated on either sides of the main channel making acute angle with respect to the main channel which gives a look of fish bone from the top. In such cases the mouth of channels are required to be cleaned/ desilted annually to facilitate interrupted saline water inundation into the plantation area.

iv) Each and every plantation site must be fenced around by spreading fishing nets supported by posting RCC pillars, so that the domestic cattle and buffalos cannot enter into the plantation during the initial 3 years of maintenance. The fencing is required to be maintained every year.

v) Profuse growth of grasses within the fish bone channel suppresses the growth of desired mangrove species in the initial years. So regular uprooting of weeds and grasses must be carried out till the seedlings grow up to 1 meter height.

vi) The patches showing repeated casualty indicate unsuitability to a particular species. In such case suitable species can be selected and replanted to maintain the plant population in these areas. If a patch is not getting adequate water species like Thespesia, Pongamia can be tried.

21.6.13 Prescription for Avenue Plantation:

Lot of Avenue plantations have been raised in the past plan period. After planting operation, no specific management practices have been set up. Due to cyclonic storm many old trees usually uprooted and caused road block, loss of life and property. It is warranted to have a set of guiding principle for avenue plantation (TOF).

21.6.13.1 Special objectives of Management.

The objectives of Avenue plantations are

a) To utilize the Road side vacant land for creation of green belt,
b) To increase the aesthetic value of the landscape,
c) To check spreading of noise and dust from traffic to nearby institutions / habitations.
d) To provide shade to passerby,
e) Act as wind break during Cyclonic wind,
f) To add to Forest cover of the district / state,

g) To increase bio mass production &act as Carbon Sink.
h) To provide shelter to avifauna.

21.6.13.2 Avenue Plantations included for management.

All avenue plantations raised during last ten years and Roads leading to Puri from other districts i.e. NH and State Highways linking to Puri. During last plan period (2011-12 to 2018-19) 600.592 RKM (Running Kilometre) avenue plantation has been raised. This entire Avenue Plantations have been included for management.

21.6.13.3 Allotment to Treatment Series / Section:

The entire Avenue Plantation are included in one Series i.e.**"Avenue Treatment Series"** and divided in to ten sections as follows.

Table No:21.10 Avenue Treatment Series

Name of the Section.	Avenue Plantation Name	Extent of Plantation In RKM	Year of Plantation	Year of Treatment.
ATS-I	Brahmagiri-Sukala	29.00	2011-12	2021-22
	Brahmagiri-Sukala	29.00		
ATS-II	Malatipatapur-Salipatana	8.00	2012-13	2022-23
	Baliput-Jamarasuan	4.00		
	Chhaitana-Madaranga	8.00		
	Chhaitana-Badagaon	8.00		
	Satyabadi PWD road-Raichakradharpur	8.00		
	Alasaranga-Parahat	4.00		
	Narua-Tarakora	10.00		
	Subarnapur-Gabadiha	6.00		
	Jamadharma-Dhanitri	6.00		
	Sudhikeswar-Sahana	4.00		
ATS-III	Bangurigaon-Sarei	10.00		
	Astaranga-Beguniabasta	4.00	2012-13	2023-24
	Alasahi-Nagara	2.00		
	Astaranga T4-Raiberuhan	5.00		
	Astaranga RD road-Athatira	2.00		
	Alasahi-Asana	2.00		
	Kundhei-Naiguan	3.00		
	Kerandiapala-Naiguan	5.60		
	Alasahi-Papira	6.00		
	Hiradeipur-Bangurigaon	10.00		
	Bangurigaon-Nasikeswar	3.00		
	Haladia Chhaka-	6.00		

Table No:21.10 Avenue Treatment Series				
Name of the Section.	Avenue Plantation Name	Extent of Plantation In RKM	Year of Plantation	Year of Treatment.
	Jagannathpatana			
	Ranacharanapur-Talamala	8.00		
ATS-IV	Brahmagiri PWD – Talakokala	8.00	2012-13	2024-25
	Sunamuhin-Barakudi	8.00		
	Bhabakundaleswar- Dahikhia	8.00		
	Krushnaprasad- Manikapatana PRF	5.20		
	Patapur-Bamanala	6.00		
	Ampara-Baharana	6.00		
	Nimapada- Arisandha	3.00		
	Badaninigaon-Bramhanachandapur	6.00		
	Avenue Plantation inTalabania	7.00		
ATS-V	Sanapali-Podapada	5.00	2013-14	2025-26
	Baliput-Palli	5.00		
	MB Road-Dandasahi	5.00		
	Chilapatana-Padmapur	4.80		
	Dhabachhaka-Kusubenti	10.00		
	Payara-Kanti	10.00		
	Amaranga-Gopalpur	8.00		
	Tikina-Kanpur	6.00		
	Sutana-Patelia	4.00		
	Soma-Santrasa	2.00		
	Bodala-Mahadevbasta	4.00		
	Fakirasahi-Nilakanthapur	4.00		
ATS-VI	Astaranga-Baradihi	2.00	2014-15	2026-27
	Sidhipur-Bantilo	4.00		
	Astaranga-Nuagarh	6.00		
	Nilakanthapur-Patasundar	2.00		
	Balidokana-Tikarapada	10.00		
	Khelara-Balanga	8.00		
	Kajipatana-Gangua	10.00		
	Nimapada-Banishree Mahavidyalaya	4.00		
	Khelara-Red Bazar	4.00		
	Nuagaon-Balamaharana Chhaka	5.00		
	Hantuka-Siruli	2.00		
	Bhuan-Beleswar Temple	5.00		
ATS-VII	Junei Bridge-Sutan Chhaka	5.00	2015-16	2027-28
	Avenue Plantation along NH-203	13.528		

Table No:21.10 Avenue Treatment Series				
Name of the Section.	Avenue Plantation Name	Extent of Plantation In RKM	Year of Plantation	Year of Treatment.
	Sahupada-Miteipur Road	10.00		
	Satasankha-Balanga-Nimapada PWD Road	14.00		
	Pipili-Nimapada-Konark PWD Road	12.00		
	Uttara-Athantara-Nimapada PWD Road	8.00		
ATS-VIII	Bayabar-Khelar PWD Road	8.00	2015-16	2028-29
	Hyngira-Chaataban	10.00		
	Bhanpur-Rench	10.00		
	Nimapada-Astaranga	10.00		
	Sahanpur-Kendrapathi	4.00		
	Sisua-Balanga	2.00		
	Astharanga-Nuagaon	2.00		
	Batachhaka-B. Jena Gheri	6.00		
	Sunamuhin-Haripur	10.00		
ATS-IX	Hyngira-Chaataban	10.00	2015-16	2029-30
	Bhanpur-Rench	10.00		
	Nimapada-Astaranga	10.00		
	Sahanpur-Kendrapathi	4.00		
	Sisua-Balanga	2.00		
	Astharanga-Nuagaon	2.00		
	Harapada-Markandapada	5.00	2016-17	2029-30
	National Highway-203	12.20		
	NH Feeder Nimapada-Konark PWD Road	10.00		
ATS-X	Nuharakiri-Uhanga	2.00	2016-17	2030-31
	Sarada-Gadarupash	2.40		
	Sarada –Kundis	2.00		
	Bilabarapada-Dandasahi	5.00		
	Potala Chhaka-Korana Village	2.00		
	Astaranga-Nuagada	2.00		
	Kanamana-Sundara	2.00		
	Hanuman Temple-Suhanapur	2.00		
	Othaka-Mohanty Sahi	4.00		
	Delta Bridge-Kandi Sahi	2.00		
	Block Chhak-Nilakanthapur	2.00		
	Olangara-Khandasahi	4	2017-18	2030-31
	Anakana-Daluakani	4		
	Jagannathpur-Talamala	3		
	Sarada-Kharipadia Road	1		

Table No:21.10 Avenue Treatment Series				
Name of the Section.	Avenue Plantation Name	Extent of Plantation In RKM	Year of Plantation	Year of Treatment.
	Raitasahi-Palabasta Chhak	2		
	Bajabandha-Hatuadanda	3.5		
	Gabakunda-Jamarsuan	10		
	Avenue plantation along NH-203	8.164		
	Avenue plantation along NH-203	8.00	2018-19	
	Total	**600.592**		

21.6.13.4 Treatment Prescribed.

The avenue plantations included in this treatment series are at young stage and partly damaged due to cyclone "Phani" occurred during 3rd May,2019. Considering the present condition, the following prescriptions are recommended.

