



**REVISED WORKING PLAN OF
MANGROVE FOREST DIVISION (WILDLIFE)
RAJNAGAR**



FOR THE PERIOD 2022-23 TO 2031-32

Prepared By
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*Revised Working Plan of Mangrove Forest Division (WL) Rajnagar
2022-23 to 2031-32*





No.8(31)43/2017-FCE

7th November, 2024

To

The Addl. Chief Secretary,
 Forest, Environment & CC Department,
 Govt. of Odisha,
 Bhubaneswar.

Sub: Approval of draft Revised Working Plan of Mangrove (WL) Division, Rajnagar for the period from 2022-23 to 2031-32 - reg.

Ref: The PCCF & HoFF, Odisha letter No. 12799/11F (SFM) 92/2014 dated 29.06.2022 and letter No. 18211/11F (SFM) 07/2019 dated 06.09.2024.

Sir,

The revised draft Working Plan of Mangrove (WL) Division, Rajnagar for the period 2022-23 to 2031-32 submitted by the PCCF, Odisha has been examined and accordingly, the Central Government (MoEF&CC) with the powers vested under Forest (Conservation) Act, 1980, has decided to accord approval of the working plan of Mangrove (WL) Division, Rajnagar for the period 2022-23 to 2031-32, subject to the following General and Specific conditions:

The formal endorsement / approval from the State Govt. may also be obtained.

General Conditions:

1. The orders of Hon'ble Supreme Court of India in the matter of W.P. No. 202/95 Godaverman Therumulkpad Vs Union of India and related Interlocutory applications shall be strictly complied with. Any prescription or operation at variance with the order of Hon'ble Apex Court shall be kept in abeyance till such order is in force or otherwise not modified.
2. Further, in strict compliance with Hon'ble Supreme Court's order dated 22.09.2000, the State Government of Odisha shall ensure that regeneration of forest is commensurate with fellings, if any, to be carried out under the present working plan.
3. Consequently, **no felling should be carried out without making allocation of requisite funds for undertaking regeneration operation** in order to ensure regeneration to be commensurate with fellings. In case of failure of regeneration or any shortfall in achieving the target of regeneration, further harvesting shall remain suspended till backlog/ shortfall in regeneration is made up and subsequent formal approval from the Regional Office, MoEF&CC, Bhubaneswar is to be obtained.
4. This working plan is approved for the period **2022-23 to 2031-32.**
5. Standing snags/dead or dying trees should not be removed and shall be preserved for wildlife habitat/shelter. In site specific coupes / sections having unduly large no. of such trees needing removal, the State Forest Department may take special permission from Regional Office, MoEF&CC, Bhubaneswar.
6. Deviation statement along with the prescribed documents shall be reported and got endorsed from the competent authority by the end of the year of operation. Accordingly, a summary of the report/certificate shall be submitted along with the Annual Action Taken Report to the Regional Office, MoEF&CC, Bhubaneswar for information and record.
7. No new road shall be constructed and no fresh forest area shall be broken for widening / reconstruction of existing roads without obtaining prior approval under Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980.

8. Approval of the working plan does not permit to carry out any non-forestry work including construction of building, for which necessary permission under Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 shall be obtained, as may be required.
9. CF (T) shall submit to the CCF (WP) / PCCF the yearly action taken report against the physical & financial targets of felling & regeneration against each working circle of this W.P. by the end of the year of operation.
10. Immediate action may be taken for repairing of old pillars, if any. Prescriptions may be provided for revisiting all pillars every five years for purpose of maintenance and appropriate action be taken depending on condition of boundary pillars. Staff in charge of beat will verify physically the boundary pillars and shall give a certificate annually to the DFO with copy to the CCF, Working Plan confirming that no fresh encroachments have taken place. Vulnerable areas will be verified by the Range Officers.
11. The detail copy of the PF/RF Notification, if any, may be compiled and a copy of each shall be kept with the DFO/Working Plan Officer and CCF, Working Plan for reference.
12. The encroachment details, if any, may be furnished along with a map.
13. Identification of locally important medicinal plant species, if any, which are becoming rarer, should be provided in the Working Plan.
14. State Forest Department shall initiate the process for the preservation of old available maps.

Specific Conditions:

The prescriptions under the proposed working circles are approved with observations stated above and with specific condition that:

1. Sporadic, wind fallen / uprooted trees, if any, shall also be allowed to be harvested in addition to the approved working scheme prescriptions for the year 2021-22 after its special approval of the list of enumerated trees by the CF (T) / RCCF (T) forwarding a copy to I Regional Office, Bhubaneswar. In case of large scale wind fallen, damaged and epidemic outbreak, special permission for tree felling may be obtained from the Regional Office of MoEF&CC, Bhubaneswar. The volume extracted out of wind fallen/ uprooted trees shall be deducted out of the total volume of yield as calculated and permission for felling is allowed for balance volume only.
2. A mid-term evaluation of the implementation of working plan prescriptions and its impact on the forests may be done after the end of initial five years for which reasonable number of benchmark / sample plots may be maintained.
3. After recording the GPS and checking the records of each planting site DFO to certify that plantation is not taken up in the existing old plantation sites, without the prescribed action required prior to replanting.
4. Plantation details along with current status (conditions of plantation and survival) may also be included along with GPS surveyed boundary locations shown on a map, so that chances of mismanagement, confusion, encroachment and problem of identification of the site are reduced.
5. The Department should prepare a programme for DGPS survey of forest boundaries and prepare geo-referenced maps with important administrative and management details, if not done earlier.
6. Prescriptions must be provided for demarcation of un-demarcated balance forest area. The area details of un-demarcated forest area, number of pillars and funds required to demarcate it and year wise plan for demarcation so as to complete it at the earliest should be provided.
7. No forest, bearing naturally grown trees shall be clear felled for any purpose what so ever.
8. The prescriptions are to enable necessary co-existence of development with nature, and to ensure implementation strictly adhering to the provisions of Indian Forest Act, 1927, Wildlife (Protection) Act, 1972, Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980, Panchayats (Extension to the Scheduled Areas) Act, 1996 (PESA), Biological Diversity Act, 2002, and Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

9. People Biodiversity Register (PBR) formulation as well as Access of Benefit sharing Regulation has to be implemented and monitored. Sustainable harvesting protocols for NTFPs and their replacement plan has to be prepared and accented.
10. Listed wetland, defined under the Wetland (Conservation & Management) Rules, 2017 situated in and outside forest to be restored and sustainable managed. Annual target along with riparian restoration will be done strictly in accordance under the provision of aforesaid Rules.
11. Raising of genetically improved seedlings/clonal propagation needs emphasis for timber productivity enhancement for future. Accordingly, year-wise raising of clonal seedlings will be fixed in proportion in the Division.
12. No permanent structure for Eco-Tourism purpose should be allowed. Ecotourism should be focused with identification of sites, traditions, community practice and future management involving local communities. Benefit accrued from eco-tourism to be plowed back to local communities. Number of visitors shall be fixed as per the carrying capacity study. Safety audit to be carried out in all the eco-tourism sites. No other tourism activities, other than that approved in this Working Plan shall be implemented. Eco-tourism inside Mangrove Forest Division shall be done as per the approved Eco-tourism Plan in accordance with the Eco-tourism Guidelines, 2022 of MoEF&CC, which will form a part of the approved Working Plan strictly adhering to the carrying capacity study. Since, ecotourism inside the Mangrove Forest Division is carried out as a forestry activity; it has to be conducted by the Forest Department only and by no other agency.

Since, there is no ecotourism plan in the Working Plan, it is inferred that no ecotourism activity is being conducted at present in the Mangrove Division. Any ecotourism conducted without approval of Working Plan shall be construed as a violation. Hence, if the Mangrove Division intends to carry out ecotourism, the name of sites mentioned in the Working Plan, then a detailed Ecotourism Plan with Carrying Capacity Study needs to be submitted within 6 months from the date approval.

Central Govt. reserves the right to review, modify or withdraw this approval at any time, if any, of the conditions of approval are not implemented or relevant modifications in the Working Plan, if any, is required so as to keep it in conformity with the orders, circulars and guidelines issued by the Central Govt. under Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 or any other statute and National Forest Policy.

Yours faithfully,

Padma Mahanti

(Dr. Padma Mahanti)

Dy. Inspector General of Forests (C)

Copy to:

1. The Addl. Director General of Forests (FC), Ministry of Environment, Forest & Climate Change, Indira Paryavaran Bhawan, Agni Wing, Aliganj, Jorbagh Road, New Delhi-110 003 for kind information.
2. The Principal Chief Conservator of Forests, Forest Department, Govt. of Odisha, Aranya Bhawan, Chandrasekharpur, Bhubaneswar for kind information and necessary action.
3. The Addl. PCCF (P&SM), Forest Department, Govt. of Odisha, Aranya Bhawan, Chandrasekharpur, Bhubaneswar for kind information and necessary action.
4. The Managing Director, Odisha Forest Development Corporation Limited, Bhubaneswar for kind information.
5. Guard File.

Padma Mahanti
Dy. Inspector General of Forests (C)



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Rajnagar, Odisha for 2022-23 to 2031-32*

Abbreviations used:

Abbreviations	Full Form
ACF	Assistant Conservator of Forests
B.G.	Broad Gauge
CA	Compensatory Afforestation
CF(T)	Conservator of Forests (Territorial)
CAMPA	Compensatory Afforestation Fund Management and Planning Authority.
CCF(WP)	Chief Conservator of Forests (Working Plan)
CGWB	Central Ground Water Board
DFO	Divisional Forest Officer
DFO (WL)	Divisional Forest Officer (Wildlife)
DGPS	Differential Global Positioning System
DLC	District Level Committee
DPF	Demarcated Protected Forest
DRDO	Defense Research and Development Organization
EN	Endangered
FAO	Food & Agriculture Organization
FC Act	Forest (Conservation) Act
FDA	Forest Development Agency
FRA	Forest Rights Act
FSI	Forest Survey of India
GHG	Green House Gases
GPS	Global Positioning System
Ha.	Hectare
IFS	Indian Forest Service
Imp. WC	Improvement Working Circle
IOCL	Indian Oil Corporation Limited
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JFM (O)WC	Joint Forest Management (Overlapping) Working Circle
JFMC	Joint Forest Management Committee
L.M	Local Migrant
LC	Least concerned
LULUCF	Land Use, Land Use Change and Forestry
MAI	Mean Annual Increment
MAP	Medicinal & Aromatic Plants
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoEF&CC	Ministry of Environment, Forest & Climate Change
NAEB	National Afforestation and Eco Development Board
NAP	National Afforestation Program
NRSC	National Remote Sensing Centre
NRWC	Non-Rehabilitation Working Circle
NT	Near Threatened
NTFP	Non-Timber Forest Produce



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OFD	Odisha State Forest Department
OFDC Ltd	Odisha Forest Development Corporation Limited
OFS	Odisha Forest Service
OR	Offence Register
ORSAC	Odisha Space Application Centre
PBR	Peoples Biodiversity Register
PCA	Penal Compensatory Afforestation
PCCF	Principal Chief Conservator of Forests,
PCCF & HoFF	Principal Chief Conservator of Forests & Head of Forest Force
PCCF (P&SM)	Principal Chief Conservator of Forests (Protection & Sustainable Management)
PCCF (WP)	Principal Chief Conservator of Forests (Working Plan)
PESA	Panchayats (Extension to Scheduled Areas) Act, 1996.
PF	Protected Forest
Pl.Wc	Plantation Working Circle
PMGSY	Pradhan Mantri Gram Sadaka Yojana
Pr.WC	Protection Working Circle
PRF	Proposed Reserved Forest
QPM	Quality Planting Material
RCCF (T)	Regional Chief Conservator of Forests (Territorial)
RD	Rural Development
REDD+	Reducing Emissions from Deforestation and forest Degradation
Res.	Resident
RF	Reserved Forest
RKM	Row Kilometer
RWC	Rehabilitation Working Circle
S.M	Summer Migrant
SC	Schedule Caste
SOI	Survey of India
ST	Schedule Tribe
SWC	Selection Working Circle
SWOT	Strength, Weaknesses, Opportunity and Threats
TOF	Tree Outside Forest
U.D	Un detected
UNDP	United Nations Development Program
V. Rare	Very Rare
VF	Village Forest
VFC	Village Forest Committee
VSS	Van Sanrakshyana Samiti
VU	Vulnerable
W.M	Winter Migrant
W.P.	Working Plan
WC	Working Circle



Executive Summary

Along With the Constrains Faced During Writing of the Plan

1. Introduction:

Mangrove Forest Division (Wildlife), Rajnagar came into existence with effect from 3rd November, 1990 in pursuant to reorganization of Forest Department vide Notification No. BF(W)-41/88 26118/FFAH of Govt. of Orissa, erstwhile Forests, Fishery & Animal Husbandry Department consequent upon transfer of Kujanga Range from Athagarh Division to Wildlife Conservation Division, Chandbali. Prior to 1990 in 1980 Kanika Range of Athagarh Forests Division was carved out to constitute Wildlife Conservation Division with headquarter at Chandbali and thereafter in 1988 Kujang Range was transferred from the jurisdiction of Athagarh Forest Division to Wildlife Conservation Division, Chandbali. The present jurisdiction of Mangrove Forest Division (Wildlife), Rajnagar is the partly geographical area of Kendrapara Revenue district and partly of Jagatsinghpur Revenue District after creation of Bhadrak WL Division in 2003. Thus the boundary of the division covers two districts.

The Division is having mostly Mangrove forests along the Bay of Bengal coast starting from Dhamra river mouth in the border of Bhadrak district in north to Devi River in the border of Puri District in south. The coastal casuarina forest along with the mangrove forest coming within the protected areas of this division are managed as per the prescription of the management plan and the forest areas of Mahakalapada WL Range in Kendrapada District and Kujang WL Range of Jagatsinghpur District of this division were managed as per the prescription of outgoing Working plan of Rajnagar (Wildlife) Division for the period 2007-08 to 2016-17.

2. Vision Statement:

The forests of the Mangrove Forest Division, Rajnagar shall be managed sustainably through scientific management by following the prescriptions given in the working plan in consonance with wildlife management of adjoining sanctuaries and National Parks with people's participation through Joint Forest Management.

3. Objectives and Objectives of Management:

The proposals of the present Working Plan should be based on scientific management of its forest and wildlife without contradicting the genuine interest of the people. During the plan period, Acts/Rules and regulations whatsoever associated with management of forests, wildlife and environment have undergone



amendments. A list of Acts / Rules promulgated during the current plan period is listed below.

- Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of F.R) Act-2006
- Scheduled Tribes and Other Traditional Forest Dwellers(Recognition of F.R) Rules-2008
- PESA
- JFM (Orissa) Resolution-2011
- Biological Diversity Act-2002
- Coastal Regulation Zone Notification-2019

These factors are required to be attended to during revision of this working plan.

Degradation of natural forests due to various factors has dwindled the biodiversity of the region. The approach towards the future management should also be aimed at catering genuine needs of the local poor and also to suggest possible ways and means to engage the rural poor in other productive activities so as to minimize the illicit cutting of trees inside the forests.

Now the approach towards the forest management needs to be changed and more emphasis has to be given on conservation of biodiversity and participation of people in regeneration and development of forests. The emphasis in the present plan is to conserve and restock the forests for maintaining the ecological balance. The proposed Working Plan shall have the following general objectives for sustainable management of forests:

- 1) To prevent further degradation of environment by giving more emphasis on conservation and protection of flora and fauna of these forests.
- 2) To maintain permanent closed cover near water bodies and reservoirs to check soil erosion, to maintain hydrological cycle and to regulate water yield.
- 3) To improve conditions, composition and productivity of these forests by increasing investment and through appropriate scientific management.
- 4) To protect and manage wildlife resources in their full scope and range in the Division with a view to conserve and enrich biodiversity.
- 5) To restock barren degraded and depleted forests using appropriate silvicultural prescription.
- 6) To meet the needs of local people for forest produce as far as possible with active involvement of community under Joint Forest Management (JFM) system subject to the aforesaid environmental imperatives.



- 7) To provide employment opportunities to rural people in general and weaker sections including scheduled castes / tribes and women in particular, through regulation of NTFP and the above mentioned conservation oriented activities.

4. SWOT Analysis for Prescriptions of Strategies for Achieving the Goals & Objectives

In the preparation of working plans with the objectives for achieving sustainable forest management, Strengths, weakness, Opportunities and Threats are identified. Based on the SWOT analysis alternative strategies are developed for the division.

(i) Strength

- Ability to maintain forest cover.
- Trained Staff.
- Area of the forest department is well spread.
- Rich biodiversity.
- Infrastructure of nurseries, offices and quarters are good.
- The local people involve in the VSS activities through Joint Forest Management.

(ii) Weakness

- Inability to maintain dense forest.
- Lack of legal awareness and implementation.
- Less Staff position in the Division.
- Lack of intelligence networking in Forest department.
- Rate of Conviction in Forest offence cases is very low.

(iii) Opportunity

- More coverage of area under mangrove plantation.
- Training in new technology and exposures to staff.
- Creation of assets and infrastructures.
- Involvement of people and NGOs in conservation of Biodiversity.
- Increasing the scope of sustainable ecotourism.

(iv) Threats

- Encroachment of forest land for aqua culture.
- Poaching for bush meat.
- Wild boar depredation.
- Expansion of industries in close proximity of forests.



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External and Internal factors of environment are considered to achieve the expected outcome.

5. Expected Outcome

- (i) Increase in productivity of the forest ecosystem and maintenance of the vitality
- (ii) Reduction in soil erosion, enhancement of fertility of the soil and ensured stability of the forest ecosystem
- (iii) Enhancing water conservation capacity of the forest ecosystem and assisting in regulating the flow of water from its catchment.
- (iv) Mitigation/carbon sequestration capacity of the forests and adaptation with change in climate.
- (v) Meeting the fuel wood, fodder and small timber requirements of the local communities, enhancing livelihood and employment opportunities, ensuring usufruct/ benefit sharing and protection of their traditional knowledge and traditional/cultural practices, etc.

6. Abstract of Plan Prescription

Chapter No	Para No./ Sub Para No.	Prescribed Activity	Remarks
A	B	C	D
1. Basis of Proposal	1.1 Objectives of Management	1. To prevent degradation of environment	
		2. To maintain permanent closed covers	
		3. To protect and manage wildlife resources	
		4. To restore degraded mangrove cover	
		5. To meet the need of local people	
		6. To provide employment opportunities	
	1.2 Method of treatment to be adopted	1. Reconnaissance survey of all forest areas	
		2. Stock mapping	
		3. Point sampling of forest blocks	
		4. biodiversity regeneration survey	
		5. Extensive survey of potential of NTFP	
		6. Study of medicinal plants and utilization	
		7. Inspection of forest blocks	
	1.3 Constitution of Working Circles	1. The Rehabilitation WC	
		2. The Plantation WC	
		3. The Protection (O) WC	
		4. The Wildlife (O) WC	
		5. The JFM (O) WC	
		6. The Mangrove Improvement (O) WC	



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	1.4 Allocation of area to different WC		
	1.5 Period of working plan	2020-21 to 2030-31	
	1.6 Rationalization of boundary of Bhitarkanika sanctuary		
2. The Rehabilitation Working Circle	2.1 General constitution	Total area allotted is 8516.138 Ha	
	2.2 General character of vegetation		
	2.3 Specific objectives of the management	1. To induce natural regeneration	
		2. To enhance soil productivity	
		3. To regulate surface water runoff	
		4. To restock barren areas	
		5. To partner the local community	
		6. To restore and improve the microclimate	
		7. To increase biodiversity	
		8. to increase the water retaining capacity of soil	
		9. to restore degraded forests	
		10. To protect and conserve flora and fauna	
	2.4 Area allotment and treatment series	Total area allotted is 8516.138 Ha in two treatment series	
	2.5 Analysis and valuation of crop		
	2.6 Silvicultural system	No formal silvicultural system. Regeneration cleanings, SMC, gap planting etc will be carried out.	
	2.7 Rotation and conversion period	No prescription except removal of dead fallen trees.	
	2.8 Choice of species	Depending on local factors indigenous species will be planted. Mangrove species in mangrove areas.	
	2.9	10 years which synchronizes with plan period	



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	Rehabilitation cycle		
	2.10 Calculation of yield	No yield prescribed	
	2.11 Table of rehabilitation period		
	2.12 Method of execution of operation	Demarcation of annual rehabilitation coupe	
	2.13 Preparation of site and treatment maps		
	2.14 Treatment plan	Site specific treatment plan shall be developed	
		Provision of monitoring	
	2.15 Rehabilitation operation	Silvicultural treatment	
		Creation of barriers	
	2.16 Rehabilitation in different treatment series		
	2.17 Control	Journals and records as per Plantation manual shall be maintained	
	2.18 Misc. regulations		
	2.19 Rights & concessions	As per relevant gazettee notifications of different forest blocks and policy with regards to JFM	
	2.20 Interim revision & cost norm		
3. The Plantation Working Circle	3.1 General constitution		Blank, degraded, encroached forest areas have been included in this WC.
	3.2 General observation and vegetation		
	3.3 Special objectives of	1. To reforest all barren and degraded area	
		2. To maintain and tend the plantations already	



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	management	raised	
		3. To take effective measures to prevent soil erosion	
	3.4 Area allotment and planting series	Total 1492.37 Ha allotted with two planting series	
	3.5 Analysis & valuation of crop		
	3.6 Silvicultural system	No silvicultural system prescribed, but tending operations, SMC works to be carried out	
	3.7 Choice of species	Mangroves, casuarina	
	3.8 Plantation cycle	Plantable areas to be covered in 10 years to synchronize to the plan period	
	3.9 Constitution of plantation series	Two series namely Jatadhar and Nuagaon	
	3.10 Method of execution of plantation	Demarcation of annual plantation coupes	
	3.11 Site preparation, treatment plan		
		Nursery	
	3.12 Stacking, pitting & planting		
	3.13 Post planting operation		
	3.14 Control	Plantation journals & other records as per plantation manual	
	3.15 Treatment of old plantations		
	3.16 Misc. regulations		
	3.17 Rights & concessions		
	3.18 Annual cost of operations		
	3.19 Interim revision		



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4 The Protection (O) Working Circle	4.1 General constitution		
	4.2 General observation & vegetation		
	4.3 Special objectives of management	1. Protection from grazing	
		2. Protection from illegal removal of forest produce	
		3. Protection of staff from smugglers	
		4. Provision of separate legal cell	
		5. Prescription for protection & management	
		6. Protection from forest fire	
		7. Creation of awareness among locals	
	4.4 Area allotment	Total area allotted is 10145.408 Ha	
	4.5 Analysis & valuation of crop		
	4.6 Silvicultural system	No silvicultural system prescribed. Area will be rigidly protected from all biotic interferences and existing growing stocks shall be improved upon.	
	4.7 Sequence of operation	Two protection series constituted namely Mahakalpada & Kujanga	
	4.8 Methods of execution of operations	Encroachments	
		Protection against illegal felling	
		Boundary fencing	
		Construction of watch towers	
5. The Wildlife (O) working circle	4.9 Misc. regulations	Grazing control	
		People participation	
		Protection of endangered species	
		Rights & concessions	
		Control	
	4.10 Interim revision		
	4.11 Cost norm		
	5.1 General constitution		Wildlife rich area outside the sanctuary and
	5.2 Special objectives of management	1. To improve the cover	



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			National park have been included .
		2. To create favourable conditions for wildlife	
		3. To develop the forest blocks near villages	
		4. To develop the ground flora and middle storey to attract more animals	
		5. To increase population of wild animals by creating favourable conditions	
		6. To assess & recommend prescriptions for sustenance of biodiversity	
		7. To identify & map water resources	
	5.3 Analysis & valuation		
	5.4 Area allotment	Total area allotted is 4770.67 Ha	
	5.5 Methods of treatment	Social issues	
		Natural issues	
		Management issues	
		Treatment of the area	
		Habitat improvement	
		Fencing of crocodile prone area	
		Wildlife crime	
		Research	
		Ecotourism	
		Block wise details of ponds & meadows	
	5.6 Misc. regulations	Awareness	
		Infrastructure & training	
		Information network & records keeping	
		Grazing control	
		Fire protection	
		Incentives & rewards	
		Rights & concessions	
	5.7 Interim revision and working cost		
6. JFM (O) working	6.1 General constitution		Out of 23 VSS of the Division, forest areas of 5



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circle	6.2 Characteristics of vegetation		VSS have been diverted for POSCO India Ltd. And after rationalization of Bhitarkanika sanctuary boundary, areas of 5 VSS included in sanctuary limit. Remaining 13 VSS have been included in the Working Circle,
	6.3 Special objectives of management	1. To involve communities in forest and natural resource management	
		2. To make people & forest department partners in management	
		3. To restock degraded forests	
		4. To increase productivity of soil through SMC	
		5. To motivate people in NTFP collection & trade	
		6. To create income generating activities in the villages protecting the forests	
	6.4 Area allotment	All existing VSSs over 250 Ha and new VSSs created in future	
	6.5 Silvicultural system	No silvicultural system, area to be guided by micro plans	
	6.6 Methods of execution of operations	Demarcation of area, preparation of micro plans, adopting PRA technique, tending operations, awareness, motivation for income generating activities, formation of new VSSs	
7. The mangrove Improvement (O) working circle	6.7 Control		
	6.8 Rights & concessions	As per JFM guidelines of govt	
	6.9 Interim revision		
	7.1 General constitution		Potential blank areas and encroached areas suitable for mangrove plantation have been included in the Working Circle.
	7.2 Objectives of management	1. Conservation of mangrove forests	
		2. Increasing biodiversity, ecology of the area	
		3. Protection of estuarine ecology	
		4. Promotion of research on mangroves	
		5. Enhancement of the productivity	
	7.3 Area allotment	230 Ha in five forest blocks have been included. No annual coupe prescribed.	
	7.4 Analysis & valuation of crop		
	7.5 Silvicultural system	No formal system prescribed	
	7.6 Method of treatment	Habitat improvement	
		Creek renovation	



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		Digging of freshwater ponds	
		Construction of new fishbone channels	
		Removal of unwanted weeds	
		Mangrove plantation	
		Habitat restoration	
		Habitat protection	
		Creation of mounds	
		Encroachment for aquaculture	
		Research	
		Inspection paths	
		Watch towers	
		Block wise prescriptions	
	7.7 Interim revision		
	7.8 Cost norms		
8. Miscellaneous regulations	8.1 General considerations		
	8.2 Forest consolidation		
	8.3 Area discrepancy		
	8.4 Forest fire management		
	8.5 Grazing regulation		
	8.6 Maintenance of forest block boundaries		
	8.7 Grazing regulation		
	8.8 Maintenance of infrastructure		
	8.9 Petty felling & extraction		
	8.10 Rights & concessions		
	8.11 Deviations		
	8.12 Research & monitoring		
	8.13 Roads, paths, bridges &		



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	buildings		
	8.14 System of sale/ disposal of forest produce		
	8.15 Capacity building of frontline staff		
	8.16 Maintenance of records	Register of forest blocks	
		Compartment histories	
		Control forms	
		Plantation journals	
		Plantation register	
		Fire map	
	8.17 Survey & maintenance of maps	Working plan map	
		Stock map	
		Index map	
		Management map	
	8.18 Capacity building of forestry personnel		
	8.19 Interim revision		
9. Establish ment & labour	9.1 Establishment		
	9.2 Administrative reorganization		
	9.3 Labour		
10. Financial forecast	10.1 Financial forecast		
	10.2 Treatment of Rehabilitation WC	RDF plantation	
	10.3 Treatment of Plantation WC		
	10.4 Treatment of Protection (O) WC		
	10.5 Treatment	Creek renovation	



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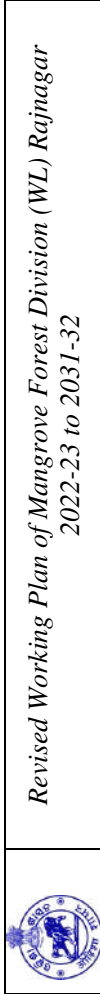
	of Mangrove Improvement WC	Watch towers	
		Removal of weeds	
		Inspection paths	
		Construction of mounds	
		New fishbone channels	
		Habitat protection	
	10.6 Treatment of Wildlife (O) WC		
	10.7 Treatment of JFM (O) WC		
	10.8 Misc. Regulation	Forest consolidation	
		Maintenance of boundary	
		Fire protection	
		Infrastructure	
		Buildings	
		Ecotourism	
		Capacity building	
		Library, equipment, maps, tools	
		Misc. contingencies	
	10.9 Project cost		
11. Trees Outside Forest (TOF)			
12. Summary of prescriptions			



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7. Works Prescribed During the Plan with Annual Target

Chapter No.	Para No./ Sub Para No.	Prescribed Activity	Year Wise Distribution of Physical Target									
Part II			1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
2	2.12.1	Demarcation of Annual Rehabilitation Coupe Area in Ha	665.71	835.34	859.64	884.12	736.05	2218.045	396.8	473.07	194.483	317.16
	2.13	Preparation of Site and Treatment Map	665.71	835.34	859.64	884.12	736.05	2218.045	396.8	473.07	194.483	317.16
	2.14	Treatment Plan										
	2.15.1	Silvicultural Treatments	665.71	835.34	859.64	884.12	736.05	2218.045	396.8	473.07	194.483	317.16
	2.15.3	Creation of Barriers										
	2.16	Rehabilitation in Different Treatment Series	665.71	835.34	859.64	884.12	736.05	2218.045	396.8	473.07	194.483	317.16
	2.17	Control										
	2.18	Miscellaneous regulations										
3	3.10.2	Demarcation of Annual Plantation Coupes in Ha	103.52	144.14	125	123.39	114.09	174.39	224.81	122.22	168.96	88.75
	3.11	Preparation of Site, Treatment Map and Plan	103.52	144.14	125	123.39	114.09	174.39	224.81	122.22	168.96	88.75
	3.12	Stacking, Pitting and Planting	103.52	144.14	125	123.39	114.09	174.39	224.81	122.22	168.96	88.75
	3.13	Post-planting Operations	103.52	144.14	125	123.39	114.09	174.39	224.81	122.22	168.96	88.75
	3.14	Control										
	3.15	Miscellaneous Regulations										
	4.8.1	Encroachment eviction										
	4.8.2	Protection Against Illicit Felling	795.71	977.48	989.64	1148.51	934.27	2563.225	671.29	722.12	515.463	768.02
4	4.8.2.3	Boundary fencing in km	10	10	10	10	10	10	10	10	10	10
	4.8.2.4	Construction of Watch towers	1	1	1	1	1	1	1	1	1	1
	4.9.1	Grazing control										
	4.9.2	Peoples Participation										
	4.9.3	Protection of Endemic & Endangered Species										



GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

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[illegible]



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[illegible]



I. List of Plants

Sl. No.	Name of the family	Scientific Name of the plant species.
(A)	DICOTYLEDONS	
1	<i>Acanthaceae</i>	<i>Acanthus ilicifolius</i>
2		<i>Rungiapectinata</i>
3		<i>Justicia prostrate</i>
4	<i>Aizoaceae</i>	<i>Gisekiapharnaceoides</i>
5		<i>Gisekiapharnaceoides</i>
6		<i>Gilniuslotoides</i>
7		<i>G. oppositifolious</i>
8		<i>Trainthemaportulacastrum</i>
9		<i>T. triquetra</i>
10		<i>Sesuviumportulacastrum</i>
11	<i>Amarathaceae</i>	<i>Digera muricata</i>
12		<i>Allmanianodiflora</i>
13		<i>Celosia argentia</i>
14		<i>Arvalanata</i>
15		<i>Achyranthes sessilis</i>
16		<i>A. paronychoides</i>
17	<i>Anacardiaceae</i>	<i>Holigamaarnottiana</i>
18		<i>Lnneacoromandelica</i>
19	<i>Annonaceae</i>	<i>Alphonseaventricosa</i>
20		<i>Polyalthiakorinti</i>
21		<i>P. suberosa</i>
22	<i>Apocynaceae</i>	<i>Carissa spinarum</i>
23		<i>Cerberaodallum</i>
24		<i>Ishnocarpus frutescens</i>
25	<i>Aristolochiaceae</i>	<i>Aristolochia indica</i>
26	<i>Asclepiadaceae</i>	<i>Pentatropis capensis</i>
27		<i>Hoya parasitica</i>
28		<i>Sarcolobuscarinatus</i>
29		<i>S. globosus</i>
30		<i>Tylophore tenuis</i>
31	<i>Avicenniaceae</i>	<i>Avicennia alba</i>
32		<i>A. officinalis</i>
33		<i>A. marina</i>
34	<i>Basellaceae</i>	<i>Basella alba</i>
35	<i>Boraginaceae</i>	<i>Cordial dichotoma</i>
36		<i>Heliotropiumcurassavium</i>



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37		<i>H. supinum</i>
38		<i>H. marifolium</i>
39		<i>H. strigosum</i>
40		<i>H. indicum</i>
41		<i>Trichodesma indica</i>
42		<i>Coldenia procumbens</i>
43	<i>Caesalpinaceae</i>	<i>Parkinsonia aculeate</i>
44		<i>Caesalpinia bonduc</i>
45		<i>C cristata</i>
46		<i>Intsiabijuga</i>
47		<i>Cynometrairipa</i>
48		<i>Rothia indica</i>
49		<i>Canavalia maritime</i>
50		<i>Cynometramiflora</i>
51	<i>Capparaceae</i>	<i>Crataevaadansonil</i>
52	<i>Caryophyllaceae</i>	<i>Polycarpaeacorymbosa</i>
53		<i>Polycarponprostratum</i>
54	<i>Ceratophyllaceae</i>	<i>Ceratophyllumdemersum</i>
55	<i>Chenopodiaceae</i>	<i>Salicornia brachiata</i>
56		<i>Suaedanudiflora</i>
57		<i>S. martima</i>
58		<i>S. monoecia</i>
59	<i>Combretaceae</i>	<i>Lumnitzera racemosa</i>
60	<i>Compositae</i>	<i>Launaeasermentosa</i>
61		<i>Gnaphalium indicum</i>
62		<i>Sphaeranthus indicus</i>
63	<i>Convolvulaceae</i>	<i>Cuscutareflexa</i>
64		<i>Evolvulusalsinoides</i>
65		<i>Merremia tridentate</i>
66		<i>Riveahypocrateriformis</i>
67		<i>Ipomoea tuba</i>
68		<i>I. per-caprae</i>
69		<i>I. mauritiana</i>
70	<i>Cucurbitaceae</i>	<i>Cucumis callous</i>
71		<i>Citrullus colocynthis</i>
72	<i>Ebenaceae</i>	<i>Diospyros buxifolia</i>
73		<i>D. cordifolia</i>
74	<i>Euphorbiaceae</i>	<i>Euphorbia rosea</i>
75		<i>E. hyporhysifolia</i>
76		<i>E. hirta</i>
77		<i>E. thymifolia</i>



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78		<i>Phyllanthus virgatus</i>
79		<i>P. rotund folius</i>
80		<i>Synostemonbacciformis</i>
81		<i>Brideliastipularis</i>
82		<i>Breynia vitis-idaea</i>
83		<i>Antidesmaghesaembilla</i>
84		<i>Jatropha gossypifolia</i>
85		<i>J. curcus</i>
86		<i>Chrozophorarottleri</i>
87		<i>Suregada multiflora</i>
88		<i>Excoecariaagallocha</i>
89	<i>Flacourtiaceae</i>	<i>Flacourtia indica</i>
90	<i>Hippocrateaceae</i>	<i>Salacia prinoides</i>
91	<i>Lamiaceae</i>	<i>Leucas stricta</i>
92		<i>Hyptissuaveolens</i>
93		<i>Anisomeles indica</i>
94	<i>Lauraceae</i>	<i>Litsea glutinosa</i>
95		<i>L. nitida</i>
96	<i>Lentibulariaceae</i>	<i>Utricularia stellaris</i>
97		<i>U. gibba</i>
98		<i>U. polygolides</i>
99		<i>U. minutissima</i>
100	<i>Loganiaceae</i>	<i>Strychnos nux-vomica</i>
101	<i>Loranthaceae</i>	<i>Viscum ovalifolium</i>
102		<i>Scurrulaphilipenis</i>
103		<i>Dendrophthoe falcata</i>
104	<i>Malvaceae</i>	<i>Thespesia populnea</i>
105		<i>Pavonia procumbens</i>
106		<i>Sida cordifolia</i>
107		<i>Abutilon indicum</i>
108		<i>Hibiscus tiliaceus</i>
109	<i>Meliaceae</i>	<i>Aglaia cucullata</i>
110		<i>Xylocarpus granatum</i>
111		<i>X. mokongensis</i>
112	<i>Menispermaceae</i>	<i>Cisampelos pareira</i>
113	<i>Molluginaceae</i>	<i>Mollugo pentaphylla</i>
114		<i>M. disticha</i>
115	<i>Moraceae</i>	<i>Ficus retusa</i>
116		<i>F. virens</i>
117	<i>Myrsinaceae</i>	<i>Ardisia solanacea</i>
118		<i>Aegiceras corniculatum</i>



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119	<i>Ochnaceae</i>	<i>Ochna obtusata</i>
120	<i>Olacaceae</i>	<i>Olax scandens</i>
121	<i>Ongraceae</i>	<i>Ludwigiahyssopifolia</i>
122		<i>L. perennis</i>
123	<i>Opliaceae</i>	<i>Canesierarheedil</i>
124	<i>Papilionaceae</i>	<i>Indigofera glabra</i>
125		<i>Tephrosia purpurea</i>
126		<i>T. vilosa</i>
127		<i>Zornia diphylla</i>
128		<i>Tavernieracuneifolia</i>
129		<i>Alysicarpus vaginalis</i>
130		<i>Desmodiumtriflorum</i>
131		<i>Arbus precatorius</i>
132		<i>Dalbergia spinosa</i>
133		<i>Pongamia pinnata</i>
134		<i>Mucuna gigantia</i>
135		<i>Derris scandens</i>
136		<i>D. heterophylla</i>
137		<i>Atylosiascrabaeoides</i>
138	<i>Pedaliaceae</i>	<i>Pedaliummurax</i>
139	<i>Peripocaceae</i>	<i>Finalayasoniaobovata</i>
140		<i>Hemidesmus indicus</i>
141	<i>Plumbaginaceae</i>	<i>Aegialitis rotundifolia</i>
142	<i>Polygalaceae</i>	<i>Polygala arvensis</i>
143		<i>Salomoniaciliate</i>
144	<i>Portulacaceae</i>	<i>Portulaca pilosa</i>
145	<i>Rhamnaceae</i>	<i>Ziziphus oenoplia</i>
146		<i>Colubrine asiatica</i>
147	<i>Rhizophoraceae</i>	<i>Bruguieragymnorhiza</i>
148		<i>B. sexangula</i>
149		<i>B. parviflora</i>
150		<i>B. cylindrical</i>
151		<i>Ceriopsdecandra</i>
152		<i>C. tagal</i>
153		<i>Kandeliacandel</i>
154		<i>Rhizophora apiculata</i>
155		<i>R. mucronata</i>
156		<i>R. stylosa</i>
157	<i>Rubiaceae</i>	<i>Randiamalabarica</i>
158		<i>Pavetta indica</i>
159		<i>Ixora arborea</i>



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160		<i>I. coccinea</i>
161		<i>Morindacitrifolia</i>
162		<i>Canthiumdicocoum</i>
163		<i>Oldenlandiacorymbosa</i>
164		<i>O. umbellata</i>
165		<i>O. stricta</i>
166		<i>O. herbacea</i>
167		<i>O. biflora</i>
168		<i>Hydrophylaxmartima</i>
169		<i>Knoxiasumatrensis</i>
170		<i>Borreria articularis</i>
171	<i>Rutaceae</i>	<i>Merope angulata</i>
172		<i>Toddalia asiatica</i>
173		<i>Clausenaheptaphylla</i>
174	<i>Salvadoraceae</i>	<i>Salvadora persica</i>
175	<i>Sapindaceae</i>	<i>Dodonaea viscosa</i>
176		<i>Allophyluscobbe</i>
177		<i>Lepisanthetetrrophylla</i>
178	<i>Sapotaceae</i>	<i>Manikarahexandra</i>
179		<i>M. littoralis</i>
180	<i>Scrophulariaceae</i>	<i>Verbascum chinense</i>
181		<i>Bacopa monnieri</i>
182		<i>Lindernia crustacean</i>
183		<i>L. antipoda</i>
184		<i>Centrantheratranqaebarica</i>
185	<i>Solanaceae</i>	<i>Solonomtrilobatum</i>
186		<i>S. incanum</i>
187		<i>Physalis minima</i>
188		<i>Datura metel</i>
189	<i>Sonneratiaceae</i>	<i>Sonneratia apetala</i>
190		<i>S. caseolaris</i>
191		<i>S. griffithii</i>
192	<i>Sphenocleaceae</i>	<i>Sphenocleazetlanica</i>
193	<i>Sterculiaceae</i>	<i>Heritiera fomes</i>
194		<i>H. littoralis</i>
195		<i>H. globosa</i>
196		<i>Pterospermumxylocarpum</i>
197		<i>Waltheria Americana</i>
198	<i>Tamaricaceae</i>	<i>Tamarixtroupil</i>
199		<i>T. ericoides</i>
200		<i>T. dioica Roxb</i>



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201	<i>Tiliaceae</i>	<i>Brownlowiaterisa</i>
202	<i>Verbenaceae</i>	<i>Vitex negundo</i>
203		<i>Clerodendrum inerme</i>
204		<i>Premnacorymbosa</i>
205	<i>Violaceae</i>	<i>Hybanthus cneaspermus</i>
206	<i>Vitaceae</i>	<i>Cayratia trifolia</i>
207	<i>Monocotyledons</i>	
208	<i>Alismataceae</i>	<i>Limnophyton obtusifolium</i>
209	<i>Amaryllidaceae</i>	<i>Crinum asiaticum</i>
210		<i>C. defixum ker</i>
211	<i>Aponogetonaceae</i>	<i>Aponogeton natans</i>
212		<i>A. crispum thumb</i>
213	<i>Araceae</i>	<i>Cryptocoryne cillata</i>
214	<i>Arecaceae</i>	<i>Phoenix paludosa</i>
215	<i>Commelinaceae</i>	<i>Commelina attenuate</i>
216		<i>Murdannia nudiflora</i>
217		<i>Cyanotis cristata</i>
218	<i>Cyperaceae</i>	<i>Cyperus corymbosus</i>
219		<i>C. platystylis</i>
220		<i>C. kylinga</i>
221		<i>C. polystachyos</i>
222		<i>C. laegatus</i>
223		<i>C. malaccensis</i>
224		<i>C. dubius</i>
225		<i>C. compressus</i>
226		<i>C. iria</i>
227		<i>C. rotundus</i>
228		<i>C. brevifolius</i>
229		<i>C. dislans</i>
230		<i>C. haspan</i>
231		<i>C. difformis</i>
232		<i>C. exaltatus</i>
233		<i>C. pumilus</i>
234		<i>C. globosus</i>
235		<i>C. alopecuroides</i>
236		<i>C. pachyrhizus</i>
237		<i>C. arenarius</i>
238		<i>Bulbostylis barbata</i>
239		<i>Fimbristylis aestivalis</i>
240		<i>F. squarosa</i>
241		<i>F. complanata</i>



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242		<i>F. monostachyos</i>
243		<i>F. cymosa</i>
244		<i>F. dichotoma</i>
245		<i>F. ferruginea</i>
246		<i>Eleocharis capitata</i>
247		<i>Fuirenaciliaris</i>
248	<i>Dioscoreaceae</i>	<i>Dioscorea bulbifera</i>
249		<i>D. puber</i>
250		<i>D. oppositifolia</i>
251	<i>Eriocaulaceae</i>	<i>Eriocaulon sieboldianum</i>
252	<i>Flagellariaceae</i>	<i>Flagellaria indica</i>
253	<i>Hydrocharitaceae</i>	<i>Hydrilla verticillata</i>
254		<i>Vallisneria spiralis</i>
255	<i>Lilaceae</i>	<i>Gloriosa superba</i>
256		<i>Asparagus racemosus</i>
257		<i>Scilla hyacinthine</i>
258	<i>Pandanaceae</i>	<i>Pandanus tectorius</i>
259		<i>P. fascicularis</i>
260	<i>Poaceae</i>	<i>Saccharum spontaneum</i>
261		<i>Apludamutica</i>
262		<i>Hemarthria compressa</i>
263		<i>Rottobellia exaltata</i>
264		<i>Vetiveria zizanioides</i>
265		<i>Chrysopogon aciculatus</i>
266		<i>Spinifolius littoreus</i>
267		<i>Panicum repens</i>
268		<i>Digitaria longiflora</i>
269		<i>Brachiaria reptans</i>
270		<i>Oplismenus burmannii</i>
271		<i>O. compositus</i>
272		<i>Aruadodonax</i>
273		<i>Phragmites karka</i>
274		<i>Sporobolus marginatus</i>
275		<i>S. diander</i>
276		<i>Myriostachya wightiana</i>
277		<i>Prostria coarctata</i>
278		<i>Leersia hexandra</i>
279		<i>Eleusine indica</i>
280		<i>Eragrostis tenella</i>
281		<i>E. ciliate</i>



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282		<i>E. natans</i>
283		<i>E. tremula</i>
284		<i>Chloris dolichostachya</i>
285		<i>Leptochloa panacea</i>
286		<i>Aristida setacea</i>
287		<i>Perotis indica</i>
288		<i>Sacciolepis interrupta</i>
289		<i>Heteropogon contortus</i>
290		<i>Brachiaria distachya</i>
291		<i>Paspalum punctatum</i>
292		<i>Setaria tomentosa</i>
293		<i>Dinebra retroflexa</i>
294		<i>Zoysia metralia</i>
295	<i>Polypodiaceae</i>	<i>Acrostichum aureum</i>
296		<i>Stenochlaena palustris</i>
297	<i>Smilacaceae</i>	<i>Smilax parvifolia</i>
298	<i>Thyphaceae</i>	<i>Typha angustata</i>
299	<i>Xyridaceae</i>	<i>Xyris indica</i>





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II. List of Mammals with Their Status:

Sl. No.	English Name	Scientific Name	Schedule as per WL(P) Act, 2022(amended)
1.	Spotted Deer	<i>Axis axis</i>	Sch-II
2.	Sambar	<i>Cervus unicolor</i>	Sch-I
3.	Indian Wild Boar	<i>Sus scrofa</i>	Sch-II
4.	Asiatic Jackal	<i>Canis aureus</i>	Sch-I
5.	Fishing Cat	<i>Felis viverrina.</i>	Sch-I
6.	Jungle Cat	<i>Felis.chaus</i>	Sch-II
7.	Leopard Cat	<i>Felis bengalensis.</i>	Sch-I
8.	Striped Hyena	<i>Hyaena hyaena</i>	Sch-I
9.	Common Mongoose	<i>HerpestesEdwardsi.</i>	---
10.	Smooth Coated Indian Otter.	<i>Lutraperspicillata.</i>	Sch-I
11.	Small Indian Civet	<i>Viverricula indica.</i>	Sch-I
12.	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	Sch-I
13.	House Shrew	<i>Suncus murinus</i>	---
14.	Rhesus Macaque	<i>Macaca mulatta mulatta.</i>	---
15.	Hanuman Langur	<i>Presbytes entellus</i>	Sch-II
16.	Three striped palm squirrel	<i>Funambulus palmarum</i>	--
17.	Indian Porcupine	<i>Hystrix indica.</i>	Sch-I
18.	Indian Field Mouse	<i>Mus booduga</i>	--
19.	Common White bellied House Rat.	<i>Rattus rattusarboreus.</i>	--
20.	The Bandicoot Rat	<i>Bandicota indica.</i>	
21.	Indian mole rat	<i>Bandicota bengalensis</i>	--
22.	Short nosed Fruit Bat	<i>Cynopterus sphinx sphinx.</i>	---
23.	Indian Pipistrelle	<i>Pipistrellus cormandracormandra</i>	---
24.	Chemenia.	<i>Taphozousmelanopog onmelanopogon.</i>	---
25.	Gangetic Dolphin	<i>Platamistaganetica.</i>	Sch-I
26.	Humpback Dolphin	<i>Sousa chinensis.</i>	Sch-I
27.	Irrawady Dolphin	<i>Orcaellabrevirostris.</i>	Sch-I
28.	Little Indian Porpoise.	<i>Neophocaenaphocaen oides</i>	Sch-I



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III. List of Birds:

Sl.No	Family	Common Name	Scientific Name	Schedule as per WPA,1972	Status
1.	<i>Podicipedidae</i>	Little grebe	<i>Tachybaptus ruficollis</i>	II	LM, Rare
2.	<i>Pelecanidae</i>	Spot billed Pelican	<i>Pelicanus phillippensis</i>	II	-do-
3.	<i>Phalacrocoraci dae</i>	Little cormorant	<i>Phalacrocorax niger</i>	II	Res.
4.		Great cormorant	<i>Phalacrocorax carbo</i>	II	Rare
5.		Darter	<i>Anhinga melanogaster</i>	II	Rare, Res.
6.	<i>Ardeidae</i>	Cattle egret	<i>Bubulcus ibis</i>	II	Res. Comm.
7.		Great egret:	<i>(Casmerodius albus</i>	II	Res.
8.		Intermediate egret	<i>Mesophoyx intermedia</i>	II	Res.
9.		Little egret:	<i>Egretta garzetta</i>	II	Res.
10.		Western reef egret	<i>Egretta alula</i>	II	W.M.
11.		Black-crowned night heron	<i>Nycticorax nycticorax</i>	II	Res.
12.		Grey heron	<i>Ardea cinerea</i>	II	Res.
13.		Purple heron	<i>Ardea purpurea</i>	II	Res.
14.		Indian pond heron	<i>Ardeola bacchus</i>	II	Res.
15.		Little Green heron	<i>Butorides striatus</i>	II	Res.
16.		Black Bittern	<i>Ixobrychus flavicollis</i>	II	Res.
17.		Yellow bittern	<i>Ixobrychus sinensis</i>	II	Res.
18.		Cinnamon bittern	<i>Ixobrychus cinnamomeus</i>	II	Res.
19.	<i>Ciconiidae</i>	Lesser Adjutant	<i>Leptoptilos javanicus</i>	II	Res.
20.		Asian openbill	<i>Anastomus oscitans</i>	II	Res.
21.		Painted stork	<i>Mycteria leucocephala</i>	II	Res.
22.		Black necked stork	<i>Ephippiorhynchus asiaticus</i>	II	W.M.
23.	<i>Threskiornithidae</i>	Black headed ibis	<i>Threskiornis melanocephala</i>	II	Res.
24.		Eurasian spoonbill	<i>Platalea leucorodia</i>	II	W.M.
25.	<i>Anatidae</i>	Gadwall	<i>Anas strepera</i>	II	W.M.
26.		Garganey	<i>Anas querquedula</i>	II	W.M.
27.		Northern Pintail	<i>Anas acuta</i>	II	W.M.
28.		Eurasian wigeon:	<i>Anas Penelope</i>		W.M.
29.		Common teal	<i>Anas crecca</i>	II	W.M.
30.		Lesser whistling duck	<i>Dendrocygna javanica</i>	II	Res.
31.		Fulvous whistling duck	<i>Dendrocygna bicolor</i>	II	Res.
32.		Ruddy Shelduck	<i>Tadorna ferruginea</i>	II	W.M.
33.		Northern Shoveler	<i>Anas clypeata</i>	II	W.M.
34.		Cotton Pygmy Goose	<i>Nettion coromandelianus</i>	I	Res.
35.		Common Pochard	<i>Aythya ferina</i>	I	W.M.



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36.		Baer's Pochard	<i>Aythya baeri</i>	I	W.M.
37.	<i>Accipitridae</i>	Booted hawk eagle	<i>Hieraaetus pennatus</i>	II	Res, L.M.
38.		Changeable hawk eagle	<i>Spizaetus cirrhatus</i>	II	W.M.
39.		Crested serpent eagle	<i>Spilornis cheela</i>	II	Res, L.M.
40.		Short-toed snake eagle	<i>Circaetus gallicus</i>	II	Res.
41.		White-bellied sea eagle	<i>Haliaeetus leucogaster</i>	II	Res.
42.		Tawny eagle	<i>(Aquila rapax)</i>	II	L.M.
43.		Black eagle	<i>Ictinaetus malayensis</i>	II	L.M.
44.		Greater spotted eagle	<i>Aquila clanga</i>	II	L.M.
45.		Lesser spotted eagle	<i>Aquila pomarina</i>	II	L.M.
46.		Pallas's fish eagle	<i>Haliaeetus leucoryphus</i>	II	W.M.
47.		Eurasian Marsh harrier	<i>Circus aeruginosus</i>	I	W.M.
48.		Pied harrier	<i>Circus melanoleucos</i>	I	W.M.
49.		Pallid harrier	<i>Circus macrourus</i>	I	W.M.
50.		Eurasian Sparrow hawk	<i>Accipiter nisus</i>	II	W.M.
51.		Shikra	<i>Accipiter badius</i>	I	Res, Com.
52.		Brahminy kite	<i>Haliastur indus</i>	I	L.M, Rare
53.		White backed vulture	<i>Gyps bengalensis</i>	I	Res.
54.		Osprey:	<i>Pandion haliaetus</i>	I	W.M.
55.		Black kite	<i>Milvus migrans</i>	II	Res, L.M.
56.		Black-shouldered Kite	<i>Elanus caeruleus</i>	II	Res
57.		Oriental Honey buzzard:	<i>Pernis ptilorhynchus</i>	II	W.M. Rare
58.	<i>Falconidae</i>	Saker falcon	<i>Falco cherrug</i>	I	L.M, Rare
59.		Red necked falcon	<i>Falco chicquera</i>	I	LM, Rare
60.		Peregrine falcon	<i>Falco peregrinu</i>	I	L.M, W.M.
61.		Common kestrel	<i>Falco tinnunculu</i>	II	W.M.
62.	<i>Phasianidae</i>	Gray francolin	<i>Francolinus pondicerianus</i>	II	Rare
63.		Red jungle fowl	<i>Gallus gallus</i>	II	Res.
64.	<i>Rallidae</i>	Slaty breasted rail	<i>Rallus striatus</i>	II	Res.
65.		Common coot	<i>Fulica atra</i>	II	W.M, Rare
66.		Water cock	<i>Gallicrex cinerea</i>	II	Res.
67.		Purple swamp hen	<i>Porphyrioporphorio</i>	II	Res.
68.		Common moorhen	<i>Gallinula chloropus</i>	II	Res.
69.	<i>Jacaniidae</i>	Bronze-winged Jacana	<i>Metopidius indicus</i>	II	Res.



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70.		Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	II	Res.
71.	Charadriidae	Grey-headed lapwing	<i>(Vanellus cinereus</i>	II	W.M.
72.		Red wattled lapwing	<i>(Vanellus indicus</i>	II	Res.
73.		White tailed lapwing	<i>Vanellus leucurus</i>	II	W.M, Rare
74.		Yellow wattled lapwing	<i>Vanellus malarbaricus</i>	II	Res.
75.		Common ringed Plover:	<i>Charadrius hiaticula</i>	II	W.M.
76.		Little ringed Plover	<i>Charadrius dubius</i>	II	W.M.
77.		Kentish Plover	<i>Charadrius alexandrinus</i>	II	W.M.
78.		Lesser Sand Plover	<i>Charadrius mongolus</i>	II	W.M.
79.		Greater sand Plover	<i>Charadrius leschenaultii</i>	II	W.M.
80.		Pacific Golden Plover	<i>Pluvialis fulv</i>	I	W.M.
81.		Grey plover:	<i>Pluvialis squatarola</i>	II	W.M.
82.		Eurasian curlew	<i>Numenius arquata</i>	II	W.M.
83.		Whimbrel	<i>Numenius phaeopus</i>	II	Res, W.M.
84.		Red Knot	<i>Calidris cautus</i>	II	W.M.
85.		Dunlin	<i>Calidris alpina</i>	II	W.M.
86.		Black tailed Godwit	<i>Limosalimosa</i>	II	W.M.
87.		Bar tailed Godwit	<i>Limosalapponica</i>	II	W.M, Rare
88.		Common Redshank	<i>Tringatotanu</i>	II	W.M.
89.		Spotted Redshank	<i>Tringa erythropus</i>	II	W.M, Rare
90.		Common Greenshank	<i>Tringanebularia</i>	I	W.M, Com.
91.		Spotted Greenshank	<i>Tringaguttifer</i>	I	W.M, Rare
92.		Greater painted snipe	<i>Rostratulabenghalensis</i>	II	Res.
93.		Jack snipe	<i>Lymnocyrtes minimus)</i>	II	W.M.
94.		Common snipe	<i>Gallinagogallinago</i>	II	W.M.
95.		Pintail snipe:	<i>Gallinagostenura</i>	II	W.M.
96.		Common Sandpiper	<i>Tringahypoleucos</i>	II	W.M.
97.		Curlew Sandpiper	<i>Calidris testacea</i>	II	W.M, Com.
98.		Wood sandpiper	<i>Tringaglareola</i>	II	W.M, Com.
99.		Green Sandpiper	<i>Tringa ochropus</i>	II	W.M, Com.
100.		Terek Sandpiper	<i>Tringa terek)</i>	II	W.M.
101.		Marsh Sandpiper	<i>Tringastagnatilis</i>	II	W.M.
102.		Ruddy turnstone	<i>Arenaria interpres</i>	II	W.M.
103.		Spoonbilled sandpiper	<i>Eurynorhynchus pygmeus</i>	I	W.M.
104.		Ruff and Reeve	<i>Philomachus pugnax</i>	II	W.M.
105.		Little stint	<i>Calidris minuta</i>	II	W.M.
106.		Temminck's stint	<i>Calidris temminckii</i>	II	W.M, Com.
107.		Long toed stint	<i>Calidris subminu</i>	II	W.M, Rare



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108.		Sanderling	<i>Calidris alba</i>	II	W.M, Rare.
109.		Red Necked Phalaropus	<i>Phalanoslobatus</i>	II	W.M, Rare
110.		Crab plover	<i>Dromasardeola</i>	II	W.M.
111.	<i>Rostratulidae</i>	Greater painted snipe	<i>Rostratulabenghalensis</i>	II	Rare
112.	<i>Recurvirostridae</i>	Black winged stilt	<i>Himantopus himantopus</i>	II	L.M.
113.		Pied avocet	<i>Recurvirostraavosetta</i>	II	W.M.
114.	<i>Burhinidae</i>	Greater thicknee	<i>Esacusrecurvirostris)</i>		W.M, Rare
115.		Eurasian thicknee	<i>Burhinusoedicnemus</i>		W.M.
116.	<i>Glareolidae</i>	Oriental Pratincole	<i>Glareolamaldivarum</i>	II	W.M.
117.		Small Pratincole	<i>Glareola lacteal</i>	II	Rare
118.	<i>Laridae</i>	Black headed gull	<i>Larus ridibundus</i>	II	W.M.
119.		Brown headed gull	<i>Larus brunnicephalu</i>	II	W.M.
120.		Heuglin's Gull:	<i>Larus beuglin</i>	II	W.M.
121.		Pallas's Gull	<i>Larus ichthyaetus)</i>	II	W.M.
122.		Black bellied terns	<i>Sterna acuticauda</i>	II	W.M.
123.		Capsian tern:	<i>Hydroprognecaspia</i>	II	W.M
124.		Greater crested tern	<i>Sterna bergii</i>	II	W.M
125.		Lesser crested tern	<i>Sterna bengalensis</i>	II	W.M.
126.		Gull billed tern	<i>Gelochelidonnilotica</i>	II	L.M
127.		River tern	<i>Sterna aurantia</i>	II	L.M.
128.		Whiskered tern	<i>Chlidoniashybrida</i>	II	L.M.
129.		Indian skimmer	<i>Rynchopsalbicollis</i>	II	W.M, Rare
130.	<i>Haematopodidae</i>	Eurasian oystercatcher	<i>Haematopusostralegus</i>	II	W.M.
131.	<i>Columbidae</i>	Emerald dove	<i>Chalcophaps indica</i>	II	Res.
132.		Spotted dove	<i>Streptopelia chinensis</i>	II	Res.
133.		Eurasian collared dove	<i>Streptopeliadecaocto</i>	II	Res.
134.		Oriental turtle dove	<i>Streptopeliaorientalis</i>	II	L.M
135.		Blue rock Pigeon:	<i>Columba livia)</i>	II	Res.
136.		Orange breasted Green Pigeon	<i>Treronbicincta</i>	II	Res. ,L.M
137.		Pale capped Pigeon:	<i>Columba punicea)</i>	II	L.M,Rare
138.		Thick-billed green pigeon:	<i>Treroncurvinostro</i>	II	L.M, Rare
139.	<i>Psittacidae</i>	Alexandrine Parakeet	<i>Psittaculaeupatria</i>	II	L.M, Rare
140.		Rose ringed Parakeet	<i>Psittaculakrameri</i>	II	Res., Rare
141.		Blossom headed Parakeet	<i>Psittacula roseate</i>	II	Res., Very rare
142.		Red breasted Parakeet:	<i>Psittaculaalexandri</i>	II	L.M, Rare
143.	<i>Cuculidae</i>	Chestnut-winged	<i>Clamatorcoromandus</i>	II	L.M.



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		cuckoo			
144.		Pied cuckoo	<i>Clamatorjacobinus</i>	II	L.M
145.		Common hawk cuckoo	<i>Hierococcyxvarius</i>	II	Res.
146.		Eurasian cuckoo	<i>Cuculuscanoru</i>	II	L.M.
147.		Oriental cuckoo:	<i>Cuculussaturatus</i>	II	Rare
148.		Indian plaintive cuckoo	<i>Cacomantispasserinus</i>	II	Rare
149.		Asian Koel	<i>Eudynamysscolopacea</i>	II	Res.
150.		Large green billed malkoha	<i>Phaenicophaeusviridirostris</i>	II	Res.
151.		Greater coucal	<i>Centropus sinensis</i>	II	Res.
152.	<i>Strigidae</i>	Barn owl	<i>Tyto alba</i>	II	Res.
153.		Brown fish owl	<i>Ketupazeylonensis</i>	II	Res.
154.		Spotted owlet	<i>Athene brama</i>	II	Res.
155.		Collared scops owl	<i>Otusbakkamoena</i>	II	Res.
156.		Pallid scops owl	<i>Otus brucei</i>	II	Res.
157.		Eurasian scops owl	<i>Otus scops</i>	II	Res.
158.	<i>Caprimulgidae</i>	Grey Nightjar:	<i>Caprimulgus indicus</i>	II	Res.
159.		Large-tailed Nightjar:	<i>Caprimulgus macrurus</i>	II	Res.
160.	<i>Apodidae</i>	Asian palm swift	<i>Cypsiurusparvus</i>	II	Res.
161.		House swift:	<i>Apus affinis</i>	II	Res.
162.	<i>Alcedinidae</i>	Black-capped kingfisher	<i>Halcyonpileata</i>	II	L.M
163.		Brown winged kingfisher:	<i>(Halcyon amauroptera</i>	II	Res.
164.		Ruddy Kingfisher	<i>Halcyon coromanda</i>	II	W. M, V.Rare.
165.		Collared Kingfisher	<i>Todiramphuschloris</i>	II	Res.
166.		Pied Kingfisher:	<i>Cerylerudis</i>	II	Res.
167.		White-throated Kingfisher	<i>Halcyon smyrnensis</i>	II	Res.
168.		Common Kingfisher:	<i>Alcedoatthis</i>	II	Res.
169.		Stork-billed Kingfisher:	<i>Halcyon capensis</i>	II	Res.
170.	<i>Meropidae-</i>	Blue tailed bee eater	<i>Meropsphillipinus</i>	II	S.M
171.		Green bee eater	<i>Meropsorientalis</i>	II	Res.
172.		Chestnut headed bee eater	<i>(Meropsleschenaulti</i>	II	L.M., Rare
173.	<i>Coracidae</i>	Indian roller	<i>Coracias benghalensis</i>	II	Res.
174.	<i>Upupidae</i>	Common hoopoe	<i>Upupa epops</i>	II	Res.
175.	<i>Bucerotidae-</i>	Indian Grey hornbill	<i>Ocyerosbistrostris</i>	II	Res.
176.	<i>Capitonidae</i>	Blue throated barbet	<i>(Megalaima asiatica</i>	II	L.M.
177.		Brown headed	<i>Megalaimazeylanica</i>	II	W.M



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		barbet			
178.		Coppersmith barbet	<i>Megalaimahaemacephala</i>	II	Res
179.	<i>Picidae</i>	Grey-capped pygmy wood pecker	<i>Dendrocoposcanicapillus</i>	II	LM. Rare
180.		Stripe breasted woodpecker	<i>Dendrocoposatratus</i>	II	Rare
181.		Fulvous breasted woodpecker	<i>Dendrocoposmacei</i>	II	Res.
182.		Grey-headed woodpecker	<i>Picuscanus</i>	II	Res.
183.		Rufous woodpecker	<i>Celeusbrachyurus</i>	II	Res.
184.		Eurasian wryneck	<i>Jynxtorquilla</i>	II	Res.
185.		Black ramped flameback:	<i>Dinopiumbenghalense</i>	II	Res.
186.		Greater flameback	<i>Chrysocolapteslucidus</i>	II	Res.
187.		Speckled Piculate	<i>Picumnusinnominatus</i>	II	L.M
188.	<i>Pittidae</i>	Indian Pitta	<i>Pitta brachyura</i>	II	L.M
189.		Mangrove Pitta:	<i>Pitta megarhyncha</i>	II	Res.
190.	<i>Alaudidae</i>	Bengal bush lark	<i>Mirafraassamica</i>	II	W.M
191.		Singing bush lark	<i>Mirafraacantillans</i>	II	W.M
192.		Indian bush lark	<i>Mirafraerythroptera</i>	II	Res.
193.		Ashy crowned sparrow lark	<i>Eremopterix grisea)</i>	II	Res.
194.		Oriental sky lark	<i>Alauda gulgula</i>	II	Res.
195.		Crested lark	<i>Galerida cristata</i>	II	Res.
196.		Greater short-toed lark	<i>Calandrellabrachydactyla</i>	II	Rare
197.	<i>Hirundinidae</i>	Barn swallow	<i>Hirundorustica)</i>	II	W.M
198.		Red rumped swallow	<i>Hirundodaurica</i>	II	W.M
199.		Asian house martin:	<i>Delichondasypus</i>	II	W.M
200.	<i>Daniidae</i>	Grey backed shrike	<i>Laniustephronotus</i>	II	W.M
201.		Brown shrike	<i>Laniuscristatus</i>	II	Res.
202.	<i>Oriolidae</i>	Black hooded oriole	<i>Oriolusxanthornus</i>	II	Res.
203.		Eurasian golden oriole	<i>Oriolusoriolus</i>	II	W.M, Rare.
204.	<i>Dicruridae</i>	Black drongo	<i>Dicrurusmacrocerus</i>	II	Res.
205.		Ashy drongo	<i>Dicrurusleucophaeus</i>	II	Res.
206.		White bellied drongo	<i>Dicruruscaerulescens</i>	II	Res.
207.		Sprangled drongo	<i>Dicrurushottentottus</i>	II	Res.
208.	<i>Sturnidae</i>	Asian pied starling	<i>Sturnus contra</i>	II	Res.
209.		Brahminy starling	<i>Sturnus Pagodarum</i>	II	L.M., Rare
210.		Chestnut tailed starling:		II	Res.



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211.		Common Myna	<i>Acridotheres tristis</i>	II	Res.
212.		Jungle Myna	<i>Acridotheres fuscus</i>	II	Res.
213.	<i>Curvidae</i>	Ruddy breasted crows	<i>Porzana fusca</i>		Res.
214.		Large-billed crow	<i>Corvus macrorhynchos</i>	II	Res.
215.		Rufous tree pie	(<i>Dendrocitta bagabunda</i>	II	Res.
216.		House crow	<i>Corvus splendens</i>)		Res.
217.		Black winged cuckoo shrike	<i>Coracinamelaschistos</i>	II	Res.
218.	<i>Campephagidae</i>	Black headed cuckoo shrike	<i>Coracinamelanoptera</i>	II	Res.
219.		Large cuckoo shrike	<i>Coracinamacei</i>	II	Res.
220.		Small minivet:	<i>Pericrocotus cinnamomeus</i>	II	Res.
221.		Ashy minivet	<i>Perricrocotus divaricatus</i>	II	W.M, Rare
222.		Common iora	<i>Aegithina tiphia</i>	II	Res. Common
223.	<i>Irenidae</i>	Blue winged leaf bird	<i>Chloropsis cochinchinensis</i>		W.M, Rare
224.	<i>Pycnotidae</i>	Red vented bulbul	<i>Pycnonotus cafer</i>	II	Res
225.		Red whiskered bulbul	<i>Pycnonotus jocosus</i>	II	Res.
226.		White throated bulbul	<i>Alophoixus flaveolus</i>	II	L.M, Rare
227.	<i>Muscicapidae-</i>	Common babbler	<i>Turdoides caudatus</i>	II	Res.
228.		Jungle babbler	<i>Turdoides striatus</i>	II	Res.
229.		Striated babbler	<i>Turdoides earlei</i>	II	Res.
230.		Stripe tit babbler	<i>Macronousgulari</i>	II	Res.
231.		Chestnut capped babbler	<i>Timalia pileata</i>	II	Res.
232.		Ashy Prinia	<i>Priniasocialis</i>	II	Res.
233.		Plain Prinia	<i>Prinia inornata</i>)	II	Res.
234.		Yellow bellied Prinia	Prinia	II	Res.
235.		Common tailor bird	<i>Orthotomus sutorius</i>	II	Res.
236.		White throated fantail	(<i>Rhipidura albicollis</i>	II	Res.
237.		Red throated fly catcher	(<i>Ficedula parva</i>	II	Res.
238.		Blue throated flycatcher:	<i>Cyornis rubecoloides</i>	II	Res.
239.		Paradise flycatcher	<i>Tarpsiphone paradisi</i>	II	Res.
240.		Verditer flycatcher	<i>Eumyias thalassila</i>	II	W.M
241.		Blue throat	<i>Lusiniavesicia</i>	II	W.M.
242.		Oriental magpie robin	<i>Copsychus saularis</i>	II	Res.
243.		Blyth's reed warbler	<i>Acrocephalus dumetorum</i>	II	L.M.



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			m		
244.		Clamorous reed warbler	<i>Acrocephalus tentoreus</i>	II	W.M
245.		Greenish warbler	<i>Phylloscopus trochiloides</i>	II	L.M., Common.
246.		Plain leaf warbler	<i>Phylloscopus neglectus</i>	II	W.M
247.		Paddy field warbler:	<i>Acrocephalus agricola</i>	II	L.M.
248.		Brownish flanked bush warbler	<i>Cettia fortipes</i>	II	W.M.
249.		Pale footed bush warbler	<i>Cettia pallidipes</i>	II	L.M.
250.		Garden warbler	<i>Sylvia borin</i>	II	Res.
251.		Common chiffchaff	<i>(Phylloscopus collybita)</i>	II	W.M
252.		Black redstart	<i>Phoenicurus ochruros</i>	II	Res., Rare
253.		Black-naped Monarch	<i>Hypothymis azurea</i>	II	Res.
254.		Orange headed ground thrush	<i>Zosterocitta</i>	II	V.rare
255.		Tickel's thrush	<i>Turdus unicolor</i>	II	W.M.
256.		Streaked fantail-warbler	<i>Cisticola juncidis</i>	II	Common
257.	<i>Paridae</i>	Great tit	<i>Parus major</i>	II	Res.
258.	<i>Motacillidae</i>	Olive backed Pipit	<i>Anthus hodgsoni</i>	II	S. migrant.
259.		Tree Pipit	<i>Anthus trivialis</i>	II	S. migrant
260.		Tawny Pipit	<i>(Anthus campestris)</i>	II	S. migrant
261.		Richard's Pipit	<i>Anthus richard</i>	II	Res.
262.		Paddy field Pipit	<i>Anthus rufus</i>	II	Res.
263.		Citrine wagtail:	<i>Motacilla cinerea</i>	II	W.M
264.		Grey-headed wagtail	<i>Motacilla cinerea</i>	II	W.M.
265.		Yellow wagtail	<i>Motacilla flava</i>	II	W.M., Rare.
266.		Forest wagtail	<i>Dendronanthus indicus</i>	I	W.M.
267.		White wagtail	<i>Motacilla alba</i>	II	W.M.
268.	<i>Nectarinidae</i>	Loten's sunbird	<i>Nectarina lotenia</i>	II	W.M., Rare.
269.		Olive backed Sunbird	<i>(Nectarina jugularis)</i>	II	W.M, Rare.
270.		Purple rumped Sunbird	<i>Nectarina zeylonica</i>	II	Res.
271.		Purple sunbird	<i>Nectarina asiatica</i>	II	Res.
272.	<i>Ploceidae</i>	Indian silverbill:	<i>Lonchura malabarica</i>	II	Res.
273.		House sparrow	<i>Passer domesticus</i>	II	Res.
274.		Baya weaver bird	<i>Ploceus philippinus</i>	II	Res.
275.		Black breasted	<i>Ploceus benghalensis</i>	II	Res., Rare



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		weaver bird			
276.		Black headed Munia	<i>Lonchuramalacca</i>	II	Res.
277.		Scaly breasted Munia:	<i>Lonchurapunctulata</i>	II	Res.
278.	<i>Zosteropidae</i>	Oriental white eye	<i>Zosteropsalpebrosus</i>	II	Res.
279.	<i>Emberizidae</i>	Brambling	<i>Fringila montifringilla</i>	II	Rare
280.		Crested bunting	<i>Melophuslathami</i>	II	

L.M. – Local Migrant, W.M – Winter Migrant, S.M – Summer Migrant, Res. – Resident, V. rare – Very rare

IV. List of Amphibians:

Sl.No.	English Name	Scientific Name	Schedule as per WPA,1972
1.	Common Indian Toad	<i>Bufo melanostictus.</i>	
2.	Common Tree Frog	<i>Polypedates maculatus.</i>	
3.	Indian Skipper Frog	<i>Rana cyanophlyctis.</i>	
4.	Indian Cricket Frog	<i>Rana limnocharis.</i>	
5.	Indian Bull Frog	<i>Rana tigerina.</i>	II

V. List of Reptiles with National and Local Status:

SL. No.	English Name	Scientific Name	Schedule as per WPA, 1972
1.	Salt water Crocodile	<i>Crocodylusporosus</i>	I
2.	IndianGarden Lizard.	<i>Calotes versicolor.</i>	
3.	Fan-Throated Lizard	<i>Sitanaponticeriana</i>	
4.	Indian Chameleon	<i>Chamaeleon zeylanicus</i>	I
5.	Spotted Indian House Gecko	<i>Hemidactylus brooki.</i>	
6.	Common Indian House Gecko	<i>Hemidactylus flaviviridis.</i>	I
7.	Skink	<i>Riopa punctata</i>	
8.	Sand Skink	<i>Mabuyabibroni</i>	
9.	Common Skink	<i>Mabuyacarinata</i>	
10.	Indian Monitor Lizard	<i>Varanus bengalensis.</i>	
11.	Yellow Monitor Lizard	<i>Varanus flavescens.</i>	
12.	Water Monitor Lizard	<i>Varanus salvator</i>	I
13.	Indian Python	<i>Python molurus.</i>	I
14.	Common Green whip snake	<i>Ahaetullanasutus.</i>	
15.	Golden tree snake	<i>Chrysopeleaornata</i>	
16.	Painted Bronze Back	<i>Dendrelaphis pictus</i>	
17.	Common Indian Bronze Back	<i>Dendrelaphis tristis</i>	
18.	Indian rat snake	<i>Ptyasmucosus</i>	I



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19.	Common Kukri Snake	<i>Oligodonamensis</i>	
20.	Common Cat snake	<i>Boiga trigonata</i>	
21.	Dog faced Water Snake	<i>Cerberus rhynchops</i>	I
22.	Buff striped Keel back	<i>Amphiesmastolata</i>	I
23.	Checkered Keelback	<i>Xenochrophis piscator</i>	I
24.	Common Worm snake	<i>Typhlinabramina.</i>	
25.	Common Indian Krait	<i>Bungarus caeruleus</i>	
26.	Banded Krait	<i>Bungarus fasciatus</i>	
27.	King Cobra	<i>Ophiophagus hannah</i>	I
28.	Hook nosed Sea Snake	<i>Enhydrinaschistosa</i>	
29.	Estuarine Sea Snake	<i>Hydrophis obscurus</i>	
30.	Bamboo pit Viper	<i>Trimeresurusgramineus</i>	II
31.	Russell's Viper	<i>Viperarusselli.</i>	I
32.	Batagur Turtle	<i>Batagurbaska</i>	
33.	South Indian Roofed Turtle	<i>Kachuga tentoria.</i>	
34.	North Indian Roofed Turtle	<i>Kachuga tecta tecta</i>	
35.	Indian Flapshell Turtle	<i>Lissemys punctata punctata</i>	I
36.	Peacock Eye Turtle	<i>Trionyxhutum</i>	
37.	Indian or Ganges Soft-Shell Turtles	<i>Aspideratus gangeticus</i>	I
38.	Asian Giant soft shelled Turtle	<i>Pelochelysbibroni</i>	I
39.	The Leatherback Sea Turtle	<i>Demochelys coriacea</i>	I
40.	The Green Sea Turtle	<i>Chelonia mydas</i>	I
41.	The Hawksbill Sea Turtle	<i>Eretmochelys imbricate</i>	I
42.	The OliveRidleySea Turtle	<i>Lepidochelys olivacea</i>	I

VI. List of Different Species of Fish:

SL. No	Local name	English name	Scientific name
1.	Ilishi	Indian shad	<i>Hilsa ilisha.</i>
2.	Sahala	Mango fish	<i>Polynemus indicus</i>
3.	Khainga	Grey mullet	<i>Mugil cephalus</i>
4.	Khasuli/Mengi	Mullet	<i>Liza parsia</i>
5.	Bhekti	Sea bass	<i>Lates calcarifer</i>
6.	(a) Chauhi	Anchory or white bait	<i>Anchoviella indica</i>
	(b) Oliari	-do-	<i>Coiliadussumeri</i>
	(c) -do-	-do-	<i>Stolepherus indicus</i>
7.	Khanda balia	Silver bar	<i>Chirocentrusdovats</i>
8.	Chaanra	Milk bar	<i>Chanoschanos</i>
9.	Paniakhia	Indian tarpon	<i>Megalops oynnoid</i>
10.		Gizzard shad	<i>Anadontistonachakunda</i>
11.	Borei		



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	a) Borei	Croaker	<i>Preduosuanadiaconthus</i>
	b) -do-	-do-	<i>Ottolithusbruicus</i>
	c) -do-	-do-	<i>Johaeusdussumeri</i>
12.	Para	Leather skin	<i>Scomberomeruslyseni</i>
13.	Morua	Indian mackerel	<i>Rastreligerkhangurta</i>
14.	Khuranta	Long spine sea bream	<i>Arqiropsspinfor</i>
15.	Bagada	Black tiger	<i>Penaeus monodon</i>
16.	Kantala	White prawn	<i>Penaeus indicus</i>
17.	Marandi	Brown shrimp	<i>Melapenacumenecerus</i>
18.	Disco cookies	Oil sardine	<i>Sardinella longiceps</i>
19.	Cookies	Short sardine	<i>Sardinella albela</i>
20.	Kokoli	Anchovy	<i>Coliadussumieri.</i>

VII. List of Important Invertebrates:

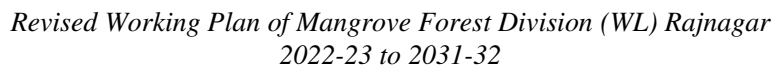
SL. No.	Phylum	Family	Scientific Name
1.	Protozoa		<i>Polystonella spp.</i>
2.			<i>Rotaliabeccarii</i>
3.	Coelenterata		<i>Lobophytum spp.</i>
4.			<i>Sclerophytum spp.</i>
5.			<i>Gyrostoma spp.</i>
6.	Annelida	Aphroditidae	<i>Polydontes spp.</i>
7.			<i>Polynoe spp.</i>
8.		Pisionidae	<i>Pisione spp.</i>
9.		Amphinomidae	<i>Pscudoerythoe spp.</i>
10.			<i>Eurythee spp.</i>
11.		Unicidae	<i>Morophyse spp.</i>
12.			<i>Lumbriconereis spp.</i>
13.		Syllidae	<i>Odontosylhia spp.</i>
14.		Nearidae	<i>Nerieschilkausia</i>
15.			<i>Pseudonereis spp.</i>
15.			<i>Perinereis spp.</i>
16.			<i>Lycastis indica</i>
17.			<i>Lycasticmeraukensia.</i>
18.			<i>Platyneries spp.</i>
19.		Hesionidae	<i>Leocratides spp.</i>
20.			<i>Podarke spp.</i>
21.		Glyseridae	<i>Glycera spp.</i>
22.			<i>Goniades spp.</i>
23.		Phyllodocida	<i>Phyllodoce spp.</i>
24.		Spionidae	<i>Prinospia spp.</i>
25.			<i>Scolelepis spp.</i>



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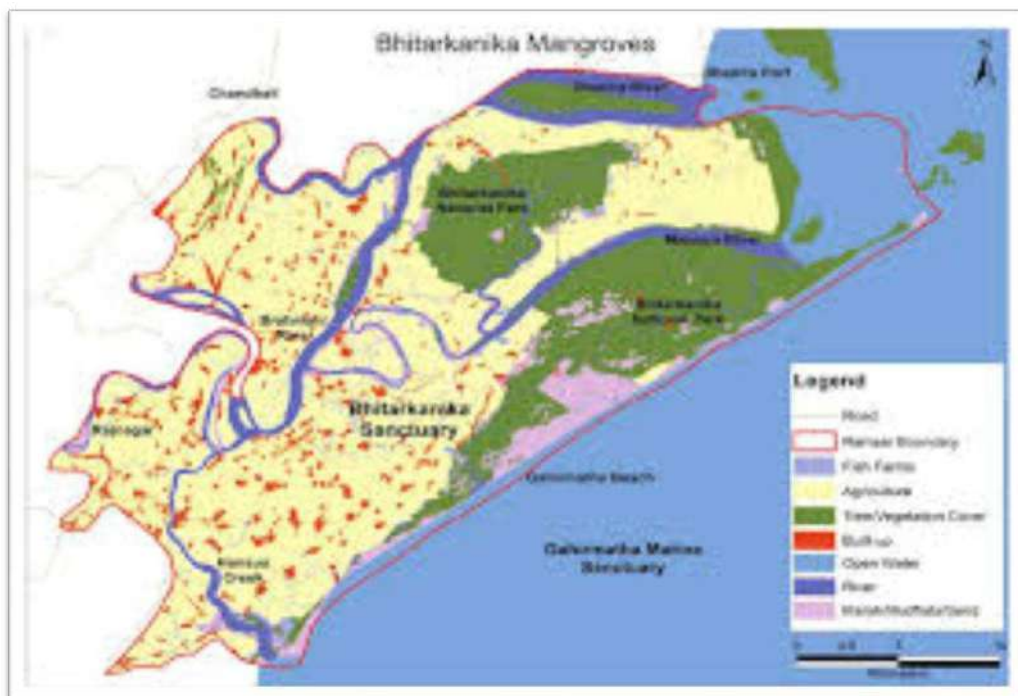
26.			<i>Nerine spp.</i>
27.			<i>Poludora spp.</i>
28.		Magilonidae	<i>Magilone spp.</i>
29.		Owenidae	<i>Myriochelepicta.</i>
30.		Maldanidae	<i>Axitholla spp.</i>
31.			<i>Clymene spp.</i>
32.		Chaetopteri	<i>Mesochaiploptria spp.</i>
33.		Terebellidae	<i>Thelepus spp.</i>
34.		Ophellidae	<i>Ammotrypane spp.</i>
35.		Capitellidae	<i>Capitelluthis spp.</i>
36.			<i>Capitella spp.</i>
37.			<i>Hetromastus spp.</i>
38.			<i>Notomastus spp.</i>
39.		Sabellidae	<i>Darychone spp.</i>
40.	Arthropoda		<i>Leptocheta spp.</i>
41.			<i>Tanaiss spp.</i>
42.			<i>Pseudotanaia spp.</i>
43.			<i>Cirolene spp.</i>
44.			<i>Exorphaevoma spp.</i>
45.			<i>Corophium spp.</i>
46.			<i>Ampelisea spp.</i>
47.			<i>Hyale spp.</i>
48.			<i>Elasmopus spp.</i>
49.			<i>Acetes spp.</i>
50.			<i>Emivita spp.</i>
51.			<i>Ocypodamacvour</i>
52.			<i>Ocypodaplatytarmis</i>
53.			<i>Ocypodaceratophthalmus.</i>
54.			<i>Scylla serrata.</i>
55.	Mollusca		<i>Umbonium spp.</i>
56.			<i>Epitonium spp.</i>
57.			<i>Hydrobis spp.</i>
58.			<i>Nasa orisensia.</i>
59.			<i>Tapes spp.</i>
60.			<i>Chandium spp.</i>
61.			<i>Dentallium spp.</i>





PART - I

SUMMARY OF FACTS ON WHICH PROPSALS ARE MADE





CHAPTER -01

The Tract Dealt With:

1.1 Name and Situation:

1.1.1 Introduction:

The tract dealt in this Plan broadly comprises Reserved Forests, Protected Forests, Demarcated Protected Forests & proposed reserved Forests of Mahakalapada and Kujanga Ranges of Mangrove Forest Division (Wildlife), Rajnagar which are not included in Sanctuary/ National Park of the Division. The entire area extends over Kendrapada and Jagatsinghpur Districts. Mangrove Forest Division (Wildlife), Rajnagar came into existence with effect from 3rd November, 1990 in pursuant to reorganization of Forest Department vide Notification No. BF (W) - 41/88 26118 / FFAH of Govt. of Orissa, erstwhile Forests, Fishery & Animal Husbandry Department consequent upon transfer of Kujanga Range from Athagarh Division to Wildlife Conservation Division, Chandbali. Prior to 1990 in 1980 Kanika Range of Athagarh Forests Division was carved out to constitute Wildlife Conservation Division with headquarter at Chandbali and thereafter in 1988 Kujanga Range was transferred from the jurisdiction of Athagarh Forest Division to Wildlife Conservation Division, Chandbali. The present jurisdiction of Mangrove Forest Division (Wildlife), Rajnagar is the partly geographical area of Kendrapara Revenue district and partly of Jagatsinghpur Revenue District after creation of Bhadrak WL Division in 2003. Thus the boundary of the Division covers two districts.

The Headquarters of Mangrove Forest Division (Wildlife), Rajnagar is located at Rajnagar with effect from 14.11.1990. The area of the Division lies between 19° 57' 46.44"N to 20° 31' 25.80"N Latitude and 84° 55' 42.8" E to 86° 48' 52.96"E Longitude. The total Geographical area of the Division is 2971.019 Sq. Km. and total forest area is 310.439 Sq. Km.