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

Name of the Treatment Section	Name of the Road & Distance / Chainage in Km	Name of Species	Height in Meter	BGH in cm	Present Condition.	Remark / Suggestion.

b) If any plant / tree is badly damaged and above 30cm GBH it is recommended to remove the plant and a new plant with promising growth is to be planted.
c) Any old / hollow diseased tree likely to fall down in moderate wind is to be marked and enlisted. Such trees are to be jointly visited by Range Officer and any representative of PWD / NH Authority and record their suggestion on removal or retention. In case of suggestion for removal DFO is to intimate the district authority and take steps for its removal followed by planting in the assigned year.
d) All retained plants above 3cm GBH are to be checked for hanging branches if found to be removed.
e) The PWD / NH authority may be requested to put Radiant paints on trees at Breast Height for visibility during night.
f) Similar exercise is recommended for other avenue plantations not included in this series.
g) In case of cyclone or storms many avenue trees get uprooted and some get partially uprooted, which can be restored immediately within a week. Those trees

can be straightened by pulling from other side with the help of rope. Obstructing soil of root zone can be removed from bottom of tree to keep the tree at erect position. While pulling to straighten the tree care should be taken to avoid further damage of root system. After erecting, foreign soil can be added to make a soil mound at base of the tree. The tree can be kept at its upright position by tieing its trunk to nearby tree or structure by help of rope. If required broken branches can be used as prop/ stack to provide mechanical support. Regular watering up to a month is required to support the tree to restore its original position.

21.6.13.5 Species suggested for Road Side Plantation.

Considering the soil characteristics, proximity to tourist spots, prone to cyclonic storms the following species are recommended for avenue plantations. It is also suggested for planting one species on both the sides over a length of 2 km to add to the beauty / aesthetic value of the road. Species suggested are

(i) Lagerstoemia flosreginae (Patuli),
(ii) Cassia fistula (Sunari),
(iii) Dalbergia sissoo (Sissoo),
(iv) Syzigium cumini (Jamu)
(v) Mangifera indica (Aamba)
(vi) Anogeissus accuminata(Phasi)
(vii) Samania saman (Bada Chakunda)
(viii) Peltophorumferrugineum (Radha Chuda)
(ix) Spathodia campanulata (Mysore Queen)
(x) Mimosops elengi (Baula)
(xi) Azadirachta indica (Neem)
(xii) Alstonia scolaris (Chhatiana)
(xiii) Pongamia pinnata (Karanja)

Planting of one year old promising seedlings is recommended.

21.6.14: Associated Regulations and Measures:

21.6.14.1: It is required to conduct a survey from Satpada to Astaranga along the sea coast and identify areas of Government / Private Ownership within one kilometre from coast “High tide Line” in a phased & time bound manner and comprehensive planning may be made for raising **“Casuarina plantation and Incentive based Farm Forestry”.** The help of GIS Cell of PCCF Office, Odisha, ORSAC or Private organization may be availed for identification of vacant land through Satellite imagery interpretation. Other Regulations i.e. Coastal Regulation Zone notification is also to be followed. The plantation activities

may be extended to nearby areas to meet growing demand of Jagannath Temple / Swargadwar and industrial requirement.

21.6.14.2: Future Planning: The village roads after upgraded to concrete or tar road under PMGSY can be taken up with permission from R.W. Department. Avenue plantation on the side of PWD road, NH or SH can be taken up with the permission from the concerned authorities, if they do not have planning for widening of road within 10 years. In many cases it is seen that such roads are being expanded to double lane or 4 lane by cutting the trees on both sides of the road. As per Rule they have to bear the cost of plantation and its maintenance up to 4 years of double the number of trees felled due to expansion. In this case the NH or PWD authorities may be asked to provide land preferably on the same road side to plant the required number of seedlings. Compensatory plantation of double the number can be taken up at other places when space at the same site is not available for plantation after expansion of the road.

Instead of cutting the pole size trees, modern technologies can be adopted to uproot the pole size trees and shift them to a distance from the road beyond the expansion area if forest land or acquired private land is available nearby. In such case the tree needs to be uprooted along with its ball of earth of 1mt radius and 1 mt deep without disturbing its root system by bringing a earth mover or extractor. The uprooted tree can be replanted/ transplanted in a pit already dug at a safer place with 2 mt X 2 mt X 2mt size. Foreign soil, CDM can be put to plant the tree. Regular watering is to be made for a month or so till it is established.

CHAPTER -22
Reduce Emissions from Deforestation and forest Degradation (REDD+)

22.1. Introduction:

REDD+ stands for countries' efforts to “Reduce Emissions from Deforestation and forest Degradation”, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks.Deforestation and forest degradation are the second leading cause of global warming, responsible for about 15% of global greenhouse gas emissions, which makes the loss and depletion of forests a major issue for climate change. In some countries, such as Brazil and Indonesia, deforestation and forest degradation together are by far the main source of national greenhouse gas emissions.

Eighty percent of the Earth's above-ground terrestrial carbon and forty percent of below-ground terrestrial carbon is in forests. In addition to the large contribution of deforestation and forest degradation to global emissions, combating both has been identified as one of the most cost-effective ways to lower emissions.

Currently, there appears to be a consensus that the issue of deforestation and forest degradation must be effectively tackled as it would otherwise limit the options available to reduce greenhouse gas emissions, greenhouse gas concentrations and increases in temperature to acceptable levels. Any reduction in the rate of deforestation and forest degradation has the benefit of avoiding a significant source of carbon emissions and reducing other environmental and social problems associated with deforestation.

Unlike afforestation and reforestation activities, which generally cause small annual changes in carbon stocks over long periods of time, stemming deforestation causes large changes in carbon stocks over a short period of time. Most emissions from deforestation take place rapidly, whereas carbon removal from the atmosphere through afforestation and reforestation activities is a slow process.

In addition to mitigating climate change, stopping deforestation and forest degradation and supporting sustainable forest management conserves water resources and prevents flooding, reduces run-off, controls soil erosion, reduces river siltation, protects fisheries and investments in hydropower facilities, preserves biodiversity and preserves cultures and traditions. With all that at stake it is clear what has to happen. With all the services that forests provide both to humanity and the natural world, there is now widespread understanding of a simple yet profound fact that forests are more important left

standing, than cut. Out of that understanding, the Forest Carbon Partnership Facility have come up.

Country commitments to mitigate and adapt to climate change are an integral part of the 2030 Agenda for Sustainable Development with its 17 global goals that countries have adopted to guide development efforts. The REDD+ mechanism contributes directly to achieving Sustainable Development Goals (SDGs) 13 and 15. Those address climate change, reducing deforestation and sustainable use of ecosystems. REDD+ can also contribute to achieving other SDGs – including those which address poverty reduction, health and well-being, hunger alleviation, and improving institutions.

22.2 FAO's support to countries' Nationally Determined Contributions (NDCs):

With FAO's technical support, countries can use REDD+ actions as catalysts to deliver on their Nationally Determined Contributions (NDCs) towards climate change mitigation and adaptation. In Agriculture, Forestry and Other Land Use (AFOLU) are among the climate actions that most countries have included their NDCs, which underscores the important role these sectors play in climate change mitigation and adaption. Many NDCs have also made specific reference to REDD+ plans, offering an opportunity to mainstream REDD+ and climate efforts into countries' national planning processes and ultimately, actions on the ground.

22.3 REDD+ Implementation:

FAO's support to countries is based on technical expertise in assessing the drivers of deforestation and forest degradation and finding opportunities for forest carbon conservation, management and enhancement. FAO also helps countries design and implement REDD+ mitigation actions, which offer both carbon and non-carbon benefits, taking advantage of cross-sectoral expertise and building on existing experience. FAO works to strengthen collaboration with other initiatives and helps to promote public-private partnerships to scale up investments on REDD+ implementation.

22.3.1 Country highlights:

Equatorial Guinea highlights the transformational role of women in climate action. Aiming to address gender inequalities and strengthen women's contributions to the planning of national climate action, Equatorial Guinea organized a national workshop with the participation of 53 women representing various sectors and social groups. The workshop complemented an ongoing participatory process to develop the country programme for the Green Climate Fund (GCF), which defines the national priorities to

contribute to the global fight against climate change, and ways to translate these priorities into projects to be submitted to the GCF.

The 21st session of the Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) was held in Paris in November and December 2015. 195 participating countries negotiated and adopted the Paris Agreement, which includes objectives to peak greenhouse gas emissions as soon as possible, to limit the global average temperature increase above pre-industrial levels to well below 2°C, and to pursue efforts to limit the increase to 1.5°C.

The Paris Agreement, which entered into force on 4 November 2016, requires Parties to put forward their best efforts through "nationally determined contributions" (NDCs). These NDCs represent targets and actions for the post-2020 period. India ratified its'contribution the 2 of October 2016.

22.3.2 India's first NDC includes commitments:

Our country's commitment for **"Nationally Determined Contributions" (NDCs) are**

- To reduce the emissions intensity of its GDP by 33-35% from 2005 levels by 2030.
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.

India announces its INDC, pledges to cut emission intensity of its GDP by 33-35 per cent by 2030

All countries are required to submit voluntary climate action plans as contribution. These will form part of the outcome of Paris climate summit.

India's INDC is fair, and its renewable energy and forestry targets are ambitious, says CSE

Ahead of the UN Conference of Parties on Climate Change, scheduled in December 2015 in Paris, India on Sunday submitted its Intended Nationally Determined Contribution

(INDC) to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). Delhi-based non-profit Centre for Science and Environment (CSE) has called the Indian INDC "fair" and its renewable and forestry targets "ambitious".

In its INDC, India has pledged to improve the emissions intensity of its GDP by 33 to 35 per cent by 2030 below 2005 levels. It has also pledged to increase the share of non-fossil fuels-based electricity to 40 per cent by 2030. It has agreed to enhance its forest cover which will absorb 2.5 to 3 billion tonnes of carbon dioxide (CO_2, the main gas responsible for global warming) by 2030.

India has accepted the huge impact that climate change is exerting and will exert on different sectors of its economy and has agreed to enhance investments to adapt in vulnerable sectors like agriculture, water resources, coastal regions, health and disaster management.

India has also reiterated its need for international finance and technology support to meet its climate goals. In this regard, it has said it would require at least US $ 2.5 trillion (at 2014-15 prices) to meet its climate change actions between now and 2030.

India's forestry target is also very ambitious. It intends to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2through additional forests by 2030.

Talking about the efforts already in the pipeline, the government highlights

- India's National Solar Mission,
- Green Energy Corridor projects,
- Swatchh Bharat,
- National Air Quality Index,
- Smart Cities,
- ParamparagatKrishiVikasYojana,
- Soil Health Card Scheme,
- Pradhan MantriKrishiSinchayeeYojana,
- National Mission for Clean Ganga etc among others.

22.3.3 Indicative Work plan to combat Climate Change:

- Government harps on sustainable lifestyle to fight climate change
- Promising raising requisite funds and adopting new technology.
- More focus on agriculture, water resources, coastal regions, and health and disaster management.

- To tackle climate change by adopting healthy and sustainable lifestyle, which were "inherent in traditions and values of conservation & moderation.
- To reduce consumerism in our lifestyle& reduce to reduce per capita consumption by not wasting food and limiting the number of durables / cars per household.
- To have ambitious focus on energy efficiency and dramatic increase in renewable energy.
- To enhance dependency on non-fossil fuel-based energy.

22.3.4 Suggestive measures on Forestry Sector.

In forestry sector to combat climate change the following activities are suggested.

a) To reduce felling of trees in all sphere and enhance creation of renewable energy.
b) To reduce dependency on fossil fuel including that of firewood.
c) To enhance use of solar energy / wind energy or electricity where ever possible.
d) To motivate people to reduce consumerism& reduce generation of solid waste.
e) Conserve water body and enhance efficient use of water.
f) To promote urban forestry, roof top gardening to sink atmospheric carbon.
g) To adopt soil conservation measures.

CHAPTER-23
APPLICATION OF MODERN TECHNOLOGY TO FOREST MANAGEMENT

23.0 Introduction:

A number of popular technologies are currently being used in the field, but Geographic Information Systems (GIS) and Global Positioning System (GPS) rank at the top. Pick up a modern smart phone and you'll see how far this technology has come in just a short period of time. For modern foresters and loggers, an array of similar handheld receivers can be used to download data gathered from GPS, which can then be input into databases that combine it with other GIS information. This data can then be added directly into spreadsheets, modeling programs, visualization applications and mapping projects. Such technology helps foresters and loggers monitor and analyze timberland health, improve transportation routing, track forest growth and maintain a database of timberland changes.

LIDAR technology (Light Detection and Ranging) is also beneficial for modern foresters, which collects tree measurements and detailed imaging. While traditional prisms are still valuable tools, LIDAR helps to measure canopy heights and volume, basal areas and habitat mapping.

Drones are also proving to be increasingly valuable to foresters. While drones are still considered to be a hobbyist toy by many, forestry professionals use them to help with forest management planning, detecting disease, managing forest fires and monitoring wild animals. For large properties, drones are a great device for assessing volume and the overall condition of tree plantations.

Most of these tools have practical applications on the ground and in the field, which result in real-world information that cannot be replaced. However, combining this information with the detailed, customizable datasets that are available in SilvaStat360 allows foresters to apply context to the information they gather in the field so they are better equipped to make more informed decisions.

All of these technologies provide incredible benefits to the forestry industry and the pace of exciting, new technological developments continues to quicken. Members of the modern forest supply chain who embrace and utilize these technologies will be well-positioned to succeed in the modern global forest economy.

23.1 Modern Technology being adopted:

At present the Forest Officials are quite conversant with the following technology and frequently using for forest management. These are

- Use of Global Positing System (GPS) in survey, Demarcation & locating the specified spot.
- Use of Differential Global Positing System (DGPS) for survey of Forest blocks / area with an exact accuracy of 95% level.
- GIS applications for map study / Map preparation etc.
- Study and use of Satellite Imagery for detecting vegetation change, Sea Shore erosion, CRZ management.
- Use of Satellite data (MODIS/SNPP satellite) for detection of Fire and faster communication of location of incidents.
- Clonally Propagation with mist chamber facilities for better genetically improved seedlings for plantation purpose.
- Root trainer nursery for mass seedling production.
- Use of Sprinkler or drip irrigation for watering in Nursery.
- Various mobile applications, Infra Red radio collars, GPS Transmitters to monitor animal movement & reporting. Use of camera trap, drone camera, night vision binocular, M-stripe, distance software help in wildlife monitoring.