1.1.2 Boundaries:

The Division is bordered by Bhadrak WL Division in North and East, Cuttack Division and Puri WL Division in West and Bay of Bengal in the South.

1.1.3 Geographical Area & Demographic Details:

Total geographical of the Division is 2971.019 sq. km and total forest area is 310.439 sq. km.



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Table No. 1.1 Demographic Profile (Kujang / Mahakalapada WL Range)

Name of the WL Range	Area in sq. Km	CD Block / Tahasil Covered	Population as per 2011 Census	Important Town / NAC/ MC etc
Kujang	1075.79	Kujang / Tirtol/ Balikuda/ Erasama / Nuagaon	4,04,107	Paradeep MC / Kujanga / Tirtol
Mahakalapada	519.99	Mahakalapada/ Pattamundai (P)	1,65,970	Pattamundai NAC
S. Total	1595.78	6+1(P)	5,70,077	1 MC & 1 NAC

1.1.4 List of Buildings:

The list of Buildings of Mahakalapada WL Range and Kujang WL Range has been furnished at **Annexure-I**

1.1.5 List of Forest Rest Houses:

There is one FRH at Kujang under Kujang WL Range. The details are as follows (Table No 1.2)

Table No 1.2 List of FRH in Rajnagar WL Division (Kujang / Mahakalapada WL Range)

Range	FRH	Location	No of Suits available	Present Status
Kujang	FRH	Kujang	2	Needs maintenance / Class-I
Mahakalapada	Forest Shed	Batighar	2	Needs Maintenance

1.1.5 List of Forest Roads:

There are 4 Forest Roads in Kujanga Range. The list of Forest Roads / Present status is furnished at Table No 1.3

Table No 1.3 Forest Roads of Rajnagar WL Division

Sl No.	Name of WL Range / Block	Forest Block	Name of Forest Road	From	To	Total length in Km	Status
1	Kujanga WL Range / Erasama	Balitutha PRF	Banatia Basa - Balitutha	Banatia Basa	Balitutha Beat House	1.30	Motorable / Earthen
2		Baruhan PF	Baruhan River Ferighat – Patharbandha	Pathar bandha	Pathar bandha	1.50	Motorable / Earthen
3		Ramtara	Ramtara – Sea beach	Ramtara Beat	Sea Beach	1.00	Motorable / Earthen



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4		Jatadhar Tanda	Jatadhar Tanda	House Jatadhar Tanda River Ghat-	Jatadhar Tanda-II Beat House	0.55	Motorable / Earthen
Total – 4 Forest Road						4.35	

1.1.6 Administrative Structure:

In Mangrove Forest Division (Wildlife), there are 5 (Five Ranges), 15 sections and 46 Beats. The detail administrative structure is at **Annexure-II**

1.2 Configuration of the Ground

1.2.1 The area covered in this Plan has landscapes mostly of coastal plains and delta area. There are three major rivers flowing in the area, namely Mahanadi, Brahmani and Baitarani and they multiply into a number of distributaries in this region as they approach the delta. The deltaic plain has vast expanse of cultivated lands. Numerous creeks and canals breaking the continuity of the land mass characterize the physiography of the region. Mangrove vegetation existing in the coastal area of the Division are also included in the plan.

1.2.2 The topography of the Working Plan area is mostly plain.

1.3 Drainage and Water Supply:

The general drainage is from west to east. Major rivers Mahanadi, Brahmani and Baitarani along with their distributaries Kathjori, Birupa, Devi and Serua etc., flow in the Division. There are number of Nallahs inside the forest blocks. The Nallahs flowing in different blocks is detailed in the table 1.4 below.

Table: 1. 4Different Nallahs Passing Through Various Forest Blocks

Sl No.	Forest Block	Name of the Nallah	Drainage point of Nallah
1	Jamboo PF	Jamboo Nallah	Mahanadi
2	Sanatubi PRF	Tubi Nallah	Mahanadi
3	Badatubi PRF	Kharanasi Nallah	Mahanadi
4	Nipania PRF	Khola Nallah	Mahanadi
5	Barakoli khola PRF	Batigharagolia Nallah	Mahanadi
6	Hetamundia PRF	Khola Nallah	Mahanadi
7	Kansaridia PRF	Batigharagolia Nallah, Hukitolagolia Nallah	Mahanadi
8	Garbishnupur PF	Sankhu Nallah	Boitakolia Nallah
9	Kathiakholda PRF	Biribedi Nallah	Boitakolia Nallah



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10	Gopalpur PF	Biribedi Nallah	Boitakolia Nallah
11	Baruhan PF	Kathagodi Nallah, Baruhan Nallah, Boitakulia Nallah	Bay of Bengal
12	Salio PF	Baruhan Nallah, Boitakulia Nallah	Bay of Bengal
13	Akashdia PF	Akashdia Nallah	Bay of Bengal
14	Marichpur PF	Marichpur Nallah, Bandar Nallah	Devi River
15	Garaharishpur PF	Sankhu Nallah	Boitakolia Nallah
16	Bhuiarpal PF	Mahananga Nallah	Jatadhar River
17	Dhobei PF	Haladia Nallah	Jatadhar River
18	Muguria PF	Muguria Nallah, Nara Nallah	Jatadhar River
19	Ramtara PF	Muguria Nallah, Nara Nallah	Jatadhar River
20	Kantilo R.F.	Jagatajhor Nallah	Bay of Bengal Baruneimuhan
21	Suniti PRF	Jagatajhor Nallah	Brahmani River
22	Kandarapatia PRF	Kandarapatia Nallah	Bay of Bengal Baruneimuhan
23	Sasanpeta PRF	Jagatajhor Nallah, Kandarapatia Nallah	Bay of Bengal Baruneimuhan
24	Petchhela PRF	Ramachandigolia Nallah	Gobari River then Mahanadi
<i>Source: Field observation</i>			

1.4 Geology, Rock and Soil:

1.4.1 Three principal rivers flowing through this Division have developed fertile alluvial plains, which is the youngest formation and covers the major portion of the total land area. According to the report of Geological Survey of India, the type of rocks present in the forests is given in the following sequence in order of increasing antiquity.

(a) Recent: The Division has large deposits of alluvium along the major river systems of Mahanadi, Brahmani and Baitarani.

1.4.2 Mineral Resources:

The coastal sand of Kendrapara and Jagatsinghpur districts contain heavy mineral like Ilmenite, Zircon, Monazite, Garnet and Sillimanite.

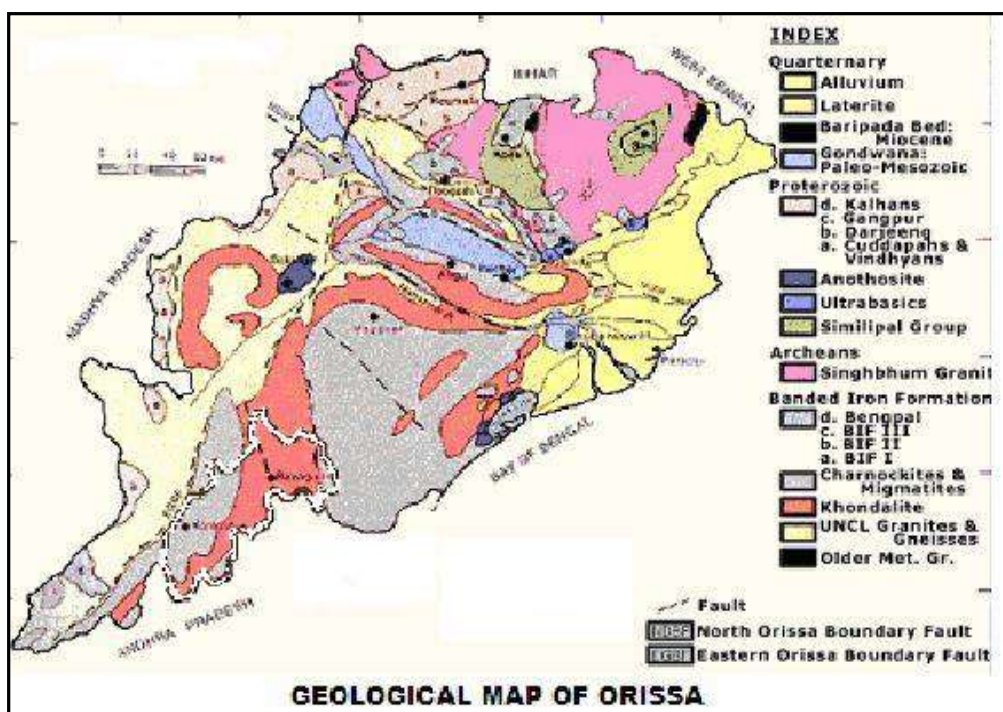
1.4.3 Soils: The different types of soils present are broadly classified as follows:

1.4.3.1 Alluvial Soil: These soils are derived from the deposition of silts brought by the rivers and numerous streams that traverse the forest. The soil shows marked



stratification of sand, clay and loam. Along the edge of delta streams and sheltered coasts, the soil remains permanently wet with saline inundation by tidal waves and support Mangrove vegetation.

1.4.3.2 Coastal sandy soil: Along the coast, stretches of sand and sand hills alternate with deltaic mud. The soil is characterized by quartzite or calcareous sands with low silt and clay fraction. The depth is variable and water table is characteristically high. The nutrient status is typically low. In this soil, extensive Casuarina plantations are raised in the Division.



Map: Geological Map of Odisha

1.4.3.3 The soil survey has not been carried out separately during the Working Plan revision. The survey conducted by the National Bureau of Soil Survey & Land Use Planning, Nagpur for the Soils of Orissa has been utilized in this Working Plan and their report is given in the Plan. The details of the description of the soil in different forest blocks are given in the Table 1.5 Below.

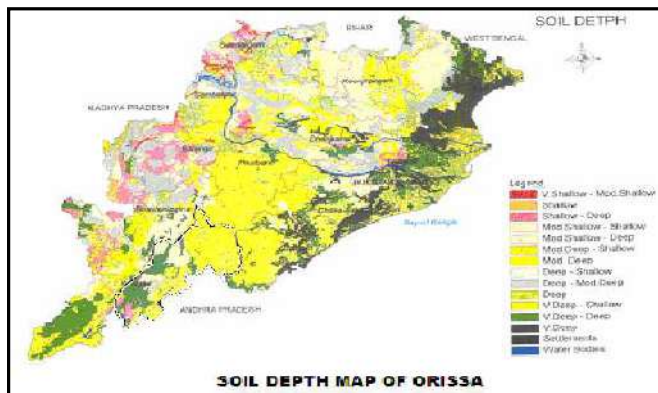


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Table 1.5 Distribution of Soil In Mangrove Forest division (WL), Rajnagar

Sl. No.	Soil Index Number	Name of Forest Block	Description of soil
22	156	Kantilo RF, Bagagahan PRF, Sasanpeta PRF, Petchhela PRF, Kaunsiapal PF	Deep, moderately well drained, fine loamy soils on very gently sloping recent deltaic plain with loamy surfaces slight erosion slight flooding and slight salinity, associated with deep, imperfectly drained fine soils with loamy surfaces, slight erosion and moderate flooding.
23	154	Jogidhankund PRF, Saralikuda PRF, Nipania PRF, Sanatubi PRF, Badatubi PRF, Batighar PRF, Barakolikholia PRF, Majhidia PF, Bhuijanpal PF, Madhuban 'A' PF Madhuban 'B' PF, Noliasahi PF, Nuagaon Dhinkia PF	Deep, excessively drained, sandy soils on very gently sloping sand dunes with sandy surface, moderate erosion and strong salinity.
24	151	Jatadhar RF, Kathia Kholda PRF, Brahmandia PRF, Musadia PF Jatadharta PRF, Barkud PF, Kankan PF, Dhobei PF, Ramtara PF, Muguria PF, Goda PF, Garaharishpur PF, Garbishnupur PF, Gopalpur PF, Salio PF, Sahadabedi PF, Padmapur PF, Baruhan PF, Marichpur PF, Tentulibelari PF,	Deep, Moderately well drained, fine loamy soils on nearly level lower delta with clayey surface slight erosion and moderate flooding associated with very deep, poorly drained, fine loamy soils with loamy surface, slight erosion, moderate flooding and strong salinity (limited extent.)
25	155	Kansaridia PRF, Hetamundia PRF, Jamboo PF, Akashdia PF	Deep, poorly drained, fine soils on very gently sloping swamps with loamy surface, slight erosion, very severe flooding and strong salinity associated with. Deep very poorly drained final loamy soils with loamy surface, slight erosion and moderate flooding.
26	150	Suniti PRF, Kandarapatia PRF, Balitutha PRF	Deep, well drained coarse- loamy soils on very gently sloping lower delta with sandy surface, moderate erosion and moderate flooding associated with very deep, poorly drained, very fine cracking soils with clayey surface, slight erosion and moderate salinity (limited extent).

Source: National Bureau of Soil Science and Land Use Planning



1.5 Climate:

1.5.1 The area has a tropical climate with very warm humid summer and mild winter. There are three distinct seasons, hot summer from March to June, rainy season from July to October and winter from November to February. Winter is not severe. Maximum rainfall is received from south-west monsoon and some rains are also received from north-east monsoon in the cold months. The coastal tracts remain humid for most part of the year in view of proximity to the sea.

1.5.2 Rainfall:

The rainfall in the tract is received mainly from monsoon and the cyclonic depressions in the Bay of Bengal. Pre-monsoon showers with thunder storms are experienced in April and May. The rainfall pattern in two districts i.e., Jagatsinghpur, and Kendrapara is elaborated below. The normal rainfall is around 1500 mm. In Jagatsinghpur district, the variation from the normal rainfall is very high, in some years, the total annual rainfall is less than 1000 mm like in the year 1996 and 2000 and in some years more than 1800 mm rainfall is received. The area normally receives 75% to 87% rainfall by south-west monsoon between second week of June and last week of September. The rainfall is evenly distributed across the division. It is observed that this division receives most rainfall during the month of June, July and August and gradually decreases towards end of the September. The details of the rainfall in this district are shown in the **Table No.1.6** and the **Graph – I & II**. In Kendrapara district, the variations are still higher.

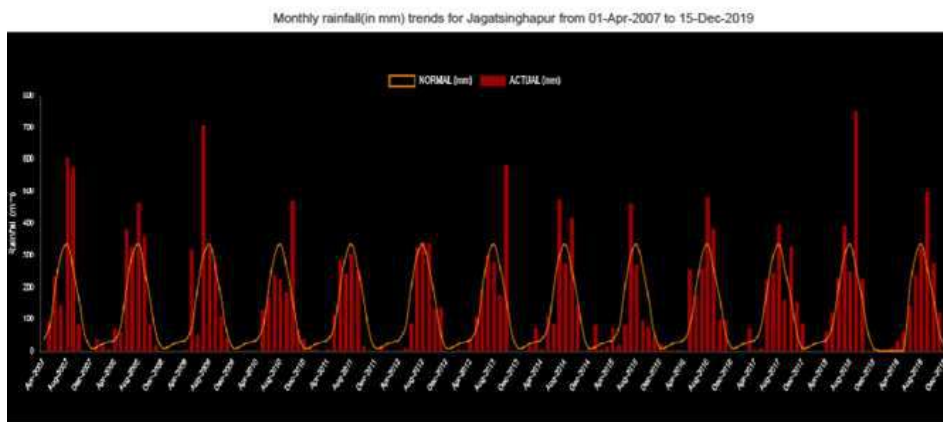


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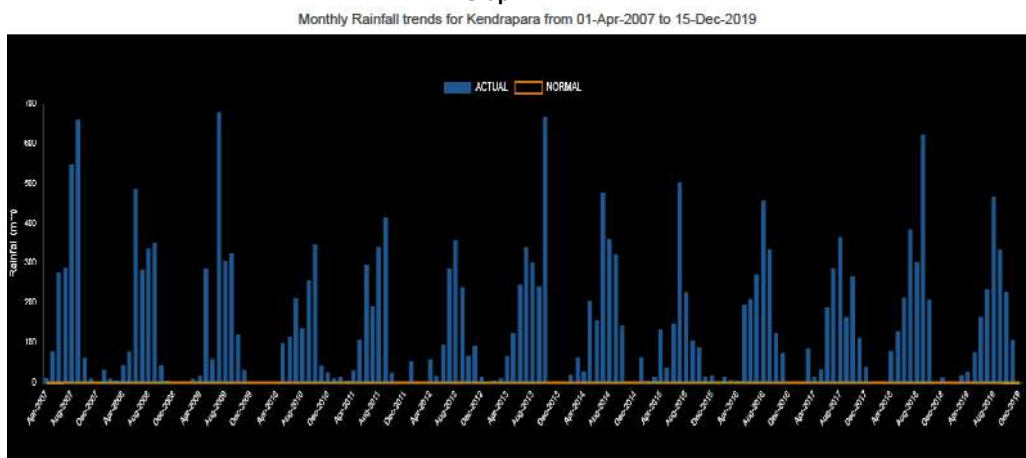
Table No. 1.6Year / Month Wise Rainfall Report (In mm) Of Kendrapara District.													
Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2007	0	61.89	25.22	2.56	97.08	190.22	206.17	438.56	498	110.11	8.33	0	1638.14
2008	35.33	14.22	5	78.89	83.61	431	176.03	252.89	509.11	75	0	0	1661.08
2009	8.89	0	0	1.44	172.89	39.56	589	175.67	362.33	170.78	34.67	0	1555.23
2010	0	0	4	0	92.33	96.5	225.39	182.11	201.44	380	34.56	33.89	1250.22
2011	0	1.89	20.89	34.33	114.22	421.39	228.56	293.78	380.78	13.67	0	0	1509.51
2012	33.56	0	0	13.89	38.78	90.22	309.28	224.89	171.11	65.56	164.67	6.94	1118.9
2013	0	0	3.33	77.89	100.56	229.94	273.22	217.78	163.89	647	0	0	1713.61
2014	0	24.11	68.67	0	189.89	121	396.33	328.44	295.33	136.11	0	1.44	1561.32
2015	51.56	3.56	14.56	78.44	26	121	431.33	247.89	123.33	87.67	19.22	0.33	1204.89
2016	2.44	17	6.44	4	184.22	192.67	216.49	510.47	276.09	149.68	83.18	0	1642.68
2017	0.67	0	81.47	2.67	30.53	142.83	343.24	330.92	148.02	228.89	146.16	48.93	1504.33
2018	0	0	0	18.42	100.89	251.89	383.84	270.07	653.04	204.89	0	2.78	1885.82



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Graph I

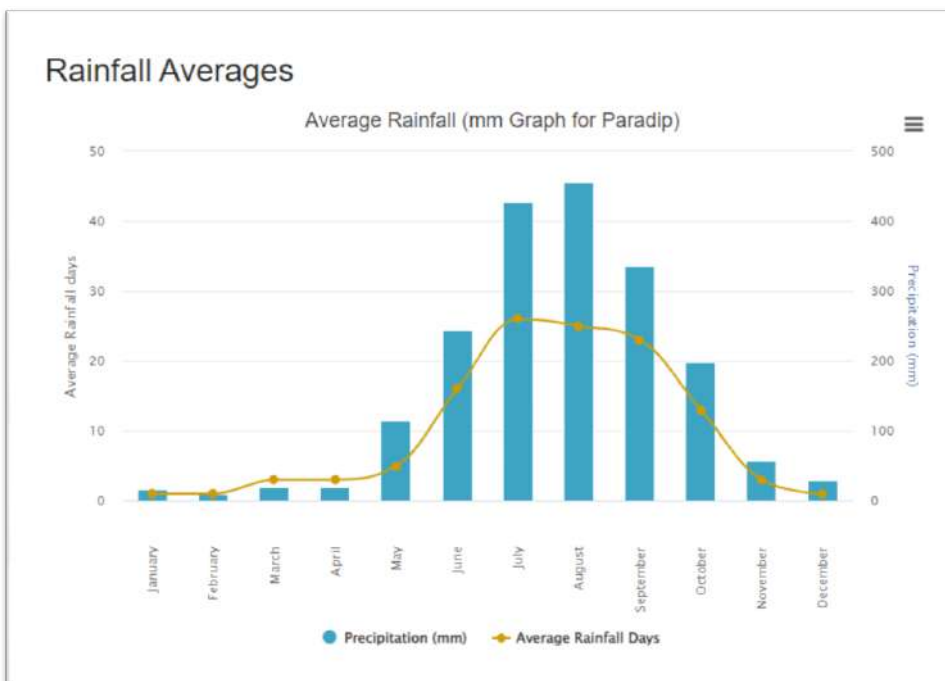


Graph II

The rainfall data has been furnished at Para 1.5.2 of the draft plan. The average Rainfall of the tract is about 1500mm. As Paradeep is the representative area of the tract, the average Rainfall of the area and other climatic parameters are depicted below.



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These are the historical data that for this weather station. The complete information of the annual average values including the ephemeris of the maximum and minimum values recorded and furnished below (Table No 1.7)

Table No 1.7: Climatic Parameters (Average) at Paradeep – Rajnagar WL Division											
Year	T	TM	Tm	PP	V	RA	SN	TS	FG	TN	GR
2015	-	-	-	-	-	-	-	-	-	-	-
2016	28.4	30.8	24.3	1816.6	7.4	66	0	30	14	0	0
2017	28.3	30.7	24	-	9.1	77	0	39	17	0	0
2018	-	-	-	-	-	-	-	-	-	-	-
2019	28.1	30.3	23.7	-	8.4	55	0	19	20	0	0
2020	27.5	30.1	23.7	1941.84	6.6	86	0	40	21	0	0
2021	27.6	30.4	24.1	2361.42	5.7	79	0	32	14	0	0
2022	27.5	31.1	23.8	1606.76	6.1	69	0	24	17	0	0
2023	28	32	24.2	1070.36	5.1	74	0	32	11	0	0

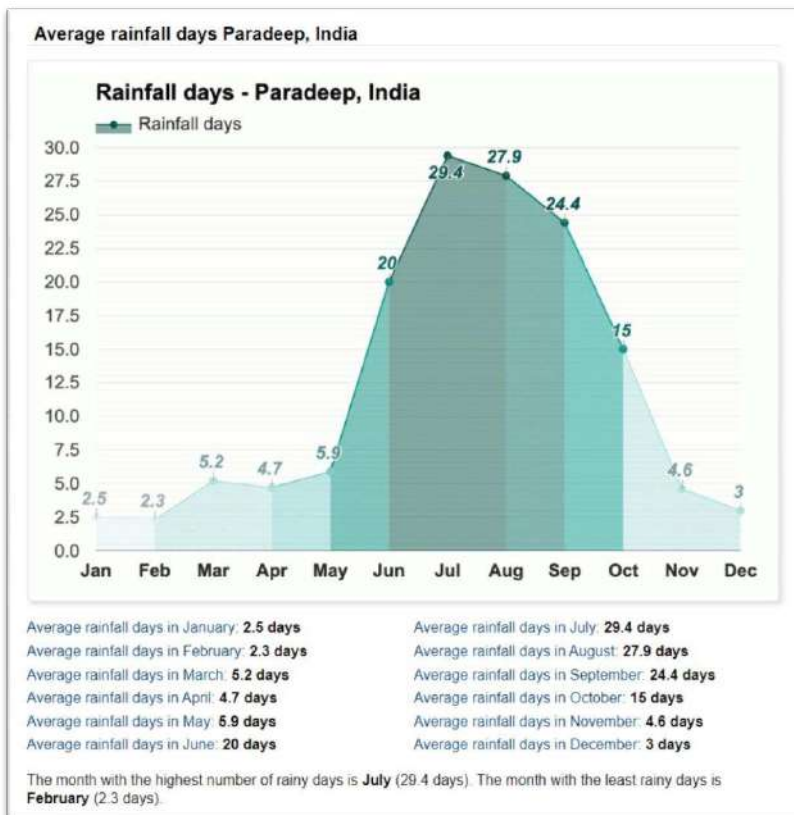


If the table appears fields without values with the symbol (-) this only indicates that has not been performed average, this happens if there is no sufficient data to compute.

The total rainfall value 0 (zero) may indicate that there has made such measurement and / or the weather station does not broadcast.

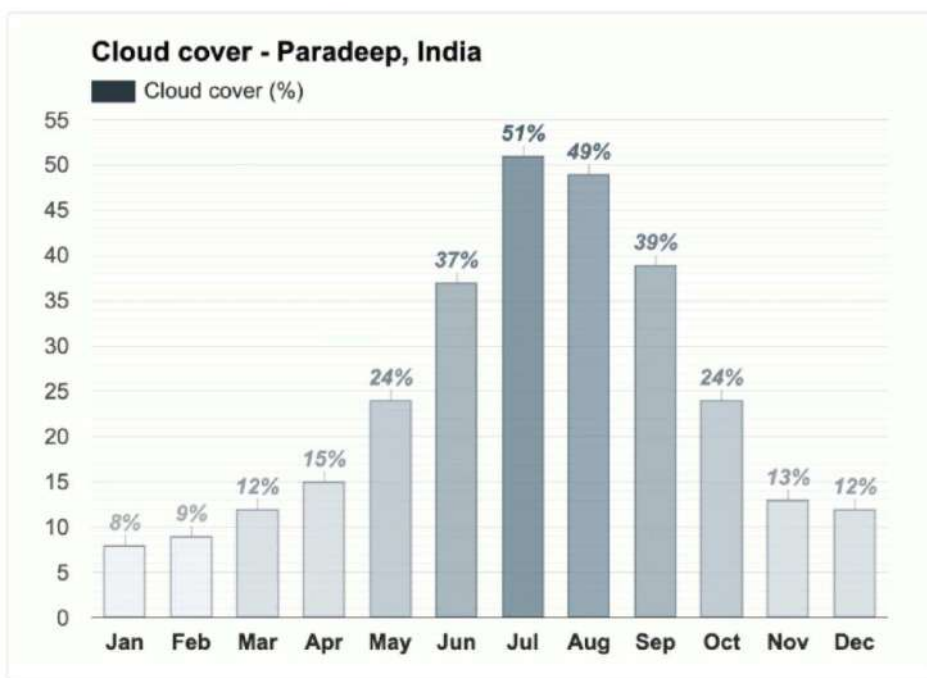
1.8 Interpretation annual average climate values

T	Average annual temperature	SN	Number of days with snow
TM	Annual average maximum temperature	TS	Number of days with storm
Tm	Average annual minimum temperature	FG	Number of foggy days
PP	Rain or snow precipitation total annual	TN	Number of days with tornado
V	Annual average wind speed	GR	Number of days with hail
RA	Number of days with rain		





Average cloud cover Paradeep, India

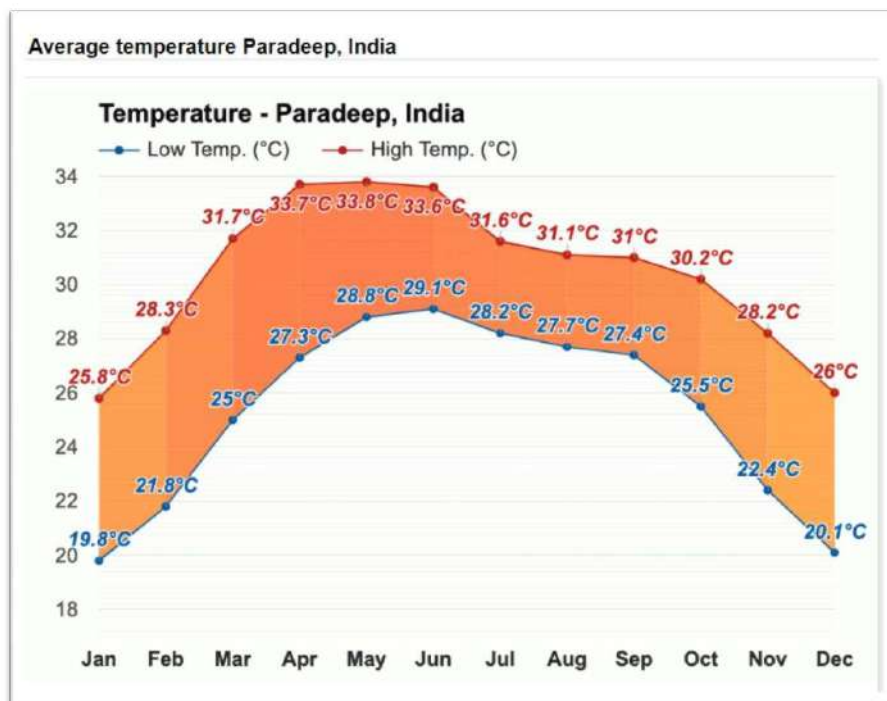


Average cloud cover in January: **8**
Average cloud cover in February: **9**
Average cloud cover in March: **12**
Average cloud cover in April: **15**
Average cloud cover in May: **24**
Average cloud cover in June: **37**

Average cloud cover in July: **51**
Average cloud cover in August: **49**
Average cloud cover in September: **39**
Average cloud cover in October: **24**
Average cloud cover in November: **13**
Average cloud cover in December: **12**

1.5.3 Temperature:

It is observed that over a period of time, the maximum temperature is rising. There are remarkable temperature changes in Paradeep centre over the last twenty years. The maximum temperature in the month June has raised from 34° C in 1987 up to 46°C in recent years. This is a very disturbing trend & needs the attention of the planners. In these coastal districts, the humidity is also high in summer months. The high



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uncomfortable in these districts.

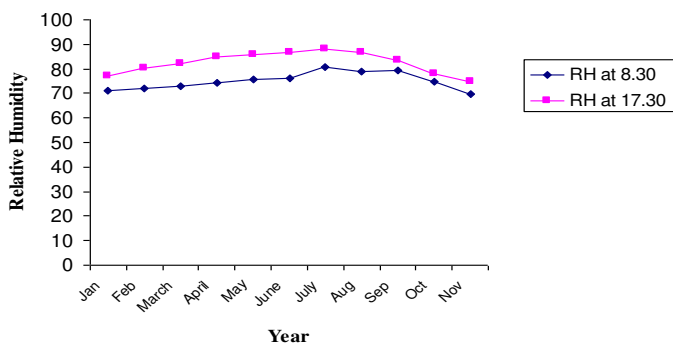
1.5.4 Relative Humidity (RH):

It is generally high throughout the year. Humidity is very high in the months of June, July and August. The lowest humidity is recorded in November and December at Paradeep. The summer months are quite uncomfortable, with higher temperature combined with high humidity. The diurnal variation of humidity in different months at 8.30 am and 5.30 P.M at Paradeep is given in the **Graph – III**. The Relative Humidity is comparatively higher at the Paradeep centre, the obvious reason is the nearness to the coast.

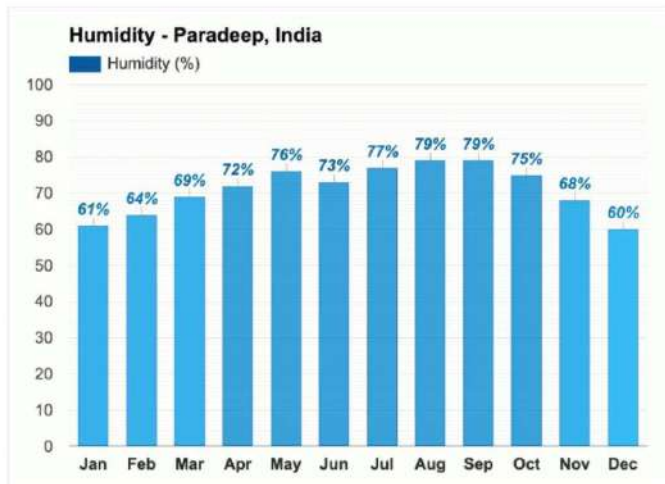


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Graph- XI RELATIVE HUMIDITY AT PARADEEP CENTRE



Average humidity Paradeep, India



Average humidity in January: 61%

Average humidity in February: 64%

Average humidity in March: 69%

Average humidity in April: 72%

Average humidity in May: 76%

Average humidity in June: 73%

Average humidity in July: 77%

Average humidity in August: 79%

Average humidity in September: 79%

Average humidity in October: 75%

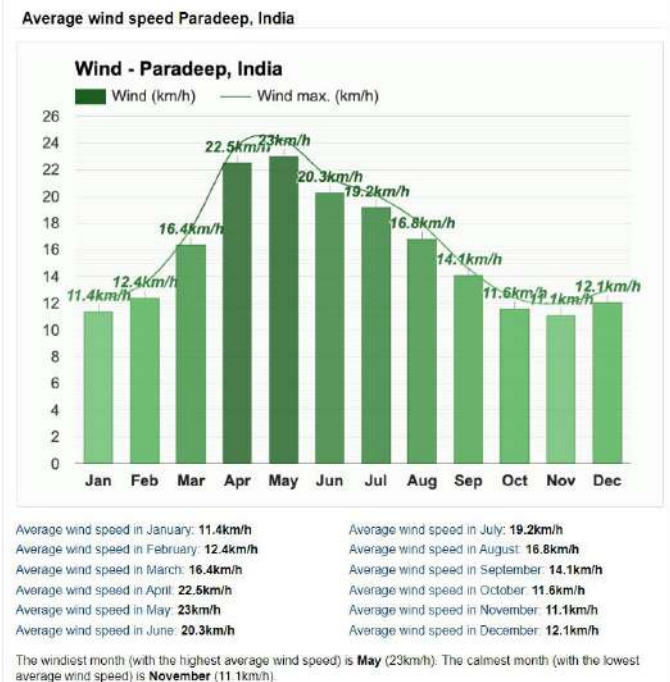
Average humidity in November: 68%

Average humidity in December: 60%

The months with the highest relative humidity are **August** and **September** (79%). The month with the lowest relative humidity is **December** (60%).



1.5.6 Wind Speed at Paradeep:



1.5.7 History: Cyclones of Odisha that affected the State / Division:

The sea coasts of Odisha experiences oceanic Cyclone originating in Bay of Bengal. Important cyclones that affected the State / Division during last 2 decades are furnished below. (Table No 1.9)

Table No 1.9 History of Climatic factors (Cyclone) in Odisha Coast		
Sl No	Name & Date	Impact
1	1999 Supper Cyclone , 29.10.1999	Most devastating Cyclone; 10000 people died, affected Coastal districts of Odisha i.e. Balashore, Bhadrak, Kendrapara, Jagatsinghpur, Puri, Khordha and Ganjam
2	Cyclone Phailin , 3-4 October, 2013	Around 14514 villages in 12 coastal districts of Odisha affected. Most affected district were Ganjam, Puri and Khordha
3	Cyclone Hudhud/	Landfall in east coast of Vishakhapatnum. Much



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	12.10.2014	Structural damage, Forests of Ganjam District severely affected. 24800 people in 320 villages affected.
4	Cyclone Titli/ 2 nd week of October, 2018	Landfall in South West coast of Gopalpur near Palasa in Andhrapradesh. Eight Districts of Idisha i.e. Ganjam, Gajpati, Khordha, Puri, Jagatsinghpur, Kendrapara, Bhadrak and Balashore were affected. Unexpectedly changed its course and triggered heavy rainfall in Ganjam, Gajapati and Puri District. Flooding and Land Slide occurred.
5	Cyclone Phani/ 03.05.2019	Phani hit Odisha Coast at Puri. Weed Speed around 175kmph. Damage due to Pani is estimated to be 11942 crores. Killed 64 People and affected 140000 ha of crop area.
6	Cyclone Bulbul / 09.11.20219	2 nd Cyclone in 2019. Landfall near Sagar Island in West Bengal. Extensive damage to Agriculture in Odisha.
7	Cyclone Amphan 19-20 May, 2020	Barreled along the Odisha Coast before making Landfall near Sundarban in West Bengal. Strongest Cyclone ever after Super Cyclone. It affected 44.45 lakh people in 9833 villages and 22 Urban Bodies.
8	Cyclone Yaas/ 26.05.2021	Landfall at Dhamra and South of Haldia in West Bengal. About 60 lakh people in 11000 villages were affected. Loss estimated to a tune of 610.00 Crores.
9	Cyclone Gulab / 26.09.2021	Landfall in between Kalingapatnam and Gopalpur. Costal belt of South Odisha and North Andhra Pardesh.
10	Cyclone Jawad/ 5 th December, 2021	Coastal district received heavy rainfall- no remarkable damage. Reached Puri and taken a re- curve in North, North East Direction.

1.6 Water Resources:

In the coastal tracts the water table is generally high and water availability is not a problem barring few areas. The details of the ground water levels are recorded in different places in each district. There are about 28 places in Jagatsinghpur and 17 places in Kendrapara district where the ground water level is monitored. The water level is higher in Kendrapara and Jagatsinghpur districts and the probable reason may be nearness to the coast. The water level recorded at different places is given in the **Table 1.10& 1.11**. The forest blocks within Mangrove Forests Division (WL), Rajnagar included in Working Plans are basically islands and land areas which can be designated as



wetlands. Water level varies widely from places to places in this division. In coastal sandbar freshwater is available in shallow wells and ultra deep bore wells where as presence of saline water is seen in between these extremes. Water level in the wells in the vicinity (up to 5km) of forest area shall be studied and documented for periodic monitoring of water level with respect to annual rainfall for assessment of the status of ground water. A number of water bodies have been created in the forest areas of this division during the last plan period. During the current plan period 07 Water bodies are excavated at Baradia, Hetamundia, Kansaridiha, Jamboo and Ramatara for multipurpose utility.

Table: 1.10 Depth of Ground Water (In Mts.) In Jagatsinghpur District

Sl. No.	Location	Near the Forest Block	Jan.	April	Aug.	Nov.
1	Balikuda	Goda PF, Garhbishnupur RF	1.42	1.97	0.74	0.68
2	Balikuda	Goda PF, Garhbishnupur RF	3.33	4.56	1.56	2.86
3	Balituth	Balitutha PF, Madhuban A& B PF	2.12	2.55	1.29	1.66
4	Borikina	Goda PF, Brahmandia PRF	1.9	2.58	0.83	0.91
5	Ersama	Gopalpur PF, Dhobei PF, Garhbishnupur PF	1.27	2.34	0.44	0.58
6	Gobindpur	Dhinkia-Nuagaon PF	2.08	1.78	0.56	0.65
7	Gopinathpur		1.34	3.1	0.22	0.43
8	Jagannathpur	Brahmandia PRF, Tentulibelari PF	2.39	3.52	1.55	1.66
9	Jagatsinghpur	Dhaltangarh PRF	2.57	2.89	0.64	0.74
10	Jagatsinghpur	Dhaltangarh PRF	5.87	6.2	3.7	4.65
11	Jaipur	Gopalpur PF, Garhbishnupur PF	1.13	1.27	0.72	0.75
12	Kanakpur	Kilipal PRF	1.45	1.74	0.72	0.74
13	Khandatari-I	Dhaltangarh PRF	3.73	4.22	3.6	3.61
14	Khandatari-II	Dhaltangarh PRF	2.25	3.53	0.79	2.09
15	Kujang	Balitutha PF, Kankan PF	2.44	2.85	1.15	1.2
16	Kujang	Balitutha PF, Kankan PF	1.1	1.51	0.15	0.75
17	Kumartota chak		2.06	2.36	1.25	1.19
18	Machgaon	Marichpur PF, Brahmandia PRF	2.85	3.68	1.18	1.66
19	Manijanga	Kilipal PRF	1.68	2.21	0.68	1
20	Nuagaon	Madhuban A & B, Bhuijanpal PRF, Noliasahi PF	2.37	3.54	0.77	1.2
21	Paradeep	Majhidia PF, Boitarkud PF, Saralikuda PRF	3.26	3.55	2.86	3
22	Paradeepgarh	Majhidia PF, Boitarkud PF, Saralikuda PRF	1.08	0.51	0.36	0.1
23	Paradeepgarh	Majhidia PF, Boitarkud PF, Saralikuda PRF	1.23	1.74	0.8	1.12



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24	Raghunathpur	Dhaltangarh PRF	3.93	4.89	2.45	3.23
25	Tirtol	Kilipal PRF	2.01	2.29	1.45	1.46
26	Tirtol-I	Kilipal PRF	2.65	3.67	2.14	2.51
27	Tirtol-II	Kilipal PRF	2.86	3.85	2.36	2.35
28	Tirtol-III	Kilipal PRF	2.91	3.99	2.26	2.34

Source: Director, Central Ground Water Board

Table: 1.11 Depth of Ground Water (In Mts.) In Kendrapara District

Sl No.	Location	Near the Forest Block	Jan.	April	Aug.	Nov.
1	Aul (Ali)		3.2	4.7	1.7	2.2
2	Banpur		2.7	1.73	0.6	1.6
3	Chadeidhaara		3.7	6.23	0.8	1.8
4	Chatua		1.6	2.16	0.5	0.7
5	Gogua		2.5	3.21	1.6	1.9
6	Indupur		3.9	4.6	1.8	3
7	Indupur		1.9	2.43	1.8	2.2
8	Kendrapara	Kandarapatia PRF, Kantilo RF	1.8	0.7	1.8	0.2
9	Kendrapara	Kandarapatia PRF, Kantilo RF	5.1	6.05	3.9	4.2
10	Mahakalpara	Kaunsiapal PF, Jamboo PF, Bagagahan PF	1.7	2.31	0.9	0.9
11	Marshaghai	Petchhela PRF, Sanatubi & Badatubi PRF	1.8	2.27	0.6	0.7
12	Nikrai		3	3.61	1.9	2.3
13	Patkura	Petchhela PRF, Sanatubi & Badatubi PRF	3.7	4.35	1.6	2.4
14	Pattamundai	Kantilo RF, Sasanpeta PRF, Suniti PRF	1.2	1.18	0.7	0.8
15	Pattamundai	Kantilo RF, Sasanpeta PRF, Suniti PRF	3.5	3.9	2.6	3.1
16	Rajgarh		2.2	3.04	1.1	1.4
17	Rajnagar-R	Kantilo RF, Sasanpeta PRF	2.3	2.93	1.8	1.5

Source: Director, Central Ground Water Board





CHAPTER – 2

Maintenance/ Increase in the Extent of Forest and Tree Cover:

2.1. Area of Forests under Different Legal Classes:

This Division is having 45 Forest blocks over an area of 16333.71Ha which were included in the last working plan, which comprise 2RFs, 18 PRFs and 25 PFs. The proposed forest area to be added or deleted from the forest areas of previous working plan for preparation of new Working Plans is furnished below (Table No 2.1, 2.2 & 2.3).

Table No 2.1: Proposed Forest Area to be included/deleted From the Outgoing Working Plan

Prescriptions:					
Sl. No.	Name of the Range	Name of the forests block	Area to be added (In Ha.)	Area to be deleted (In Ha.)	Remarks
1.	Kujang	Jatadhar RF	0	68.980	Area has been diverted for POSCO India Pvt. Ltd
2.		Nuagaon-Dhinkia PF	0	1106.877	
3		Noliasahi PF	0	18.56	
4.		Padmapur PF	13.355	0	Added from revenue land for compensatory afforestation in lieu of diverted land for POSCO India Pvt. Ltd.
5	Mahakalpada	Kantilo RF	0	139.28	Included in Bhitarkanika Wildlife Sanctuary after rationalization of sanctuary boundary vide Notification No. 2289 Dated 01.02.2020 of F&E Department, Odisha.
6		Sanatubi PRF	0	594.68	
7		Kansaridiha PRF	0	1411.52	
8		Hetamundia PRF	0	1168.86	
9		Suniti PRF	0	238.49	
10		Sasanpeta PRF	0	1515.18	
11		Kandrapatia PRF	0	106.98	
12		Jamboo PF	0	369.90	
		Total	13.355	6739.307	

Table 2.2: New Forest Blocks to be included in the Working Plan for First Time

Sl. No.	Name of the Range	Name of the Forest Block	Area in Ha.
1	Kujang	Kathagadi PF	46.43
2	Kujang	Nadiakhia	128.96
3	Kujang	Musadia	15.80
4	Kujang	Jatadhartanda B	13.35
5	Kujang	Harishpurgada	46.40
TOTAL			250.94



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Table 2.3: The Forest Area to be covered in the Revised Working Plan

RESERVED FOREST (RF)						
Sl. No	Name of the Range	Forest Block	Comp t.	Area in Ha.	Notification No. & Date	
1	Kujang	Jatadhar RF	01	55.28	S.R.O 29/77 dtd. 05.01.1977	
PROPOSED RESERVED FOREST (PRF)						
1	Kujang	Balitutha PRF	01	84.90	No. 50144 dtd. 11.08.1980	
		Kathiakholda PRF	01	44.27	No. 27003 dtd. 11.4.1980	
		Brahmandia PRF	01	81.77	No. 46715 dtd. 23.06.79	
		Jatadhartanda PRF	01	596.52	No.FS-23/2006 dt.23-10.06	
2	Mahakalapada	Jogidhankud PRF	01	392.14	S.R.O No. 531/70 dtd. 27.06.1970	
		Saralikuda PRF	01	263.33	S.R.O. No. 519/70 dtd. 27.6.1970	
		Nipania PRF	01	77.98	S.R.O. No. 515/70 dtd. 27.6.1970	
		Badatubi PRF	01	28.83	No. 34642 dtd. 27.6.1970	
		Barakalikhola PRF	01	12.00	S.R.O No.517/70 dtd. 27.06.1970	
		Batighar PRF	01	166.20	No.39003/R dtd. 27.7.68	
		Bagagahana PRF	01	12.41	SRO No. 320/70 dtd. 6.6.1970	
		Petchhala PRF	01	259.73	SRO No. 476/70 dtd. 5.06.1970	



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		Baruhan PF	01	254.73	33237/D dt. 04.10.61
		Marichpur PF	01	3379.20	33237/D dt.04.10.61
		Tentilibelari PF	01	126.78	33237/D dt.04.10.61
		Akashdia PF	01	249.29	33237/D dt.04.10.61
		Boitarakud PF	01	227.33	33237/D dt.04.10.61
		Kathagadi PF	01	46.43	33237/D dt.04.10.61
		Nadiakhia PF	01	128.96	
		Musadia PF	01	15.80	
		Jatadharta B PF	01	13.35	
		Harishpurgada PF	01	46.40	
2	Mahakalapada	Kaunsiapal PF	01	97.10	33237/D dt.04.10.61
		Total	28	8070.048	
		Total RF	01	55.28	
		Total PRF	12	2020.08	
		Total PF	28	8101.489	
		G. Total	41	10145.408	

Notification of Forest Blocks i.e. Kantilo Reserved Forests, Saralikund PRF, Sana tubi PRF, Bada tubi PRF, Hetamundia PRF, Sasanpeta PRF, Suniti PRF, Jatadhar RF, Balituth PRF enclosed as Annexure-III

2.1.1 DLC report

The total DLC Area in Kendrapada District portion of the Division is 33556.29 Ac (1439.21) hectares where as in Jagatsinghpur District portion of the Division the DLC Area comes to 11576.92 Ac (4865.11 hectares). The detail list of DLC areas of the Division is enclosed as **Part-III**.

2.1.2 Forest area given under Forest Rights Act, 2006

During last plan period forest land allotted under FRA is detailed in Table 2.4 below.

Table: 2.4 Forest land given under FRA		
Name of the District	No of Claim Petition approved by DLC	Total area involved in hectare
Jagatsinghpur	047	012.89
Kendrapada	305	178.90
Total	352	191.79



2.1.3 Area diverted under Forest Conservation act, 1980

Forest land diverted under FC Act during last plan period has been detailed in Table 2.5 below.

Table 2.5. Forest land diverted under Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980. (Rajnagar WL Division)

Sl.No	Name of the Project	Forest Area Diverted in Ha.
1	EIRP (Final)	36.5
2	Paradip-Haladia Crude Oil Pipeline by IOCL (Final)	0.6940
3	Establishment of Integrated Steel Plant and Captive Port by POSCO India Pvt. Ltd. (Final)	1253.225
4	Dredging & Reclamation work(Phase-II) by IOCL(Final)	0.561
5	Establishment of DAP Fertilizer by IFFCO	24.65
6	Construction of Surge Protection Embankment by Paradip Port. (Stage-I)	11.79
7	Paradip-New Sambalpur-Ranchi-Raipur Pipeline by IOCL (Final)	1.1393
8	Laying of 3 nos. 48" Petroleum Oil Pipeline by IOCL. (Final)	1.1535
9	Construction of two nos. additional berths for handling of Iron Ore and Coal on BOT basis by Paradip Port. (Final)	87.028
10	Rediversion for Laying of Storm Water outfall pipelines to Sea by IOCL.	1.1535 (The land already diverted in Laying of 3 nos. 48" Petroleum Oil Pipeline by IOCL)
11	Development of Southern Dock Complex inside Paradip Port Trust (Final)	25.74
12	Diversion of 5.928 Ha of Revenue Forest land for laying of 01 no. of crude oil, 08nos. of product and 03 nos. of utilities pipeline from Paradip Port to Refinery of IOCL. (Final)	5.928
13	Paradip- Haladia Crude Oil Pipeline by IOCL (Final)	2.0499
14	Construction of Marine Police Station at Jamboo (Final)	0.385
15	Paradip- Haladia-Durgapur LPG Pipeline by IOCL (Stage-I)	0.5672
16	Haridaspur- Paradip New B.G Rail Link Project (Stage-I)	0.10



Table No.2.6 Details of Forest Diversion Proposal and Compensatory Afforestation done/land identification for Compensatory Afforestation

Sl.No	Name of the Project	Category of Forests	Area in Ha.	Compensatory Afforestation done /land identification for Compensatory Afforestation	Remarks
1	Eastern India Refinery Project (EIRP) by Indian Oil Corporation Ltd.	Revenue Forest	36.5	Compensatory Afforestation over 183 Ha done in Baruhan and Kaudia PF of Kujang Wildlife Range	In Notified Forest land
2	Paradeep-Haladia Crude Oil pipeline by IOCL	Revenue Forest	2.7439	Compensatory Afforestation done over by 12 Ha in Sasanpeta PRF in Gahirmatha (Wildlife) Range	In Notified Forest land
3	Establishment of Integrated Steel Plant and Captive Port by POSCO India Pvt.Ltd.	R.F-68.980 Ha PF- 1134.557 Ha Revenue Forest – 49.688 Ha	1253.2	150Ha identified in Nadiakhia of BalikudaTahasil and Harishpurgarh in Kujang Tahasil of Kujang (Wildlife) Range in Jagatsinghpur district. Plantation over 56.94 Ha done at Nadiakhia	PF Declaration not completed. Balance Land in Cuttack Division
4	Dredging & Reclamation Work (Phase-II) by IOCL	Revenue Forest	0.561	PCA in Jatadhartanda PRF = 0.561 Ha	In Notified Forest land
5	Establishment of Marine Police Station at Jamboo	Revenue Forest	0.385	Area less than 1 ha	
6	Establishment of DAP Fertilizer by IFFCO	Revenue Forest	24.65	24.65 Ha of NFL in Mankadakhia and Nadiakhia mouza of BalikudaTahasil in Kujang (Wildlife) Range	Diversion Proposal not made through
7	Construction of Surge Protection Embankment by Paradeep Port	Revenue Forest	11.79	12Ha of NFL identified in Padampurvillage of	PF Declared



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				ErasamaTahasil.	
8	Paradeep –New Sambalpur – Ranchi-Raipur Pipeline by IOCL	Revenue Forest	1.1393	142 ha in Bhuban RF in Dhenkanal Division	In Notified Forest land
9	Laying of 3 nos 48” Petroleum oil Pipeline by IOCL	Revenue Forest	1.1535	1.16 Ha of Land identified in Jatadharta PRF in Kujang Wildlife Range	In Notified Forest land
10	Construction of two nos additional berths for handling of Iron Ore and Coal on BoT basis by Paradeep Port Trust	Revenue Forest	87.028	174.056Ha of degraded forest Land identified in Kansaridaia PRF in Mahakalpada Wildlife Range	In Notified Forest land
12	Rediversion for Laying of Storm Water outfall pipeline to sea by IOCL	Revenue Forest	1.1535	Not Applicable	Re-diversion Proposal
13	Laying of 01 no. of Crude Oil, 08nos. of Product and 03 nos. of utilities pipeline from paradeep Port to Refinery of IOCL	Revenue Forest	5.928	12.00 ha Land Identified in Tangi DPF of Khordha Forest Division	In Notified Forest land
14	Development of Southern Dock Complex at Paradeep	Revenue Forest	25.74	Land Identified in Jariput DPF of Khordha Forest Division	In Notified Forest land
15	Haridaspur-Paradeep New B.G Rail Link Project.	Revenue Forest	0.608	Land Identified by Divisional Forest Officer, Cuttack Forest Division	Pertain to Other Division
16	Re-diversion for laying of LPG pipeline From Paradeep to Durgapur	Revenue Forest	0.5672	2.0ha of Land Identified in Sasanpeta PRF of Gahirmatha WL Range	In Notified Forest land



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Abstract of Forest Land added:

Table No.2.6A Forest land added & mentioned in Divisional Area statement

Sl. No.	New Forest Block	Area in ha	
1	Nadiakhia PF	128.96	Final Notification not received
2	Harispurgarh	46.40	

2.2 Forest Area under Different Working Circle/ Management Plan:

The forest blocks of Kendrapada and Jagatsinghpur District which have been included in the outgoing working plan for the period 2007-2016 which are listed below.

Table 2.6 List of Forest Blocks with notification numbers

Mahakalapara	1	Kantilo RF	139.33	No. 77046 dtd. 31.10.1979
	Total RF		139.33	
	2	Jogidhankud PRF	392.14	No. 19697 dtd. 07.05.1969
	3	Saralikuda PRF	263.33	S.R.O. No. 531/70 dtd. 27.06.1970
	4	Nipania PRF	77.98	S.R.O. No. 519/70 dtd. 27.06.1970
	5	Sanatubi PRF	594.69	S.R.O. No. 515/70 dtd. 27.06.1970
	6	Badatubi PRF	28.83	S.R.O. No. 533/70 dtd. 27.06.1970
	7	Barakolikhola PRF	12.01	No. 34642 dtd. 27.06.1970
	8	Batighar PRF	166.87	S.R.O. No. 517/70 dtd. 27.06.1970
	9	Kansaridia PRF	1411.53	No. 39003/R dtd. 27.07.1968
	10	Hetamundia PRF	1168.87	No. 34551 dtd. 27.06.1970
	11	Suniti PRF	235.50	S.R.O. No. 525/70 dtd. 26.07.1970
	12	Bagagahan PRF	12.40	S.R.O. No. 436/70 dtd. 05.06.1970
	13	Sasanpeta PRF	1515.19	S.R.O. No. 320/70 dtd. 06.06.1970
	14	Petchhela PRF	259.72	S.R.O. No. 476/70 dtd. 05.06.1970
	15	Kandarapatia PRF	106.90	S.R.O. No. 476/70 dtd. 05.06.1970
	Total PRF		6248.96	
	16	Jamboo PF	369.75	33237/D dtd. 04.10.1961
	17	Kaunsiapal PF	97.05	33237/D dtd. 04.10.1961
	Total PF		466.80	
Kujang	18	Jatadhar RF	124.26	S.R.O. No. 29/77 dtd. 05.01.1977
	Total RF		124.26	



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	19	Balitutha PRF	97.76	No. 50144 dtd. 11.08.1980
	20	Khatikholda PRF	44.26	No. 27003 dtd. 11.04.1980
	21	Brahmandia PRF	81.76	No. 46715 dtd. 23.06.1979
	22	Jatadhartanda PRF	596.53	No. FS/23/2006 dtd. 23.10.2006
	Total PRF		820.31	
	23	Majhidia (Kaudia) PF	52.46	33237/D dtd. 04.10.1961
	24	Bhuianpal PF	129.67	33237/D dtd. 04.10.1961
	25	Noliasahi PF	18.55	33237/D dtd. 04.10.1961
	26	Madhuban 'A' PF	19.12	33237/D dtd. 04.10.1961
	27	Madhuban 'B' PF	20.45	33237/D dtd. 04.10.1961
	28	Nuagaon&Dhinkia PF	1313.65	33237/D dtd. 04.10.1961
	29	Barakuda PF	95.35	33237/D dtd. 04.10.1961
	30	Kankan PF	404.07	33237/D dtd. 04.10.1961
	31	Dhobei PF	16.48	33237/D dtd. 04.10.1961
	32	Ramatara PF	23.97	33237/D dtd. 04.10.1961
	33	Muguria PF	84.80	33237/D dtd. 04.10.1961
	34	Goda PF	14.14	33237/D dtd. 04.10.1961
	35	Garaharishpur PF	273.60	33237/D dtd. 04.10.1961
	36	Garabishnupur PF	101.35	33237/D dtd. 04.10.1961
	37	Gopalpur PF	21.70	33237/D dtd. 04.10.1961
	38	Sahadabedi PF	388.00	33237/D dtd. 04.10.1961
	39	Padmapur PF	1269.16	33237/D dtd. 04.10.1961
	40	Salio PF	53.25	33237/D dtd. 04.10.1961
	41	Baruhan PF	254.73	33237/D dtd. 04.10.1961
	42	Marichpur PF	3379.24	33237/D dtd. 04.10.1961
	43	Tentulibelari PF	126.78	33237/D dtd. 04.10.1961
	44	Akashdia PF	249.49	33237/D dtd. 04.10.1961
	45	Boitarakud PF	224.04	33237/D dtd. 04.10.1961
	Total PF		8534.05	
	G. Total RF		263.59	
	G. Total PF		9000.85	
	G. Total PRF		7069.27	
	G. Total Area		16333.71	



2.2.1 Allotment of area to different Working Circle:

The Revised working Plan covers forests of Mahakalapada WL Range and Kujang WL Range. The Forests of these two Ranges were allotted to 6 Working Circles as detailed below in the Outgoing Plan. Rehabilitation WC is the only Independent WC and rest five WC are Overlapping in Nature.

Table No. 01: Allotment of area to different Working Circles in Outgoing Plan

Range	Total area in ha	Allotted to Working Circle						Total
		RWC	PL.(O) WC	PR. (O) WC	JFM (O) WC	WL (O) WC	Mangrove Imp. (O) WC	
Mahakalapada	6650.97	6650.97	0	6650.97	220.0	5212.66	1904.50	6650.97
Kujang	7127.12	7127.12	713.0	7127.12	270.0	4608.84	272.10	7127.12
Total	13778.09	13778.09	713.0	13778.09	490.00	9821.5	2176.60	13778.09
Kujang (VF)	36.0	36.00						36.00
G. Total	13814.090	13814.090	713.0	13778.090	490.000	9821.500	2176.600	13814.090

In the Outgoing Plan the entire area was allotted to two Rehabilitation Treatment Series i.e. **Mahakalapada Treatment Series (MHP)** and **Sarala Treatment Series (SRL)**.

2.3 Percentage of Forests with Secured Boundaries:

There are 12 PRF & 28 PF blocks which are included in the revised plan. These were all notified between 1956 to early eighties. The condition of these blocks is deplorable; most of these blocks do not have boundaries and are infested with heavy encroachments. The boundaries are to be demarcated and all blocks notified. Non availability of regular FSOs in the districts of Jagatsinghpur and Kendrapada is a hindrance. Presently, there are 9 numbers of Forest Blocks in Mahakalapada WL Range, out of which 8 numbers have been notified as P.R.F u/s-21 and 4(1) of either Indian Forest Act, 1927 or Orissa Forest Act, 1972 respectively. Of the remaining 1, proposal has already been submitted for notification u/s-4(1) of Orissa Forest Act, 1972. As regards, Mahanadi Delta portion of Jagatsinghpur district (Kujang Range), there are 32 numbers of Forest Blocks of which only one Forest Block has been notified as R.F and 4 Forest Blocks have been notified as P.R.F. The remaining 27 numbers of Forest Blocks are still protected forest only.

Accretion and erosion changes the boundaries of Forest Blocks regularly. The boundaries of various forest blocks maintained and boundary pillars posted are washed away frequently during tidal surges. But non-maintenance of boundaries in the past has given scope for encroachment. Boundary pillars will be periodically repaired, painted and numbered. Boundary lines will also be cleared and properly maintained. All the boundaries of forest blocks have been digitized for use of GIS technology, GPS (Geographical



Positioning System) reading of all the boundary pillars will be obtained. All forest boundaries shall be verified with the help of GPS/ DGPS and maintained during the Plan period.

Register of Reserved Forests, Protected Forests, and Village Forest are maintained as per the codal provisions. This register should preferably contain copies of the original notification (or an attested copy thereof) declaring the forest blocks under a particular category. Accurate maps of the block delineating the boundaries and showing the position of the boundary pillars as they exist on the ground and other details like boundary lengths, number of pillars, GPS readings etc should also be kept as part of this register. All changes in area due to diversion, de-reservation along with copies of such notifications should also be maintained in the register. There has been substantial increase in the human population and the cattle population in the Division. The pressure of demand on forest is steadily increasing day by day. A lot of ecological changes have taken place. The division is devoid of good natural forest except Mangrove Forests along the Mahanadi Delta Area and coastal Casuarina Plantation, which are in various stages of degradation due to anthropogenic pressures. Almost all the forest areas are prone to encroachment. The encroached areas are to be demarcated in the field. The pre-1980 encroached areas are to be regularized and the post-1980 encroached areas are to be evicted from the encroachers except those are eligible to have rights as per SC & OTF Dwellers Right to Forest Act-2006. The exact extent of forest land for which the title of rights issued under this act should be assessed. A five-year cycle of maintenance of boundary have been prescribed under Miscellaneous Regulations in **Chapter 13 (Part-II)**.

Table: 2.7 Boundary & Pillars of Rajnagar Division

Sl No	Name of the Forest Block	Area in Ha	Boundary length in Km	No. of Pillars Required	No. of Pillars Existing
1	Jogidhankund PRF	392.14	7.25	32	0
2	Saralikuda PRF	263.33	7.85	41	0
3	Nipania PRF	77.98	8.441	34	0
4	Badatubi PRF	28.83	8.442	32	0
5	Barakalikhola PRF	12.00	3.51	17	0
6	Batighar PRF	166.20	18.338	91	0
7	Bagagahan PRF	12.41	1.5	19	0
8	Petchhela	259.73	11.285	80	0
9	Kaunsiapal PF	97.10	2.75	35	0



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10	Jatadhar RF	55.28	12.34	40	25
11	Balitutha PRF	84.90	6.97	33	0
12	Kathiakholda PRF	44.27	6.32	49	0
13	Brahmandia PRF	81.77	6.54	33	0
14	Majhidia PF	52.47	3.74	24	20
15	Bhuiarpal PF	129.67	7.4	73	0
16	Madhuban 'A' PF	78.11	6.47	22	0
17	Madhuban 'B' PF	20.46	2.237	13	0
18	Nuagaon and Dhinkia PF	206.773	26.09	90	0
19	Jatadharta PRF	596.52	22.91	139	71
20	Barkud PF	95.36	4.95	122	0
21	Kankan PF	404.69	6.65	130	0
22	Dhobei PF	16.49	2.6	11	0
23	Ramtara PF	23.98	3.01	28	0
24	Muguria PF	71.91	6.032	62	0
25	Goda PF	14.14	2.55	16	0
26	Garaharishpur PF	273.60	7.5	89	0
27	Garbishnupur PF	101.35	3.4	73	0
28	Gopalpur PF	21.71	3.57	29	0
29	Sahadabedi PF	638.20	13.28	98	0
30	Padmapur PF	1282.515	2.06	12	11
31	Salio PF	53.25	3.59	20	20
32	Baruhan PF	254.73	10.14	20	20
33	Marichpur PF	3379.20	26	122	0
34	Tentilibelari PF	126.78	6.11	21	0
35	Akashdia PF	249.49	9.15	27	0
37	Boitarakud PF	227.33	10.12	36	0
38	Kathagadi PF	46.43	9.68	25	0
39	Nadiakhia PF	128.96	6.0	77	0
40	Musadia PF	15.80	2.7	23	0
41	Jatadharta B PF	13.35	1.9	27	0
42	Harishpurgada PF	46.40	10.47	69	0
	Total	10145.408	321.845	2034	167

The Boundary pillars has been checked / verified. The abstract of Boundary pillars / status is furnished below(**Table No 2.7 (A)**).



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Table No 2.7 (A) Boundary pillar Status- Rajnagar WL Division

Sl No	Description	Quantum
1	Boundary Length of Forest Blocks (in Km)	321.845
2	Number of Total Boundary Pillar (as per map)	2034
3	Number of Pillars existing	167
4	Percentage of Boundary Pillars in good condition	8.20%

From the above it is inferred that the boundary lines of forest blocks are not secured.

Now all Forest Blocks are being surveyed by DGPS system and likely to be completely digitized by end of 2024. After that Latitude / Longitude of all pillar position will be made available. The completion of DGPS Survey will be intimated to IRO, MoEF&CC, Eastern Region, Bhubaneswar.

Table No 2.8: List of Forest Blocks having common Boarder with Bay of Bengal Rajnagar Division

Sl No	Name of Forest Block having Boarder with Bay of Bengal	Length of Common Boarder with Boarder with Bay of Bengal	Remark
1	Jatadhartanda PRF	7.00	Special measures for checking Sea coast erosion & Sand dun fixation required
2	Padmapur PF	2.00	
3	Sahadabedi PF	3.00	
4	Baruhan PF	1.00	
5	Akashdia PF	2.00	
6	Nadiakhia PF	3.50	
	Total	18.50	

Table No 2.9 Extend of Forest Block Boundary maintain in Km: Rajnagar Division

Year	Extend of Forest Block Boundary maintain in Km					
	RF	PRF	DPF	VF	PF	Total
2018-19		34.74				34.74
2019-20		-			5.8	5.80
2020-21		22.91				22.91
2021-22		10				10.00
2022-23		-				0
Total		67.65			5.8	73.45



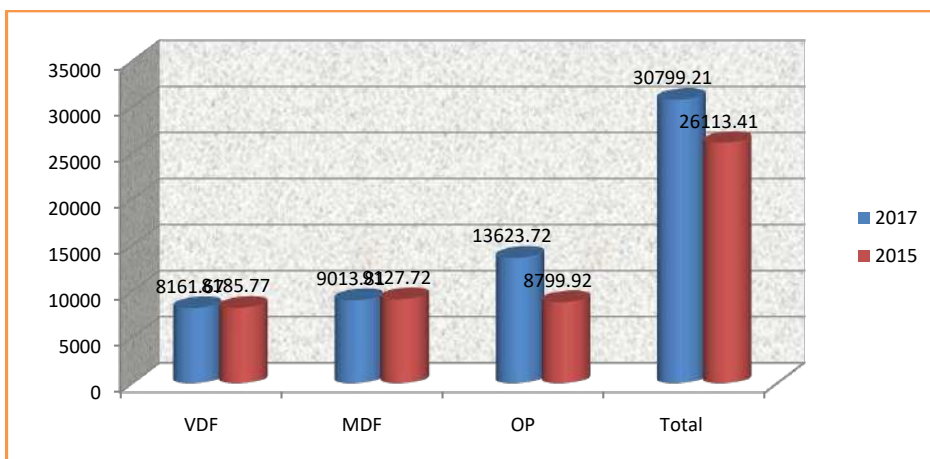
Table No 2.10: Number of Pillars Constructed / Maintained			
Year	Number of Pillars Constructed / Maintained		
	New	Maintenance	Total
2018-19	121	0	121
2019-20	34	0	34
2020-21	25	0	25
2021-22	48	0	48
2022-23	0	0	0
Total	228	0	228

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

Due to demographic pressure, urbanisation, industrialisation and other development activities coupled with effects of climate change, there is significant change in land use in the area over the period of times. Major changes is conversion of paddy fields to shrimp culture which is more lucrative in terms of profit. Forest land particularly, mangrove forests have been encroached upon for shrimp culture. The shrimp culture require saline water which is being drawn from nearby rivers/ creeks and the chemical mixed water from shrimp culture ponds are discharged to the same water channels. This has adverse impact on the mangroves.

The change in Forest Cover of Rajnagar WL Division has been analyzed by the FSI / GIS Cell of the PCCF & HoFF, Odisha for the period 2015 & 2017. The data published is furnished below. During this period the forest area though increased, there is decrease in forest under VDF and MDF. The Forest Cover Change Matrix is at **Table No 2.11**

Table No 2.11 Change of Forest area Rajnagar Division (Area in Ha)					
	VDF	MDF	OP	Total	% to GA
2017	8161.67	9013.81	13623.72	30799.21	10.78
2015	8185.77	9127.72	8799.92	26113.41	9.14
Forest Cover Change	(-) 24.10	(-) 113.91	(+)4823.80	(+) 4685.80	(+) 1.64



The ISFR change for the district / state published during 2021 is at **Annexure-III**

2.5 Threats to Forest:

2.5.1 Threats to Flora:

There has been substantial increase in the human population and the cattle population in the division. The pressure of demand on forest is steadily increasing day by day. A lot of ecological changes have taken place. However, there are some exceptional areas where forest cover has increased due to protection and restocking of mangroves by eviction of encroachment and increasing tree cover outside forest area.

The division is having mostly Mangrove forests along the Bay of Bengal coast starting from Dhamra River Mouth in the border of Bhadrak district in north to Devi River Mouth in the border of Puri District in south. The coastal Casuarinas forest along with the mangrove forest coming within the protected areas of this division are managed as per the prescription of the management plan and the forest areas of Mahakalapada WL Range in Kendrapada District and Kujang WL Range of Jagatsinghpur district of this division are managed as per the prescription of outgoing Working plan of Rajnagar (Wildlife) Division for the period 2007-08 to 2016-17.

The main factors responsible for causing damage are divided into two categories, biotic and abiotic. The important biotic factors are human, animals, and weeds and abiotic factors are climatic factors like drought, flood, cyclone and tidal surge etc. The details of different injuries will be elaborated in the Working Plan.



In Kujang WL Range the industries like Goa Carbon Limited, IFFCO, IOCL, Paradeep Phosphates and Orissa Breweries Ltd. are present in and around Paradeep. The floating population of the industries put lot of pressure on the forest especially for firewood. The forest blocks are encroached for agriculture, prawn culture, etc. It is not that the action of human agency is always deliberate. The demand for firewood is the compelling need of the local population in absence of other alternative sources of energy. The supply of firewood by the OFDC is very meagre as compared to the demand of the population. This large gap is met from the forest. Rural poor, most particularly, womenfolk earn their livelihood by selling the firewood fetched from forests. The agriculture is providing livelihood only for 4-5 months in a year and in the rest of the time there are no livelihood activities and hence cutting of the forest to meet the day to day requirement has become a common feature. This result in unscientific exploitation of forests rendering the forests degraded.

Many of the forest blocks of this division are not finally notified. Notifications of PRF and PF have been done much earlier. Boundary is not consolidated for which there are disputes at most of the blocks as regards boundary of the forest block vis-à-vis boundary of revenue plots and private plots.

Due to coastal area the forest blocks are subject to cyclones causing lot of damage to the forests.

(i) Illegal collection of timber and firewood:

There is no high forest in this Division, but there is a demand of small timber and firewood from the existing growth and coastal *Casuarina* plantations from the villages. Number of cases detected during the last plan period for illegal collection of timber and firewood has been furnished in Table 2.12

Table 2.12 Cases booked for forest offence including wildlife in last plan period				
Name of the Range	Sl. No	Year	Total O.R. Case	Total U. D. Cases
Kujang (WL) Range	1	2007-2008	257	13
	2	2008-2009	251	11
	3	2009-2010	291	03
	4	2010-2011	328	03
	5	2011-2012	338	05
	6	2012-2013	260	03



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	7	2013-2014	272	02
	8	2014-2015	252	02
	9	2015-2016	26	02
Total			2275 Nos.	44 Nos.
Mahakalapada (WL) Range	1	2007-2008	412	07
	2	2008-2009	402	06
	3	2009-2010	380	03
	4	2010-2011	459	02
	5	2011-2012	449	-
	6	2012-2013	458	03
	7	2013-2014	367	02
	8	2014-2015	226	02
	9	2015-2016	20	-
Total			3173 Nos.	25 Nos.
Total			5448	69

(ii) Encroachment of forest:

The encroachment is a serious problem in the Division. The encroachment is more serious in case of PRF and PF blocks. The extent and nature of encroachments have different dimensions. All most 80 per cent of the forest blocks in both the ranges are subjected to encroachments. Some of the blocks are totally encroached. In some of the blocks, the land is encroached for cashew plantations, in other areas it is for agriculture and prawn culture. In some cases, the plain land is encroached for homestead purpose. The efforts are made to find out the reasons for this alarming rate of encroachments in Rajnagar Division. Mostly the encroachments are done after 1971 cyclone. The headquarters of the Division was at a far off place then (Athgarh) and the administration did not have grip in these areas. The terrain is also quite difficult to negotiate for most of the time in the year. The activities of the Forest Department were also limited in these areas resulting in the massive encroachments. There are many title suits pending in the courts against these encroachments. The approximate extent of area encroached in each block is given in the area statement. This needs further field verification and demarcation. Some progress is made in the eviction of some of the encroachments in Mahakalapada Range. The plantations have been raised immediately after eviction.



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Table: 2.13 Encroachment In Forest Blocks.

Name of the district	Range	Forest Block	Extend of area encroachment In Ha			
			Prawn culture	Agriculture	Homestead	Total
Kendrapada	Mahakalapada	1.Badatubi PRF	18.00	-	-	18.00
		2.Bagagahan PRF	-	20.66	10	30.66
		3.Petchhela PRF.	-	29.00	-	29.00
		4.Batighar PRF	-	-	27.00	27.00
		5.Jogidhankund PRF	115	-	-	115
		TOTAL	133.00	49.66	37.00	219.66
Jagatsinghpur	Kujanga	1.Jatadhar RF	55.00	-	-	55.00
		2.Balithutha PRF	-	6.68	0.27	6.95
		3.Brahmandia PRF	23.19	-	-	23.19
		4. Dhinkia- Nuagaon PRF	0	-	12.29	12.29
		5.Khatikholda PRF	18.73	-	-	18.73
		8.Barakuda RF	40.88	-	-	40.88
		9.Baruhan PF	81.18	19	-	100.18
		10.Bhuinpal PF	4.30	2.78	-	7.08
		11.Dhobei PF	-	-	1.79	1.79
		12.Garaharipur PF	5.55	-	2.4	7.95
		13.Goda PF	0	-	2.04	2.04
		14.Gopalpur PF	16.60	-	-	16.60
		15.Jatadhartanda PRF	54.65	-	-	54.65
		16.Kankan PF	16.60	-	-	16.60
		17.Madhubana 'A' PF.	2.36	-	-	2.36
		18.Madhubana 'B' PF.	11.53	-	-	11.53
		19.Marichipur PF	10.0	90	34.39	134.39
		20.Muguria PF	-	20.03	9.03	29.06
		21.Padampur PF	-	13.79	22	35.79
		22.Sahadabedi PF	21.19	-	-	21.19
		23.Salio PF	13.25	-	-	13.25
		24.Tentulibelari PF	14.41	-	0.30	14.71
		25.Boitarakuda	184.81	-	-	184.81
		TOTAL	574.23	152.28	84.51	811.02
		G. Total	707.23	201.94	121.51	1030.68
		%	68.62	19.59	11.79	100.00



(iii) Grazing of cattle in forest:

Grazing is one of the serious problems. Due to heavy livestock pressure in the division, natural regeneration in some blocks of the forest is affected severely.

The live Stock of Kendrapara and Jagatsinghpur district as per 20th live stock Census carried out during 2019 as available is furnished at table No 2.14. The live stock population for Mahakalpura WL Range and Kujanga WL Range has also been estimated basing on Block data / area. The same is produced below (Table No 2.15).

Table No 2.14 Livestock Census data -2019				
District	Cattle	Buffalo	Sheep	Goat
Kendrapara	322484	14561	15675	112532
Jagatsinghpur	209978	10761	12101	107573

Table No 2.15 Cattle population & Forest dependency: Mahakalpura and Kujanga Range						
Range	Forest Block subject to grazing	Species Palatable to cattle / Animal	Approximate no of animals grazing on Forest			
			Cattle	Buffalo	Sheep	Goat
Mahakalpura	All Forest Blocks /	Dhani Dhan, Luni Doob Grass, Giria Grass, Keuti, Nalia , Chauli Grass,	40311	1820	1959	14067
Kujanga	Rev. Forest	Jagula, Miringa, Bani, Hentala, Bani, Keruaetc	94490	4842	5445	48408

Considering the available forest area and livestock population, the grazing pressure is considered to be very heavy. Heavy grazing has affected the forest in the following manners.

- Affected the natural regeneration,
- Damage to Planted species causing establishment difficult sometimes resulted in failure of plantation.
- Cutting of branches resulted retardation of growth.
- Transmission of diseases to wildlife,



The positive effects of Grazing:

- i. Helps in Seed dispersal,
- ii. Fallen seeds naturally dibbled due to movement of Cattle, Goat etc in soft soil- Helps in dibbling of naturally fallen seedlings.
- iii. On the event of broadcasting of collected seeds, the seeds will be naturally pushed in to soil and helps in retaining seeds – not washed away due to tide.

The area is mostly populated by persons coming from West Bengal and outsiders (Bengali Speaking). The common livelihood is Agriculture and Fishing. There no community depending on Cattle rearing. There are also no forest dwellers. The local people are interested in encroachment and trying to establish constructing house. The administration is in favour of evicting them.

The palatable species / grasses available in Forests are *Jagula, Miringa, Bani, Hentala, Bani, Kerua* – tree species and *Dhani Dhana, Luni Doob, Giria, Keuti, Nalia, Chauli Grasse*. The tree species are subjected to lopping. The lopping intensity is moderate.

The availability of Pasture land is poor. Most of the pasture land has been encroached. Now cattle are resorting to graze on Canal banks, Road sides, Agricultural field bonds (when idle)

(iv) Natural calamities like cyclone:

Due to coastal area the forest blocks are subject to cyclones every year. The forests have been exposed to consecutive two super cyclones – “*Phailin*” in 2013 and “*Hudhud*” in 2014 causing lot of damage to the forests. Further three major cyclones “*Titli*” in 2018, “*Fani*” and “*Bulbul*” in 2019 have significantly impacted the forests of this Division.

2.6 Distribution of Different Forest Types:

Forests of this Division can be classified into following types and sub-types in the line of the revised classification adopted by Champion & Seth.

Table 2.16Types Of Forests Present In The Working Plan Area			
Sl. No	Type		Code
1	Costal Vegetation	Tidal Swamp Forest (Mangrove)	4B/TS
		Littoral Forest	4A/L1



4A/L1 Littoral Forests:

Group 4	Littoral and Swamp Forests
Sub Group 4A	Littoral Forest

It is normally called beach forest. The most characteristic species is *Casuarina*; it is almost pure in the beaches. There are shrubs, grasses and creepers binding the sand are present in the undergrowth. The *Casuarina* is also seen combined with Cashew in some places, in other places it is present in patches adjoining to Mangrove vegetation in the Kujanga WL Ranges and Mahakalapada WL Ranges.

Occurrence:

These forests occur in Balitutha, Kathiakholda, Bhuianpal, Noliasahi, Baruhan, Jatadhartanda, Ramatara, Marichipur and Akasadia, Forest Blocks.

4B/TS Tidal Swamp Forest:

Group 4	Littoral and Swamp Forests
Sub Group 4A	Littoral Forest
Type TS 1 & TS2	Mangrove Scrub & Mangrove Forest

Mangrove Scrub (TS1)

It is commonly called Salt Water Forest. The crop is short heightened and evergreen with entire leathery leaves. The germination is usually viviparous. The forest is characterized by periodic submergence by the tides. This forest is very dynamic, with new areas getting added as the process of land accretion continues. The important species present are Bani (*Avicennia alba*), Guan (*Excoecaria agallocha*), Sundari (*Heritiera minor*), Rai (*Rhizophora candelaria*), Keruan (*Sonneratia apetala*), Baniah (*Hibiscus tiliaceus*). *Acrostichum aureum* is a beautiful fern found near the edges of water.

Mangrove Forest (TS2):

In this forest type, all the mangrove species mentioned above are present. The only difference is that the trees are of moderate height and the forest is a closed evergreen type.

Occurrence:

The Mangrove Forests are present in Batighar, Petchhala and Saralikuda Blocks of Mahakalapada WL Range and Salio, Baruhan, Jatadhar, Majhidia blocks of Kujang WL Range.



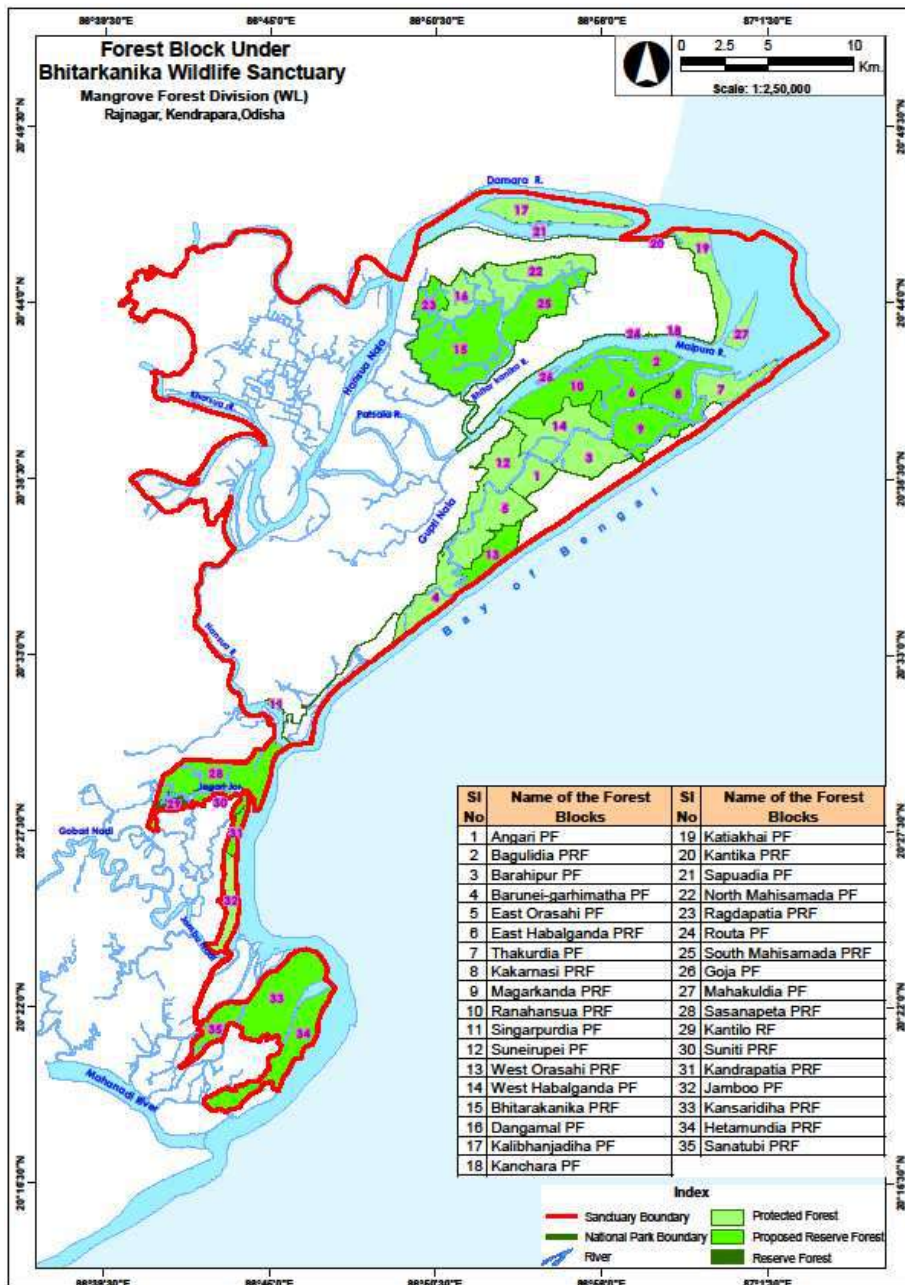
Mangroves serve as roosting, nesting, feeding and breeding for several faunal groups. Mangrove plants are the source of rich food for the organisms associated with the mangrove ecosystem. Variety of mammals, reptiles, birds, amphibians, fishes, crustaceans, protozoan, zooplanktons & molluscs are associated with the mangroves. These animals meet their food requirement from the leaves, degraded products of mangrove litter. The degraded product of mangrove litter act as food for detritivores (viz. shrimps, prawns, nematodes, mud skipper, grey-mullets and other crustaceans).

The forest type of the entire working Plan area has been classified as 4 Littoral & Swamp forests, Sub Group: 4A Littoral Forest, Type: 4A/ TS1, TS2 Mangrove Scrub Forest and Mangrove Forest.

The entire Forest is of one forest type. The forest type / Forest Cover map as received from NRSC; Hyderabad is furnished below.