The available technology at the hands of Forester, as stated above are not used / applied in an extensive manner that is required & desirable. During this plan period it is expected that each forester in field should have access to all these facilities and use them for day to day management.

23.2 Modern Technology to be introduced in Forest Management:

With advancement of technology it is proposed to have the following facilities available with Puri Wildlife Division for better management.

a. Identified Plus trees within the Division and maintaining a Clonal Orchard.
b. To have improved Mega Nursery with clonal propagation facilities with mist chamber, Sprinkler System.
c. Root trainer facilities and capacity to meet requirement of Quality Planting Materials for the division instead of depending upon temporary nursery.
d. All forest blocks / plantations surveyed with DGPS and mapping thereof.
e. Establishment of GIS Cell with available Satellite imagery for monitoring purpose.
f. Modern logging tools to meet emergency in **Post Cyclone Management**.
g. Drone camera facilities to watch sea erosion, wildlife movement and Olive Ridley turtles mass nesting phenomena.

23.3 Improvement of Communication facilities

Being a Wildlife division, it is required to develop the fast and reliable communication system. It is proposed to

i. Maintain the existing VHF network.
ii. Additional VHF Network is to be developed
iii. Satellite phones is required to be installed in the division as the division is prone to cyclone and there is possibility of disruption of mobile network during cyclone.

CHAPTER-24
GENERAL

24.1 General financial forecast and financial plan of operation:

Considering the prescriptions in various working circles, the activities involve & its quantum of operation with financial forecast at the present price level is furnished at Table no 25.1

Table No 25.1: General Financial forecast at the present price level

Sl No	Name of Working Circle	Suggested area of operation. In Ha	Per unit Cost norm in Lakh Rs	Total amount in Lakh Rs
01	Rehabilitation Working Circle	77.90 x2=155.80 ha	1.00	155.80
		Barbed wire Fencing, as required 110 Rkm	7.00	770.00
		Misc. Activities/ bamboo operation 155.80 ha	0.75	116.85
02	Casuarina Working Circle	746.717 ha	(Marking etc- 1.00 Silvicultural operation: 0.50 Planting: 1.80) =2.30	1717.50
03	Plantation Working Circle	386.382 ha	Survey demarcation Marking etc- 1.00 Planting ; 1.80	1081.87
04	Protection Working Circle	386.382	1.00	386.382
05	Wildlife (Overlapping) Working Circle	981.792	0.20	196.358
06	Joint Forest Management (Overlapping) Working Circle	388.636	Demarcation of VSS area & activation - 0.50.	194.318
07	TOF Working Circle	438.5 ha Plantation &600.592 RKM avenue Plantation	0.75 per ha & RKM	779.32
		Additional Area for planting 500 ha	2.00	1000.00
		Additional coverage of Avenue Plantations: 200 RKM	5.00 lakh	1000.00
08	Miscellaneous Working Circle	42.188 ha		
		FRH Maintenance	20.00	90.00
		Jahanapeer Eco Complex	20.00	
		Mega Nursery	50.00	

Table No 25.1: General Financial forecast at the present price level				
Sl No	Name of Working Circle	Suggested area of operation. In Ha	Per unit Cost norm in Lakh Rs	Total amount in Lakh Rs
09	REED+	General / Motivation etc	20.00	20.00
10	Adoption of New Technology		100.00	100.00
11	Eviction of Encroachment & Pillar Posting		100.00	100.00
	Total Financial Forecast			**7708.398**

(NB: The financial requirement to implement the plan prescription is 7708.398 lakhs at the present price level on a holistic approach. Basing on Wage escalation, the cost of implementation will be hiked by minimum 20% of the estimated cost.)

24.2 Source of Funding:

This division normally receives funds from State Plan, Central Plan, National Afforestation Program, CAMPA, Odisha Environment Management Fund. CSR from OMC, SRC, ICZMP, Increasing Green Cover, Green Mahanadi Mission, MGNREGA, district Planning untied Funds. The level of present resource allocation is to a tune of 5.00 Crores to 6.00 Crores. For restoration of 'Phani' damaged area government is keen on more plantations, Green Belt creation and better wildlife management. Hence funds for implementation of working plan prescription will not be a problem.

24.3 Miscellaneous regulations:

Besides the Working Plan Prescription various miscellaneous regulation in form Acts/ Rules / administrative directives are framed and being implemented by the Forest Department. These are

1) Forest (Conservation) Act,1980;
2) Costal Regulation Zone, 1991
3) Balukhanda Sanctuary ESZ Notification,
4) Ban on use of Polythene in State / Country.
5) Forest Rights Act,2005, etc.

These rules / guidelines are to be followed for better management of Forest & Environment.

24.4 Petty felling and Extraction:

Petty Felling and extraction for research and training needs may be allowed by Divisional Forest Officer on academic interest. It is necessary to emphasize the fact that experimental, preservation and sample plot, seed stand and their demarcated surrounds, etc. are excluded from all operations prescribed in the working plan. Special grants in exceptional circumstances for maintenance of these may be allowed, which do not cause much deviation.

24.5 Rights and Concessions:

At present Rights & Concessions those are allowed are

i) Right of Way on Forest Blocks,
ii) Collection of Non Timber Forest Produce as admissible in JFM Resolution-2011
iii) Rights on Forest land either individual or Community to be allowed as per provisions of Forest Rights Act,2005 / Rules,2006

No other rights & concessions are allowed at this stage.

24.6 Other research and experimental plot.

There is an Research Plot at Patnaikia PRF maintained by State Silviculturist. The area has been included under Miscellaneous Working Circle. There is no other research Plots in the division except one at Phulpatna in Balukhanda RF which is within Balukhanda-Konark sanctuary.

CHAPTER-25
SUMMARY OF PRESCRIPTION

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25. Introduction:

This chapter provides a brief description of prescriptions and suggestions as per working circles. This would help as ready reference.

25.1 Working Circles Constituted & prescribed:

Considering the Crop condition & objectives of management eight working circles are constituted. These are

i. Rehabilitation Working Circle –(Area assigned -77.90 Ha)
ii. Casuarina Working Circle – (Area assigned –746.717 Ha)
iii. Plantation Working Circle-(Area assigned –386.382 Ha)
iv. Protection Working Circle- (Area assigned- 434.545Ha)
v. Wildlife (Overlapping) Working Circle- (Area assigned –981.792 Ha)
vi. Joint Forest Management (Overlapping) Working Circle.(Area assigned – 388.636Ha)
vii. TOF Working Circle (Area- 438.50ha &600.592 RKM Avenue Plantation)
viii. Miscellaneous Working Circle (Area assigned - 42.188 Ha)

There are Five stand alone Working Circles having independent area where as there is proposal to constitute Two Working Circle with overlapping jurisdiction and one TOF (Tree outside the Forest Area) Working Circle, which does not cover any RF/ PRF or VF,
The period of this working Plan is from 1st April, 2021 to 31st March, 2031. The implementation and probable impact of various prescriptions may be reviewed after five years of working. If it is so required, revision of some chapters may be made.

25.2 Prescription for Rehabilitation Working Circle: (Area-77.90 ha)

The Silvicultural System to be adopted for this working Circle is ***"Silvicultural Cleaning, Tending followed by Aided Natural Regeneration supplemented with enrichment Plantation".*** The operations prescribed involve Silvicultural Cleaning, Silvicultural Tending (Thinning) and Aided Natural Regeneration.