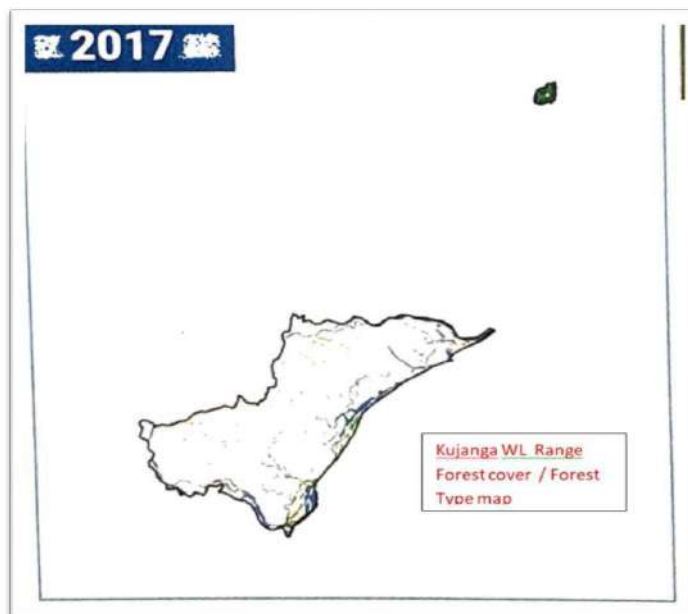
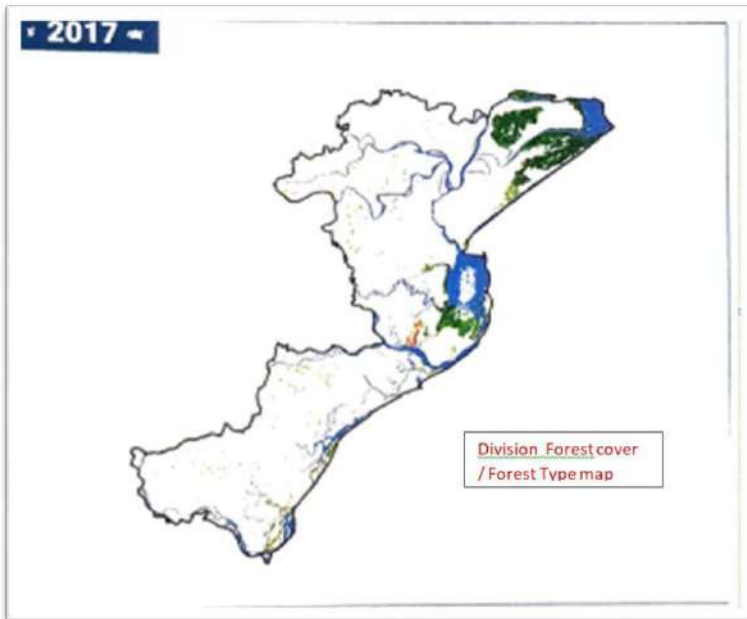


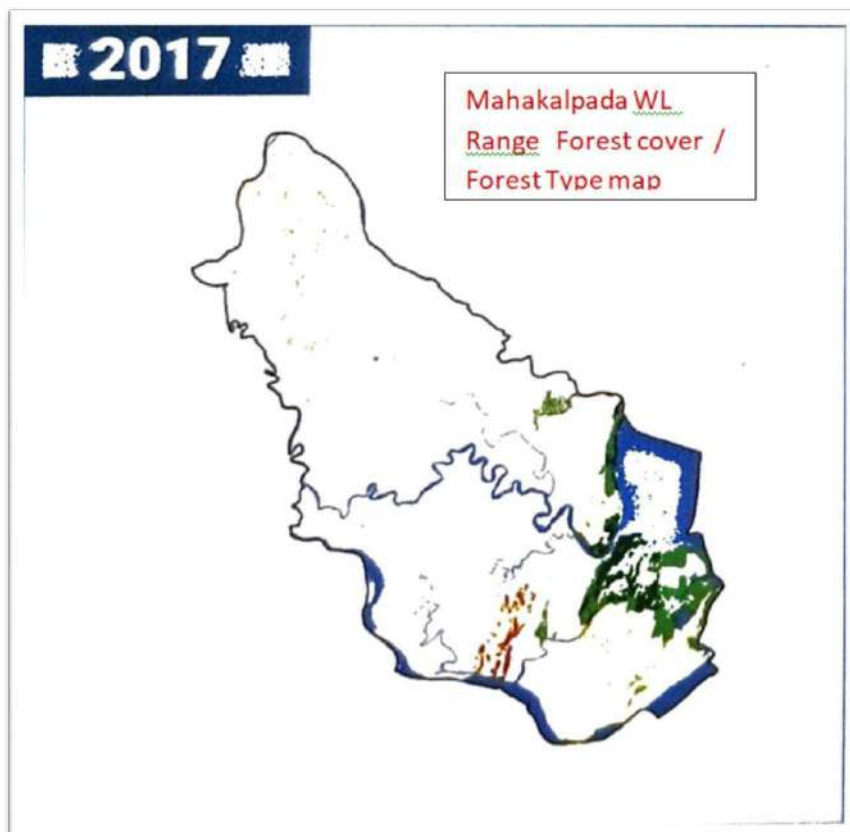
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2.7 Tree Cover Outside Forest Area:

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. dunes, both abandoned and accomplished mining sites). They not only contribute nearly one fourth of the total growing stock of the country but also have become major source of wood in India. 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. Tree species raised under afforestation programme viz. National Afforestation Programme (NAP), Central Plan, State Plan, MGNREGS, Avenue Plantation are to be properly assessed and their management



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shall be prescribed in the Working Plan. During last plan period, 65 Ha Block Plantation, 377 RKMs of Avenue Plantations and 339.4 ha through Farm Forestry have already been raised outside forest area.

Table No 2.17 : Probable TOF Created through Farm Forestry – Seedling distribution: Rajnagar WL Division (Kujanga&Mahakalpada Range)

Year	No of Seedlings distributed (in Lakh)			Probable area covered taking 1600 plants per ha
	Mahakalpada	Kujanga	Total	
2017-18	0.1	0	0.1	6.3
2018-19	0.78	0.30	1.08	67.5
2019-20	0.80	0.50	1.3	81.3
2020-21	0.70	0.125	0.825	51.6
2021-22	0.75	1.375	2.125	132.8
Total	3.13	2.3	5.43	339.4

The Avenue Plantation during last 5 years taken up in Kujanga & Mahakalpada Range is furnished below. (Table No 2.18)

Table No 2.18 : Probable TOF Created through Avenue Plantation: Rajnagar WL Division (Kujanga & Mahakalpada Range)

Year	Name of the Road	RKM covered
2017-18	Harenpada School to Kanspal Village	4.00
	Manapatana Chhaka to Jayasinghpur	8.00
	Mangalapur Chhaka to Keyarbanka village	4.00
	Dasamauji Bridge to Karamkul village	6.00
	Baulanga to Balipari RD Road	4.00
	Pankapal to Taladanda Canal Embankment	8.00
	Sirala to Bailo Irrigation Road	4.00
	Badakana to Apandara RD Road	4.00
	Marichipur to Baramunduli RD Road	4.00
	Panchapalli to Ibrisingh R&B Road	8.00
	Balitutha to Gadakujang RD Road	4.00
	Thailo to Aliha RD Road	4.00
2018-19	Gangarampur GP office to Maa Chhulalia Pitha	6.00
	Romita to subala	4.00
	Jagisri to Guptara Bridge	6.00
	Khosalpur Bridge to Hansura G.P Office Irrigation Road	8.00
	Ghodamara to Panapalli RD Road	4.00



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	Nuagaon to Chatua RD Road	8.00
	Bhitarandhari to Baulapada RD Road	4.00
	Olara to Asia RD Road	4.00
	Gadakujiang to Noliasahi RD Road	8.00
	Santho to Alikantha RD Road	4.00
	Sarana to Basantapur PMGSY Road	4.00
	Bandar to Marichipur RD Road	8.00
	EradaBadheisahi to Galadhari Sai Mandira RD Road	4.00
2019-20	Bijayanagar to Patragarh	8.00
	Baharasobala to Raigada	4.00
	Mirdha to Ramakani	8.00
	Subala to Romita	6.00
	Raigana to Banito RD Road	8.00
	Badabuda to Kankadagotha RD Road	8.00
	Gunutia to Baigani PMGSY Road	4.00
	Durgapur to Asia RD Road	4.00
	Marichipur to Naharana RD Road	4.00
	Anantapur to Alana RD Road	4.00
	Balidaia to Mushadia Mahanadi River Embankment	4.00
2020-21	Jagatjore RD Road to Suniti	4.00
	Ghanashyampur to Karamkul	6.00
	Panikhia Saline Road to Gagua RD Road	8.00
	Kalikuda to Choudhurykuda River Embankment	8.00
	Baulanga to Jamukana PMGSY Road	4.00
	Balitutha to Kankardia RD Road	4.00
	Gadharishpur to Patua River Embankment	8.00
	Bandar P.S to Balijori Rd Road	8.00
	Paikasahi to Chhatian PMGSY Road	4.00
2021-22	Suniti to Babangadhia	16.00
	Patharabandha to Sarat Das House	8.00
	Babangdhia to Puruna Field	8.00
	Petachhela to OSDMA	6.00
	Kentia Hanuman Temple to Kochila	6.00
	Avenue plantation from Pathuria to Pankapal Canal Embankment	12.00
	Choudhury Goda to Sandhapur Canal Embankment	12.00
	Siju to Rangiagarh Inside Plastic Park	3.00
	Kathada to Siju Plastic Park Road	6.00
	Kansaripatia to Abhayachandapur Embankment	4.00



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	Nimabelari to Batabelari Saline Road	4.00
	Somapur to Grameswar Mandir RD Road	10.00
	Tandikula G.P Office Garia Saffei PMGSY Road	12.00
	Bandar to Pilipahi RD Road	20.00
	Total	377.00

(NB: 377 RKM equivalent to = 58.90 ha)

List of Plantations Raised during last Plan Period is at **Annexure-IV**

2.7.1 ToF Change Matrix:

The Forest Coverage of Rajnagar WL Division has been analyzed and published by the PCCF & HoFF, Odisha pertaining to 2015-17. The observation / classification is furnished below.

Table No 2.19: Change of Forest area Rajnagar Division in Ha					
	VDF	MDF	OP	Total	% to GA
2017	8161.67	9013.81	13623.72	30799.21	10.78
2015	8185.77	9127.72	8799.92	26113.41	9.14
Forest Cover Change	(-) 24.10	(-) 113.91	(+)4823.80	(+) 4685.80	(+) 1.64

The forest area indicated above includes the Forest area of Kujanga WL Range, Mahakalpada WL Range. The total area in these two Forest Ranges is 13814 Ha. Bhitarkanika National Park is 14500 Ha (145.00 Sq. Km) About 20% of the National Park is Water bodies, Forest over 50% area. Balance 30% is of habitation etc. Forest area involved in Bhitarkanika National Park is about 7250 ha. Tree Cover outside the Forest is about 5049 ha in 2015 as indicated below. During 2017 the tree cover enhanced by 2580 ha.

Table No 2.20: Change in TOF Matrix – Rajnagar WL Division.				
Year	Total Forest Area as per FSI Report in Ha	Forest Area (NP+ Outside NP)	TOF	Variation
2015	26113.41	21064	5049.41	
2017	30799.21	23169	7630.21	2850.8 ha

The ToF enhancement is due to Planting by Forest department outside the forest by way of Avenue Plantation, Backyard plantation through Seedling distribution and planting by



other agencies. Seedling distributed under Farm Forestry during last five years and probable area covered is furnished under Table No 2.17 and 2.18.

2.8 Shifting Cultivation (Jhumming):

There is no practice of shifting cultivation in this Division.





Chapter 03

Maintenance, Conservation & Enhancement of Biodiversity:

3.1 Forest Composition and Distribution:

On one side of the division along coastal line the forest are capable of supporting *Casuarina* with associate species of *Neem*, *Eucalyptus* & *Sissoo* and whereas mangrove forests with miscellaneous species are found in other forests in Kendrapada and Jagatsinghpur District. There are about 100 different species of mangroves and their associates. The important species present are Bani (*Avicennia alba*), Guan (*Excoecaria agallocha*), Sundari (*Heritiera minor*), Rai (*Rhizophora candelaria*) and Keruan (*Sonneratia apetala*).

3.2 Plant Species Diversity:

The special objectives of 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 recreation opportunity
- iv. To develop the ground flora and middle story even in plantation in order to attract more wild animals
- v. To increase population of wild animals 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

During the preparation of last 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 the Division. The 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 project and are also exclusively collected for the purpose where ever required.



As per National Working Plan Code, 2014, Grid based sampling method is to be adopted for preparation of working plan. However, in consultative discussion with the Scientific Officers of NRSC and ORSAC it was stressed that Stratified Random Sampling method is better than the Grid based systematic sampling method as described in the National Working Plan Code-2014. Though the latter needs more sample points, the accuracy will remain the same as per statistical procedure.

102 sample points have been allocated for inventory of forests of Mangrove Forest Division(Wildlife) by NRSC through ORSAC. The sample plot allocation by NRSC was on the basis of the spatial information on forest type (derived from Sentinel classification at 10m) and forest canopy density (derived from visual interpretation of WV2 data at 1:25,000 scale). The type and density layer were combined in a GIS operation. The 42 resultant strata (7 type and 6 density classes) were simplified into ten type and density classes. For calculation of sample points to be allotted at the Division level the density classes were stratified into two classes >40 and <40. The sample point intensities were fixed as below (as suggested by Odisha Forest department, no separate pre-inventory was carried out to estimate the coefficient of variation, inventory data for 12 forest divisions carried out in 2006-2008 was used).

The calculated number of points were then distributed on the basis of forest cover and type on an area weighted basis at the compartment level.

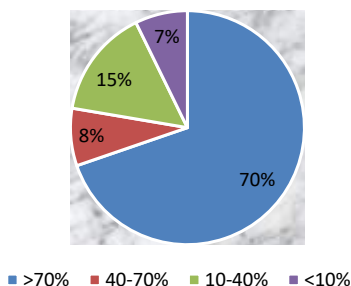
Maximum area has crown density of 25-40% and the proportion of the area in this density class is nearly 80 percent. 14 percent area is under the category of Scrub and 3 percent of the area has a crown density of 10-25%. 3 percent of the area has a crown density of more than 40%. The crown density details of the different forest blocks is given in the **Table No.3.2** and depicted in the **Graph- 3.2**.

Overall crown density data wise inventory points as per NRSC analysis is furnished in Table 3.1 and Graph 3.1 below:

Table 3.1 Number of Sample Points by Canopy Density Class					
Range	Number of Sample Points by Canopy Density Class				
	>70%	40-70%	10-40%	<10%	Total
Gahirmatha	0	1	0	1	2
Kujanga	0	6	7	12	25
Mahakalapada	0	18	7	14	39
Total	0	25	14	27	66



Number of sample points by Canopy Density Class



Graph 3.1 Number of Sample Points by Canopy Density Class

Table: 3.2 BLOCK WISE CROWN DENSITY AREA

KUJANGA RANGE						
Name of the Block	Crown Density Class					Total
	NF	<10%	10-40%	40-70%	>70%	
AKASDIA PRF	221.11	36.51	16.79	0.00	0.00	274.41
BALITUTHA PRF	63.12	45.86	3.30	0.00	0.00	112.29
BARKUD PRF	96.57	0.00	11.01	0.00	0.00	107.59
BARUHAN PRF	132.72	12.52	66.96	42.96	25.81	280.97
BHUIANPAL PRF	154.27	0.00	6.71	0.00	0.00	160.98
BOITARKUD PRF	205.74	0.00	4.53	0.00	0.00	210.27
BRAHMANDIAN PRF	25.51	15.11	24.83	0.00	0.00	65.45
DHOBEI PRF	254.93	0.00	0.00	0.00	0.00	254.93
GARH BISHUNPUR PRF	83.39	0.00	0.00	0.00	0.00	83.39
GARHARISPUK PRF	254.93	0.00	0.00	0.00	0.00	254.93
GODA PRF	9.76	0.00	8.54	0.00	0.00	18.30
GOPALPUR PRF	25.91	0.00	0.00	0.00	0.00	25.91
JATADHAR RF	66.26	0.00	0.00	0.00	0.00	66.26
JATADHARATANDA PRF	201.38	2.01	402.87	3.65	0.00	609.91
KANKANA PRF	487.08	0.00	2.61	0.00	0.00	489.69

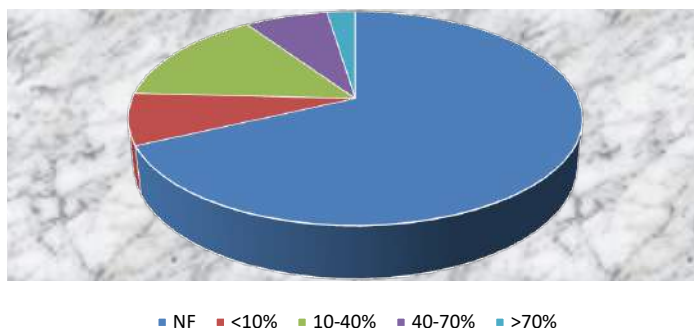


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KATHIAKHOLDA PRF	50.86	0.00	0.00	0.00	0.00	50.86
MADHUBAN A PRF	32.68	0.00	0.00	0.00	0.00	32.68
MADHUBAN B PRF	32.68	0.00	0.00	0.00	0.00	32.68
MAJHIDIA PRF	29.71	0.00	45.80	12.89	0.00	88.40
MARICHIPUR PRF	2029.53	883.88	201.96	262.19	0.00	3377.56
MUGURIA PRF	110.94	0.00	10.04	0.00	0.00	120.99
NOLIASAHI PRF	25.22	40.06	0.00	0.00	0.00	65.27
NUAGAONDHINKIA PRF	336.39	33.00	303.50	4.43	0.00	677.32
PADMAPUR PRF	21.51	12.90	32.36	0.00	0.00	66.77
RAMTARA PRF	35.86	0.00	34.25	0.00	0.00	70.12
SAHADABEDI PRF	77.41	0.00	16.63	1.30	0.00	95.34
SALIO PRF	25.44	16.24	34.15	4.28	0.00	80.11
TENTULI BELARI PRF	84.77	0.00	8.15	0.00	0.00	92.91
MAHAKALPADA RANGE						
BADATUBI PRF	32.79	0.00	0.00	0.00	0.00	32.79
BARAKOLIKHOL PRF	27.23	0.00	3.72	0.00	0.00	30.95
BATIGHAR PRF	46.54	0.00	20.87	0.00	0.00	67.41
HETAMUNDIA PRF	891.78	0.00	207.14	241.88	0.00	1340.80
JAMBOO PRF	74.14	0.00	59.60	92.43	13.66	239.86
JOGIDHANAKUDA PRF	299.61	0.00	51.92	0.00	0.00	351.54
KANDARAPATIA PRF	103.05	0.00	0.00	15.98	6.98	126.01
KANSARIDIA PRF	553.59	0.00	379.27	242.79	282.65	1458.30
KANTILO RF	186.18	0.00	14.31	0.00	0.00	200.50
NIPANIA PRF	100.63	0.00	0.00	0.00	0.00	100.63
PETCHHELA PRF	187.43	0.00	0.00	0.00	0.00	187.43
SANATUBI PRF	403.01	0.00	10.84	46.46	0.00	460.31
SARALIKUDA PRF	261.89	0.00	19.63	0.00	0.00	281.52
SASANPETA PRF	1471.49	19.81	95.45	50.00	0.00	1636.45
SUNITI PRF	83.12	0.00	24.36	0.00	17.39	124.87
Total	9822.04	1117.89	2123.99	1021.25	346.49	14431.66



Crown Density Area of Forest Blocks



Graph 3.2 Crown Density Data of Forest blocks

Presently there is no harvesting practice of forest produce for conservation of biodiversity. However, harvestable trees planted in Govt. land under various schemes shall be harvested scientifically & keeping in mind of 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.

3.3 Status of Biodiversity Conservation in Forests:

There is no high forest existing in this Division. Most of the forests on the coastal area are covered with plantations, *Casuarina* being the most predominant species which has been planted extensively as coastal shelterbelt. Mangroves on the estuaries are also restocked with mangrove plantation particularly areas of encroachments after eviction. No in-situ and ex-situ conservation of RET species has been undertaken in the past.

For conservation of bio-diversity, Biodiversity Act 2002 has been enacted with an aim to provide conservation of biological diversity and sustainable use of its components & equitable sharing of benefits arising there from.

This Act creates a three-tier structure of authorities to manage the biodiversity of the country. This includes National Biodiversity Authority (NBA), the State Biodiversity Board of State level and the Bio-diversity Management Committees of Regional Level.



Odisha Biodiversity Board is authorized to implement the legal provisions of Biological Diversity Act 2002 in the State. To conserve the biological resources of the State, Odisha Biological Diversity Rules were made by the State Government in 2012. As per Section 41 of the Act, the local bodies shall constitute a Biodiversity Management Committee at GP, Block, District, Urban areas like Municipal Corporation and District Level.

As per Rules 21 of the OBD Rules 2012 BMCs shall prepare People's Biodiversity Registers at the entire local bodies level. The BMCs have the power and responsibilities to protect and conserve the native biodiversity in their respective jurisdiction and they can levy charges on any companies, traders and manufactures against the commercial collection of bio resources under Access and Benefit Sharing Agreement (ABS) fees which is 3 to 5% of the ex-factory gross sale of the total value of the bio resources. This ABS fees shall be utilized for protection conservation and restoration of native biodiversity and the money shall be kept in a joint account named Local Biodiversity Fund (LBF).

The PBRs shall consists of detailed information on local biological resources and it's associated traditional knowledge including flora fauna and agricultural diversity of the local areas for monitoring and evaluation.

Maintenance of PBR at Block/ Gram Panchayat Level is under Progress.

3.3.1 Species diversity in Bhitarkanika Mangrove ecosystem:

Species diversity in Bhitarkanika Mangrove ecosystem in Orissa, India has been studied by P K Mishra, J R Sahu and V P Upadhyay during 2005 and the report has been published in *lyonia – A journal of ecology and application*. The same is enclosed as **Annexure-V**.

3.4 Status of Species Prone to Over Exploitation:

No coupe working has been done during the last plan period. The forest blocks of this Division have very low potentiality of NTFP.

3.4.1 List of Rare, Endangered & Threatened (RET) plant species (As per IUCN Red data book).

The floral / faunal list of Bhitarkanika along with IUCN Status is furnished at **Annexure-VI**.



3.5 Conservation of Genetic Resources:

No sample plot/ preservation plot/ medicinal plants conservation area/ community conservation area has been established in this Division due to want of high forest.

3.6 Fauna and their Habitats:

Faunal diversity of the forests of the Division is rich due to mangroves. Mangroves support spotted deer, sambar, wild boars, fishing cats, porcupines, water monitor lizards, king cobra and varieties of birds including 8 species of kingfishers and a number of migratory birds. The list of fauna is appended in the end of this chapter.

3.7 Threats and Challenges to Wildlife:

Threats to wildlife in the mangrove system are manifold. Human induced threats viz. hunting, disturbance to habitat, teasing of animals, illegal fishing, encroachment, illicit felling, transmission of disease, grazing, use of pesticides, chemical discharges, bonding of creeks, growth of industries in the periphery and natural calamity like drought, flood, cyclone, beach erosion, changes in landscape etc. The major causes are categorized as follows:

1. Hunting of wild ungulates.
2. Prawn gherries near the forest area disrupting natural water flow. The feeds and medicines used in the gherries also contaminate the creek water.
3. Avian Influenza. There is threat of migratory birds acting as carrier of the disease when they migrate from different parts of the world.
4. Natural calamities like cyclone affect faunal mortality.
5. Clandestine movement of motorized boats for fishing purposes.
6. Movement of trawlers close to sea coast in no-fishing zone affect the movement of Olive Ridley turtles who come in thousands for mating and nesting. Large scale mortality of turtles along the sea coast occurs due to strangulating in trawling nets.

There are dedicated staffs for protection/management of the wild fauna. Olive Ridley Marine Turtles arrive in the small islands like Wheeler Group of Islands, etc. and conspicuous in the coastal waters in 2nd half of October every year and remain till end of May. During this period, patrolling is organized by the division with help of trawlers to prevent unauthorized entry of fishing vessels. Indian Coast Guard also carries out its own patrolling and at times joint patrolling is carried out. Illegal fishing vessels when



apprehended are prosecuted under Wildlife Protection Act, 1972. Onshore and offshore camps are established to monitor turtle mortality, movement of illegal fishing vessels and organizing movement. Movement pattern of turtle congregation is monitored in the water during the course of patrolling. The beach is monitored and suitable sites for nesting are cleared of debris. At the time of mass nesting, census of nesting turtles are carried out scientifically and the number is estimated. Steps are taken to prevent damage of eggs by dogs, wild animals like jackals and wild boars. At the time of hatching, steps are taken to prevent mortality by seagulls, crows etc. and if required the hatchlings are helped manually to enter into the sea. During the time of nesting and hatching, lights on the seaward side are switched off by DRDO authorities. Ant poaching Squads. Anti depredation Squads are engaged to prevent illegal poaching at vulnerable points. Awareness campaigns are organized among people to protect wildlife.

3.8 Protection and Management of Fauna:

There are dedicated staffs for protection/management of the wild fauna. Olive Ridley Marine Turtles arrive in the small islands like Wheeler Group of Islands, etc. and conspicuous in the coastal waters in 2nd half of October every year and remain till end of May. During this period, patrolling is organized by the division with help of trawlers to prevent unauthorized entry of fishing vessels. Indian Coast Guard also carries out its own patrolling and at times joint patrolling is carried out. Illegal fishing vessels when apprehended are prosecuted under Wildlife Protection Act, 1972. Onshore and offshore camps are established to monitor turtle mortality, movement of illegal fishing vessels and organizing movement. Movement pattern of turtle congregation is monitored in the water during the course of patrolling. The beach is monitored and suitable sites for nesting are cleared of debris. At the time of mass nesting, census of nesting turtles are carried out scientifically and the number is estimated. Steps are taken to prevent damage of eggs by dogs, wild animals like jackals and wild boars. At the time of hatching, steps are taken to prevent mortality by seagulls, crows etc. and if required the hatchlings are helped manually to enter into the sea. During the time of nesting and hatching, lights on the seaward side are switched off by DRDO authorities. Ant poaching Squads. Anti depredation Squads are engaged to prevent illegal poaching at vulnerable points. Awareness campaigns are organized among people to protect wildlife. Details of year wise cases booked including wild life cases during last plan period have been furnished in Table 2.6



3.8.1 Status survey of birds:

Annual status survey of birds is conducted in the month of January every year. Data on bird population is collected by direct count from 20 different units through formation of team and analyzed centrally. Report of bird population survey for last 10 years is given in Table 3.3 below.

Table 3.3 Bird Population Report of last 10 years				
Year	Inside Protected Area (BKNP, BKWLS, GMWLS)	Outside Protected Area Mahanadi Delta Area (Kujang&Mahakalapada)	No of Species	Total No. of Birds
2011	45,610	7,526	107	53,136
2012	50,078	02,164	118	52,242
2013	65,159	16,242	111	81,401
2014	30, 938	37,576	106	68,514
2015	84,219 + 344= 84,563	28,277+ 386=28,663	109	1,13,226
2016	81, 874	24,482	87	1,06,356
2017	25,310	46,958	109	72,268
2018	66,019	46,918	83	1,12,937
2019	44,101	64,958	74	1,09,059
2020	40440	77886	105	1,18,326

3.8.2 Status survey of Dolphins:

Annual status survey of dolphins is being conducted since 2014 annually. Dolphin status survey report from 2014 to 2019 is given in Table 3.4

Table 3.4 Status Survey of Dolphins from 2014 to 2019								
Years	Number of Dolphins							
	Irrawaddy Dolphin	Bottle nose	Humpback Dolphin (Sousachinensis)	Humpback Dolphin (Sousaplumbea)	Pantropical Spotted Dolphin	Finless porpoise	Ganges River Dolphin	Total
2015	58	23	123	50	15	01	00	270
2016	12	00	07	00	00	00	00	19
2017	55	00	16	06	05	00	00	82
2018	45	92	108	62	00	00	00	307
2019	14	00	96	02	00	00	00	112



3.8.3 Monitoring of Olive Ridley sea turtles:

Gahirmath is one of the largest rookery of olive ridley sea turtle in the world. Two offshore and 14 onshore camps are established from November to May every year. Daily information on turtle mortality, nesting and hatching is collected from all the camps and reporting made to state wildlife headquarters. State wildlife headquarters is developing software for monitoring of sea turtles. While mass nesting site is in Gahirmatha Wildlife Sanctuary, sporadic nesting takes place all along the sea shore of the Division.

3.8.4 Herbivore Survey:

Annual status survey of herbivore is conducted every year in the month of November. The status report on "Estimation of mammals except aquatic is given in **Annexure-VII**.

3.8.5 Status Survey of estuarine crocodile:

Status survey of estuarine crocodiles in the river system of the Division is conducted annually during December/ January under supervision of experts. The crocodile census is done every year in the Rajnagar (WL) Division, from 89-90. Earlier the census was carried out only in the Sanctuary area, from 2001-02 onwards, census is being done outside Sanctuary area also. The status of last plan period outside Bhitarkanika sanctuary is furnished below.

Table 3.5 Status survey of estuarine crocodile					
Sl. No.	Year	Nos. of Crocodile	Sl. No.	Year	Nos. of Crocodile
1	2006-07	69	6	2011-12	110
2	2007-08	77	7	2012-13	107
3	2008-09	88	8	2013-14	89
4	2009-10	101	9	2014-15	62
5	2010-11	102			

The information pertaining to Animal / Birds Survey data after 2018 onwards are furnished below. The further development from 2018 onwards are furnished below

1. Crocodile Census Data:

Table No 3.6 Estimation of Saltwater Crocodile Survey From The Year 2018-19 To 2023-24						
Year	Hatchling	Yearling	Juvenile	Sub Adult	Adult	Total
2018-19	619	347	273	178	325	1742
2019-20	620	325	288	185	339	1757



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2020-21	593	367	320	152	336	1768
2021-22	564	378	338	158	346	1784
2022-23	569	388	325	166	345	1793
2023-24	582	387	327	167	348	1811
Average	591	365	312	168	340	1776

2. Dolphins Population Estimation From The Year 2018 to 2024

Table No 3.7: Dolphins Population Estimation From The Year 2018 to 2024

Year	No. of Dolphins Estimated							
	Irrawaddy Dolphin	Bottle nose	Humpback Dolphin	Pantropical Spotted Dolphin	Striped Dolphin	Finless Porpoise	Spinner Dolphin	Total
2018	45	92	170	00	00	00	00	307
2019	14	00	98	00	00	00	00	112
2020	60	00	02	00	00	00	00	62
2021	39	22	281	00	00	00	00	342
2022	45	135	332	00	13	00	15	540
2023	06	52	489	00	00	00	03	550
2024	22	00	480	00	00	00	00	502
Aver.	33	43	265	0	13	0	19	345

3. Number of Mass Nesting of Olive Ridley Sea Turtle in Gahirmatha Coast From 2018-19 TO 2022-23

Table No 3.8 Mass Nesting of Olive Ridley Sea in Gahirmatha Coast

Sl. No.	Year	No. of Nesting Olive Ridley Turtles Counted.	No. of Olive Ridley Turtles Emergence Hatchlings	Ratio(Hatchling/ Olibe Ridley turtle
1	2018-19	4,50,949	1,95,71,655	43
2	2019-20	4,07,204	2,05,94,000	51
3	2020-21	3,49,649	1,71,81,710	49
4	2021-22	5,01,157	2,19,62,476	44
5	2022-23	5,12,175	2,19,62,476	43
Average		4,44,227	2,02,54,463	46



4. Status Survey on Colonial Nesting Birds at Heronries in Bhitarkanika Mangroves (Bagagahan) from the year 2018 to 2023

Table No 3.9 Colonial Nesting Birds at Heronries in Bhitarkanika Mangroves (Bagagahan)

Year	No. of Trees with Nests	No. of Nests counted	Total No. of Birds Estimated	Species
2018	1911	19,890	91,224	10
2019	1723	19,296	88,614	10
2020	1424	21,185	97,866	10
2021	1404	22,828	1,08,639	10
2022	1618	24,464	1,16,070	10
2023	1760	26,118	123867	10
Ave	1640	22297	104380	10

5. Mid- Winter Waterfowl Status Survey

Table No 3.10: Mid- Winter Waterfowl Status Survey

Year	Inside Protected Area	Outside Protected Area Mahanadi Delta Area (Kujang & Mahakalapada)	No of Species	Total No. of Birds
2018	66,019	46,918	83	1,12,937
2019	44,101	64,958	74	1,09,059
2020	40,440	77,886	105	1,18,326
2021	69,122	66,970	121	1,36,092
2022	Inside & outside Protected Areas		144	1,38,107
2023	Inside & outside Protected Areas		140	1,39,959
2024	Inside & outside Protected Areas		121	1,51,421
	Average		113	129414

3.8.6 Man-Animal Conflict:

Man-animal conflict in the Division is in the form of human injury and kill by crocodile and wild boar and crop damage by wild boar and deer. The intensity of conflict in working plan area is less in comparison to the sanctuary area. To reduce the conflict activities like fencing along forest boundary with chain link wire mesh and wire mesh fencing of bathing ghats in crocodile prone area is taken up every year. Compassionate amounts are paid to victims.



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Table 3.11 Depredation and Compassion Amount paid during last plan period

Year	Human Kill	Human Injury by Crocodile	Human Injured by Wild Pig	Crop Damage	Cattle Kill	Compassionate Amount paid
2006-07	-	0	0	0	0	0
2007-08	-	0	0	0	0	0
2008-09	-	0	0	0	0	0
2009-10	-	0	0	0	1	1500/-
2010-11	-	0	0	0	0	0
2011-12	-	0	0	0	0	0
2012-13	-	0	0	0	0	0
2013-14	-	0	8	0	1	5000/-
2014-15	-	5	3	0	0	30,000/-
2015-16	-	0	0	0	1	2500/-

Table 3.12 Human kill and injury and compensation paid.

Year	Human Kill	Human Injury	
		by Crocodile	by Wild Pig
2006-07	-	0	0
2007-08	-	0	0
2008-09	-	0	0
2009-10	-	0	0
2010-11	-	0	0
2011-12	-	0	0
2012-13	-	0	0
2013-14	-	0	8
2014-15	-	5	3
2015-16	-	0	0

Table: 3.13 Death of Wild Animal with cause of death

Name of the Range	Sl. No.	Date of detection	Name of the death Wild Animals	No. of death of Wild Animals	Cause of death	O.R./U.D. Case No. & Year
Mahakalapada (Wildlife) Range	1	27.02.2008	Spotted Deer	01	Poaching	O.R. Case No.313M of 2007-2008
	2.	05.07.2008	Spotted Deer	01	Natural	O.R. Case No.56M of 2008-2009
	3.	02.01.2009	Dolphin	01	Poaching	U.D. Case No.04M of .2008-2009
	4	21.03.2009	Wild Boar	01	Natural	U.D. Case No.06M of 2008-2009
	5	20.11.2009	Trionyx Gangeticus	01	Natural	U.D. Case No.03M of 2009-2010
	6	09.03.2011	Spotted Deer	01	Natural	U.D. Case No.04M of 2010-2011



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	7	28.03.2011	Rotten Chital stay	01	Poaching	U.D. Case No.05M of 2010-2011
	8	19.06.2010	Crocodile	01	Poaching	O.R. Case No.37M of 2010-2011
	9	04.03.2011	Spotted Deer	01	Poaching	O.R. Case No.318M of 2010-2011
	10	05.12.2011	Open Bill Stork	01	Poaching	O.R. Case No.286M of 2011-2012
	11	03.06.2012	Indian Shelled Turtle	01	Poaching	U.D. Case No.01M of 2012-2013
	12	08.10.2012	Wild Boar	01	Natural	U.D. Case No.02M of 2012-2013
	13	27.10.2012	Crocodile	01	Natural	U.D. Case No.03M of 2012-2013
	14	23.09.2013	Crocodile	01	Natural	U.D. Case No.01M of 2013-2014
	15	08.11.2013	Crocodile	01	Natural	U.D. Case No.02M of 2013-2014
	16	16.10.2014	Spotted Deer	01	Poaching	O.R. Case No.122M of 2014-2015
	17	25.12.2014	Wild Boar	01	Natural	U.D. Case No.01M of 2014-2015
	18	29.12.2014	Wild Boar	01	Natural	U.D. Case No.02M of 2014-2015
Kujang (Wildlife) Range	1	27.03.2008	Spotted Deer	01	Natural	U.D. Case No.13Kj of 2007-2008
	2.	14.01.2008	Flap shell Turtle	01	Poaching	O.R. Case No.182Kj of 2007-2008
	3.	25.07.2008	Spotted Deer	01	Natural	U.D. Case No.05Kj of 2008-2009
	4	24.04.2009	Spotted Deer	01	Natural	U.D Case No.01Kj of 2009-2010
	5	01.01.2011	Kesharipandia	06	Poaching	U.D. Case No.03Kj of 2010-2011
	6	09.04.2011	Spotted Deer	01	Natural	U.D. Case No.01Kj of 2011-2012
	7	21.10.2014	String ray	01	Poaching	U.D. Case No.01Kj of 2014-2015

(i) Cases Booked under WPA,1972

The cases booked under Wildlife Protection Act, 1972 in MahakalpadaWL Range &KujangaWL Range is furnished below. (Table No-3.14)

Table No 3.14 : Cases Booked under Wildlife Protection Act, 1972				
Year	No of UD cases	No of OR cases	No of case send to Court	No of Person arrested
Mahakalpada WL Range				
2018-19	1	0	0	0
2019-20	1	3	3	10
2020-21	2	2	2	3
2021-22	1	2	0	2
2022-23	0	2	0	1
Kujanga WL Range				
2018-19	0	1	1	2
2019-20	0	0	0	0
2020-21	0	0	0	0
2021-22	0	1	1	1
2022-23	0	1	1	1

(ii) Animal death Reported;

Animal death reported from Mahakalpada WL Range &Kujanga WL Range is furnished below. (Table No-3.15)



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Table No 3.15: Animal death Mahakalpada WL Range &Kujanga WL Range

Sl.No.	Date of detection	Name of the Wild Animal	No. of death Wild Animal	Cause of Death	O.R/ U. D Case No. & Year
Mahakalpada WL Range:					
1	02.11.2018	Wild pig	1	Natural	U.D Case No. 1M of 2018-19
2	01.05.2019	Wild pig	1	Natural	U.D Case No. 01M of 2019-20
3	23.10.2019	Water Lizard	1	Poaching	O.R Case No. 77M of 2019-20
4	26.12.2019	Deer	1	Poaching	O.R Case No. 98M of 2019-20
5	21.01.2020	Deer	1	Poaching	O.R Case No. 110M of 2019-20
6	01.04.2020	Wild boar	1	Poaching	O.R Case No. 1M of 2020-21
7	02.05.2020	Small Wild pig	4	Natural	U.D Case No. 01M of 2020-21
8	09.09.2020	Wild boar	1	Poaching	U.D Case No. 02M of 2020-21
9	03.10.2020	Wild pig	1	Poaching	O.R Case No. 30M of 2020-21
10	21.04.2021	Deer	1	Poaching	O.R Case No. 1M of 2021-22
11	14.02.2022	Brahmin Ruddy Shelduck	7	Poaching	O.R Case No. 55M of 2021-22
12	11.03.2022	Wild pig	1	Natural	U.D Case No. 1M of 2021-22
13	05.02.2023	Deer	1	Poaching	O.R Case No. 26M of 2022-23
14	25.03.2023	Deer	1	Poaching	O.R Case No. 37M of 2022-23

Kujang WL Range:-

Sl.No	Year	No. Of Animal Death Reported	Reason of Death	Remarks(Animal Involved)
1	2018-19	5 nos	By Poaching	Migratory Birds
2	2019-20	1 nos	By Shock	Spotted Deer
3	2020-21	0	NA	NA
4	2021-22	8 Nos	By Shock, By Suffocation By consequences of starvation	Spotted Deer-4nos Dolphin-3nos, Shark-1nos
5	2022-23	4 Nos	By Shock, By Suffocation By Verminous pneumonia	Deer-2nos Dolphin-2nos
6	2023-24	8 Nos	Due to ruminal impaction, Due to hypo volume shock , By Suffocation	Deer-5nos, Shark-1nos Dolphin-2nos





CHAPTER – 4

Maintenance and Enhancement of Forest Health and Vitality:

4.1 Status of Regeneration:

Adequate data on status of regeneration is not available though natural regeneration of select group of mangrove Species are noticed in abundance. Seeds and hypocotyls drift in tidal water within creeks, rivers and bays establish in suitable sites. However no scientific study has been carried out. As is observed, regeneration is very low in coastal shelterbelt due to predominance of *Casuarina* plants. Other forests are mostly open forest with inadequate regeneration. The data on population dynamics of seedlings, saplings and young trees shall be collected to monitor the status periodically and find out the conditions in which a species regenerates best. Depending upon the status of regeneration, research plots for regeneration study may be provided in the prescription under chapter “Science and Research”.

4.2 Area Affected by Forest Fire:

Casuarina plantations are prone to fire hazard even at in the green stage, due to the presence of inflammable materials of thick mat of leaf needles on the ground during summer. The past reports of forest fire in the forests of this Division is below (at table No 4.1)

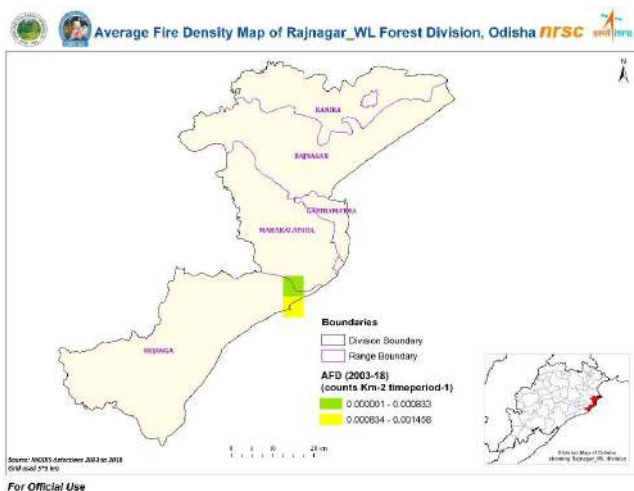
The Mangrove WL Division is not in a high fire probability zone of the state due to marshy landscape and tidal effect. The fire data obtained from Satellite (MODIS fire data) and steps taken for its extinction is furnished below (table No 4.1).

Table No 4.1 Incidence of Forest Fire in Rajnagar Division for Last 10 years (2013-14 to 2022-23)				
Year	No of Fire Incidence	Area in ha	Action Taken	Name of Forest Blocks affected
2013-14 to 2016-17	0	0	0	0
2017-18	3	1.13	Forest Staffs extinguished the fire with the help of the fire Bridget staff, Tirtol	BalikaniSandhakuda Casuarina Block Plantation &Barunei-Gahirmatha Forest
2018-19	1	0.52	Forest Staffs extinguished the fire by using Fire extinguisher	East Orasahi Forest Block (No Mangrove vegetation affected)
2019-20 to 22-23	0	0	0	0

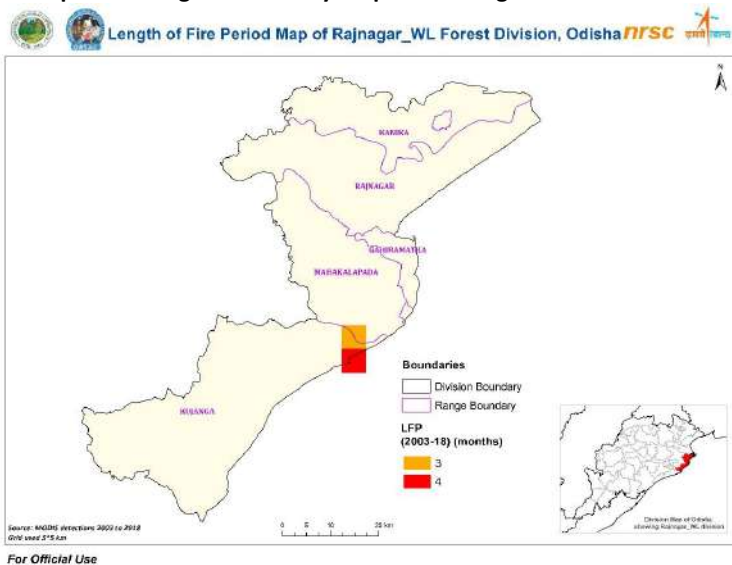


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Details of Forest fire from 2008-09 to 2018-19 are at **Annexure- VIII**



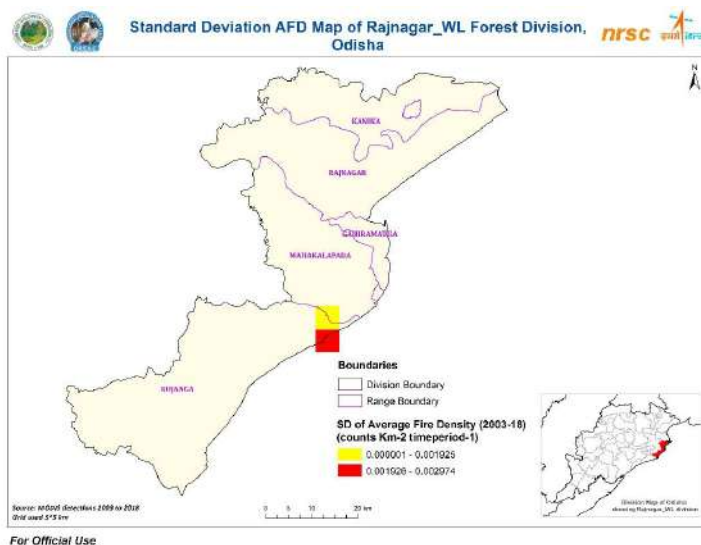
Map 4.1 Average Fire Density Map of Working Plan Area



Map 4.2 Length of Fire Period Map of Working Plan Area



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Map 4.3 Standard Deviation AFD Map of Working Plan Area

4.3 Area Damaged by Natural Calamities:

Cyclonic storms are now observed to be becoming regular phenomena. Major cyclonic storms experienced during last plan period is furnished below.

Year	2013	2014	2018	2019	2019
Name of Cyclone	Phailin	Hudhud	Titli	fani	Bulbul

Damage to infrastructure and new plantations happened both during *Phailin* & *Hudhud*. No significance damage to other forests occurred. Cyclonic storms have been experienced in subsequent years but of less intensity.

4.4 Area Protected from Grazing:

Grazing is one of the serious problems. Due to heavy livestock pressure in the division, natural regeneration in some blocks of the forest is affected severely.

4.5 Lopping Practices:

No practice of lopping is found in the forests of this Division.



4.6 Area Infested by Invasive Weed Species in Forests:

Invasion of *Eupatorium* and *Acanthus* is noticed in some open patches of mangrove forest. The forest blocks which are covered with *Casuarina* plantation, are not infested with invasive weeds.

4.7 Incidence of Pests and Diseases:

No incidence of pests and disease in the forest has been reported.

4.8 Forest Degradation and Its Drivers:

4.8.1 Illegal collection of timber and firewood:

There is no high forest in this Division. But there is a demand of small timber and firewood from the existing growth and coastal *Casuarina* plantations from the villages. Number of cases detected during the last plan period for illegal collection of timber and firewood has been furnished in Table No. 2.12. The intensity of illicit felling in different forest blocks is given in Table No.4.1

Table: 4.1 Intensity of Illicit Felling in Forest Blocks	
High	Jatadhar, Batighar, Balitutha
Moderate	Saralikuda, Nipania, Akashdia
	Bhuiarpal, Madhuban A & B, Kankan, Gopalpur, Salio
Low	Bagagahan, Petchhela, Kaunsiapal, Majhidia,

4.8.2 Encroachment of forest:

No forest block of this Division is finally notified. Notifications of PRF and DPF have been done much earlier. Boundary is not consolidated for which there is dispute at most of the blocks as regards boundary of the forest block vis-à-vis boundary of revenue plots and private plots. Though no forest land encroachment case has been booked due to disputed boundary, but there is always threat of encroachment unless boundary is consolidated. List of encroachment in the forest blocks has been furnished in Table 2.13.

4.8.3 Unregulated and illegal collection of NTFP:

Major NTFP of the forest blocks of this Division are Cashew nuts in Kujanga Range. Cashew nut is now being disposed through annual auction of existing plantations by forming a lot. Result of auction of cashew lot in last plan period is furnished in **Annexure VII**.



4.9 Pollution Control and Protection of Environment:

A number of industries have been established in Paradeep area. These industries are likely to affect the environment by air pollution and discharge of effluents to water body. One regional office of State Pollution Control Board has been established at Paradeep to monitor pollution control by the industries. The list of industries established in Paradeep is furnished in the table 4.2 below.

Table 4.2 List of Industries and other establishments in and around Working Plan Area		
SL.No	Name of the Industry / Establishment	Product/ Activity
1.	Paradeep Port Trust	Major port
2.	Paradeep Phosphate Ltd.	Chemical Fertilizer
3.	Indian Farmers Fertilizer Co-operative Ltd	-do-
4.	ESSAR STEEL (now AM/NS)	Steel
5.	Cargil India Ltd.	Edible oil
6.	SKOL Breweries	Breweries
7.	JSW Ltd.	Steel & captive port
8.	Eastern India Refinery Project (EIRP)	Petroleum products
9.	FALCON Marine export	Marine food processing
10	Surya Udyog Ltd.	-do-
11	Paradeep Carbon	Calcinite petroleum coke
12	IOCL	Refinery





CHAPTER – 5

Conservation and Maintenance of Soil & Water Resources:

5.1 Area Treated Under Soil & Water Conservation Measures:

The interventions for soil and moisture conservation in the forests is mainly creation of water bodies to make available fresh water in mangrove forests and also in forests grown on coastal sand. Apart from these, to facilitate flow of saline water to mangrove forests, fishbone channels are being created in upland areas of the forests. List of water bodies created during last plan period is furnished in the table 5.1 below.

Table 5.1 List of water bodies created in last plan period			
Year	Range	Location	Number
2010-11	Kujanga	Ramtara	01
2013-14	Kujanga	Baradia (Marichipur PF)	02

5.2 Duration of Water Flow in the Selected Seasonal Streams:

The state of Odisha normally receives 75% to 87% rainfall by South-West monsoon between second week of June and last week of September. The rainfall is evenly distributed across the Division. It is observed that this Division receives most rainfall during the month of June, July and August and gradually decreases towards end of the September. Water flow in the working plan area of the Division is in the form of discharge of water by Mahanadi and its branch systems in the form of a number of rivers/ rivulets, seasonal and perennial streams.

5.3 Wetlands in Forest Areas:

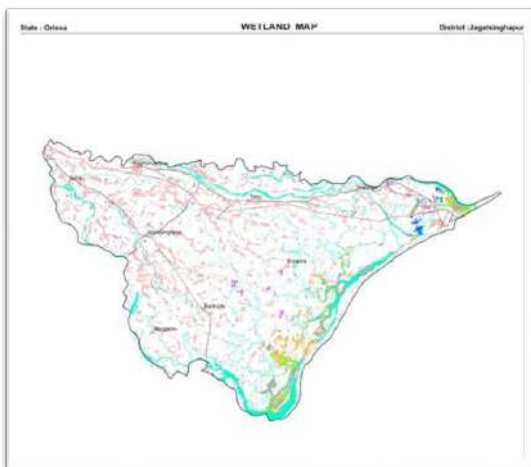
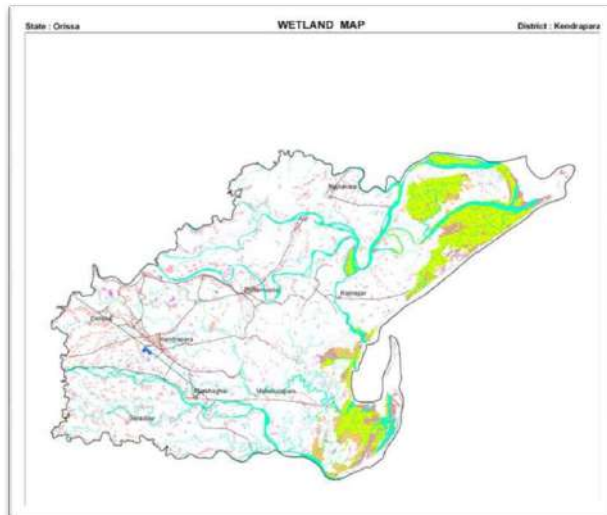
The forest blocks within Mangrove Forests Division (WL), Rajnagar included in Working Plans are basically islands and land areas which can be designated as wetlands. The mangroves in Mahakalapada Range form part of Bhitarkanika wetland which is a “Ramsar Site” i.e, wetland of international importance.

(i) Wetlands of the Division:

The wetlands available in Rajnagar WL Division are Mahanadi River System, Brahmani, Baitarani River system, Sea coast of Bay of Bengal, Tidal Mud flats of the river system and number of Creeks javelining the mangrove forests of the division. The wetland atlas of Kendrapara District and Jagatsinghpur Division are given below.



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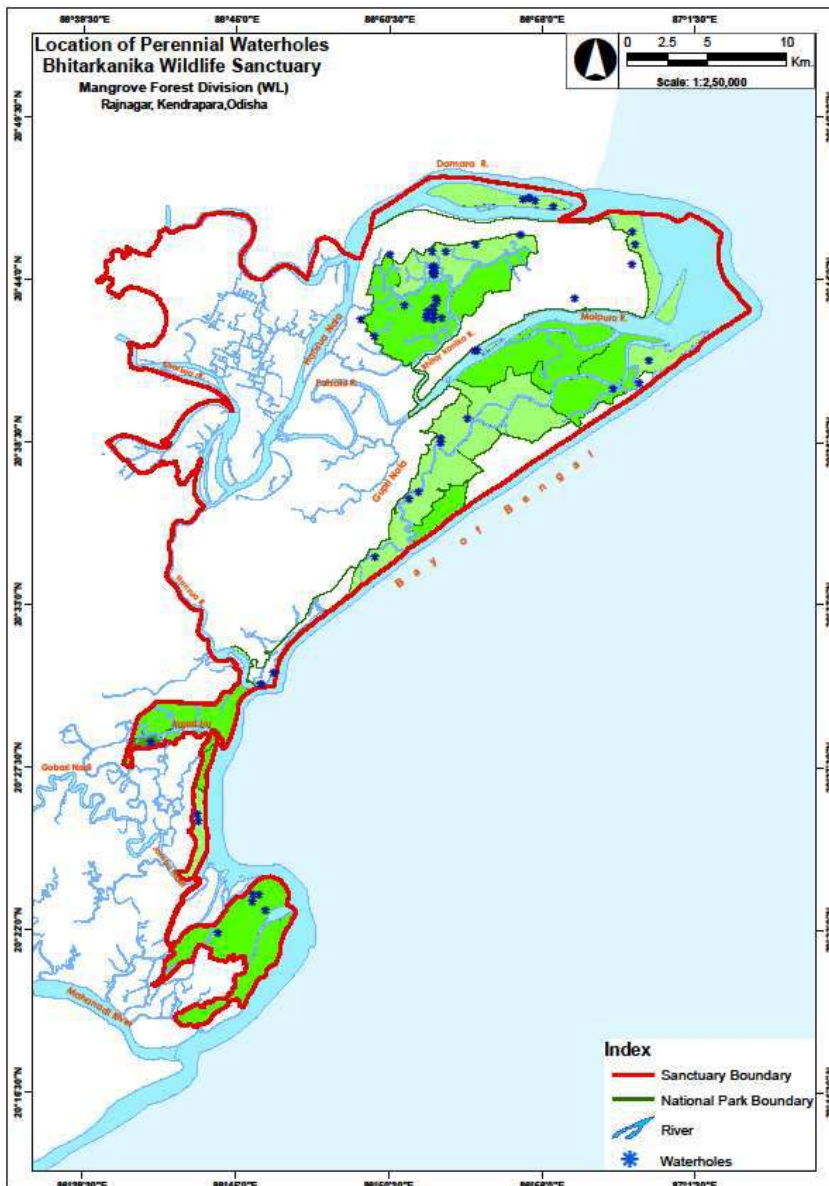


Symbol	Typecode	Level I	Level II	Level III
		Island Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			On-low lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			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

Wetland maps of Rajnagar WL Division has been provided by NRSC, Hyderabad and furnished below for reference.



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Out of all these Wetlands of Kendrapara district and Jagatsinghpur district, the Bhitarkanika has already been declared as Ramsar Site / National Park / Wetland / Integrated ESZ. The copy of the notification is at **Annexure-V**.

Besides the above there is no other proposal for declaration of Wetlands in the Division.

5.4 Water Level in the Wells in the Vicinity (Up To 5 Km) Of Forest Area:

In the coastal tracts the water table is generally high and water availability is not a problem barring few areas. The details of the ground water levels are recorded in different places in each district. There are about 28 places in Jagatsinghpur and 17 places in Kendrapara district where the ground water level is monitored. The water level is higher in Kendrapara and Jagatsinghpur districts and the probable reason may be nearness to the coast. The water level recorded at different places is given in the Table 5.2& 5.2. Water level varies widely from places to places in this division. In coastal sandbar freshwater is available in shallow wells and ultra deep bore wells whereas presence of saline water is seen in between these extremes. A number of water bodies have been created in the forest areas of this division during the last plan period. During the last plan period 07 Water bodies have been excavated at Baradia, Hetamundia, Kansaridiha, Jamboo and Ramatara for multipurpose utility.

Table: 5.2 Depth of Ground Water(in Mts.)in JagatsinghpurDistrict						
Sl. No.	Location	Near the Forest Block	Jan.	April	Aug.	Nov.
1	Balikuda	Goda PF, Garhbishnupur RF	1.42	1.97	0.74	0.68
2	Balikuda	Goda PF, Garhbishnupur RF	3.33	4.56	1.56	2.86
3	Balituth	Balitutha PF, Madhuban A& B PF	2.12	2.55	1.29	1.66
4	Borikina	Goda PF, Brahmandia PRF	1.9	2.58	0.83	0.91
5	Ersama	Gopalpur PF, Dhobei PF, Garhbishnupur PF	1.27	2.34	0.44	0.58
6	Gobindpur	Dhinkia-Nuagaon PF	2.08	1.78	0.56	0.65
7	Gopinathpur		1.34	3.1	0.22	0.43
8	Jagannathpur	Brahmandia PRF, Tentulibelari PF	2.39	3.52	1.55	1.66
9	Jaipur	Gopalpur PF, Garbishnupur PF	1.13	1.27	0.72	0.75
10	Kujang	Balitutha PF, Kankan PF	2.44	2.85	1.15	1.2
11	Kujang	Balitutha PF, Kankan PF	1.1	1.51	0.15	0.75
12	Kumartotachak		2.06	2.36	1.25	1.19



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13	Machgaon	Marichpur PF, Brahmandia PRF	2.85	3.68	1.18	1.66
14	Nuagaon	Madhuban A & B, Bhuiyanpal PRF, Noliasahi PF	2.37	3.54	0.77	1.2
15	Paradeep	Majhidia PF, Boitarkud PF, Saralikuda PRF	3.26	3.55	2.86	3
16	Paradeepgarh	Majhidia PF, Boitarkud PF, Saralikuda PRF	1.08	0.51	0.36	0.1
17	Paradeepgarh	Majhidia PF, Boitarkud PF, Saralikuda PRF	1.23	1.74	0.8	1.12

Source: Director, Central Ground Water Board

Table: 5.3 Depth of Ground Water (in Mts.)in Kendrapara District

Sl No.	Location	Near the Forest Block	Jan.	April	Aug.	Nov.
3	Mahakalpara	Kaunsiapal PF, Bagagahan PF	1.7	2.31	0.9	0.9
4	Marshaghai	Petchhela PRF, Badatubi PRF	1.8	2.27	0.6	0.7
5	Nikrai		3	3.61	1.9	2.3
6	Patkura	Petchhela PRF, Badatubi PRF	3.7	4.35	1.6	2.4
8	Pattamundai		3.5	3.9	2.6	3.1
9	Rajgarh		2.2	3.04	1.1	1.4
10	Rajnagar-R		2.3	2.93	1.8	1.5

Source: Director, Central Ground Water Board

5.4.1 Water Quality:

Coastal areas represent zones where land and sea meet and comprises variety of complex environments including deltas, estuaries, bays, marshes, dunes and beaches. Coastal aquifers have boundaries in contact with seawater and are always under dynamic equilibrium with it. As per a report of Central Ground Water Board, Ground water in coastal areas occurs under unconfined to confined conditions in a wide range of unconsolidated and consolidated formations. Normally, saline water bodies owe their origin to entrapped sea water (connate water), sea water ingress, and leachates from navigation canals constructed along the coast, leachates from salt pans etc. In general, the following situations are encountered in coastal areas



- i. Saline water overlying fresh water aquifer
- ii. Fresh water overlying saline water
- iii. Alternating sequence of fresh water and saline water aquifers

In India, salinity problems have been observed in a number of places in coastal areas of the country. In Orissa in an 8-10 km. wide belt of Subarnrekha, Salandi, Brahamani outfall regions in the proximity of the coast, the upper aquifers contain saline horizons decreasing landwards. Some of the options available for removal of salinity from drinking water are –

- i) Electro dialysis
- ii) Reverse Osmosis
- iii) Ion exchange

As per 2015 report of CBGW on ground water in shallow aquifers, Kendrapada District is affected by salinity (high electrical conductance). Iron contamination is high in many Districts of Odisha including Kendrapada and Jagatsinghpur. Both the Districts also show nitrate contamination beyond permissible limit. The locations of different contaminations in working plan area are furnished in the table below.

Table 5.4 Location of different water contaminations			
District	Block	Location	Type of contamination
Jagatsinghpur	Balikuda	Balikuda	Iron (>1.0 mg/l) 3.135
	Ersama	Balitutha	Iron (>1.0 mg/l) 1.571
		Machhagaon	Iron (>1.0 mg/l) 1.586
	Kujanga	Balarampur	Iron (>1.0 mg/l) 38.73
		Bhutamundai	Iron (>1.0 mg/l) 9.108
		Paradeep Garh	Iron (>1.0 mg/l) 10.63
Kendrapada	Pattamundai	Rajgarh	Iron (>1.0 mg/l) 2.487
	Rajnagar	Rajnagar	Iron (>1.0 mg/l) 1.445

5.5 Status of Aquifers

In the coastal tracts the water table is generally high and water availability is not a problem barring few areas. The details of the ground water levels are recorded in different places in each district. There are about 28 places in Jagatsinghpur and 17 places in Kendrapara district where the ground water level is monitored. The water level is higher in Kendrapara and Jagatsinghpur districts and the probable reason may be nearness to the coast. The



water level recorded at different places in both the Districts is given in Table 5.2 & 5.3. The forest blocks within Mangrove Forests Division (WL), Rajnagar included in Working Plans are basically islands and land areas which can be designated as wetlands. Water level varies widely from places to places in this division. In coastal sandbar freshwater is available in shallow wells and ultra deep bore wells whereas presence of saline water is seen in between these extremes.





CHAPTER –6

Maintenance and Enhancement of Forest Resource Productivity:

6.1 Growing Stock of Wood:

There is no high forest to study the mean annual increment (MAI) of tree species with respect to base year. In this plan advanced technologies of Remote Sensing and Geographical Information System have been employed to make an assessment of the growing stock of Division. NRSA have developed the methodology for use of this technology in the preparation of Working Plan. Satellite remote sensing and GIS based methods have been operationally employed to provide forest working plan inputs in various forest divisions across the country. These efforts have demonstrated that significant reductions in cost and time can be achieved by relying on stratified sampling methods based on mapping forest canopy density and forest type using satellite remote sensing.

With this background the Orissa Remote Sensing Application Center (ORSAC) and the Forest and Ecology Division of National Remote Sensing Agency (NRSA) were requested to provide working plan inputs for forest divisions in Orissa by the Orissa State Forest Department (OFD).

6.1.1 Methodology:

The methodology adopted for the assessment of the growing stock and yield calculation is given in the following flow diagram. (The entire text of methodology is provided by NRSA, Hyderabad)

Standard FCC imagery generated by combining bands 4, 3 and 2 of LISS-111 camera. In the Image, the forests are appearing in dark red to light red tone. The richness of the red indicates the vigour of the leaves and their sizes. Patches of light red mottled tones represent scrub vegetation. In agricultural lands, the bright tones are an indication of dry fallow fields. The light blue patches indicate moist fallow lands. The light greenish tones are ploughed fields. Water bodies were indicated in blue and black tones. Supervised classification procedures are the most important analytical tools used for the extraction of more information from remotely sensed digital image data. So, the multi spectral classification was carried out using supervised classification technique with maximum likelihood classifier.

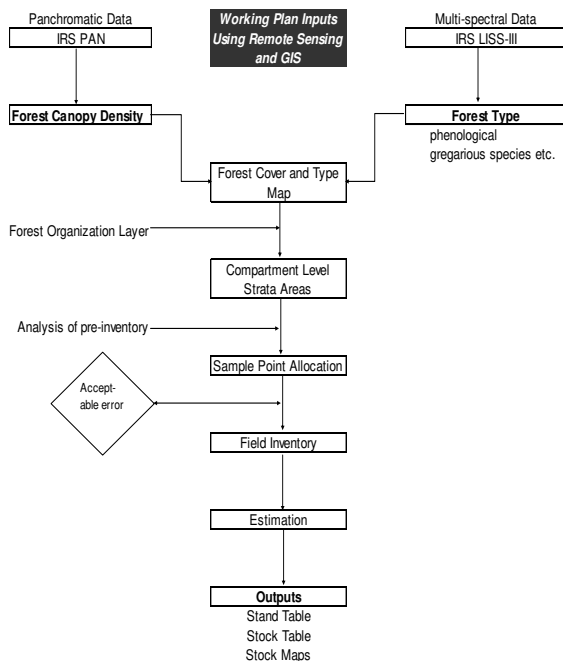


Fig.No. 8.1: Methodology Flow Chart

Prior to this, field inventory details and on the basis of tone, texture, colour, spectral reflectance pattern, homogenous training sites for classification identified on the satellite image.

6.1.2 Sampling design:

The objective of field inventory was to provide estimates of the growing stock of economically important species. Inventory design was based on a stratified random sampling design which was followed based on the forest canopy density and forest type layers generated using satellite remote sensing. A pre-inventory was first carried out to assess the variability within and across strata.

Sampling intensity, inventory point allocation at the compartment/ division level and allowable sampling error, and approaches to optimize the inventory effort for the project



was technically deliberated and approved by Project Execution Committee and Project Management Committee.

The entire Division was divided into Rehabilitation Working Circle (RWC) and Non Rehabilitation Working Circle (NRWC) based on historical information of growing stock. Accordingly it was planned to generate stand and stock and yield information at compartment/coupe level for the Rehabilitation Working Circle (RWC) areas and only growing stock information at forest block level for Non Rehabilitation Working Circle (NRWC) areas. Based on this suitable sampling design and estimation procedures were followed to address the requirements of RWC and NRWC areas.

An optimal sampling design with high precision in the estimate was adopted to address the large variability of forest composition and stock in the division. The precision of the sample estimate of the population depends not only on the size of the sample but also on the variability in the population. When the variability in the population was very high, the sample variance was reduced by dividing the population into number of homogenous vegetation strata and then selecting the inventory points randomly. This procedure is called as stratified random sampling. The use of stratification was very convenient with the advantage of forest type classified map and forest crown density map available from remotely sensed data. Therefore to optimize the intensity of ground inventory and enhance the precision of the estimates, stratified random sampling procedure was adopted for growing stock assessment.

The precise sample estimates are generated based on adequate sample size and its distribution pattern and finally estimation procedure followed against a defined error, time and cost limits. Sample size and distribution was determined in consonance with spatial variability in the strata distribution and growing stock conditions. 102 number of sample points were distributed randomly across the entire division as pre inventory points to understand the spatial trends in the variability of growing stock and estimate the sample size. Out of the 102 points provided, 27 points are outside the Working Plan area. The number of points distributed in different ranges and forest blocks are given in the Table No. 6.1. The location of the individual sample points along with latitude and longitude, the forest block and compartment are given in the Annexure VII. However considering the details required for NSWC areas are limited to only total growing stock at forest block level, the sampling intensity of 0.05% was fixed.



Table 6.1 Range wise distribution of Sample Plots		
Sl No	Name of the Range	No. of Sample Point
1	Mahakalpada (WL) Range	52
2	Kujang WL Range	44
3	Gahirmatha (WL) Range	06
	Total	102

Inventory points were located on the ground using GPS receivers. As an alternate method inventory points were also transferred onto 1:50,000 scale SOI topographic sheets as complementary information to the field staff to reach the desired locations.

Total 102 sample points are assigned to this Division for enumeration, out of which 75 sample points came inside the working plan area and 27 points outside. The enumeration has been done in the 102 points.

The details of the categorization of the sample points on the basis of canopy density is given in the Table No. 6.2

Table 6.2 Canopy density strata wise distribution of sample points					
Range	No. of sample points by canopy Density Class				
	>70%	40-70%	10-40%	<10%	Total
Kujanga	0	6	7	12	25
Mahakalapada	0	19	7	15	41
Total	0	25	14	27	66

6.1.3 Forest inventory:

The field inventory was carried out by field staff of Working Plan Division. The field staff were trained and equipped in accordance with the inventory manual prepared by NRSA/ORSAC.

The sample points distributed over the compartments were overlaid on the 1:50,000 scale Survey of India (SOI) map. The sample point location maps along with latitude and longitude positions were provided to the field party. A field inventory workshop and orientation camp was organized for all the field officers to train them about the methodology, use of GPS and different types of maps and maintain uniform methodology across the teams. Field inventory manual detailing all the steps of data collection was provided to field officers.

Collection of Inventory Data: The enumeration sheets given to field staff consisted of 3 formats such as Form No. A, B and C.



- I. *Form No. "A"* meant for recording of data of situation of the point its longitude, latitude, map index, landscape, forest type, slope, soil type and texture, reference point etc. and about the identity of enumeration party including regeneration survey.
- II. *Form No. "B"* for recording enumeration result of different forest species of a particular point within 0.1 Ha. Area beyond the girth class of 31.4 cms including clear bole height and tree height.
- III. *Form No. "C"* meant to record information of bamboo enumeration. The growth of the bamboo, circumference of the clumps in meters, culms height in mtrs., Number of culms existing in clumps in 1st Year, 2nd Year, 3rd Year, 4th Year and above. Data generated by the field inventory crews were entered into the inventory database. The data collected through point enumeration were compiled and all data are sent to NRSA for further analysis. This data was integrated with the geodatabase.

6.1.4 Data analysis and outputs:

After the final phase inventory was completed, the total inventory data was overlaid on the forest type/ crown density intersected layer. For the estimation of growing stock, the crown density map was collapsed into two major classes – 10-40% and >40% crown density classes. The forest type with three classes was intersected with the crown density layer with two classes as mentioned above. Thus the six main spatial strata were obtained. Similarly, the inventory points, spatial layer were intersected with the six strata with the infrastructure layer.

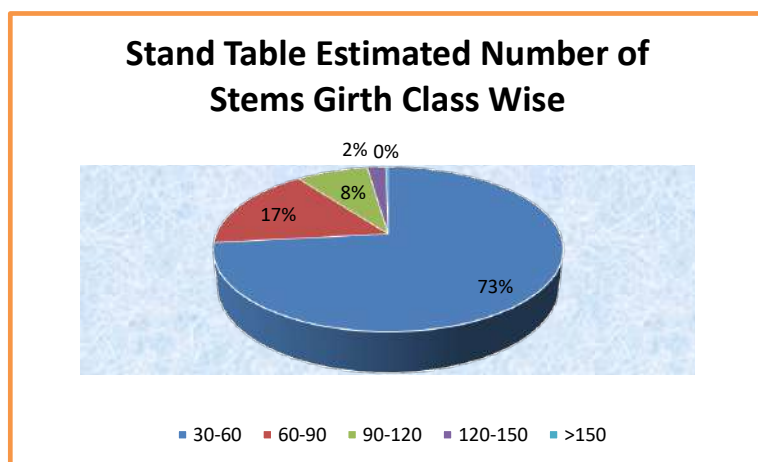
As a first step, timber volume was computed for each inventory point for the identified economic species as well as for the pooled "misc" category. The timber volume was computed using the following volume equations.

Now, for each compartment, based on the mean value for the plots falling in each stratum, the stand and stock for each economic species was computed. The stratum in the compartments where there are at least three sample points are called "represented" where the mean timber volume can be extrapolate for the specific stratum. The remaining strata are called "unrepresented" for which minimum number of inventory points are not available. As the compartment number is fairly large, it was not optimal to have at least three points in each stratum in each compartment. Moreover based on the remotely sensed data as well as sample points it is known that similarity do exist amongst the



compartments in terms of volume ranges and species composition. In order to resolve this, the similar compartments were grouped into zones in terms of context, neighbourhood, physiography, terrain and species composition. Thus, for the unrepresented stratum in the compartment, the zone level mean for the particular stratum was taken and the value for the stand and stock were computed. Finally compartment wise total stand and stock table was computed by adding up the contributions from each stratum. Finally the stand and stock table is prepared for the entire Division (The entire above text of Data analysis and outputs was provided by NRSA).

Table 6.3 Range wise Stand Table Estimated number of Stems						
Range	Girth Class (Cm)					Total
	30-60	60-90	90-120	120-150	>150	
Kujanga	305260	73876	34245	7644	1282	422307
Mahakalapada	489738	103986	52022	14045	2107	661898
Total	794998	177861	86268	21689	3389	1084204

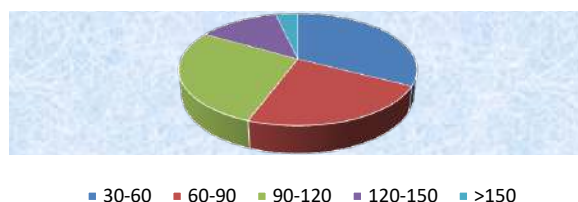


Graph 6.1 Stand Table Estimated Number of Stems



Table 6.4 Range wise Stock Table Summary Estimated Volume of Trees (Volume in Cum)						
Range	Girth Class (Cm)					Total
	30-60	60-90	90-120	120-150	>150	
Kujanga	21659	15229	18151	7586	2216	64911
Mahakalapada	32173	22940	27513	14046	3707	100379
Total	53832	38239	45663	21631	5924	165290

**Stock Table Estimated Volume
of Trees Girth Class Wise**



Graph 6.2 Stock Table Estimated vol. of trees

Details of sample Points provided for Sample Point enumeration is at **Annexure-IX** & corresponding Stock maps generated by NRSC, Hyderabad are at **Annexure-IXA**. The Sample Point Crop analysis Divisional Report is at **Annexure XIX**.

6.2 Growing Stock of Bamboo:

No bamboo forest exists in the working plan area of the Division.

6.3 Increment in Volume of Identified Timber Species:

There is no high forest to study the mean annual increment (MAI) of tree species with respect to base year.

6.4 Efforts Towards Enhancement of Forest Productivity through Quality Plantation Activities

Plantation activities in this Division is very low and maximum activities are restocking of mangrove forests which have been encroached or cleared for aquaculture or other purpose. There is no commercial exploitation in the forests and most of the mangrove areas are now included in Bhitarkanika wildlife sanctuary. Enhancing productivity has never been aimed at.



6.4.1 Clonal sapling, and year wise raising clonal saplings for quality production:

There is no Central Nursery in Mahakalapada or Kujang Range producing Clonal seedlings for plantation. In this division, mostly mangrove seedlings are produced and planted. There is one nursery at Jagatjore (Mahakalapada Range), Steps will be taken to produce 50000 seedlings annually (QPM) for mangrove plantations.

Table No 6.5: List of Nursery (Rajnagar WL Division)		
Name of Central Nursery	Target for Clonal seedling production	QPM (Year wise, if proposed.
Jagatjore (Mahakalapada Range)	Nil	50000 seedlings per year (QPM)

6.5 Carbon Stock:

The carbon stock assessment has not been done in past due to want of high forests. The field inventory was carried out by field staff of this Division.

6.6 Carbon Sequestration and Mitigation:

Utmost care shall be taken to enhance carbon sequestration through recognized and innovative silvicultural practices, eco-restoration of degraded forestlands so as to improve biomass productivity thereby resulting in improving forest health and vitality. Forest soil must be kept as healthy and fertile as possible and the forest crops must be kept as vigorous as possible to produce as rapidly as they can till the biomass production attains its most desirable level. The growing stock of trees must be so constituted that it provides regularly the greatest possible quantity of the desired products including intangible benefits.

Degradation and deforestation of the world's tropical forests are cumulatively responsible for about 10% of net global carbon emissions. Therefore, tackling the destruction of tropical forests is core to any concerted effort to combat climate change. Traditional approaches to halting tropical forest loss have typically been unsuccessful, as can be seen from the fact that deforestation and forest degradation continue unabated.

The UN-REDD Programme is the United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD+) in developing countries. The Programme was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations



Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD Programme supports nationally-led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation. REDD incentivizes a break from historic trends of increasing deforestation rates and greenhouse gases emissions. It is a framework through which developing countries are rewarded financially for any emissions reductions achieved associated with a decrease in the conversion of forests to alternate land uses. Having identified current and/or projected rates of deforestation and forest degradation, a country taking remedial action to effectively reduce those rates will be financially rewarded relative to the extent of their achieved emissions reductions.

REDD⁺ provides a unique opportunity to achieve large-scale emissions reductions at comparatively low abatement costs. By economically valuing the role forest ecosystems play in carbon capture and storage, it allows intact forests to compete with historically more lucrative, alternate land uses resulting in their destruction. It encourage developing countries to contribute to mitigation actions by voluntarily undertaking activities that reduce greenhouse gas (GHG) emissions and that enhance carbon sinks in the forest sector. The five activities that comprise REDD⁺ are:

- a) Reducing emissions from deforestation;
- b) Reducing emissions from forest degradation;
- c) Conservation of forest carbon stocks;
- d) Sustainable management of forests;
- e) Enhancement of forest carbon stocks.

Within its remit, REDD⁺ has the potential to simultaneously contribute to climate change mitigation and poverty alleviation, whilst also conserving biodiversity and sustaining vital ecosystem services. At present there is no high forest in this Division to avail the benefit of REDD⁺, the scientific management of the forests of this Division shall have to aim at sustainability along with improvement of the growing stock to take to them to the extent of qualifying for availing the benefits of REDD⁺. The VSSs protecting a large chunk of forests of this division shall have to be motivated in this direction.

Chaturvedi et al. (2011) have assessed the impact of climate change on forests of India including for Odisha State and has reported that forests in Odisha state are likely to be among least vulnerable forests in the country under A1 as well as B2 emission scenarios



during the present century, and this is on account of high diversity, low fragmentation, high tree density and low rate of forest vegetation change. Odisha Forests are likely to be benefited by increase in NPP from lower warming and increase in precipitation. Projected change in forest grids (which means change in present vegetation since the future climate is not likely to be suitable for it) is indicative of high carbon flux activity at local level, which has implications for REDD+ initiatives and carbon stocks. Alongside this projected biophysical response of Odisha forests, the anthropogenic pressure on forests due to removal of round-wood and fuel wood, incidents of fire, land-use change to non-forest purposes, cattle grazing etc., which result in forest carbon loss also needs to be considered and mechanisms that ensure avoiding such loss must be established for securing forest carbon. Formally engaging local communities in protection, development and conservation of forests provides such an opportunity. By June 2011, 19.76 % (1.148 million hectare) of notified forest area in Odisha state was under joint management between 12,494 local community institutions at village level VSSs and Odisha Forest Department (ICFRE 2011). This process is harmonizing the unregulated usage of forest by addressing demand-supply situation, and the communities are taking over the role of planner, manager, user and regulator of the forest resource. This forest-securing mechanism is likely to be operationalized over remaining forest areas in Odisha state, which is likely to set up a carbon-conservation regime that would develop carbon consciousness in use of forest products and forestland. Also, the Climate Change Action Plan developed by the Government of Odisha is an important document setting direction for necessary mitigatory and adaptation actions to be taken in all the relevant sectors of development including forestry, which is further likely to address the vulnerability issue in respect of forest carbon stocks. In view of the above, forest carbon stocks in Odisha State appear largely secured, however, this inference could be only as certain as the projections about climatic changes, the actual turn out of community involvement mechanism, and implementation of the other mitigation-adaptation actions proposed in the climate change action plan.





CHAPTER –7

Optimization of Forest Resource Utilization:

7.1 Recorded Removal of Timber:

No timber coupe exists in this Division.

7.2 Recorded Removal of Fuel Wood:

No coupe has been worked during the last plan period. Trees uprooted due to cyclonic storms are converted to firewood and disposed.

7.3 Recorded Removal of Bamboo/Rattans:

No bamboo coupe exists in this Division.

7.4 Recorded Removal of locally important NTFPS Including MAPS:

The forest blocks of this Division have very low potentiality of NTFP except cashew trees available in Kujanga Range which is sold through annual auction by forming lot. The sale result of cashew lot in the last plan period is furnished in **Annexure VI**.

7.5 Demand and Supply of Timber and Important Non-Timber Forest Produce:

There is yawning gap between demand and supply of forest products due to rapid urbanizations and expansion of nearby towns. The pressure on forests to meet the growing requirements of timbers for house constructions, furniture, and also the demand for small timbers, poles, bamboos, fodder grasses, firewood etc. enormous. Hence this division is not capable to fulfill such increasing demands, for which some quantity of forest produces is entering the area of this division from outside divisions to suffice the requirements. To cater the requirement of timber and fuel wood, numbers of licensed depots are operating the list of which is furnished in Table 7.1 below.

Table 7.1 List of Licensed timber/ Firewood Depots		
Sl.No.	Name of owner	Place of Depot
1	Sri Rabindra Kumar Barik,	Sandhakuda
2	Sri Gobinda Ch. Rout,	Hatina
3	Sri Sandipta Ku. Baliarsingh,	Bhutumundai
4	Sri Rajanikanta Mandal,	Krushnanagar



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5	Sri Sarbeswar Das,	Nuagaon
6	Sri Sridhar kumar Sahoo,	Madanpur
7	Sri Sumant Kumar Das,	Nial
8	Sri Basanta Kumar Sutar,	Mahulia
9	Sri Dhwojarja Khandual,	Deuli
10	Sri Basanta Kumar Sutar,	Mahulia
11	Sri Indramani Mallick	Bidanasi
12	Sri Ashok Kumar Moharana	Badagar
13	Sri Akshaya Kumar Sahoo,	Mahinsasura
14	Sri Mukesh Patra	,Madhypada,
15	Sri Soumendra Keshari Sethi,	Rajnagar
16	Sri Subrat Nayak,	Kasnata
17	Sri Bijaya Kumar Nanda,	Pokhariapada
18	Sri Debakanta Nayak,	Tanupur
19	SK Arief,	Gopa
20	Sri Manas Kumar Behera,	Beltal
21	Smt. Sanjukta Jena,	Pokharia Pada
22	Sri Pramod Kumar Khandai,	Gobindapur
23	Sri Prakash Ch. Behera	Mangalpur
24	Sri Ramakanta Ojha,	Kujang
25	Sri Binaya Kumar Mohanty,	Garjanpur
26	Sri Satrugan Mallik,	Aul
27	Sri Rabindranath Sharma	
28	Sri Ajay Kumar Behera,	Koilpur
29	Sri Biswajit Muduli,	Deuli
30	Sri Ambika Prasad Mohapatra	Paradeep
31	Sri Karnadhar Mandal,	Krushnanagar
32	Sri Sudarshan Barik,	Iswardpur
33	Sri Ayaskanta Mohapatra,	Balipari
34	Smt. Usharani Mohanty,	Paradeep
35	Sri Mohadeb Barik,	Panchupally
36	Sri Rajendra Kumar Bayee	
37	Sri Aswin Kumar Samal,	Kandiahath



38	Sri Prtap Kumar Panda,	Demal
39	Sri Bairagi Charan Jena,	Beltal
40	Sri Dukhishyam Mohanty,	Paradeep
41	Sri Sarbeswar Das,	Bhitargada
42	Sri Sujit Kumar Nayak,	Balipatana
43	Sri Sanjay Das, Sikarpahi	
44	Sri Ayaskanta Mohapatra,	Badagabapur
45	Sri Ramesh Chandra Ojha,	Janakadeipur

7.6 Import and Export of Wood and Wood Products:

There is no production of wood as no timber coupe is present in the forests of the Division. Timbers grown in private lands are mostly transit free species and are meant for local consumption only. Due to low urbanisation, there is no demand of wood to be imported from outside.

7.7 Import and Export of NTFPS:

There is no potential NTFP area existing in the Division and there is no report of export and import of NTFPs in the Division.

7.8 Removal of Fodder:

There are very less pasture land available in the Division. Many people particularly cattle rearing communities' rear buffaloes. Available lands have been converted for paddy cultivation or aqua culture. Due to salinity, forest lands do not provide much of fodder requirement for the cattle.

7.9 Valuation of Products:

Except for private timber depots there is no sale depot of Odisha Forest Development Corporation existing in the Division. So sale price of timber/ firewood has not been recorded. Prices adopted by private depots are not uniform. The Sale result of Cashew lot in the last plan period is at **Annexure-X**





CHAPTER –8

Maintenance and Enhancement of Social, Economic, Cultural and Spiritual Benefits:

8.1 Number of JFM Committees and area(s) protected by them:

Total 23 No. of JFM Committees designated as *Vana Surakshya Samities* have been formed in Kujanga and Mahakalapada Ranges and 657.02 hectares of forest area was allotted for the purpose in accordance with JFM Resolution 2011. Due to diversion of forest land in Kujanga WL Range for POSCO India Pvt. Ltd. and internal conflict among the members of the committees leading to serious law and order problem, activities of these JFMCs are not up to desired level. However steps are being taken to rationalize JFM Committees in new areas in lieu of the defunct committee as per the guidelines of JFM Resolution 2011 with amendment of 2015. List of VSSs existing in both the Ranges is furnished in **Annexure-XIA and XIB**.

8.2 Status of Empowerment of JFMCs:

Consultation with the members of the JFM committees (VSS) during different occasions are done to assess the level of participation of the members in JFM activities and their expectations from the proposed plan. The major issues and concerns emerging from the consultation are highlighted below.

1. There is initial hesitation among the villagers to participate in JFM programme. But after the super cyclones of 1999, 2013 and 2014 the coastal shelterbelts played major role in withstanding the wind velocity and safeguarding the nearby villages. Realizing this potential of the coastal shelterbelts, the villagers became serious in protecting this patch of forest.
2. The area demarcation of the allotted forest patches to different JFM committees is not clear due to want of authentic and clear revenue maps. The forests have been allotted to different villages on the basis of coupe lines of earlier working plans and revenue maps have not been properly referred. This sometimes lead to conflict.
3. The resolutions of JFM are not clearly understood to many members. They are of the impression that once registered; the allotted forest patch shall stand recorded in the name of that particular committee.



4. There is conflict among some villages who were earlier jointly protecting a patch of forest and now want to be separated from each other. The reasons might be due to misunderstanding of the facts, issues on sharing of usufructs, social and other issues.
5. Due to rigid protection measures adopted by the JFM committees in some forests, population of wild boars particularly in the coastal forests has increased. These wild boars are causing a lot of damages to the crop raised by the villagers in their fields near to the forests. The villagers demand adequate protection from damage by wild boars and compensation to the crop damage.

8.3 Labour Welfare:

Local people are provided direct employment in shape of labourers on daily wage under different schemes of State and Central Government namely, State Plan (Programme Expenditure), CAMPA, Integrated Development of Wildlife Habitat, MGNREGS etc. the activities include plantation, habitat improvement works, Soil & Moisture Conservation, protection watchers etc. About man days are generated annually due to the above activities. Major of the labour force are from Scheduled Caste communities, few from Scheduled Tribes and other communities. Engagement of women labourers is also significant.

8.3.1 Labour Welfare & Minimum Wages:

The Labour & ESI Department, Government of Odisha is fixing the minimum wage rate depending upon price index and living standard. The minimum wage rate is periodically enhance / revised. The revision of wage rate is being changed half yearly basing on Consumer Price index as on 1st April and 1st October every year. The revised wage rate from different date since 1995 is furnished below (Table No 8.1).

Table No 8.1: Wages rate from different dates from years 1995					
Sl No	Notification Date (Month / Year)	Wage Rate (in Rs.)			
		Unskilled	Semi Skilled	Skilled	High Skilled
1	13.12.1995	30.00	36.00	42.00	48.00
2	29.04.1999	40.00	48.00	56.00	64.00
3	14.02.2002	50.00	60.00	70.00	80.00
4	15.02.2006	75.00	85.00	90.00	100.00
5	14.07.2009	90.00	103.00	116.00	129.00
6	06.10.2012	150.00	170.00	190.00	205.00



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7	30.04.2015	200.00	220.00	240.00	260.00
8	04/2017	213.50	233.50	253.50	273.50
9	11/2018	280.00	320.00	370.00	430.00
10	05/2019	286.30	326.30	376.30	436.30
11	11/2019	298.00	338.00	388.00	448.00
12	07/2020	303.40	343.40	393.40	453.40
13	10/2020	308.00	348.00	398.00	458.00
14	05/2021	311.00	351.00	401.00	461.00
15	11/2021	315.00	355.00	405.00	465.00
16	04/2022	326.00	366.00	416.00	476.00
17	10/2022	333.00	366.00	416.00	476.00
18	04/2023	345.00	385.00	435.00	495.00
19	10/2023	352.00	392.00	442.00	502.00
20	3/2024	450.00	500.00	550.00	600.00

The current notification on wage rate vide Resolution No LESI-LLIII-0081-2017 – 2348/ LESI dated 14th March, 2024 is at **Annexure- XII**

8.4 Use of Indigenous Knowledge:

During preparation of micro plans of different VSS (*VanaSurakshyaSamiti*), working groups consisting of concerned VSS representatives are involved so that the indigenous traditional knowledge can be documented and incorporated in the micro plans and it has also been utilized in enlisting prescriptions of the working plan.

8.5 Extent of Cultural/ Sacred Grooves:

No sacred groove exists in the forests of this Division.

8.6 Ecotourism Areas and Activities

Mangrove Forest Division (Wildlife), Rajnagar attracts tourists from all over India and abroad for its mangrove forests, estuarine crocodiles, birds particularly, eight species of kingfishers, dolphins and natural landscapes, pristine beaches and historical monuments such as Hukitola. Tourism activities are confined mostly in Sanctuary and National Park where accommodation as well as day visit facilities have been developed for tourists. These areas are outside the working plan area. However, visitors often visit Siali beach in Kujanga Range as day visitors or picnickers during winter. In the Working Plan Area the following Eco-Tourism Circuits are conceived in the Previous Plan and the same is reproduced below in a modified concept.



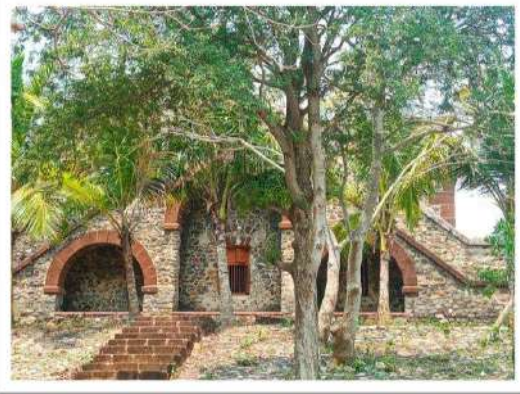
1. Jamboo- Batighar-Hukitola-Jamboo Eco tourism Circuit:

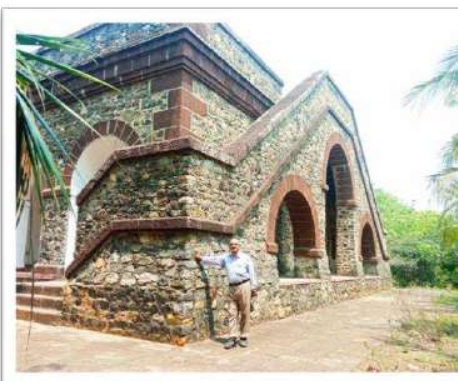
Hukitola is situated on Jamboo island in the Bay of Bengal of Mahakalapada Block in Kendrapara District. The building having plinth area more than 7000 sq ft, on the island was constructed by the Britishers in 1866/67 during the “*NaankaDurbhikshya*”. This was used to store rice imported from Burma and other places through sea route. It bears testimony to advancement made in construction technology in the 19th century. The monument, a majestic building with underground rainwater harvesting system is symbol of the state’s glorious past in maritime.

The place attracts students, scholars and history lovers throughout the year for its scenic location and historical significance. The port and the palace started losing its importance in 1924 when the Britishers established a port at false point.

The uniqueness of the palace lies in its roof slope in design. It helps rain water to flow down to four big water pots. The collected water was used for drinking purposes by the merchants throughout the year.

INTACH under ICZM program renovated Hukitola for eco-tourism.



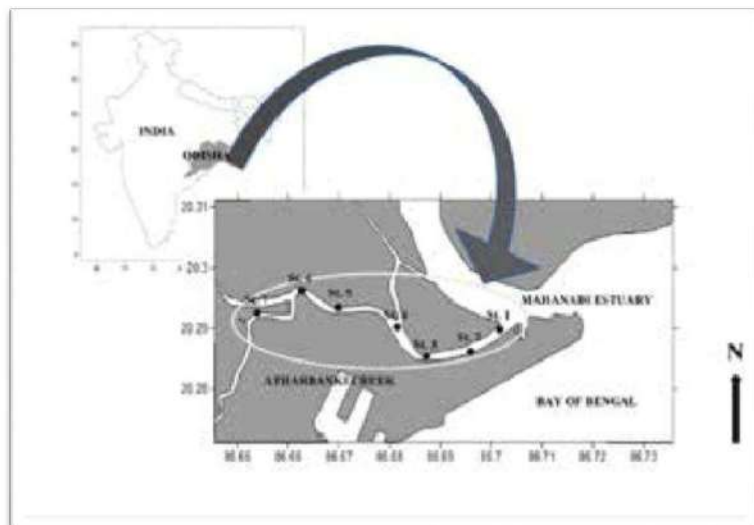


2. Atharabanki-Mahanadi- Batighar-Hukitola-Kharanasi creek- Mahanadi- Atharabanki(Paradeep) Eco tourism Circuit:

This is the first lighthouse installed in eastern coast of India. It is around 45 KM from District HQ. It is situated in a village named Batighar, on the other bank of river Kharinasi. It is surrounded with pleasant natural beauty. Once upon a time, this was known as Kaudia Dwip and used as hunting ground of Kujang Kings. Construction of this lighthouse was started on 6th December, 1836 and it was lighted on 16th October 1837. The stones used were transported from Barabati Fort, Cuttack. The height is 125 feet, foundation wall is 15 feet thick. The diameter at land level is 10 feet. To reach the top, 138 steps made of cement concrete and 16-step ladders are there. The specialty of this lighthouse is that it is operational from the date of its lighting and presently it is managed by Calcutta Light House.



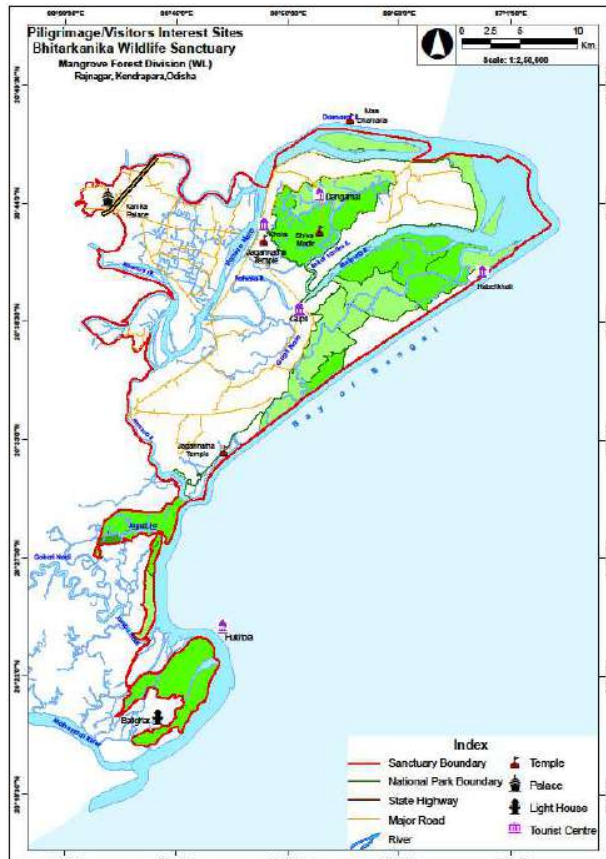
On 16th October 1837 first light came out from this light house. This Light house was built by Mr H. Wright. This light house is 60 feet above sea level built on sand heap. This is a six storied building having space to take rest on each floor having a big window. There are 16 Bullet proof glasses attached at the top floor. Year 1857 is inscribed on that glass which is remaining as it is. Within the circular room there is a wheel of 3 feet radius having an electric bulb at the center. This bulb is of 440 v 230 w, this light can be seen from 60 km in the sea. This Light House is opened for Tourist from 7.00 am to 10. am and 4 pm to evening.





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Atharbanki, a mangrove waterway of Mahanadi Estuary ($17^{\circ}49'N-22^{\circ}34'N$; $81^{\circ}24'-87^{\circ}29'E$) on the east coast of India has been under considerable anthropogenic pressure. Within the mangrove areas *Avicennia*, *Rhizophora*, *Bruguiera*, *Kandelia*, *Ceriops*, and *Aegiceras* sp. are the most common. The river meanders southeast to northeast for nearly 13.5 km skirting the highly industrial belt of Paradip, courses adjacent a major fishing harbor into Mahanadi Estuary before opening into the Bay of Bengal. Though there are many prospective for tourism purpose, the facilities have not yet developed to cater the need of tourist. The Tourist map of Rajnagar WL Division is furnished below.





8.6.1 Tourist inflow:

As discussed in previous para no tourism activity has been developed in the working plan area. Some basic facilities for day visitors coming from Paradeep to Hukitola need to be developed at Paradeep entry points.

8.7 Social Customs:

The population in the tract contains many religions. Majority of the population is Hindus (95%). The proportion of other religions is very insignificant in both the districts. The predominant castes among Hindus are Karana, Brahmans, Khestriya, Gowda, Bania, Chasa, etc. The main Scheduled Caste people belong to Kamar, Dhoba, Keuta, Pana, Hadi, Barika, Kandara, castes. The important ST castes are Kandha, Ganda, and Munda etc.

Highest literacy rate is observed in Jagatsinghpur district (80%), followed by Kendrapara district (79.53%). The literacy rate in the rural areas is highest in Jagatsinghpur district (78.7%), followed by Kendrapara district (76.61%). However, both the districts have literacy rate higher than the average literacy rate of the State

The population of SC and ST is less in the coastal districts. The population of ST is more in Kendrapara district in comparison to Jagatsinghpur district. The literacy rate among SC and ST is not encouraging. The average literacy rate is 86.6% in Jagatsinghpur district and 85.2% in Kendrapara district, the average of the State being 72.9%. Population of the Districts with percentage of SC & ST population is furnished in Table No. 8.2 below.

Table No. 8.2 Population of the Districts as per 2011 census					
District	Total population	Schedule Casted population	% of SC Population	Scheduled Tribe Population	% of ST Population
Kendrapada	1440361	309780	21.5	9484	0.7
Jagatsinghpur	1136971	248152	21.8	7862	0.7

The Socio Economic Profile of Villages of Mangrove Forest division (Wildlife) is at **Annexure-XIII**

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

The list of individuals in whose favour Forest land has been assigned under The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 has



been maintained at Division Office in a Bound book. It is voluminous. The abstract is furnished below (Table No 8.3).

Table: 8.3 Forest land given under FRA (Individual Claims)		
Name of the District	No of Claim Petition approved by DLC	Total area involved in hectare
Jagatsinghpur	047	012.89
Kendrapada	305	178.90
Total	352	191.79



8.8.1 Community Rights admitted under FRA, 2006

Table No.35: Community Rights admitted under FRA, 2006: Mangrove Forest Division (Wildlife) Rajnagar						
Sl. No.	Name of village/Community	Area assigned in Ha.	Name of the Forest Block	Khata No.	Plot No.	Order No. & Date issued
01	Indira Colony, Beltal	0.4702	Gramya Jungle	1754	452	O.O No.27/04F-476/2023 dated. 20 th January, 2023
02	Rice Mill, Paradip Municipality	0.760	Jhadi Jungle	59	426	O.O No.181/04F-476/2022 dated. 29 th June, 2022
03	Giridhari Chhak	0.242	Jhadi Jungle	59	460 & 464	O.O No.181/04F-476/2022 dated. 29 th June, 2022
04	Kasturba Govt. Girls High School, Derik	2.428	Gramya Jungle	658	1265	O.O No.226/04F-480/2022 dated. 08 th August, 2022
05	Ananta Gadibrahma Govt. High School, Badagaon, Gaithipur	0.0890	Gramya Jungle	138	180	O.O No.226/04F-480/2022 dated. 29 th June, 2022
06	Kusunpur Primary School, Mangarajpur	0.0485	Gramya Jungle	193	35/891	O.O No.235/04F-488/2022 dated. 19 th August, 2022
07	Suniti New Field UGUP School, Suniti	0.0809	Jungle	185	98	O.O No.259/04F-488/2022 dated. 02 nd September, 2022
08	Govt. Project UGUP School, Kantilo	0.0971	Jhadi Jungle	113	152 & 153	O.O No.260/04F-488/2022 dated. 02 nd September, 2022
09	Pitapata Project UGUP School, Bahakuda	0.0809	Jungle	66	257/527	O.O No.261/04F-488/2022 dated. 02 nd September, 2022



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10	Barajabahakud Govt. Upper Primary School, Barajabahakud	0.0809	Jungle-2	199	665	O.O No.262/04F-488/2022 dated. 02 nd September, 2022
11	Govt. Project Primary School, Nipania	0.0809	Jungle-2	3	55/66	O.O No.263/04F-488/2022 dated. 02 nd September, 2022
12	Ramchandi Govt. Primary School Lunimatia, Petchhela	0.235	Jungle	206	1367,1368, 1369 & 1370	O.O No.287/04F-488/2022 dated. 06 th October, 2022
13	Govt. Project Primary School, Pandaramaili	0.178	Jungle	206	592	O.O No.288/04F-488/2022 dated. 06 th October, 2022
14	Petchhela Project UGUP School, Petchhela	0.121	Jungle	206	880	O.O No.289/04F-488/2022 dated. 06 th October, 2022



8.9. Other Rights & Concessions

Since final notification u/s 21 of Orissa Forest Act have not been made in case of any forest block, the rights and concessions have not yet been settled.

8.9.1 Details of Milestone for PBR, Access benefit sharing regulation and mechanism:

Constitution of People's Biodiversity Committee at Panchayat level / Block level is being taken up by Odisha Bio Diversity Board. As it is observed, there is no progress in this direction and no Milestone for PBR, Access benefit sharing regulation has been designed. In view of the authority's comments it is decided as follows.

- The Odisha Biodiversity Board will be pursued to constitute 3 Block level BDC (Rajnagar, Mahakalapada of Kendrapara District and Kujang of Jagatsinghpur District).
- Besides Block Level Biodiversity Committee, 9 Panchayat Level BDC will be constituted and People's Bio Diversity Register will be prepared.
- The instruction / guidelines contend in National Biodiversity Act, 2002 and Rules 2004 will be followed.

8.10 Dependency of Local People on NTFPs:

The forest blocks of this Division have very low potentiality of NTFP Cashew plantation at present is being leased out by forming annual lots. Old plants are gradually dying due to senility. Existing plantations shall be maintained till viable and no new plantation shall be raised as cashew plantation is a non-forestry activity as per Forest Conservation Act.





CHAPTER –9

Adequacy of Policy, Legal and Institutional Framework:

9.1 Existing Policy and Legal Framework and their compliance:

During the last plan period, Acts/Rules and regulations whatsoever associated with management of forests, wildlife and environment have undergone amendments. A list of Acts / Rules promulgated during the last plan period is listed below.

1. Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of F.R) Act-2006
2. Scheduled Tribes and Other Traditional Forest Dwellers(Recognition of F.R) Rules-2008
3. PESA
4. JFM (Orissa) Resolution-2015
5. Biological Diversity Act-2002
6. Coastal Regulation Zone Notification-2019

The forests in this Division are now in a degraded stage. There was less emphasis on silvicultural operations in the forests in absence of any program/target in the outgoing Plan. Climber cutting, thinning operations and other subsidiary silvicultural operations were neglected to a large extent. The boundary was not maintained, the boundary pillars are not traceable in many forest blocks. The process of reservation of forest blocks in the Division has been vastly neglected. Many of the forest dwellers and villagers still greatly depend on the forests for their livelihood. Illegal collection of firewood, poles etc. has gone on increasing with the exploding human population and their increasing demands.

9.2 Status of Approved Working Plan and Compliance:

The forest blocks of Mangrove Forest Division (Wildlife), Rajnagar in Kendrapada and Jagatsinghpur District outside the Protected Areas were included in the Revised Working Plan of Cuttack Forest division and Rajnagar (Wildlife) Division for the period from 2007-08 to 2016-17 prepared by Smt. Uma Nanduri, IFS.



9.3 Number of Forest Offences:

The details of cases booked under Odisha Forest Act, 1972 and The Wildlife (Protection) Act, 1972 have been furnished in the Table No. 2.12 of Part I.

9.3.1 Animals rescued / relocated during Plan period:

The year wise wild animals rescued / relocated during Plan period & beyond is furnished below. (As it pertains to Mahakalapada and Kujang WL Range) (Table No. 9.1)

Table No 9.1: Rescuing/relocating the wild animals during Plan Period; Rajnagar WL Division (As it pertains to Mahakalapada and Kujang WL Range)			
Year	Details of the animal Rescued / Relocated		Remark
2007-08 to 2012-13	NIL		
Year	Captured Location	Release Location	Animal involved
2013-14 / Date			
April -2013	Aradapali	Barunei F.B.	Spotted deer
11.5.2013	Ramchandi	B. Kharinasi RF (Kankia nala)	Salt water crocodile
14.5.2013	Nilakanthapur, P.Much	B. Kharinasi RF	Boda Sapa (R.viper)
24.5.2013	Rajagarh	B. Kharinasi RF	Rana Sapa
24.6.2013	Badajoria		Ajagar (Python)
03.12.2013	Kantabana	Jamboo PF	Banded krait
03.12.2013	Kantabana	Jamboo PF	White owl
25.12.2013	Haladijodi	Phategarh PF	Cobra
6.1.2014	Nipania village	Kansaridia	Phython (Ajar)
20.02.2014	Baradanga Village	Kharinasi RF	Wild boar
21.03.2014	Kansarbada	BhitarKharinasi RF	Spotted deer
2014-15			
21.12.2014	Kajalapatia Village	Hetamundia PRF	Phython
2015-16			
27.4.2015	Maledhi	BhitarKharinasi RF'A'	Cobra –de-capello
03.08.2015	Arunanagar	Kharinasi RF	Boda snake
4.8.2015	Charakani	B. Kharinasi RF	Black Cobra (2)
6.8.2015	Ghuhalakoni	B.Kharinasi RF	Black cobra
10.9.2015	MangalapurChhak	B.KharinasiRF	Cobra
6.11.2015	Chhapoli	B.Kharinasi RF	Kolathia Tampa (Monocellate cobra)



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4.12.2015	Batighar	Kansarida PRF	Ajgar (Python)
10.1.2016	Chhapali	Kharnasi	Monocellate cobra
17.1.2016	Ramnagar	Kharnasi	Monkey
31.1.2016	Bairaj	Kharnasi	Spotted deer
3.2.2016	Khursia	Kharnasi RF	Monocellate cobra
7.2.2016	KansarBadaor	Kharnasi RF	Spotted deer
16.2.2016	Chhanda	Kharnasi RF	Monocellate cobra
24.2.2016	Badpal	Jamboo PF	Cobra
25.2.2016	Chhapali	Kharnasi RF	Monocellate cobra
3.3.2016	Badapal	Kharnasi RF	Cobra
4.3.2016	Sachiabati	Kharnasi RF	Cobra(copule)(2)
11.3.2016	Sachiabati	Kharnasi RF	Cobra
19.3.2016	Kalatunga	Kantilo RF	Monocellate cobra
2016-17			
3.4.2016	Baranumber	Jamboo PF	R. Viper(boda)
7.4.2016	Chadeiguan	Kharanasi RF	Monocellate cobra
23.05.2016	Romita	Kharnasi RF	Cobra
15.08.2016	Gojabandha	Kharnasi RF	Monocellate cobra
23.08.2016	Amirabad	Kharnasi RF	Monkey
29.08.2016	Provakarpur	Kharnasi RF	Monocellate cobra
14.09.2016	Amiyapal	Kharinasi RF	Cobra
27.11.2016	Mahakalpada	BhitarKharnasi	Monocellate cobra
14.12.2016	Bali	BhitarKharnasi	Open bill stork
18.02.2017	Chhedakani	Petachhela PRF	Cobra
4.3.2017	Pravakarpur	B. KharinasiRF	Monocellate cobra
4.3.2017	Mulabasant	B. Kharinasi RF	Owl
12.3.2017	Batighar	Kansaridia PRF	Phython
27.3.2017	Chhapali	B. Kharinasi RF	Monocellate cobra
2017-18			
5.5.2017	Ramchandi	B. Kharinasi RF	Cobra
6.5.2017	Rajgada	B. Kharinasi RF	Monkey
7.5.2017	Ramnagar	Kantianali RF	Crocodile
8.5.2017	Sarkarpoda	B. Kharinasi RF	Monocellate cobra
15.5.2017	Bolipotna	B. Kharinasi RF	Owl
13.6.2017	Ramnagar	Kharnee	Cobra
4.7.2017	Kayarbanka	Jamboo PF	Chandan Boda
20.07.2017	Rajagarh	Sanatubi PRF	Kahama Bird
02.10.2017	Chhapali	B. KharinasiRF	Cobra



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07.10.2017	Deulipada	B. Kharinasi RF	Banded kraits
08.10.2017	Deulipada	B. Kharinasi RF	Banded krait
22.11.2017	Baranumber	B. Kharinasi RF	Crocodile
21.12.2017	Baranumber	B. Kharinasi RF	Banded krait
8.3.2018	Janra village	B. Kharinasi RF 'A'	Spotted deer (male)
11.03.2018	Chhatar	B. Kharinasi RF 'A'	Crocodile
25.3.2018	Sana Teragan	B. Kharinasi RF 'A'	Spotted deer (male)
2018-19			
11.06.2018	Kansapal Village	Jamboo PF	Monocellate cobra
10.07.2018	Gokhakhati Village	Jamboo PF	Cobra
10.07.2018	Pandarmile	Jamboo PF	Monocellate cobra
12.7.2018	Mahakalpada	Kharinali RF	Monocellate cobra
02.08.2018	Sartola Village ,G.P. Pakhoda, Goradpur Beach	Kharinali RF	Spotted deer (male)
31.08.2018	Pondar mile	Kharinali RF	Monocellate cobra
08.09.2018	Olia	B. Kharinasi RF	Monocellate cobra
08.09.2018	Olia	B. Kharinasi RF	Banded krait
08.09.2018	Olia	B. Kharinasi RF	Banded krait
26.09.2018	Bettalpattamuni	Kantilo RF	Chameleon
17.10.2018	Pattamundai	B. Kharinasi RF	Cobra
03.11.2018	Ramnagar	B. Kharinasi RF	Monocellate cobra
22.12.2018	Godalamita	Jamboo PF	Monkey
13.01.2019	Mahakalpada	Jamboo PF	Chandan Boda (2no)
09.02.2019	Gadromita	B. Kharinasi RF	Cobra
07.03.2019	Jamboo Village	Jamboo PF	Spotted deer (male)
15.3.2019	Pravakarpur Village	B. Kharinasi RF	Monocellate cobra
23.03.2019	Shathiabati	B. Kharinasi RF	Cobra
2019-20			
19.5.2019	Arada Village of Rodhia Kansol G.P.	Kanrunal (B. Kharinasi RF)	Salt water crocodile
25.05.2019	Kharinasi Village	B. Kharinasi RF	Rhesus monkey
03.07.2019	Godaromita	B. Kharinasi RF	Cobra
16.07.2019	Pattamundai	Kantilo RF	Cobra
27.07.2019	Goyaspur Rajgarh	Jamboo PF	Chandan Boda
13.08.2019	Sikhar	Jamboo PF	Cobra
13.08.2019	Rajgarh	Jamboo PF	Cobra
16.08.2019	Pattamundai (Pokharpada village)	Kantilo RF	Chameleon



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21.08.2019	Chhapali	Kharnasi RF	Cobra
22.08.2019	Oliha	Kharianali RF	Cobra
02.10.2019	Pandormole	Kharianali RF	Krait (5no)

Table No. 9.1(A) Abstract of Animals Rescued and Released: Rajnagar WL Division

Year	No. of animals
2013-14	11
2014-15	1
2015-16	20
2016-17	14
2017-18	16
2018-19	19
2019-20	15
Total	96

9.3.2 Wild Animal Rescue Procedure Adopted:

The situation and condition from which the animals are rescued are completely different. The procedure adopted is decided on the spot considering the animal's situation, Condition and threat prospect. After rescue of the animal it has been released in the nearby forests / water body as required and as per instructions of Chief Wildlife Warden / Wildlife Warden. Precautionary measures are adopted to cause minimum hardships to animals / birds / Reptiles.

9.4 Status of Research & Development:

There is no sample plot/ preservation plot or other research plot in the forest area of this Division. The research activities undertaken in this Division are mostly focussed on the biodiversity of Protected Areas.

9.5 Human Resource Capacity Building Efforts:

Apart from the induction courses of the staff, on the job trainings are imparted to the frontline staff from time to time on different themes at Division level such as:

1. Forest and wildlife law and prosecution
2. Forest protection and biodiversity conservation



3. Nursery and afforestation techniques
4. Use and maintenance of fire arms
5. Orientation training for newly recruited staff

No specialized training on wildlife has been given to any staff. DFO, ACF and Range Officers attend short training programmes in training institutes in the state and outside as per nomination made from Forest and wildlife headquarters. Training programmes for eco-guides, boatmen and tour operators are conducted from time to time. Exposure visit of staff to other protected areas are also organized on availability of fund for the purpose.

Students and trainees from a number of training institutions visit the sanctuary every year. Apart from Foresters and Forest Guards of the training institutions of the state, Forest Ranger trainees, IFS probationers, ACF trainees, officer trainees of PG Diploma course on Wildlife Management & Master Degree course from WII also visit the sanctuary as a part of their field training programme.

9.6 Forest Resource Accounting:

Forests of the Division are not potentially productive. As discussed earlier, the forests are in various stages of degradation. Majority of the forests are either mangrove forests or *Casuarina* forests (planted as coastal belt plantations). However, these forests particularly mangroves provide protection to the coastal communities who face cyclones almost every year on regular basis. Apart from that mangroves are nursing grounds for many commercially available fishes, prawns and crabs and in that way the forests support the large numbers of fishers living in the area.

9.7 Budgetary Allocation to the Forestry Sector:

The budgetary allocation to this Division during the last plan period is furnished below.

Table No 9.2: Allotment & expenditure			
Year	Scheme	Allotment (in Rs.)	Expenditure (in Rs.)
2015-16	Non-Plan	566100	566100
	State Plan	27110015	27110015
	RCSS-APOs	7767840	7767840
	MAP-Bknk	4400000	4400000



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	CAMPA APO	24076000	24076000
	MGNREGS	8183000	8183000
2019-20	Administrative Expenditure	960000	960000
	Programme Expenditure	51462339	51462339
	CAMPA	38046059	38046059
	MGNREGS	29028535	29028535

9.8 Existence of Monitoring Assessment and Reporting Mechanism:

Steps shall be taken for effective monitoring, assessment and reporting mechanism relating to different resolutions, rules and regulations in the management of forest.

9.9 Public Awareness and Education:

The activities to increase public awareness on forest and wildlife which are carried out regularly are listed below.

1. Awareness meetings for the public
2. Awareness meetings for the students
3. Involvement of eco clubs of schools in awareness programmes
4. Awareness rallies
5. Observation of important days with public participation such as wildlife week, vana mahotsava, environment day, forestry day, biodiversity day, wetland day and turtle day etc
6. Distribution of pamphlets/ brochures

9.10 Adequate Manpower in Forest Division:

The details of sanctioned strength of staff of this Division are furnished in **Annexure XIV**. There is large scale vacancy in field level particularly in Forest Guard level.

9.10.1 Incumbency Chart of DFO, Mangrove Forest Division (WL):

The Incumbency Chart of Divisional Forest Officers of the Division is at **Annexure-XV**





CHAPTER – 10

Five Year Plans:

10.1 General Trends in Forestry Investment:

The investments in forestry sector require long gestation period and most of the time these inputs are linked with the livelihood needs of the people. It is also difficult to explain the tangible benefits always in monetary terms. Since the commencement of the First Five Year Plan (FYP) in 1951, Rs 85 billion has been spent by the end of the Eighth FYP in 1996-97 on forestry development activities in the whole country. In this period, afforestation activities of about 26.9 million ha. have been carried out. Financial allocation to the forestry sector has been increased from Rs 76 million in the First FYP to Rs 40, 818 million in the Eighth FYP, but it has always been less than 1% of the total plan outlay of the country. This is one of the main reasons for the continuous deterioration of forest resources. The priorities in different plan periods and the achievements are discussed in the paragraphs below.

10.2. First Five-Year Plan (1951-56):

The two world wars drew heavily on the forest resources. Major river valley projects, development of industries and communications and other projects so vital to the developing economy of the country also leaned heavily on the utilization of the forests and forest areas. While the fundamental concepts underlying the forest policy laid down in 1894 remained the same, the National Forest Policy enunciated in 1952 emphasized that the forests should be managed on the principle of progressively increasing, and eventually getting the highest sustained yield to meet the requirements of defence, industries and the people, ensuring at the same time that the production of both wood and fodder is maintained. Therefore attention was focused on rehabilitating the forest that had been over-exploited during the wars, and consolidation and settlement of private forests taken over by the government. A modest beginning was also made to raise plantations of matchwoods and other economic species.

10.3. Second Five-Year Plan (1956-61):

Most of the schemes of the previous plan were continued. Some of the important new schemes initiated related to the creation of plantations of economically valuable species, conservation of wildlife and preparation of working plans. A number of wildlife



sanctuaries were established, some degraded forests were rehabilitated and many new forest roads constructed.

10.4. Third Five-Year Plan (1961-66):

While the first two plan centred on rehabilitation and consolidation of forests, in the third plan a beginning was made to lift forests from purely conservative and biological management to increasing production from them by creating man-made forests of quick-growing and valuable species in place of the existing ones. Special emphasis was laid on measures to meet the long-term requirements and more economic and efficient utilization of valuable forest products, and to increase the outturn from the existing depleted forests through better technique of timber extraction, improvement of communication and popularizing the use of secondary timbers after proper seasoning and preservative treatment.

Full assistance from the Centre was given in order to encourage State governments to undertake large scale plantations of quick-growing species, mainly to meet the requirements of the paper and pulp industry.

A new scheme undertaken was “Pre-Investment Survey of Forest Resources” implemented in collaboration with the U.N. Special Funds and FAO. This project was designed to investigate by stages the economic availability of surplus forest resources for feeding the wood-based industries. The PIS was the forerunner of the Forest Survey of India of today.

Another project related to the establishment of “Logging Training Centres” also with the assistance of the U.N. Special Funds. The object was to train forest officers and field executives of State government and forest lessees and contractors in basic logging cableways, planning and efficiency studies etc., with a view to obtain higher timber yields from forests by minimizing wastage.

10.5. Post-Third Plan Period (1966-69):

The progress of departmental activities in forestry during this period was remarkable. Specific emphasis was laid on plantations of quick-growing species and the modernizing of harvesting and plantation techniques. Training of officers and forest rangers as Resource managers was undertaken to embark upon the next five-year plan.



10.6. Fourth Five-Year Plan (1969-74)

While adhering to the objectives and principles of the third plan, greater emphasis was placed on increased plantation activities and intensive management of forests to attain self-sufficiency. The basic considerations and the guiding principles were –

- (i) Adequate forest cover to prevent floods, conserve soil and moisture, protect water reservoirs;
- (ii) Adequate supplies of forest raw materials for wood based industries and of construction timber for which there was a growing demand;
- (iii) Adequate supplies of fuel wood; and
- (iv) Preserving natural environs for scenic beauty, sport, recreation and scientific study.

Based on these considerations the specific obligations considered were: scientific management of hitherto unorganized forests; stricter protective measures against pilfering, excessive grazing, fire, encroachments etc.; formation of manageable units and appointment of adequate staff; replacement of slow-growing and less valuable species by those which are quick growing and valuable; afforestation of barren lands; introduction of improved methods of harvesting; extension of communication; better housing facilities for the staff; wildlife and nature conservation; intensive research and training provision of statistical cells, etc.

10.7. Fifth Five-Year Plan (1974-79)

This plan introduced an important element of change in the country's strategy in forestry; conservation-oriented forestry was to give way to dynamic progress of production forestry, to increased production of industrial wood and other forest products of economic importance. Extensive man-made forests were to be created, with institutional financing, to feed the existing and prospected industries utilizing forest products. Lands along roads, canal banks, railway lines and flood embankments, mixed plantation for commercial use was to receive greater attention. Farm Forestry and communication were to form an important part of the forest programme.

10.8. Sixth Five-Year Plan (1980-85)

The Sixth Five-Year Plan continued the momentum gathered during the previous plan period. However the thrust was on social and plan period. However the thrust was on



social and community forestry and development without destruction. The following broad strategy was adopted –

- (i) The environment was improved by producing man made forests and undertaking massive afforestation on degraded lands;
- (ii) Strict protection was afforded to wildlife and its habitat;
- (iii) A massive social and farm forestry and village fuelwood plantation programme was taken up to meet the ever growing energy needs of the rural people;
- (iv) Employment was provided to the ever increasing rural population with special attention to the weaker sections of the society; and
- (v) The following four programmes of thrusts were introduced during this plan period
 - (a) Tree for every child programme;
 - (b) Eco-Development force of ex-servicemen
 - (c) Eco-Development camps for students
 - (d) Agro-Forestry programme.

10.9. Seventh Five-Year Plan (1985-90):

The role and importance of forests in the general economic development of the country in terms of protection of the eco-system and supply of forest products was better appreciated. The main objectives, approaches and strategies of this plan were:

- (i) Conservation of ecologically fragile eco-systems and preservation of biological diversity in terms of fauna and flora;
- (ii) Increasing substantially the vegetative cover by massive afforestation through social forestry, farm forestry and other plantation programmes;
- (iii) Meeting the basic needs of the people in respect of fuelwood, fodder, minor forest produce and small timber;
- (iv) Ensuring close linkages between Forestry programmes and welfare of the tribal and other communities traditionally dependent upon forests;
- (v) Special emphasis on forestry research, education, training and extension
- (vi) Implementing the national wildlife action plan for wildlife conservation, and
- (vii) Creating a massive people's movement for achieving the above objectives.

The main achievements during this plan period were –



- (a) Massive social and farm forestry programmes were taken up;
- (b) More emphasis was laid on the afforestation of degraded lands and wastelands. The national wastelands development board (NWDB) was set up.
- (c) Research & Training were strengthened by the creation of the ICFRE and IGNFA.
- (d) More stress was laid on preserving the eco-system and wildlife.

10.10. Eighth Five-Year Plan (1992-97)

The eighth five year plan aims at for restoration of ecosystem and taking of massive plantation programmes. In other words its objectives are to increase afforestation programmes, preserve the eco-system and wildlife and to strengthen forestry research, education and training.

The major objectives for this Plan are:

1. To protect the natural environment;
2. To regenerate and restore degraded ecosystems and increase their productivity and to generate employment through these activities;
3. To decentralise control over nature and natural resources;
4. To develop and share an understanding of nature and natural processes;
5. To formulate a national policy for environment and an appropriate institutional and legal framework in support of the policy;
6. To ensure co-ordinated and integrated Governmental action aimed at conserving nature and sustainable use of natural resources;
7. To make individuals and institutions more accountable to the people for their actions impinging on environment and ecosystem; and
8. To monitor the state of environment.

10.10.1 National parks and sanctuaries would be further strengthened. Stress will also be laid on eco-development, especially around protected areas, so that the human population in these areas is not deprived of the basic life support resources and continue to participate in the protection of the environment



10.10.2 An important task before the Government is the formulation of a comprehensive national policy on nature and natural resources. To be effective it must be evolved in consultation with the people. The policy must also spell out the position regarding environmental needs of the society in general and the rights of the weaker sections such as, tribals, nomads, women and children, especially in terms of giving access to and control over natural resources, in particular. The total investment in forestry sector is given in Table No- 5.1 and the percentage of investments is depicted in the graph. From the graph it is evident that the percentage of investments has increased from 0.32 percent in the First Plan to just about 1 percent in the 7th Plan. Again in the 8th Plan the investments are below one percent of the total plan outlay.

10.10.3 Review of Eighth Plan:

10.10.3.1 Bio-diversity Conservation:

The scheme on Bio-diversity Conservation was initiated during 1991-92 to ensure proper coordination among various agencies concerned with the issues relating to conservation of biological diversity and to review, monitor and evolve adequate policy instruments for the same. The Convention on Biological Diversity (CBD) was signed by 168 countries, including India, during the Rio meetings. India has since ratified the Convention.

10.10.3.2 During the Eighth Plan, considerable attention was given to make the pollution control laws more effective and to bring umbrella legislation for protection of environment. A number of Central and State executive authorities have been delegated powers for effective implementation of the Environment Protection Act. The Air (Prevention and Control of Pollution) Act - 1981 and the Water (Prevention and Control of Pollution) Act - 1974 have been amended to bring certain provisions of the Acts at par with those of the Environment (Protection) Act - 1986.

10.10.3.3 During the Eighth Plan, a Centrally Sponsored Scheme 'Modern Forest Fire Control Methods in India' was continued. The scheme was launched during the Seventh Plan with UNDP assistance as a pilot project in Uttar Pradesh and Maharashtra mainly to protect forests from fire. The Project was implemented in 13 states during Eighth Plan.



10.10.3.4 Afforestation of Degraded Forests:

The National Afforestation and Eco-Development Board was created at the time of the bifurcation of the erstwhile National Wasteland Development Board, then under the Ministry of Environment and Forests in July, 1992. Areas adjoining forests and fragile eco-systems were brought under the National Afforestation and Eco-Development Board (NAEB), while other wastelands were covered under the newly created National Wasteland Development Board in the Department of Wasteland Development in the Ministry of Rural Areas and Employment. The Investment in Forestry Sector from 1st FYP to 8th FYP is shown in Table No. 5.1 and percentage of plan outlay to Forestry sectors from 1st FYP to 8th FYP is shown in Figure No. 5.1. An outlay of Rs. 461 crore was finally allocated to the NAEB for reclaiming degraded forest area adjoining forests during the Eighth Plan. Some of the schemes of NAEB are:

- (i) Integrated Afforestation and Eco-Development Projects (IAEP) Scheme;
- (ii) Fuel wood and Fodder Project Scheme;
- (iii) Non-Timber Forest Produce Scheme;
- (iv) Grants-in-Aid Scheme;
- (v) Encouraging NGOs for taking up Afforestation and building upon peoples' movement.

Table No. 10.1 Investments In Forestry Sector (in Crores)

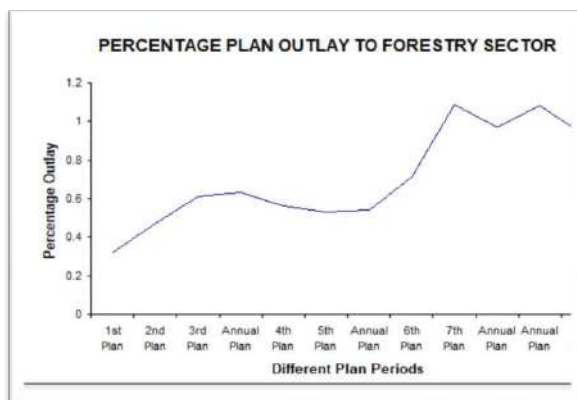
Plan/Year	Total Plan		Agriculture Plan		Forest and Wildlife Plan		Forest Outlay (% of total)
	Outlay	Actual	Outlay	Actual	Outlay	Actual	
First Plan(1951-1956)	23780	19600	3540	2 900	76	85	0.32
Second Plan (1956-1961)	45000	46720	5100	5 490	212	212	0.47
Third Plan(1961-1966)	75000	8577	10860	10890	458	459	0.61
Annual Plan (1966-1969)	66250	66225	10370	11070	419	421	0.63
Fourth Plan (1969-1974)	159020	157790	27280	23200	894	938	0.56
Fifth Plan (1974-1979)	393220	394260	47660	48650	2088	2088	0.53
Annual Plan (1979-1980)	126010	121760	18150	19960	683	683	0.54
Sixth Plan(1980-1985)	975000	1092920	125390	152010	6924	NA	0.71
Seventh Plan (1985-1990)	1800000	2187300	222330	315090	18519	19759	1.09
Annual Plan (1990-1991)	647170	583690	91420	85420	6299	5764	0.97



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Annual Plan (1991-1992)	723170	647500	100580	90600	7831	7153	1.08
Eight Plan (1992-1997)	4341000	-	636420	-	40820	39930	0.94
Ninth Plan (1997-2002)	-	-	-	-	68 228		
Total up to 8 th FYP	9374620		1299100		85295		0.90
Source: Developing Wastelands, Ministry of Environment and Forests							

Fig.No. 10.1 Percentage Plan Outlay to Forestry Sector



10.11 Nineth Plan (1997-2002):

The main objectives of this plan are:

- 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.

10.11.1 The main emphasis is to be given to the participation of people in the management and sharing of usufruct through Joint Forest Management. The involvement of NGOs is also sought for building awareness and acting as an interface. The priority is also to be given to the development of villages in and around the forest areas. It is also decided to take up the survey and demarcation of existing forest area during the Ninth Plan. Efforts will be made to take advantage of various Employment Generation Schemes of Rural Development Department to supplement funds for plantation activities. Emphasis is also laid down on the research aspects like tree improvement, non-timber forest produce, agro-forestry, alternatives of timber, value addition to the various forest products, etc. The efforts will be made to empower the women by ensuring their involvement from micro-planning stage to implementation and usufruct sharing.

10.11.2 Evaluation of 9th Plan

The programmes/schemes of Ninth Five Year Plan are generally similar to those taken up during the Eighth Plan, such as Integrated Afforestation and Eco-Development Project, Fuel wood and Fodder Project Scheme, Non-Timber Forest Produce Scheme, Grants-in-Aid Scheme, Seed Development Scheme, etc. with greater focus and improved implementation on the basis of the experience gained during Eighth Plan. The Planning Commission had set up a Working Group to examine the prospects of leasing out of degraded forest lands to the private entrepreneurs/Forest Corporations. The main term of reference of the Working Group was to assess the economic, social and environmental feasibility of leasing or otherwise making degraded forest land available to the private entrepreneurs/Forest Corporations. The Working Group has submitted its report and has not recommended leasing of forest land to the private entrepreneurs either directly or indirectly through forest corporations.



10.12 Tenth Plan (2002-07):

India is privileged to host the Eighth Conference of the Parties (COP8) to the UNFCCC in Oct-Nov, 2002. The Hon'ble Prime Minister Shri Atal Behari Vajpayee in his speech at the High Level Segment of the COP8 asserted the high priority given to the forests. In his own words *"India accords high priority to conservation of forests and wildlife for long-term ecological and environmental security. The participation of local communities is ensured through the 'Joint Forest Management' programme. I am happy to say that this has helped to increase our forest cover significantly"*.

The tenth five year plan is measure landmark in the history of development in India. It is the first five year plan of the new century. It aims at acheiveing GDP growth of 8% average annual during tenth plan. A.B. Vajpayee the then Prime Minister had given opening remarks at the 50th meeting of the National Development Council, New Delhi, 21 December, 2002 while Approach Paper to the tenth plan was unanimously approved by NDC. He made specific suggestions for the consideration of that meeting.

1. The Governance reforms, with Special Reference to e-governance
2. Barriers to Internal Trade
3. Creating an investor friendly climate
4. Financial and Administrative Empowerment of Panchayati Raj Institutions.

The scheme titled National Afforestation Programme (NAP) was formulated by merger of four 9th Plan centrally sponsored afforestation schemes of the Ministry of Environment and Forests. namely, Integrated Afforestation and Eco-Development Projects Scheme (IAEP), Area Oriented Fuel wood and Fodder Projects Scheme (AOFFPS), Conservation and Development of Non-Timber Forest Produce Including Medicinal Plants Scheme (NTFP) and Association of Scheduled Tribes and Rural Poor in Regeneration, of Degraded Forest (ASTRP) with a view to reducing multiplicity of schemes with similar objectives, ensuring uniformity in funding pattern and implementation mechanism, avoinding delays in availability of funds to the field level and institutionalising peoples participation in project formulation and implementation. The Scheme will be operated by the National Afforestation and Eco-Development Board, Minister of Environment and Forest as a 100% Control Sector/ Centrally Sponsored scheme.

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 Jatropha, pongamia etc., would be promoted to encourage the livelihood opportunities of the rural masses.
- It is 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 Years Plan (2007-2012)

Environmental concerns are growing globally as well as within the country. While there may appear to be a trade-off between environmental sustainability and economic growth in the short run, it has to be recognised, that in the longer run environmental sustainability and human well-being are not necessarily in conflict. Neglect of environmental considerations, as for example, in profligate use of water or deforestation can lead to adverse effects very quickly. The threat of climate change also poses real challenge to the wellbeing of future generations which we can ill afford to ignore. Our development strategy has to be sensitive to these growing 6 concerns and should ensure that these threats and trade-offs are appropriately evaluated.



10.13.1 Sectorial policy For Forest & Environment Sector

Population growth increases the environmental load irrespective of the rate of economic growth. Rapid economic growth can intensify environmental degradation. The solution does not lie in slowing growth since slow growth also leads to its own form of environmental deterioration. With rapid growth we can have the resources to prevent and deal with environmental problems, but we must also ensure that rapid growth is environmentally benign. This can be achieved through greater awareness, starting with school children, and appropriate policies. The 11th Plan must integrate development planning and environmental concerns, providing the use of economic instruments based on the polluter pays principle, supplemented by command and control policies where these are more appropriate.

(a) Improving Air and Water Quality

Real time monitoring of air and water quality is crucial for devising programmes and policies related to pollution management. The existing 300 monitoring stations for air and 850 for water quality need augmentation in number and technology. Establishing a reasonably adequate monitoring network with contemporary technology will be a priority. The objective of river cleaning is to restore the water quality of all the major rivers to the designated best use which is the 'bathing class' (category B). We are very far from achieving this objective. The National River Conservation Plan needs a critical review of the present strategy of central assistance to states for creation of facilities. Sustainability and operational issues remain unresolved in most cases. Ways of linking treatment of sewage and industrial effluents to the urban and industrial development planning need to be worked out. The goal should be to ensure that by the end of the 11th Plan no untreated sewage or effluent flows into rivers from cities and towns. Studies on minimum essential flow in the rivers and plans to maintain it must be drawn up. This should include workable mechanisms to expedite solution of water sharing problems between states. The demands of river cleaning increase with population and expansion of townships and success depends on the efforts of all stakeholders. Civic bodies should have a pivotal role to play in this context. This must be ensured through policy/legislative means. The impact on water quality of the "Water Quality Assessment Authority (WQAA)" constituted in June 2001, in different states is yet to be ascertained. A workable mechanism will be developed for monitoring and early warning systems for improving water quality.



(b) Solid Waste Management

The increasing generation of solid waste is a growing problem in all cities. Uncollected garbage is not only visually ugly, it also causes diseases. Dumping garbage into landfills is not an attractive option in our land scarce cities and should be minimised. Most industrial countries now require their citizens to segregate wastes at home into recyclable products. While recycling is done by rag pickers in India, their lives can be made less unpleasant if citizens sort out organic and inorganic waste and dispose of organic waste in local compost or vermiculture pits. 42 Cities and towns must be encouraged to evolve systems with citizen participation, for segregation of waste at point of origin, maximising recycling and safe disposal of the rest.

(c) Preservation of Wildlife and Bio-diversity

Management planning for the Protected Areas will be a priority and each sanctuary/national park will be enabled to maintain a database of vital information on its biodiversity and habitat status. Important wildlife habitats of the country will be conserved and protected with participation of people. While an interface with communities will be developed, communication and surveillance of forests and wildlife will be augmented through Integrated Forest Protection scheme of MoEF. People living in deep forests will be encouraged to shift to fringes voluntarily for providing inviolate space for wildlife. To facilitate this process, an appropriate programme including provision for livelihood opportunities will be formulated as suggested by the Tiger Task Force.

(d) Mitigating Land Degradation Through Green Cover

Overuse of resources has been identified as a major cause of land degradation. Creation of forest/biomass resources in all the culturable vacant lands will be taken up for strengthening life support system of communities and maintaining soil/water regimes. A programme for social forestry will support development and sustainable management of the common property resources through Panchayati Raj Institutions. Encouraging agro/farm forestry and building interface between industry and farmers is an important strategy suggested in the National Forest Policy 1988. An enabling environment will be created for encouraging tree growing by farmers. Subsidised supply of raw material to industries from government forests will be discouraged. Domestic and international



trade of the farm forestry produce by support price mechanisms and exim/tariff regulation will be considered. Forest management will be encouraged to withdraw from raising farm forestry plantations in government forests to provide better market opportunities to the farmers.

(e) Increasing the Green Cover

Satellite data for 2002 indicate green cover of 23.68%, representing a net improvement of 0.65% since 2000. This is a welcome development and if the trend continues, the 10th Plan target of 25% will be fulfilled by 2007. However, it is a matter of concern that the quality of green cover has deteriorated. There has been a 6.3% reduction in dense forests indicating degradation. State forest management would need to work for attaining productivity potential of the forests. Timber and non-timber benefits must be optimised with adequate investment for regeneration. The Eleventh Finance Commission has also supported this cause through grants-in-aid for forest maintenance. 43 Joint Forest Management (JFM) evolved in 1990s aimed at involving communities in improving degraded forests. This was largely based on benefit sharing. It failed where the forests managed by the communities were so degraded that no significant benefits accrued to the communities. However, there was success in places where leadership was in the hands of highly motivated individuals and significant benefits could be generated. Certain aspects of empowerment, reciprocal commitment for protection and sense of ownership remain to be strengthened in JFM. The 10th Plan proposed universalisation of JFM. In the 1.70 lakh villages in the vicinity of forests, 99708 JFM Committees were formed till 2005 against about 62890 in the beginning of the 10th Plan. The emphasis in the 11th Plan will be on consolidation of JFM through augmenting productivity and linking forests with livelihood and gainful employment generation. Management of NTFP for value addition and link to markets will need to be organised for better returns to the communities.

Among the initiatives to be pursued in the 11th Plan are the following:

- Encourage PRIs to revive common property resources through social afforestation.
- Rationalise forest regulations to allow industry to partner farmers in undertaking agro-forestry for augmenting the raw material base for forest based industries like paper & pulp.



- Encourage the corporate sector to participate in development of degraded land for forestry, without compromising communities priorities.
- Rationalise rules and procedures under environmental laws to expedite investment, production and employment growth.

(f) Environmental Clearances:

As we put in place a policy of environmental protection, we must also pay attention to the danger of creating a new license permit raj system which will replicate all the ills associated with the old licensing regime. A comprehensive review of environmental clearance procedures is necessary to ensure that the system is transparent and avoids unnecessary delay. Unless this is done, the large increases in investment required for accelerated growth will not fructify.

10.14 Twelfth Five Year Plan (2012-2017):

The aim of the 12th Five Year Plan is to achieve “faster, sustainable and more inclusive growth”. Broad objectives of the 12th Five Year Plan are;

- To reduce poverty
- To improve regional equality across states
- To improve living conditions for SCs, STs, OBCs, Minorities
- To generate attractive employment opportunities for Indian youth
- To eliminate gender gaps

The growth indicator in environment sector are

- Development of a National Action Plan for Climate Change to achieve target of 20% to 25% reduction in emission levels by 2020.
- Increasing Green Cover (as measured by Satellite Imagery) by 1 million hectare every year.

With the dissolution of Planning Commission and formation of NITI Aayog, no more formal plans are made for economy except for Five Year defence Plans for 2017-2022. There will be no Thirteenth Five year Plan.





CHAPTER –11

Past System of Management:

11.1 General History of the Forest:

11.1.1 History of the Division:

With the abolition of anchals, the management of Ex- Zamindary Forests of Kanika and Kujanga were vested in Athagarh Forests Division in 1957. Records reveal that during 1959 two new ranges Kanika and Kujanga were constituted.

11.1.2.1 In the year 1980 the Kanika Range of Athagarh Forests Division with the Ex-Zamindary Forests (16,207.01 Ha. Cuttack Dist. and 1027.48 hectares in Balasore Dist) was separated from Athagarh Division for constitution Wildlife Conservation Division at Chandbali. In 1988 Kujanga Range was transferred to Wildlife Conservation Division, Chandbali.

11.1.3 History of the Forests (Ex-Zamindary Forests):

There were no Plans or Schemes for the management of forests under the control of Zamindars. The main intension was to meet the local tenants demand on payment of royalty as per schedule of rates fixed by the Zamindars. In Kujanga Zamindary, the tenants were allowed to sell the timber outside on payment of double royalty. In 1927 Mr. R.L. Derry had suggested light selection fillings in Kujanga block in small concentrated patches. He also prescribed to cut all the useless and unserviceable species as firewood. The records were not available to know whether the prescriptions were followed. The total area of Kujanga forests was 55,501 acres of which 25,692 acres were leased out to Midnapur Settlers as well as to the local people by the Zamindars.

With the enforcement of the Orissa Estate Abolition Act 1951, the Zamindaries were vested with the Revenue Department in 1951 and the Forest Management was transferred to the Forest Department in 1957. In 1957 five forest blocks namely, Hetamundia, Hukitola, Jogidhankud and Bhitarkharinasi 'A' & 'B' were declared as Protected Forests under section 29 of the Indian Forest Act, 1927.

11.1.4 A number of social forestry plantations raised in revenue land exist in the Division, which needs to be managed scientifically. Trees outside forest area are also located on agricultural land, river bank, nallah bank and on different road sides. This also needs to be accounted for and their management prescribed.



11.2 Past System of Management and Their Results:

11.2.1 Working Circles as per Outgoing Plan:

Forests of two Ranges i.e. Mahakalapada WL Range and Kujanga WL Range Two Ranges of this Division are included in the purview of the Working Plan. In the outgoing Plan, there was Six Working Circles i.e.

- (i) Rehabilitation Working Circle; (13814.090 ha)
- (ii) Plantation (Overlapping) Working Circle, (713.00 ha)
- (iii) Protection (Overlapping) Working Circle, (13778.090 ha)
- (iv) Joint Forest Management (Overlapping) Working Circle, (490 ha)
- (v) Wildlife (Overlapping) Working Circle, (9821.50 ha)
- (vi) Mangrove Improvement (Overlapping) Working Circle (2176.60 ha)

11.2.2 Rehabilitation Working Circle:

As per the guidelines issued in the National Working Plan code, all the forest blocks were included in this working circle. The total area needs different kinds of treatments like protection, eviction of encroachments, rehabilitation of the degraded areas, etc. The total area allotted to this working circle is 13 778.09 Ha. In addition, Village Forests in Kujang WL Range over 36 Ha is also allotted to this working circle. Two Treatment Series have been constituted one in each range. Each series is divided into 10 coupes

Achievement under Rehabilitation WC;

The year wise area allotted for treatment and achievement is as follows. (Table No 11.1)



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Table No.11.1: Achievement under Rehabilitation WC (Rajnagar WL Division)									
Year	Treatment Coupe No.	Area allotted under Treatment series (In Ha)		Rehabilitation		Achievement in Ha			Remark (Reason for Shortfall)
		MHP TS	SRL TS	Total		MHP TS	SRLTS	Total	
2007-08	I	641.06	665.71	1306.77		0		0.00	Out of 13778.09 ha allotted for Rehabilitation, 772.00 ha could be treated during Plan period and 70.0 ha beyond plan period (up to 2021-22) totaling 842.00 ha. The shortfall is due to paucity of funds
2008-09	II	654.77	835.34	1490.11		0		0.00	
2009-10	III	534.92	859.64	1394.56		0		0.00	
2010-11	IV	842.30	715.07	1557.37		0	200.0	200.00	
2011-12	V	540.59	699.41	1240		400.0	72.00	472.00	
2012-13	VI	678.34	677.63	1355.97		100.00		100.00	
2013-14	VII	655.97	678.92	1334.89		0		0.00	
2014-15	VIII	749.51	616.04	1365.55		0		0.00	
2015-16	IX	586.36	667.77	1254.13		0		0.00	
2016-17	X	767.15	711.59	1478.74		0		0.00	
	S. Total	6650.97	7127.12	13778.09		500.00	272.00	772.00	
2017-18	I	641.06	665.71	1306.77		0		0.00	
2018-19	II	654.77	835.34	1490.11		0	0	0.00	
2019-20	III	534.92	859.64	1394.56		0	0	0.00	
2020-21	IV	842.30	715.07	1557.37		0	70.00	70.00	
2021-22	V	540.59	699.41	1240.00		0	0	0	
	S Total	3213.640	3775.170	6988.810		0	70.0	70.0	
	Total	9864.610	10902.29	20766.900		500.0	342.00	842.00	



Results:

The main activities of this working circle are demarcation of boundaries, habitat improvement, habitat protection and gap plantation. During the plan period boundary of 09 PF forest blocks having 621 Nos. of pillars have been demarcated spreading over a total length of 81.1 Kms and gap plantation of 623 hectares has been taken up under different scheme.

The mangrove forests are degraded mostly due to encroachment. For habitat improvement and habitat protection, 1665 hectares of encroached forest land have been evicted and restored with mangrove species. Apart from this 523.03 hectares of area has been taken up silvicultural operation like cleaning, climber cutting and removal of unwanted weeds.

There is a problem of availability of fresh water in the mangrove areas due to salinity and affects the wildlife of the area. Hence 15 Nos. of fresh water ponds have been created.

Illicit felling and collection of firewood from the mangrove areas causes a great damage to the mangrove forests. To reduce the dependency of people on mangrove forest, trees have been planted outside forest area under various schemes and seedlings have been distributed free of cost to the local people to increase the tree cover outside forest. During the plan period 1807.40 Ha. of block plantation and 140 RKM of avenue plantation have been taken and 8.00 Lakhs seedling have been distributed.

For protection of casuarina forest by involving the people of local community 23 Nos. of VSS have been formed and total area of 440 hectares has been allotted for protection. These institutions are being revitalized.

11.2.3 The Plantation (Overlapping) Working Circle

In the two ranges, wherever the blank areas are present, they are included in this working circle. The plantation is mainly of either mangrove or Casuarina depending on the site. The total area allotted to this working circle is 713 Ha. Two planting series were constituted namely Jatadhar and Nuagaon in Kujanga WL Range.



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Achievement under Plantation (Overlapping) WC;

The Plantation Working Circle is an Overlapping WC. The total area allotted is 713 ha in Kujang Range Only. The area is allotted to two Planting series i.e. Jatadhar PS and Nuagaon P.S. The year wise allotment and achievement is as follows (Table No 11.2).

Table No. 11.2: Achievement under Plantation (O) WC (Rajnagar WL Division)

Year	Coupe	Allotment of Area Pl.WC in Ha			Achievement in Ha			Reason For shortfall
		Jatadhar PS	Nuagaon PS	Total	Jatadhar PS	Nuagaon PS	Total	
2007-08	I	35.00	40.0	75.0	0	0	0	Out of 713.0 ha prescribed for plantation 242.4ha could be planted during plan period & 192.00 ha beyond Plan period (up to 2021-22) totaling 334.40ha .The shortfall is due to paucity of funds
2008-09	II	35.00	35.0	70.0	20.0	0	20.0	
2009-10	III	30.00	35.0	65.0	10.0	0	10.0	
2010-11	IV	30.00	35.0	65.0	40.0	0	40.0	
2011-12	V	40.00	35.0	75.0	40.0	0	40.0	
2012-13	VI	40.00	35.0	75.0	42.40	0	42.40	
2013-14	VII	40.00	35.0	75.0	40.0	0	40.0	
2014-15	VIII	40.00	35.0	75.0	0	0	0	
2015-16	IX	40.00	40.0	80.0	50.0	0	50.0	
2016-17	X	23.00	35.0	58.0	0	0	0	
S. Total		353.00	360.0	713.0	242.40	0	242.40	
2017-18	I			75.00	0	0	0	
2018-19	II			70.00	0	0	0	
2019-20	III			65.00	0	0	0	
2020-21	IV			65.00	192.00	0	192.00	
2021-22	V			75.00	0	0	0	
S Total				350.00	192.00	0	192.00	
Total					434.40		434.40	

Results:

During the plan period total 207.4 Ha. of block plantation has been taken up out of 713 Ha. of allotted areas for plantation because 68.980 Ha. of forest area from Jatadhar RF and remaining 55.29 Ha. is not suitable for plantation due to few are covered by mangrove vegetation and rest submerged under river water. 1106.877 Ha. of Nuagaon Dhinkia PF and 27.680 Ha. of Noliasahi PF have been diverted to POSCO India Pvt. Ltd. In Balitutha PRF, 70 hectares of plantation raised during the year 2001-02 was existing and no more suitable area was available for further planting.



11.2.4 The Protection (Overlapping) Working Circle:

In the Division, there is problem of encroachment & biotic interference in all the forest blocks. The entire area of the two ranges is kept in this working circle.

Achievement under Protection (Overlapping) WC;

Under Protection (overlapping) WC, activities prescribed are

- (i) Forest Block Boundary Fencing,
- (ii) Construction of Watch Towers:

The year wise achievement is furnished below (Table No. 11.3)

Table No. 11.3: Achievement under Protection (O) WC (Rajnagar WL) Division			
Works Prescribed	Achievement If any		
Forest Block Boundary Fencing:	Year	Forest Block	Length in km
	2014-15	Kantilo RF	1.50
		Jamboo PF	1.0
	2016-17	Suniti PRF	1.0
		Jamboo PF	0.835
		Kansaridia PRF	1.0
		Sanatubi PRF	0.600
	2017-18	Jamboo PF	2.00
		Sanatubi PRF	1.00
		Kansaridia PRF	1.00
Forest Block Boundary Fencing:	2018-19	Kansaridia PRF	2.50
		Sanatubi PRF	2.50
	2019-20	Barkalikhola PRF	1.40
		Suniti PRF	1.00
		Kansaridia PRF	1.40
	2020-21	Barakolikhola PRF	1.00
		Kajalapatia- Batighar PRF	1.00
		Suniti PRF	1.00
	2021-22	Batighar PRF	1.617
		Total Fencing	23.352
Construction of Watch Towers: Location suggested:Kansaridia, Hetamundia, Sanatubi, Sasanpeta, Jamboo and Kandarapatia.	No Watch Tower has been constructed during Plan Period & Beyond in Kujang and Mahakalapada WL Range		



Results:

Large portion of all most all forest blocks of these two ranges coming in the working plan description was encroached by illegal aquaculture ponds and agricultural farms. During the plan period 1665 hectares of area has been made free from encroachment by eviction of prawn gheries and restored by planting mangrove species.

To reduce the biotic interference in forest and preventing the movement of wildlife from forest to human habitation avoiding Human-Wildlife Conflict 2 Km fencing in the boundary of forest blocks in vulnerable areas has been provided. Further, existing 23 Nos. of JFM committees will be revitalized to involve the local people in protection activities and an area of 440 hectares forest area has been allotted. No forest fire has been occurred due to preventive fire protection measures during the plan period.

11.2.5 Achievement under Mangrove Imp. (Overlapping) WC:

In some of the areas, the mangrove forest needs improvement like attending the salinity, digging of fish bone channels, etc. the important activities are creek renovation, construction of new fishbone channels, digging of fresh water ponds, removal of unwanted weeds, creation of mounds, watch towers, inspection path etc. These areas are kept in this working circle and the total area allotted to this working circle is 2176.60 hectares.

In the outgoing working Plan 2176.60 ha was proposed for treatment. The year wise achievement is furnished below (Table No. 11.4)

Table No. 11.4: Achievement under Mangrove Imp. (O) WC (Rajnagar WL Division)

Year	Coupe	Allotted area in ha			Area treated in ha			Remarks for deviation
		Kujangl. S	Batighar I.S	Total	Kujangl. S	Batigharl. S	Total	
2007-08	I	26.00	187.00	213.00				
2008-09	II	26.00	165.00	191.00				
2009-10	III	26.00	165.00	191.00				
2010-11	IV	26.00	200.00	226.00		398.96	500.65	NB:1
						101.69		NB:2
2011-12	V	26.00	200.00	226.00		100.00	200.00	NB:3
						100.00		NB:4
2012-13	VI	25.00	200.00	225.00				
2013-14	VII	25.50	200.00	225.50				



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2014-15	VIII	32.40	215.00	247.40				
2015-16	IX	30.00	185.00	215.00				
2016-17	X	29.20	187.50	216.70				
Total		272.1	1904.5	2176.60	0	700.65	700.65	

NB:1: JamboorPF ; NB:2- Suniti PRF; NB:3 Kandarapatia PRF, NB:4- Suniti PRF

Results:

For the improvement of mangroves in the areas of this working circle the above said activities have been taken up. During the plan period as per the prescription of working plan 11.6 KM of creeks have been renovated along with 3 Nos. of mounds, 2 Km of inspection paths and fishbone channels over an area of 56 Ha have been constructed for improvement of mangrove vegetation. Removal of unwanted weeds over an area of 26.5 hectares and gap planting of 623 hectares have been taken up for restoration of mangrove forests.

11.2.6 Achievement Under JFM(O) WC:

This overlapping working circle overlaps mainly the Rehabilitation Working Circle. The forest areas that are being protected by Vana Samrakshana Samitis are included in this working circle. Further all the notified Village forests have also been brought under this working circle. The forest under this overlapping circle will be managed through micro plans prepared by the village committees. The total area allotted to this working circle is 490 hectares including 36 hectares of Village Forests of Kujanga WL Range. (Table No 11.5)

Table No. 05: Achievement under JFM WC (Rajnagar WL Division)				
Range	No. of VSS available	No. of Additional VSS constituted		
Mahakalapada	11	1	Total 4 VSS constituted	
Kujang	8	3		

The list of VSS of Mahakalapada WL Range / Kujang WL Range is furnished below (Table No.11.6(A) and 11.6(B))



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Table No. 11.6(A) VSS List of Mahakalapada Range, Rajnagar WL Division						
Sl. No.	Name of the Section	Name of the VSS	Name of the Village	Name of the G.P	Name & Status of Forest land	Area in ha assigned to VSS in Ha
	Mahakalapada Range					
1	Jamboo	Jamboo South	Jamboo	Jamboo	Jamboo PRF	20.00
2	Jamboo	Jamboo North	Jamboo	Jamboo	Jamboo PRF	20.00
3	Jagatjore	Suniti West	Suniti	Suniti	Suniti PRF	20.00
4	Jagatjore	Kalatunga	Kalatunga	Gagua	Kantilo RF	20.00
5	Jagsatjore	Radhiakansara	Radhia&Kansar	Badhi	Rev. For.	20.00
6	Jagatjore	Jagatjore	Datapur&Kantilo	Suniti	Suniti PRF	20.00
7	Jamboo	Kandarapatia	Kandarapatia	Jamboo	Kandarapatia PF	20.00
8	Jamboo	Jamboo East	Jamboo	Jamboo	Jamboo PF	20.00
9	Jamboo	Suniti East	Suniti	Suniti	Jamboo PF	20.00
10	Barunei	Ratapanga	Ratapanga	Gagua	Ratapanga PF	20.00
11	Barunei	Bhopal	Bhopal	Gagua	Bhopal PF	20.00
12	Jamboo	Petchhela	Petchhela		Petchhela PRF.	20.00
	Total (12 No)					240.00



Table No. 11.6 (B) List of VSS Kujang WL Range						
Sl. No.	Name of the Section	Name of the VSS	Name of the Village	Name of the G.P	Name & Status of Forest land	Area in ha assigned to VSS
	Kujang WL Range					
1	Nuagaon	Gada Kujang-A	Bayanalkandha	Gada Kujang	Madhuban (A) P.F.	20.00
2	Nuagaon	Gada Kujang-B	Polanga	Gada Kujang	Madhuban (B) P.F.	20.00
3	Nuagaon	Gada Kujang-C	Bhuyanpal	Gada Kujang	Bhuyanpal PF	50.00
4	Borikina	Ramatara	Ramatara	Padmapur	Ramatara PF	20.00
5	Borikina	Sahadabedi-A	Sahadabadi	Padmapur	Sahadabedi PF	60.00
6	Hawakhana	Sahadabedi-B	Sahadabadi	Padmapur	Sahadabedi PF	60.00
7	Borikina	Naupala	Naupala	Kusupur	Salio PF	20.00
8	Borikina	Amarpat	Amarpat	Kusupur	Salio PF	20.00
9	Bandar	Baliore	Baliore	Baramundali	BalioreRev. Forest	42.90
10	Bandar	Bandara	Bandara	Baramundali	Rev. Forest	51.00
11	Bandar	Baradia	Baradia	Baramundali	Rev. Forest	50.00
	Total (11 No.)					413.90
	Division Total (23 Number)					653.90

Results:

Total 23 No. of JFM Committees was formed in these ranges and 653.90 hectares of forest area was allotted for the purpose. But due to diversion of forest land in Kujanga WL Range for POSCO India Pvt. Ltd. and internal conflict among the members of the committee leading to serious law and order problem, activities of these JFMCs are not up to desired level. However steps are being taken to rationalize JFM Committees in new areas in lieu of the defunct committee as per the guidelines of JFM Resolution 2011 with amendment of 2015.



11.2.7 The Wild Life (Overlapping) Working Circle

Some of the areas in the two ranges are wildlife rich areas. Specific management interventions are required in these areas. The most important activities to be taken as per the working plan prescription are renovation of creeks, development of meadows, digging of fresh water ponds, creation of mounds for improvement of habitats and control of wildlife crime through protection measures, Development of eco-tourism facility for providing alternative livelihood to the local people to elicit their support in conservation and protection of wildlife and their habitats and awareness of people about importance of wildlife conservation. The total area allotted to this working circle is 9821.50 Ha.

Achievement under Wildlife (O) WC

Under Wildlife (Overlapping WC) the activities prescribed are given below:

- Meadow Development (80ha)
- Digging of Fresh Water Ponds (21 No.)
- Creation of Mounds
- Fencing in Crocodile Prone Areas
- Eco-tourism

The activities prescribed and achievements done during Plan period & beyond are furnished below. (Table No. 07)

Table No. 07: Activities implemented during Plan Period &beyond (Rajnagar WL Division)			
Activities Prescribed		Activities Implemented / undertaken	
Meadow Development (80ha)	Year	Forest Block	Meadows Developed in Ha
	2007-08	Kansaridia PRF	2.00
		Hetamundia PRF	4.00
		Sasanpeta PRF	4.00
	2009-10	Jamboo PF	5.00
		Kansaridia PRF	5.00
	2015-16	Hetamundia PRF	2.00
		Kansaridia PRF	1.00
	2016-17	Hetamundia PRF	7.28
		Jamboo PF	4.30
	During Plan Period		34.58
	2017-18	Jamboo PF	3.00



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		Hetamundia PRF	2.00
		Kansaridia PRF	3.00
	2018-19	Hetamundia PRF	3.00
		Kansaridia PRF	3.00
		Jamboo PF	3.00
	2019-20	Kansaridia PRF	3.00
	2020-21	Kansaridia PRF	2.00
		Jamboo PF	2.00
		Kantilo RF	5.00
	Beyond Plan Period		29.00

Under this Meadow Development program during Plan Period, the achievement is 34.58 ha i.e. 43.22 % and beyond Plan period the achievement is 29.00 Ha 36.25%. The total achievement is about 79.48%. The shortfall is due to paucity of funds under the plan / non plan budget.

<i>Digging of Fresh Water Ponds (21 No.)</i>	Year	Forest Block	<i>Fresh Water Ponds (Creation) in No.</i>
	2008-09	Sasanpeta PRF	01
		Kansaridia PRF	01
	2009-10	Jamboo PF	01
		Hukitola	01
	2011-12	Kansaridia PRF	01
	2012-13	Kansaridia PRF	01
	2013-14	Jamboo PF	01
		Hetamundia PRF	01
	2015-16	Bhitarakharanasi RF	01
	2016-17	Hetamundia PRF	01
		Kansaridia PRF	01
	During Plan Period		11
	2018-19	Hetamundia PRF	01
	2020-21	Hetamundia PRF	01
	Beyond Plan Period		02

Digging of fresh water pond the achievement during Plan period is 11 no which is about 52.40% and beyond Plan period is 02 i.e. about 10%. The total achievement is 61.90%. Paucity of funds under this subhead is the reason for shortfall.

<i>Creation of Mounds</i>	Year	Forest Block	<i>No of Mounds Created</i>
	2013-14	Bhitarakharanasi RF	01
	2015-16	Hetamundia PRF	01
		Bhitarakharanasi RF	01



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	During Plan Period		03
	2018-19	Bhitarakharanasi RF	01
	Beyond Plan Period		01
Fencing in Crocodile Prone Areas	Year	Village / Location	On River / Creek
	2019-20	Barakolikhola	Batighar River / Creek
		Baranumber	Ramachandi Creek
		Batighar	Batighar Creek
		Kajalapatia	Batighar Creek
		Chandiapali	Gobari River
	2020-21	Mangala Tutha	Gobari River
		Harijanpada	Gobari River
Fencing in Crocodile Prone Areas	2020-21	Olia	Gobari River
		Bijayanagar	Gobari River
		Nilakanthapur	Gobari River
		Bachhada	Gobari River
		Jalakana	Gobari River
		Jagati	Gobari River
	2021-22	Alatanga	Brahmani River
		Bachhada	Brahmani River
		Karamanta	Brahmani River
		Nilakanthapur	Brahmani River
		Atharabatia	Brahmani River
		Mandapada-I	Brahmani River
		Mandapada-II	Brahmani River
		Chadakulahat	Brahmani River
		Dihapada	Gobari River
		Ekalpur	Gobari River
		Malianch	Gobari River



Table No. 08: Activities Pertaining to Eco- Tourism

Eco-tourism		
Jamboo- Batighar-Hukitola-Jamboo		Described below
Atharabanki-Mahanadi- Kharanasi creek- Atharabanki(Paradeep)	Batighar-Hukitola- Mahanadi-	Described below

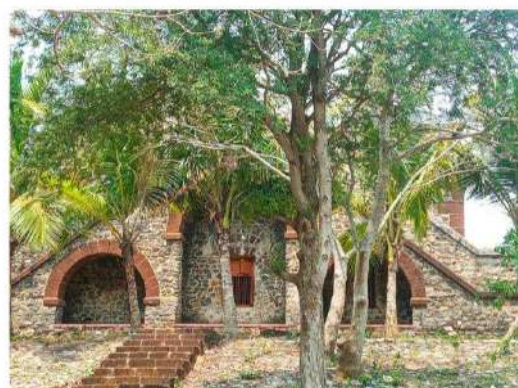
Jamboo- Batighar-Hukitola-Jamboo Eco tourism Circuit:

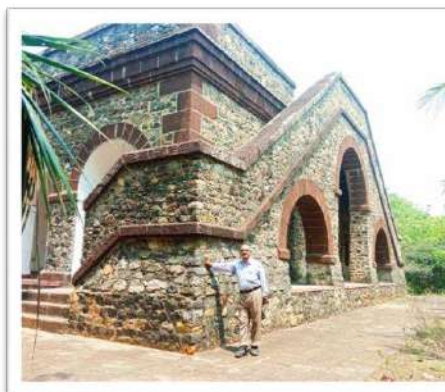
Hukitola is situated on Jamboo island in the Bay of Bengal of Mahakalapada Block in Kendrapara District. The building having plinth area more than 7000 sq ft, on the island was constructed by the Britishers in 1866/67 during the “*NaankaDurbhikshya*”. This was used to store rice imported from Burma and other places through sea route. It bears testimony to advancement made in construction technology in the 19th century. The monument, a majestic building with underground rainwater harvesting system is symbol of the state’s glorious past in maritime.

The place attracts students, scholars and history lovers throughout the year for its scenic location and historical significance. The port and the palace started losing its importance in 1924 when the Britishers established a port at false point.

The uniqueness of the palace lies in its roof slope in design. It helps rain water to flow down to four big water pots. The collected water was used for drinking purposes by the merchants throughout the year.

INTACH under ICZM program renovated Hukitola for eco-tourism.



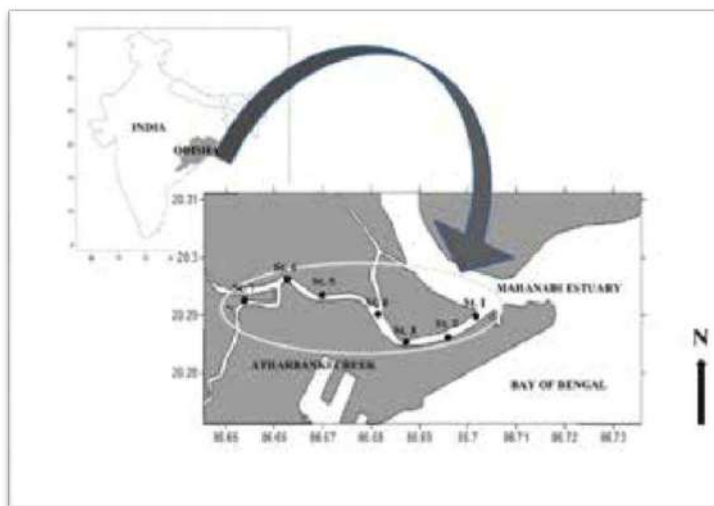


**Atharabanki-Mahanadi- Batighar-Hukitola-Kharanasi creek- Mahanadi-
Atharabanki(Paradeep) Eco tourism Circuit:**

This is the first lighthouse installed in eastern coast of India. It is around 45 KM from District HQ. It is situated in a village named Batighar, on the other bank of river Kharanasi. It is surrounded with pleasant natural beauty. Once upon a time, this was known as Kaudia Dwip and used as hunting ground of Kujang Kings. Construction of this lighthouse was started on 6th December, 1836 and it was lighted on 16th October 1837. The stones used were transported from Barabati Fort, Cuttack. The height is 125 feet, foundation wall is 15 feet thick. The diameter at land level is 10 feet. To reach the top, 138 steps made of cement concrete and 16-step ladders are there. The specialty of this lighthouse is that it is operational from the date of its lighting and presently it is managed by Calcutta Light House.



On 16th October 1837 first light came out from this light house. This Light house was built by Mr. H. Wright. This light house is 60 feet above sea level built on sand heap. This is a six storied building having space to take rest on each floor having a big window. There are 16 Bullet proof glasses attached at the top floor. Year 1857 is inscribed on that glass which is remaining as it is. Within the circular room there is a wheel of 3 feet radius having an electric bulb at the center. This bulb is of 440 v 230 w, this light can be seen from 60 km in the sea. This Light House is opened for Tourist from 7.00 am to 10. am and 4 pm to evening.

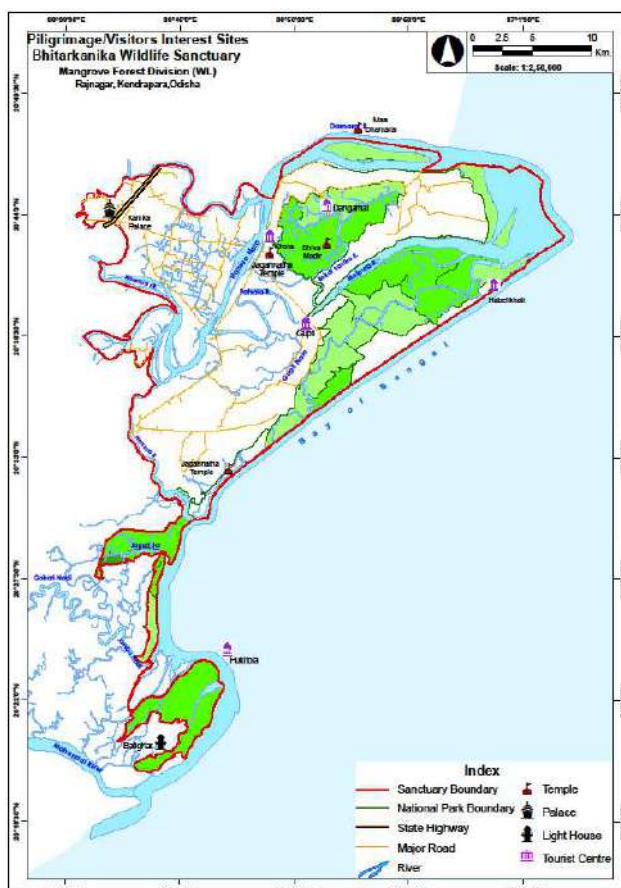


Atharbanki, a mangrove waterway of Mahanadi Estuary (17°49'N-22°34''N; 81°24'-87°29'E) on the east coast of India has been under considerable anthropogenic



pressure. within the mangrove areas *Avicennia*, *Rhizophora*, *Bruguiera*, *Kandelia*, *Ceriops*, and *Aegiceras* sp. are the most common. The river meanders southeast to northeast for nearly 13.5 km skirting the highly industrial belt of Paradip, courses adjacent a major fishing harbor into Mahanadi Estuary before opening into the Bay of Bengal.

Though there are many prospective for tourism purpose, the facilities have not yet developed to cater the need of tourist. The Tourist map of Rajnagar WL Division is furnished below.



Results:

During the plan period all the prescribed activities are being taken for protection of wildlife and their habitat. The wildlife population has increased to a great extent during the plan period in all most all working plan areas due to intensive protection and habitat improvement measures. In the new working plan area of this



working circle may be extended to all areas prescribed in the working plan.

11.3 Special Works of Improvement Undertaken

11.3.1 Protection work taken up in fire prone Forest area by raking fire line and fire watchers are engaged. VHF network along with mobile phones are supplied to staffs for enhancement of communication facilities. Quarters, water facility, electricity and solar light facility **are** provided to the staffs which will be analyzed during preparation of plan.

11.4 Past Yield, Revenue and Expenditure

11.4.1 Activities like Plantation, Protection of Wildlife and Anti-smuggling activities have been undertaken out of funds made available under central and state plan schemes.

11.4.2 The movement of Crocodiles in different Rivers and creeks is monitored. Compensation payment made for Human kill, Human injury, Cattle kill etc. During nesting of Olive Ridley Turtles, patrolling is conducted by staffs on-shore & off-shore.

11.2.3 No coupe working has been done in the last plan period as no timber, firewood or bamboo coupe existed in the working plan area of the Division.

11.5 Working Scheme:

11.5.1 The working scheme for the forest areas of the Division was approved for the year 2020-21 in absence of valid working plan. The working circles constituted in this working scheme are:

- (i) The Rehabilitation Working Circle
- (ii) The Plantation (Overlapping) Working Circle
- (iii) The Protection (Overlapping) Working Circle
- (iv) The wildlife (Overlapping) Working Circle
- (v) The JFM (Overlapping) Working Circle
- (vi) Mangrove Improvement (Overlapping) Working Circle

11.5.2 Rehabilitation Working Circle:

942.91Ha degraded forest area have been allotted to this working circle. The target could not be achieved due to want of target.



11.5.3 Plantation Working Circle:

No specific target prescribed. Barren plantable area as per availability are to be achieved depending on annual target and fund received for the Division. Could not be achieved due to want of annual plantation target for the Division.

11.5.4 Protection Working Circle:

942.91 Ha allotted to this working circle. General protection activities for all the forest blocks continued. Other prescriptions specific to the working circle could not be implemented.

11.5.5 Wildlife Overlapping Working Circle:

The habitats of estuarine crocodile, olive ridley sea turtles and wetland birds are included in the working circle.

11.5.6 JFM Overlapping Working Circle:

All VSS areas are included in the working circle. Awareness programmes of VSS members were carried out.

11.5.7 Mangrove Improvement Working Circle:

Potential areas for mangrove plantation are included in the working circle. 76 Ha area allotted out of which 50 Ha was achieved.





CHAPTER –12

Statistics of Growth and Yield:

12.1 Introduction:

The Current Annual Increment and Mean Annual Increment of various species and yield of the growing stocks of a particular patch of forest depend upon different parameters like the geology, climatic factor, position of ground water table, mineral content of soil and biomass of that locality. Soil formation on the earth's surface is a slow continuous process, which takes ages to form surface soil of 1" depth. Changing climatic factors like temperature, light, rainfall, wind etc. is bound to exert considerable impacts upon the growth rate of the growing stocks thereby affecting yield statistics of that particular patch of forest. So at the time of assessment of growth and yield of growing stock, a localized patch needs to be considered and all research works needs to be focused to know the influence of those factors on climate and soil no such research works have been undertaken nor any local volume table and yield table are available to assess the yield.

12.1.1 Mean Annual Increment:

Owing to the absence of any research activities for assessment of rate of growth of different species, it would be very difficult to assess the mean annual increment as the year wise past enumeration data for last 20 years are not available. Illicit felling is a regular feature in most forest blocks. As such illicit removal of timber from the forest would make the calculation of M.A.I. even more difficult task.

12.1.2 Local Volume Equation:

The Forest Survey of India has developed Local volume equation for different forest species both principal and secondary species taking the forest of Phulbani, Sambalpur and Koraput district as per their sampling for Orissa state. The 'Report on Resources Survey of Phulbani Forest Catchment (Orissa) prepared by Forest Survey of India, Dehradun, 1982 is being referred for relevant local volume equation for determination of volume and yield in various working plans of the State. As there is no working coupe for timber and firewood, this has not been used.

12.1.3 Study of Growth and Yield in This Plan:

As per National Working Plan Code, 2014, Grid based sampling method is to be adopted for preparation of working plan. However, in consultative discussion with



the Scientific Officers of NRSC and ORSAC it was stressed that Stratified Random Sampling method is better than the Grid based systematic sampling method as described in the National Working Plan Code-2014. Though the latter needs more sample points, the accuracy will remain the same as per statistical procedure.

102 sample points have been allocated for inventory of forests of Mangrove Forest Division (Wildlife) by NRSC through ORSAC. The sample plot allocation by NRSC was on the basis of the spatial information on forest type (derived from Sentinel classification at 10m) and forest canopy density (derived from visual interpretation of WV2 data at 1:25,000 scale). The type and density layer were combined in a GIS operation. The 42 resultant strata (7 type and 6 density classes) were simplified into ten type and density classes. For calculation of sample points to be allotted at the Division level the density classes were stratified into two classes >40 and <40. The sample point intensities were fixed as below (as suggested by Odisha Forest department, no separate pre-inventory was carried out to estimate the coefficient of variation, inventory data for 12 forest divisions carried out in 2006-2008 was used).

The calculated number of points were then distributed on the basis of forest cover and type on an area weighted basis at the compartment level.