25.2.1 Aided Natural Regeneration:

Besides Silvicultural Cleaning the following activities are prescribed for the Aided Natural Regeneration (ANR).

- Regeneration from Seed Origin (Recruits, Seedlings and Saplings) to be aided with weeding, Soil Working and application of fertilizer to enhance growth & speedy establishment.
- Extensive Soil & Moisture Conservation measures to be taken up. Besides Contour trenches, contour bonding, gully plugging, Vegetative check dams, percolation pits are required to be taken up to improve soil moisture regime. Individual plants of Natural origin need to be provided with Half Moon Trench, Soil Mulching etc.

25.2.2 Enrichment Plantation

In Blanks, seedlings of indigenous species matching with the natural seedlings / saplings / vegetation available nearby area are to be planted. Planting of teak Acacia, Chakunda, Eucalptyus inside natural forest is to be avoided.

The objective of this Working Circle is not to harvest any Forest Produce within this Plan period. There are few NTFP species available within the forest blocks. Bamboo is the main species forming congested clumps need to be managed. The treatment period is made coterminous with the Plan period i.e. 10 years. As the area is small, the treatment is restricted within three years and repetition after 5 year i.e. a five year cycle.

A treatment Cycle of 5 (Five) years is prescribed. For management of available Bamboo, a cutting Cycle of 5 (Five) years is also prescribed. For other NTFP like Fruits / Berries / Grasses / fodders an Annual Cycle is to be followed. Within the plan period two cycles will be completed.

25.2.3 Silvicultural System for Bamboo: The silvicultural System prescribed is

- Culm Selection-cum-Clump-improvement Combined with simultaneous cleaning and cultural operation for Saila Bamboos. &
- Clump Improvement combined with simultaneous cleaning and cultural operation for Daba Babmboos.

25.3 Casuarina Working Circle :(746.717ha)

The Casuarina Plantations raised in Sahana PRF and Sahana Extension of Astaranga Wildlife Range are proposed to be worked under this Working Circle. In the previous working plan, this Working circle was named as **"Car Timber Working Circle"**. The sole species is *Casuarina equisetifolia*. The area allotted to this working Circle is **746.717 ha**

25.3.1 Constitution of Felling Series:

Two **Felling Series** i.e. **Sahana Felling Series** and **Muhanmuha Felling Series** are constituted covering area 305.617 and 441.100 ha respectively.

25.3.2 Crop Composition& Silvicultural System:

The overall crop looks like a mosaic of casuarinas trees with patches of **"Different Age Class".** The productivity is more or less equal.The prescribed Silvicultural System is **"Clear Felling followed by Artificial regeneration by Planting**".To induce coppice shoots the area after main felling is to be control burnduring February.The area is to be planted up in the assigned year.

25.3.3 Rotation Period:

The Rotation period is fixed to 10 years from the year of planting which is co-terminus with the plan period.

25.3.4 Execution of Felling:

The Coupe area is to be demarcated by the Section Forester as per the management map provided with the help of GPS.The identified points are to be marked with stone cairns of 75 cm base and 60 cm height or preferable with RCC Pillars of 20cm x 20cm with 120cm height. The pillar numbers to be marked clock wise with Lat / long on it.The line connecting adjacent pillars is to be cleared at a width of 90 cm. Any tree coming within the Coupe line should not be felled but to be provided with a double black ring at Breast Height. If the Coupe line coincides with PRF boundary line, then a width of 10m to be maintained as per Boundary maintenance guidelines.

25.3.5. Coupe Working:

Coup working is to be carried out by OFDC Ltd after marking & delivery by Forest Department. The yield is regulated by Area. After main felling in a coupe, subsidiary silvicultural operation is required to be taken up to obtain a healthy crop in second and subsequent rotation.

25.3.6. Restocking of Area:

The area is to be restocked by Planting following standard planting procedure in the year assigned.

25.4. Plantation Working Circle: (Area-386.382 ha)

Besides the area covered under **"Casuarina Working Circle",** there are many plantations of Eucalyptus, Acacia, Casuarina and Cashew taken up by Forest Department in other areas. During Social Forestry Project period i.e. 1985-1993, Plantations have been raised at various villages and declared as village forest u/s 30 of the Odisha Forest Act, 1972. Similarly under "National Afforestation Program" through Forest Development Agency plantations have been raised in various villages. All the areas covered up under various plantation schemes (within the administrative control of Forest Department) are to be managed under this Working Circle.

25.4.1 Area Assigned & Constitution of Planting Series:

The area covered under this "Plantation Working Circle" is 386.382 hectare. The planting area coming within PRF of this Division is allotted to **Tavagolara- Manikapatna Planting Series.** Area under this planting series is 60.800 ha. The area coming under Village Forest is allotted to two Planting series i.e. **Kushabhadra Planting Series (KBPS) (Area 159.716 ha) and Alarnath Planting Series (ALP) 165.866ha.**

25.4.2 Silvicultural System:

Silvicultural System adopted for this Working Circle is **"Clear felling with standard followed by Artificial Regeneration"** through planting. Where ever promising coppice shoots will be developed / come up, the same will also be retained to reduce the replanting cost. The number of standards per hectare will depend upon proximity to Sea, Biotic interference, possibility of dispersal of seeds for a high forest system, fruit bearing species, having timber value at a higher girth class especially required for Construction of Chariots for **Lord Jagannath / Balabhadra and Devi Subhadra**. The minimum number of trees prescribed for retention is 25 number and maximum 75 numbers per hectare.

25.4.3 Rotation Period:

The normal rotation period is Ten years which is co-terminus with the plan period. The standard trees those will be retained are required to be removed when they will either achieve their objectives or attain utilizable girth. The standard trees those are likely to be retained are Acacia, Neem, Simal, Fashi, Cashew and fruit bearing species. Jagannath Vana Prakalpa trees will be felled on attaining desired girth class as mentioned in Para 16.6.3.

25.4.4: Execution of Felling& Sharing of Forest Produce:

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.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.

25.4.5 Subsidiary Silvicultural Operation (SSO)

Subsidiary Silvicultural Operation (SSO)after main felling in any coupe is essential to maintain the hygiene of any forest. It involves in Cleaning of the debris and thinning in the advance growth if retained during marking. In this case no thinning will be required as the felling cycle is ten year and clear felling with standard system is adopted.

25.4.6 Restocking of Area:

The Coupe area is to be restocked through artificial regeneration i.e. by planting of seedlings with adequate Soil & Moisture Conservation measures. The standard planting technique has been enumerated in approved cost norm.There are PRFs which has been partly or fully encroached either by individual / group or community. It will be the prime endeavour to get the area vacated and make the area free from encroachment.

25.5 Protection Working Circle: (Area- 434.545 ha)

Forests adjacent to sea shore are required to be managed so as to put a check to wind speed. It is also required to create more wind break all along the coast line at a width of 50m to 500 m depending upon availability of land.

Sahana Extension is the extension of the Sahana PRF which has been covered with Casuarina Plantation. It is proposed to retain a strip of 2 chain width (40m) from the sea shore outer line as wind break and will be managed under **"Protection Working Circle".** The area calculated to be 54.187 ha covering a length of 13.546 Km along the sea shore. The assigned area is to be protected against theft, fire etc. No felling is permitted within the Plan period. No area from this working circle is assigned to any VSS.