Maximum area has crown density of 25-40% and the proportion of the area in this density class is nearly 80 percent. 14 percent area is under the category of Scrub and 3 percent of the area has a crown density of 10-25%. 3 percent of the area has a crown density of more than 40%. The crown density details of the different forest blocks is given in the **Table No.3.2** and depicted in the **Graph- 3.2** of Part-I.

12.2 Statistics of Forest Carbon Stock:

12.2.1 Carbon Stock of forest area:

Forest carbon stock is the amount of carbon that has been sequestered from the atmosphere and is now stored within the forest ecosystem, mainly within living biomass and soil, and to a lesser extent also in dead wood and litter. To estimate the stocks of live tree carbon in the area of interest, the biomass of all sampled trees is first estimated and then a plot-level estimate is calculated. A mean carbon stock is then calculated by taking the average of all plot estimates. Forest Block wise statistics of forest carbon stock is furnished in Table 12.1.



Table 12.1 Carbon Stock inside the Forest Blocks of Mangrove Forest Division (WL) Rajnagar

Sl. No.	Name of forest block	No of trees	Volume in Cum	Total Growing stock including underground biomass in Cum	Wood density (T / Cum)	Growing stock (Biomass) 10 ³ T / Cum	Carbon Equivalent in 10 ³ T / Cum	CO2 Equivalent Thousand Cum	in T /
1	Akasdia	4221	669.0000	802.8	0.7	0.56196	0.224784	0.823383792	
2	Balitutha	830	132.0000	158.4	0.7	0.11088	0.044352	0.162461376	
3	Barkud	2769	439.0000	526.8	0.7	0.36876	0.147504	0.540307152	
4	Baruhan	31254	4689.0000	5626.8	0.7	3.93876	1.575504	5.771071152	
5	Bhuanpal	1688	268.0000	321.6	0.7	0.22512	0.090048	0.329845824	
6	Boitarkuda	1140	181.0000	217.2	0.7	0.15204	0.060816	0.222769008	
7	Brahmandia	6244	990.0000	1188	0.7	0.8316	0.33264	1.21846032	
8	Goda	2148	341.0000	409.2	0.7	0.28644	0.114576	0.419691888	
9	Jatadhartanda	102517	16239.0000	19486.8	0.7	13.64076	5.456304	19.98644155	
10	Kankan	655	104.0000	124.8	0.7	0.08736	0.034944	0.127999872	
11	Madhuban A	468	74.0000	88.8	0.7	0.06216	0.024864	0.091076832	
12	Majhidia	15842	2432.0000	2918.4	0.7	2.04288	0.817152	2.993227776	
13	Marichpur	138770	20370.0000	24444	0.7	17.1108	6.84432	25.07074416	
14	Muguria	2525	401.0000	481.2	0.7	0.33684	0.134736	0.493537968	
15	Nuagaon Dhinkia	77795	12312.0000	14774.4	0.7	10.34208	4.136832	15.15321562	
16	Padmapur	8137	1291.0000	1549.2	0.7	1.08444	0.433776	1.588921488	
17	Ramtara	8612	1366.0000	1639.2	0.7	1.14744	0.458976	1.681229088	



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18	Sahadabedi	4618	724.0000	868.8		0.7	0.60816	0.243264	0.891076032
19	Salio	10025	1563.0000	1875.6		0.7	1.31292	0.525168	1.923690384
20	Tentulibelari	2048	325.0000	390		0.7	0.273	0.1092	0.3999996
21	Barkolikhola	935	148.0000	177.6		0.7	0.12432	0.049728	0.182153664
22	Batighar	5248	832.0000	998.4		0.7	0.69888	0.279552	1.023998976
23	Jogidhankud	13055	2071.0000	2485.2		0.7	1.73964	0.695856	2.548920528
24	Saralikuda	4936	783.0000	939.6		0.7	0.65772	0.263088	0.963691344
TOTAL			68744.0000	82492.8			57.74496	23.097984	84.60791539



12.2.2 Carbon Stock outside forest area (ToF):

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 (65 Ha block plantation and 215 Rkm avenue plantation) during last plan period. The biomass has been estimated on visit to plantations and observing the growth status. The carbon stock for ToF is furnished in Table 12.2 below.

Table 12.2 Carbon Stock outside the forest blocks (ToF) in Mangrove Forest Division (WL) Rajnagar								
Sl. No.	Name of plantation	Area planted in ha	Volume in Cum	Total Growing stock including underground biomass in Cum	Wood density (T / Cum)	Growing stock (Biomass) 10 ³ T / Cum	Carbon Equivalent in 10 ³ T / Cum	CO2 Equivalent in Thousand T / Cum
1	Badapal	20	40.0000	48	0.7	0.0336	0.01344	0.04923072
2	Gopalpur	15	35.0000	42	0.7	0.0294	0.01176	0.04307688
3	Badabandha	10	30.0000	36	0.7	0.0252	0.01008	0.03692304
4	Khuranta	10	30.0000	36	0.7	0.0252	0.01008	0.03692304
5	Salabelapur	10	30.0000	36	0.7	0.0252	0.01008	0.03692304
6	Avenue Plantation 215 Rkm equivalent to 33.59 Ha	33.59	40.0000	48	0.7	0.0336	0.01344	0.04923072
TOTAL			205.000	246		0.1722	0.06888	0.25230744

12.2.3 Carbon Stock estimation at Bhitarkanika

Carbon Stock estimation at Bhitarkanika by outside agency MDPI and a copy is enclosed as **Annexure-XVI**





PART II

FUTURE MANAGEMENT





CHAPTER-01

Basis of Proposal:

1.1 Objective of Management:

The past management of the forests in the division and the results of earlier prescriptions have been discussed and analyzed in detail in Chapter VII of Part-I of this Plan. The analysis indicates that there has been general degradation of the natural forest which has led to dwindling of bio-diversity in the division. The main reasons for such degradation are different forms of biotic interferences and negligible invests in the forests for silvicultural operations during the outgoing plan period. Hence, the thrust of the management strategy has to be on conserving and restoring the forest for maintaining ecological balance with active participation of the people in the process of regeneration and development of the forest. Biodiversity of the region is to be maintained. Future management should aim at genuine needs of the local poor and their engagement in different forestry activities to minimize their dependency on forests. Maintenance of boundary and pillars is required. Exploding human population and their increasing demands has put an adverse impact on forest.

1.1.1 Specific Objectives of this Plan:

Keeping in view the above mentioned aspects, the objectives of the Plan are as follows:

- 1) To prevent further degradation of environment by giving more emphasis on conservation and protection of flora and fauna of these forests.
- 2) To maintain permanent closed cover on banks of rivers, water bodies and cost line to check soil erosion and preventing the damage from natural calamities like flood, cyclone & tidal surges.
- 3) To protect and manage wildlife resources in their full scope and range in the Division with a view to conserve and enrich biodiversity.
- 4) To restore the degraded and depleted mangrove forest by eviction of encroachment and restocking by mangrove and other suitable species with appropriate silvicultural operations.
- 5) To meet the needs of local people for forest produce as far as possible with active involvement of community under JFM subject to the aforesaid environmental imperatives.



- 6) To provide employment opportunities to rural people in general and weaker sections including scheduled castes / tribes and women in particular, through regulation of NTFP and the above mentioned conservation oriented activities;
- 7) To improve conditions, composition and productivity of these forests by increasing investment and through appropriate scientific management.

1.2 Method of Treatment to Be Adopted:

In order to achieve the aforesaid objectives keeping the ground reality in view, an approach for management of these forests has been prescribed based on the outcome of following exercise:

- a) Reconnaissance survey of all the forest areas,
- b) Stock mapping,
- c) Point sampling of the forest blocks,
- d) Biodiversity and regeneration survey of the forest blocks,
- e) Extensive survey of potential of NTFP resources and the dependence of the people on various NTFP items for their livelihood needs.
- f) Study of medicinal plant availability and utilization in different forest blocks
- g) Inspection of forest blocks and discussions with officers and field staff of the Division regarding the nature of treatment required there in.

1.2.1 In the forest blocks where the extent of degradation is high, emphasis will have to be given on afforestation and soil & moisture conservation works. In some of the areas, especially the areas forming the habitats, the wildlife protection and conservation have to be prioritized.

1.2.2 Protection of any forest block may be possible if its boundaries are demarcated and maintained. A special drive will have to be taken up to consolidate the block boundaries to check for encroachment and prevent further encroachment. Along with consolidation, fixing/repairing of boundary pillars, determining the coordinates of pillars and fixing of signboards at prominent locations will have to be taken up. All forest block maps should be put in GIS domain for easy reference and field verification.



1.2.3 Tool for integrated development.

The total Forest area involved for Management under this Plan is 10145.408. Considering the crop condition and density, it is proposed to manage the forests under 3 (Three) Independent Working Circle and four overlapping Working Circle. The independent working Circles and area assigned are as follows.

1. Rehabilitation Working Circle (8516.138 ha),
2. Plantation Working Circle (1492.370 ha)
3. Mangrove Improvement Working Circle (230.00 Ha)
4. Protection (Overlapping) Working Circle (10145.408 ha)
5. Wildlife (Overlapping) Working Circle (4770.67 Ha)
6. JFM (Overlapping) Working Circle (250.00 Ha)
7. Eco- tourism (Overlapping) Working Circle (818.00ha)

For integrated development of forests assigned to different Working Circles, the following tools / Scope thereof will be used by the foresters / administrators. The tools are categorized under three different head such as

- Silvicultural Tools,
- Financial Tools,
- Human Resource / Legal Tools.

The working circle wise uses of various tools are furnished below. (Table No 1.1)



Table No 1.1 Development Tools & Scope			
Working Circle (WC)	Silvicultural	Financial	Human Resource / Legal tools
Rehabilitation WC	a) Aided Natural Regeneration (ANR) involving Silvicultural Cleaning. b) Gap Planting @200 Plants / @500 Plants with maintenance for 4 years as per approved Cost norm c) Dispersal of seeds of viviparous Mangrove species d) Soil & Moisture Conservation involving Fish bone channel, Cross bonds to retain tidal water in forests, e) Maintenance of Creeks (deepening / Widening , Removal of Silt, f) Closing to Grazing / Control grazing, encouraging Stall feeding g) Grass Land / meadows development using grass slops,	I. Allocation under State Plan / Non Plan budget II. Dovetailing resource from District administration under MNREGA III. Resource from Site Specific Wildlife Conservation Plan-Habitat Improvement Finance Commission Grant IV. Allocation from CAMPA funds through APO	a) Up-gradation of Skill improvement through training b) Use of Modern Technology (Mobile App / GIS / Satellite imagery c) Use of legal Provisions to control illicit felling, encroachment and prevent grazing



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Working Circle (WC)	Development Tools & Scope			Human Resource / Legal tools
	Silvicultural	Financial		
Plantation WC	i. Standard Planting Procedure for mangrove plantation & Hypocotyls planting, ii. Standard Nursery Practices and Production of QPM at Jagatjore Central Nursery, Development of Mangrove Plantation in Mud flats / Intertidal mudflats, iv. Sandy River banks for Casuarinas Plantation with adequate watering provisions. v. Establishment of Casuarinas Nursery by Clonally Propagation	a) Funds allocation through State Plan / Non Plan Budget b) Implementation of NAP (through FDA) c) Resource from District administration / implementation of MNREGA d) Habitat Improvement by Block Planting under SSWLCP	A. Updating Planting technique and dissemination of Knowledge B. Declaration of Plantations as “Protected Forests” on the event of planting outside the forest area.	



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Development Tools & Scope			
Working Circle (WC)	Silvicultural	Financial	Human Resource / Legal tools
		Allocation under State Plan / Central Plan From Site Specific Wildlife Conservation Plan	i. Awareness creation among Public ii. Enhancing Eco Tourism prospect, iii. Implementation of Wildlife (Protection) Act, 1972 & Rules thereof iv. Steps to reduce Human- Animal Conflict
Wildlife (O) WC	a) Development of Meadows / Grass lands b) Maintaining Salt Licks c) Creation of Fresh water ponds / Ground Water recharge d) Creation of Earthen Mounds		
JFM (O) WC	Improvement of Vegetation through Silvicultural measures	Funds through FDA , OFSDP-II / III	i. JFM Resolution, 2011 and amendments thereof, ii. Village Forest Rules, 1985 iii. Strengthening Usufruct sharing mechanism iv. Confidence building mechanism through EPA (Entry Point Activities)



1.3 Area assigned for Management under this Plan:

The Forest area assigned to individuals under FRA, 2006 has been discussed / provided at Para 2.1.2 of the Revised Working Plan (Part-I).

The forest area diverted under FC Act, 1980[The Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980.]has been provided at Para 2.1.3 of the Revised Working Plan (Part-I). Area diverted & area coming within Purview of the Revised Working Plan is at Table No1.2

Table No 1.2: Revised Working Plan Area diverted & area coming within Purview of the Revised Working Plan

Sl No	Total Forest area Diverted in Ha		Total Forest area under WP Purview (to be set outside the Management Purview) in ha		
	Under FRA	Under FC Act	Under FRA	Under FC Act	Total
1	191.79	1426.924	12.89	1175.857	1188.747
2	Total Forest area for management				11334.155
3	Balance area taken for management				10145.408
3	Allotted to Various WC (independent)		RWC		8516.138
			Pl. WC		1399.27
			Mangrove Imp. WC		230.00
			Total		10145.408



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Table No 1.3: Comparison of area Outgoing Plan vrs- Current Plan										
Sl No	Category of Forest	Outgoing Plan		New Area included		Area transferred to Sanctuary		Current Plan		Remark
		No	Area In Ha	No	Area In Ha	No	Area in Ha	No	Area in Ha	
1	RF	2	263.59			1	139.33	01	55.28	68.98 Ha Diverted area to JSW
2	PRF	18	7069.27			6	5035.68	12	2020.08	
3	PF	24	9000.85	5	264.295	1	369.90	28	8070.048	1125.43 Ha Diverted area to JSW
	Total	44	16333.71	5	264.295	8	5544.91	40	10145.408	



1.4 Constitution of Working Circles:

Two ranges of this Division are included in the purview of the Working Plan. The Working Circles constituted in these two ranges are given below:

- (i) The Rehabilitation Working Circle (8516.138 Ha)
- (ii) The Plantation Working Circle (1492.370 Ha)
- (iii) The Protection (Overlapping) Working Circle (10145.408 Ha)
- (iv) The Wildlife (Overlapping) Working Circle (4770.670 Ha)
- (v) The Joint Forest Management (Overlapping) Working Circle (250.00Ha)
- (vi) Mangrove Improvement (Overlapping) Working Circle (230.00Ha)
- (vii) Eco Tourism (Overlapping) Working Circle (818.00Ha)

Activities like Plantation, Protection of Wildlife and Anti-smuggling activities have been undertaken out of funds made available. As this Division is devoid of natural High Forest, protection activities are restricted to Anti-smuggling only to prevent movement of illegal timber from adjoining Forest Divisions. This Division also forms a part of buffer area of Bhitarkanika National Park. The movement of Crocodiles in Baitarani and Mantei River is monitored. Payment of compassionate grant for Human kill, Cattle kill etc. are also made as and when required. During nesting of Olive Ridley Turtles, patrolling is conducted by staffs on-shore & off-shore.

1.4.1 Rehabilitation Working Circle:

As per the guidelines issued in the National Working Plan code, all the forest blocks are included in this working circle. The total area needs different kinds of treatments like protection, eviction of encroachments, rehabilitation of the degraded areas, etc. The total area allotted to this working circle is 8516.138 ha.

1.4.2 The Plantation Working Circle:

In the two ranges, wherever the blank areas are present, they are included in this working circle. The plantation is mainly of either mangrove or Casuarina or mixed plantation depending on the site. The total area allotted to this working circle is 1492.37 ha.

1.4.3 The Protection (Overlapping) Working Circle:

In the Division, there is problem of encroachment & biotic interference in all the forest blocks. The entire area of the two Ranges is kept in this working circle (area: 10145.408 ha).

1.4.4 The Wild Life (Overlapping) Working Circle:

Some of the areas in the two Ranges are wildlife rich areas. Specific management interventions are required in these areas. The total area allotted to this working circle is 4770.67 ha.



1.4.5 Joint Forest Management (Overlapping) Working Circle:

This overlapping working circle overlaps mainly the Rehabilitation Working Circle. The forest areas that are being protected by *Van Surakshya Samities* (VSS) are included in this working circle. Further all the notified Village forests have also been brought under this working circle. The forest under this overlapping circle will be managed through microplans prepared by the village committees. The total area allotted to this working circle is 250.00 ha. This Working Circle is kept open like in other Divisions.

1.4.6 Mangrove Improvement Working Circle:

In some of the areas, the mangrove forest needs improvement like attaining the salinity, digging of fish bone channels, etc. These areas are kept in this working circle and the total area allotted to this working circle is 230.00 ha.

1.4.7 Eco- tourism (Overlapping) Working Circle:

Under this working Circle three Eco Tourism Circuit has been planned. These are

- 1) *Jamboo- Mahakalpada Eco Circuit,*
- 2) *Atharbanki- Siali Eco Circuit and*
- 3) *Bandar- Devinadi Eco Circuit.*

Total area involved 818.00 Ha from Working Plan area and some area on bhitarkaniaka NP has also been included.

1.5 Allocation of Area to Different Working Circles:

There are 1RF, 12 PRF, 28PF blocks in the two ranges of the Division. The total area in the management fold is **10145.408Ha**. The proposed block wise allocation of the area to different working circles is given in Table 1.4 below.

Table No 1.4 Area allotted to Different Working Circle (Area available for management) (All area in ha)					
Sl. No.	Name of the Forest Block	Area in Ha	Area Diverted in Ha.		Area under this Plan
			Under FRA	Under FCA	
Mahakalapada Range					
1	Jogidhankud PRF	392.14	0	0	392.14
2	Saralikuda PRF	263.33	0	0	263.33
3	Nipania PRF	77.98	0	0	77.98
4	Badatubi PRF	28.83	0	0	28.83
5	Barakalikhola PRF	12.00	0	0	12.00
6	Batighar PRF	166.20	0	0	166.20
7	Bagagahan PRF	12.41	0	0	12.41
8	Petchhala PRF	259.73	0	0	259.73
9	Kaunsiapal PF	97.10	0	0	97.10



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	Total	1309.72	0	0	1309.72
	Kujanga WL Range				
10	Jatadhar RF	124.26	0	68.98	55.28
11	Balitutha PRF	84.90	0	0	84.90
12	Kathiakholda PRF	44.27	0	0	44.27
13	Brahmandia PRF	81.77	0	0	81.77
14	Jatadharta PRF	596.52	0	0	596.52
15	Majhidia (Kaudia) PF	52.47	0	0	52.47
16	Bhuiarpal PF	129.67	0	0	129.67
17	Madhuban 'A' PF	78.11	0	0	78.11
18	Madhuban 'B' PF	20.46	0	0	20.46
19	Nuagaon and Dinkia PF	1313.65	0	1106.877	206.773
20	Barkud PF	95.36	0	0	95.36
21	Kankan PF	404.69	0	0	404.69
22	Dhobei PF	16.49	0	0	16.49
23	Ramtara PF	23.98	0	0	23.98
24	Muguria PF	84.80	12.89	0	71.91
25	Goda PF	14.14	0	0	14.14
26	Gadharishpur PF	273.60	0	0	273.60
27	Garhbishnupur PF	101.35	0	0	101.35
28	Gopalpur PF	21.71	0	0	21.71
29	Sahadabedi PF	638.20	0	0	638.20
30	Salio PF	53.25	0	0	53.25
31	Padmapur PF	1282.515	0	0	1282.515
32	Baruhan PF	254.73	0	0	254.73
33	Marichipur PF	3379.20	0	0	3379.20
34	Tentilibelari PF	126.78	0	0	126.78
35	Akashdia PF	249.29	0	0	249.29
36	Boitarakud PF	227.33	0	0	227.33
37	Kathagadi PF	46.43	0	0	46.43
38	Nadiakhia PF	128.96	0	0	128.96
39	Musadia PF	15.80	0	0	15.80
40	Jatadharta B PF	13.35	0	0	13.35
41	Harishpurgada PF	46.40	0	0	46.40
	Total	10024.435	12.89	1175.857	8835.688
	Grand Total	11334.155	12.89	1175.857	10145.408



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Table No 1.5 Area assigned to Different Working circle (MFD, Rajnagar)									
Sl. No.	Name of the Forest Block	Area under this Plan	Area allotted to different Working Circles in Ha					Eco Tourism (O) WC	
			RWC	Plantation WC	Protection (O) WC	Wildlife (O) WC	JFM (O) WC		Mangrove Improvement WC
Mahakalapada Range									
1	Jogidhankud PRF	392.14	277.14	115.00	392.14	0	0	0	
2	Saralikuda PRF	263.33	143.33	10.00	263.33	0	0	110.00	
3	Nipania PRF	77.98	12.98	0	77.98	0	0	65.00	
4	Badatubi PRF	28.83	10.83	0	28.83	0	0	18.00	
5	Barakalikhola PRF	12.00	12.00	0	12.00	0	0	0	
6	Batighar PRF	166.20	139.2	0	166.20	0	0	27.00	166.20
7	Bagagahan PRF	12.41	12.41	0	12.41	0	0	0	
8	Petchhala PRF	259.73	230.73	29.00	259.73	0	20.00	0	
9	Kaunsiapal PF	97.10	97.10	0	97.10	0	0	0	
	Total	1309.72	935.72	154.00	1309.72	0	20.00	220.00	
Kujanga Range									
10	Jatadhar RF	55.28	0.28	45.00	55.28	0	0	10.00	55.28
11	Balitutha PRF	84.90	14.90	70.00	84.90	0	0	0	
12	Kathiakholda PRF	44.27	25.54	18.73	44.27	0	0	0	
13	Brahmandia PRF	81.77	58.58	23.19	81.77	0	0	0	



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14	Jatadhartanda PRF	596.52	396.52	200.00	596.52	0	0	0	596.52
15	Majhidia (Kaudia) PF	52.47	52.47	0	52.47	0	0	0	
16	Bhuiarpal PF	129.67	122.59	7.08	129.67	0	50.00	0	
17	Madhuban 'A' PF	78.11	75.75	2.36	78.11	0	0	0	
18	Madhuban 'B' PF	20.46	8.93	11.53	20.46	0	0	0	
19	Nuagaon and Dhinkia PF	206.773	194.483	12.29	206.773	0	0	0	
20	Barkud PF	95.36	54.48	40.88	95.36	54.48	0	0	
21	Kankan PF	404.69	388.09	16.60	404.69	0	0	0	
22	Dhobei PF	16.49	14.70	1.79	16.49	0	0	0	
23	Ramtara PF	23.98	08.98	15.00	23.98	23.98	20.00	0	
24	Muguria PF	71.91	42.85	29.06	71.91	0	0	0	
25	Goda PF	14.14	12.10	2.04	14.14	0	0	0	
26	Gadaharishpur PF	273.60	265.65	7.95	273.60	0	0	0	
27	Garhbishnupur PF	101.35	101.35	0	101.35	0	0	0	
28	Gopalpur PF	21.71	5.11	16.6	21.71	0	0	0	
29	Sahadabedi PF	638.20	578.20	60.00	638.20	98.30	120.00	0	
30	Salio PF	53.25	40.00	13.25	53.25	53.25	40.00	0	
31	Padmapur PF	1282.515	1246.725	35.79	1282.515	60.92	0	0	
32	Baruhan PF	254.73	247.65	100.18	254.73	254.73	0	0	
33	Marichipur PF	3379.20	3244.81	134.39	3379.20	3379.20	0	0	



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34	Tentilibelari PF	126.78	112.07	14.71	126.78	0	0	0	
35	Akashdia PF	249.29	209.29	40.00	249.29	249.29	0	0	
36	Boitarakud PF	227.33	42.52	184.81	227.33	0	0	0	
37	Kathagadi PF	46.43	0.00	46.43	46.43	0	0	0	
38	Nadiakhia PF	128.96	0.00	128.96	128.96	0	0	0	
39	Musadia PF	15.80	15.80	0	15.80	0	0	0	
40	Jatadhartanda B PF	13.35	0.00	13.35	13.35	0	0	0	
41	Harishpurgada PF	46.40	0.00	46.40	46.40	0	0	0	
	Total	8835.688	7580.418	1338.37	8835.688	4770.67	230	10.00	
	Grand Total	10145.408	8516.138	1492.37	10145.408	4770.67	250.00	230.00	818.00



1.6 Period of the Working Plan:

1.6.1 This Working Plan has been prepared for a period of 10 years as prescribed in the National Working Plan Code, 2014 i.e. from 2022-23 to 2031-32. There is a scope of review in some of the working circles like Protection Working Circle, JFM Working Circle, Plantation Working Circle and Wild Life Working Circle etc. on the basis of the current protection practices in different forest blocks. With the implementation of the prescriptions of the Working Plan, there may be changes in some of the areas resulting in concentration of wildlife, people may show interest in protection of some of the patches of the forest that are not hitherto in the JFM folder and also generally protection sensitive areas keep on changing periodically. Hence there should be periodical review after every two years at the level of Conservator of Forests (Territorial) and Conservator of Forests, Working Plan for these working circles at least.

1.6.2 The working plan year shall be reckoned from 1st October to 30th September of the following calendar year.

1.7 Rationalization of Boundary of Bhitarkanika Wildlife Sanctuary:

Bhitarkanika was declared as a Sanctuary vide Notification No.6958-4F-(W)-34/75/FFAH dated 22.04.1975 of Govt. of Odisha, erstwhile FFAH Department as per Section 18 of Wildlife Protection Act, 1972. The said notification is quite broad about limits of sanctuary. In the meanwhile, a lot of changes in the land use pattern have taken place where notified Reserve Forests, Protected Forests and Proposed Reserve Forests of the sanctuary are declared as Bhitarkanika National Park. But 410 villages remained within limits of sanctuary with intensive agriculture/shrimp culture practices, development of small townships and other economic activities not commensurating with objectives of the sanctuary. So the Fresh Proposal for Rationalization of Boundary which would sanctify legal status of the Sanctuary more effectively and minimize attrition of local community and ensure their cooperation towards conservation, after getting the nod of Competent Authority of Government of India, has been notified vide No. 2289 Dated 01.02.2020 of Forest & Environment Department, Odisha in exercise of power conferred under Section 26 A (I)(b) of the Wildlife (Protection) Act, 1972.



Table. 1.6 Summary of Rationalization

Category	Details	Number of Villages
(i)	Villages excluded from Sanctuary Limits within Rajnagar Tahasil of Kendrapada District (5445 Hectares)	52
(ii)	Villages (Where no households are found at present) to be acquired and retained in Sanctuary	36(Rajnagar Tahasil-33 + Rajkanika Tahasil-03)
(iii)	Villages to be retained inside Sanctuary as ringed out villages	322(Rajnagar Tahasil-224 + Rajkanika Tahasil-98)
(iv)	Forest Areas to be added in lieu of villages proposed for exclusion in Category-(i) above (5545 Hectares)	08 Forest Blocks

Accordingly, 8 forest blocks of Mahakalapada Range totaling 55.45 sq km which were in the working plan area in the last plan were added to the sanctuary area which has been accorded approval of National Board for Wildlife. After the government notification is issued, all the activities of these forest blocks as per working plan prescription shall cease and protection and management of those blocks will be guided as per management plan for the sanctuary.

1.8 Divisional Area Statement

The Divisional Area Statement is at Annexure Is at **Annexure-XVII**





CHAPTER 02:

The Rehabilitation Working Circle (RWC):

2.1 General Constitution:

2.1.1 The total area allotted to this working circle is 8516.138 ha.

2.2 General Character of Vegetation:

2.2.1 Eight forest blocks with more than 40% canopy density have recently been included in Bhitarkanika Wildlife Sanctuary after rationalization of sanctuary boundary. Out of 66 sample points 25 sample points fall under category of 40-70%. But out of the 66 points, 47 points fall in those eight forest blocks including the above mentioned 25 points. Rest of the forest blocks have less than 40% crown density and have been included in this working circle. The most common forests present in the two ranges of the Division are Littoral forest and Tidal Swamp forest. The most common species in Littoral forest is *Casuarina*, it is present in all most pure patches. It occurs in Balitutha, Kathiakholda, Bhuianpal, Baruhan, Jatadhartanda, Ramtara, Marichpur, and Akashdia, blocks. TidalSwamp forest has mangrove vegetation. The important species present are Bani (*Avicennia alba*), Goan (*Excoecaria agallocha*), Sundari (*Heritiera minor*), Rai (*Rhizophora candelaria*), Keruan (*Sonneratia apetala*), Baniah (*Hibiscus tiliaceous*). *Acrostichum aureum* is a beautiful fern found near the edges of water. The Mangrove Forests are present in Batighar, Petchhela and Saralikuda blocks of Mahakalapara range and Salio, Baruhan, Jatadhar, Majhidia blocks of Kujanga Range. The block wise extent of area in different forest types is discussed in the Chapter 02 of Part I.

2.3 Special Objectives of the Management:

The following special objectives of management are set for the working circle which is within the ambit of the general objectives of management.

- (i) To induce natural regeneration and improve the condition of existing forests through protection against grazing, fires and illicit felling.
- (ii) To enhance soil productivity through soil and moisture conservation measures.
- (iii) To regulate surface water runoff to enhance percolation and water availability down the stream.
- (iv) To restock barren areas through artificial regeneration with most desirable indigenous specie



- (v) To partner the local community in protection and management of the forests;
- (vi) To restore and improve the microclimate and micro edaphic condition;
- (vii) To increase the biodiversity and heterogeneity in the forest crop by encouraging natural regeneration.
- (viii) To increase the water retaining capacity of the soil,
- (ix) To restock and restore the degraded mangrove areas to its original shape.
- (x) To protect & conserve the floral and faunal diversity of mangrove forest in its entirety.

2.4 Area Allotment and Treatment Series:

2.4.1 The total area allotted to this working circle is 8516.138 ha. Two Treatment Series have been constituted one in each range. Each series is divided into 10 coupes. The block wise details of the area in this working circle are given in the **Table No.2.1**.

Table 2.1 Area Allotment of Rehabilitation Working Circle			
Sl. No.	Forest Block	Area in Ha.	Rehab. W.C
Mahakalapada Range			
1	Jogidhankud PRF	392.14	277.14
2	Saralikuda PRF	263.33	143.33
3	Nipania PRF	77.98	12.98
4	Badatubi PRF	28.83	10.83
5	Barakalikhola PRF	12.00	12.00
6	Batighar PRF	166.20	139.20
7	Bagagahan PRF	12.41	12.41
8	Petchhala PRF	259.73	230.73
9	Kaunsiapal PF	97.10	97.10
Total		1309.72	935.72
Kujanga Range			
10	Jatadhar RF	55.28	0.28
11	Balitutha PRF	84.90	14.90
12	Kathiakholda PRF	44.27	25.54
13	Brahmandia PRF	81.77	58.58
14	Jatadhartanda PRF	596.52	396.52
15	Majhidia (Kaudia) PF	52.47	52.47
16	Bhuanpal PF	129.67	122.59
17	Madhuban 'A' PF	78.11	75.75
18	Madhuban 'B' PF	20.46	8.93
19	Nuagaon and Dinkia PF	206.773	194.483
20	Barkud PF	95.36	54.48



21	Kankan PF	404.69	388.09
22	Dhobei PF	16.49	14.70
23	Ramtara PF	23.98	08.98
24	Muguria PF	71.91	42.85
25	Goda PF	14.14	12.10
26	Gadahasishpur PF	273.60	265.65
27	Garhbishnupur PF	101.35	101.35
28	Gopalpur PF	21.71	05.11
29	Sahadabedi PF	638.20	578.20
30	Salio PF	53.25	40.00
31	Padmapur PF	1282.515	1246.725
32	Baruhan PF	254.73	247.65
33	Marichipur PF	3379.20	3244.81
34	Tentilibelari PF	126.78	112.07
35	Akashdia PF	249.29	209.29
36	Boitarakud PF	227.33	42.52
39	Musadia PF	15.80	15.80
	Total	8835.688	7580.418
Grand Total		10145.408	8516.138

2.5. Analysis and Valuation of Crop:

2.5.1 The forest blocks of the Division show different degrees of degradation. In all the blocks allotted to this Working Circle, the studies regarding the vegetation, crop condition, extent of degradation, regeneration status, boundary position etc. have been conducted. In some of the areas there is a potential for the natural regeneration to come up provided some protection measures are taken and in other areas artificial regeneration along with soil and moisture conservation measures is necessary to rehabilitate the area. The details of the no. of trees in different blocks coming under RWC area are given in the Table No.6.4anddepicted in Graph 6.1 of Part-I.

2.5.2 Stock Details:

The volume of the trees in different girth classes in different blocks is given in the Table No. 6.5.and the details of girth class wise volume are depicted in Graph 6.2 both of Part-I.

2.6 Silvicultural System:

The prime objective is to restock these forest blocks and to reduce the biotic pressure due to which these blocks have become degraded. There will be no exploitation of mature trees except for removal of dead and uprooted trees. No



formal silvicultural system is prescribed. However to achieve the major objectives, operations like regeneration cleaning, soil and moisture conservation, gap planting, block planting along with tending will be carried out. In addition, steps will have to be taken to protect the area from grazing, theft and fire with the active support of the people wherever possible.

2.7 Rotation and Conversion Period:

As timber production is not a consideration in this working circle, the rotation period or conversion period is not prescribed. However, as a part of the rehabilitation treatment removal of dead, fallen trees is prescribed.

2.8 Choice of Species:

2.8.1 Depending upon the local factors, particularly soil condition, the species to be artificially raised shall be carefully selected for gap plantation and block plantation. Since the primary objective is to restock these areas and to improve the existing forest growth, preference should be given to local indigenous species that have the best promise to thrive in these sites. Generally species like some indigenous species having faster rate of growth may also be considered.

In Mangrove forestareas, the main species that can be planted are Rai, Sindhuka, Kaliachua and Bandari for hypocotyle plantation and Sundari, Keruan, Bani, Sisumar for seedling plantation. Casuarina can be planted in sand banks.

2.9 Rehabilitation Cycle:

The cycle has been fixed at 10 years, which synchronizes with the Plan period.

2.10 Calculation of Yield:

No yield is prescribed.

2.11 Table of Rehabilitation Operation:

There are two treatment series in this Division. The sequence of operations in the two series is given in the Table No. 2.2 and 2.3. The sequence has been suggested keeping operational convenience and work load of Range in view. Thus it is tentative and target of operation is adjustable considering resources availability and administrative feasibility. There may be changes in the habitat and the ecosystem in the subsequent years and the new areas not mentioned in the Working Plan may need rehabilitation operations. The DFO can take up these works with the concurrence of the Regional Chief Conservator of Forests, Bhubaneswar.



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Table: 2.2Year Wise Rehabilitation Mahakalapara Treatment Series (MHP)							
Name of the Block	Name of the Treatment series (MHP)	Year	Coupe No	Compt. No	Area inHa	Total Area	Area Under JFM in Ha
Bagagahan PRF	Mahakalapara	2022-23	I		12.41	130.00	0
Petchhela PRF(P)	Mahakalapara				117.59		20.0
Petchhela PRF(B)	Mahakalapara	2023-24	II		113.14	113.14	0
Badatubi PRF	Mahakalapara	2024-25	III		10.83		0
Barakolikhola PRF	Mahakalapara				12.00	85.00	0
Batighar PRF(P)	Mahakalapara				62.17		0
Batighar PRF(B)	Mahakalapara	2025-26	IV		77.03	87.003	0
Jogidhankud PRF(P)	Mahakalapara				10.00		0
Jogidhankud PRF(P)	Mahakalapara	2026-27	V		85.00	85.00	0
Jogidhankud PRF(P)	Mahakalapara	2027-28	VI		85.00	85.00	0
Jogidhankud PRF(B)	Mahakalapara	2028-29	VII		97.14	97.14	0
Saralikuda PRF(P)	Mahakalapara	2029-30	VIII		90.00	90.00	0
Saralikuda PRF(B)	Mahakalapara	2030-31	IX		53.33	53.33	0
Nipania PRF	Mahakalapara	2031-32	X		12.98	110.08	0
Kaunsiapal PRF	Mahakalapara				97.10		0
	Total				935.72	935.72	20.0



Table: 2.3 Year Wise Rehabilitation Sarala Treatment Series (SRL)							
Name of the Block	Name of Treatment series Sarala (SRL)	Year	Coupe No.	Compt. No.	Area in Ha	Total Area	Area Under JFM in Ha
Marichpur PF (P)	Sarala	2022-23	I		665.71	665.71	0
Marichpur PF (P)	Sarala	2023-24	II		835.34	835.34	0
Marichpur PF (P)	Sarala	2024-25	III		859.64	859.64	0
Marichpur PF (B)	Sarala	2025-26	IV		884.12	884.12	0
Baruhan PF	Sarala	2026-27	V		247.65	736.05	0
Brahmandia PRF	Sarala	2027-28	VI		58.58		0
Garh-Harishpur PF	Sarala				265.65		0
Goda PF	Sarala				12.10		0
Salio PF	Sarala				40.00		40.0
Tentulibelari PF	Sarala				112.07		0
Akasdian PF	Sarala				209.29		0
Garh- Bispupur PF	Sarala				101.35	2218.045	0
Gopalpur PF	Sarala				5.11		0
Kathiakholda PRF	Sarala				25.54		0
Muguria PF	Sarala				42.85		0
Padmapur PF	Sarala				1246.725		0
Ramtara PF	Sarala				08.98		8.98



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Sahadabedi PF	Sarala				578.20			120.0
Jatadharta PF	Sarala	2028-29	VII		396.52	396.80		0
Jatadhar RF	Sarala				0.28			0
Barkud PF	Sarala	2029-30	VIII		54.48			0
Dhobei PF	Sarala				14.70	473.07		0
Kankan PF	Sarala				388.09			0
Musadia PF	Sarala				15.80			0
NuagaonDhinkia PF	Sarala	2030-31	IX		194.483	194.483		0
Balitutha PF	Sarala	2031-32	X		14.90			0
Bhuiyanpal PF	Sarala				122.59			50.0
Boitarakud PF	Sarala				42.52	317.16		0
Madhuban A PF	Sarala				75.75			20.0
Madhuban B PF	Sarala				8.93			8.93
Majhidian PF	Sarala				52.47			0
Total					7580.418	7580.418		247.91
G. Total					8516.138	8516.138		267.91



2.12 Method of Execution of Operations:

2.12.1 Demarcation of Annual Rehabilitation Coupe Areas

(i) The annual treatment areas will be demarcated in the winter season (October to December) in year preceding to the year of working. Coal tar ring will be painted on trees at breast height standing on the coupe line. Small stone cairn of the half-meter height will be erected at visible distance on its periphery in case of blank patches. Boundaries of most of the coupes are coterminous with some natural features, hence clearance along the natural features is necessary before taking up the work.

(ii) The rehabilitation coupes shall be indicated by sign boards at corners or at the points of intersection with roads, inspection paths and boundary lines of reserved forests. The signboards should contain the name of the treatment series, coupe number, its area, year of working and compartment number

2.13 Preparation of Site and Treatment Maps:

This Working Circle consists of forest areas degraded and eroded in varying degrees. All areas do not require uniform treatment. The areas included in this Working Circle, may possibly be classified into the two categories based on the extent of the degradation.

Category I includes those areas where forest growth exists, but the regeneration status of many species is comparatively deficient to fair. Most of the forest blocks of this category have been included in Bhitarkanika sanctuary. The soil nutrient status is generally poor in these areas. Artificial regeneration by gap plantation and soil and moisture conservation measures are required.

Category II includes those areas where plantation were undertaken in the past but are now badly damaged resulting in creation of very large gaps and degraded / eroded sites. These areas require intensive soil and moisture conservation measures. Site specific species should be planted. The extent of encroachments is also high. These areas require intensive protection against illicit felling, encroachment and grazing. The important forest blocks falling in this category are Bagagahan, Petchhela, Batighar, etc.

2.14 Treatment Plan:

2.14.1 A site specific treatment plan has to be developed before any treatment is taken up. Microplans for VSS allotted areas should be consulted in case the VSS allotted areas form part of the rehabilitation treatment area. These site specific treatment plans will be made in order as to achieve the major objectives of management of this Working Circle. The concerned Range Officer shall prepare an annual Treatment plan in



the 0th year but will cover the treatment to be taken up at the site in the next 3-4 years. The plan shall include all vital information like,

- a) Site identification i.e. Forest block/ Compartment. No.
- b) Area and Treatment Map,
- c) Site category (i.e. Category I, II, III)
- d) Site characteristics (terrain, slope, drainage, soil type and depth),
- e) Vegetation and extent of regeneration,
- f) Extent of degradation of site/vegetation,
- g) Year of operations (including maintenance, if any),
- h) Major operations to be undertaken,
- i) Cost norms and a calendar of operations

2.14.2 The Treatment Plan shall also include provisions for monitoring of the execution of operations, e.g. operations actually performed, costs incurred, time schedule followed and the overall results of operations. The ACF shall check the annual action plan and it will be approved by the DFO. Range wise abstract of treatment plans will be sent to the Conservator of Forests for information.

2.15 Rehabilitation Operations:

2.15.1 Silvicultural Treatments

- (i) No felling or removal of trees is permitted except for dead and uprooted trees. All high stumps shall be cut.
- (ii) Complete protection against fire, grazing, and illicit felling must be ensured as per requirement of specific sites.
- (iii) The areas where the VSS is active, should be managed as per principles of JFM, of course within the ambit of prescriptions outlined for this Working Circle.
- (iv) In VSS protected areas, there is congestion in crop at many places. This should be removed by cleaning and thinning operations. These operations should be aimed to provide space for the growth of promising trees.
- (v) The indigenous hardy species should be used for planting. Preference should be given to fruit bearing and minor forest produce species.
- (vi) Preference should be given to local labour, particularly from JFM areas. In Places where the local labour is not available, other options should be explored out.
- (vii) Removal of invasive weeds shall be carried out.



2.15.2 The rehabilitation in Mangrove Scrub areas can be done by cleaning and tending operations. In the areas having no scrub or sapling growth and the areas upto the high tide line that get inundated every day or during high tides, can be planted. In some of the blocks, the Casuarina plantations are existing. These plantations need tending operations. In some blocks, the plantations are damaged, and the main shoot is cut and the branches have become wavy with no straight bole and are malformed. This type of plantations exist in blocks like in Balitutha. These areas need to be harvested in patches and fresh plantations have to be taken up.

2.15.3 Creation of Barriers:

2.15.3.1 Trenches: Some of the blocks are entirely allotted to this working circle. In these blocks, cattle proof trenches should be excavated in trapezoidal manner with a depth of 120 cms. Width at the top and bottom being 150 and 90 cms respectively. The scooped out soil shall be accumulated on the inner side to serve as a mound. Bulbils of Agave can be planted on the ridge to provide additional protection. Seeds of Babul, Gohira, Prosopis or Khair shall be sown on berms. Wherever trench is not possible due to site factor, rubble walls may have to be erected to make perimeter barrier more effective.

2.15.3.2 Barbed Wire Fencing: Wherever trench digging is not possible, wire mesh fencing may be taken up to protect from biotic interference

2.16 Rehabilitation in Different Treatment Series:

Different measures required for the rehabilitation of the series are broadly given above. Some of the specific recommendations are discussed below. Beyond this if any other steps are necessary, DFO can take up at his discretion. All the activities to be taken up in each treatment series should be incorporated in the annual treatment plan

- I. The main activities to be taken up in the two ranges of the Division include demarcation of the boundaries, habitat improvement, habitat protection, gap plantation, etc.
- II. Mangrove forest is subjected to degradation mainly due to illicit felling, grazing and encroachment. The management interventions should aim at reducing these factors.
- III. The cleaning operations in mangrove forests shall be taken up. The principal tree species like Bani, Sundari, Rai, Keruan shall be favoured during cleaning operations. All damaged and malformed shoots should be removed in favour of promising ones. All the climbers shall be cut & removed. The dead and uprooted



trees shall also be removed. While doing the cleaning operations, care should be taken not to remove the stilt roots and the pneumatophores.

- IV. There is problem of availability of fresh water in the mangrove areas due to salinity and this effects the wildlife. Hence steps should to be taken to dig the new ponds and renovation of the existing ponds.
- V. Removal of unwanted weeds
- VI. Promotion of inland fisheries to reduce the dependence of the people on creeks.
- VII. Reducing the dependence of the people on mangrove firewood
- VIII. Protection of Casuarina plantations with the help of VSS members.

2.17 Control:

The journal and other records will be maintained for each coupe in accordance with the provisions of the 'Orissa Forest Plantation Manual, 1977'. Annual Rehabilitation journal may be maintained at the Divisional level to keep track of the rehabilitation work taken up in the division. Necessary entries must be made in the compartment histories about all the works undertaken like soil conservation, plantation, etc. All the works should be reflected in the Annual Administrative Chapters and the copies of all the Chapters, Compartment histories should be kept in the computers for further reference.

2.18 Miscellaneous Regulations:

2.18.1 The annual treatment areas shall be rigidly protected and closed to grazing up to 5 years. They shall also be protected from fires. The provisions of Rule 283 of the Orissa Forest Department Code and the Orissa Forest Fire (Protection) Rules will be implemented.

2.18.2 Attempt is to be made to involve the local people in protection and management of these forests in accordance with the current policy of the Govt. of Orissa on Joint Forest Management (JFM). Wherever VSS have already been established they will be directly involved in implementation of the silvicultural operations as far as possible.

2.18.3 Perimeter barriers to keep off biotic interference in the form of hedge, stone walling or trench fencing should be attempted as far as possible.

2.18.4 The DFO shall make efforts to secure funding from all possible sources (e.g. non-plan sector, State and Central Plan sector, District Plans Schemes) to ensure that sufficient funds to implement prescription of this Working Circle are available. He shall also include requirement of funds for this purpose in his annual budget and estimates.



2.19 Rights and Concessions:

Rights and concessions in this Working Circle shall be regulated in accordance with the provisions of the relevant gazette notifications of the respective forest blocks and the Govt. of Orissa policy with regard to JFM. The existing rights and concessions are elaborated in the Chapter 1 of Part I.

2.20 Interim Revision and Cost Norm:

2.20.1 No major changes in the prescriptions of this Working Circle are anticipated. However, it may be reviewed if necessary, after five years jointly by the Regional Chief Conservator of Forests, Bhubaneswar and Chief Conservator of Forests, Working Plan. Any deviations suggested shall be subjected to the sanction of competent authority.

2.20.2 The working costs are discussed in detail in Chapter 15 'Financial Forecast' of Part II.





CHAPTER-03

The Plantation Working Circle (Pl.WC):

3.1 General Constitution:

In this Division, the plantation would be carried out in the blank patches created due to biotic and geological factors. The total area allotted to this Working Circle is 1492.37 ha. The afforestation programmes have been taken up under various state and central schemes like Compensatory Afforestation Programme (CAMPA), Central Plan, State Plan, MGNREGS, and Avenue Plantation. The area to be planted in coming 10 years shall be brought under the Plantation Working Circle.

3.2 General Observation and Vegetation:

The entire area of the division having stretches of barren land and the area having rooted waste less than 40% are proposed for allotment to this Working Circle. The total area allotted this working circle is 1492.37 Ha. The areas allotted to this working circle are devoid of forest growth barring scattered patches of grass, bushes and bushy mangroves. Felling Series, Cutting sections and JFM Areas will be done as per guideline in JFM Resolution 2011 as amended in 2015. Out of total encroachment of 1030.68 Ha, 975.38 Ha area have been added to this Working Circle and balance encroachment area added to Mangrove Improvement Working Circle.

3.3 Special Objectives of Management:

The special objective of the management of this Working Circle is within the scope of general objectives of the management for the entire Division. These are as follows: -

- (i) To reforest all barren and degraded areas having rooted waste less than 40% with economic species like Casuarina, Karanj, Arjuna, Mangrove Species etc within the Plan period.
- (ii) To maintain and tend the plantations already raised in the preceding years.
- (iii) To take effective measures to prevent soil erosion and to conserve soil-moisture in plantation areas.

3.4 Area Allotment and Planting Series:

3.4.1 The total area allotted to this Working Circle is 1492.37 ha. Two planting series are constituted, namely Jatadhar and Nuagaon in Kujanga Range. There are several encroachments which have been included in the working circle. As and when the



encroachments are evicted, those areas should be restocked with plantations. In some other areas, the degradation has been increasing year after year; these areas need to be rehabilitated with block plantations. Therefore it is recommended to keep this Working Circle open. The DFO should make an annual Plan of plantation operations, depending on the prevailing conditions in that year and extent of encroachments evicted in a particular year. The areas recommended in the Working Plan are only suggestive to the DFO, he can add or remove depending on the site conditions and availability of target. The Planting series wise and forest block wise area allotted to this Working Circle is given in the Table No.3.1.

Table: 3.1 Area assigned to Plantation Working Circle (Area in Ha)

SI No	Name of Range	Name of Planting Series	Name of Block	Area of Plantation
1	Kujanga	Jatadhar P.S	Jatadhar RF	45.000
2			Balitutha PRF	70.000
3			Jatadhartanda PRF	200.000
4			Jatadhardanda B PF	13.350
5			Jogidhankud PRF	115.000
6	Mahakalapada	Jatadhar P. S.	Saralikuda PRF	10.000
7			Petchhela PRF	29.000
			Total	482.350
1	Kujanga	Nuagaon P.S	Gopalpur PF	16.600
2			Brahmandia PRF	23.190
3			Kathiakolda PRF	18.730
4			Bhuanpal PF	7.080
5			Madhuban A PF	2.360
6			Madhuban B PF	11.530
7			Nuagaon Dhinkia PF	12.290
8			Barkud PF	40.880
9			Kankan PF	16.600
10			Dhobei PF	1.790
11			Ramtara PF	15.000
12			Akashdia PF	40.000
13			Goda PF	2.040
14			Gada Harishpur PF	7.950
15	Kujanga	Nuagaon P.S	Salio PF	13.250



16			Baruhan PF	100.180		
17			Marichpur PF	134.390		
18			Tentilibelari PF	14.710		
19			Boitarakud PF	184.810		
20			Muguria PF	29.060		
21			Sahadabedi PF	60.000		
22			Padmapur PF	35.790		
23			Kathagadi PF	46.430		
24			Nadiakhia PF	128.960		
25			Harishpurgada PF	46.400		
			Total	1010.020		
			Grand Total	1492.370		

3.5 Analysis and Valuation of Crop:

As stated in above, these areas usually have little vegetation with mangroves and its associates, the crop is some-what open and of very poor quality. This is due to edaphic factors and the climatic conditions.

3.6 Silvicultural System:

No silvicultural system shall be adopted in the Plantation Working Circle. The silvicultural operations to be carried out will include plantation and associated works such as Protection, Tending and Soil & Moisture conservation. However, silvicultural operations to be carried out will be as per the micro-plans which are in consonance with prescriptions of the Working Circles where the JFM area is located.

3.7 Choice of Species:

The species to be raised are Rai, Sindhuka, Kaliachua and Bandari for hypocotyl plantation and Sundari, Keruan, Bani, Sisumar for seedling plantation. In the areas, where the soil is formed and in the blank patches having sandy areas, Casuarina and mixed plantations can also be taken up. The blocks in which Casuarina plantations can be done are Gopalpur, NuagaonDhinkia, Jatadhartanda, Akashdia, Balitutha, etc.

3.8 Plantation Cycle:

All the plantable area included in this Working Circle shall be planted within 10 years to synchronize to the Plan period.



3.9 Constitution of Plantation Series:

3.9.1 Two planting series have been constituted namely Jatadhar and Nuagaon. The Jatadhar series contain areas from Balitutha, Jatadhar, Jatadhartanda, Madhuban A and Madhuban B blocks. The total area in this series is 353 ha. Nuagaon planting series contain areas from Nuagaon-Dhinkia, Gopalpur, Akashdia and Kathiakholda blocks. The total area in this series is 360 ha. Each series is divided into 10 annual coupes. The coupe wise area in the two series is given in the Table No. 3.2 and 3.3

Table 3.2 Area allotted to Jatadhar Planting Series (JPS)				
Name of Block	Year	Coupe Number	Area of Plantation in Ha	Total Area
Jatadhar RF	2022-23	I	45.00	45.00
Balitutha PRF	2022-23	II	70.00	70.00
Jogidhankud PRF (P)	2023-24	III	65.00	65.00
Jogidhankud (B)	2024-25	IV	50.00	50.00
Saralikuda PRF			10.00	10.00
Jatadhartanda PRF(P)	2025-26	V	40.00	40.00
Jatadhartanda PRF(P)	2026-27	VI	40.00	40.00
Jatadhartanda PRF(P)	2027-28	VII	40.00	40.00
Jatadhartanda PRF(P)	2028-29	VIII	40.00	40.00
Jatadhartanda PRF(B)	2029-30	IX	40.00	40.00
Jatadhardanda B PF	2030-31	X	13.35	42.35
Petchhela PRF			29.00	
Total			482.35	482.35

Table 3.3 Area allotted to Nuagaon Planting Series (NPS)				
Gopalpur PF	2022-23	I	16.600	108.520
Brahmandia PRF			23.190	
Kathiakolda PRF			18.730	
Baruhan PF (P)			50.000	
Bhuiarpal PF	2023-24	II	7.080	74.140
Madhuban A PF			2.360	
Madhuban B PF			11.530	
Nuagaon Dhinkia PF			12.290	
Barkud PF			40.880	
Sahadabedi PF	2024-25	III	60.000	110.180



Baruhan PF (B)			50.180	
Kankan PF	2025-26	IV	16.600	73.390
Dhobei PF			1.790	
Ramtara PF			15.000	
Akashdia PF			40.000	
Goda PF	2026-27	V	2.040	67.010
Gada Harishpur PF			7.950	
Salio PF			13.250	
Tentilibelari PF			14.710	
Muguria PF			29.060	
Marichipur PF	2027-28	VI	134.390	134.390
Boitarkud PF	2028-29	VII	184.810	184.810
Padampur PF	2029-30	VIII	35.790	82.220
Kathagadi PF			46.430	
Nadiakhia PF	2030-31	IX	128.960	128.960
Harishpurgada PF	2031-32	X	46.40	46.40
Total			1010.02	1010.02
Grand Total			1492.37	1492.37

3.10 Method of Execution of Planting Operations:

3.10.1 Prescriptions given in the Forest Plantation Manual, 1977 shall be followed meticulously in addition to the following guidelines.

3.10.2 Demarcation of Annual Plantation coupes:

The annual plantation areas shall be demarcated in the winter season (October to December) of the year preceding to the year of plantation. The areas prescribed for the plantations are shown in the management maps in 1:25,000 scale. In these areas small stone cairns of half meter height will be erected at visible distance or the coal tar ring should be painted at breast height of trees standing on the areas of plantation.

(ii) The plantation areas shall be indicated by signboards at corners or at point of intersection with roads, inspection paths and boundary lines of reserved forests. The signboards should contain the name of the plantation site, area, year of planting and compartment number and other details. Year of planting is very essential, otherwise after 5-6 years it is very difficult to know the year and the area.



3.11 Preparation of Site, Treatment Map and Plan:

3.11.1 A site map in the scale of 1: 25,000 showing the details of area, direction of slope, nature of erosion, biotic interference, site specific species, aspiration of the public and other factors shall be prepared. A treatment map shall be prepared with financial projections. This job shall be done by an officer not below the rank of a Forest Ranger and checked by an Assistant Conservator of Forests. This work shall be completed by the end of the December of the year preceding to the year of plantation.

3.11.2 Each plantation site shall be taken care for five years including the main year of operation. The plantation plan along with the treatment map in 1: 25,000 scale shall be prepared by the Range Officer, checked by the Divisional Forest Officer and approved by the Conservator of Forests.

3.11.3 Nursery:

Permanent nursery is available at Pankpal in Kujanga Range and Jagatjore in Mahakalapada Range. Temporary nurseries can be raised near plantation sites if required. Care should be taken in the seedling stage for the successful plantation.

3.12 Stacking, Piting and Planting:

3.12.1 After the completion of site preparation by the end of January, the operations like alignment, stacking and pitting shall be done. The pitting shall be completed by the end of February. This helps in curing of pits and also it becomes easy for the staff to start plantation immediately after the onset of monsoon.

3.12.2 Planting shall be taken up immediately after onset of monsoon and completed by within 2 to 3 weeks thereafter. The number of plants per hectare should be decided by the DFO depending on the site and the species to be planted. Required dosage of insecticides and fertilizers shall be applied during planting process.

3.13 Post Planting Operations:

Casualty replacement, weeding, mulching, soil working, fertilizer application (top dressing) and other operations shall be carried out as per the calendar of operations as given in Table No: 3.4



Table:3.4Schedule of Planting Operations	
Operations	Period of Completion
Advance preparation of site	End of October
Digging of pits	End of February
Stacking	End of February
Plantation And Post Plantation Operation in 1st Year	
Pre-sprouted poly potted stump planting	1 st week of July
Casualty replacement	End of July
1 st soil working, weeding & manuring	End of August
2 nd soil working and weeding	During October
3 rd soil working	During December
Post Plantation Operation in 2nd Year	
Casualty replacement, 1 st weeding, soil working & manuring	End of July
2 nd weeding and soil working	During October
Post Plantation Operation in 3rd and subsequent Years	
Soil working and casualty replacement	End of July
Pruning and singling	September

The planting technique is different for Mangrove Plantations and Casuarina plantations. In Mangrove plantations, there are two types of plantation, seedling and hypocotyls plantation. The hypocotyls is collected in July, August months and planted directly. In seedling plantation, the seeds are collected in September and October, they are kept in poly pots and the seedlings are raised. In the areas that do not get inundated, fish bone channels are to be dogged out. The main post planting operation done is the casualty replacement. The care should be taken against biotic interference and this should be the major post planting care that is needed.

3.14 Control:

The Nursery Journal, the Plantation Journal and other records will be maintained for each plantation separately in accordance with the provisions of 'The Orissa Forest Plantation Manual, 1977' indicating the physical and financial achievements. Necessary entries with regard to plantation activities undertaken shall be entered in the compartment histories. All the plantations done shall invariably be shown on the topo maps of 1: 25,000.



3.15 Treatment of Old Plantations:

The plantations raised during the last plan period have been furnished in Annexure-II. The plantations coming under the working plan area now shall be treated with tending operations and soil and moisture conservation wherever required as per site condition. The survival and growth shall be recorded species wise periodically. The plantations raised in last three years and are under post planting maintenance shall continue as per schedule. The lists of plantations of last plan period within the working plan area are listed below (Table No 3.5).

Table:3.5 Plantations raised in last plan period			
Year	Range	Forest Block	Area in Ha
2007-08	Kujanga	Nadiakhia	20.0
		Baruan	31.0
2008-09	Kujanga	Jatadhartanda	20.0
2009-10	Kujanga	Jatadhartanda	10.0
		Badapal	20.0
		Nadiakhia	10.0
2010-11	Kujanga	Jatadhartanda	20.0
		Gopalpur	15.0
		Jatadhartanda	20.0
2011-12	Kujanga	Jatadhartanda	40.0
		Nadiakhia	25.0
		Badabandha	10.0
		Khuranta	10.0
		Salabelapur	10.0
2012-13	Kujanga	Jatadhartanda	40.0
		Nadiakhia	35.0
		Nadiakhia	56.94
2013-14	Kujanga	Jatadhartanda	40.0
		Jatadhartanda	2.4
2014-15	Kujanga	Sahadabedi	20.0
2015-16	Kujanga	Sandhakuda	20.0
		Balikani	15.0
		Nadiakhia	25.0
		Jatadhartanda	0.561
		Total	515.901

No treatment series is proposed. 50 Ha area will be covered under annual treatment. The Divisional Forest Officer shall decide the sites depending upon fund availability and site requirement.



3.16 Miscellaneous Regulation:

3.16.1 All the annual coupes/treatment area under different series shall be strictly protected from grazing and fires. Suitable areas adjacent to these coupes may be developed into fodder plantation so as to even encourage stall feeding thereby diverting the grazing pressure from the annual coupes. The people in the adjoining areas of the plantations should be formally or informally associated in the plantation works and they should be asked to prevent their cattle entering the plantation area.

3.16.2 Plantation Journal and Nursery Journal shall be maintained for every plantation as per Orissa Plantation Manual, 1977. All the details of the plantations should be entered in the compartment history files in accordance with the Management Plan Procedure, 1991

3.16.3 PRA exercise shall be undertaken before executing the activities under the planting series to assess felt-needs of people and their willingness vis-à-vis choice of species so as to ensure their continued support in the entire process of regeneration.

3.17 Rights and Concessions:

Only such rights and concessions shall be admitted as have been described in Chapter I. Additional usufructuary rights may be allowed in accordance with the provisions of the current policies and programmes of the Govt. with regard to Joint Forest Management. No other rights and concessions shall be admitted in this Working Circle.

3.18 Annual Costs of Operations and Working Norm:

Plantations will be raised as per the norms approved by the competent authority. The costs are discussed in the Chapter 15 'Financial Forecast' of Part II.

3.19 Interim Revision:

This circle is recommended to be open circle. New areas can be brought into the fold of this circle as and when the situation arises. However, The Regional Chief Conservator of Forest (Territorial) and Chief Conservator of Forest (Working Plan) shall review the area under this working circle and also other prescriptions every two years.





CHAPTER 04

The Protection (Overlapping) Working Circle (Pr.WC):

4.1 General Constitution:

4.1.1 The mangrove forest area along the coast of Bay of Bengal, the area with Crocodile concentration, the nesting sites of Olive Ridley Turtle are to be brought under Protection (Overlapping) Working Circle. Eco-fragile areas shall be covered by this Working Circle. The total area allotted to this Working Circle is approximately 10145.408 Ha covering total Forest area. Most of the forest blocks are infested with heavy encroachments. These encroachments are mainly for dwelling, prawn culture, betel leaf growing, etc. The other major problems are illicit felling of mangrove forest, poaching, forest fire, etc. The extent of biotic pressure is very high in this Division. The forest blocks are surrounded by densely populated villages.

4.2 General Observation and Vegetation:

4.2.1 In Rajnagar (W.L.) Division also the biotic pressure is very high. The major problem is encroachments. More than fifty percent area is under encroachments. Rest of the forest have biotic pressure from the thickly populated adjoining villages. Nevertheless, the major proportion of the existing mangrove vegetation is in 25-40 percent density class. The major areas of this density class are present in forest blocks like Akashdia, Balitutha, Barkud, Baruhan, Jatadharta, Majhidia, etc. Only two percent of the area has a density more than 40% and this area is confined to forest blocks like Baruhan, Salio, etc. Nearly 14% of the area has a crown density of less than 10 percent. (As per records of NRSA)

4.2.2 The major forests of the Division are Littoral and Tidal Swamp Forests. The detailed description of the forests is given in the Chapter IIA of Part I. The Littoral Forests are beach forests present in Balitutha, Kathiakholda, Bhuiyanpal, Baruhan, Jatadharta, Ramtara, Marichpur and Akashdia blocks. The important species in this forest is Casuarina. The Tidal Swamp Forests contain different species of mangroves like Bani (*Avicennia alba*), Goan (*Excoecaria agallocha*), Sundari (*Heritiera minor*), Rai (*Rhizophora candelaria*), Keruan (*Sonneratia apetala*), etc. The mangrove forests are present in forest blocks like Kandarapatia, Sanatubi, Kansaridia, Batighar, Jamboo, Petchhela, Saralikuda blocks of Mahakalapara range and Salio, Baruhan, Jatadhar, Majhidia blocks of Kujanga Range.



4.3 Special Objectives of Management:

- Protection from grazing;
- Protection from illegal removal of forest produce;
- Protection of staffs from smugglers and theft (welfare scheme);
- Provision of separate legal cell to deal with prosecution cases;
- Prescription for protection and management of forests outside working plan area;
- Protection from forest fire;
- Creation of awareness among local youth;

4.4 Area Allotment:

4.4.1 The total area allotted to this Working Circle is 10145.408 ha and this Circle encompasses the major portion of the Division. The block wise and range wise details of the area allotted to this Working Circle are given in the **Table No. 4.1**.

Table 4.1 Area Allotment of Protection (OL) Working Circle			
Sl. No.	Forest Block	Area in Ha.	Rehab. W.C
Mahakalapada Range			
1	Jogidhankud PRF	392.14	392.14
2	Saralikuda PRF	263.33	263.33
3	Nipania PRF	77.98	77.98
4	Badatubi PRF	28.83	28.83
5	Barakalikhola PRF	12.00	12.00
6	Batighar PRF	166.20	166.20
7	Bagagahan PRF	12.41	12.41
8	Petchhala PRF	259.73	259.73
9	Kaunsiapal PF	97.10	97.10
Total		1309.72	1309.72
Kujanga Range			
10	Jatadhar RF	55.28	55.28
11	Balitutha PRF	84.90	84.90
12	Kathiakholda PRF	44.27	44.27
13	Brahmandia PRF	81.77	81.77
14	Jatadharta PRF	596.52	596.52
15	Majhidia (Kaudia) PF	52.47	52.47
16	Bhuiapal PF	129.67	129.67
17	Madhuban 'A' PF	78.11	78.11
18	Madhuban 'B' PF	20.46	20.46
19	Nuagaon and Dhinkia PF	206.773	206.773
20	Barkud PF	95.36	95.36



21	Kankan PF	404.69	404.69
22	Dhobei PF	16.49	16.49
23	Ramtara PF	23.98	23.98
24	Muguria PF	71.91	71.91
25	Goda PF	14.14	14.14
26	Gadaharishpur PF	273.60	273.60
27	Garhbishnupur PF	101.35	101.35
28	Gopalpur PF	21.71	21.71
29	Sahadabedi PF	638.20	638.20
30	Salio PF	53.25	53.25
31	Padmapur PF	1282.515	1282.515
32	Baruhan PF	254.73	254.73
33	Marichipur PF	3379.20	3379.20
34	Tentilibelari PF	126.78	126.78
35	Akashdia PF	249.29	249.29
36	Boitarakud PF	227.33	227.33
37	Kathagadi PF	46.43	46.43
38	Nadiakhia PF	128.96	128.96
39	Musadia PF	15.80	15.80
40	Jatadhartanda B PF	13.35	13.35
41	Harishpurgada PF	46.40	46.40
	Total	8835.688	8835.688
Grand Total		10145.408	10145.408

4.5 Analysis and Valuation of Crop:

These areas usually have little vegetation with mangroves and its associates, the crop is some-what open and of very poor quality. This is due to edaphic factors and the climatic conditions. In all the blocks included in this Working Circle, studies on vegetation condition, density, extent of erosion, degradation, boundaries, regeneration potential have been done. The details of the crown density in different forest blocks are given in Chapter IIA of Part I. The growing stock details are furnished to Chapter VIII of Part I. The extent of degradation is different in different blocks. Broadly there are two categories of areas included in this Working Circle. One is the degraded forest blocks, that need adequate attention and the other is the forests having crown density of 25-40 percent and more than 40 percent, in these areas steps should be taken to prevent degradation.



4.6 Silvicultural System:

As stated above, these areas usually have little vegetation with mangroves and its associates, the crop is some-what open and of very poor quality. This is due to edaphic factors and the climatic conditions. No silvicultural system will be prescribed for the areas proposed for allotment to this working circle. No felling, whatsoever, will be prescribed in this Working Circle. However, for boosting up and maintaining vegetative cover in the heavily degraded areas, the following protection as well as silvicultural measures shall be proposed:

1. The area will be rigidly protected from all sorts of biotic interference in the form of encroachment, illicit felling, grazing, poaching etc. so as to keep it under nature's own care and nursing.
2. The existing growing stock and young regeneration shall be improved upon by taking suitable tending and cleaning operations.

4.7 Sequence of Operations:

Two protection series have been constituted, namely Mahakalapara and Kujanga series in two ranges. Each series is divided into 10 annual coupes. The coupe wise sequence of operations in the two series is given in the **Table No.4.2 and 4.3.**

Table 4.2 Coupe Wise Sequence of Operation in MAHAKALAPADA Protection Series

Name of the Block	Year	Coupe No.	Compt. No.	Area in Ha	Total Area
Bagagahan PRF	2022-23	I		12.41	130.00
Petchhela PRF(P)				117.59	
Petchhela PRF(B)	2023-24	II		142.14	142.14
Badatubi PRF	2024-25	III		28.83	130.00
Barakolikhola PRF				12.00	
Batighar PRF(P)				89.17	
Batighar PRF(B)	2025-26	IV		77.03	130.00
Jogidhankud PRF(P)				52.97	
Jogidhankud PRF(P)	2026-27	V		130.00	130.00
Jogidhankud PRF(P)	2027-28	VI		130.00	130.00
Jogidhankud PRF(B)	2028-29	VII		79.17	79.17
Saralikuda PRF(P)	2029-30	VIII		130.00	130.00
Saralikuda PRF(B)	2030-31	IX		133.33	133.33



Nipania PRF	2031-32	X		77.98	175.08
Kaunsiapal PRF				97.10	
				1309.72	1309.72

4.8 Methods of Execution of Operations:

4.8.1 Encroachments

This is the biggest problem in this Division. Most of the forest blocks (80%) of the two ranges are partly or fully encroached. In Mahakalapara range, 65% area is under encroachments. In Kujanga range, encroachments are to the tune of 61%. Some of the blocks are totally encroached like Nipania, Badatubi, Nuagaon&Dhinkia, Sahadabedi, Boitarakud, etc. These encroachments are mainly for Cashew Plantations, agriculture, Prawn culture, etc. The details of the encroachments are discussed in Chapter I of Part I. These encroachments are mostly very old (25-30 years old) and therefore very difficult to evict in one day. Many title suits are pending in the courts. The only option is to hire eminent advocates to fight the cases and get favourable judgments for eviction. In recent years, some good progress is made in the eviction of some of the encroachments in Mahakalapara Range. Entire Sanatubi block has been made free of the encroachments. The plantations are done immediately after the eviction. This is a success story that can be emulated in other places. There are problems regarding the status of forest in different forest blocks. These issues should be settled case by case with the Revenue Administration. There should be sincere efforts to prevent any fresh encroachments. All the boundaries need to be consolidated through demarcation and pillar posting. In short, the strategy should be,

- Persuasion in the Courts for quick trial of title suits.
- Hiring of eminent advocates to fight the cases for Forest Department.
- The disputes on status land to be sorted out with Revenue Department.
- Strong action to prevent fresh encroachments
- Eviction of encroachments wherever the orders are issued by the Court.
- Consolidation of the existing boundaries.

4.8.2 Protection against Illicit Felling:

4.8.2.1 The forests are surrounded by thickly populated villages. The villagers meet their requirements of small timber and firewood from forests. Hence they resort to illicit felling inside the mangrove forests. The mangrove species which are most affected in the process are *Heritiera*, *Avicennia*, *Excoecaria* and *Sonneratia* etc. Apart from collection of firewood and timber, some of the NTFP items are also removed from the mangrove forests. The leaves and twigs of *Avicennia* and grass are removed for



fodder. Honey which has got a huge market outside is collected and transported. Fruits of *Thespesia* which has got decorative value are collected from the forest areas and marketed mostly in Kolkata.

4.8.2.2 Some of the illicit felling hot spots in the two ranges are given below in the **Table No. 4.4**. Mostly the transportation of the forest produce occur through road and river. The measures required to tackle the problem of illicit removal are already elaborated above, some of the additional measures are given below;

Table: 4.4 Details Of Protection Hot Spots In Rajnagar (WL)Division			
MahakalaparaRange.			
Sl.No.	Name of Forest Block	Routes	Hot spots
1	Hetamundia PRF	To Kharnasi and Ramnagar Village through KharnasiRiver by boat	Batighar Ghat
	Kansaridia PRF		
	Batighar PRF		
2	Jamboo PF	To Jamboo ,Chhapali and Ramnagar village through Gobari Nadi & Ramchandi Galia Nala	Jamboo
	Kansaridia PRF		
3	Sasanpeta PRF	To Bhopal,Rajnagar through HansuaRiver and by road	Rajnagar
	Kantilo RF		
	Suniti PRF		
4	Jamboo PF	To Chhapali ,Mahakalapara village through GobariNadi and then	Jamboo
	Suniti PRF	by road	
Kujanga Range.			
1	Padmapur PF	To Padmapur village by road	Padmapur
2	Ramtara PF	To Ambiki and Siali village by road	Ramatara, Ambiki
3	Jatadhartanda PRF	To Ambiki ,Kankan, DhinkiaNuagaon and Noliasahi by boat.	Sulei Ghat
			Noliasahi Ghat
			Kankan
4	Akashdia PF	To Astaranga and Puri through DeviRiver by boat	Nadiakhia
5	Marichpur PF	To Ramatara,Padmapur,Garh Harish pur& Marichpur through	Bandar
	Baruhan PF	Boitakulia nala by boat	Hawakhana
	Salio PF		



4.8.2.3 Boundary Fencing: The boundaries are not clearly identifiable in most of the blocks. No maps are also available in the Division office for the blocks. The boundaries drawn in the Working Plan maps are only tentative maps and needs further validation. The boundaries are to be demarcated wherever possible and they are to be fenced to prevent further encroachments and to provide as an effective barrier for wild animals like Crocodiles, Deer and Wild Boar etc from entering into the villages and thereby reducing man-animal conflict. Provision of galvanized iron woven wire mesh of size 4" x 4" with galvanized wire of 8 gauge on R.C.C pillars can be considered at a few sites. This was found to be effective in other places of the Division.

4.8.2.4 Construction of Watch Towers: Mangrove Forests are dense and movement on the forest floor is very difficult. Therefore, movement of the protection staff is mostly through the rivers and creeks. Even with best of efforts entry into the forests by smugglers cannot be detected easily. Watch towers help to surveillance over a large area to detect forest fires and felling of trees. Therefore, it is proposed to erect Watch Towers at a few places like Saralikuda, Badatubi, and Jamboo. The DFO is free to select the places depending on the site conditions.

4.9 Miscellaneous Regulations:

4.9.1 Grazing Control

The annual protection areas shall remain closed for grazing for at least next five years. Grazing may be controlled in forests outside the protection series areas. Steps shall also be taken, in consultation with local people, to develop fodder resources for the use of affected local people who will be encouraged to cut grasses/collect fodder for stall-feeding of their cattle/livestock. However, the Orissa Forest (Grazing of Cattle) Rules, 1980 shall be followed meticulously.

4.9.2 People Participation:

JFM is an accepted way to involve people in protection and regeneration of forests. Hence, local people shall be increasingly involved in forest protection and management in accordance with the Government policy in vogue. Steps should be taken to constitute VSS for forest protection in vulnerable pockets.

4.9.3 Protection of Endemic and Endangered species

Seeds of extremely rare, threatened or even endangered species of herbs, shrubs or trees of the Division could be sent in reasonable quantities (20 grams to 200 grams) depending upon the size and weight of species to the Director, Regional Plant



Resources Centre, Nayapalli who is maintaining a gene bank where seeds are preserved for posterity at subzero temperatures. The species, locality of collection, habitat and the name of the collector should be sent along with the specimens. Special preference should be given to endemic species and special varieties or stains of species.

4.9.4 Rights and Concessions

Rights and concessions under this Working Circle shall be regulated in accordance with the provisions of the Orissa Forest Act, 1972; Rules made there under besides the Government policies in force.

4.9.5 Control

All the entries regarding further encroachments, encroachment evictions, consolidation, illicit felling, poaching, incidence of fire, etc should be entered in the compartment histories. All the works undertaken must be entered in the compartment histories. The checking of compartment histories should form a part of the office inspections by the Conservator of Forests and the DFO.

4.10 Intermediate Revision:

No major changes in the prescriptions of this Working Circle are anticipated. However, it may be reviewed if necessary, after five years jointly by the Regional Chief Conservator of Forests (Territorial) and Chief Conservator of Forests, Working Plan. Any deviations suggested shall be subjected to the sanction of competent authority.

4.11 Cost Norms

The cost norm for implementation of prescription and the total estimated cost of working under this Working Circle is discussed in Chapter-15 of Part II.





CHAPTER 05

The Wildlife (Overlapping) Working Circle: (WL(O)WC)

5.1 General Constitution:

The forest blocks of Kujanga were under control of erstwhile Zamindars of Kujanga till 1951. Consequent upon the abolition of the Zamindari system, the forest and its administration was transferred to Revenue authorities (AnchalSasan). In AnchalaSasan (Revenue Administration), the forest administration and management became very chaotic & haphazard which resulted in large scale illicit felling and indiscriminate encroachment of forest land for various purposes. Subsequently in the year 1957, the forest and its administration were transferred to Athgarh Forest Division and the protection & scientific management of the forests started thereafter. Nevertheless, the area of the Division is very vast and it was difficult to maintain the area. These difficulties have contributed substantially to heavy encroachments in this area. Hence in 1988 Kujanga range of Athgarh Division was transferred to Rajnagar (W.L.) Division. Most of the earlier literatures referred on the sea turtles and Crocodiles of Bhitarkanika area, hence the availability of wildlife in the Kujanga area is not known much. But the local enquiry reveals that the wild life and mangrove forest were given lot of importance during the administration of the Zamindars. Subsequently, destruction has started in the anchalsasan. The wildlife was never a priority of the planners earlier; the attention is being given only in the last two decades. The 42nd amendment to the Constitution enjoined with citizen for protection of wildlife as one of the fundamental duties. The National Forest Policy 1988 has emphasized the need to conserve wildlife and their habitat. Nevertheless, the investments in the wildlife management are meager. Therefore, to provide protection to existing wildlife, to improve their habitat and to conserve bio-diversity, the Wildlife (Overlapping) Working Circle that extends to entire Working Plan area of the Division has been constituted, with optimistic idea that limitations encountered during the last plan period will not prevail during this plan period.

The habitats of estuarine Crocodile, Olive Ridley Turtles, wetland birds and other wildlife requiring specific needs shall be identified during the Working Plans exercises and brought under this Working Circle.



The wetland areas play a major role in the sustenance of forest ecology. These areas are to be surveyed, protected and developed. Water resources shall also be addressed sufficiently in this Working Circle.

5.2 Special Objectives of Management:

5.2.1 The special objectives of management of this working circle are

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

5.3 Analysis and Valuation:

Demand for forest produce, encroachment, grazing, illegal fishing, human-wildlife conflict, fragmentation of habitat, use of pesticides, discharge from shrimp culture ponds, growth of industry, natural calamities, climate change, change in landscape, change in bio-chemical characteristics like Soil Salinity, Water Salinity and lack of proper enforcement of existing Acts/Rules/Regulations etc are some of the major problems.

5.3.1 In Rajnagar (W.L.) Division, Crocodile census is done regularly every year from 1989-90 onwards. The census results are mostly emphasized on numbers, with no formal analysis and valuation at the Division level.

5.3.2 The Division has high variation in the habitat with mangroves, network of creeks and channels, periodic inundation and mixture of fresh and marine waters. These habitat variations give rise to high faunal diversity. The entire Division is a rich house of faunal diversity. It contains 42 species of reptiles, 5 species of amphibians, 280 species of birds & 28 species of mammals. The mangrove vegetation contains high population of King Cobra. Reports of poaching / stealing of these animals are received from time to time. Visibility of animals in the wild is rather uncommon. Management practices should aim at study of this elusive species and building up its population in the wild.



5.3.3 The Division has got a high variety of avian population. There are resident as well as migratory birds. The details of the census reports are given in the Chapter II B. In the entire Division including the Sanctuary portion, nearly 1, 00, 000 migratory birds visit during the winter season. In recognition of rich avifauna in the protected area of international importance, it has been declared as a "RAMSAR SITE" on 19.08.2002. More than 8 species of Kingfishers & 5 species woodpeckers are found in Division, highlighting the biodiversity of the area. Management vision aims at perpetuity of such phenomenon.

5.3.4 Mangroves are the least understood of the plant community of the world along with its associated fauna. Many plants need elaborate study and research for understanding of their growth, propagation (natural as well as artificial), silviculture etc. Similarly, many animals are required to be studied exclusively and extensively by full time researchers to understand their behaviour, breeding biology & other survival needs. Some such animals are King cobra, Monitor lizard, White bellied sea eagle, Adjutant stork, White backed vulture, Kingfishers & Indian skimmer etc.

5.3.5 Salt water Crocodile (*Crocodylus porosus*) is the flagship species of Division. Over a period of time, with research inputs from FAO specialist Dr. H.R. Bustard the population of salt water crocodile have gone up from a meagre population 96 in 1975 to 1454 as per last census of 2006 in the entire Division. The breeding animals are over 200 in number. Salt water crocodiles are amongst largest of animals found in estuarine waters. Crocodile of over 20 ft. length are frequently sighted. One skull of Salt water crocodile preserved in museum of Kanika palace suggests that the length of animal when alive was 30 ft. Recent report in Guinness book of World records suggests that the largest living crocodile in the world is found in this Division. Such unique specimen and the endangered species need protection for its long term survival.

5.4 Area Allotment:

In this Division, all the blocks are important from wildlife point of view. The areas barring encroachments are included in this Working Circle. This Working Circle will constitute the areas as described above is 4770.67 Ha & which constitutes about 47% of the total Working Plan Area. The major areas of wildlife importance in Mahakalapada Range have been included in Bhitarkanika sanctuary.



Table: 5.1 Area Allotted to Wildlife (Overlapping) Working Circle

Name of the Range	Name of the Forest Block	Area allotted in Ha
Kujanga	Jatadhartanda PRF	596.52
	Barkud PF	54.48
	Ramtara PF	23.98
	Sahadabedi PF	98.30
	Padmapur PF	60.92
	Salio PF	53.25
	Baruhan PF	254.73
	Marichpur PF	3379.20
	Akashdia PF	249.29
	Total	4770.67
	G. Total	4770.67

5.5 Method of Treatment:

5.5.1 There are several problems relating to wildlife in Rajnagar (W.L.) Division. These problems are mainly due to social, natural and human factors.

5.5.1.1 Social Issues:

- Encroachment of forest lands.
- Demand for timber and firewood leading to illicit felling.
- Grazing.
- Illegal Fishing.
- Human - animal conflicts.
- Lack of tidal inundation due to bunding across the creeks.
- Un regulated tourism.
- Forest fire;
- Disturbance to habitat;
- Teasing of animals;
- Use of pesticides;
- Chemical discharge from Prawn gherry;
- Growth of industries in the peripheral areas



5.5.1.2 Natural Issues:

- a. Flood, drought, cyclone etc.
- b. Changes in biochemical characteristics such as soil salinity, water salinity, pH.etc.
- c. Diseases and pest attack.
- d. Change in climate
- e. Changes in landscape

5.5.1.3 Management Issues:

- (a) Lack of proper enforcement of law.
- (b) Shortage of trained staff.
- (c) Poor infrastructure.
- (d) Lack of proper legal status of the forest blocks.
- (e) Lack of timely flow of funds.

5.5.2 Treatment of the Area:

Several steps are recommended for the management of the wild life area. The management interventions should take into account the various problems arising out of natural and human interactions.

5.5.2.1 Habitat Improvement

5.5.2.1.1 The habitat improvement measures are required to optimize the productivity of the eco-system and welfare of the wildlife. The area has a lot of Crocodiles. The details of the census figures are given in the Chapter II B. The creeks at times get silted up due to unstable nature of the land, thereby reducing the effective area of the Crocodiles. Smaller creeks are necessary for juveniles who are likely to be washed away in larger creeks and rivers. Smaller creeks are also used by female crocodiles to locate secluded area for their nesting. To maintain this, frequent renovation of creeks are necessary. The details of the creeks renovations are discussed further in the Mangrove Improvement Working Circle.

5.5.2.1.2 Meadow Development: The herbivore population is high in the area, this may be probably due to lack of effective predators like Tiger and Leopard. These herbivores require grasslands to survive. Hence the management interventions should aim at development of grass lands wherever the concentration of deer population is high. Moreover, the meadows are also used by varieties of birds, particularly Storks, Egrets, Ibis & migratory Ducks. They are the best area for animal sighting also. The block wise details of area to be developed as meadows is given below in the Table No. 5.2

5.5.2.1.3 Digging of Fresh Water Ponds: Mostly brackish water is present in the creeks and this water is not used by the animals for drinking purpose. Hence the wild



animals come out of the forest in search of drinking water. This enhances the man-animal conflict. Hence, digging of fresh water ponds is necessary to augment availability of fresh water for the animals, to reduce the man animal conflict and also to keep the habitat in its productive form. The block wise details of number of fresh water ponds that can be dug out are given below in the Table No. 5.2.

5.5.2.1.4 Creation of Mounds: In some of the low lying areas prone to frequent tidal inundation, mound creation is necessary for providing the landing space for the wild animals. The details of mounds to be constructed are discussed in Chapter X of Part II.

5.5.2.2 Fencing of Crocodile Prone Area

Crocodiles during rainy season stray into the rivers and creeks near to human habitations and create havoc. They attack cattle, human beings alike. The details of the human and animal casualty by Crocodiles are furnished in the Table 3.8 of Part I. The main areas prone to Crocodile attack are Suniti and Kalatunga villages of Mahakalapara range. Hence it is proposed to fence the areas adjoining these villages.

5.5.2.3 Wild Life Crime

The wild life crime can be minimized through a multipronged strategy. The offenders should be dealt sternly through effective patrolling of the rivers, creeks. This can be achieved only with young dedicated staff having the entire infrastructure like boats, fuel to run the boats, weapons, etc. Anti poaching squads should be constituted to prevent wildlife poaching. But the Rajnagar (W.L.) Division has severe shortage of staff with 50 percent vacancy at the base level Forest Guard cadre. Hence it is suggested to hire the personnel and constitute the anti poaching squads. The other approach is to take the local people into confidence and take their help. This is a long term approach and it can be effectively implemented through Forest Extension Officers and Village Forest Workers.

5.5.2.4 Research

The mangrove vegetation and the wild life associated with the mangroves are not extensively studied mainly due to difficulty in negotiating the areas. The research should aim at some of following subjects. The subjects enlisted below are only an indication, but not the exhaustive list. It is the discretion of the Chief Wild Life Warden to decide the areas of research depending on the situation and the availability of the funds.

1. Status & breeding biology of King Cobra.
2. Study on breeding habitat and behaviour Water Monitor Lizard.



3. Study on status & breeding of White Backed Vulture
4. Study on vegetation succession on newly formed islands
5. Standardization of propagation techniques of endangered mangrove species.
6. Study on effect of industrial waste on mangrove eco-system.
7. Study of fauna associated with mangrove vegetation.