All the encroached area i.e. 380.358 ha in PRF is also included in this Working circle. It is required to make this area free from encroachment and covered under plantation. Motivation / legal action may be taken up to make the land free from encroachment. Steps will be taken to evict them by the help of Tahasildar/ Collector to bring them back to the forest management. Plantation will be taken up to restore its vegetation.

25.5.1 Silvicultural System:

The assigned area is to be completely protected and maintained as tree cover. Hence no silvicultural system is prescribed. For encroached area plantation will be taken up after it is free.

26.5.2 Rotation Period & Felling Cycle:

No felling Cycle is prescribed except salvage of timer / firewood depending upon occurrence of natural calamity like cyclone resulting uprooting of trees. Cycle of Salvage depends upon occurrence of Cyclonic storm. All the encroached land is to be mage free within the plan period.

25.5.3 Procedure for Removal of Trees:

For removal of wind fallen trees, the following method is to be adopted.

a) Marking of Wind fallen trees:

Just after the natural calamity resulting uprooting of tree, the fallen trees is to be enumerated along with the GBH at 1.37m above the collar zone of the tree. The marking list is required to be cross checked by the Forest Range Officer. The marking list is to be accepted by the Divisional Forest Officer and returned to Range Officer for conversion and stacking.

b) Conversion:

After receipt of marking list from Divisional Forest Officer, the Range Officer is to take steps for its conversion to Firewood and stack it outside the area to prevent further damage to existing tree growth. The firewood is required to be stacked in size 12'x3'x3'. The conversion list is required to be submitted to DFO for disposal order.

c) Disposal:

As per the convention the converted materials are to be delivered to OFDC Ltd for needful marketing. The prevailing royalty is to be raised from OFDC Ltd. In case of un-willingness of OFDC Ltd for taking delivery for any reason, the material could be disposed of by local sale / auction.

25.5.4 Other Prescriptions:

The area under this working circle is always to be maintained at a stage of "Closed Canopy". If any permanent gap is noticed due to cyclonic effect or some other reasons, the area shall be brought under tree cover by planting at first opportunity. The species to be planted is casuarinas, neem, banyan, pithecellobium or any species suitable to site and for wind break.

The area under this Working Circle is along the sea shore covering a distance of 13.54 km. During November – January, may tourists / local people use to visit the site and make picnic. Sometimes it may cause fire hazard. Leftover food, solid waste scattered all around gives an ugly look to the site. It is required to keep the site hygienic. It is required to Prevent fire hazards, Management of Solid waste,Removal of waste food from the site, keep / maintain tranquillity of the area,No damage to vegetation and no fire wood collection from the plantation / forest area.

25.6. Wildlife (Overlapping) Working circle: (area 981.792 ha)

This Division comprises One reserved forest, Nineteen Proposed Reserved Forest and Forty three Village Forest as declared under provisions of Odisha Forest Act,1972. Out of the above forest blocks, theonly Reserved Forest of the division and six PRF constitute the Balukhanda Sanctuary. Besides the forest blocks under administrative control of the Forest Department, there are revenue forests / mangrove forests over 121.9 sq. Km. The wild animals are observed throughout the division. For the management of wild animals, 13 PRF areas are taken as an entity. The PRFblocks under administrative control of Forest department are taken in to consideration and this Wildlife (Overlapping) Working Circle is constituted. The total area under this Overlapping Working Circle is 981.792 ha.

25.6.1 Available Fauna& Management unit:

The Fauna / Avifauna / Marine live normally observed throughout the year and migratory birds, Sea turtle are the general constituents and the target species for holistic management. The wild animals are observed in all the area of the Division. The animal concentration is higher in Forest areas, near to Sea shore and water bodies. For management purpose the each Range is taken as a Management Unit.

25.6.2 Management Practices:

The general management practices involve Improvement of existing habitat and Development of new habitat for any species found in the locality. Practices encompasses Preservation of existing wetlands, Providing a conducive and safe breeding zone in and around Devi River mouth including nearby Zone in Bay of Bengal for Olive Ridley Turtles, Maintain the islands on Devi Nadi Mouth for safe & smooth egg laying phenomena (Mass nesting) of Olive Ridley Turtles & safe hatching of eggs till young's released to Sea, Protect mangroves forest and nesting of migratory Birds, Maintain creeks for allowing tidal water for inundation of river banks, Maintain Sea beach in Jahana Peer Area for recreational avenue, Provide safe shelter to animals during cyclones, Restore habitat of Birds / animals after cyclonic disturbances, Provide sweet water to animals during summer and Create & maintain grass lands.

25.6.3 Method of Treatment:

The method of treatment involves Improvement of Habitats, Providing Protection, Detail study of Animal behaviour & scientific Documentation, Creation of Public awareness & public participation in management.

25.6.4 Threat to wild animals &Suggested Mechanism:

The animals/ birds are subjected to threat from natural calamities. These are Inundation by Flood& High Tidal wave, Cyclonic Storm, Fire Hazard, Illegal Collection of eggs and Birds hunting, Fishing during mass nesting of Olive Ridley Turtles, Scarcity of Forage, Illegal trade in wild animals (soft shell turtles, monitor lizards, snakes etc.) and articles. Road accidentspose threat to spotted deer on Puri- Konark merine drive road and to Burmese python on Puri- Bhubaneswar road.

25.7. JFM (Overlapping) Working Circle: (Area- 388.636 ha)

At present there are 37 VSS and 28 EDC, functioning in the Division.63.054ha of PRF (Outside the Sanctuary area) and the Village Forest Committee constituted under Village Forest Rule, 1985 are also assigned for management of Village Forests over 325.582ha. There are 28 EDC functioning in the Balukhanada Sanctuary covering an area of 6591.79ha. Hence they are not covered under plan area.

25.7.1 Area Allotted & Crop Condition:

The areas allotted to VSS are mostly degraded PRF and Revenue forests. The vegetation is of natural growth and plantations of previous plan period. The crop density is less than 40% in most of the cases.The Forests assigned to VSS are mostly degraded in nature except plantations under various schemes like Jagannath Bana Prakalpa, CAMPA Forest Development Agency and Social Forestry Project Plantations. Crop varies from natural forest to monoculture like Eucalyptus. Crop Density also varies from 30% in case of natural forest to 70% in plantations.

25.7.2: Silvicultural System:

The VSS areas are under overlapping working circle. It overlaps with Rehabilitation Working Circle, Plantation Working Circle. The silvicultural system prescribed to these working circles will be followed as applicable.

25.7.3 Method of Execution:

The methods of execution under this Working Circle are Demarcation of VSS Area, Preparation of Micro-plan, Plantation & Choice of Species, Incentive Schemes for the VSS, Capacity Building Programmes, VFDF (Village Forest Development Fund), Engagement of specialized agencies for input support to JFM and Training camps for VSS Members.

25.7.4 Scope of expanding JFM Working Circle.

(i) There are many PRF under encroachment by individual / community. All-out effort will be taken up by the Forest Department / Staff to make the area free from encroachment and bring to the management fold. These areas may be brought within the purview of JFM for mutual cooperation & better relation with the people.

(ii) There are many forested area under the administrative control of Revenue department. The JFM resolution 2011 has extended its purview to manage Revenue Forests in a joint Forest management approach. Where PRI (Panchyat Raj Institutes) are interested in management of such forests, the same may be taken for management under VSS.

(iii) After Cyclone "Phani" on 3rd May,2019 the Government expressed its intention to create Green belt all along the Sea Coast at a width of 1KM to protect the Coastal area from effect of Cyclone. It is expected the Forest Department will play a key Role in "Green Belt Program". The area those will come under a revenue village may be assigned to the same village and a VSS may be constituted for management & sharing of forest produce in a long run.