5.5.2.5 Eco-tourism

The most important aspect of the wild life protection and conservation is the public support. This can be achieved only with the increasing awareness and education of the people. One of the best ways to achieve this is the promotion of the eco-tourism. The eco tourism can be developed only with the enhancement of the infrastructural facilities like Power boats, interpretation centres at different places like Batighar, Kharanasi, audio visual facilities like LCD projector, Generators, Solar lights and trained guides, etc. There are two important eco-tourism circuits in the area. They are given below:

1. Jamboo- Batighar-Hukiola-Jamboo
2. Atharabanki-Mahanadi- Batighar-Hukitola-Kharanasi creek- Mahanadi- Atharabanki (paradeep)

5.5.2.6 Block wise Details of Fresh Water Ponds & Meadows:

The details of some of the areas requiring the construction of fresh water ponds and areas where the meadows can be developed are furnished in the Table No.5.2. Nevertheless, this is not an exhaustive list, the DFO while implementing the prescriptions can choose or delete some of the areas depending on the site condition at the time of execution of works.

Table 5.2 BLOCK WISE DETAILS OF PONDS & MEADOWS TO BE DEVELOPED

S. No.	Name of the Block	No. of Fresh Water Ponds	Meadow Development in ha.
Kujanga Range			
1	Sahadabedi		20

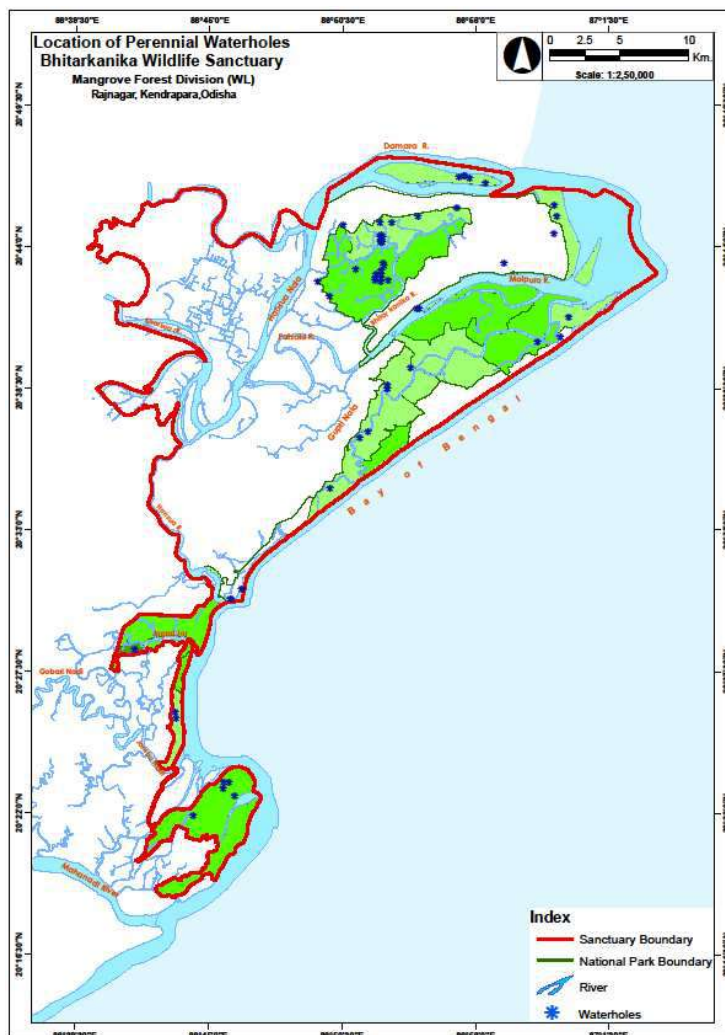
5.5.2.7 NTFP Collection & Wildlife:

The forests under management are not rich in NTFP items liked by Wildlife. Only Jamun (*Syzygium cumini*), Honey are available. The local people will be allowed to collect any NTFP items up to 65% of the available quantum and rest will be left in the wild for wildlife purpose.



5.5.2.8 Salt lick & its maintenance:

There are natural Salt licks along the water course. Besides the natural saltlick no artificial saltlick is maintained in the forest areas under management of this revised Working Plan. The natural salt licks (list) tentative location is available with the Field staff / Division Office but not disclosed in the plan due to fear of Poaching at saltlicks. Saltlick locations are broadly near to Water bodies indicated in the map.





5.6 Miscellaneous Regulations:

5.6.1 Awareness: The awareness for wildlife preservation may be created through celebration of wildlife week, competitions and debate among the school/college students. Even, publicity material shall be distributed and the benefits of wildlife conservation explained through electronic media. The legal provisions under the Wildlife (Protection) Act'1972 shall also be brought to the notice of all including the scope and extent of the compassionate amount for wildlife depredation.

5.6.2 Infrastructure and Training: To ensure better protection and to enhance their effectiveness, the field staff shall be provided with modern equipments including proper arms and ammunition. As fast and better communication is the key for protection of forests and wildlife, divisional headquarters, all the range headquarters, section headquarters, sensitive beats and check gates should be provided with VHF sets. More and more field staff shall be trained in wildlife management and in detection and investigation of wildlife crimes.

5.6.3 Information network and records keeping: A regular data base should be maintained at Divisional level comprising of details like

- schedule species found in the area,
- pictorial directory of all identified poachers to be prepared and circulated in the locality,
- List of traders in involved in trading of skin of wild animals.
- list of eating houses alleged to be serving bird/deer meat and
- Timely& proper documentation of all the incidences of man-animal conflicts including poaching.

Further, the DFO shall also submit half-yearly report to the authorities concerned with regard to steps taken by him to protect wildlife and to improve their habitat. He shall also report constraints faced by him in implementing the prescriptions of this Working Circle.

5.6.4 Control of Grazing: The wildlife rich areas shall be closed for grazing. However, grazing may be controlled elsewhere as per the provisions of the Orissa Forest (Grazing of Cattle) Rules, 1980. The local people and the VSS may even be motivated to immunize their cattle which graze inside the forests.

5.6.5 Fire protection measures: Fire lines should be cleared and maintained regularly. As most of the forest fires are man-made, it can be prevented to a large extent by motivating & educating the local people. Adequate field staff should be stationed with



necessary infrastructure in fire prone areas to control and suppress the fire menace during the summer season.

5.6.6 Incentives and Rewards: There shall be provision for rewards and incentives to the staff and public including the informers whose efforts lead to detection of wildlife crime and arrest of the offenders. Moreover, their deeds shall also be given media publicity in the locality as well as recognition on the occasions like Wildlife Week and World Forestry Day.

5.6.7 Rights and Concessions: Rights and concessions under this Working Circle shall be regulated in accordance with the provisions of the Orissa Forest Act, 1972; the Wildlife (Protection) Act, 1972; Rules made there under besides the Government policies in force.

5.7 Intermediate Revision and Working Cost:

5.7.1 No intermediate revision is anticipated. However, if so required, the Regional Chief Conservator of Forests (territorial) in consultation with the Chief Conservator of Forests (Working Plans) will send a proposal for amendment of prescriptions to the competent authority for necessary approval.

5.7.2 The estimated cost for implementation of various prescriptions of this Working circle is given in Chapter 12 of Part II.





CHAPTER 06

Jointforest Management (Overlapping) Working Circle (JFM(O)WC)

6.1 General Constituion:

Total 23 Vana Samrakshana Samiti (VSS) covering an area of 653.90 hectares have been formed. Out of the 23 VSSs, forest areas of 05 VSSs have been diverted for POSCO India Pvt. Ltd and the forest land has been handed over to IDCO Authorities. There are internal conflicts in another 05 numbers of VSS due to which these VSSs are dormant. However new JFM committees will be formed in new areas as per JFM resolution 2011as amended in 2015. These areas and the areas which are to be covered under JFM during the plan period are to be brought under this Working Circle. The following actions are proposed to be taken under this working circle. The area allotted to this Working Circle (Covered under this Plan) is 250.00 Ha.

- i. Demarcation and survey of the area allotted under each VSS
- ii. Preparation of Digitized map for each VSS
- iii. Preparation of Micro plan for each VSS
- iv. Capacity building of VSS members
- v. Allotment of funds to execute prescription of working circle in each VSS
- vi. Provision of revolving fund for SHGs under each VSS
- vii. Entry point Activity for each VSS
- viii. Sustainable Income generating Activities for VSSs
- ix. Record maintenance of each activity undertaken for each VSS

6.2 Characteristics of Vegetation:

The detailed description of the forests is given in the Chapter 2 Para 2.6 of Part I. Hence description here again is not felt necessary to avoid repetition

6.3 Special Objectives of Management:

The special objectives of management set for this Working Circle are within the ambit of the general objectives of management. The prescriptions of the micro plan should be within the overall objectives of management.

- (i) To involve communities in forest and natural resource management.
- (ii) To make the people and Forest Department equal partners in management.



- (iii) To restock the degraded forest areas through natural supplemented with artificial regeneration.
- (iv) To increase the productivity of soil through suitable soil and moisture conservation activities.
- (v) To motivate people to rationally utilize their own community resources for the betterment of the community.
- (vi) To involve people in NTFP collection and trade.
- (vii) To create income generating activities in the villages protecting the forests, particularly based on non-forest resources.

6.4 Area Allotment:

In this Division, 23 VSS are constituted and the total area covered under VSS is 653.90 ha. However after rationalization of boundary of Bhitarkanika sanctuary and consequent addition of 8 forest blocks from working plan area to the sanctuary, 8 numbers of VSS are remaining in working plan area with an area of 250 Ha in forest blocks. One VSS assigned with 42.9 Ha revenue forest has also been included in this working circle. The list of VSS have been shown in Annexure ---. The VSS which have now been included in sanctuary after rationalization have been shown in Annexure ---- B. The area allotment to this working circle is dynamic. As formation of new VSS takes place the area will be added to this working circle.

6.5 Silvicultural System:

This Working Circle is an overlapping circle and hence the silvicultural system to be followed depends on the prescriptions outlined for main Working Circle to which the block is primarily allotted. Moreover, the system of working in these particular areas would be guided by the micro plans prepared in conformity with the prescriptions of the main Working Circle. The intermediate and final felling to be proposed should be clearly mentioned in the micro plans and the yield needs to be fixed by taking into account all the safeguards.

6.6 Method of Execution of Operations:

6.6.1 The important task is to demarcate the areas assigned to the VSS and post the pillars. It helps to give a specific identity to the VSS, motivate them to protect and also avoid disputes between the villages. A uniform system may be adopted over the entire Division while demarcating VSS areas.

6.6.2 The areas assigned to the VSS are either in Rehabilitation or Protection Working Circles. The micro plans should be prepared keeping in view the overall prescriptions of



the concerned Working Circles. Prescriptions like prescribed exploitable girth class of different species for 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 microplans. The yield in the area assigned to the VSS should be calculated with due consideration to safeguard against erosion, illicit felling and other biotic pressures. In areas falling under Rehabilitation Working Circle areas, emphasis should be laid on gap plantations and soil and moisture conservation measures.

6.6.3 Micro plans should be prepared for each VSS irrespective of whether money for implementation is available or not. Planning should be done first and efforts should be taken to obtain funds from different sources like State Budget, District Budget, MGNREGS, and any other sources. While preparing the microplans, the tools like GIS and MIS can also be used for better planning. For this, the help of ORSAC and NGOs can also be taken.

6.6.4 The Micro plan shall be prepared for every VSS adopting the 'Participatory Rural Appraisal' technique (PRA). A map to scale will be prepared by the field staff and enclosed with the micro plan. Different activities like plantation, soil conservation measures, silvicultural operations like tending and cultural operations, disposal of the cleaning materials, water harvesting structures, pastures etc shall be discussed in detail along with financial outlay in the micro plan. Even, sharing mechanism shall also be clearly spelt out. However, the provisions of this micro plan shall be in conformity with the overall prescriptions of this working plan. Micro plan should also include non-forest based micro enterprises to provide engaging income generating activities to the people.

6.6.5 Wherever plantations exist in VSS allotted area, these plantations should be thinned and pruned as per requirement. Sweeping off the floor of plantations for leaves and twigs should be avoided since it affects the cycling of nutrients. Grazing and fire protection should be provided to all plantations. These prescriptions should serve as a guideline while preparing the microplans in these areas. Efforts should be made as far as possible to identify the contiguous patches of RF and PF and these areas should be planted with suitable species to meet the firewood and small timber needs of the villages.

6.6.6 Most of the times it becomes difficult to sustain the motivation level of the people to protect the forests, because the lagging period is more for flow of returns from forest. In course of time there may be many conflicts. Most of the time it is



difficult for the Forest Department personnel to upkeep the motivation level. Hence it is advisable to identify genuine NGOs or eminent persons (like teachers, doctors, village level workers etc.) closely associated with the people, who can convince the people and keep up their motivation. These persons/institutions should be closely associated and if possible some remuneration should be given to them.

6.6.7 In each village, the efforts should be made to create sustainable income generating activities. Many NTFP items are also collected in the division and efforts should be made to explore the marketing and value addition to the forest based products. The entry point activities done in different programmes should aim at sustainable income generation to the villages. There are many Self Help Groups working in the villages, it would be better to take the help of these groups also to motivate the women. Some vocational training on sustainable livelihood and value addition to different NTFP items should be provided to the women groups.

6.6.8 Well managed VSS should be identified and rewarded. Their success stories should be given wide publicity and the other VSS members, potential VSS villages should be taken to these successful VSS villages for inspirational exposure. These promotional visits would help a great deal to promote the VSS movement in the Division. Awards should be instituted to adjudge the best VSS of the Year in the Division.

6.6.9 The training inputs should be given to front line staff of the Forest Department, to help them to work along with the villages by sharing the power. In the training, the communication skills need to be imparted. The VSS members also need training and exchange of ideas. Proper orientation of the field staff through training, workshops and discussions on the philosophy and need of Participatory forest management should be imparted.

6.6.10. The feasibility of extending the VSS to other degraded areas should be explored and new VSS should be brought under the purview of the Working Circle

6.7 Control

All the areas assigned to the VSS should be marked on the top sheets of 1:25000. The works taken up in the VSS areas should be entered in the compartment histories. The checking of compartment histories should form a part of the office inspections by the Regional CCF and the DFO.



6.8 Rights and Concessions:

Rights and concessions in this Working Circle shall be regulated in accordance with the provisions of the relevant gazette notifications of the respective forest blocks and the Govt. of Orissa policy with regard to JFM Resolution, 2015. The existing rights and concessions are elaborated in Part I of this plan.

6.9 Interim Revision:

No major changes in the prescriptions of this Working Circle are anticipated. However, it may be reviewed if necessary, after five years jointly by the Regional Chief Conservator of Forests, Territorial and Chief Conservator of Forests, Working Plan. Any deviations suggested shall be subjected to the sanction of competent authority.





CHAPTER 07:

The Mangrove Improvement Working Circle (M.Imp.WC):

7.1 General Constitution:

There are 73 different species of mangroves and their associates. The mangrove habitat is very dynamic. In this area, shifting of land forms like rivers and creeks is a continuous phenomenon. Existing land forms with its forests are eroded & new islands appear from time to time. With this change, floral and faunal diversity also change. The dynamism of the geography of the area has to be maintained. The mangrove forest needs to be maintained, for this several improvement measures are necessary. The mangrove species are associated with creeks and rivers. The management interventions should aim at creek renovation, improvements and the maintenance of adequate salinity. There is also lot of biotic pressure on these forests from the densely populated adjoining villages. These pressures need to be tackled in a systematic way. All the mangrove areas that need improvement may be kept in this Working Circle. The total area allotted to this Working Circle is 230.00 ha.

7.2 Objectives of Management:

The forests in this Division are now in a degraded stage. There was less emphasis on silvicultural operations in the forests in absence of any prescription in the outgoing Plans. Climber cutting, thinning operations and other subsidiary silvicultural operations were neglected to a large extent. The boundary was not maintained, the boundary pillars are not traceable. The process of reservation of forest blocks in the Division has been vastly neglected. Many of the forest dwellers and villagers still greatly depend on the forests for their livelihood. Illegal collection of firewood, poles etc. has gone on increasing with the exploding human population and their increasing demands. Mangroves world over are under stress resulting in the degradation. Mangroves of Odisha in particular are not an exception on this score. The problems which hinder the basic purpose of mangrove conservation can be broadly classified into two categories namely

1. Natural problems induced by nature.
2. Human induced problems.

Some of the conspicuous natural problems are (a) climate, (b) Pests and diseases, (c) cyclone and tidal surges. Degradation of natural forests due to various factors has dwindled the biodiversity of the region. The approach towards the future management should also be aimed at catering genuine needs of the local poor and also to suggest



possible ways and means to engage the rural poor in other productive activities so as to minimize the illicit cutting of trees inside the forests.

Now the approach towards the forest management needs to be changed and more emphasis has to be given on conservation of biodiversity and participation of people in regeneration and development of forests. The emphasis in the present plan is to conserve and restock the forests for maintaining the ecological balance. The proposed Working Plan shall have the following general objectives for sustainable management of forests:

- 1) To prevent further degradation of environment by giving more emphasis on conservation and protection of flora and fauna of these forests.
- 2) To maintain permanent closed cover in catchments of rivers, water bodies and reservoirs to check soil erosion, to maintain hydrological cycle and to regulate water yield.
- 3) To improve conditions, composition and productivity of these forests by increasing investment and through appropriate scientific management.
- 4) To protect and manage wildlife resources in their full scope and range in the Division with a view to conserve and enrich biodiversity.
- 5) To restock barren degraded and depleted forests using appropriate silvicultural prescription.
- 6) To meet the needs of local people for forest produce as far as possible with active involvement of community under Joint Forest Management (JFM) system subject to the aforesaid environmental imperatives.
- 7) To provide employment opportunities to rural people in general and weaker sections including scheduled castes / tribes and women in particular, through regulation of NTFP and the above mentioned conservation oriented activities.

7.2.1 Special Objectives of Management:

The special objectives of the management of this working circle are,

- I) Conservation of Mangrove Forests.
- II) Increasing the biodiversity, ecology of the area Maintenance of salinity gradient.
- III) Protection of estuarine ecology.
- IV) Promotion of research in understanding the growth, propagation and silviculture of the mangrove species,
- V) Enhancement of the productivity of the habitat



7.3 Area Allotment and Treatment Series:

The total area allotted to this Working Circle is 230.00 ha. No treatment series have been constituted. Due to reduction in major mangrove area after deletion of 8 forest blocks of Mahakalapada Range from the working plan area, 230.00 Ha area of only five forest blocks have been included in the working circle which can be covered before the expiry of the plan period depending on allotment of target to the Division. Area under encroachment for aquaculture or other purpose have also been added which shall be planted after eviction of encroachments. Hence no annual coupe have been constituted. The details of the area are given in the Table No.7.1.

Table. 7.1: Area allotment to Mangrove Improvement Working Circle		
Name of the Range	Name of the forest block	Area in Ha
Kujanga	Jatadhara RF	10.00
	Total	10.00
Mahakalapada	Batighar PRF	27.00
	Saralikuda PRF	110.00
	Nipania PRF	65.00
	Badatubi PRF	18.00
	Total	220.00
	Grand Total	230.00

7.4 Analysis and Valuation of the Crop:

All the blocks allotted to this working circle have mangrove forest interfaced with number of rivers and creeks. The important rivers and nallahs associated with the vegetation are Baitakulia, Kharnasi, Tubi, Akhasida, etc. The details of all the nallahs flowing in different forest blocks is given in the Chapter- 01 of Part I. The important mangrove species present are Bani (*Avicennia alba*), Guan (*Excoecaria agallocha*), Sundari (*Heritiera minor*), Rai (*Rhizophora candelaria*), Keruan (*Sonneratia apetala*), Baniah (*Hibiscus tiliaceus*). *Acrostichum aureum* is a beautiful fern found near the edges of water. The details of the forest types and crown density of the mangrove forest are elaborated in Chapter 02 of Part I. In all the blocks allotted to this Working Circle, studies on vegetation types, boundary position, encroachments, and crop condition have been conducted and some of the inputs on crown density, growing stock, etc have been provided by the NRSC, Hyderabad.

7.5 Silvicultural System:

Since the primary objective of the management is maintenance of the estuarine ecology, enhancement of the productivity of habitat, conservation and improvement of



the mangrove vegetation, no formal silvicultural system is proposed. However to achieve the major objectives, operations like cleaning, soil and moisture conservation, plantation will be carried out. In addition steps will have to be taken to protect the habitat and to maintain the adequate salinity of the area.

7.6 Method of Treatment:

7.6.1 Habitat Improvement

7.6.1.1 The following factors are crucial in maintaining the habitat of area:

- a) Amount of fresh water flow.
- b) Tidal amplitude.
- c) Deposition of sediments.
- d) Maintenance of required salinity & pH value.
- e) Degree of biotic interference.
- f) Incidence of fire.
- g) Occurrence of natural phenomena like flood, cyclone, Tsunami, drought etc.

7.6.1.2 All the above factors influence the mangrove eco-system and significant variation in any of these factors will affect the eco-system. In order to keep the habitat in its present condition, some interference is necessary. Left to the nature, the habitat may move in a non reversible direction thereby obliterating the present balance. The following interventions are therefore suggested for maintenance and improvement of the habitat.

7.6.2 Creek Renovation:

Creeks are the life line of mangrove forest. They carry fresh water and tidal water to the adjoining forest and supply the vital nutrients. It also re-charges the soil with fresh dose of sediments. But due to several factors like change of course of rivers, biotic interference and diversion of water channel, in the upper reaches the creeks are silted up. It is necessary to renovate the creeks from time to time. The renovation of the creeks includes the maintenance of adequate depth of the creeks. The renovation has to be taken up in a 5 year cycle. The cost of labour is very high in the area and also the areas difficult to negotiate. Hence the cost of renovation would be little bit higher. The details of the cost has been discussed in Chapter 12 of Part II. The individual creek wise extent of area to be renovated is given in the Table No. 7.2. However, DFO is free to taken up fresh areas depending on the site conditions at the time of execution of works.



7.6.3 Digging of Fresh Water Ponds:

Though mangrove forests are surrounded by water bodies, the fresh water is a limiting factor in the area. The fresh water is essential for the wild life and also necessary to enhance the productivity of the area. Hence it is recommended to dig few fresh water ponds in different blocks. The details of the ponds to be dug out are given in the Table No.7.2. However, this is not an exhaustive list, DFO can decide the new areas depending the prevailing conditions.

7.6.4 Construction of New Fish bone Channels:

In some of the areas, the mangrove vegetation has come up afresh. This vegetation requires water for its growth. In these places construction of new fish bone channels is recommended. The sites where these channels are to be constructed should be decided by the DFO depending on the new areas where the mangrove vegetation is extending.

7.6.5 Removal of the Unwanted Weeds:

Harkanch weed is the predominant weed present in the mangrove vegetation. It effects the propagation and growth of the mangrove vegetation. This has to be removed. Similarly Nalia grass also grows in the mangrove vegetation. It suppresses the growth of mangroves. Hence it is recommended for the removal of the grass from the mangrove forest.

7.6.6 Mangrove Plantation:

The plantation to be taken up in different areas is discussed in the Plantation Working Circle (Chapter-03). However, few things to be noted are the species selection should depend on the site, salinity, nearness to villages, etc. For example, in more saline areas, Bani is recommended, in less saline area Sundari, Kaliachua comes up well, in degraded patches Hentala grows well. Bani species is more prone to grazing and few non browsable species are Sindhuka and Rai.

7.6.7 Habitat Restoration:

In all the blocks kept in this Working Circle major vegetation is the mangrove. In some of the places, the mangroves have been degraded due to biotic and geological factors. These areas are now devoid of forests. Restoration measures are suggested for such areas. These measures include soil conservation measures to prevent soil erosion, mangrove plantations, and strict protection against illicit felling, grazing and encroachment

7.6.8 Habitat Protection:

The mangrove forest, interspersed with creeks and rivers is a fragile ecosystem and it suffers irreversible loss, if biotic and anthropogenic pressure is allowed in the eco-



system. Densely populated human habitations around the mangrove vegetation, who are heavily dependent on these biological resources, are partly responsible for the degradation of the habitat. It is therefore, necessary that rigid protection is provided to the area for its long term conservation.

7.6.9 Creation of Mounds:

The mangrove areas are generally low lying area with tidal water submerging land mass during high tides. The problem is aggravated during rainy season. Instances of casualty of herbivores are noticed during monsoon due to lack of resting places. Hence it is recommended for the construction of mounds. The standard size of the mounds should be 50' x 5' x 5' (1250 cft). These mounds get eroded over a period of time and they need renovation and repair periodically. A total of 27 mounds are recommended in different forest blocks, as elaborated in the Table No. 7.2. But again it is the discretion of the DFO to select additional places depending on the necessity.

7.6.10 Encroachment for Shrimpculture:

Every year, encroached prawn gherries are being demolished in Mahanadi Delta and free flow of tidal inundation is ensured. About 50% of mangrove forest area in Mahanadi delta of Mahakalapada WL Range has been under encroachment for unauthorized aqua culture and agriculture and home stead since 1950. Recovering these areas and restocking with mangrove forest is the primary objective.

7.6.11 Research:

Mangroves are the least understood of the plant community of the world along with its associated fauna. Many plants need elaborate study and research for understanding of their growth, propagation (natural as well as artificial), silviculture etc. Similarly, research is also necessary on pathogens attacking mangrove vegetation, vegetation succession on newly formed islands etc. The research is as well necessary to understand their behaviour, breeding biology & other survival needs of the different wildlife species. This should be given to few organizations like Wild Life Institute of India, Dehradun, Bombay Natural History Society, Mumbai, Regional Research Laboratory, Bhubaneswar, World Wild Fund for Nature India, BSI, Kolkata, ZSI, Kolkata, Research Wing of Forest Department, Orissa, etc.

7.6.12 Inspection Paths:

The construction of inspection paths is necessary for the supervision of the area. The details of the extent of Km of inspection path to be constructed in different forest blocks are given in the Table No. 7.2. The standard size of the inspection path is 10' x 5'



x 4'. The inspection path should be constructed on the embankment with sand and morrum spreading on the top.

7.6.13 Watch Towers:

At present there is only one watch tower at Hawakhana section. This is not sufficient for entire area. Few more watch towers are to be constructed at places as to be decided by the DFO as per site requirement. These watch towers help in protection of the mangrove vegetation and the wildlife. In the approved Site Specific Wildlife Conservation Plan, there are provisions for Construction of Watch Towers at various places. The same is required to be constructed within this Plan Period.

7.6.14 Block wise Prescriptions:

The details of some of the areas requiring the renovation of creeks, construction of mounds, inspection paths, etc. are furnished in the Table No.7.2. Nevertheless, this is not an exhaustive list, the DFO while implementing the prescriptions can choose or delete some of the areas depending on the site condition at the time of execution of works

Table: 7.2 Details Of Improvements Prescribed In Different Forest Blocks					
S.No	Name of the Block	Extent of Creek Renovation in Km.	No. of Mounds to be Constructed	Inspection Path in Km.	Mangrove Plantation in Ha
Mahakalapara Range					
1	Batighar PRF	4.00	05	02	27.00
2	Saralikuda	2.00	05	02	110.00
Kujanga Range					
3	Salio	Salio creek - 2.50			
4	Baruhan	Baruhan creek - 3.50	05		

7.7 Intermediate Revision:

No major changes in the prescriptions of this Working Circle are anticipated. However, it may be reviewed if necessary, after five years jointly by the Conservator of Forests, Bhubaneswar and Conservator of Forests, Working Plan. Any deviations suggested shall be subjected to the sanction of competent authority.

7.8 Cost Norms:

The cost norms have been given in Chapter 15 of Part II.



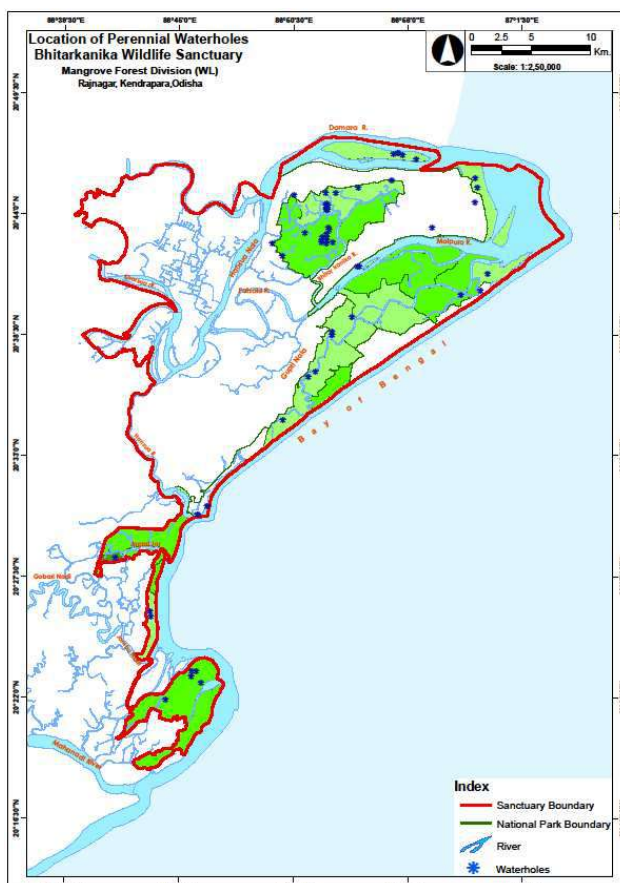


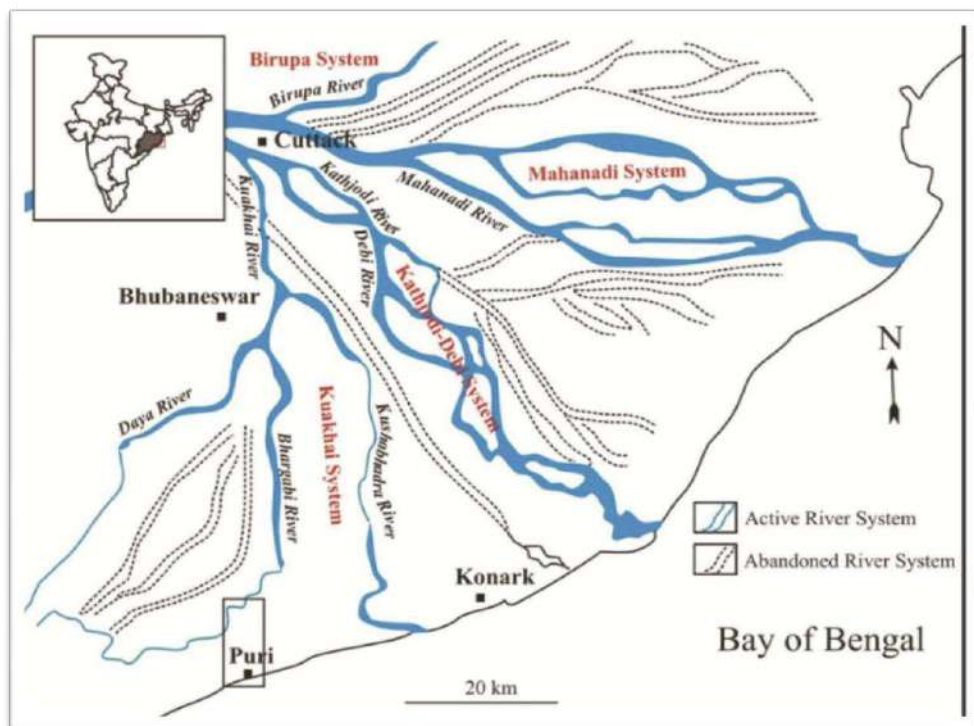
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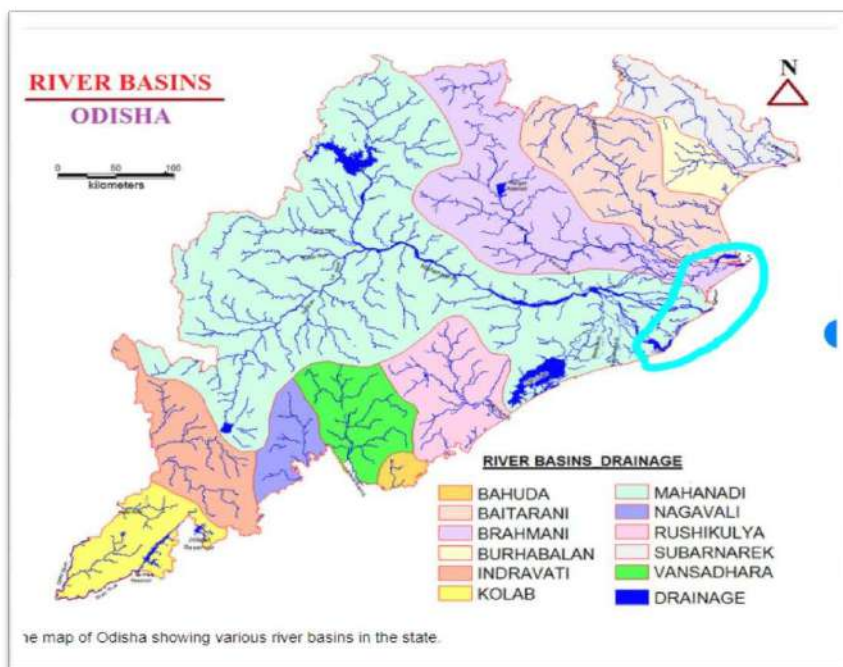
Water Resource Management:

8.0 Introduction:

Mangrove Forest (Wildlife) Division, Rajnagar is situated in part of Kendrapara District and part of Jagatsinghpur District covering mostly the River Confluences with Bay of Bengal. The River system of Brahmani / Baitarani combined known as River Dhamra and Mahanadi River system i.e. Mouth of River Mahanadi and River Devi nadi. Part of Water body coming in Bay of Bengal has been declared as Gahirmatha Wildlife Sanctuary. The water body / resource map is furnished below.







All the River System is under the administrative control of Water Resource Department, Government of Odisha.

The creeks originating from Forests, mangrove forests near to Mouth of Mahanadi and Devi nadi, Islands constituted or under buildup process etc are under consideration of this chapter in general.

8.1 Available Water Resource in the Division / Working Plan Area:

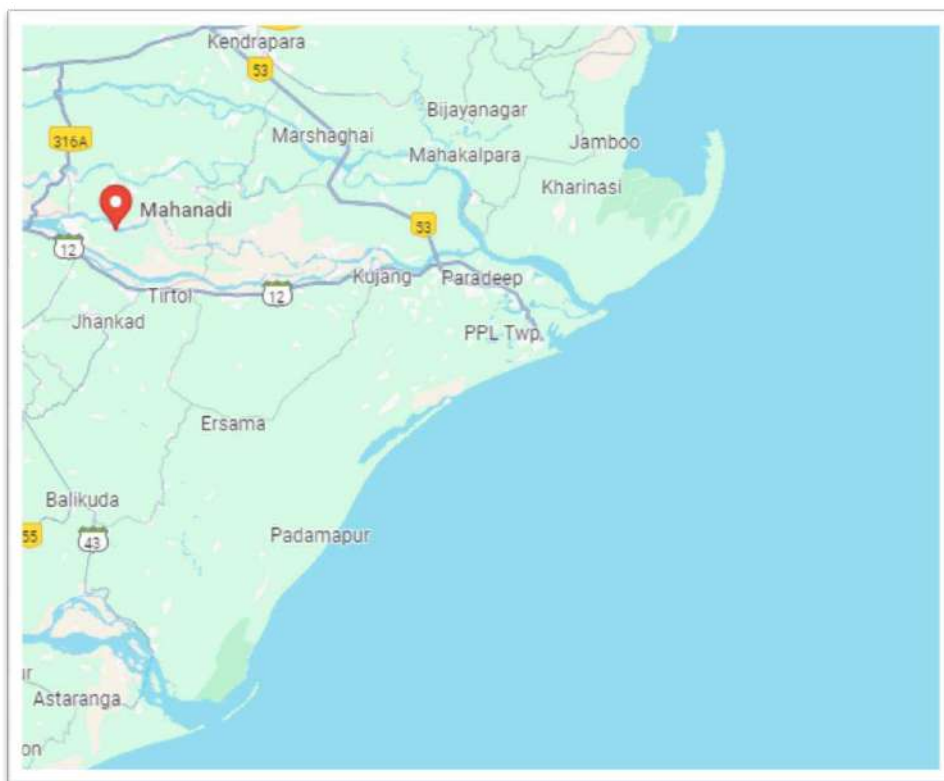
The total area of the Mangrove Division WL is 2856.38 Sq. Km. The Range wise area is as follows (Table No 8.1)

Table No 8.1 Distribution of Area – Rajnagar WL Division				
Sl No	Name of Range	Area in Sq. km	River system	Remark
1	Gahirmatha WL Range	81.29	Bay of Bengal	Bhatarkanika NP Map 01
2	Kanika WL Range	447.95	Dhamra / Brahmani	
3	Rajnagar WL range	731.36	Hansua / Gobari/	
4	Mahakalapada WL Range	519.99	Mahanadi / Devi nadi System	Map-02 (Working Plan area)
5	Kujanga WL Range	1075.79		
	Division Total	2856.38		



Out of 2856.38 Sq. Km , area under Mahakalapada WL Range (under Kendrapara District) and Kujanga WL Range (Jagatsinghpur District) adding up to 1595.78Sq. Km (55.87%) of the division's area is under Working Plan purview. For rest of the area, there is approved Sanctuary / National Park Management Plan.





8.2 Scope of Management by Forest Division:

Considering the fact that the available Water source is under the administrative control of the Water Resource department the scope of management by forest department is limited to the following aspects.

1. Development & Management of Creeks originating / flowing through forest areas;
2. Creation & Improvement of Mangrove / Casuarinas Forests on river bank and coastal sand to check River Bank Erosion & Sea Shore Erosion;
3. Fixation of Sand dune on Sea shore and newly created / on the process of creation of islands due to deposit of Sands, Silts by Flood, Tidal Wave and, Oceanic current.

8.2.1 Creeks of Kujanga & Mahakalapada WL Range:

The following creeks are identified in working plan area and listed for detail management.



a) Mahakalapada WL Range:

Table No 8.2 Creeks of Mahakalapada WL Range

Sl No	Section	Beat	Name of the Creek	Length of Creek in Km	Latitude / Longitude	
Mahakalapada WL Range					Start	End
1	Jagatjore	Suniti	Suniti Creek (1)	2.00	N20° 02'00" E086° 43'.02"	N20° 28'18" E086° 44'21"
2			Suniti Creek (2)	3.00	N20° 02'00" E086° 43'.02"	N20° 28'18" E086° 44'21"
3	Jagatjore	Jagatjore	Jagatjore to Kaltunga	1.00	N20° 02'58" E086° 41'12"	N20° 28'18" E086° 41'12"
4			Panikhia to Kaltunga Creek	2.00	N20° 28'28" E086° 42'21"	N20° 28'57" E086° 41'24"
5			Panikhia to Kaltunga Mounda Creek	1.00	N20° 28'35" E086° 42'50"	N20° 28'45" E086° 41'22"
6			Panikhia to Atharabankia Bridge	0.50	N20° 28'22" E086° 42'23"	N20° 28'45" E086° 42'30"
7			Millan mode to Jagatjore	3.00	N20° 27'52" E086° 41'16"	N20° 27'13" E086° 41'06"
8	Jamboo	Kharinasi	Bhitarkharinasi Creek	1.20	N20°22' 57.89" E86°43' 5.52"	N20°23'17.18" E86°43' 39.74"
9			Kalpana Creek	1.00	N20° 22'9.0" E086° 43'9.6"	N20° 22'28.3" E086° 43'25.4"
10			Kanamari Creek	3.00	N20° 21'.55" E086° 43'.05"	N20° 23'38" E086° 44'23"
11			Kantia Creek	1.00	N20°26'52.38" E86° 43' 34.78"	N20°26'42.18" E86°43' 53.74"
12			Jamboo Marine PS to Rama chandi Galia	5.00	N20°24' 14.69" E86°42' 28.28"	N20°24'15.24" E86°41'7.21"
13	Jamboo	Jamboo	Phuta Creek	1.00	N20°25' 25.00" E86°43' 53.12"	N20°25' 5.20" E86°43' 59.21"
14			Jamboo Creek (1)	1.00	N20°24'26.11" E86°43' 23.78"	N20°24' 2.81" E86°43' 46.62"
15			Sukuakhola Creek	0.50	N20°24' 58.87" E86°43' 53.11"	N20°24' 4.55" E86°44' 7.8"
16			Jamboo Creek(2)	2.00	N20°24' 49" E86° 43' 32"	N20°24' 21" E86°43' 47"
17	Batighar	Batighar	Bhodei Creek	2.00	N20°18'57" E86°42'51.00"	N20°18'51" E86°43'51.00"
18			Bagadia Creek-01	1.00	N20°20'07" E86°45'01.00"	N20°20'05" E86°45'19.00"
19			Fatapur Creek	6.00	N20°19'56" E86°45'35.00"	N20°22'33" E86°47'15.00"



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20			Kabulpur Creek	1.50	N20°21'07" E86°45'37.00"	N20°20'49" E86°45'51.00"
21			Kuberbandar Creek	3.00	N20°23'2.37" E86°46'45.00"	N20°21'09.0" E86°45'56.00"
22			Nidhi Budha Creek	1.50	N20°21'10" E86°45'39.00"	N20°21'19" E86°45'59.00"
23			Barakolikhola Creek	3.00	N20°20'19" E86°42'59.00"	N20°19'13" E86°42'55.00"
24			Bagadia Creek-03	2.00	N20°20'45" E86°45'22.00"	N20°20'05" E86°45'19.00"
25			60 Gheryy Nala	3.00	N20°19'50" E86°45'02.00"	N20°18'51" E86°43'48.00"
26			Bagadia Creek-02	1.00	N20°20'06" E86°45'01.00"	N20°19'50" E86°45'08.00"
27			Bagadia Creek-04	1.00	N20°20'57" E86°42'51.00"	N20°19'42" E86°45'15.00"
28			Batighar Creek	14.00	N20°18'55" E86°41'19.00"	N20°22'46" E86°47'01.00"
29			Jogidhankuda Creek	3.00	N20°17'55" E86°41'52.00"	N20°18'35" E86°42'13.00"
30	Batighar	Kanasaridida	Kansaridia Beat creek	4.00	N20°22'11" E86°44'11.00"	N20°23'47" E86°45'33.00"
31			Gopal Panda Creek	2.00	N20°22'13" E86°45'59.00"	N20°22'54" E86°45'35.00"
32			Kadua Creek	3.50	N20°22'12" E86°45'59.00"	N20°20'59" E86°45'00.00"
33			Harisamal Creek	2.00	N20°21'00" E86°44'54.00"	N20°21'04" E86°43'52.00"
34			Ashigheria Creek	3.00	N20°23'09" E86°45'08.00"	N20°21'45" E86°44'33.00"
35			Gausimiya Creek	2.00	N20°22'14" E86°45'59.00"	N20°22'55" E86°45'35.00"
36			Sanatubi Creek	5.00	N20°19'20" E86°41'07.00"	N20°20'24" E86°43'22.00"
37			Uttarkhola Creek	4.25	N20°20'26" E86°43'23.00"	N20°22'10" E86°44'11.00"
38			Singitali Creek	2.00	N20°22'10" E86°45'00.00"	N20°21'44" E86°44'33.00"
			Range Total	97.95		



b) Creeks of Kujanga WL Range

Table No 8.3 Creeks of Kujanga WL Range:

Sl. No.	Name of the Section	Name of the Beat	Name of Creek	Length of Creek in Km	Location (Lat / Long)	
					Start	End
1	Hawakhana	Hawakhana	Kathagadi	0.40	N20°02'47.32" E86°25'09.00"	N20°02'57.12" E86°24'27.09"
2	Hawakhana	Hawakhana	Baruhan	0.60	N20°03'39.12" E86°23'57.22"	N20°03'04.18" E86°23'51.00"
3	Bandar	Balijori	Mankadakhia	2.00	N19°57'40.00" E86°22'23.00"	N19°59'59.00" E86°23'08.00"
4	Hawakhana	Hawakhana	Salio p.F	1.00	N20°03'52.91" E86°23'33.02"	N20°04'00.19" E86°23'38.07"
5	Bandar	Bandar	Nadiakhia	2.00	N20°00'07.0" E86°24'04.00"	N20°00'57.00" E86°24'38.00"
6	Kujang	Paradeep	Kaudia	2.00	N20°18'33.28" E86°40'54.32"	N20°18'11.68" E86°40'50.51"
7	Hawakhana	Hawakhana	Baruhan	1.00	N20°03'16.14" E86°24'38.94"	N20°03'14.01" E86°24'38.74"
8	Hawakhana	Hawakhana	Baruhan	1.50	N20°03'18.21" E86°25'30.00"	N20°02'46.10" E86°25'15.08"
9	Bandar	Bandar	Nadiakhia	2.00	N20°00'05.0" E86°23'42.00"	N20°00'54.00" E86°24'26.00"
10	Bandar	Balijori	Nadiakhia	1.00	N19°59'54.0" E86°23'35.00"	N19°59'55.0" E86°23'58.00"
11	Bandar	Balijori	Mankadakhia	2.00	N19°59'40.0" E86°22'52.00"	N20°00'03.0" E86°23'04.00"
12	Bandar	Bandar	Nadiakhia	2.00	N20°00'10.0" E86°24'15.00"	N20°00'47.0" E86°24'34.00"
13	Hawakhana	Hawakhana	Baruhan	2.00	N20°03'23.20" E86°24'25.00"	N20°03'05.15" E86°24'10.06"
Range Total				19.50		
Division Total (Kujanga & Mahakalpada WL Range				117.45		

8.2.2 Creation & Improvement of Mangrove / Casuarinas Forests:

The forest areas coming in Mahakalapada WL Range and Kujanga WL Range have been included under Rehabilitation Working Circle, Plantation Working Circle, Protection Working Circle and Mangrove Improvement Working Circle. These forest blocks / vegetation will be managed as per prescriptions of the concerned working circle.

The area having tree growth and recorded as forest or Patita under Rakhita khata of the Revenue Records will be managed under this prescriptions after intimation / permission from the competent authority.



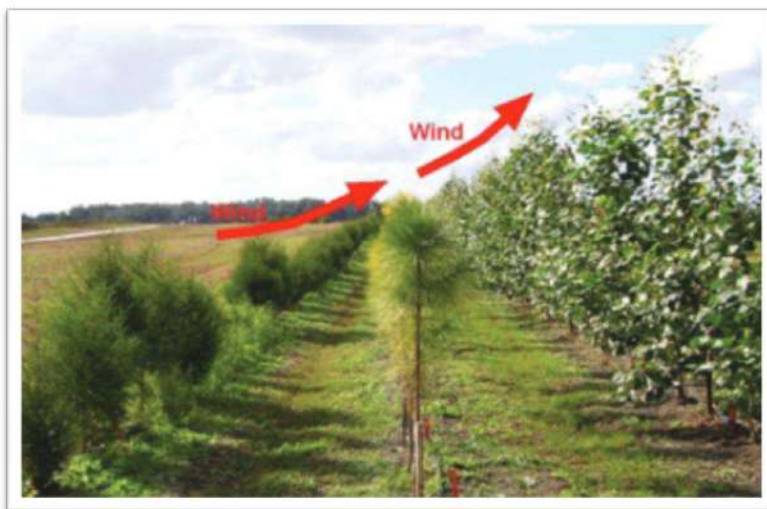
a) Mangrove Plantation:

The tidal mud flats low laying areas near to River Mouth will be covered under mangrove Plantation. In these areas the concentration / population of Hental species (*Phoenix paludosa*) has been reduced due to cutting of leave for thatching / Shed purpose. Plantation of other mangrove species i.e. Rai, Bani, Sundari with Hental species will be planted. At least 10 ha in each Range i.e. 20ha annually may be planned. Plantation by seedlings or Hypocotyls method may be adopted as per site suitability.

b) Casuarinas Plantation:

There are sandy river banks, Sea coast and newly formatted islands. The sandy banks are subjected to wind erosion, tidal wave erosion, River bank / Sea coast erosion. Due to multiple effect / impact sandy lands are in threat. It is proposed to stabilize the sand beds by Casuarina Plantation. This type of land is quite available in Kujanga WL Range. Every year 15 ha of Casuarina Plantation is recommended. The plantation is to be taken up in a Wind break pattern as depicted below.

Wind Break pattern (Traditional multi-row windbreak): A basic farmstead windbreak consists of three to eight rows of Casuarinas and shrubs. Shrubs should be located on the windward side with tall deciduous species in the center. A row of shrubs on the interior or leeward side completes the design.





8.2.3 Sand dune Fixation:



Shifting of Sand Dune by wind is an important threat to water body close to Sandy Sea shore. It is proposed to fix the sand dunes by planting grasses / *Ipomoea biloba*/ *Kia* (*Pandanus odorifer*)





A moderate program of 3 ha in Kujanga WL Range and 2 ha in Mahakalapada WL Range i.e. 5 ha per year will be taken up.

8.3 Prescription on Water Resource Management:

8.3.1 Renovation of Creeks & Annual Treatment Section:

Considering the above approach the creeks will be de-silted / widened. For this purpose two Creek Renovation Series is constituted i.e Mahakalapada Creek Treatment Series and Kujanga Creek Treatment Series.

Treatment Cycle: 10 Years.

Each series is divided to Annual treatment section as follows.

Table No 8.4 Creek Treatment Section Mahakalapada WL Range				
Year of Treatment	Symbol	Name of the Creek	Length in km	Total / Annual on Km
2022-23	MC-I	Suniti Creek (1)	2.00	7.00
		Jagatjore to Kaltunga	1.00	
		Millan mode to Jagatjore	3.00	
		Kantia Creek	1.00	
2023-24	MC-II	Bhodei Creek	2.00	11.75
		Kabulpur Creek	1.50	
		Bagadia Creek-03	2.00	
		Gopal Panda Creek	2.00	
		Uttarkhola Creek	4.25	
2024-25	MC-III	Suniti Creek (2)	3.00	10.0
		Panikhia to Kaltunga Creek	2.00	
		Jamboo Marine PS to Ramachandi Galia	5.00	
2025-26	MC-IV	Panikhia to Kaltunga Mounda Creek	1.00	8.20
		Phuta Creek	1.00	
		Bhitarkharinasi Creek	1.20	
		Jamboo Creek (1)	1.00	
		Gausimiya Creek	2.00	
		Kalpana Creek	1.00	
		Bagadia Creek-01	1.00	
2026-27	MC-V	60 Gherry Nala	3.00	10.00
		Jogidhankuda Creek	3.00	
		Kansaridia Beat creek	4.00	



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2027-28	MC-VI	Singitali Creek	2.00	10.0
		Sanatubi Creek	5.00	
		Ashigheria Creek	3.00	
2028-29	MC-VII	Batighar Creek	14.00	14.00
2029-30	MC-VIII	Harisamal Creek	2.00	11.50
		Kadua Creek	3.50	
		Fatapur Creek	6.00	
2030-31	MC-IX	Kuberbandhar Creek	3.00	7.50
		Nidhi Budha Creek	1.50	
		Barakolikhola Creek	3.00	
2031-32	MC-X	Kanamari Creek	3.00	8.0
		Panikhia to Atharabankia Bridge	0.50	
		Jamboo Creek(2)	2.00	
		Bagadia Creek-02	1.00	
		Bagadia Creek-04	1.00	
		Sukuakhola Creek	0.50	
Series Total			97.95	97.95

Table No 8.5 Creek Treatment Section Kujanga WL Range

Year of Treatment	Symbol	Name of the Creek	Length in km	Total / Annual on Km
2022-23	KC-I	Kathagadi	0.40	2.00
		Baruhan	0.60	
		Salio P.F	1.00	
2023-24	KC-II	Mankadakhia	2.00	2.00
2024-25	KC-III	Nadiakhia	2.00	2.00
2025-26	KC-IV	Baruhan	1.00	2.50
		Baruhan	1.50	
2026-27	KC-V	Kaudia	2.00	2.00
2027-28	KC-VI	Nadiakhia	2.00	2.00
2028-29	KC-VII	Mankadakhia	2.00	2.00
2029-30	KC-VIII	Nadiakhia	2.00	2.00
2030-31	KC-IX	Baruhan	2.00	2.00
2031-32	KC-X	Nadiakhia	1.00	1.00
Series Total			19.50	19.50



Table No 8.6 Abstract of Annual Creek Renovation assignment

Year	Treatment No	Mahakalapada Series	Kujanga Series	Total in Km
2022-23	I	7.00	2.00	9.00
2023-24	II	11.75	2.00	13.75
2024-25	III	10.00	2.00	12.00
2025-26	IV	8.20	2.50	10.70
2026-27	V	10.00	2.00	12.00
2027-28	VI	10.00	2.00	12.00
2028-29	VII	14.00	2.00	16.00
2029-30	VIII	11.50	2.00	13.50
2030-31	IX	7.50	2.00	9.50
2031-32	X	8.00	1.00	9.00
Creek Total on Km		97.95	19.50	117.45

8.3.2 Creation & Improvement of Mangrove / Casuarinas Forests:

It is proposed to take up Mangrove Plantation or Casuarinas plantation depending upon land available (Mangrove on Mud flats, tidal mud flats; Casuarinas on Sandy banks / Sea shore). 10 ha in each Range annually will be taken up. Total area to be covered is 200 ha

8.3.3 Sand dune fixation:

A moderate program of 3 ha in Kujanga WL Range and 2 ha in Mahakalapada WL Range i.e. 5 ha per year will be taken up. In the Plan period 50 ha of Sandy river bank and Sea shore will be fixed / stabilized by biological method.

8.3.4 Creation of Fresh water Ponds:

The area is mostly having saline water due to presence of Sea, Tidal water flow. In order to save / recharge ground water with fresh water (*Madhura Jala*). Fresh water ponds are being created in villages / forest blocks. It is proposed to create 3 fresh water ponds in working Plan area depending upon available sites in Forest blocks or adjacent to forest i.e. Forest Fringe Villages. During Plan period 30 fresh water ponds will be created.

8.3.5 Regulated fishing in Eco Sensitive Zone & River Mouths:

Fishing on marine water along Gahirmatha sanctuary and River mouths will be regulated as per "The Orissa Marine Fishing Regulation Act, 1981" and The Orissa Marine Fishing Regulation Rules, 1983. The same principle will be applicable to River Mouths coming within the Working Plan area i.e. Mahakalapada WL Range and Kujanga



WL Range. The relevant Rules of the Orissa Marine Fishing Regulation Rules, 1983 is reproduced below for ready reference.

“CHAPTER VI

16. (1) Non-Mechanized Traditional Fishing Crafts shall be allowed to operate freely without any restrictions. Waters up to five kilometers from the shore shall be reserved exclusively for such fishing crafts and in no case any other type of Mechanized Fishing vessels shall be allowed to operate in that area.

(2) Mechanized fishing vessels up to fifteen meters of length shall be allowed to operate beyond five kilometers Limit from the coast.

(3) Mechanized fishing vessels of twenty-five gross tonnes and above or above fifteen meters of length shall be allowed to operate beyond ten kilometers from the shore only. (4) In no case any fishing vessel, allowed to operate under sub-rules (1), (2) and (3) shall operate beyond twenty-four nautical miles from the shore.

17. The fishing vessels shall operate within the zone limit of the respective fishing base as specified in Form VI.

18. The mechanized vessels including off-shore and deep sea fishing vessels should be very careful during their to and fro movement in the sea in order to avoid any damage or loss to the nets, fishing gears, etc. of the other vessels laid in the sea.

19. No vessel shall ordinarily be allowed to interchange the base without permission of the concerned authorized Officer.

20. Every owner of a registered fishing vessel shall furnish under sub-section (1) of section 11 a monthly report to the concerned Authorized Officer in Form V.

8.3.6 Monsoon trawling ban

The monsoon trawling ban was introduced in 1998 in Odisha to help the unhindered breeding of fish in the sea during the rains. The summer monsoon is the breeding season of nearly 300 species of fish along the coast of Odisha.

The Odisha government announced a two-month-long ban on fishing by mechanized vessels April 15 to June 15 every year in a bid to conserve fish stocks in sea during their breeding period. This should be strictly implemented.



8.4 Human- Crocodile Conflict Management:

The people of the locality used to take bath and do other daily activities near to these creeks / water body. Many a time it has been observed that Crocodile attack human being and resulted in fatal situation. To manage this conflicting situation, it required to develop Sage Bathing Ghats along the creeks / Nala and water body.

8.4.1 Providing mess wire nets on bathing ghats:

Vulnerable bathing Ghats will be identified and putting wire mess fence to restrict the crocodile attack will be taken.



8.5 Limitations:

Water Resource management is under the control of Water Resource department. Limited prescriptions have been suggested in this Plan. In case of any contradictory situation, the administrative instructions of Water Resource Department will prevail.

8.6 Conclusion

Maintenance / Improvement of creeks, Improvement of Mangrove vegetation, fixation of sand Dunes, creation of wind breaks and regulating fishing in river mouths, around Gahirmatha marine Sanctuary will go a long way in maintain ecological balance as well as preservation of Marine eco system in these two ranges of the division.





CHAPTER: 9

Eco Tourism (Overlapping) Working Circle:

9.0 Introduction:

Odisha is the land of famed forests, mountains, valleys, waterfalls, gorges, soaring peaks with stunning wildlife in their own natural habitats. The important wildlife in State are Elephants, Tigers, Leopards, Hyena, Sambar, Spotted Deer, Wild Boar, Giant Squirrel, Crocodile, Jungle Cats, Hornbills, many migratory birds etc. A total of 110 species of reptiles including three crocodilian species, 20 species of amphibians, 479 species of birds, 86 species of mammals have been recorded so far in the State. For Nature tourists looking to experience wild landscapes in a sustainable way, from Camping to Eco-Resorts, from trekking to birding, from sightseeing to boating, Odisha offers something for everyone and the only thing surpasses the beauty of the State.

Bhitarkanika Wildlife Sanctuary and National Park is known as the “Mini-Amazon” of India. Lying on the coast of Bay of Bengal, it is the second largest Mangrove ecosystem of our country after Sundarbans. Dangamal Nature Camp, Habalikhati and Gupti Nature Camps are located inside Bhitarkanika with luxurious accommodations and different choices of cuisine and delicacies. World’s largest congregation of Salt Water Crocodiles is seen in the creeks of Bhitarkanika.

The beauty of Hulitola, Sanatube, Batighata, Kharanasi, Falls Point, Atharbanki, Siali Sea beach is some of the important eco- tourism sports in the Sideline of Bhitarkanika National Park.

9.1 Constitution of Eco Tourism Working Circle and area included:

The following forest blocks and areas outside the working Plan area are included in this working Circle. (Table No9.1)

Table No 9.1 Area included in the Eco- Tourism (O) Working Circle			
Sl No	Forest Block	Area in ha	Remark
Mahakalapada WL Range			
1	Batighar PRF	166.20	WP Area
2	Sanatubi PRF	594.68	National Park area
3	Kansaridiha PRF	1411.52	
4	Jamboo PF	369.90	



5	Hukitola		Outside the WP Area
6	Kharnasi – Falls Point		
Kujanga WL Range			
1	Jatadharta PRF	596.52	WP Area
2	Jatadhar RF	68.980	
3	Atharbanki		Outside the WP Area
4	Siali Sea Beach		
5	Hawakhana		
	Paradeep Sea beach		
6	Bandar		
	Devi River Mouth		
	Total	3207.80	

9.2 Constitution of Eco Tourism Circuits:

The entire area included in the Eco- Tourism (Overlapping) Working Circle is divided to three Eco Tourism Circuits i.e. **Jamboo- Mahakalpada Eco Circuit, Atharbanki- Siali Eco Circuit and Bandar- Devinadi Eco Circuit**. Area assigned to these circuits is as given below (Table No 9.2).

Table No 9.2 Constitution of Eco Tourism Circuits				
Sl No	Eco Circuit	Area included		Remark
		Name	Area in Ha	
1	Jamboo- Mahakalpada Eco Circuit	Batighar PRF	166.20	Mahakalpada WL Range
		Sanatubi PRF	594.68	
		Kansaridiha PRF	1411.52	
		Jamboo PF	369.90	
		Hukitola		
		Kharnasi – Falls Point		
2	Atharbanki- Siali Eco Circuit	Jatadharta PRF	596.52	Kujanga WL Range
		Jatadhar RF	68.980	
		Atharbanki		
		Siali Sea Beach		
		Hawakhana		
		Paradeep Sea beach		
3	Bandar- Devinadi Eco Circuit	Bandar		Kujang WL Range / Bandar Section
		Devi River Mouth		



9.3 Importance of the area & tourist attraction:

9.3.1 Jamboo- Mahakalpada Eco Circuit:

1. Batighar:

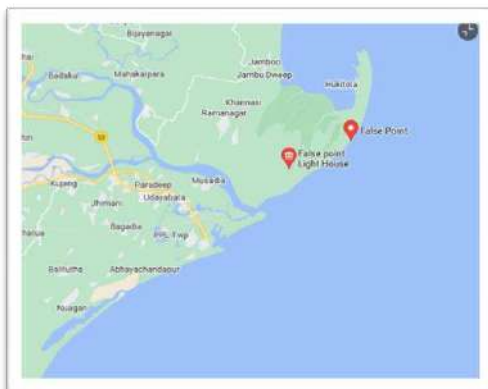
This is the first lighthouse installed in eastern coast of India. It is around 45 KM from District HQ. It is situated in a village named Batighar, on the other bank of river Kharinasi. It is surrounded with pleasant natural beauty. Once upon a time, this was known as Kaudia Dwip and used as hunting ground of Kujanga Kings. Construction of this lighthouse was started on 6th December, 1836 and it was lighted on 16th October 1837. The stones used were transported from Barabati Fort, Cuttack. The height is 125 feet, foundation wall is 15 feet thick. The diameter at land level is 10 feet. To reach the top, 138 steps made of cement concrete and 16-step ladders are there. The specialty of this lighthouse is that it is operational from the date of its lighting and presently it is managed by Calcutta Light House.

On 16th October 1837 first light came out from this light house. This Light house was built by Mr H.Wright .This light house is 60 feet above sea level built on sand heap. This is a six storied building having space to take rest on each floor having a big window. There are 16 Bullet proof glasses attached at the top floor. Year 1857 is inscribed on that glass which is remaining as it is. Within the circular room there is a wheel of 3 feet radius having an electric bulb at the center. This bulb is of 440 volt 230 watt, this light can be seen from 60 km in the sea. This Light House is opened for Tourist from 7.00 am to 10.am and 4 pm to evening.

2. False Point;

False Point is a low headland in the Bay of Bengal. It is located in the Kendrapara district of Odisha, India. The point derives its name from the circumstance that vessels proceeding up the Bay of Bengal frequently mistook it for Point Palmyras, less than a degree farther north.





Contrary to its name, False Point, the British era lighthouse standing tall on the Odisha coast in Kendrapara district, has actually been guiding ships and vessels through the choppy waters of the Bay of Bengal for the past 180 years. India's oldest functional lighthouse at 180 years continues to guide seafarers and fishermen despite entry of new devices. The lighthouse is situated 2 km inland from the point, at a place which screens it from the southern monsoon

The foundation of false Point was laid on 6th December, 1836 and construction was completed on 16th October, 1837. The light house started functioning on 1st March, 1838. The island belonged to Maharaja of Burdwan who donated the land required for the light house to the British East India Company. In the top there is a dome with an opening leading in to lantern Room.

3. Kharnasi;

Kharinasi is a Village in Mahakalapada Tehsil in Kendrapara District of Odisha State, India. It is located 37 KM towards East from District headquarters Kendrapara. 11 KM from Mahakalapada. 105 KM from State capital Bhubaneswar.





Adventurous Boat Ride in Home of Crocodile, Kharinasi River. It is famous for Adventurous boat riding.

4. Sanatube

It harbors mangrove vegetation and having very scenic beauty

5. Hukitola

Hukitola is situated on Jambu Island in the Bay of Bengal of Mahakalapara Block in Kendrapara District. The building having plinth area more than 7000 sq ft, on the island was constructed by the Britishers in 1866/67 during the "*Nahanka Durbhikshya*". This was used to store rice imported from Burma and other places through sea route. It bears testimony to advancement made in construction technology in the 19th century. The monument, a majestic building with underground rainwater harvesting system is symbol of the state's glorious past in maritime.

The place attracts students, scholars and history lovers throughout the year for its scenic location and historical significance. The port and the palace started losing its importance in 1924 when the Britishers established a port at false point.

The uniqueness of the palace lies in its roof slope in design. It helps rain water to flow down to four big water pots. The collected water was used for drinking purposes by the merchants throughout the year.

INTACH under ICZM program renovated Hukitola for eco-tourism.

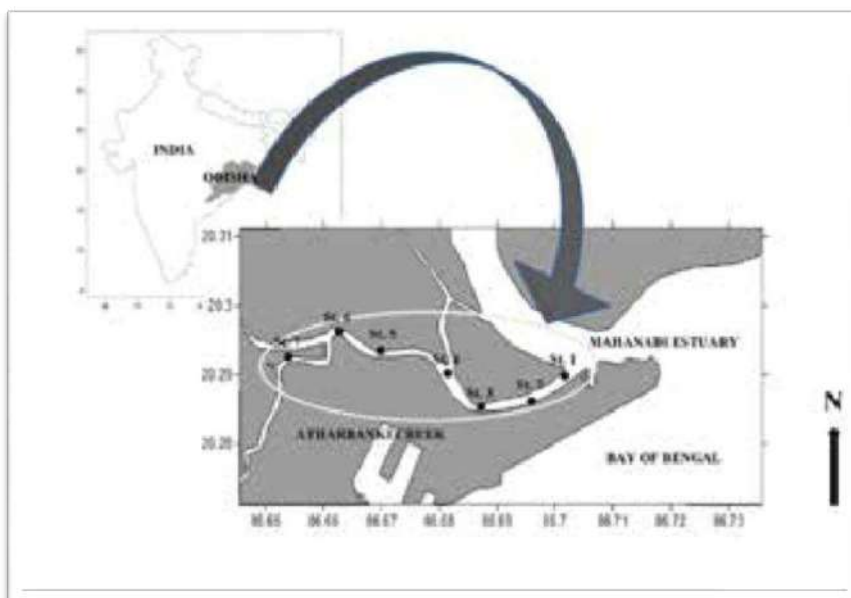




9.3.2 Atharbanki- Siali Eco Circuit:

1. Atharbanki;

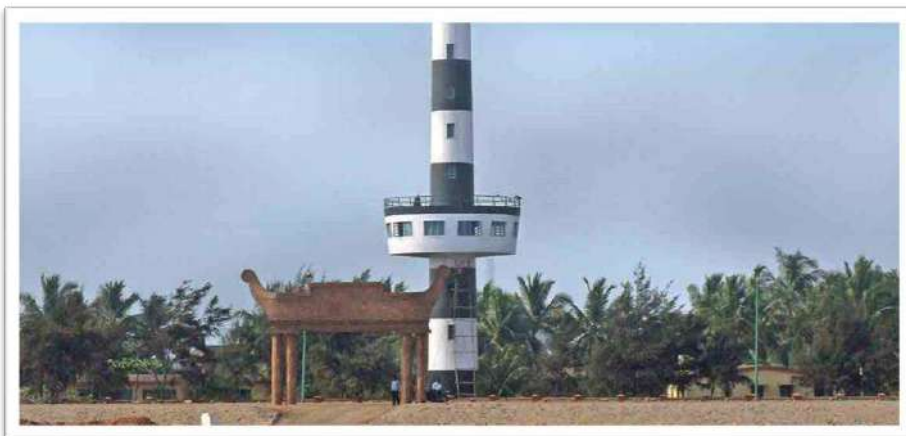
Atharbanki, a mangrove waterway of Mahanadi Estuary ($17^{\circ}49'N-22^{\circ}34'N$; $81^{\circ}24'-87^{\circ}29'E$) on the east coast of India has been under considerable anthropogenic pressure. Within the mangrove areas *Avicennia*, *Rhizophora*, *Bruguiera*, *Kandelia*, *Ceriops*, and *Aegiceras sp.* are the most common. The river meanders southeast to northeast for nearly 13.5 km skirting the highly industrial belt of Paradeep, courses adjacent a major fishing harbor into Mahanadi Estuary before opening into the Bay of Bengal.



2. Paradeep Sea beach:

The sea beach at Paradeep is stunning with vast stretches of yellow sand extending as far as the eyes can see. A beautiful place to watch the sunset and have a fun time with friends and family. It is relatively less crowded and not as commercialized as its counterparts in Puri and Konark and you won't find many people taking a bath or swimming in this beach which makes it quite offbeat.





Located 125 Km from the capital city Bhubaneswar, Paradeep is one of the most important commercial ports of the country. The beach with green forest cover, natural creeks and an island is one of the most popular beaches of the state. Clear blue waters surrounded by green forest cover and its location at the confluence of the river Mahanadi with Bay of Bengal, makes Paradeep one of the most sought after beaches of the state. A leisurely drive along the marine drive with the setting sun in the horizon is one of the highlights of this beautiful beach destination of Odisha.

The sight of huge cargo ships anchored in the port always entices the photographers for that one perfect shot for posterity.



Things to do

- One can indulge in the usual beach activities but always enlist the help of the lifeguard before venturing into the sea.
- Steal a moment for yourself, bask in the serene settings and savour the beauty of solitude.
- Paradeep Marine Aquarium – the small boat shaped building houses a variety of marine and fresh water animals and offers a good entertainment especially for the children
- One can visit the port with necessary permissions.

3. Mahanadi River confluence;

Mahanadi River deltaic coast is micro tidal with a mean tidal range measuring 1.29m. Tidal cycle is semi-diurnal. It is principally a wave-dominated coast during the southwest monsoonal season, while during the non-monsoonal period it is mixed wave and tidedominated. The north east monsoon (between December - early January) is much milder in its dynamic activity. Southwest monsoon winds generate high waves ca.3m high or more and waves striking the shore obliquely induces a littoral / long shore drift of sands from southwest to northeast along this coast which annually moves ca., 1.5 million cubic metres of sand in the nearshore regime.





4. Siali Sea beach:





Siali Sea beach is located at a distance of 46 km from Jagatsinghpur. It is one of the picturesque beaches in coastal Odisha. A beautiful and peaceful beach. The Oceanic view of the sun set is very beautiful. It is one of the top tourist attraction places at Paradeep.

5. Sandhakuda Beach:

The Sandhakuda island is an attractive tourist spot comprising vast green sheds, casuarinas vegetation, shimmering golden beach, natural creeks, and an island.





9.3.3 Bandar- Devi nadi Eco Circuit:

1. Bandar- Nadiakhia Mangrove forest;

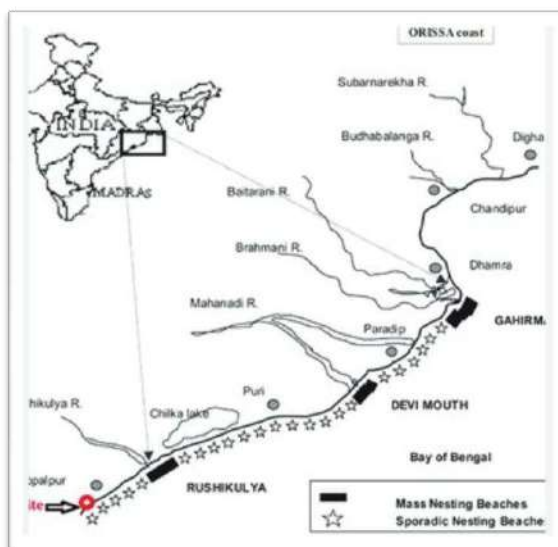
Bandar is located 40 kilometers away from Jagatsinghpur town. It is a beautiful place where river Devi meets Bay of Bengal. The confluence of River Devi and Bay of Bengal surrounded by thick mangroves and pristine beach, Bandar is a favourite place for nature seekers. The beautiful Maa Bandarei temple in village Bandar situated at the meeting point of River Devi and Bay of Bengal in the district of Jagatsinghpur.





2. Devi River Mouth & Olive Ridley nesting:

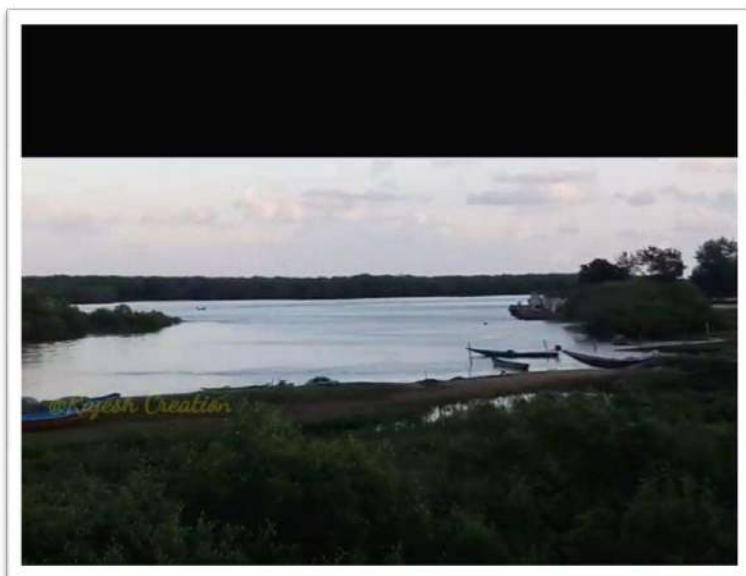
Odisha is well known as a mass nesting site for the olive ridley turtles in India. Gahirmatha, Devi river mouth and Rushikulya are the three mass nesting sites recorded in the state.



There is a proposal for taking 13.82 ha of Non Forest land very close to Devi Nadi mouth as CA (Compensatory Afforestation) Land and after declaration of Protected



Forests a nature trailing path, management of Sandy sea shore to attract olive Ridley turtles for mass nesting will be developed. There is also a proposal to have a watch tower, boat riding near to the site to attract tourist to this rarest place near River Mouth.



9.4 Distance of various sites from Important Places / Township

Table No 9.3 Distance of Eco Tourism sites from District hqs / Important Township		
Sl.No.	Important Township / Location	Distance from important town ship
1.	Jagatsinghpur	Earsama-30Km.
		Subhadra Khetra (Chatua)- 40Km.
		Paradeep sea coast-60 Km.
		Neheru Bangala(Costal Forest Spot)- 60Km.
2.	Jagatsinghpur	Athara Banki -60Km.
		Hukitola by Boat 25Km. from Paradeep
3.	Jamboo	Kharnasi Creek & Gobari River -25Km.
		Sana tubi forest & Back-20 km from Mahakalpada
4.	Kendrapada	Jamboo by Road – 40Km.
		Kharnasi & Ramanagar(Ramachandi Temple) by road & boat -40Km.
		Batighara & Hukitola by boat -35Km & 40km by Road .



9.5 Proposed development of the Tourism Circuit. :

For development of tourism in these two ranges, the following activities are suggested

- Regular Boat Service to Jamboo, Hukitola, Batighar and Sanatubi ;
- Construction of Cottage at Batighara and Sanatubi to accommodate tourist,
- Construcyion of Permanent Jetty at Jamboo, Hukitola, Batighar and Sanatubi,
- Renovation of Important Creeks to make all day boat services possible,
- Day time tourist amenities at all the above locations,
- Kharnasi Creek to be developed,
- Regular Boat service connecting Atharabanki-Mahanadi- Batighar-Hukitola-Kharanasi ,
- Day time tourist amenities at all the above locations;
- Constitution of a Trust / Society to handle tourism;

In due course a tourism development plan will be prepared and on approval it will be implemented to tap vast eco-tourism potential of these locations.





CHAPTER-10

Reduce Emissions from Deforestation and Forest Degradation (REDD+)

10.1. 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.

Deforestation and forest degradation are responsible for about 15% of global greenhouse gas 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.

10.2 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.

10.3 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.

10.3.1 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.

10.3.2 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 CO₂ 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 (CO₂, 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 CO₂ through 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,
- Paramparagat Krishi Vikas Yojana,
- Soil Health Card Scheme,
- Pradhan Mantri Krishi Sinchayee Yojana,
- National Mission for Clean Ganga etc among others.

10.3.3 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.

10.3.4 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 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.





CHAPTER 11

Trees Outside Forests (TOF)

11.1 Tree Outside Forest;

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. dunes, both abandoned and accomplished mining sites). They not only contribute nearly one fourth of the total growing stock of the country but also have become major source of wood in India. 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. In this Division tree species are being raised mostly in Avenue plantation mode under different afforestation programme viz. State Plan (Increasing Green Cover), MGNREGS and Green Mahanadi Mission. Apart from Forest Department, avenue plantations and block plantations are also being raised by Panchayats and also by Industrial Establishments. Block plantations are also being raised in small scales by village communities in village common land with seedling supports from Forest Department. During last plan period, 65 Ha Block Plantation and 198 RKM of Avenue Plantations have already been raised outside forest area. The detail list is furnished in the table 14.1 below.

Table 11.1. Plantations Outside Forest Areas (During Plan Period)

Type of plantation	Location	Area/ Rkm
Block	Badapal Economic Plantation	20.00
	Badabandha MGNREGS	10.00
	Khuranta MGNREGS	10.00
	Salabelapur MGNREGS	10.00
	Balikani Economic	15.00
Avenue	Barar to Jagatjore	5.00
	Lanjuda to Jagatjore	10.00
	JambooGhat to Benakanda	4.00
	Jamboo Lock to Chhapali	4.00
	Samagola to Baulanga	2.00
Avenue	Chatua to Ersama	4.00
	Deriki to Garai	2.00



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	Balikuda to Machhagaon	2.00
	Bhateni to Jagatjore	8.00
	Chhapaligada to Arunnagar	8.00
	Baligoda to 22 No. canal	4.00
	RabindraSamal house to Mohani Pradhan house	4.00
	Jamboo High School to Hari Jardar house	3.00
	Samagol to Baulanga	4.00
	AndhariKiadingari RD road	4.00
	GadabishnupurtPanchapali RD road	4.00
Avenue	JharapatiGaramat embankment	4.00
	DerikiMohanpari PWD road	2.00
	KothamulaPotanai RD road	2.00
	22 No. Canal Branch to Janara Bridge	4.00
	Nalapada to Amirbad	4.00
	Bandhapada to GaguaChhaka	4.00
	Ekalpur to Radhia	4.00
	Bijaynagar Hanuman temple to Kanpur	4.00
	GaguaChhaka to Babar RD Road	2.00
	Millan mode to Jagatjore	4.00
	14 No.A Canal Embankment near Badabandha	4.00
	14 No.A Canal Embankment near Badabandha	4.00
	BigachapurGarei RD Raod	4.00
	ChatuaErsama RD Raod	4.00
	Baulanga to Bamadeipur	4.00
	Khambakulamatha to Kantuania Hat R D road	4.00
	NuagaonRohia RD Raod	4.00
	ChampahatDihhasahi to Sompur RD Road	4.00
	EkalpurGherry to Radhia	4.00
	Bijayanagar Culvert to Kanpur	4.00
	Bagadia to Jhimani PMGSY Road	4.00
	Shophapata to GhosagharaR.D.Road	4.00
	Gadakujanga to BalituthyaR.D.Road	4.00
	Nuagaon to BalituthaR.D.Road	4.00
Avenue	Marichipru to BaramundaliR.D.Road	4.00
	Tigiria to Budhishahi PMGSY Road	4.00



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	Dhiatelasara to Gothadanda PMGSY Road	4.00
	Odapanga to Gopalpur PMGSY Road	4.00
	Avenue Plantation from Dharijana to Dahal Switch Gate R.D.Road	4.00
	Avenue Plantation from Pankapal to Gareir.D.Road	4.00
	HansuraBalikaniR.D.Road	5.00
	Rahama to Sanakrupa	5.00
	Total: Block: 65.00 Ha; Avenue: 198.00 Rkm	

Table No 11.2 Probable TOF Created through Avenue Plantation: Rajnagar WL Division (Kujanga & Mahakalpada Range)- Beyond Plan Period

Year	Name of the Road	RKM covered
2017-18	Harenpada School to Kanspal Village	4.00
	ManapatanaChhaka to Jayasinghpur	8.00
	MangalapurChhaka to Keyarbanka village	4.00
	Dasamauji Bridge to Karamkul village	6.00
	Baulanga to BalipariRD Road	4.00
	Pankapal to Taladanda Canal Embankment	8.00
	Sirala to Bailo Irrigation Road	4.00
	Badakana to Apandara RD Road	4.00
	Marichipur to Baramunduli RD Road	4.00
	Panchapalli to Ibrisingh R&B Road	8.00
	Balitutha to Gadakujang RD Road	4.00
	Thailo to Aliha RD Road	4.00
2018-19	Gangarampur GP office to Maa ChhulaliaPitha	6.00
	Romita to subala	4.00
	Jagisri to Guptara Bridge	6.00
	Khosalpur Bridge to Hansura G.P Office Irrigation Road	8.00
	Ghodamara to Panapalli RD Road	4.00
	Nuagaon to Chatua RD Road	8.00
	Bhitaraandhari to Baulapada RD Road	4.00
	Olara to Asia RD Road	4.00
	Gadakujang to Noliasahi RD Road	8.00
	Santho to Alikantha RD Road	4.00
	Sarana to Basantapur PMGSY Road	4.00
	Bandar to Marichipur RD Road	8.00
	EradaBadheisahi to Galadhari Sai Mandira RD Road	4.00
2019-20	Bijayanagar to Patragarh	8.00
	Baharasobala to Raigada	4.00



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2022-23 to 2031-32*

	Mirdha to Ramakani	8.00
	Subala to Romita	6.00
	Raigana to Banito RD Road	8.00
	Badabuda to Kankadagtha RD Road	8.00
	Gunutia to Baigani PMGSY Road	4.00
	Durgapur to Asia RD Road	4.00
	Marichipur to Naharana RD Road	4.00
	Anantapur to Alana RD Road	4.00
	Balidaia to Mushadia Mahanadi River Embankment	4.00
2020-21	Jagatjore RD Road to Suniti	4.00
	Ghanashyampur to Karamkul	6.00
	Panikhia Saline Road to Gagua RD Road	8.00
	Kalikuda to Choudhurykuda River Embankment	8.00
	Baulanga to Jamukana PMGSY Road	4.00
	Balitutha to Kankardia RD Road	4.00
	Gadharishpur to Patua River Embankment	8.00
	Bandar P.S to Balijori Rd Road	8.00
	Paikasahi to Chhatian PMGSY Road	4.00
2021-22	Suniti to Babangadhia	16.00
	Patharabandha to Sarat Das House	8.00
	Babangadhia to Puruna Field	8.00
	Petachhela to OSDMA	6.00
	Kentia Hanuman Temple to Kochila	6.00
	Avenue plantation from Pathuria to Pankapal Canal Embankment	12.00
	Choudhury Goda to Sandhapur Canal Embankment	12.00
	Siju to RangiarhInside Plastic Park	3.00
	Kathada to Siju Plastic Park Road	6.00
	Kansaripatia to Abhayachandapur Embankment	4.00
	Nimabelari to Batabelari Saline Road	4.00
	Somapur to Grameswar Mandir RD Road	10.00
	Tandikula G.P Office Garia Saffei PMGSY Road	12.00
	Bandar to Pilipahi RD Road	20.00
	Total	377.00

As per present guidelines, plantations shall be raised and maintained up to third year of formation by the executing agency and afterwards protection of the plantations shall be taken up by concerned villages/ *Gram Panchayats*. Efforts shall be taken during the plan period to increase green cover outside the forest area.

1. Raising avenue plantation along roads, canal/river bank etc under MGNREGS.
2. Raising block plantations in village common lands under MGNREGS.
3. Promoting Panchayats to raise avenue plantation and block plantations with



seedling support from Forest Department.

4. Institutional plantations in school/ college campus under MGNREGS.
5. Promoting Eco Club of Schools to raise plantation in school campus.
6. Raising and distribution of seedlings to public.
7. Massive green belt plantation in Industrial Area.





CHAPTER 12

Climate Change and REDD+

12.1	Climate Change Climate is nothing but the weather at a location over a period of time. Within a span of 30 years normal variation may occur. Climate change means more than changes in the weather. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity and alters the composition of global atmosphere which is in addition to natural climate variability observed over comparable time periods. Evidence of Global Warming can be observed in global average air & ocean temperatures widespread melting of snow & ice for rising the Sea level. Causes of Global Warming is the increased emission of greenhouse gases with Carbon dioxide (CO₂) being the main component. Some of the main human activities that contribute to global warming are : 1) Increasing atmospheric concentrations of greenhouse gases, for warming effect. 2) Global changes to land surface such as deforestation for a warming effect.
12.2	Importance Of Forest For Climate Change Forests are linked to climate change in 3 ways. i. They are source of green house gas (GHC) emissions. ii. They offer mitigation opportunities to stabilize GHG concentration because they act as both Sink & Pool. Carbon Pools are forest biomass & forest can act as sink through the tree growth & resultant biological carbon sequestration. iii. They are impacted by climate change. Changing biodiversity, pattern of growth of species, physiological changes in plant life cycles, changes boundaries of eco systems and other biotic & abiotic response. As Global community is increasingly concerned about Climate change, attention has been drawn to the role of forest in this regard. Forest plays an important role in the Global carbon Cycle because they store larger quantities of carbon in vegetation and soil. Studies reveals that 17% of global green house gas emission is only contributed by deforestation. The increase in green house gases is projected



	to lead 1-3.5° in Global Mean Surface Temperature by the year 2100.
12.3	REDD+
	REDD+ Reducing emission from deforestation and degradation, along with conservation of forests has been recognised as a very innovative way to tackle climate change. During REDD+ decision taken in the meeting of conference of parties in Cancun, Govt. of India agreed to boost action to curb emissions from deforestation and forest degradation with the technological and financial support of the developed countries. It has also been decided to incentivize local communities, who are involved in this endeavour. Pursuant to various decisions taken at the Conference of Parties of UNFCCC on REDD+, following actions are required to be initiated at National level in India. (i) To develop National REDD+ Strategy and results-based action that should be fully measured, reported, and verified (ii) To identify drivers of deforestation and forest degradation and also the activities that result in reduced emissions and increased removals, and stabilization of forest carbon stocks (iii) To estimate anthropogenic forest related Greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes (iv) To develop and implement the Monitoring Reporting and Verification (MRV) protocols and fair benefit sharing mechanisms at National and State levels, and (v) To protect & safeguard, ensuring the full participation of local people and local communities, and conserving biodiversity. To implement specific REDD+ action in the Keonjhar (WL) Division following interventions are required to be taken for forest management.
12.3.1.	Addressing Drivers of Deforestation & Degradation Due to dependence of local people on the forests, the forests of Keonjhar (WL) Division are in various stages of degradation. As per report of ORSAC and NRSC, there is empty-forest syndrome. Following interventions are needed to be implemented to manage the situation.
12.3.2	Provision of alternative Energy Sources In VSS meetings the forest personnel should persuade the villagers to use LPG instead of fuelwood.