25.7.5 Evaluation of Performance & Incentive:

The performance of VSS are required to be evaluated periodically and provisions for income generation/ livelihoodoptions to VSS will go a long way in motivating the people and ensure successful joint forest management in the division.

25.8 Miscellaneous Working Circle: (Area-42.188 ha)

Miscellaneous Working **Circe**is consisting of Mangrove Retreat Centre &Protection camp Complex in Sahana PRF, Eco Tourism Complex at Jahania Peer in Sahana Extension, Mega Nursery in Tavagolora PRF and Silvicultural Research Plot at Patnaikia PRF. An area of 42.188 hectare has been assigned to this **"Miscellaneous Working Circle".**

25.8.1 Mangrove Retreat Centre:

There is a **Mangrove Retreat Centre**and Protection camp at Muhanmuha in Sahana PRF over an area of 8.005 Ha. This MRC has been constructed to facilitate Forest Inspection, Mangrove plantations, monitor mass nesting of Olive Ridley Turtles and Migratory Birds.

25.8.2 Eco Tourism Complex- Jahaniapeer:

One Eco Tourism Spot is in developing stage at Jahana Peer under Astaranga WL Range coming in Sahana Extension over an area of 13.383ha. Many People are coming to the spot to enjoy the beauty of Sea Beach and Casuarina Forest throughout the year except the Rainy Season. The pick visiting period is from November to March. There is also a Peer temple named "Jahania Peer" after which the place is named. To manage the crowd and keep the sea shore clean, this administrative complex has been developed by Forest Department.

25.8.3 Mega Nursery:

One Mega Nursery is being maintained at Tavagorala PRF over an area of 14.50ha. At present Seed Storage house, Seed treatment yard, Forest Guard House and watcher shed have been constructed. One Deep Bore well with overhead water tank facilities available for watering of seedlings. About three lakh seedlings can be produced at a time and can handle the requirement of the nearby Ranges by establishing root trainer nursery and mist chamber.

25.8.4 Silvicultural Research Plot:

There is "Silvicutural Research Plot" in Patnaikia PRF over an area of 6.30ha. Silvicultural Research is being carried out by the State Silviculturist, Bhubaneswar. One Range Officer under administrative control of Silviculture Division, Bhubaneswar is looking after Research programs.

25.8.5 Recommendations:

a) The MRC with addition of two suits with Solar lighting arrangements is strongly suggested at muhanmuha.
b) A watch tower nearing to Kadua River is also suggested.
c) It is suggested to construct more accommodation facilities at least for ten persons at Jahaniapeer.
d) The catering facilities may also be developed and SHG may be assigned to run the catering / housekeeping and ancillary maintenance.
e) Existing interpretation centre to be modernized to encompass details on marine life especially on Olive Ridley Turtles, Sea beach management, Effect of Shelter

belt / wind break may be constructed and managed for education of local people / School Children and tourists.

f) One watch Tower near the Eco Complex is recommended. Some hoardings depicting message on protection and conservation of environment / wildlife may be placed in a safer place considering cyclonic effect.

g) At mega nursery annual seedling production of one lakh shall be arranged for plantation, Farm Forestry and supply to public on cost plus basis throughout the year. To modernise the facilities and encourage clonally propagation, a clonal orchard may be developed at different sites of the Range. To facilitate vegetative propagation a mistchamber, Springer irrigation system may be developed in a phased manner with root trainers.

25.9 TOF (Tree outside the Forest): (Area-438.50ha +600.592 RKM Avenue Plantation)

This TOF Working Circle encompasses the forest outside the designated forest land. The plantations raised by Forest department under various schemes outside RF / PRF/ VF will be the major components under this Working Circle. For other plantations like Farm Forestry, Avenue Plantations, Mangrove plantation on river bed, CSR (Corporate Social Responsibility) Plantations, FFRP, Urban Tree Plantation and other plantations raised during Social Forestry Project but not declared as Forests will be considered in general. The Total area under this working circle for declared as village detail management Practice is 438.50 ha and Avenue Plantations.

25.9.1 FDA Plantation:

The Plantations raised under National Afforestation Program (NAP) through Forest Development Agency (VSS) during last plan period is over 145.5 ha taken up during 2008-09 to 2010-11 (in three years).

25.9.2 Mangrove Plantations:

The mangrove plantations have been raised on the river bed and banks of Kadua River & near to mouth of Devi River over an area of 190.00 ha. The plantations are established mostly. The species planted are Rai, Guan, Bani, Keruan, Karanja , Bandari etc. The growth is satisfactory. The crop density is above 75%. It needs to protect the plantation from gazing and encroachment of land for prawn culture.

25.9.3 Plantations under Other Plan:

Plantations raised under other Plan are of mixed species of Casuarina and Acacia. The plantations are of inter mixer of various species of fast growing species mostly Casuarina and Acacia (Rotation age- 10 years) and long term species (Rotation age- 40-60 years).

The plantations are with about 75% survival. 103 ha were planted outside the Sanctuary / PRF limitations. Hence these area have been taken in to consideration in this working circle. The crop is not uniform. The crop height also varies depending upon the species growth pattern. Some plantations have been severely damaged due to Cyclone "Phani" during May,2019.

25.9.4 PKDA Plantation:

The Ground water of Puri town is mostly saline due to proximity to Bay of Bengal. There are some pockets ofunderground Sweet Water Reserves near Talabania and Baliapanda. In order to protect the sweet water reserve, plantation has been taken up in and around the Sweet Water Reserve area. The plantations are mostly of Casuarina and Acacia species and maintained as soil cover to allow percolation of rain water to recharge the ground water table. The plantation is of 10 years old with crop density of 70%. It is felt to allow the stand to grow, accumulate humus with silvicultural treatment / intervention. During Cyclone "Phani" on 3rd May,2019 most of the trees have been up rooted and the mostly removed by the local people for use. However, 2.5 lakh Acacia and Casuarina were planted to restock the area by a private agency as a voluntary activity although it was not scientifically sound.

25.9.5 Avenue Plantations:

During outgoing plan period 194.264 RKM avenue plantations have been taken up. During widening of NH / SH many big sized trees have been felled & removed. During Phani Cyclone may big trees, Ficus trees along the road side have been up-rooted. This is included in this working circle for better management.

25.9.6 Recommendation:

The prescriptions for Avenue Plantations are

- The avenue plantation site is to be visited and existing plants are to be recorded.
- If any plant / tree is badly damaged and above 30cm GBH it is recommended to remove the plant and a new plant with promising growth is to be planted.
- Any old / hollow/ diseased tree likely to be fell down in moderate wind is to be marked and enlisted. Such trees are to be jointly visited by Range Officer and any representative of PWD / NH Authority and record their suggestion on removal or retention. In case of suggestion for removal DFO is to intimate the district authority and take steps for its removal followed by planting in the assigned year.
- All retained plants above 30cm GBH are to be checked for hanging branches if found to be removed.

- The PWD / NH authority may be requested to put Radiant paints on trees at Breast Height for visibility during night.
- Similar exercise is recommended for other avenue plantations not included in this series.
- Planting one species on both the sides over a length of 2 km to add to the beauty / aesthetic value of the road.
- Planting of one year old promising seedlings in a block mixture than intimate mixture form is recommended.
- It is required to conduct a survey from Satpada to Astaranga along the sea coast and identify areas of Government / Private Ownership within one kilometre from coast "High tide Line" in a phased & time bound manner and comprehensive planning may be made for raising **"Casuarina plantation and Incentive based Farm Forestry".**

25.10.REDD+ :

REED+ stands for countries' efforts to "Reduce Emissions from Deforestation and forest Degradation", and forest conservation, sustainable management of forests, and enhancement of forest carbon stocks. Deforestation and forest degradation are the second leading cause of global warming, responsible for about 15% of global greenhouse gas emissions, which makes the loss and depletion of forests a major issue for climate change.