	Energy efficient chullahs should be provided to the household of forest fringe villages.
12.3.3	Enhancement of fodder availability Almost all the cattle of villagers of nearby forest areas are dependent on forest for their fodder. Hence, livestock grazing in forests should be effectively addressed by securing enhanced fodder availability beyond across forests, grasslands/agro ecosystem. For this Interdepartmental co-ordination is necessary.
12.3.4	Conservation and Enhancement of Forest Carbon Stocks There is a wide scope in this Division for enhancing carbon stocks. I) Enhancing forest carbon stocks in Moderately Dense Forests. Approximately 93.05 sqkm (as per FSI report,2021) of forests of the Division are moderately dense forests. Better protection, fire protection and control, regulated grazing, eradication of invasive species, management of insects and other pathogens required soil moisture conservation are the key intervention to increase the stocking density, enhance biomass and carbon stocks. II) Restoration of open Forests. About 295.39 sqkm (as per FSI report,2021) of forest land is available as open forests, Mostly on the fringes of villages with crown density 10-40%. Such areas are subjected to intense biotic and abiotic pressure and biomass removal. Following interventions are required to be carried out which has already been discussed in concerned Working Circle. • ANR plantation of indigenous species. • Plantation of grasses in Gochar/non-forest land. • Construction of soil-moisture conservation measures or rain Water HarvestingStructures. • Protection from fire. III) Restoration of Scrub forests: The lands with less than 10% cover amounting to some 1.73 sqkm are under Scrub category. These lands can be restored through following methods. • Plantation of scrub species with palatable grasses. • Intensive soil moisture conservation methods. IV) Enhancing carbon stocks in trees of Urban Areas. Trees in urban areas have been providing Environmental services along with supply of fuel wood to Urban poor. Urban forests emerge as an existing opportunity to mitigate Climate change, ameliorate air pollution, and help in



	improving water regime & biodiversity in Urban environment. V) Agro-forestry for creation of carbon sinks outside forests. To cater to the need of growing population, planting of trees or creation of forest outside traditional forest area is necessary. Trees on non-agriculture rural lands like homesteads, school yards, compounds of various offices, Private/Public establishments, Road side, Canal side etc can be planted.
12.3.5	Sustainable Management of Forests Sustainable management is the management which is Economically feasible, Socially acceptable & Environmentally sound. If the drivers of REDD would be addressed then it is expected to bring positive change in Environment and Climate change.
12.3.6	Safeguards under REDD+ As per Cancun agreements, there is a need to ensure social and environmental safeguard for successful implementation of REDD+ <u>Environmental Safeguard :</u> • In no case natural forests be converted to plantations. • Land use change should be arrested. • Native species should be conserved & restored. <u>Social Safeguard</u> Committees have already been engaged in protection of forest through JFM. Total 23 nos of VSS have been formed and there is a wide scope to increase this number





CHAPTER 13

Miscellaneous Regulations:

13.1 General Considerations:

This chapter deals with the important activities which includes mostly all those prescriptions, regulations and recommendations which are not made earlier in the main Working Circles. Therefore, the prescriptions made here would be applicable to all the forest blocks, unless and until specified other wise. Some of the important subjects for which regulations have already been prescribed are also re-emphasis here.

13.2 Forest Consolidation:

In Rajnagar (W.L.) Divisions, the proportion of PRF and PF are high. There are 12 PRF blocks and 28 PF blocks present in the working plan area. They were all notified between 1956 to early eighties. The condition of these blocks is deplorable, most of these blocks do not have boundaries and are infested with heavy encroachments. The boundaries are not known to majority of the field functionaries. The consolidation of forests has been grossly neglected in the past. In fact, no further RF blocks could be notified during the outgoing plan and even in the intervening period. All the pending blocks need to be notified u/s 21 of OFA, 1972 during this plan period. Utmost priority is to be given to this work and a phased programme is to be drawn by the DFO and pursued vigorously with the Collector/Forest Settlement Officer (FSO) for final notification of all such blocks as RF for better and intensive forest management. Further other forest areas as per DLC Report and borne in the Revenue records especially large areas with good tree growth should also be converted to RF/PFs for better management. New reservation proposals for areas having good forest cover and/ or coming within the identified wildlife corridor should also be submitted after proper survey, demarcation on the ground and mapping.

As PFs and PRFs have been notified since long back i.e. more than one century, these blocks may need fresh redemarcation to ascertain their exact location, size and area in present condition. In fact, in many such blocks, the boundary lines are not traceable leading to confusion in the field. These blocks need to be re-demarcated in consultation with the FSO and assistance should be provided to the FSO to complete his enquiry so that the final notification is facilitated. The DFO should sincerely pursue all the pending



proposals and facilitate the notification in a fixed time frame. Besides, new proposals for notification as RFs during the plan period shall also be dealt with promptly.

13.3 Area Discrepancy and Its Reconciliation:

There are some variations between the notified area and digitized topo area/GIS area in case of some RFs, PRFs and DPFs. The field verification carried out vis-vis reference to the notification and the corresponding forest block maps reveals that topo depiction is prima-facie correct in case of Mahakalapada WL Range. Most of the PRFs area has not been depicted on the Survey of India topo sheets for which the demarcation of topo sheet is difficult in case of Forest Blocks of Kujang WL Range. Hence the topo depicted and digitized area has been taken for the current plan till detailed survey of all these forest blocks and reconciliation of the discrepancy by the DFO during the currency of the plan. The maps of Revenue Department (Village Sheets), entries in RORs in Hal & Sabik Settlement and DGPS Survey will be used for the purpose.

13.4 Forest Fire Management:

Annual Fire Plan shall be drawn out by the DFO and shall be implemented during the fire season out of available fund for control of forest fire.

13.5 Grazing Regulation:

The local community have a tendency to drive their cattle to the forest area for grazing. In all identified forest blocks of the Proposed Plan Area. Effective control measures should be taken. Prophylactic immunization of cattle should be ensured in coordination with veterinary officials/NGOs having expertise to prevent contamination of disease from the cattle to the wild animals.

13.6 Maintenance of Forest Block Boundaries:

13.6.1 The boundaries of various forest blocks are poorly maintained due to a variety of reasons including paucity of funds as has been elaborately explained in Part-1. Non-maintenance of boundaries in the past has given scope for encroachment. During field verification, many of the boundary pillars were found missing or not properly maintained. Boundary pillars are required to be periodically repaired, painted and numbered. Boundary lines are also required to be cleared and properly maintained. Details of block boundaries, e.g., length of forest boundary, number of pillars, pillar to pillar bearings and distances (along with GPS readings), and a record of maintenance of boundaries shall be meticulously maintained in the Divisional Office.



13.6.2 The inter divisional boundaries shall be cleared to a width of 10 meters, block boundaries to 6 meters and interior village ring line to 3 meters. Compartment lines, where they do not follow natural features like nallah, etc., should be cut to the width of 3 meters. All the boundary pillars should be repaired at the time of boundary maintenance. In case of replacement, the old pillars should be replaced by masonry pillars or stone cairns depending on the site. Forest Guard, Forester and Range Officer shall inspect the boundaries regularly as per Codal provisions. The Divisional Forest Officer and the Assistant Conservator of Forests should annually inspect 10 % of boundary lines of the division.

13.6.3 The boundary pillars existing in different forest blocks are elaborated in Chapter I of Part I. In some of the blocks the total number of pillars to be present as per notification is not available. Hence it is not possible to suggest the number of pillars required to be constructed in those blocks. The number of pillars to be constructed in different forest blocks as per the field observation are given in the **Table No. 2.7** Part-I of the plan. This serves as a guideline to the DFO to draw the annual action Plan depending on the availability of the funds.

The total boundary length in Rajnagar Division 321.845 Km. A five year cycle of maintenance of boundaries and boundary pillars is prescribed below. As per actual need and funds available the DFO will decide the annual programme of the blocks to be treated in a particular year.

Table 13.1: 5 Years maintenance Cycle of Forest Block boundary			
Year	Name of Forest Block	Length of boundary in Km	Year Total (in Km)
1 st Year	Jogidhankund PRF	7.25	61.393
	Saralikuda PRF	7.85	
	Nipania PRF	8.441	
	Badatubi PRF	8.442	
	Barakalikhola PRF	3.51	
	Garbishnupur PF	3.4	
	Gopalpur PF	3.57	
	Sahadabedi PF	13.28	
	Padmapur PF	2.06	
	Salio PF	3.59	
2 nd Year	Batighar PRF	18.338	82.353
	Bagagahan PRF	1.5	
	Petchhela	11.285	
	Kaunsiapal PF	2.75	



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	Jatadhar RF	12.34	
	Baruhan PF	10.14	
	Marichpur PF	26	
3 rd Year	Tentilibelari PF	6.11	56.350
	Akashdia PF	9.15	
	Boitarakud PF	10.12	
	Balitutha PRF	6.97	
	Kathiakholda PRF	6.32	
	Brahmandia PRF	6.54	
	Majhidia PF	3.74	
	Bhuiarpal PF	7.4	
4 th Year	Kathagadi PF	9.68	53.177
	Nadiakhia PF	6.0	
	Musadia PF	2.7	
	Madhuban 'A' PF	6.47	
	Madhuban 'B' PF	2.237	
	Nuagaon and Dhinkia PF	26.09	
5 th Year	Jatadharta PRF	22.91	68.572
	Barkud PF	4.95	
	Jatadharta B PF	1.9	
	Harishpurgada PF	10.47	
	Kankan PF	6.65	
	Dhobei PF	2.6	
	Ramtara PF	3.01	
	Muguria PF	6.032	
	Goda PF	2.55	
	Garaharishpur PF	7.5	
	Total	321.845	321.845

- The inter-divisional boundaries shall be cleared to a width of 10 m, external boundaries and common block boundaries to 6 m and enclosed village ring lines to 3 m. Compartment lines where they do not follow natural features like nallah, road, bridges etc shall be cut to a width of 3 m.
- The boundary cleared forest blocks would be taken for construction of missing pillars besides repair of existing damaged pillars. The pillars to be constructed should last for a minimum period of 10 years and should be of either of stone masonry or stone mud mortar with cement pointing or of dry stone packing.
- Forest Guard, Forester and Range Officer shall inspect the boundaries regularly as per Codal provisions. The Divisional Forest Officer and the Assistant



Conservator of Forests should annually inspect 10 % of boundary lines of the division.

13.6.4 It is of vital importance that the field staff regularly inspects the boundaries of blocks. Every Forester shall submit quarterly certificate (1st April, 1st July, 1st October and on 1st January) of having inspected the boundaries of all the blocks within their respective jurisdictions to the Range Officers concerned, for transmission of the same to the Divisional Forest Officer. Similarly every forest guard should submit a monthly certificate of verification of boundaries of all forest blocks under his charge and it should be reflected in his tour diary.

13.6.5 Since all the boundaries of forest blocks have been digitized for use of GIS technology, there is need for GPS (Geographical Positioning System) reading of all the boundary pillars. The DFO shall ensure obtaining this data at the time of boundary verification.

Table: 13.2 Details of Boundary Works to be Taken Up In Rajnagar (W.L.) Division			
S.No.	Name of the Block	Boundary Length in Km to be maintained	No. of Boundary Pillars to be constructed
1	Jogidhankund PRF	7.25	32
2	Saralikuda PRF	7.85	41
3	Nipania PRF	8.441	34
4	Badatubi PRF	8.442	56
5	Barakolikholra PRF	3.51	17
6	Batighar PRF	18.338	91
7	Bagagahan PRF	1.5	19
8	Petchhela PRF	11.285	80
9	Kaunsiapal PF	2.75	35
10	Jatadhar RF	12.34	8
11	Balitutha PRF	6.97	33
12	Kathiakholda PRF	6.32	49
13	Brahmandia PRF	6.54	33
14	Majhidia PF	3.74	4
15	Bhuiapal PF	7.4	73
16	Madhuban 'A' PF	6.47	22
17	Madhuban 'B' PF	2.237	13
18	Nuagaon and Dhinkia PF	26.09	90
19	Jatadharta PRF	22.91	68
20	Barkud PF	4.95	122
21	Kankan PF	6.65	130
22	Dhobei PF	2.6	11



23	Ramtara PF	3.01	28
24	Muguria PF	6.032	62
25	Goda PF	2.55	16
26	Garaharishpur PF	7.5	89
27	Garbishnupur PF	3.4	73
28	Gopalpur PF	3.57	29
29	Sahadabedi PF	13.28	98
30	Padmapur PF	2.06	12
31	Salio PF	3.59	20
32	Baruhan PF	10.14	20
34	Marichpur PF	26	122
35	Tentulibelari PF	6.11	21
36	Akashdia PF	9.15	27
37	Boitarakud PF	10.12	36
38	Kathagadi PF	9.68	25
39	Nadiakhia PF	6.0	77
40	Musadia PF	2.7	23
41	Jatadhartanda B PF	1.9	27
42	Harishpurgada PF	10.47	69
	Total	321.845	1935

13.7 Grazing Regulation:

13.7.1 Estimation and analysis of grazing problem has been discussed in Chapter II and Chapter III of Part I. Due to heavy livestock pressure in the division, natural regeneration in some blocks of the forest is affected severely. For better fodder availability, following measures should be adopted:

- In collaboration with Animal Resources Department, forest fringe villagers may be motivated through the platform of VSS to gradually reduce unproductive cattles and adopt quality milching cows. Stall feeding may have to be made a habit with the communities.
- Plantations of fast growing fodder species and development of silvipasture plots in the selected high-density cattle areas may be taken up under various schemes of the Government.

13.7.2 To regulate grazing of cattle on forest land the following steps should be taken by the DFO through his field staff:-

- Grazing will be allowed strictly basing on the carrying capacity of the forest area. Goats and Sheep should not be allowed inside the forest areas.



- ii. Lopping of trees for fodder is to be discouraged. Mild lopping of branches may be permitted.
- iii. Grazing should not be allowed in such areas where cleaning operation has been carried out to induce natural regeneration.
- iv. All plantations shall remain closed for grazing for a period of 5 years including the year of planting.

13.7.3 To control the damage caused by indiscriminate grazing of forests, the Government has framed the Orissa Forest (Grazing of Cattle) Rules 1980, but the implementation of these rules at the field level has been tardy and ineffective. Therefore, during this Plan period, proper implementation of grazing rules should be ensured.

13.8 Maintenance of Infrastructure:

A lot of infrastructures have been developed in recent pasts in the division in the form of residential buildings, office buildings, interpretation centres, watch towers etc. particularly under CAMPA. Annual maintenance schedule of the infrastructure should be drawn out and proposal in the APOs should be made for funding accordingly.

13.9 Petty Felling and Extraction:

Petty felling, if any, for the developmental work like departmental demand, research needs, in exceptional circumstances like cyclone, floods, fires etc. will be prescribed in the proposed plan.

13.10 Rights and Concessions:

The rights and concessions shall be regulated in accordance with the provisions of the relevant gazette notification of the respective forest blocks and the Govt. of Odisha Policy with regard to JFM Resolution in force.

13.11 Deviations:

Any deviation made in the prescription will be reflected in the deviation statement.

13.12 Research & Monitoring:

The experimental and sample plots and scope for creation of further research plots/ silvicultural garden will be ascertained from the Silviculturist, Bhubaneswar and incorporated in the proposed plan.



13.13 Roads, Paths, Bridges & Buildings:

The list of existing buildings, wells, rest houses and rest sheds with their cost and year of constructions will be documented. During last few years, a number of buildings including residential buildings for field staff have been constructed under CAMPA and different Plan/ Non-plan schemes. There is no forest road existing in this division. However, the navigational creeks within forest blocks will be maintained for movement of staff & vessels for protection and for monitoring the movement of wildlife by Anti-depredation Squad. The list of buildings existing in this Division is given in Annexure-II.

13.14 System of Sale / Disposal of Forest Produce:

Since OFDC Ltd. is the agency for marketing of forest produce, sale of the same will be done through them. However, for disposal of small quantities of timber, poles, the thinning materials out of JFM areas will be discussed and documented in the Working Plan.

13.15 Capacity Building of Frontline Staffs:

Regular capacity building of frontline staff is required to acquaint them on various aspects of protection and management, to update them on latest happening in the forest & environment sector, hands on exercise on use of tools, law, maintenance & use of arms & ammunitions etc. theme based training programme shall be chalked out by the DFO and proposal should be made in due time for funding for the purpose.

13.16 Maintenance of Records:

13.16.1 Register of Forest Blocks: Proper maintenance of this register is vital. Registers of Reserved Forests, Protected Forests, Village Forest is to be maintained as per the codal provisions. This register should preferably contain copies of the original notification (or an attested copy thereof) declaring the forest blocks under a particular category. Accurate maps of the block delineating the boundaries and showing the position of the boundary pillars as they exist on the ground and other details like boundary lengths, number of pillars, GPS readings etc should also be kept as part of this register. All changes in area due to diversion, dereservation along with copies of such notifications should also be maintained in the register. Register of forest blocks may be additionally maintained in soft form i.e. CD or DVD along with scanned copies of original notification and maps in appropriate scale of forest blocks.

13.16.2 Compartment Histories: No compartment histories are available for Cuttack and Rajnagar Divisions. Hence all the work has to be done denovo. It is a difficult task of the preparation the compartment histories. The compartment history files are



computerized for all the blocks and given to the DFO and the Range Officers concerned. The Range Officers should maintain the compartment history files in accordance with the standard instructions contained in the O.F.D. Code. A stock map on 1:25,000 scales showing growing stock of the compartment has been attached to each such file. Entries in the compartment histories should be completed by Range Officer before 30th of June every year and sent to the Divisional Forest Officer for onward transmission to the Conservator of Forests for perusal within 31st July. During office inspection, maintenance of compartment histories shall be checked.

13.16.3 Control Forms: Standard control forms will be used and maintained as per Rule 132 of the O.F.D. Code and Working Plan Code.

13.16.4 Plantation Journals: Journals will be maintained for each plantations/ rehabilitation work taken up in the Division showing details of operations and their cost, in the forms prescribed in Orissa Forest Plantation Manual 1977. Maps of the plantations with all details will also be kept in the plantation journal. All the plantation locations should be shown on topo sheets of 1:25000 and 1:50000 scale.

13.16.5 Plantation Register: A plantation register shall be maintained at the Division level giving details of every plantation carried out like year of plantation, location, area, species planted and agency involved. A unique index number will be assigned to individual plantation, and this will also be shown in the Plantation journal. This register should not show any detail of operations, which will be shown in the plantation journals. The plantation register should be maintained as prescribed under Plantation manual 1977. The plantations taken up should be reflected in the GIS database for the division in the divisional office and the database in the GIS lab of the PCCF should also be updated in October/November each year.

13.16.6 Fire Maps: Fire maps shall be maintained as per Rule 283 (22) of the Orissa Forest Department Code. The record should be submitted annually in code Form No. 39, along with fire map to the Conservator of Forests. Burnt area shall be shown on a trace copy of compartment map and details shall be given in respective compartment history. The incidents of fire and the area burnt should be reflected in the GIS database at the Divisional level and in the GIS lab of the PCCF office.

13.17 Survey and Maintenance of Maps:

13.17.1 During the revision of this Working plan all administrative boundaries of the Division up to beat level has been digitized at 1:50,000 scale and all the blocks of RF PRF, PF and DPFs included in this Plan have also digitized at this scale. A GIS database



showing forest types and density type has now been created. The following maps have now been prepared through this GIS database

13.17.2 Working Plan Map: The working plan map has been prepared on 1:50,000 scale. The map shows different working circles. It also shows the permanent features, territorial boundaries, name of the block, number of compartments etc. One set is to be supplied to the DFO for use in the Division and one set retained in the office of Working Plans Officer for record.

13.17.3 Stock Map: The stock map has been prepared giving details of crop composition for all the blocks included in the plan. Stock map for each compartment shall be pasted in the respective compartment history file. One complete set of stock maps shall be prepared for use in the Division.

13.17.4 Index Maps: Index map shall be prepared on 1:2, 50,000 scale. The map shall depict the important towns, roads, forest blocks, river system, range headquarters, beat headquarters, section headquarters, etc of the Division.

13.17.5 Management Maps: Two sets of management maps shall be prepared on 1:50,000 scale topo sheets. Annual coupes with coupe numbers in each Working Circle have been shown.

13.18 Capacity Building of Forestry Personnel:

13.18.1 The skill and the information requirements of the staff at the beat, section and range level has undergone a lot of change in the last two decades. The interaction of the staff with the public, people's representative, NGOs and officials of other departments has increased manifold. The following proposal may be considered by the DFO for improving the efficiency in performance of the field staff.

- i. Proper training and regular refresher courses for the field executives.
- ii. Good communication skill training to the FG/FR level
- iii. Regular in-house discussion to update knowledge of the field staff. Important relevant rulings of different Courts should be discussed & changes brought about in Forest Act and Rules in recent years should be brought to their notice. New techniques of plantation, nursery raising etc be demonstrated to the field staff.
- iv. Monthly meeting at the Range level should give opportunity to Foresters and Forest Guard to express views and opinion on various current issues. Successful tackling of situations should be discussed and analyzed.



- v. Important circulars and changes in methods/ technology/approach should be discussed at length by the DFO during monthly meeting of Range Officers
- vi. Supply of firearms to all Range Officers, Section foresters and Guards and impart arms training to them.
- vii. Frequent raids and surprise checks should be conducted in the smuggling prone areas and check gates.
- viii. Awards/Incentives should be given to the field staff for exemplary work in the protection and development activities.
- ix. Malkhanas to keep seized produce should be available in all smuggling prone areas.
- x. Personal entitlements of field staff especially those posted in remote areas should be settled with priority.

13.18.2 Some of the administrative changes as stipulated below may also be considered by the authorities concerned

- i. Promotional opportunity to the field staff should be increased. At present most of the FGs/Foresters who are at the cutting edge of the territorial administration, are disgruntled as they are retiring without any promotion. Minimum of one promotion should be assured.
- ii. Power of Executive Magistrate be given to the ACFs and DFOs for eviction operations and forest raids/search
- iii. Secret Service Funds should be provided to the DFO to collect intelligence about timber smuggling, poaching etc.
- iv. Attractive compensatory/ rehabilitation package be given to the families of field staffs laying their life or getting badly injured on forest protection duty.

13.19 Interim Revision:

No major changes in the prescription of this Working Circle are anticipated. However, if necessity arises, after five years the prescription may be reviewed jointly by the Chief Conservator of Forests (Working Plans) and the concerned Regional Chief Conservator of Forests. Deviation, if any, proposed is subject to the approval by the competent authority.

13.19.1 The cost norm for implementation of prescription and the total estimated cost of working under this chapter is discussed in Chapter 15 (Financial Forecast) of Part II.





CHAPTER 14

Establishment and Labour:

14.1 Establishment:

14.1.1 The main job of the territorial DFO is to protect the forest and wildlife resources of the division. There is a spurt in the forest and wild life crimes over the last two decades. The gravity of crimes and the modus operandi have changed over a period of time. It has become hi-tech in the sense that sophisticated fast moving vehicles and cellular phones are now being used in smuggling operations. At the same time number of assaults and firing cases against the forest staff is increasing of late. To combat such a situation, the protection mechanism needs to be strengthened by increasing the number of staff and equipping them with arms and ammunition. In the reorganization, there is separation of protection and afforestation jobs at the ACF level and two ACF posts have been created for these two jobs separately. But there is no such separation of job at the field level.

14.1.2 Another daunting problem of the Division is the staff structure. There are nearly 30 to 40 percent vacancies in the field functionaries of the Division and the vacancy position is still increasing day by day. The age structure of the staff is also another area of major concern. Most of the staff has crossed 50 years of age and they lost zeal to work in the forest. The human resource development aspect is also grossly neglected over a period of time. The sanctioned strength and vacancy position of the staff is furnished in Annexure IX.

14.2 Administrative Reorganization:

In the reorganization of the Forest Department, some administrative changes have been brought in like separation of afforestation and enforcement activities, changing the size of the ranges, etc. Nevertheless, there are several grey areas that need to be addressed.

- I. The human resource development at all the levels should be given top most priority. The positive work culture has to be brought into the Department. The facilities provided to the field functionaries should be at par with the army and police. There should be regular recruitment in the Forest Department, just like in army and a green army should be created for the protection of the natural resources. The young blood should be brought into the Department and they



should be made responsible for the protection of the forest. The developmental activities should be given to the experienced staff

- II. The protection staff should be totally different from the staff doing plantation, JFM and extension activities. It is just not possible for the same Forest Guard and Forester to do protection on one hand and constitute the VSS on the other hand. Separate mind set is required for the two different activities. The developmental works should be handled by a separate group of people involving Foresters, Forest Guards, Village Forest Workers and should be headed by Forest Extension Officer. He should be stationed in the range headquarters and report to the Range Officer. The integration of two functions should be done at the range officer level

14.3 Labour:

The availability of labour is a major problem in the Division. There is a lot of industrial activity in Paradeep area. Hence the wage rates are very high. The labour is not available at the prevailing minimum wage rates. This problem is acute in Kujanga and Mahakalapara areas. In these areas it is recommended to enhance the wage rates, 25 percent more than the minimum wage rate.





CHAPTER 15

Financial Forecast:

15.1 Financial Forecast:

The total cost of implementation of the prescriptions of the plan comes to Rs14839.584 lakh. The cost is indicative and the actual cost will depend on site condition, annual target and availability of fund. The year wise requirement is given in Table 13.1.

15.2 Treatment of Rehabilitation Working Circle:

The forests are in a highly degraded state. The treatment measures include RDF plantation and soil and moisture conservation works.

15.2.1 RDF Plantation:

The total area of rehabilitation in Mangrove Forest Division (WL), Rajnagar is 8516.138 ha. The average annual treatment area is roughly 851 ha. The total cost of RDF works as per the existing norms is Rs. 36974/- per ha spread over four years. This norm is on the lower side and there is problem of higher wage rates in the Division and also the material cost is increasing every year. Hence 10% escalation cost has been added each year in calculation of cost.

The average annual area of treatment	=	851 ha
The cost per ha	=	Rs. 36,974
The total cost for RDF works	per annum	= Rs. 3, 14, 64,874/-.

15.3 Treatment of Plantation Working Circle:

The total area of plantation is 1492.37 ha. The cost of plantation per ha is Rs.166886 for mangrove plantation and Rs. 166777 for Casuarina plantation. Out of 1492.37 ha, it is difficult to separate the extent of area of mangrove and Casuarina plantations at this juncture. However, the mangrove plantation would be in around 300 ha and Casuarina plantation would be in 1192.37 ha. Nevertheless, the DFO has to make the site specific plans before implementation. Hence the cost may change little bit. The average annual area of mangrove plantation would be 30 ha and the average annual area of Casuarina plantation would be 109 ha.

Cost of Mangrove plantation per ha = Rs.1, 66,886/-

Annual cost of Mangrove plantation = 30 x 166886= Rs.50, 06,580/-

Cost of Casuarina plantation per ha = Rs. 1, 66,777/-



Annual cost of Casuarina plantation = $109 \times 1,66,777/-$ = Rs.68,37,857/-

Total Annual Plantation cost of Two Ranges = **Rs. 1,81,78,693/-**

15.4 Treatment of Protection (Overlapping) Working Circle:

The total area allotted to this Working Circle is 10145.408 ha. The average annual treatment area is 1014 ha. The main protection measures are directed for tackling problems like illicit felling, encroachments, fire, communication network, etc. The annual cost of the protection of forest per ha is should be 10000/- per annum.

The average annual area = 1014 ha

Annual cost per ha = 10,000/-

Total cost per annum = Rs.1,01,40,000/-

15.5 Treatment of Mangrove Improvement Working Circle:

The total area under this Working Circle is 230 ha. Hence the average annual area for the improvement would be 23 ha. The important steps required to be taken up are creek renovation, construction and renovation of fish bone channels, removal of unwanted weeds, creation of mounds, construction of inspection paths, watch towers, protection of the habitat, etc.

15.5.1 Creek Renovation: Creeks are the life line of mangroves. They carry fresh water and tidal water to the adjoining forest and supply it with vital nutrients. It also re-charges the soil with fresh dose of sediments. The extent of creek to be renovated is approximately 12 km. The renovation should be done in a five year cycle. Hence the annual average creek to be renovated will be 1.2 km. The creek renovation includes clearance and deepening. The cost of creek renovation will be Rs.100000/- per km.

Renovation cost per Km = Rs.100000/- Km

Total annual creek renovation cost= 100000×1.2 = Rs.1,20,000

15.5.2 Construction of Watch Towers: It is recommended to construct watch towers at places like Saralikuda, Salio etc. These watch towers help in protection of the mangrove vegetation and the wildlife. For this work an annual amount of Rs20.00 lakhs is required.



15.5.3 Removal of Unwanted Weeds: The main weeds in the area are Harkanch and Nalia grass. They effect the growth of mangrove vegetation. For the removal of unwanted weeds an annual amount of Rs 10.00 lakhs is required.

15.5.4 Construction of Inspection Paths: The standard size of the inspection path is 10' x 5' x 4'. The inspection path should be constructed on the embankment with sand and morrum spreading on the top. 21 Km of inspection path is required to be constructed. The average annual path will be 2.1 km. Annual amount of Rs.10 lakhs is required for the construction of inspection path.

15.5.5 Construction of Mounds:15 mounds are recommended to be constructed at different places. The average cost of one mound is Rs1,00,000/- The average annual mounds to be constructed is 2 and the total annual cost is Rs 2.00 lakhs.

15.5.6 Construction of New Fish bone channels: These channels are required in the new areas where the mangrove vegetation has come up. For this work an annual amount of Rs 5.00 lakhs is required with 5% escalation every year.

15.5.7 Habitat Protection: The annual average expenditure required for the protection of the habitat is Rs. 20 lakhs with 10% annual escalation

15.5.7.1 Total annual cost of the Working Circle

1. Creek Renovation	= Rs1, 20,000
2. Construction of WatchTower	= Rs20, 00, 000
3. Removal of unwanted weeds	= Rs 10, 00, 000
4. Inspection Path	= Rs10, 00, 000
5. Construction of Mounds	= Rs2, 00, 000
6. Fish bone channel	= Rs5, 00, 000
7. Habitat Protection	= Rs20, 00, 000
Total Cost	= Rs68,20,000 or Rs. 68.00 lakhs

15.6 Treatment of Wildlife (Overlapping) Working Circle:

The total area allotted to this Circle is 4770.67 ha and the average annual treatment area is 477.00 ha. The treatment includes habitat improvement, enhancing availability of water, prevention of wildlife crime, reducing man-animal conflict, creation of waterholes, game tanks, grass land development, protection, research and publicity etc. The average total expenditure on these activities is expected to be Rs.2000/- per ha.



Average annual area of treatment = 477.00 ha

Average expenditure per ha = Rs2000/-

Total annual expenditure per circle = Rs9,54,000/-

15.7 Treatment of Joint Forest Management (Overlapping) Working Circle:

The total area allotted to this Circle is 250.00 ha and the average annual area for treatment is 250.00 ha. Efforts should be made to strengthen the VSS in the RF and beyond RF areas equally. For the demarcation, cleaning and preparation and implementation of micro plans, annual expenditure of Rs20.00 lakhs is required for each Range, Hence the amount required for the entire Tract would be Rs 40.00 lakhs with an escalation of 10% annually.

15.8 Miscellaneous Regulations:

15.8.1 Forest Consolidation

There are several PRF blocks notified long back. At least consolidation works should be prioritized in few blocks. The annual cost required for the consolidation works is projected at Rs5.00 lakhs with 10% annual escalation.

15.8.2 Maintenance of Forest Boundary:

The total boundary length is 280.975 Km. A five year cycle of maintenance of boundaries is prescribed. Annual length of the boundary to be maintained is tentatively 60Km. and the same area would be maintained after five years. There are 725 pillars need to be constructed and in some of the blocks the details of boundary pillars are not available. Hence it is taken that on an average 100 pillars need to be constructed annually. The pillars should be made permanent and the concept of stone cairns should go away, as the cairns cannot be maintained even after two years. The average cost of one pillar should be Rs.2000/- The existing pillars also need to be repaired. The average number of pillars to be repaired is kept at 100 and the average repair cost per pillar is Rs.1000/-

Boundary clearance @ 10 Man Days per Km.= Rs1, 78,800/-

Construction of pillars @ Rs2000 per pillar= Rs2, 00,000/-

Repair of existing pillars @ Rs1000 per pillar = Rs. 1, 00,000/-

Total Cost = Rs. 4.78Lakhs



15.8.3 Fire Protection:

For spreading awareness and engaging fire watchers in all the forest fringe villages at least for three months, a minimum of Rs5.00 lakh rupees is essential per each range. The amount required for the entire Tract will be Rs10.00 lakhs, with 10% increase every year.

15.8.4 Infrastructure Development and Maintenance:

For the replacement of old vehicles, purchase of new vehicles, maintenance of VHF sets, purchase of new sets, expenditure on arms and ammunition and other miscellaneous works an approximate cost of Rs10.00 lakhs is to be incurred annually with an escalation of 10% annually.

15.8.5 Buildings:

The list of building is provided in the Annexure VIII. Maintenance of the buildings regularly is essential. For carrying out these works an annual expenditure of Rs5.00 lakhs is required per each range, making a total of Rs10.00 lakhs for the entire Tract with an escalation of 10% every year.

15.8.6 Eco-Tourism:

There are several eco-tourist spots in the Division. These spots need to be developed with basic amenities for visitors. For this an annual expenditure of Rs50, 00,000/- is required with 10% annual increase.

15.8.7 Capacity Building:

The enhancement of the skills of the Forest Department personnel at all the levels is highly essential for the better management of the resources. For this an annual expenditure of Rs2.00 lakhs is required for each range, making a total of Rs4.00 lakhs for the entire area.

15.8.8 Library, Equipments, Maps & Tools

An amount of Rs1.00 lakhs is estimated on lump sum basis with an annual raise of 10% every year.

15.8.9 Miscellaneous Contingencies:

An amount of Rs2.00 lakhs per annum is estimated with subsequent raise of 10% every year.



15.9 Projected Cost of the Implementation of the Plan:

		Table No: 15.1 PROJECTED COST OF THE WORKING PLAN (In Lakhs)														
Budget Head	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	Total					
Rehabilitation W.C.	314.64	346.104	380.71	418.78	460.66	506.73	557.40	613.14	674.45	741.90	5014.514					
Plantation W.C.	181.78	199.95	219.95	241.94	266.14	292.75	322.03	354.23	389.66	428.62	2897.050					
Protection W.C.	101.40	111.54	122.69	134.96	148.45	163.30	179.63	197.59	217.35	239.09	1616.000					
Mangrove Impro. W.C.	68.00	74.80	82.28	90.50	99.55	109.51	120.46	132.51	145.76	160.34	1083.710					
Wild Life O.W.C.	9.54	10.49	11.54	12.69	13.96	15.36	16.9	18.59	20.44	22.49	152.000					
JFM O.W.C.	40.00	44.00	48.40	53.24	58.56	64.42	70.86	77.94	85.74	94.31	637.470					
Forest Consolidation	5.00	5.50	6.05	6.65	7.32	8.05	8.85	9.74	10.71	11.78	79.650					
Buildings	10.00	11.00	12.10	13.31	14.61	16.10	17.71	19.48	21.43	23.57	159.310					
Boundary	4.78	5.25	5.78	6.36	6.99	7.69	8.46	9.31	10.24	11.27	76.130					
Fire Protection	10.00	11.00	12.10	13.31	14.61	16.10	17.71	19.48	21.43	23.57	159.310					
Infrastructure	10.00	11.00	12.10	13.31	14.61	16.10	17.71	19.48	21.43	23.57	159.310					
Eco-tourism	50.00	55.00	60.50	66.55	73.20	80.50	88.55	97.40	107.15	112.90	791.750					
Library, tools etc.	1.00	1.10	1.21	1.00	1.46	1.61	1.77	1.94	2.14	2.35	15.580					
Capacity Building	4.00	4.40	4.84	5.32	5.85	6.44	7.08	7.79	8.57	9.43	63.720					
Combating Climate Change & REDD ⁺	50.00	55.00	60.50	66.55	73.20	80.50	88.55	97.40	107.15	112.90	791.750					
Water Resource Management	50.00	55.00	60.50	66.55	73.20	80.50	88.55	97.40	107.15	112.90	791.750					
TOF Management	20.00	22.00	24.20	26.62	29.28	32.21	35.43	38.97	42.87	47.16	318.740					
Misc. Contingency	2.00	2.20	2.42	2.66	2.92	3.22	3.54	3.89	4.28	4.71	31.840					
Total	932.14	1025.334	1127.87	1240.3	1364.57	1501.09	1651.19	1816.28	1997.95	2182.86	14839.584					





The End



ANNEXURES





Annexures

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ANNEXURE – I

LIST OF BUILDINGS

Sl. No.	Name of the Range	Name of the District	Name of the Building	Plinth area in Sq. ft.
1	Kujang	Jagatsinghpur	FRH cum store	1516
2			Range Office cum Store (Old)	776
3			FG Quarter at Kujang	384
4			FG Quarter at Nuagaon	470
5			Watch Tower cum FG Shed at Sandhakuda	4.84
6			FG Quarter at Jatadhartanda-I	393
7			FG Quarter at Jatadhartanda-II	292
8			Forester Quarter at Kujang	448
9			Forester Quarter at Nuagaon	470
10			FRO Quarter at Kujang	1027
11			Range Officer Residence at Kujanga	1008
12			F.G. Quarter at Ramatara	470
13			F.G. Quarter at Kujang	470
14			F.G. Shed at Hawakhana	470
15			Range Office at Kujang	1008
16			Malakhana at Kujang	800
17			F.G. Quarter at Bandar	470
18	Mahakalapada	Kendrapada	FG Hut-2, Sasanpeta	252
19			FG Hut-2, Kansaridia	280
20			Watch Tower at Jamboo	182
21			Food distribution Centre at Jamboo	250

22			CRF Office Rood Range Office at Jamboo	320
23			APR Barrack	600
24			Vocational Training Centre at Batighar	574
25			FG Hut-2, Kharnasi	310
26			FG Hut-2, Batighar	522
27			Community Awareness Centre at Jamboo	800
28			Permanent Camp at Batighar	600
29			Range office at Mahakalapada	1008
30			Common Toilet Facility at Jamboo	126
31			F.G. Quarter at Hariabanka	470
32			Barrack at Jamboo	600
33			F.G. Quarter at Batighar	470



ANNEXURE –II

**ADMINISTRATIVE STRUCTURE OF MANGROVE FOREST DIVISION (WILDLIFE),
RAJNAGAR**

Range		Section	Beat
1. Rajnagar (WL)	1	Rajnagar	1. Rajnagar South
			2. Rajnagar North
			3. Aul
			4. Barunei
			5. Pentha
			6. Kathuaganda
	2	Gupti	7. Gupti
			8. Krushnapriyapur
			9. Bagapatia
	3	Satabhaya	10. Satabhaya
			11. Habalikhathi
			12. Ekakula
2. Kanika (WL)	4	Dangmal	13. Dangamal
			14. Krushnanagar
			15. Nalitapatia
			16. Thanapati
			17. Bhitarkanika
	5	Khola	18. Khola
			19. Ajgarpatia
			20. Barhapita
	6	Talchua	21. Talchua
			22. Pattaparia
			23. Sailendrasarai
			24. Mahisamada
			25. Kalibhanjadia

3 Kujanga (WL)	7	Kujanga	26. Kujanga
			27. Sandhakuda
			28. Paradeep
			29. Balitutha
	8	Nuagaon	30. Nuagaon
			31. Jatadhartanda-I
			32. Jatadhartanda-II
	9	Bandar	33. Bandar
			34. Balijore
	10	Hawakhana	35. Hawakhana
			36. Ramtara
4. Mahakalpada	11	Jamboo	37. Jamboo
			38. Kharinasi
			39. Hariabanka
	12	Jagatjore	40. Jagatjore
			41. Suniti
	13	Batighar	42. Batighar
			43. Kansaridia
5 Gahirmatha (WL)	14	Barunei	44. Agarnasi
			45. Sasanpeta
	15	Ekakula	46. Chinchiri



ANNEXURE- III

NOTIFICATIONS OF FOREST BLOCKS

Notification

Dated Bhubaneswar, the 31-10.1979.

No. FS-280/79 77046 /R ., In exercise of the powers conferred U/S.21 of Orissa Forest Act,. 1972 (Orissa Act 14 of 1972) the State Government do hereby declare that the land situated in the Marshaghai Tahasil, P.S Mahakalpara under Athagarh Forest Division of Kujang Forest Range in the District of Cuttack the limits of which are specified below and the approximate area of which is AC. 344-46 dec. shall be reserve Forest with affect from 15th December, 1979 and shall be know as Kantilo Reserve Forest Block.

Description.

The block is situated in the Eastern side of the village Kalatunga Th. No. 114, and the other three sides are surrounded by a creek locally know as Jagati Jora in the north and east, and the river Gobari in the south.

Detailed boundary description of the Kantilo Forest Block declared as Reserve Forest.

North	Natural boundary of the Jagata Jori Nala i.e. plot No. 22 of the Revenue village, Kantilo Jungle No. 115. To the North of the Jagat Jora Nala the Revenue Village Bhuinpada is situated.
East	The natural boundary of the Nala Jagati A Jora i.e. plot No. 23 of the Revenue village Kantilo Jungle 115
South	The natural boundary of the river Gobari i.e. plot No. 15 and 21 of the Rev. village Kantilo Jungle No. 115
West	Boundary of the village Kalatunga No. 114

The limits of the reserve Forest are in the line marked green on the copy of each of the 16" = 1 mile Cadastral map of the village Kantilo Jungle which has been signed by the Collector of the District and deposited in his Record Room. The State Govt.

By order of the Governor,

Sd/-

Dharmananda Nayak

Deputy Secretary to Government.

Office of the Divisional Forest Officer: Athgarh Division

Memo No. 94 / Dated 15.11.29

Copy forwarded to the Range officer Kujang for information and Record.

Divisional Forest Officer
Athgarh Division.

Revenue department
Notification
The 27th June 1970

No. S.R.O. 530/70- In exercise of the Powers conferred by section 4 of the Indian Forest Act, 1927 (Act XVI of 1927), the State Government do hereby notified that it has been decided to constitute as reserved forest of the land situated in the district of Cuttack; the limits of which has been demarcated by cairns and lines cleared to a width of 15'-0" or by natural boundaries as specified below:-

Saralikud Forest Block in Kujang Range under Marshaghai Tahasil in Cuttack districts
Situation of the Block

The Block is situated on the Northern bank of Mahanadi River and is at a distance of 2 miles from Bay of Bengal at the mouth of the River Paradeep Port is 5 miles to the south of the block

Boundaries of the Block

North- Batighar Galia and village area Batighar

East- Batighar Galia, River Mahanadi and Hetamundia Forest Block

South- Mahanadi River

West- Jogidhankud Forest Block

Description

The boundary line cleared to a width of 15'-0" The block comprises the following plots of the Revenue Khata No. 2 of Mouza Saralikud,

Khata No.	Village	Plot No.	Area
2	Saralikund	6	6.59
		1	9.37
		2	39.62
		3	86.95
		4	110.75
		5	135.87
		3/18	4.30
		7	121.25
		12	114.81
		12/17	10.56
		13	11.62
		Total	650.69

2. In exercise of the powers aforesaid the State Government do hereby appoint the S.D.O Kendrapara to be the Forest Settlement Officer, to enquire into and determine the existence of nature and extent any rights alleged to exist in favour of any person of over any land comprises within the limits specified above or in or over any forest produce to be found thereon and deal with the same as provided in Chapter-II of the said Act.

(No. 34689- FS-144/70-R)

By order of the Governor
B.B. Parida
Deputy Secretary to the Government

REVENUE DEPARTMENT
NOTIFICATION
THE 27TH JUNE 1970

S.R.O. No. 515/70- In exercise of the powers conferred by section 4 of the Indian Forest Act, 1972 (Act XVI of 1972) the State Government do hereby notify that it has been decided to constitute as Reserve Forests Land situated in the district of Cuttack, the limits of which have been demarcated by cairn and line cleared to a width of 15'-0" or by natural boundaries as specified below.

Sana tubi Block in Kujang Range

Situation of the Block

The Block is surrounded by Kharnasi Nala in the North and Tubi Galia in the East and South and it is situated 1 ½ miles away from light house fabe point in the South –West

Boundaries of the Block

North- Kharnasi Nala

East- Tubi Galia and Kansaridia Forest Block

South- Tubi Galia and Barakoli Khalas Nipania Village areas

West- Bada Tubi Village area.

Description

The boundary line of the block were cleared to width of 15' the Starting point i.e. Settlement pillar of Sana tubi Block and Bada Tubi block starts in the Southern direction to B.P. No. 328.80 Chains

Then it turns to South-West direction to B.P No. 4 up to 11.20 chains

Then it turns to Southern direction to B.P No. 6 up to 21.00 Chains

Then it turns to South-East direction to B.P. No 7 up to 3.20 Chains

Then it turns to South direction to B.P No. 8 up to 4.60 Chains

Then it turns to South-West direction to B.P No. 11 up to 19.70 chains

Then it turns to South-East direction to B.P. No 12 up to and approaches the Nala 9.20 Chains

Then it turns to North-East direction in the back of the creek 98.00 Chains

Then it turns to south direction up to 38.00 chains

Then it turns to East direction up to 1.40 Chains

Then it turns to South direction and approaches Tubi Galia up to 5.40 chains

Then it turns to Eastern direction in the bank of Tubi Galia 42.00 Chains

Then it turns to North-East direction in the Bank of Tubi Galia 23.10 Chains

Then it turns to Northern direction in the bank of tubi Galia 82.20 chains

Then it turns to North-East direction and crosses a creek and runs in the bank of tubi Galia up to 42.00 chains

Then it turns to Northern direction in the bank of Tubi Galia and approaches kharnasi Nala up to 44.00 chains

Then it turns to western direction in the bank Kharnasi Nala up to 74.00

Then it turns to South-West direction in the bank of Kharnasi Nala upto 56.00 chains
Then it turns to Southern direction in the bank of Kharnasi Nala up to 24.20 chains
Then it turns to south-west direction in the bank of Kharnasi Nala and reaches at the starting point 65.00 chains

Thus the entire traverse of the proposed Block is 8 miles 53 chains and follows the natural boundaries on three sides and artificial boundary on one side demarcated and posted with 12 boundary pillars.

2. In exercise of the powers aforesaid the State Government do hereby appoint the S.D.O Kendrapara to be the Forest Settlement Officer to enquire into and to determine the existence nature and extend any rights alleged to exist in favour of any person in or over any land comprises within the limits specified above or in or over any forest produce to be found thereon and deal with the same as provided in Chapter-II of the Said Act.

(No. 34667-F.S-142/70-R)

By order of the Governor

B.B. Parida

Deputy Secretary to Government

REVENUE DEPARTMENT
NOTIFICATION
THE 27TH JUNE 1970

S.R. No. 533/70 In exercise of the powers conferred by section 4 of the Indian Forest Act: 1927 (Act XVI of 1927), the State Government do hereby notify that it has been decided to constitute as reserve forests the land situated in the district of Cuttack, the limits of which has been demarcated by cairns and line cleared to a width of 15'-0' or by natural boundaries as specified below:-

BADA TUBI FOREST BLOCK IN KUJANG RANGE

Situation of the block

The block is situated near Mahanadi river and at a distance of 6 miles from the Bay of Bengal where river meets the sea at the mouth under Marsaghai Tahasil in Cuttack district.

North- Kharnasi River
East- Sanatubi village area
South- Badatubi village area
West- Badatubi village area

Description

The boundary line of the block cleared to a width of 15'-0' runs parallel to the creek Angarkati forming a reserve belt of forest.

The starting point i.e. B. P. No. 1 starts from the bank of Kharnasi river and goes to ..2.50 south to B. P. No. 2

Then it turns to East and goes to B. p. No. 3...	0.80
The it turns to North- East direction to B. P. No. 4...	0.60
Then it turns to East and goes to B. P. No. 5..	16.00
Then it proceeds in the same direction to B. P. No. 6...	15.00
Then it turns to south direction to B. P. No. 7...	6.50
Then it proceeds in the same direction to B. P. No. 8...	16.00
Then it turns to south-west direction to B. p. No. 9...	14.00
Then it turns to south and goes to B. P. No. 10...	11.00
Then it turns to south-west direction to B. P. No. 11	20.00
Then it turns t west and goes to B. P. No. 12..	12.00
Then it turns in the same direction and meets B. p. No.13..	7.00
From B. P. No. 11 it runs to south and goes to B. P. No.14...	2.50
Then it runs in the same direction and goes to B. p No. 15	5.75
Then it runs to south-West direction to B. P. No. 16...	8.10
Then it runs in the same direction to B. P. No. 17...	11.75
Then it runs in the same direction to B. P. No..18...	6.75

Then it runs in the same direction to B. P. No. 19...	7.00
Then it runs in the same direction to B.P No. 20...	8.50
Then it runs in the same direction to B.P No. 21...	10.00
Then it runs in the same direction to B.P No. 22...	8.00
Then it turns west and goes to B.P No. 23...	8.00
Then it turns south and goes to B.P. No. 24...	2.50
Then it turns west and goes to B. P. No. 25...	18.75
Then it turns to South and goes to B. P. No. 26...	13.50
Then it turns to North-East direction to B. p. No. 27...	2.00
Then it turns to South and goes to B. P. No. 28...	4.50
Then it turns to South-East direction to B. p. No. 29...	10.00
Then it started from the Northern corner of forest Plot No. 191 i.e. B. P. No/ 30..	5.00
In the south direction and goes to B. p. No. 31....	4.50
Then it turns to south east direction to B. P. No.32...	5.50

Revenue department
Notification
The 27th June 1970

S.R. no. 529/70-In exercise of the powers conferred by Section 4 of the Indian Forest Act, 197 (Act XVI of 1927), the State Government do hereby notify that it has been decided to constitute as Reserve Forest the land situated in the district of Cuttack of which have been demarcated by cairns and line cleared to a width of 15;-0" natural boundaries as specified below:-

HETAMUNDIA FOREST BLOCK IN KUJANG RANGE

Situation of the block

The block is situated along the sea coast of bay of Bengal and in front of the false point Light house. The Mahanadi River flows to the south of the block and joins the sea at the mouth near the block.

Boundaries of the Block-

North- Hukitola take and Hukitola Block

East- Bay of Bengal

South- Mahanadi River

West- Batighar and Kansardia Block

Description

The boundary line of the block was cleared to a width of 15'-0". The natural features of coast of Bay of Bengal in the East. The Bank of Mahanadi River in the south and Khola Nala in the West from the natural boundaries . The starting point starts from the northern most corner of the Block near the sea const and goes in south direction along the sea coast up to 100 chains.

Then it follows in South direction along sea coast up to...	100
Then it follows in South direction along sea coast up to...	150.00
Then it follows in South direction along sea coast up to...	135.00
Then it turns to the South west along the Mahanadi River...	34.50
Then it turns to West direction and follows Batighar Galls....	44.00
Then it turns to North-East direction follows the Kholanala up to ...	77.00
Then it follows to North-East direction and follows the Kholanala upto..	100.00
Then it turns to North direction and follows the Kholanala up to	102.00
Then it follows to Northern direction and follows Khola nala up to...	138.00
Then it turns to North-East direction and follows, Khola nala up to..	102.00
Then it turns to west direction and meets the starting point at he sea up to..	6.50

Thus the entire traverse of the proposed block is 13 miles 50 chains 0 link and runs along the .

2. In Exercise of the powers aforesaid the State Government do hereby appoint S.D.O Kendrapara to be the Forest Settlement Officer, to enquire into and determine the existence nature and extent any rights slleged to exist in favour of any person in or over any land comprises within limits specified above or in or over any forest produce to be found thereon or deal with the same as provided in Chapter-II of the said Act.

No. 34651-F.S 133/70-R/

By Order of the Governor

B.B.Parida
Deputy Secretary to Government.

Revenue Department
Notification
The 28th April 1970

No. S.R.O-320/70- In exercise of the powers conferred by section 4 of the Indian Forest Act, 1927 (Act XVI of 1927), the State Government do hereby notify that it has been decided to constitute as reserve forest, the unsurveyed lands situated in the district of cuttack, the limits of which have been demarcated by cairns and the line cleared to a width of 15'-0 or by natural boundaries as specified below:-

Sasanpeta Forest Block in Kujang Range-

North- Saline Embankment and Sasanpeta River
East- Bay of Bengal
South – Kandarapatia River
West – Panikhia River and Saline Embankment

Description

The boundary lines of the block were cleared to a width of 15'-0'. The Starting point i.e. BP No. 1 goes to south-East Direction

Then it goes to	South-East	direction to BP No. 10	24.41
Ditto	South-East	direction to BP No. 15	22.93
Ditto	South-East	direction to BP No. 21	22.14
Then it turns to	South	direction to BP No. 28	23.73
Ditto	West	direction to BP No. 29	2.66
Ditto	South-West	direction to BP No. 40	58.24
Ditto	South	direction to BP No. 42	19.20
Ditto	North-West	direction to BP No. 46	42.90
Ditto	West	direction to BP No. 47	8.80
Ditto	North	direction to BP No. 48	9.20
Ditto	West	direction to BP No. 55	35.69
Ditto	West	direction to BP No. 60	23.10
Ditto	West	direction to BP No. 70	55.50
Ditto	West	direction to BP No. 74	23.55
Ditto	South-west	direction to BP No. 80	34.95
Ditto	South-West	direction to BP No. 87	40.38
Ditto	South	direction to BP No. 91	21.05

Form BP No. 91 it follows the Panikhia River bank in south-East direction and meet the Kandarapatia River. Then it turns to the East and follows the Northern bank of Kandarapatia River until it meets Bengal over a distance of 4 m -2 chs- o link

Then it turns North-East direction and follows the sea coast along the Bay of Bengal to a distance of 2M-33 Chs-0 link until it meets the Sasanpeta river.

Then it turns North-West direction and follows Southern bank of Sasanpeta river to a distance of 38 Chs.

Then it turns in the Northern direction and follows the Western bank of Sasanpeta river to a distance of 36.00 chs.

Then it turns in the North-West direction and continues to follow the natural boundary along the bank of Sasanpeta river to a distance of 31.00 Chs.

Then it turns in the Northern direction and follows the Western bank of Sasanpeta river to a distance of 36.00 chs.

Then it turns in the North-West direction and continues to follow the natural boundary along the bank of Sasanpeta river to a distance of 16'-50 chs.

Then it turns of the west and continue to follow the natural boundary along the Southern bank of Sasanpeta river until it meets BP No. 1 at a distance of 1M-5chs-0 link

Thus the entire traverse of the proposed Block is 15 M -6 chs. -94 links

There is a ring line inside the Block around the private land which has been properly demarcated and pillars have been posted after due clearance of line to a width of 15'-0' over length of 45 chs 55 links

In exercise of the powers aforesaid the State Government do hereby appoint S.D.O Kendrapara to be the Forest Settlement Officer to enquire into and determine the existence nature and extent any rights alleged to exist in favour of any person in or over any land comprised within the limits specified above of in or over any forest produce to be found thereon or deal with the same as provided in Chapter-II of the said Act.

No. 2785-FS-80/70-R)

By Order of the Governor.

B.B. Parida

Deputy Secretary to Government

Revenue Department
Notification
The 27th June

S.R.O No. 525/70- In exercise of the powers conferred by Section of the Indian Forest Act, 1927 (Act XVI of 1927) the State Government do hereby notify that it has been decided to constitute as reserved forest of the land situated in the district of Cuttack, the limits of within have been demarcated by cairns and line cleared to a width of 16'-0" by Natural boundaries as specified below:-

The block is situated at the coast of Bay of Bengal where the Kandarapatia Nala joins the it is about 5 miles distance from Jamboo villages in the South under Marasaghai Tahasil in Cuttack district

North- River Kandarapatia
East- Bay of Bengal
South- Village area Suniti
West- River Kandarapatia

Description

The boundary line of the Block was cleared to a width of 15'-0" the starting i.e. B.P. No. I goes in northern direction to B.P. No. 4 ... 36.00Ch.

Then it turns to north-west direction	to BP No. 5	13.00
Ditto northern direction	to BP No. 6	4.25
Ditto east direction	to BP No. 7	7.50
Ditto north-east direction	to BP No. 8	23.00
Ditto Western direction	to BP No. 9	35.50
Ditto Southern direction	to BP No. 10	9.00
Ditto South-west direction	to BP No. 11	23.00
Ditto South direction	to BP No. 12	2.50
Ditto west direction	to BP No. 13	8.50
Ditto south direction	to BP No. 14	17.50
Ditto west direction	to BP No. 16	33.00
Ditto south-west direction	to BP No. 17	2.75
Then it turns south-east direction	to BP No. 18	5.00
Ditto eastern direction	to BP No. 19	4.50
Ditto south-east direction	to BP No. 20	5.25
Ditto south-west direction	to BP No. 21	17.00
Ditto west direction	to BP No. 22	5.00
Ditto northern direction	to BP No. 23	20.00
Ditto south-west direction	to BP No. 24	5.00
Ditto north-west direction	to BP No. 25	3.25
Ditto north-east direction	to BP No. 26	6.50
Ditto south-east direction	to BP No. 17	3.00
Then it does back in North east direction	to BP No. 16	2.75
And from BP No. 16 in turns to northern direction	to BP No. 27	28.00
Then it turns to eastern direction	to BP No. 29	33.70
Ditto south-east direction	to BP No. 30	19.50

Ditto north-east direction	to BP No. 31	25.00
Ditto south-east direction	to BP No. 33	66.25
Ditto south- west direction	to BP No. 36	53.00
Then it goes to south-west direction	to BP No. 37	12.00
Ditto south west direction	to BP No. 38	23.00
Then it turns to western direction and meets	to BP No. 1	7.00

Thus the entire traverse of the proposed Block is 6 miles 77 chains 95 links consisting of 38 nos. of boundary pillars.

2. In exercise of the powers aforesaid the State Government do hereby appoint S.D.O Kendrapara to be the Forest Settlement Officer, to enquire in to and determine the existence, nature and extent any rights alleged to exist in favour of any person in or over any land comprises within the limits specified above of in over any first produce to be found thereon and deal with same as provided in Chapter II of the said act.

(No. 34634-F.S-140/70-R)

By order of the Governor

B.B. Parida

Deputy Secretary to Government

Revenue department
Notification
The 5th January 1977

S.R.B. No. 29/77 – In exercise of the powers conferred under section 21 of Orissa Forest Act, 1972 (Orissa Act 140 of 1972) the State Government do hereby declare that the lands situated in Kujanga tahasil, Police Station Erasama under Athgarh Forest Division of Kujang Forest Range in the district of Cuttack, the limits of which are specified below, and the approximate area of which is 307.06 acres shall be reserved forces with affect from the lat February 1977 and shall be known as Jatadhar Reserve forest Block.

DESCRIPTION

The block consists of 6 patches has, which are existing as small islands at Jatadhar Muhan Nala near the mouth of the above river close to the Bay of Bangal

Name of the R.F.B	Patch Number	Boundary village	Khata	Plot area	Local name of boundaries
1	2	3	4	5	6
Jatadhar	I	Jatadhar	I	32.94 37.36	Natural boundaries River Jatadhar on all sides
	II	Jatadhar	I	17.30 22.35 16.01	N-Nuagan 14B S-Natural boundaries E- River Jatadhar W-
	III	Jatadhar	I	22.38 30.60 09.80	N-Pulanga-Nuagan 14B, 16B S- River Jatadhar E- W- Nolia sahi 170
	IV	Jatadhar	I	05.42	Natural boundaries on all sides, namely Jatadhar.
	V	Jatadhar	I	22.77	Ditto
	VI	Jatadhar	I	28.65 61.48	Ditto

Details of boundary description

Patch No.I Consists of revenue plot no. 1 and 2 of village Govindpur. ... 19. 20
The starting point starts from station No. 1 near the triangular village boundary pillar of Govindpur village and goes in the North-East Direction to station No. 2 17. 30 From Station No. 2 the boundary line goes in the North-East direction to station No.3 from station No.3 the line .. 17.65 turns in the south and meets station No. 4. Then it turns X 13.70 in the south-West and meets station No. 5 Then it goes .. 11.20 in the South- West and meets station No. 6 Then it turns in the west and meets station No.7 .. 12.80 Then it turns in the northern direction and meets station No. 1 .. 13.30

Patch No. II- Consists of reserve plot Nos. 3,4 4/24. The starting 21.00 Station No.8 near Nuagan village goes in the North-East direction meets station No.9

Then it goes to further North- East Direction along river bank meets station No. 10 17.00
Then it turns in the northern direction towards the river and meets station No. 11 .. 5.50
Then it turn in the South – West and meets station No. 12 .. 14.60
From station No. 12 it turns in the South and meets station No. 13 .. 40.00
Then it turns in the North- West and meets station No. 8 .. 29.45

Patch No. III – Consists of Plot No. 5, 5/25 and 6. The starting ... 35.40 i.e. station No.14 starts from the triangular village boundary pillar W of Nolia Sahi and Polanga village and goes in the eastern to station No. 15 at another village boundary pillar of .. 17.80 and Nuagan village along the river bank. Then it goes in the eastern direction and meets station No. 16

Then it turns in the North- East and meets station No. 17.	... 16.30
Then it turns towards the river in the South and meets station No. 18	.. 20.70
Then it turns to South- West and meets station No. 19.	... 12.60
Then it turns to South and meets station No. 20	.. 17.40
Then turns to the South – West and meets station No. 21.	... 20.20
Then it turns to the West and meets station No. 14 on the bank	 9.45

Patch No. IV- Consists of Revenue plot No. 7. The starting point Station No. 22 starts from North- East corner of the patch and in the south- West and meets station No. 23. 10.80

Then it continues South-West and meets station No. 24	.. 7.10
Then it turns to North –West and meets station No. 25	... 2.15
Then it turns to North-East and meets Station No. 26	... 7.45
Then it turns to East and meets and meets Station No.22	... 12.10

Patch No. V- Consists of Revenue plot No. 8. The starting point goes in the South – West direction and meets station No. 28 24.50

Then it turns in the South- West direction and meets station No. 29 .. 16.45

Then it turns in the North-West and meets station No. 30	... 3.70
Then it turns in the North and meets station No. 31 ...	12.85
Then it turns in the East and meets Station No. 32.	 15.30

Then it continues in the East and meets station No. 27 16.65

Patch No. VI- Consists of Revenue plot Nos. 9 and 10. The starting point i.e. station No. 33 starts from eastern corner of the patch and goes in the South- West direction and meets boundary station No. 34. 40.35

Then it turns in the North-West and meets station No. 35 12.75

Then it turns in the South- East and meets station No. 38 11.50

Then it continues in the South-East and meets station No. 39. 10.00

Then it continues in the South –East and meets station No. 40. 9.65

Then it turns in the South –East and meets station No. 33 ... 21.30

That the entire traverse of the proposed block is 8 miles 2 chains and 85 links and runs along natural features, namely, the bank of the river Jatadhar Muhan – Nalla.

The limits of the Reserve Forests are the line mark in green on the copy by the Collector of the District and deposited in his record – room.

2. The State Government do hereby further declare that the rights admitted are nil in respect of all the six patches of the Jatadhar Reserved Forest Block.

By order of the Governor
Dharmananda Nayak
Deputy Secretary to Government.

REVENUE DEPARTMENT
NOTIFICATION
The 11th July 1979

S.R.O. No. 844/79 – In exercise of the powers conferred under section 4 of the Orissa Forest Act 1972 (Orissa Act of 1972), the State Government do hereby declare that it has been proposed to constitute' as Reserve Forest the land situated in the District of Cutack under Athgarh Forest Division, the limits of which have been demarcated by cairns or line cleared to a width of 15' or natural boundary as specified below:-

Name of the Forest Block – Balituth

Scale-16 = 1 mile

Area – 242 acres

Boundary description-

North- Village Jalapada

East- Jalapada

South- Village Borapat

West- Balituth

P.-S Erasama, Subdivision Jagatsinghpur, Kujang tahasil, district Cuttack. The pillar No. 1 starts from North- West corner of the block.

Pillar No	Forward bearing	Distance	
		Chains	Links
1	127	8	80
2	122	8	60
3	49	21	80
4	49	9	40
5	50	22	80
6	61	9	80
7	120	3	92
8	41	6	46
9	41	2	20
10	51-30	4	20
11	115-30	4	72
12	67-30	7	00
13	65-30	10	25
14	6-45	10	70
15	51	8	55
16	45-45	10	85
17	9	6	95
18	25-30	12	15
19	32	10	00
20	300	6	5
21	215-30	18	00

22	233	7	45
23	227-30	17	34
24	221	17	20
25	288-30	5	40
26	213	6	75
27	259-30	7	90
28	314	8	89
29	237-30	12	45
30	237-30	22	60
31	233-30	9	25
32	226-30	15	20
33	218	15	00

In exercise of the powers aforesaid State Government do hereby appoint the Forest Settlement Officer, Cuttack to enquire into and determine the existence, nature and extent of any rights or privileges claimed by or alleged to exist in favour of any persons in or over the land comprised within the limits specified above or in or any forest produce to be found thereon and to deal with the same as provided in Chapter II of the said Act.

{No. 50844-F. S.-5/79-R.}

By order of the Governor
B. P. Choudhury

Under –Secretary to Government

ANNEXURE - IV

PLANTATIONS RAISED DURING LAST PLAN PERIOD

BlockPlantation.

Sl.No.	Name of plantation site	Area	Range
1	Kansaridia Mangrove Plantation	63 Ha	Mahakalapada
2	Sasanapeta Mangrove Plantation	39 Ha	-do-
3	Hetamundia Mangrove Plantation	10 Ha	-do-
4	Nadiakhia (Bandar) Mangrove Plantation	20 Ha	Kujanga
5	Baruhan Casuarina Plantation (CA)	31 Ha	Kujanga

Avenue Plantation--- NIL

2008-09

BlockPlantation.

Sl.No.	Name of plantation site	Area	Range
1	Kantilo Mangrove plantation	45 Ha	Mahakalapada
2	Hetamundia Mangrove Plantation	58 Ha	-do-
3	Sasanapeta Mangrove Plantation	97 Ha	-do-
4	Kansaridia RDF Mangrove Plantation	10 Ha	-do-
5	Jatadharatanda Economic Plantation	20 Ha	Kujanga

2009-10

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Kansaridia Mangrove Plantation	110 Ha	Mahakalapada
2	Hetamundia Mangrove Plantation	215 Ha	-do-
3	Sasanapeta Mangrove Plantation	85 Ha	-do-
4	Kandarapatia Mangrove Plantation	30 Ha	-do-
5	Sanatubi Mangrove Plantation	60 Ha	-do-
6	Jatadharatanda Economic Plantation	10 Ha	Kujanga
7	Badapal Economic Plantation	20 Ha	-do-
8	Nadiakahia Casuarinas Plantation	10 Ha	-do-

2010-11

BlockPlantation.

Sl.No.	Name of plantation site	Area	Range
1	Hetamundia Economic plantation	5 Ha	Mahakalapada
2	Sasanapeta Mangrove Plantation(CAMPA)	100 Ha	-do-
3	Hetamundia Mangrove Plantation	200 Ha	-do-
4	Jatadharatanda Economic plantation	20 Ha	Kujanga
5	Gopalpur Economic plantation	15 Ha	-do-
6	Jatadharatanda Casuriana plantation(MGNREGS)	20 Ha	-do-

Avenue Plantation--- Jamboo to Marshaghari Canal Bridge-6 RKM

2011-12

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Sanatubi RDF Mangrove plantation	200 Ha	Mahakalapada
2	Jatadharatanda Economic plantation	40 Ha	Kujanga
3	Nadiakhia Economic plantation	25 Ha	-do-
4	Badabandha (MGNREGS)	10 Ha	-do-
5	Khuranta (MGNREGS)	10 Ha	-do-
6	Salabelapur (MGNREGS)	10 Ha	-do-

Avenue Plantation--- Barar to Jagatjore- 5 RKM- Mahakalapada
Lanjuda to Jagatjore-10 RKM- Mahakalapada

2012-13

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Sanatubi Mangrove Plantation	15 Ha	Mahakalapada
2	Kansaridia Mangrove Plantation	100 Ha	-do-
3	Jatadharatanda Casuarina Plantation	40 Ha	-do-
4	Nadiakhia Casuarina Plantation	35 Ha	Kujanga
5	Nadiakhia MangrovePlantation	56.94 Ha	-do-

Avenue Plantation--- Jamboo Ghat to Benakanda- 4 RKM-Mahakalapada
Jamboo Lock to Chhapali-4 RKM- Mahakalapada
Samagola to Baulanga RD Road- 2RKM- Kujanga
Chatua to Ersama RD Road- 4RKM- Kujanga
Deriki Garai PWD Road-2 RKM-Kujanga
Balikuda to Machhagaon-2 RKM- Kujanga

2013-14

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Jamboo PF ANR Casuarina Plantation	50 Ha	Mahakalapada
2	Jatadharatanda Economic plantation	40 Ha	Kujanga
3	Jatadharatanda Casuarina Plantation(CA)	2.4 Ha	-do-

Avenue Plantation--- Bhateni to Jagatjore-8 RKM- Mahakalapada
Chhapaligada to Arunnagar-8 RKM- Mahakalapada
Baligoda to 22 No.Canal Branch-4 RKM- Mahakalapada
Rabindra Samal House to Mohani Pradhan House-4 RKM- Mahakalapada
Jamboo High School to Hari Jardar House-3 RKM- Mahakalapada
Samagol Baulanga R&Broad-4 RKM- Kujanga
Andhari Kiadingri R.D.Road-4 RKM-Kujanga
Gadabishnupur Panchapali R.D.Road-4 RKM- Kujanga

Jharapit Garama Canal Embankment-4 RKM- Kujanga
 Deriki Mohanpari PWD Road- 2 RKM- Kujanga
 Kothamula Potanai R.D.Road-2 RKM - Kujanga

2014-15

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Hetamundia Economic Plantation	20 Ha	Mahakalapada
2	Sanatubi Mangrove Plantation	100 Ha	-do-
3	Kansaridia Mangrove Plantation (CA)	176.056 Ha	-do-
4	Sahadabadi Economic plantation	20 Ha	Kujanga

Avenue Plantation- 22 No. Canal Branch to Janara Bridge- 4 RKM- Mahakalapada

Nalapada to Amirbad-4 RKM- Mahakalapada

Bandhapada to Gagua Chhaka-4 RKM- Mahakalapada

Ekalpur to Radhia-4 RKM-Mahakalapada

Bijayanagar Hanuman Temple to Kanpur – 4RKM- Mahakalapada

Gagua Chhaka to Babar RD Road- 2 RKM- Mahakalapada

Millan mode to Jagatjore- 4 RKM Mahakalapada

14No.A Canal Embankment near Badabandha- 4 RKM- Kujanga

Bigachapur Gare RD Raod- 4 RKM- Kujanga

Chatua Ersama RD Raod- 4 RKM- Kujanga

Baulanga to Bamadeipur- 4 RKM-Kujanga

Khambakulamatha to Kantuania Hat RD road- 4 RKM- Kujanga

Nuagaon Rohia RD Raod- 4 RKM- Kujanga

Champahat Dihasahi to Sompur RD Road- 4 RKM- Kujanga

2015-16

Block Plantation.

Sl.No.	Name of plantation site	Area	Range
1	Hetamundia Economic Plantation- State Plan	15 Ha	Mahakalapada
2	Sandhakuda Economic Plantation- State Plan	20 Ha	Kujanga
3	Balikani Economic plantation- State Plan	15 Ha	Kujanga
4	Nadiakhia Mangrove Plantation under CAMPA APO-2014-15	25 Ha	Kujanga
5	Jatadharatanda Casuarina Plantation under CAMPA APO 2014-15	0.561	Kujanga

Avenue Plantation-

MGNREGS

Avenue Plantation from Ekalpur Gherry to Radhia	4 RKM	Mahakalapada
Avenue Plantation from Bijayanagar Culvert to Kanpur	4 RKM	Kujanga
Avenue Plantation from Bagadia to Jhimani PMGSY Road	4 RKM	Kujanga
Avenue Plantation from Shophapata to Ghosaghara R.D.Road	4 RKM	Kujanga
Avenue Plantation from Gadakujanga to Balituthya R.D.Road	4 RKM	Kujanga
Avenue Plantation from Nuagaon to Balitutha R.D.Road	4 RKM	Kujanga
Avenue Plantation from Marichipru to Baramundali R.D.Road	4 RKM	Kujanga
Avenue Plantation from Tigiria to Budhishahi PMGSY Road	4 RKM	Kujanga
Avenue Plantation from Dhiatelasara to Gothadanda PMGSY Road	4 RKM	Kujanga
Avenue Plantation from Odapanga to Gopalpur PMGSY Road	4 RKM	Kujanga
Avenue Plantation from Dharijana to Dahal Switch Gate R.D.Road	4 RKM	Kujanga
Avenue Plantation from Pankapal to Gareii R.D.Road	4 RKM	Kujanga

Avenue under State Plan

Hansura Balikani R.D.Road	5 RKM	Kujanga
Rahama to Sanakrupa	5 RKM	Mahakalapada

Abstract:

Total Block Plantation : 1385.957 Ha. (515.901 Ha. In Working Plan area)

Total Avenue Plantation: 198 Rkm



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Annexure-V

Species diversity in Bhitarkanika Mangrove ecosystem in Orissa, India

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Species diversity in Bhitarkanika Mangrove ecosystem in Orissa, India

Mangroves forests serve as ecotones between land and sea and elements from both are stratified horizontally and vertically, between the forest canopy and subsurface soil. In India, mangroves occur in two groups, the mangroves of the West coast and those of the East coast. The present study is an effort to collect ecological information by carrying out field studies based on phytosociological methods at four forest sites in Mangrove Ecosystems of Orissa coast. 16 species were recorded from 11 families at Thakurdia site. The Dangmal forest block encompasses a total of 20 tree species belonging to 14 families at Dangmal, 24 tree species belonging to 13 families at Bhitarkanika and 17 tree species from 10 families at Kakranasi forest sites. The Bhitarkanika site has the highest number of species among all the 4 study sites. This block along with Dangmal is also designated as the core area of the Bhitarkanika wildlife sanctuary. Number of plants/ha was recorded higher in the Thakurdia and Kakranasi sites than the Dangmal and Bhitarkanika sites. *Excoecaria agallocha*, *Ceriops decandra*, *Avicennia officinalis*, and *Sonneratia caeseolaris* exhibited highest number of plants /ha in Thakurdia and Kakranasi and *Heritiera fomes*, *E. agallocha* and *Cynometra ramiflora* in the Dangmal and Bhitarkanika sites. *H. fomes*, *E. agallocha* and *C. ramiflora* make up 84 % of the total number of plants/ha in the Dangmal forest block. In Bhitarkanika *H. fomes* (42.05 %) exhibited highest density/ha followed by *E. agallocha* (24.18 %), and *C. ramiflora* (10.36 %) and these three species together accounted for 77 % of the total number of plants/ha. In the Thakurdia block, *E. agallocha* and *C. decandra* represented 36.13 % and 26.24 %, respectively. It is observed that the classification usually done for terrestrial forests (Misra, 1968) to determine seedlings, trees etc. does not apply to mangroves and a large number of individuals in the mangrove forest belong to the DBH category of 2.5- 5 cm. *H. fomes* and *E. agallocha* have maximum basal area in the Dangmal and Bhitarkanika sites and Thakurdia and Kakranasi forest sites respectively. In the Dangmal forest block, *H. fomes*, *E. agallocha* and *A. officinalis* constitute 81 % of the basal area. In the Bhitarkanika forest block, *H. fomes*, *A. officinalis*, *E. agallocha*, and *Sonneratia apetala* accounted for 78 % of the total basal area. In Thakurdia and Kakranasi blocks, *E. agallocha*, *L. racemosa*, *C. decandra*, and *H. fomes* accounted for 74 -75 % of the total basal area. It is observed that most of the characteristics of Orissa mangroves of India are not similar to other riverine mangroves of the world. The Orissa mangroves are of low height having less basal area and higher number of species compared to the mangroves of Mexico and Costa Rica. The riverine mangrove forests of Florida surprisingly have similar values of height and the basal area as in the forest of the present study.

Introduction

Mangrove forests, dominated by estuarine trees serve as ecotones between land and sea and elements from both are stratified horizontally and vertically, between the forest canopy and subsurface soil (Rao & Deshmukh, 1994). Mangrove has been defined as "any woody, tropical halophyte that is an obligate inhabitant of 'mangal' (wetland community) (Tomlinson, 1986). The word mangrove has traditionally been used to describe either the total community or the individual tree/ bushes, growing in the clayey, silty, inter-tidal coastal zones, deltaic and estuarine coasts and backwaters/ sheltered regions, in the tropical/subtropical belts of the world (Nayak & Bahuguna, 2001). Mangroves can often survive non- saline habitats (Cintron & Schaeffer-Novelli, 1983; Walsh, 1974). However, according to Lugo (1980), a saline environment is required for stable mangrove ecosystems. About 54-70 species (including hybrids) in 20-27 genera and 16-19 families fit comfortably into this broad category (Tomlinson, 1986; Cronquist, 1981; Duke, 1992). Mangrove areas have wide range of families, including ferns, grasses, sedges, palms and legumes. Mangroves grow throughout the tropics wherever the average monthly minimum temperature is 20°C (Chapman, 1976) and are believed to be limited in their subtropical distribution by lack of low temperature resistance (Dodd et al. 1995). Between 25°N and 25°S, mangroves colonize almost 75 % of the coastline (Day et al., 1987) although they only represent 1 % (100000 km²) of the area of tropical forest are quite productive (350 to 500 gram C m⁻² yr⁻¹) (Mann, 1982). Mangroves may show strong, weak or no spatial zonation (Tomlinson, 1986; Ellison et al., 2000), although the abundance of individual species may follow the gradient of salinity (Helalsiddiqui, 1999). Mangroves prefer a salinity range of 5- 30 parts per thousand.

The ecological importance of these ecosystems for maintaining marine life was stressed by Upadhyay et al. (2002); Fromard et al. (1998); Odum & Heald (1975). Studies have demonstrated their role in supplying organic material to coastal marine ecosystems (Odum & Heald, 1972; Lugo et al. 1980; Boto & Bunt, 1981; Rojas-Beltran, 1986; Hutching & Saengar, 1987). Mangrove ecosystems are being studied with more interest worldwide because of their economic importance in support of commercial fisheries alone (Cintrón et al. 1980). Uses and values of mangroves are many and varied. For example, they provide habitat as well as spawning and nursery ground for various marine species (fish, shellfish, crustaceans etc), enrich the near-shore environment, act as windbreakers and protect the shoreline from storms, stabilize the shoreline, and decrease coastal erosion (Nayak & Bahuguna, 2001).

Out of 4,87,100 ha. of mangrove wetlands in India, nearly 56.7 % (2,75,800 ha.) is present along the east coast, 23.5 % (1,14,700 ha.) along the west coast, and the remaining 19.8 % (96,600 ha.) is found in the Andaman and Nicobar islands (FSI, 1999). Mangroves in the densely populated East Coast of India have been degraded for decades and are still continuing to be degraded due to loss of biomass, species composition simplification mainly due to overgrazing, fuel wood extraction and conversions (Blasco & Aizpuru, 2002).

Mangroves are spread over an area of 214 sq. km (FSI, 1999) in Orissa. The assessment has indicated an increase of 20 sq. km (FSI, 1997, 1999) in Bhadrak and Kendrapara districts. Although the overall assessment shows an increase, several areas have shown marked decrease in quality and quantity of the vegetation cover. Causes for degradation of mangroves in Orissa are, shoreline changes, settlements, conversion for agriculture and aquaculture (Upadhyay et al. 2002). Recent researches carried out on biosystematics of mangrove phanerogams (Dodd et al. 1995; Duke, 1995; Tomlinson, 1986); on biogeography (Saengar, 1996); ecology (Snedaker, 1995) and distribution (Spalding et al. 1997) can be considered as being of direct interest to the knowledge of the mangroves of India (Blasco & Aizpuru, 1997). Taxonomical works on mangroves have been done by Banerjee et al. (1989), Banerjee (1984, 1987); Banerjee & Rao (1990); Choudhury (1984, 1990); Choudhury et al. (1991, 1995); Majumdar & Banerjee (1985); Mishra & Panigrahi (1987). The present paper highlights ecological structures of mangroves ecosystem of Orissa coast based on phytosociological studies.

The Study Site

The state of Orissa has a geographical area of 155707 sq. km with an actual forest cover of 47107 sq. km. (30.3 %). Area under Mangrove forests is 195 sq. km which comes to 0.125 % of geographical area and 0.414 % of actual forest cover (Daniels & Acharjyo, 1997). The study site located at 20° 4' - 20° 8' N Latitude and 86° 45' - 87° 5' E Longitude, in the north-eastern coastal plain of Kendrapara district in Orissa is in Bhitarkanika sanctuary. Total area of sanctuary is 672 Sq. km of which mangrove forests constitute 130 sq. km. This area receives water from three rivers, known to be rich in species diversity and trees are dense and tall like those of Sunderbans (Selvam, 2003). Four forest blocks in the Bhitarkanika wildlife sanctuary were selected for carrying out vegetation survey. The area of Bhitarkanika forest block is 1712 ha., Dangmal 636 ha., Kakranasi 310 ha., and Thakurdia 272 ha. (Chadha & Kar, 1999). Bhitarkanika and Dangmal Blocks constitute the core area. These sites experience tide of semi diurnal type. The mean sea level in the region is about 1.66 meters. The Bhitarkanika sanctuary is bounded by river Dhamra in the north, the river Hansua to the west and Bay of Bengal on the eastern and southern sides. The sanctuary encompasses 35 km sea coast known as 'Gahirmatha Coast' from Dhamra mouth to Barunei, the mouth of river Hansua. The area has about 200 km. of water body inside the sanctuary and falls in the deltaic region of the river Brahmani, Baitarani, and their tributaries. The estuarine rivers- Brahmani, Baitarani, Kharasrota, Dhamra, Pathasala, Maipura, Hansua, and Hansina during their course flow into the Bay of Bengal are further criss crossed by numerous creeks, channels, and nallahs, thus providing the peculiar ecological niche for the growth, development of rich and varied mangrove life forms, both flora and fauna along with their associates. There are many villages within the sanctuary as well as surrounding it. The population in these villages has been growing very fast. Part of the population rise is because of the heavy influx of refugees from East Bengal and West Bengal and habitations are reported to have been started by clearing mangrove forests. A total of 81 villages are adjacent to the mangrove forests. The population increase is attributed as one of the reasons for decreasing mangrove of the area.

Climate

The region comes under the tropical monsoon climate with three pronounced seasons: winter (October to January), summer (February to May) and rainy (June to September). The maximum

temperature is recorded in the month of April and May and the minimum temperature in winter during the month of January. The relative humidity ranges from 70% to 84% through out the year. Wind speed from March to June is over 20 km. per hour, and the predominant wind direction is from south and south-west. Rainfall is around 1642.34 cm per annum and maximum rainfall is received between June and October. The most important weather phenomenon is the prevalence of tropical cyclones. The mean track of the cyclone passes over this region (Singh & Panda, 1999). Rainfall conditions decide the sequence of mangrove distribution in the different zones in the tidal region. A successive tidal flood inundates the land surface and the subsequent exposure of the soil substratum evaporates the water. This result in thick salt crust on the soil surface and these salt crusts inhibit or limit the regeneration and growth of the mangroves. Frequent rainwater flushing helps in washing off the surface and leaching down the salt particles and makes the land suitable for growth of mangroves. Tidal amplitude in the Baunsagada River ranges from 1.5 to 2.5 meters in summer months to 3 to 5 meters during monsoon months. In the Bhitarkanika River, and especially in creeks such as Khola (which receives tidal water from both ends) tidal amplitude reaches 3- 4 meters in summer months to 5-6 meters during rainy season.

Soils and Geology

The soil sediments are divided into two categories, indicating recent or sub-recent forms named as 'newer alluvium' and Pleistocene forms named as 'older alluvium' (GSI, 1974). The recent sediments are represented by sand, silt, and clay with assorted boulders and pebbles. These are dark and loosely compacted with high moisture content. The Pleistocene deposits comprise of clay, sand, silt, and 'kankar', with locally cemented pebbles and gravels. These are reddish brown due to high degree of oxidation (Banerjee & Rao, 1990).

Methods

Phytosociological Analysis in four forest blocks was carried out by quadrat method following Misra (1968), Kershaw (1973), Cintron and Schaefer-Novelli (1984) and Snedaker & Snedaker (1984). Thirty quadrats of 10m X 10 m size were laid out at each site. Each site was divided into 6 segments of 1 km each along tidal line from the riverbank. A line transect was laid towards landward side from the water line. In each segment, 6 quadrats of 10 m X 10 m size were laid at 0, 50, 100, 150, 200 and 250 meter interval towards the land ward side for phytosociological analysis. 120 quadrats were laid in four forest blocks to study forest structure (trees). On the basis of data obtained from quadrat samples, the structural parameters like frequency, abundance, density, basal area, and IVI were calculated (Tables 1a-d).

Results and Discussion

Vegetation Analysis

The Bhitarkanika forest block contains highest number of tree species followed by Dangmal, Kakranasi and Thakurdia blocks. Bhitarkanika and Dangmal are part of core area of the Bhitarkanika wildlife sanctuary. Availability of fresh water through Bhitarkanika (Maipura river) and Brahmani rivers and saline water from sea in core area help wide range of niches for different species to occur and, thus, species diversity is the highest. Table 1 provides details on structural parameters of vegetation of study sites. *H. fomes* and *E. agallocha* exhibited greater density, frequency and IVI values across all sites. The species with lower density and IVI are different from one site to the other. All the species show contagious distribution. A/F ratio range in Dangmal block is proportionately less wide compared to other blocks. According to Odum (1971) contagious distribution is commonest in nature, random distribution is found only in very uniform environment and regular distribution occurs where severe competition exists between individuals.