25.10.1 FAO's support:

FAO's support to countries is based on technical expertise in assessing the drivers of deforestation and forest degradation and finding opportunities for forest carbon conservation, management and enhancement. Our country's commitment for **"Nationally Determined Contributions" (NDCs) are**

- To reduce the emissions intensity of its GDP by 33-35% from 2005 levels by 2030.
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture,

water resources, Himalayan region, coastal regions, health and disaster management.

25.10.2 Indicative Work plan to combat Climate Change:

- Government harps on sustainable lifestyle to fight climate change
- Promising raising requisite funds and adopting new technology.
- More focus on agriculture, water resources, coastal regions, and health and disaster management.
- To tackle climate change by adopting healthy and sustainable lifestyle, which were "inherent in traditions and values of conservation & moderation.
- To reduce consumerism in our lifestyle & reduce to reduce per capita consumption by not wasting food and limiting the number of durables / cars per household.
- To have ambitious focus on energy efficiency and dramatic increase in renewable energy.
- To enhance dependency on non-fossil fuel-based energy.

25.10.3 Suggested measures in Forestry Sector:

In forestry sector to combat climate change the following activities are suggested.

a) To reduce felling of trees in all sphere and enhance creation of renewable energy.
b) To reduce dependency on fossil fuel including that of firewood.
c) To enhance use of solar energy / electric energy/ wind energy where ever possible.
d) To motivate people to reduce consumerism & reduce generation of solid waste.
e) Conserve water body and enhance efficient use of water.

25.11. Adoption of New Technology in Forestry:

With advancement of technology it is proposed to have the following facilities available with Puri Wildlife Division for better management.

a. Identified Plus trees within the Division and maintaining a Clonal Orchard.
b. To have improved Mega Nursery with clonal propagation facilities with mist chamber, Sprinkler System.
c. Root trainer facilities and capacity to meet requirement of Quality Planting Materials for the division instead of depending upon temporary nursery.
d. All forest blocks / plantations surveyed with DGPS and mapping thereof.
e. Establishment of GIS Cell with available Satellite imagery for monitoring purpose.
f. Modern logging tools to meet emergency in **Post Cyclone Management**.
g. Drone camera facilities to watch sea erosion, wildlife movement and Olive Ridley turtles mass nesting phenomena.

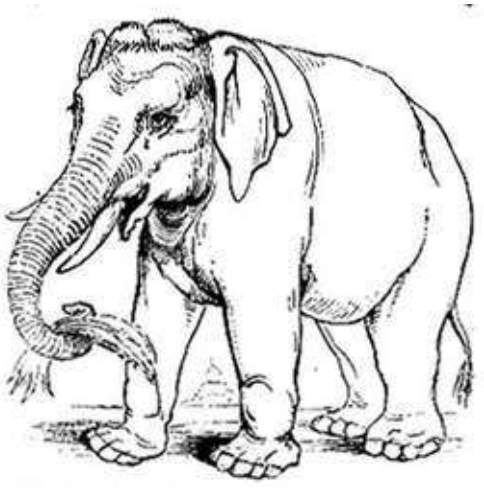
25.12 Financial Requirement:

The financial requirement to implement the plan prescription is **Rs.7708.398 lakhs** at the present price level on a holistic approach over 10 years of plan period. Basing on Wage escalation, the cost of implementation will be hiked by minimum 20% of the estimated cost.

25.12.1 Source of Funding:

The division receives funds from State Plan, Central Plan, National Afforestation Program, MANREGA, district Planning untie Funds, CAMPA, ICZMP, CSR fund of companies, OEMF, DMF, OMBADC etc.. The level of present resource allocation is to a tune of 5.00 Crores to 6.00 Crores. For restoration of Phani damaged area government is keen on more plantations, Green Belt creation and better wildlife management. Hence funds for implementation of working plan prescription will not be a problem.

THE END



ANNEXURES

Annexure

Sl No	Details of annexure	Annexure No	No of Pages
Part-I			
1	Forest & Environment Notification No 1F(A)-100/2003/13228/ F&E dated 8.8.2003	I	9
2	The detail of Buildings	II	5
3	The details of Forest Rest Houses	III	1
4	Village Forest Notification	IV	6
5	Letter No RDM/-LRGEA.POLICY – 0018-23784/ R&DM Dated 30.06.2018 to enter this DLC Forest land in the BHULEKH DATA BASE.	V	4
6	The Year wise avenue plantations raised is furnished	VI	3
7	Sanctuary was designated in 1984 vide Government notification No.9013/FFAH dated 23rd April, 1984 and the notification was amended vide Government notification No.15261/FFAH dated the 1st September, 1987	VII& VIII	4
8	The Eco- Sensitive Zone (ESZ) has been notified vide No S.O.1654(E) dated 19th May, 2017	IX	9
9	List of Flora and Fauna is placed	X	8
10	JFM Resolution 2011 and subsequent amendment in 2015 and in 2018	XI(a) &(b)	25
11	List of VSS & EDC members of Puri (WL) Division	XII	4
12	The Members of the Executive body of the FDA	XIII	1
13	Economic study conducted in the State during 2014-15 by Planning and coordination department	XIV	43
14	Annual Working scheme for the year 2017-18: Approved vide Letter no 8(31)35/2016-FCE dated 22.11.2017 of Regional MoEF&CC, Bhubaneswar	XV	4
15	Annual Working scheme for the year 2018-19: Approved vide Letter no 8(31)7/2017-FCE-II dated 05.10.2018 of Regional MoEF&CC, Bhubaneswar	XVI	4
16	The PWPR for preparation of revised working plan has been approved by Standing Consultative Committee meeting held on 15-12-2016 under the chairmanship of PCCF, Odisha, Bhubaneswar	XVII	2
17	The offence booked for violation of Odisha Forest Act, 1972 and Rules framed thereof from 2003-04 to 2018-19	XVIII	1
18	The number of cases booked / Quantum of forest produce involved	XIX	1
19	The activities undertaken for Balukhand Konark sanctuary development are carried out in consultation with the respective villages. The detail study report is enclosed.	XX	4
20	The decision for any sort of village developmental activity is taken in the village meeting. The detailed draft report is eclosed	XXI	14

21	The fan-throated lizard, Sitana ponticeriana, is a medium-sized ground living agamid distributed throughout India, preferably in dry and more or less open country habitats. The complete report is placed	XXII	6
22	*Status of blackbuck in Orissa* -The complete report is placed	XXIII	24
23	Incumbency Chart of Puri Wildlife Division	XXIV	1
Part-II			
24	Letter no 3628/ 11F (SFM)-15 / 2018 dated 26.02.2019 (Development of Working circle)	XXV	6
25	The Divisional Area statement	XXVI	2
26	The sample Points coming within the Forest Blocks are furnished. The data has been uploaded on the web site for analysis by ORSAC, Bhubaneswar / NRSC, Hyderabad	XXVII	2
27	Approved Cost norm for barbed wire fencing based on wage rate of Rs280/- per Person days	XXVIII	2
28	Approved cost norm for Casuarina plantation (with waterhole based watering system) vide letter no 1335/ 12F-25/2018 dated 18th December, 2018	XXIX	5
29	Ongoing research activities carried out by Siliviculturalist of Odisha	XXX	6
30	Coupe Control Forms-3nos	XXXI	1

Working Plan, Part-III
Puri (Wildlife) Division, Puri.

(DLC Report of the Division)