Table 1.A : Phytosociological Parameters of Dangmal Block

Sl. No.	Species	Density	% Frequency	Abundance	Abundance/ Frequency Ratio *	Relative Density	Relative Frequency	Relative Dominance	L.V.I
1	<i>E. agallocha</i>	15.7	100	15.70	0.16	21.83	19.35	15.36	56.54
2	<i>H. fomes</i>	32.7	100	32.70	0.33	45.46	19.35	56.98	121.80
3	<i>C. ramiflora</i>	12	56.67	21.18	0.37	16.68	10.97	4.91	32.56
4	<i>P. paludosa</i>	0.7	20	3.50	0.18	0.97	3.87	0.50	5.35
5	<i>H. blanceana</i>	2.6	40	6.50	0.16	3.61	7.74	1.49	12.85
6	<i>P. pinnata</i>	1.8	30	6.00	0.20	2.50	5.81	3.95	12.26
7	<i>A. officinalis</i>	0.8	20	4.00	0.20	1.11	3.87	8.67	13.65
8	<i>S. apetala</i>	0.5	10	5.00	0.50	0.70	1.94	2.43	5.06
9	<i>K. candel</i>	0.27	10	2.67	0.27	0.37	1.94	0.17	2.47
10	<i>A. cucullata</i>	0.4	13.33	3.00	0.23	0.56	2.58	0.89	4.03
11	<i>R. mucronata</i>	0.4	20	2.00	0.10	0.56	3.87	0.57	5.00
12	<i>H. littoralis</i>	0.47	16.67	2.80	0.17	0.65	3.23	0.96	4.83
13	<i>C. manghas</i>	0.17	6.67	2.50	0.38	0.23	1.29	0.31	1.83
14	<i>X. granatum</i>	0.37	10	3.67	0.37	0.51	1.94	0.75	3.20
15	<i>A. corniculatum</i>	1.77	20	8.83	0.44	2.46	3.87	0.55	6.87
16	<i>B. gymnorrhiza</i>	0.7	16.67	4.20	0.25	0.97	3.23	1.14	5.34
17	<i>T. troupi</i>	0.2	6.67	3.00	0.45	0.28	1.29	0.11	1.68
18	<i>C. decandra</i>	0.3	10	3.00	0.30	0.42	1.94	0.11	2.46
19	<i>X. molluscensis</i>	0.03	3.33	1.00	0.30	0.05	0.65	0.08	0.77
20	<i>B. tersa</i>	0.07	6.67	1.00	0.15	0.09	1.29	0.07	1.45
Total		71.93	516.67	132.25	5.49	100.00	100	100	300

* A/F Ratio- below 0.025- regular distribution/ between 0.025 to 0.05- random distributions/ More than 0.05- contagious distribution

Table 1A. Phytosociological parameters of Dangmal Block

Table 1B: Phytosociological Parameters in Bhitarkanika Block

Sl. No.	Species	Density	% Frequency	% Abundance	Abundance/ Frequency Ratio	Relative Density	Relative Frequency	Relative Dominance	I.V.I
1	<i>A. officinalis</i>	1.97	36.67	5.36	0.15	2.68	6.59	18.25	27.51
2	<i>H. fomes</i>	30.83	100	30.83	0.31	42.05	17.96	35.46	95.47
3	<i>E. agallocha</i>	17.73	90.00	19.70	0.22	24.18	16.17	14.14	54.49
4	<i>S. apetala</i>	2.37	36.67	6.45	0.18	3.23	6.59	10.59	20.40
5	<i>P. pinnata</i>	0.67	20	3.33	0.17	0.91	3.59	3.11	7.61
6	<i>I. bijuga</i>	0.27	13.33	2.00	0.15	0.36	2.40	0.82	3.58
7	<i>A. corniculatum</i>	3.63	26.67	13.63	0.51	4.95	4.79	0.97	10.71
8	<i>C. ramiflora</i>	7.6	43.33	17.54	0.40	10.36	7.78	3.00	21.15
9	<i>A. cucullata</i>	1.23	16.67	7.40	0.44	1.68	2.99	2.98	7.66
10	<i>X. granatum</i>	0.73	23.33	3.14	0.13	1.00	4.19	1.83	7.02
11	<i>S. caeseolaris</i>	0.73	10	7.33	0.73	1.00	1.80	1.21	4.00
12	<i>R. mucronata</i>	0.63	20.00	3.17	0.16	0.86	3.59	1.96	6.41
13	<i>K. candel</i>	0.53	16.67	3.20	0.19	0.73	2.99	0.57	4.29
14	<i>C. manghas</i>	0.43	13.33	3.25	0.24	0.59	2.40	1.33	4.32
15	<i>C. decandra</i>	1.03	23.33	4.43	0.19	1.41	4.19	0.24	5.84
16	<i>A. alba</i>	0.1	3.33	3.00	0.90	0.14	0.60	0.83	1.57
17	<i>T. populnea</i>	0.1	3.33	3.00	0.90	0.14	0.60	0.08	0.82
18	<i>X. molluscensis</i>	0.4	3.33	4.00	1.20	0.55	1.80	0.95	3.29
19	<i>B. gymnorrhiza</i>	0.6	6.67	9.00	1.35	0.82	1.20	0.32	2.33
20	<i>R. apiculata</i>	0.20	3.33	6.00	1.80	0.27	0.60	0.18	1.05
21	<i>H. thiacous</i>	0.83	16.67	5.00	0.30	1.14	2.99	0.59	4.72
22	<i>X. mekongensis</i>	0.33	10.00	3.33	0.33	0.45	1.80	0.39	2.64
23	<i>B. tersa</i>	0.13	66.00	2.00	0.30	0.18	1.20	0.06	1.44
24	<i>P. paludosa</i>	0.23	6.67	3.50	0.53	0.32	1.20	0.15	1.67
Total		73.33	550.00	169.61	11.7	100.00	100	100	300

* A/F Ratio- below 0.025- regular distribution/ between 0.025 to 0.05- random distribution/ More than 0.05- contagious distribution

Table 1B. Phytosociological parameters of Phitarkanika Block

Table 1C: Phytosociological Parameters in Thakurdia Block

Sl. No.	Species	Density	% Frequency	% Abundance	Abundance/ Frequency Ratio	Relative Density	Relative Frequency	Relative Dominance	I.V.I
1	<i>H. fomes</i>	8.33	43.33	19.23	0.44	5.17	10.74	6.22	22.13
2	<i>E. agallocha</i>	58.20	83.33	69.84	0.84	36.13	20.66	37.17	93.95
3	<i>C. decandra</i>	42.27	80.00	52.83	0.66	26.24	19.83	10.83	56.90
4	<i>P. paludosa</i>	1.60	16.67	9.60	0.58	0.99	4.13	0.76	5.89
5	<i>A. alba</i>	7.27	30.00	24.22	0.81	4.51	7.44	7.78	19.73
6	<i>A. officinalis</i>	0.50	13.33	3.75	0.28	0.31	3.31	1.72	5.34
7	<i>R. mucronata</i>	0.30	6.67	4.50	0.68	0.19	1.65	0.79	2.63
8	<i>T. populnea</i>	0.17	10.00	1.67	0.17	0.10	2.48	0.21	2.80
9	<i>A. rotundifolia</i>	2.03	30.00	6.78	0.23	1.26	7.44	2.31	11.01
10	<i>L. racemosa</i>	18.77	33.33	56.30	1.69	11.65	8.26	19.69	39.61
11	<i>X. granatum</i>	0.1	3.33	3.00	0.90	0.06	0.83	0.21	1.10
12	<i>A. corniculatum</i>	18.70	26.67	70.13	2.63	11.61	6.61	6.91	25.13
13	<i>S. caeseolaris</i>	0.17	6.67	2.50	0.38	0.10	1.65	0.83	2.59
14	<i>A. marina</i>	2.47	10.00	24.67	2.47	1.53	2.48	4.11	8.12
15	<i>S. apetala</i>	0.13	3.33	4.00	1.20	0.08	0.83	0.41	1.32
16	<i>K. candel</i>	0.10	6.67	1.50	0.23	0.06	1.65	0.04	1.76
Total		161.10	403.33	354.52	14.19	100.00	100.00	100.00	300.00

* A/F Ratio- below 0.025- regular distribution/ between 0.025 to 0.05- random distribution/ More than 0.05- contagious distribution

Table 1C. Phytosociological parameters of Thakurdia Block

Table 1D: Phytosociological Parameters in Kakranasi Block

Sl. No.	Species	Density	% Frequency	Abundance	Abundance/ Frequency Ratio	Relative Density	Relative Frequency	Relative Dominance	L.V.I
1	<i>A. alba</i>	9.7	30	32.33	1.08	7.16	7.38	7.15	21.69
2	<i>C. decandra</i>	37.53	70	53.62	0.77	27.70	17.21	14.50	59.41
3	<i>A. corniculatum</i>	1.5	13.33	11.25	0.84	1.11	3.28	0.44	4.83
4	<i>H. fomes</i>	8.67	53.33	16.25	0.30	6.40	13.11	7.68	27.19
5	<i>A. rotundifolia</i>	1.07	26.67	4.00	0.15	0.79	6.56	1.35	8.70
6	<i>S. caseolaris</i>	10.13	30	33.78	1.13	7.48	7.38	12.85	27.70
7	<i>A. officinalis</i>	12.13	56.67	21.41	0.38	8.95	13.93	14.46	37.35
8	<i>L. racemosa</i>	1.5	13.33	11.25	0.84	1.11	3.28	1.06	5.44
9	<i>E. agallocha</i>	51.93	66.67	77.90	1.17	38.33	16.39	38.20	92.92
10	<i>X. granatum</i>	0.13	10.00	1.33	0.13	0.10	2.46	0.40	2.96
11	<i>R. apiculata</i>	0.1	6.67	1.50	0.23	0.07	1.64	0.67	2.38
12	<i>T. populnea</i>	0.07	3.33	2.00	0.60	0.05	0.82	0.10	0.97
13	<i>X. mekongensis</i>	0.10	3.33	3.00	0.90	0.07	0.82	0.26	1.16
14	<i>R. mucronata</i>	0.40	6.67	6.00	0.90	0.30	1.64	0.37	2.31
15	<i>H. filiceous</i>	0.30	6.67	4.50	0.68	0.22	1.64	0.19	2.05
16	<i>B. gymnorhiza</i>	0.07	6.67	1.00	0.15	0.05	1.64	0.13	1.81
17	<i>S. apetala</i>	0.17	3.33	5.00	1.50	0.12	0.82	0.19	1.13
Total		135.5	406.67	286.13	11.74	100.00	100	100	300

* A/F Ratio- below 0.025- regular distribution/ between 0.025 to 0.05- random distribution/ More than 0.05- contagious distribution

Table 1D. Phytosociological parameters of Kakranasi Block

From list of species encountered through quadrat surveys of trees and seedlings (Table 2), it is observed that the family Rhizophoraceae and Meliaceae represented maximum number of species followed by Avicenniaceae. Bhitarkanika is the most species rich site with 24 species and Thakurdia has the lowest species number with 16 species (Table 3). Bhitarkanika has the highest mean species value per quadrat (5.56 species per quadrat). The average value for all the forest blocks is 4.69 species per quadrat. Ellison (2002) established a correlation between latitude and longitude and species richness and observed that the species richness is higher (> 30 to 55 species) between 0 and 200 N lat and at 70 and 1350 E long. Species richness is highest in the Indo West Pacific and declines relatively smoothly from 1000 E which is the longitude of peak species richness (Ellison et al. 1999).

Table 2. Mangrove and associated species in the study area

Sl No	Species encountered through quadrat survey	Species encountered through seedling survey	Other species encountered during survey
	Dicotyledons		
1	Acanthaceae		
		<i>Acanthus ilicifolius</i>	
2	Aizoaceae		
		<i>Sesuvium portulacastrum</i>	
3	Apocynaceae		
	<i>Cerbera manghas</i>	<i>Cerbera manghas</i>	

4	Avicenniaceae		
	<i>Avicennia alba</i>		
	<i>Avicennia officinalis</i>	<i>Avicennia officinalis</i>	
	<i>Avicennia marina</i>		
5	Caesalpiniaceae		
		<i>Caesalpinia crista</i>	
	<i>Cynometra ramiflora</i>	<i>Cynometra ramiflora</i>	
	<i>Intsia bijuga</i>	<i>Intsia bijuga</i>	
6	Chenopodiaceae		
			<i>Salicornia brachiata</i>
			<i>S. maritima</i>
7	Combretaceae		
	<i>Lumnitzera racemosa</i>		
8	Euphorbiaceae		
	<i>Excoecaria agallocha</i>	<i>Excoecaria agallocha</i>	
9	Malvaceae		
	<i>Thespesia populnea</i>	<i>Thespesia populnea</i>	
	<i>Hibiscus tiliaceus</i>	<i>Hibiscus tiliaceus</i>	
10	Meliaceae		
	<i>Amoora cucullata</i>		
	<i>Xylocarpus granatum</i>	<i>Xylocarpus granatum</i>	
	<i>Xylocarpus mekongensis</i>	<i>Xylocarpus mekongensis</i>	
	<i>Xylocarpus molluccensis</i>	<i>Xylocarpus molluccensis</i>	
11	Myrsinaceae		
	<i>Aegiceras corniculatum</i>	<i>Aegiceras corniculatum</i>	
12	Papilionaceae		
		<i>Dalbergia spinosa</i>	
	<i>Pongamia pinnata</i>	<i>Pongamia pinnata</i>	
13	Peripocaceae		
			<i>Finlaysonia obovata</i>
14	Plumbaginaceae		

	<i>Aegialitis rotundifolia</i>		
15	Rhizophoraceae		
	<i>Bruguiera gymnorhiza</i>	<i>Bruguiera gymnorhiza</i>	
	<i>Ceriops decandra</i>	<i>Ceriops decandra</i>	
	<i>Kandelia candel</i>	<i>Kandelia candel</i>	
	<i>Rhizophora apiculata</i>	<i>Rhizophora apiculata</i>	
16	Rutaceae		
			<i>Merope angulata</i>
17	Salvadoraceae		
			<i>Salvadora persica</i>
18	Sonneratiaceae		
	<i>Sonneratia apetala</i>	<i>Sonneratia apetala</i>	
	<i>Sonneratia caeseolaris</i>	<i>Sonneratia caeseolaris</i>	
19	Sterculiaceae		
	<i>Heritiera fomes</i>	<i>Heritiera fomes</i>	
	<i>Heritiera littoralis</i>	<i>Heritiera littoralis</i>	
20	Tamaricaceae		
	<i>Tamarix troupii</i>	<i>Tamarix troupii</i>	
21	Tiliaceae		
	<i>Brownlowia tersa</i>	<i>Brownlowia tersa</i>	
22	Verbenaceae		
			<i>Clerodendrum inerme</i>
	Monocotyledons		
23	Arecaceae		
	<i>Phoenix paludosa</i>	<i>Phoenix paludosa</i>	
24	Flagellariaceae		
			<i>Flagellaria indica</i>
25	Poaceae		
		<i>Myriostachya wightiana</i>	
		<i>Porteresia coarctata</i>	
26	Polypodiaceae		

(fern)	<i>Acrostichum aurum</i>	

A total of 22 families of Dicotyledons and 4 families of Monocotyledons were represented across all sites in Bhitarkanika Mangrove ecosystem. A total of 43 species of mangrove and associated plants belonging to 32 genera were recorded from 26 families of Angiosperms. The flora is extremely diverse in the estuarine regions of Bhitarkanika, (Banerjee & Rao 1985, 1990). Abundance of phanerogams is presumably higher than that of the Sunderbans Gangetic delta. Though the factors influencing biodiversity and floristic richness in each deltaic region is not fully understood (Duke et al. 1998), the assumption is that the propagules originated in the Sunderbans are water buoyant and dispersed to the nearest deltaic area which is the mouth of the Mahanadi river. This could explain the high degrees of relationship between the flora of the Gangetic and the Mahanadi deltas (Blasco & Aizpuru, 2002). *H. fomes*, *Sonneratia. griffithii* and *Aegialitis rotundifolia* Roxb. are endemic to the coastal part of South Asia (Blasco et al. 2001) and later two species are not recorded during the study.

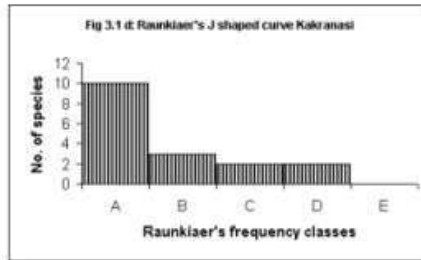
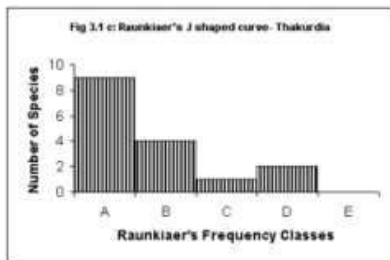
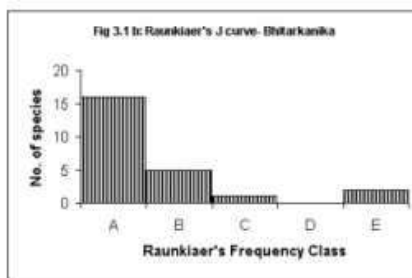
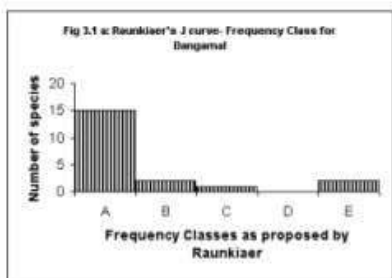
Table 3. Number of species/ mean number of species per quadrat at various sites

Forest Block	Total number of species	Mean Number of tree species per Quadrat ($\pm$ SE)
Dangmal	20	5.16 $\pm$ 0.23
Bhitarkanika	24	5.56 $\pm$ 0.27
Thakurdia	16	4.03 $\pm$ 0.22
Kakranasi	17	4.06 $\pm$ 0.18

Table 3. Number of species / mean number of species at various quardat sites

Raunkiaer's Frequency Class Distribution

Raunkiaer's Law of Frequency (in graphical form referred to as Raunkiaer's J shaped distribution curves) was studied (Raunkiaer, 1934). The law (also known as the law of homogeneity) was expressed as $A > B > C \geq D \geq E$, wherein, A to E are frequency classes suggested by Raunkiaer's from 0 to 100. According to Kershaw (1973), "the increase in class E reflects the theoretical infinite range of density and contrasts with the more strictly defined limits for classes A, B, C, and D. This E class has a density range greatly exceeding frequency classes A to D. Accordingly many more species fall into this class, despite the general tendency for 'common' species to be relatively few in number in a community" (Fig.1).



Raunkiaer's Frequency classes for the study sites

Species Diversity

The species diversity depends upon adaptation of species and increases with stability of community (Singh et al, 1994). Species diversity was 0.72, 0.82, 0.75, 0.73, respectively, in Dangmal, Bhitarkanika, Thakurdia, and Kakranasi blocks. The above data indicate that Bhitarkanika site is highly diverse and Dangmal the least. The Concentration of Dominance was 0.28, 0.25, 0.23, 0.24, respectively, in Dangmal, Bhitarkanika, Thakurdia, and Kakranasi indicating the dominance is more pronounced in Dangmal block (Table 4). The Dangmal and Kakranasi blocks exhibited least similarity in species composition (59.46 %) with each other followed by Thakurdia and Bhitarkanika (65 %), Thakurdia and Kakranasi (78.79 %), and Bhitarkanika and Dangmal blocks (86.36%) (Table 5). The latter two sites are adjacent to each other and thereby there is a great deal of species mix. In the Eastern hemisphere number of mangrove species reported by Tomlinson (1986) and Duke (1992) are 58 compared to only 12 in Western hemisphere. High mangrove diversity in South East Asian region is because it has been the center of origin of mangrove speciation. There is presence of adjacent diverse terrestrial flora which has enabled diversity to increase and prevented extinctions (Ricklefs & Latham, 1993). Duke et al. (1998) found the Indo-Malaysia region with most mangrove species number with 48 species.

Table 4. Species diversity and Concentration of dominance in the study area

Forest Block	Species Diversity	Concentration of Dominance
Dangmal	0.72	0.28
Bhitarkanika	0.82	0.25
Thakurdia	0.75	0.23
Kakranasi	0.73	0.24

Table 4. Species diversity and concentration of dominance in the study area**Table 5.** Similarity Index in species composition among study sites

	Dangmal	Bhitarkanika	Thakurdia	Kakranasi
Dangmal	100			
Bhitarkanika	86.36	100		
Thakurdia	61.11	65	100	
Kakranasi	59.46	73.17	78.79	100

Table 5. Similarity index in species composition between study sites

Table 6. Total forest block wise (for all the species together) Basal Area and number of plants at study sites (per Hectare)

Forest Block	Total Basal Area (m ² per hectare)	Total number of plants per hectare
Dangmal	24.37	7186
Bhitarkanika	37.04	7326
Thakurdia	21.69	16094
Kakranasi	23.87	13536
Average for the area	26.74	11036

Table 6. Total Basal Area and number of species per study site

The species diversity is higher in the India mangrove ecosystems compared to that of Latin America and Africa. Large physical forces in tidewater, salinity level, and lack of stable substratum are some of the natural factors that affect the species diversity (Pathway et al. 2002). Studies on the changes in the species composition for Bhitarkanika are not available like other mangrove areas on the east coast i.e., Sunderbans, Pichavaram and Muthupet, Guava, and Andaman & Nicobar Islands (Kannupandi & Kannan, 1998; Caratini et al., 1973; Mathuda, 1959; Azariah et al. 1992). *H. fomes* is known to require low soil and water salinities. When the salinity increases, the species becomes stunted, rare, and ultimately disappears. It is known to be 'top dying' (trees shedding their leaves due to stress and could be dying) in parts of Bangladesh (Siddiqi, 1998) and Sunderban because of the increase in dry season demand for freshwater, damming of rivers and apparent downstream effects of increase in soil salinities (Blasco et al. 2001). Therefore, this species is a leading dominant in the mangroves of Bhitarkanika, and thereby confirms to the availability of good ecological conditions that harbours it well. However, caution has to be exercised to see that the preconditions that are now suitable continue to be so. In the mangrove areas of Myanmar *H. fomes* was available in plenty between the mouth of Mayu and Lamu city about 50 years back and has been completely depleted due to high salinity stress (Blasco, et al. 2001). Others have also reported about die back of *Heritiera fomes* due to adverse increase in soil salinity (Christensen & Snedaker, 1984; Chaffey et al. 1985). Several authors have worked on phytosociological parameters of Tropical Mangroves. In French Guiana forests Fromard et al. (1998) observed that in mature coastal and adult riverine mangrove sites *Avicennia* exhibited the highest value of IVI (144 - 181) followed by *Rhizophora* species. These mangrove types are more frequent in Guiana and are homogenous and dominated by *A. germinatus*. The mangroves on sea fronts generally have high basal area (24.6 - 33.6 m² ha⁻¹). The riverine mangrove ecosystems are more diversified and mixed type and richer in species having tree density. However, the species, *H. fomes* and *E. agallocha* exhibited dominance with high value of IVI followed by *A. officinalis* in the mangroves of Orissa coast at Bhitarkanika.

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4

Annexure-VI

Floral & Faunal diversity of Bhitarkanika Mangrove Eco-system with RET Status and IUCN Status furnished below.

Sl.No.	Local Name	Species	Family	IUCN Status
Tree:-				
1	Banarua	<i>Aegialities rotundifolia</i>	<i>Plumbaginaceae</i>	E
2	Kaliachua	<i>Bruguiera cylindrica</i>	<i>Rhizophoraceae</i>	E
3	Bandari	<i>Bruguieragymnorhiza</i>	<i>Rhizophoraceae</i>	CE
4	Bandari	<i>Bruguierasexangula</i>	<i>Rhizophoraceae</i>	LC
5	Bani	<i>Avicennia officinalis</i>	<i>Avicenniaceae</i>	E
6	Churanda	<i>Lumnitzera racemosa</i>	<i>Combretaceae</i>	E
7	Dhala Bani	<i>Avicennia alba</i>	<i>Avicenniaceae</i>	CE
8	Garani	<i>Ceriopsdecandra</i>	<i>Rhizophoraceae</i>	E
9	Garani	<i>Ceriops tagal</i>	<i>Rhizophoraceae</i>	LC
10	Gosinga	<i>Dolichandronepathacea</i>	<i>Bignoniaceae</i>	-
11	Guan	<i>Excoecariaagallocha</i>	<i>Euphorbiaceae</i>	V
12	Habali	<i>Thespesia populnea</i>	<i>Malvaceae</i>	-
13	Hentala	<i>Phoenix paludosa</i>	<i>Arecaceae</i>	E
14	Dot	<i>Bruguiera parviflora</i>	<i>Rhizophoraceae</i>	CE
15	Keruan	<i>Sonneratia apetala</i>	<i>Sonneratiaceae</i>	E
16	Kharsi	<i>Aegicerascorniculatum</i>	<i>Myrsinaceae</i>	E
17	Masitha	<i>Intsiabijuga</i>	<i>Caesalpiniaceae</i>	NT
18	Ooanra	<i>Aglaia cucullata</i>	<i>Meliaceae</i>	-
19	Orua	<i>Sonneratiacaseolaris</i>	<i>Sonneratiaceae</i>	E
20	Orua/Chakada	<i>Sonneratiagriffithii</i>	<i>Sonneratiaceae</i>	CE
21	Pani Amba	<i>Cerbera odollam</i>	<i>Apocynaceae</i>	LC
22	Pitamari	<i>Xylocarpusmekongensis</i>	<i>Meliaceae</i>	E
23	Pitakorua	<i>Xylocarpusmolluccensis</i>	<i>Meliaceae</i>	LC
24	Rai	<i>Rhizophoraapiculata</i>	<i>Rhizophoraceae</i>	E
25	Rai	<i>Rhizophoramucronata</i>	<i>Rhizophoraceae</i>	V
26	Shlshumar	<i>Xylocarpus granatum</i>	<i>Meliaceae</i>	E
27	Sinduka	<i>Kandeliacandel</i>	<i>Rhizophoraceae</i>	E
28	Singada	<i>Cynometrairipa</i>	<i>Caesalpiniaceae</i>	-
29	Singala Bani	<i>Avicennia marina</i>	<i>Avicenniaceae</i>	E
30	Sundari	<i>Heritiera fomes</i>	<i>Sterculiaceae</i>	E
31	Jagula	<i>Tamarix dioica</i>	<i>Tamaricaceae</i>	-
32	Jagula	<i>Tamarix troupii</i>	<i>Tamaricaceae</i>	E
33	MIriga	<i>Salvadora persica</i>	<i>Salvadoraceae</i>	-
34	Nypa palm	<i>Nypa fruticans</i>	<i>Arecaceae</i>	LC

Herb:-				
35	Batula	<i>Salicornia brachiata</i>	<i>Chenopodiaceae</i>	NT
36	Goda Bani	<i>Sesuvium portulacastrum</i>	<i>Aizoaceae</i>	E
37	Giria saga	<i>Suaeda maritima</i>	<i>Chenopodiaceae</i>	E
38	Giria saga	<i>Suaeda monoica</i>	<i>Chenopodiaceae</i>	E
39	Giria saga	<i>Suaedanudiflora</i>	<i>Chenopodiaceae</i>	E
40	Harakancha	<i>Acanthus ilicifolius</i>	<i>Acanthaceae</i>	E
41	Harakancha	<i>Acanthus volubilis</i>	<i>Acanthaceae</i>	LC
42	Panikenduli	<i>Crinum asiaticum</i>	<i>Amaryllidaceae</i>	-
43	Panikenduli	<i>Crinum defixum</i>	<i>Amaryllidaceae</i>	-
Shrub:-				
44	Ghigidi	<i>Sapium indicum</i>	<i>Euphorbiaceae</i>	LC
45	Bania	<i>Hibiscus tiliaceus</i>	<i>Malvaceae</i>	-
46	Bana Lembu	<i>Merope angulata</i>	<i>Rutaceae</i>	-
47	Luni Kia	<i>Pandanus foetidus</i>	<i>Pandanaceae</i>	-
	Lati Sundari	<i>Brownlowia tersa</i>	<i>Tiliaceae</i>	E
Creeper:-				
48	Bahumruga	<i>Flagellaria indica</i>	<i>Flagellariaceae</i>	LC
49	Batra	<i>Salacia chinensis</i>	<i>Hippocrateaceae</i>	NT
50	Chiani	<i>Clerodendrum inerme</i>	<i>Verbenaceae</i>	E
51	Gohirakanta	<i>Dalbergia spinosa</i>	<i>Fabaceae</i>	-
52	Katiranai	<i>Derris trifoliata</i>	<i>Fabaceae</i>	E
53	Katiranai	<i>Derris scandens</i>	<i>Fabaceae</i>	-
54	Latirai	<i>Finlaysonia obovata</i>	<i>Periplocaceae</i>	CE
55	Katukala	<i>Sarcolobus carinatus</i>	<i>Asclepiadaceae</i>	-
56	Nentei	<i>Caesalpinia crista</i>	<i>Caesalpiniaceae</i>	-
57	Gila	<i>Caesalpinia bonduc</i>	<i>Caesalpiniaceae</i>	-
Grass:-				
58	Dhani Dhana	<i>Porteresia coarctata</i>	<i>Poaceae</i>	V
59	KeutiGhasa	<i>Cyperus corymbosus</i>	<i>Cyperaceae</i>	-
60	LuniGhasa	<i>Fimbristylis ferruginea</i>	<i>Cyperaceae</i>	-
61	Nala	<i>Phragmites karka</i>	<i>Poaceae</i>	
62	Nalia Ghasa	<i>Myriostachya wightiana</i>	<i>Poaceae</i>	E
63	Tianshi	<i>Cyperus compactus</i>	<i>Cyperaceae</i>	LC
Fern:-				
64	Kharkhari	<i>Acrostichum aureum</i>	<i>Acrostichaceae</i>	LC

E-Endangered V-Vulnerable LC-Least Concern CE-Critically Endangered NT-Near Threatened

LIST OF BIRDS

Sl.No	Family	CommonName	ScientificName	Status
1.	<i>Podicipedidae</i>	Littlegrebe	<i>Tachybaptusruficollis</i>	LM,Rare
2.	<i>Pelecanidae</i>	SpotbilledPelican	<i>Pelicanusphilippensis</i>	-do-
3.	<i>Phalacrocoracidae</i>	Littlecormorant	<i>Phalacrocoraxniger</i>	Res.
4.		Greatcormorant	<i>Phalacrocoraxcarbo</i>	Rare
5.		Darter	<i>Anhingamelanogaster</i>	Rare,Res.
6.	<i>Ardeidae</i>	Cattleegret	<i>Bubulcusibis</i>	Res.Comm.
7.		Gretegret:	<i>(Casmerodiusalbus</i>	Res.
8.		Intermediateegret	<i>Mesophoyxintermedia</i>	Res.
9.		Littleegret:	<i>Egrettagarzetta</i>	Res.
10.		Westernreefegret	<i>Egrettaularis</i>	W.M.
11.		Black-crownednightheron	<i>Nycticoraxnycticorax</i>	Res.
12.		Greyheron	<i>Ardeacinerea</i>	Res.
13.		Purpleheron	<i>Ardeapurpurea</i>	Res.
14.		Indianpondheron	<i>Ardeolabacchus</i>	Res.
15.		LittleGreenheron	<i>Butoridesstriatus</i>	Res.
16.		BlackBittern	<i>Ixobrychusflavicollis</i>	Res.
17.		Yellowbittern	<i>Ixobrychussinensis</i>	Res.
18.		Cinnamonbittern	<i>Ixobrychuscinnamomeus</i>	Res.
19.	<i>Ciconiidae</i>	LesserAdjutant	<i>Leptoptilosjavanicus</i>	Res.
20.		Asianopenbill	<i>Anastomusoscitans</i>	Res.
21.		Paintedstork	<i>Mycterialeucocephala</i>	Res.
22.		Blackneckedstork	<i>Ephippiorhynchus asiaticus</i>	W.M.
23.	<i>Threskiornithidae</i>	Blackheadedibis	<i>Threskiornismelanocephala</i>	Res.
24.		Eurasianspoonbill	<i>Platalealeucorodia</i>	W.M
25.	<i>Anatidae</i>	Gadwall	<i>Anasstrepera</i>	W.M.
26.		Garganey	<i>Anasquerquedula</i>	W.M.
27.		NorthernPintail	<i>Anasacuta</i>	W.M.
28.		Eurasianwigeon:	<i>AnasPenelope</i>	W.M.
29.		Commonteal	<i>Anascrecca</i>	W.M.
30.		Lesserwhistlingduck	<i>Dendrocygnajavanica</i>	Res.
31.		Fulvouswhistlingduck	<i>Dendrocygnabicolor</i>	Res.
32.		RuddyShelduck	<i>Tadornaferruginea</i>	W.M.
33.		NorthernShoveller	<i>Anasclypeata</i>	W.M.
34.		CottonPygmy Goose	<i>Nettapuscoromandelianus</i>	Res.
35.		CommonPochard	<i>Aythyaferina</i>	W.M.
36.		Baer'sPochard	<i>Aythyaaberti</i>	W.M.

37.	<i>Accipitridae</i>	Bootedhawkeagle	<i>Hieraaetus pennatus</i>	Res, L.M.
38.		Changeablehawkeagle	<i>Spizaetus cirrhatus</i>	W.M.
39.		Crestedserpenteagle	<i>Spilornis cheela</i>	Res, L.M.
40.		Short-toedsnakeeagle	<i>Circaetus gallicus</i>	Res.
41.		White-belliedsea eagle	<i>Haliaeetus leucogaster</i>	Res.
42.		Tawnyeagle	<i>(Aquila rapax</i>	L.M.
43.		Blackeagle	<i>Ictinaetus malayensis</i>	L.M.
44.		Greaterspottedeagle	<i>Aquila clanga</i>	L.M.
45.		Lesserspottedeagle	<i>Aquila pomarina</i>	L.M.
46.		Pallas'sfish eagle	<i>Haliaeetus leucoryphus</i>	W.M.
47.		EurasianMarshharrier	<i>Circus aeruginosus</i>	W.M.
48.		Piedharrier	<i>Circus melanoleucos</i>	W.M.
49.		Pallidharrier	<i>Circus macrourus</i>	W.M.
50.		EurasianSparrowhawk	<i>Accipiter nisus</i>	W.M.
51.		Shikra	<i>Accipiter badius</i>	Res, Com.
52.		Brahminykite	<i>Haliastur indus</i>	L.M, Rare
53.		Whitebackedvulture	<i>Gyps bengalensis</i>	Res.
54.		Osprey:	<i>Pandion haliaetus</i>	W.M.
55.		Blackkite	<i>Milvus migrans</i>	Res, L.M.
56.		Black-shoulderedKite	<i>Elanus caeruleus</i>	Res
57.		OrientalHoneybuzzard:	<i>Pernis ptilorhynchus</i>	W.M. Rare
58.	<i>Falconidae</i>	Sakerfalcon	<i>Falco cherrug</i>	L.M, Rare
59.		Rednecked falcon	<i>Falco chichquera</i>	LM, Rare
60.		Peregrinefalcon	<i>Falco peregrinus</i>	L.M, W.M.
61.		Commonkestrel	<i>Falco tinnunculus</i>	W.M.
62.	<i>Phasianidae</i>	Grayfrancolin	<i>Francolinus pondicerianus</i>	Rare
63.		Redjunglefowl	<i>Gallus gallus</i>	Res.
64.	<i>Rallidae</i>	Slatybreastedrail	<i>Rallus striatus</i>	Res.
65.		Commoncoot	<i>Fulica atra</i>	W.M, Rare
66.		Watercock	<i>Gallicrex cinerea</i>	Res.
67.		Purpleswamphen	<i>Porphyrio porphyrio</i>	Res.
68.		Commonmoorhen	<i>Gallinula chloropus</i>	Res.
69.	<i>Jacaniidae</i>	Bronze-wingedJacana	<i>Metopidius indicus</i>	Res.
70.		Pheasant-tailedJacana	<i>Hydrophasianus chirurgus</i>	Res.
71.	<i>Charadriidae</i>	Grey-headedlapwing	<i>(Vanellus cinereus</i>	W.M.
72.		Redwattledlapwing	<i>(Vanellus indicus</i>	Res.
73.		Whitetailedlapwing	<i>Vanellus leucurus</i>	W.M, Rare
74.		Yellowwattledlapwing	<i>Vanellus malarbaricus</i>	Res.
75.		CommonringedPlover:	<i>Charadrius hiaticula</i>	W.M.
76.		LittleringedPlover	<i>Charadrius dubius</i>	W.M.
77.		KentishPlover	<i>Charadrius alexandrinus</i>	W.M.

78.		LesserSandPlover	<i>Charadriusmongolus</i>	W.M.
79.		GreatersandPlover	<i>Charadriusleschenaultii</i>	W.M.
80.		PacificGoldenPlover	<i>Pluvialisfulv</i>	W.M.
81.		GreyPlover:	<i>Pluvialisquatarola</i>	W.M.
82.		Eurasiancurlew	<i>Numeniusarquata</i>	W.M.
83.		Whimbrel	<i>Numeniusphaeopus</i>	Res,W.M.
84.		RedKnot	<i>Calidriscautus</i>	W.M.
85.		Dunlin	<i>Calidrisalpina</i>	W.M.
86.		BlacktailedGodwit	<i>Limosalimosa</i>	W.M.
87.		BartailedGodwit	<i>Limosalapponica</i>	W.M,Rare
88.		CommonRedshank	<i>Tringatotanu</i>	W.M.
89.		SpottedRedshank	<i>Tringaerythropus</i>	W.M,Rare
90.		CommonGreenshank	<i>Tringanebularia</i>	W.M,Com.
91.		SpottedGreenshank	<i>Tringaguttifer</i>	W.M,Rare
92.		Greaterpaintedsnipe	<i>Rostratulabenghalensis</i>	Res.
93.		Jacksnipe	<i>Lymnocyptesminimus)</i>	W.M.
94.		Commonsnipe	<i>Gallinagogallinago</i>	W.M.
95.		Pintailsnipe:	<i>Gallinagostenura</i>	W.M.
96.		CommonSandpiper	<i>Tringahypoleucos</i>	W.M.
97.		CurlewSandpiper	<i>Calidristestacea</i>	W.M,Com.
98.		Woodsandpiper	<i>Tringaglareola</i>	W.M,Com.
99.		GreenSandpiper	<i>Tringaochropus</i>	W.M,Com.
100.		TerekSandpiper	<i>Tringaterek)</i>	W.M.
101.		MarshSandpiper	<i>Tringastagnatilis</i>	W.M.
102.		Ruddy turnstone	<i>Arenariainterpres</i>	W.M.
103.		Spoonbilledsandpiper	<i>Eurynorhynchus pygmeus</i>	W.M.
104.		Ruffand Reeve	<i>Philomachuspugnax</i>	W.M.
105.		Little stint	<i>Calidrisminuta</i>	W.M.
106.		Temminck'sstint	<i>Calidristemminckii</i>	W.M,Com.
107.		Longtoedstint	<i>Calidrissubminu</i>	W.M,Rare
108.		Sanderling	<i>Calidrisalba</i>	W.M,Rare.
109.		RedNeckedPhalaropus	<i>Phalanoslobatus</i>	W.M,Rare
110.		CrabPlover	<i>Dromasardeola</i>	W.M.
111.	<i>Rostratulidae</i>	Greaterpaintedsnipe	<i>Rostratulabenghalensis</i>	Rare
112.	<i>Recurvirostridae</i>	Blackwingedstilt	<i>Himantopus</i> <i>himantopus</i>	L.M.
113.		Piedavocet	<i>Recurvirostraavosetta</i>	W.M.
114.	<i>Burhinidae</i>	Greaterthicknee	<i>Esacusrecurvirostris)</i>	W.M,Rare
115.		Eurasianthicknee	<i>Burhinusoedicnemus</i>	W.M.
116.	<i>Glareolidae</i>	OrientalPratincole	<i>Glareolamaldivarum</i>	W.M.
117.		SmallPratincole	<i>Glareolalactea</i>	Rare

118.	<i>Laridae</i>	Blackheadedgull	<i>Larusridibundus</i>	W.M.
119.		Brownheadedgull	<i>Larusbrunnicephalu</i>	W.M.
120.		Heuglin'sGull:	<i>Larusbeuglin</i>	W.M.
121.		Pallas'sGull	<i>Larusichthyaetus)</i>	W.M.
122.		Blackbelliedterns	<i>Sternaacuticauda</i>	W.M.
123.		Capsiantern:	<i>Hydroprogneaspia</i>	W.M
124.		Greatercrestedtern	<i>Sternabergii</i>	W.M
125.		Lessercrestedtern	<i>Sternabengalensis</i>	W.M.
126.		Gullbilledtern	<i>Gelochelidonnilotica</i>	L.M
127.		Rivertern	<i>Sternaaurantia</i>	L.M.
128.		Whiskeredtern	<i>Chlidoniashybrida</i>	L.M.
129.		Indianskimmer	<i>Rynchopsalbicollis</i>	W.M,Rare
130.	<i>Haematopodidae</i>	Eurasianoystercatcher	<i>Haematopusostralegus</i>	W.M.
131.	<i>Columbidae</i>	Emeralddove	<i>Chalcophapsindica</i>	Res.
132.		Spotteddove	<i>Streptopeliachinensis</i>	Res.
133.		Eurasiancollareddove	<i>Streptopeliadecaocto</i>	Res.
134.		Orientalturtledove	<i>Streptopeliaorientalis</i>	L.M
135.		BluerockPigeon:	<i>Columbalivia)</i>	Res.
136.		Orangebreasted GreenPigeon	<i>Treronbicincta</i>	Res.,L.M
137.		PalecappedPigeon:	<i>Columbapunicea)</i>	L.M,Rare
138.		Thick-billedgreenpigeon:	<i>Treroncurvinastro</i>	L.M,Rare
139.	<i>Psittacidae</i>	AlexandrineParakeet	<i>Psittaculaeupatria</i>	L.M,Rare
140.		RoseringedParakeet	<i>Psittaculakrameri</i>	Res.,Rare
141.		BlossomheadedParakeet	<i>Psittacularoseate</i>	Res.,Very are
142.		RedbreastedParakeet:	<i>Psittaculaalexandri</i>	L.M,Rare
143.	<i>Cuculidae</i>	Chestnut-wingedcuckoo	<i>Clamatorcoromandus</i>	L.M.
144.		Piedcuckoo	<i>Clamatorjacobinus</i>	L.M
145.		Commonhawkcuckoo	<i>Hierococcyxvarius</i>	Res.
146.		Eurasiancuckoo	<i>Cuculuscanoru</i>	L.M.
147.		Orientalcuckoo:	<i>Cuculussaturatus</i>	Rare
148.		Indianplaintivecuckoo	<i>Cacomantispasserinus</i>	Rare
149.		AsianKoel	<i>Eudynamysscolopacea</i>	Res.
150.		Largegreenbilledma lkoha	<i>Phaenicophaeus viridirostris</i>	Res.
151.		Greatercoucal	<i>Centropussinensis</i>	Res.
152.	<i>Strigidae</i>	Barnowl	<i>Tytoalba</i>	Res.
153.		Brownfishowl	<i>Ketupazeylonensis</i>	Res.
154.		Spottedowlet	<i>Athenebrama</i>	Res.
155.		Collaredscopsowl	<i>Otusbakkamoena</i>	Res.
156.		Pallid scopsowl	<i>Otusbrucei</i>	Res.
157.		Eurasianscopsowl	<i>Otusscops</i>	Res.

158.	<i>Caprimulgidae</i>	GreyNightjar:	<i>Caprimulgusindicus</i>	Res.
159.		Large-tailedNightjar:	<i>Caprimulgusmacrurus</i>	Res.
160.	<i>Apodidae</i>	Asianpalmswift	<i>Cypsiurusparvus</i>	Res.
161.		Houseswift:	<i>Apusaffinis</i>	Res.
162.	<i>Alcedinidae</i>	Black-cappedkingfisher	<i>Helcyonpileata</i>	L.M
163.		Brownwingedkingfisher:	<i>(Halcyonamauroptera</i>	Res.
164.		RuddyKingfisher	<i>Halcyoncoromanda</i>	W. MV Rare.
165.		CollaredKingfisher	<i>Todiramphuschloris</i>	Res.
166.		PiedKingfisher:	<i>Cerylerudis</i>	Res.
167.		White-throatedKingfisher	<i>Halcyonsmyrnensis</i>	Res.
168.		CommonKingfisher:	<i>Alcedoatthis</i>	Res.
169.		Stork-billedKingfisher:	<i>Halcyoncapensis</i>	Res.
170.	<i>Meropidae-</i>	Bluetailedbee eater	<i>Meropsphillipinus</i>	S.M
171.		Greenbee eater	<i>Meropsorientalis</i>	Res.
172.		Chestnutheaded bee eater	<i>(Meropsleschenaulti</i>	L.M., Rare
173.	<i>Coracidae</i>	Indianroller	<i>Coraciasbenghalensis</i>	Res.
174.	<i>Upupidae</i>	Common hoopoe	<i>Upupaepops</i>	Res.
175.	<i>Bucerotidae-</i>	IndianGreyhornbill	<i>Ocyrocero birostris</i>	Res.
176.	<i>Capitonidae</i>	Bluethroatedbarbet	<i>(Megalaimaasiatica</i>	L.M.
177.		Brownheadedbarbet	<i>Megalaimazeylanica</i>	W.M
178.		Coppersmithbarbet	<i>Megalaima haemacephala</i>	Res
179.	<i>Picidae</i>	Grey-cappedpygmywoodpecker	<i>Dendrocopos canicapillus</i>	LM.Rare
180.		Stripe breastedwoodpecker	<i>Dendrocopos atratus</i>	Rare
181.		Fulvousbreastedwoodpecker	<i>Dendrocopos macei</i>	Res.
182.		Grey-headedwoodpecker	<i>Picuscanus</i>	Res.
183.		Rufouswoodpecker	<i>Celeusbrachyurus</i>	Res.
184.		Eurasianwryneck	<i>Jynx torquilla</i>	Res.
185.		Blackrumpedflameback:	<i>Dinopiumbenghalense</i>	Res.
186.		Greaterflameback	<i>Chrysocolaptes lucidus</i>	Res.
187.		SpeckledPiculate	<i>Picumnusinnominatus</i>	L.M
188.	<i>Pittidae</i>	IndianPitta	<i>Pittabrachyura</i>	L.M
189.		MangrovePitta:	<i>Pittamegarhyncha</i>	Res.
190.	<i>Alaudidae</i>	Bengalbushlark	<i>Mirafrascasamica</i>	W.M
191.		Singingbush lark	<i>Mirafracantillans</i>	W.M
192.		Indianbushlark	<i>Mirafractroptera</i>	Res.
193.		Ashycrownedsparrow lark	<i>Eremopterixgrisea)</i>	Res.

194.		Oriental skylark	<i>Alauda gulgula</i>	Res.
195.		Crested lark	<i>Galeridacristata</i>	Res.
196.		Greater short-toed lark	<i>Calandrellab achydactyla</i>	Rare
197.	<i>Hirundinidae</i>	Barn swallow	<i>Hirundonustica</i>)	W.M
198.		Red-rumped swallow	<i>Hirundodaurica</i>	W.M
199.		Asian house martin:	<i>Delichondasypus</i>	W.M
200.	<i>Daniidae</i>	Grey-backed shrike	<i>Laniustephronotus</i>	W.M
201.		Brown shrike	<i>Laniuscristatus</i>	Res.
202.	<i>Oriolidae</i>	Black hooded oriole	<i>Oriolusxanthornus</i>	Res.
203.		Eurasian golden oriole	<i>Oriolusoriolus</i>	W.M., Rare.
204.	<i>Dicruridae</i>	Black drongo	<i>Dicrurusmacrocerus</i>	Res.
205.		Ash drongo	<i>Dicrurusleucophaeus</i>	Res.
206.		White bellied drongo	<i>Dicruruscaerulescens</i>	Res.
207.		Sprangled drongo	<i>Dicrurushottentottus</i>	Res.
208.	<i>Sturnidae</i>	Asian pied starling	<i>Sturnuscontra</i>	Res.
209.		Brahmin starling	<i>SturnusPagodarum</i>	L.M., Rare
210.		Chestnut-tailed starling:		Res.
211.		Common Myna	<i>Acridotherestristis</i>	Res.
212.		Jungle Myna	<i>Acridotheresfuscus</i>	Res.
213.	<i>Curvidae</i>	Ruddy-breasted crows	<i>Porzanafusca</i>	Res.
214.		Large-billed crow	<i>Corvusmacrorhynchos</i>	Res.
215.		Rufous tree pie	(<i>Dendrocittabagabunda</i>	Res.
216.		House crow	<i>Corvussplendens</i>)	Res.
217.	<i>Campephagidae</i>	Black-winged cuckoo-shrike	<i>Coracinamelaschistos</i>	Res.
218.		Black-headed cuckoo-shrike	<i>Coracinamelanoptera</i>	Res.
219.		Large cuckoo-shrike	<i>Coracinamacei</i>	Res.
220.		Small minivet:	<i>Pericrocotusc innamomeus</i>	Res.
221.		Ashy minivet	<i>Perricrocotusdivaricatus</i>	W.M., Rare
222.	<i>Irenidae</i>	Common iora	<i>Aegithinatifolia</i>	Res. Common
223.		Blue-winged leaf bird	<i>Chloropsiscocbi nchinensis</i>	W.M., Rare
224.	<i>Pycnotidae</i>	Red-vented bulbul	<i>Pycnonotuscafer</i>	Res
225.		Red-whiskered bulbul	<i>Pycnonotusjocosus</i>	Res.
226.		White-throated bulbul	<i>Alophoixusflaveolus</i>	L.M., Rare
227.	<i>Muscicapidae-</i>	Common babbler	<i>Turdoidescaudatus</i>	Res.
228.		Jungle babbler	<i>Turdoidesstriatus</i>	Res.
229.		Striated babbler	<i>Turdoidesearlei</i>	Res.
230.		Striped babbler	<i>Macronousgulari</i>	Res.

231.		Chestnutcappedbabbler	<i>Timaliapileata</i>	Res.
232.		AshyPrinia	<i>Priniasocialis</i>	Res.
233.		PlainPrinia	<i>Priniainornata)</i>	Res.
234.		YellowbelliedPrinia	Prinia	Res.
235.		Common tailor bird	Orthotomussutorius	Res.
236.		Whitethroatedfantail:)	<i>(Rhipiduraalbicollis</i>	Res.
237.		Redthroatedflycatcher	<i>(Ficedulaparva</i>	Res.
238.		Bluethroatedflycatcher:	<i>Cyornisrubecoloides</i>	Res.
239.		Paradiseflycatcher	<i>Tarpsiphoneparadisi</i>	Res.
240.		Verditerflycatcher	<i>Eumyiasthalassila</i>	W.M
241.		Bluethroat	<i>Lusiniasevecicia</i>	W.M.
242.		Orientalmaggierobin	<i>Copsychussaularis</i>	Res.
243.		Blyth'sreedwarbler	Acrocephalus dumetorum	L.M.
244.		Clamorousreedwarbler	<i>Acrocephalusstentoreus</i>	W.M
245.		Greenishwarbler	<i>Phylloscopus trochiloides</i>	L.M., Common.
246.		Plainleafwarbler	<i>Phylloscopusneglectus</i>	W.M
247.		Paddyfieldwarbler:	Acrocephalusagricola	L.M.
248.		Brownishflankedbushwa rbler	Cettiafortipes	W.M.
249.		Palefootedbushwarbler	Cettiapallidipes	L.M.
250.		Gardenwarbler	Sylviaborin	Res.
251.		Commonchiffchaff	<i>(Phylloscopuscollybita</i>	W.M
252.		Blackredstart	<i>Phoenicurusochruros</i>	Res.,Rare
253.		Black-napedMonarch	<i>Hypothymisazurea</i>	Res.
254.		Orangeheadedgroundth rush	<i>Zootheracitrina</i>	V.rare
255.		Tickel'sthrush	<i>Turdusunicolor</i>	W.M.
256.		Streakedfantail-warbler	<i>Cisticoloajuncidis</i>	Common
257.	<i>Paridae</i>	Greattit	<i>Parusmajor)</i>	Res.
258.	<i>Motacillidae</i>	OlivebackedPipit	<i>Anthushodgsoni</i>	S.migrant.
259.		TreePipit	<i>Anthustriviali</i>	S.migrant
260.		TawnyPipit	<i>(Anthuscampestris</i>	S.migrant
261.		Richard'sPipit	<i>Anthusrichard</i>	Res.
262.		PaddyfieldPipit	<i>Anthusrufulus</i>	Res.
263.		Citrinewagtail:	<i>Motacillacireola</i>	W.M
264.		Grey-headedwagtail	<i>Motacillacinerea</i>	W.M.
265.		Yellowwagtai	<i>Motacillaflava</i>	W.M., Rare.
266.		Forestwagtail	Dendronanthusindicus	W.M.
267.		Whitewagtail	<i>Motacillaalba</i>	W.M.
268.	<i>Nectarinidae</i>	Loten'ssunbird	<i>Nectarinalotenia</i>	W.M.,Rare.
269.		OlivebackedSunbird	<i>(Nectarinajugularis)</i>	W.M.,Rare.

270.		PurplerumpedSunbird	<i>Nectarinazeylonica</i>	Res.
271.		Purplesunbird	<i>Nectarinaasiatica)</i>	Res.
272.	<i>Ploceidae</i>	Indiansilverbill:	<i>Lonchuramalabarica</i>	Res.
273.		Housesparrow	<i>Passerdomesticus</i>	Res.
274.		Bayaweaverbird	<i>Ploceusphilippinus</i>	Res.
275.		Blackbreasted weaverbird	<i>Ploceusbenghalensis</i>	Res.,Rare
276.		BlackheadedMunia	<i>Lonchuramalacca</i>	Res.
277.		ScalybreastedMunia:	<i>Lonchurapunctulata</i>	Res.
278.	<i>Zosteropidae</i>	Orientalwhiteeye	<i>Zosteropsalpebrosus</i>	Res.
279.	<i>Emberizidae</i>	Brambling	<i>Fringilamontifringilla</i>	Rare
280.		Crestedbunting	<i>Melophuslathamii</i>	

Abbreviation used:

W.M : Winter Migrant; S.M: Summer Migrant Res; V. Rare: Very Rare;

ANNEXURE - VII

ESTIMATION OF MAMMALS (EXCEPT AQUATIC) BY DIRECT SIGHTING IN MANGROVE FOREST DIVISION (WL) RAJNAGAR

2014

Sl. No.	Name of the Range	Chital	Wild Pig	Sambar	Rhesus Macaque	Common Langur	Jackal	Fishing Cat	Hyena	Otter	Jungle Cat	Mongoose	Wolf	Fox	Hare	Porcupine	Leopard Cat	Indian Civet
1	Kanika WL Range	1370	605	13	623	3	18	1	1	11	8	0	0	0	0	0	0	0
2	Rajnagar WL Range	353	376	4	133	8	169	0	0	7	3	3	0	0	0	0	0	0
3	Gahirmatha WL Range	43	145	0	686	0	35	0	0	1	0	0	0	0	0	0	0	0
4	Mahakalapada WL Range	91	87	0	81	0	33	0	0	18	0	0	0	0	0	0	0	0
5	Kujang WL Range	15	0	0	0	28	50	2	4	1	0	4	0	10	0	0	0	0
Total:		1872	1213	17	1523	39	305	3	5	38	11	7	0	10	0	0	0	0

2015

Sl. No.	Name of the Range	Chital	Wild Pig	Sambar	Rhesus Macaque	Common Langur	Jackal	Fishing Cat	Hyena	Otter	Jungle Cat	Mongoose	Wolf	Fox	Hare	Porcupine	Leopard Cat	Indian Civet
1	Kanika WL Range	1891	498	4	711	0	28	0	4	37	8	0	0	0	0	3	3	0
2	Rajnagar WL Range	1015	647	0	285	0	64	23	0	18	0	0	0	0	0	0	0	0
3	Gahirmatha	9	51	0	15	19	11	0	0	50	0	0	0	0	0	0	0	0

1	Kanika WL Range	1876	781	0	1137	0	10	11	4	68	5	1	0	0	0	4	2	0
2	Rajnagar WL Range	1100	570	0	165	5	39	14	0	29	9	0	0	0	0	0	0	0
3	Gahirmatha WL Range	8	61	0	56	0	12	0	0	0	0	0	0	0	0	0	0	0
4	Mahakalapada WL Range	187	246	0	461	0	57	3	0	8	0	0	0	0	0	0	0	0
5	Kujang WL Range	13	2	0	0	10	106	0	4	8	0	13	0	28	16	0	0	0
Total:		3184	1660	0	1819	15	224	28	8	113	14	14	0	28	16	4	2	0

2018

Sl. No.	Name of the Range	Chital	Wild Pig	Sambar	Rhesus Macaque	Common Langur	Jackal	Fishing Cat	Hyena	Otter	Jungle Cat	Mongoose	Wolf	Fox	Hare	Porcupine	Leopard Cat	Indian Civet
1	Kanika WL Range	1903	825	0	1539	0	11	12	7	86	5	0	0	0	0	14	2	0
2	Rajnagar WL Range	1045	574	0	47	4	43	5	0	7	0	0	0	0	1	4	0	0
3	Gahirmatha WL Range	12	63	0	88	0	35	0	0	0	0	0	0	0	0	0	0	6
4	Mahakalapada WL Range	201	279	0	472	0	66	3	0	8	0	0	0	0	0	0	0	0
5	Kujang WL Range	14	15	0	112	7	140	0	7	10	0	22	0	24	10	0	0	0
Total:		3175	1756	0	2258	11	295	20	14	111	5	22	0	24	11	18	2	6

2019																		
Sl. No.	Name of the Range	Chital	Wild Pig	Sambar	Rhesus Macaque	Common Langur	Jackal	Fishing Cat	Hyena	Otter	Jungle Cat	Mongoose	Wolf	Fox	Hare	Porcupine	Leopard Cat	Indian Civet
1	Kanika WL Range	1976	1050	1	1536	3	60	26	8	63	4	2	0	0	0	11	1	0
2	Rajnagar WL Range	809	403	0	205	12	56	4	0	13	2	2	0	0	0	3	0	0
3	Gahirmatha WL Range	18	88	0	101	0	19	0	0	0	0	0	0	0	0	0	0	8
4	Mahakalapada WL Range	218	320	0	529	0	85	1	0	10	0	0	0	0	0	0	0	0
5	Kujang WL Range	87	65	0	79	9	151	0	2	3	0	32	0	28	2	0	0	0
Total:		3108	1926	1	2450	24	371	31	10	89	6	36	0	28	2	14	1	8



ANNEXURE - VIII
FOREST FIRE INCIDENTS FROM THE YEAR 2008-09 TO 2018-19

Sl No.	Name of the Division	Year	Name of the Range	No of fire incidents & date	Burnt Area (Ha)	Causality/ loss of Human life.	Loss of wildlife	No of crown fires(if any) & area affected (Ha.)	Estimated loss(Rs. in Lakhs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Mangrove Forest Division (Wildlife) Rajnagar	2008-09	-	-	-	-	-	-	-
02		2009-10	-	-	-	-	-	-	-
03		2010-11	Rajnagar WL	01 On 22.04.2010	2 Hectare	-	-	No Crown fire. Only Ground fire happened in West Orasahi Forest Block of Bhitarkanika National Park	-
04		2011-12		01 On 25.04.2011	70 Dec	-	-	No. Crown fire	-
05		2012-13	-	-	-	-	-	-	-
06		2013-14	-	-	-	-	-	-	-
07		2014-15	-	-	-	-	-	-	-
08		2015-16	-	-	-	-	-	-	-
09		2016-17	-	-	-	-	-	-	-
10		2017-18	Kujang WL	01 on 24.05.2017	0.80 Hectare	-	-	Balikani Casuarina Block Plantation one miscraent Bapuni Mallick of village Hansua (Nuasahi)	-
11				01 on 08.03.2018	0.18 Hectare	-	-	469 nos. Casuarina trees partly damaged in Sandhakuda Casuarina Block Plantation	-
12			Rajnagar WL	01 on 07.03.2018	0.15 Hectare	-	-	22 nos. of Hental trees damaged in Kathuaganda Beat	-
13		2018-19		01 on 15.04.2018	0.52 Hectare	-	-	No Mangrove vegetation affected	-

ANNEXURE –IX
SAMPLE POINTS IN MANGROVE FOREST DIVISION (W.L) RAJNAGAR

UP TO 17.04.2019

Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	Range
1	rg-02	468115.0923	2259650.838	20.435014	86.694341	Mahakalpada
2	rg-09	472350.3048	2248385.422	20.333287	86.737033	Mahakalpada
3	rg-22	472336.2539	2247694.929	20.326502	86.734996	Mahakalpada
4	rg-23	472713.2585	2247808.886	20.32808	86.7386	Mahakalpada
5	rg-26	473769.4889	2248586.096	20.335117	86.748707	Mahakalpada
6	rg-27	471497.1011	2259319.339	20.432072	86.726757	Mahakalpada
7	rg-28	471499.118	2257007.191	20.41118	86.726823	Mahakalpada
8	rg-29	471344.6499	2258478.065	20.424468	86.725319	Mahakalpada
9	rg-30	471012.9091	2255594.129	20.398403	86.722186	Mahakalpada
10	rg-31	471058.6546	2256171.636	20.403623	86.722615	Mahakalpada
11	rg-32	471491.7008	2258000.157	20.420152	86.726736	Mahakalpada
12	rg-37	468034.4048	2245032.601	20.302919	86.693828	Mahakalpada
13	rg-38	471528.9678	2261205.862	20.44912	86.727042	Mahakalpada
14	rg-44	473842.906	2253751.297	20.381792	86.749336	Mahakalpada
15	rg-51	473667.4231	2252410.595	20.369675	86.747673	Mahakalpada
16	rg-54	473630.9986	2253249.869	20.3777258	86.747312	Mahakalpada
17	rg-55	47386.8919	2251879.789	20.364872	86.743077	Mahakalpada
18	rg-57	472518.7622	2250639.89	20.353658	86.736689	Mahakalpada
19	rg-58	473566.1155	2251693.562	20.363194	86.746713	Mahakalpada
20	rg-59	469068.8452	2264900.856	20.482469	86.703393	Mahakalpada
21	rg-60	469734.9908	2264664.945	20.480349	86.709784	Mahakalpada
22	rg-83	469819.7966	2247202.064	20.322552	86.710892	Mahakalpada
23	rg-89	465147.3813	2254829.801	20.391398	86.665986	Mahakalpada
24	rg-91	470357.9611	2250156.779	20.352513	86.715993	Mahakalpada
25	rg-92	471904.6436	2251223.928	20.358927	86.730801	Mahakalpada
26	rg-93	470106.5554	2250099.902	20.348743	86.713591	Mahakalpada
27	rg-94	471086.9394	2251532.45	20.361702	86.722961	Mahakalpada
28	rg-95	471840.2954	2251914.386	20.365165	86.730173	Mahakalpada
29	rg-96	468788.8799	2246295.522	20.314344	86.701033	Mahakalpada
30	rg-14	476524.4218	2252511.309	20.370623	86.775049	Mahakalpada
31	rg-15	476984.1508	2252447.139	20.370048	86.779455	Mahakalpada
32	rg-16	474732.1424	2249706.196	20.345252	86.757914	Mahakalpada
33	rg-17	477274.8399	2252899.83	20.374142	86.782234	Mahakalpada
34	rg-18	475711.2393	2252168.765	20.367517	86.767261	Mahakalpada
35	rg-19	475225.6651	2250011.388	20.348016	86.762638	Mahakalpada
36	rg-20	475377.6647	2249776.575	20.345896	86.764098	Mahakalpada
37	rg-21	474001.424	2249089.137	20.339666	86.750922	Mahakalpada
38	rg-24	474012.8225	2247971.029	20.329563	86.751047	Mahakalpada
39	rg-25	474572.6219	2248091.908	20.330663	86.756408	Mahakalpada
40	rg-40	476293.3362	2253535.507	20.379875	86.772821	Mahakalpada
41	rg-41	476874.5501	2254482.824	20.388442	86.778378	Mahakalpada
42	rg-42	475546.8175	2252628.506	20.371669	86.765679	Mahakalpada
43	rg-43	474785.3532	2252671.183	20.372045	86.758382	Mahakalpada

44	rg-45	474598.8283	2253250.824	20.37728	86.756586	Mahakalpada
45	rg-46	475484.3532	2254211.017	20.385968	86.765059	Mahakalpada
46	rg-47	474540.7425	2252721.101	20.372493	86.756037	Mahakalpada
47	rg-48	476279.292	2253967.119	20.383775	86.77268	Mahakalpada
48	rg-49	474886.2419	2252332.737	20.368988	86.759354	Mahakalpada
49	rg-50	475890.4122	2253209.114	20.37692	86.768964	Mahakalpada
50	rg-52	474199.1292	2251687.24	20.363146	86.752779	Mahakalpada
51	rg-53	475248.2272	2251633.335	20.362673	86.762832	Mahakalpada
52	rg-56	474724.489	2250485.275	20.352292	86.75783	Mahakalpada
53	rg-1	441764.5199	2211205.612	20.068924	86.443047	Kujang
54	rg-3	447115.0479	2229814.029	20.164938	86.493909	Kujang
55	rg-4	437347.0126	2218354.916	20.061099	86.40083	Kujang
56	rg-5	437512.8766	2218134.273	20.059111	86.402424	Kujang
57	rg-6	439565.7869	2217290.546	20.051552	86.422083	Kujang
58	rg-7	438729.6927	2217586.806	20.054203	86.414078	Kujang
59	rg-8	437811.6145	2217800.267	20.056102	86.405292	Kujang
60	rg-11	432904.0182	2219895.883	20.074874	86.358285	Kujang
61	rg-12	440082.8753	2220048.925	20.076493	86.426937	Kujang
62	rg-13	439104.6917	2226235.12	20.132362	86.417375	Kujang
63	rg-33	447573.57	2227128.901	20.140687	86.498374	Kujang
64	rg-35	447611.6282	2228007.283	20.148625	86.498713	Kujang
65	rg-39	446002.086	2229683.352	20.163726	86.483262	Kujang
66	rg-61	439187.3479	2224606.16	20.117645	86.41822	Kujang
67	rg-65	438305.4537	2215062.773	20.031381	86.410106	Kujang
68	rg-66	438614.4285	2216284.343	20.04243	86.41302	Kujang
69	rg-67	438397.2654	2216434.715	20.043781	86.410938	Kujang
70	rg-68	437491.5022	2213555.984	20.01774	86.402376	Kujang
71	rg-69	438036.6424	2214703.754	20.028129	86.407548	Kujang
72	rg-70	437942.3744	2213573.1	20.017909	86.406686	Kujang
73	rg-71	437021.5061	2213201.277	20.014519	86.397895	Kujang
74	rg-72	437523.2291	2214463.727	20.025943	86.402648	Kujang
75	rg-73	438036.595	2212409.866	20.007401	86.407626	Kujang
76	rg-74	436612.4666	2214127.852	20.022879	86.393952	Kujang
77	rg-75	437132.2846	2211946.309	20.003183	86.398997	Kujang
78	rg-77	438295.8147	2211974.413	20.003474	86.410118	Kujang
79	rg-82	445081.416	2226079.794	20.131138	86.474561	Kujang
80	rg-88	445186.533	2223487.796	20.107719	86.475645	Kujang
81	rg-90	442899.193	2220723.591	20.082675	86.453851	Kujang
82	rg-76	436459.6591	2209887.481	19.984557	86.392638	Kujang
83	rg-78	437601.8673	2211117.973	19.995713	86.403514	Kujang
84	rg-79	434544.2814	2209698.356	19.982784	86.374337	Kujang
85	rg-80	435803.4932	2209699.006	19.982832	86.386373	Kujang
86	rg-81	435551.2076	2210597.074	19.990939	86.38393	Kujang
87	rg-10	448091.0644	2232042.947	20.185105	86.503185	Kujang
88	rg-34	449435.1053	2230107.796	20.167655	86.516102	Kujang
89	rg-36	449581.6377	2230473.918	20.170967	86.517494	Kujang
90	rg-62	449761.3807	2234298.396	20.20553	86.519108	Kujang
91	rg-84	450328.7703	2232897.33	20.192885	86.524578	Kujang
92	rg-85	453099.2636	2235372.237	20.215318	86.55103	Kujang

93	rg-86	455891.8279	2236826.351	20.228524	86.577727	Kujang
94	rg-87	453022.6872	2235631.119	20.217656	86.550291	Kujang
95	rg-63	467051.5943	2244818.311	20.300966	86.684419	Kujang
96	rg-64	466810.1654	2245625.403	20.308255	86.682091	Kujang
97	rg-99	473107.2591	2265475.109	20.48772	86.742109	Gahirmatha
98	rg-100	473596.3808	2266188.257	20.494171	86.746789	Gahirmatha
99	rg-101	473052.1693	2266033.702	20.492767	86.741572	Gahirmatha
100	rg-102	469517.9973	2266295.685	20.495081	86.707676	Gahirmatha
101	rg-97	471443.1599	2267470.614	20.505727	86.726119	Gahirmatha
102	rg-98	469493.4873	2266887.442	20.500427	86.707431	Gahirmatha

RANGE WISE ABSTRACT

Sl. No.	Range	No. of Sample Point	No. of Sample Point with no objection	No. of Sample Point with objection
1	Mahakalpada	52	12	40
2	Kujang	44	23	21
3	Gahirmatha	06	04	02

TOPOSHEET NAME-F45U12

SAMPLE POINT MAP OF RAJNAGAR WL DIVISION

IN KUJANG WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-10	448091.0644	2232042.947	20.185105	86.503185	Bhuiarpal P.F.
2	rg-34	449435.1053	2230107.796	20.167655	86.516102	Jatadhar Tanda P.R.F.
3	rg-36	449581.6377	2230473.918	20.170967	86.517494	Jatadhar Tanda P.R.F.
4	rg-62	449761.3807	2234298.396	20.20553	86.519108	Madhuban-(A) P.F.
5	rg-84	450328.7703	2232897.33	20.192885	86.524578	Noliasahi P.F.
6	rg-85	453099.2636	2235372.237	20.215318	86.55103	Nuagaon Dhinkia P.F.
7	rg-86	455891.8279	2236826.351	20.228524	86.577727	Nuagaon Dhinkia P.F.
8	rg-87	453022.6872	2235631.119	20.217656	86.550291	Nuagaon Dhinkia P.F.

TOPOSHEET NAME-F45C05

SAMPLE POINT MAP OF RAJNAGAR WL DIVISION

IN KUJANG WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-76	436459.6591	2209887.481	19.984557	86.392638	Marichpur P.F.
2	rg-78	437601.8673	2211117.973	19.995713	86.403514	Marichpur P.F.
3	rg-79	434544.2814	2209698.356	19.982784	86.374337	Marichpur P.F.
4	rg-80	435803.4932	2209699.006	19.982832	86.386373	Marichpur P.F.
5	rg-81	435551.2076	2210597.074	19.990939	86.38393	Marichpur P.F.

TOPOSHEET NAME-F45U08

SAMPLE POINT MAP OF RAJNAGAR WL DIVISION

IN KUJANG WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-1	441764.5199	2211205.612	20.068924	86.443047	Akashdia P.F.
2	rg-3	447115.0479	2229814.029	20.164938	86.493909	Barkuda P.F.
3	rg-4	437347.0126	2218354.916	20.061099	86.40083	Baruhan P.F.
4	rg-5	437512.8766	2218134.273	20.059111	86.402424	Baruhan P.F.
5	rg-6	439565.7869	2217290.546	20.051552	86.422083	Baruhan P.F.
6	rg-7	438729.6927	2217586.806	20.054203	86.414078	Baruhan P.F.
7	rg-8	437811.6145	2217800.267	20.056102	86.405292	Baruhan P.F.
8	rg-11	432904.0182	2219895.883	20.074874	86.358285	Brahmanidhi P.R.F.
9	rg-12	440082.8753	2220048.925	20.076493	86.426937	Gadaharihpur P.F.
10	rg-13	439104.6917	2226235.12	20.132362	86.417375	Gopalpur P.F.
11	rg-33	447573.57	2227128.901	20.140687	86.498374	Jatadhar Tanda P.R.F.
12	rg-35	447611.6282	2228007.283	20.148625	86.498713	Jatadhar Tanda P.R.F.
13	rg-39	446002.086	2229683.352	20.163726	86.483262	Kankan P.F.
14	rg-61	439187.3479	2224606.16	20.117645	86.41822	Khatikholda P.R.F.
15	rg-65	438305.4537	2215062.773	20.031381	86.410106	Marichpur P.F.
16	rg-66	438614.4285	2216284.343	20.04243	86.41302	Marichpur P.F.
17	rg-67	438397.2654	2216434.715	20.043781	86.410938	Marichpur P.F.
18	rg-68	437491.5022	2213555.984	20.01774	86.402376	Marichpur P.F.
19	rg-69	438036.6424	2214703.754	20.028129	86.407548	Marichpur P.F.
20	rg-70	437942.3744	2213573.1	20.017909	86.406686	Marichpur P.F.
21	rg-71	437021.5061	2213201.277	20.014519	86.397895	Marichpur P.F.
22	rg-72	437523.2291	2214463.727	20.025943	86.402648	Marichpur P.F.

23	rg-73	438036.595	2212409.866	20.007401	86.407626	Marichpur P.F.
24	rg-74	436612.4666	2214127.852	20.022879	86.393952	Marichpur P.F.
25	rg-75	437132.2846	2211946.309	20.003183	86.398997	Marichpur P.F.
26	rg-77	438295.8147	2211974.413	20.003474	86.410118	Marichpur P.F.
27	rg-82	445081.416	2226079.794	20.131138	86.474561	Muguria P.F.
28	rg-88	445186.533	2223487.796	20.107719	86.475645	Padmapur P.F.
29	rg-90	442899.193	2220723.591	20.082675	86.453851	Sahadabedi P.F.

TOPOSHEET NAME-F45U10

IN GAHIRMATHA WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-97	471443.1599	2267470.614	20.505727	86.726119	Paddy Field of Bhopal Village
2	rg-98	469493.4873	2266887.442	20.500427	86.707431	Paddy Field of Bhopal Village

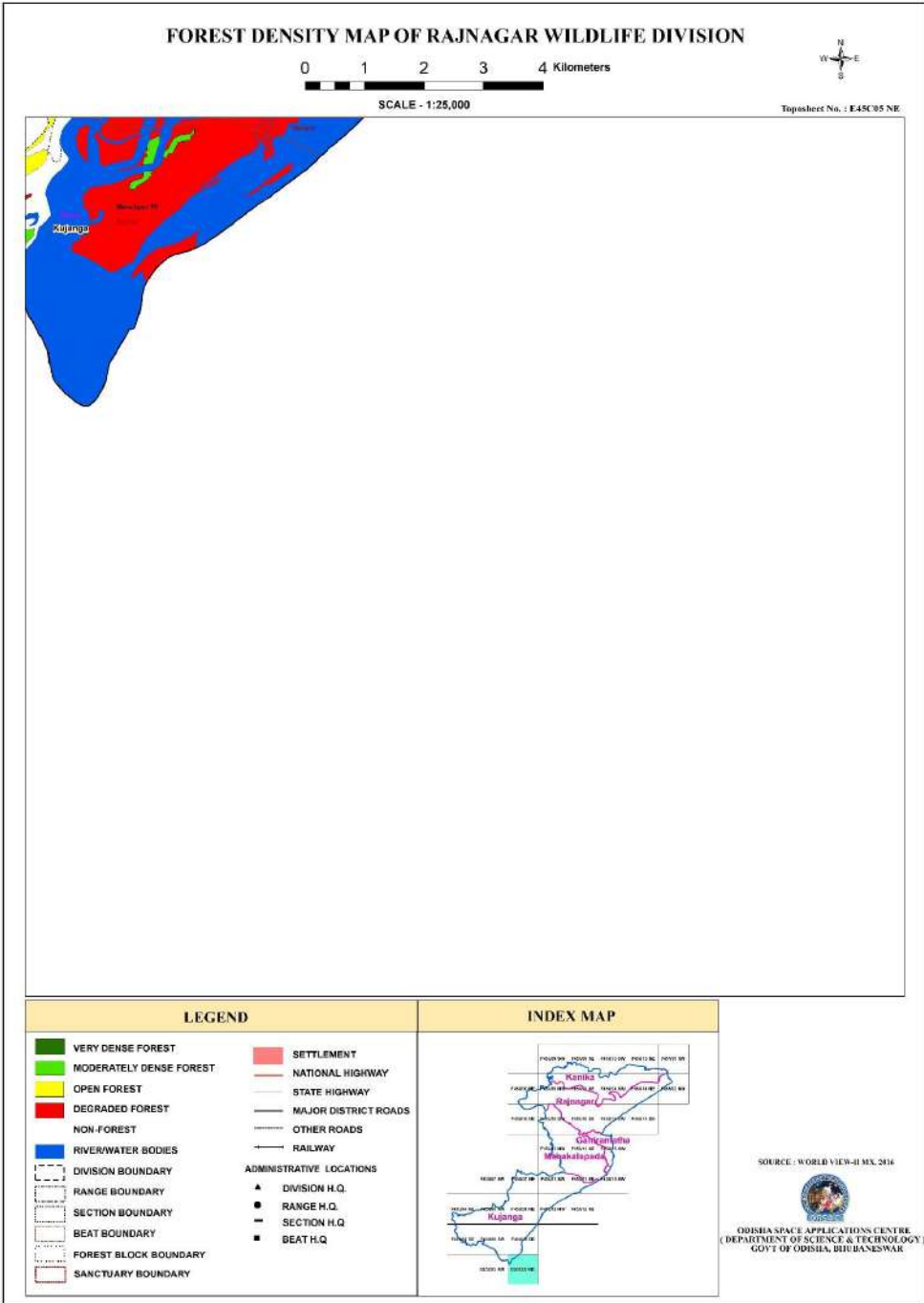
TOPOSHEET NAME-F45U15

IN MAHAKALPADA WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-14	476524.4218	2252511.309	20.370623	86.775049	Hetamundia P.R.F.
2	rg-15	476984.1508	2252447.139	20.370048	86.779455	Hetamundia P.R.F.
3	rg-16	474732.1424	2249706.196	20.345252	86.757914	Hetamundia P.R.F.
4	rg-17	477274.8399	2252899.83	20.374142	86.782234	Hetamundia P.R.F.
5	rg-18	475711.2393	2252168.765	20.367517	86.767261	Hetamundia P.R.F.
6	rg-19	475225.6651	2250011.388	20.348016	86.762638	Hetamundia P.R.F.
7	rg-20	475377.6647	2249776.575	20.345896	86.764098	Hetamundia P.R.F.
8	rg-21	474001.424	2249089.137	20.339666	86.750922	Hetamundia P.R.F.
9	rg-24	474012.8225	2247971.029	20.329563	86.751047	Hetamundia P.R.F.
10	rg-25	474572.6219	2248091.908	20.330663	86.756408	Hetamundia P.R.F.
11	rg-40	476293.3362	2253535.507	20.379875	86.772821	Kansaridia P.R.F.
12	rg-41	476874.5501	2254482.824	20.388442	86.778378	Kansaridia P.R.F.
13	rg-42	475546.8175	2252628.506	20.371669	86.765679	Kansaridia P.R.F.
14	rg-43	474785.3532	2252671.183	20.372045	86.758382	Kansaridia P.R.F.
15	rg-45	474598.8283	2253250.824	20.37728	86.756586	Kansaridia P.R.F.
16	rg-46	475484.3532	2254211.017	20.385968	86.765059	Kansaridia P.R.F.
17	rg-47	474540.7425	2252721.101	20.372493	86.756037	Kansaridia P.R.F.
18	rg-48	476279.292	2253967.119	20.383775	86.77268	Kansaridia P.R.F.
19	rg-49	474886.2419	2252332.737	20.368988	86.759354	Kansaridia P.R.F.
20	rg-50	475890.4122	2253209.114	20.37692	86.768964	Kansaridia P.R.F.
21	rg-52	474199.1292	2251687.24	20.363146	86.752779	Kansaridia P.R.F.
22	rg-53	475248.2272	2251633.335	20.362673	86.762832	Kansaridia P.R.F.
23	rg-56	474724.489	2250485.275	20.352292	86.75783	Kansaridia P.R.F.

TOPOSHEET NAME-F45U11
IN MAHAKALPADA WL RANGE

GEO-CODINATES OF SAMPLE POINTS						
Sl. No	UID	EASTING	NORTHING	LATITUDE	LONGITUDE	REMARKS
1	rg-02	468115.0923	2259650.838	20.435014	86.694341	Bagagahan
2	rg-09	472350.3048	2248385.422	20.333287	86.737033	Batighar P.R.F.
3	rg-22	472336.2539	2247694.929	20.326502	86.734996	Batighar P.R.F.
4	rg-23	472713.2585	2247808.886	20.32808	86.7386	Batighar P.R.F.
5	rg-26	473769.4889	2248586.096	20.335117	86.748707	Batighar P.R.F.
6	rg-27	471497.1011	2259319.339	20.432072	86.726757	Jamboo P.F
7	rg-28	471499.118	2257007.191	20.41118	86.726823	Jamboo P.F
8	rg-29	471344.6499	2258478.065	20.424468	86.725319	Jamboo P.F
9	rg-30	471012.9091	2255594.129	20.398403	86.722186	Jamboo P.F
10	rg-31	471058.6546	2256171.636	20.403623	86.722615	Jamboo P.F
11	rg-32	471491.7008	2258000.157	20.420152	86.726736	Jamboo P.F
12	rg-37	468034.4048	2245032.601	20.302919	86.693828	Jogidhankuda P.R.F.
13	rg-38	471528.9678	2261205.862	20.44912	86.727042	Kandarapatia P.R. F
14	rg-44	473842.906	2253751.297	20.381792	86.749336	Kansaridia P.R.F.
15	rg-51	473667.4231	2252410.595	20.369675	86.747673	Kansaridia P.R.F.
16	rg-54	473630.9986	2253249.869	20.3777258	86.747312	Kansaridia P.R.F.
17	rg-55	47386.8919	2251879.789	20.364872	86.743077	Kansaridia P.R.F.
18	rg-57	472518.7622	2250639.89	20.353658	86.736689	Kansaridia P.R.F.
19	rg-58	473566.1155	2251693.562	20.363194	86.746713	Kansaridia P.R.F.
20	rg-59	469068.8452	2264900.856	20.482469	86.703393	Kantilo R.F
21	rg-60	469734.9908	2264664.945	20.480349	86.709784	Kantilo R.F.
22	rg-63	467051.5943	2244818.311	20.300966	86.684419	Machidia (Kaudia) in Kujang WL Range
23	rg-64	466810.1654	2245625.403	20.308255	86.682091	Machidia (Kaudia) in Kujang WL Range
24	rg-83	469819.7966	2247202.064	20.322552	86.710892	Nipania P.R. F.
25	rg-89	465147.3813	2254829.801	20.391398	86.665986	Petchhela P.R.F
26	rg-91	470357.9611	2250156.779	20.352513	86.715993	Sanatubi P.R.F.
27	rg-92	471904.6436	2251223.928	20.358927	86.730801	Sanatubi P.R.F.
28	rg-93	470106.5554	2250099.902	20.348743	86.713591	Sanatubi P.R.F.
29	rg-94	471086.9394	2251532.45	20.361702	86.722961	Sanatubi P.R.F.
30	rg-95	471840.2954	2251914.386	20.365165	86.730173	Sanatubi P.R.F.
31	rg-96	468788.8799	2246295.522	20.314344	86.701033	Saralikuda P.R.F.
32	rg-99	473107.2591	2265475.109	20.48772	86.742109	Sasanapeta P.R. F in Gahirmatha WL Range
33	rg-100	473596.3808	2266188.257	20.494171	86.746789	Sasanapeta P.R. F in Gahirmatha WL Range
34	rg-101	473052.1693	2266033.702	20.492767	86.741572	Sasanapeta P.R. F in Gahirmatha WL Range
35	rg-102	469517.9973	2266295.685	20.495081	86.707676	Sasanapeta P.R. F in Gahirmatha WL Range

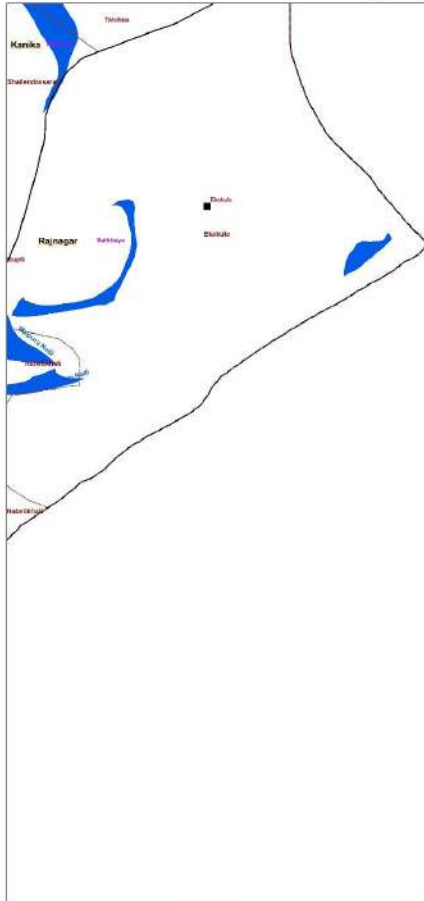


FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

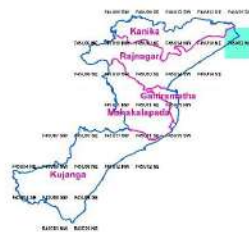
Toposheet No. : F45V 02 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-III IEC, 2010



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESHWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



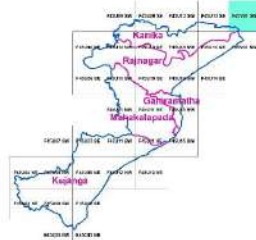
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LEGEND

	VERY DENSE FOREST		SETTLEMENT
	MODERATELY DENSE FOREST		NATIONAL HIGHWAY
	OPEN FOREST		STATE HIGHWAY
	DEGRADED FOREST		MAJOR DISTRICT ROADS
	NON-FOREST		OTHER ROADS
	RIVER/WATER BODIES		RAILWAY
	DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS	
	RANGE BOUNDARY		DIVISION H.Q.
	SECTION BOUNDARY		RANGE H.Q.
	BEAT BOUNDARY		SECTION H.Q.
	FOREST BLOCK BOUNDARY		BEAT H.Q.
	SANCTUARY BOUNDARY		

INDEX MAP



SOURCE: WORLD VIEW-2 MX, 2016



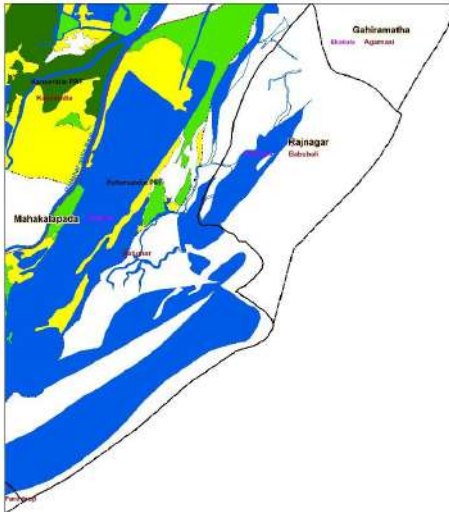
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT. OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

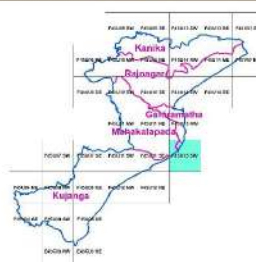
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LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE: WORLD VIEW-2 MX, 2016



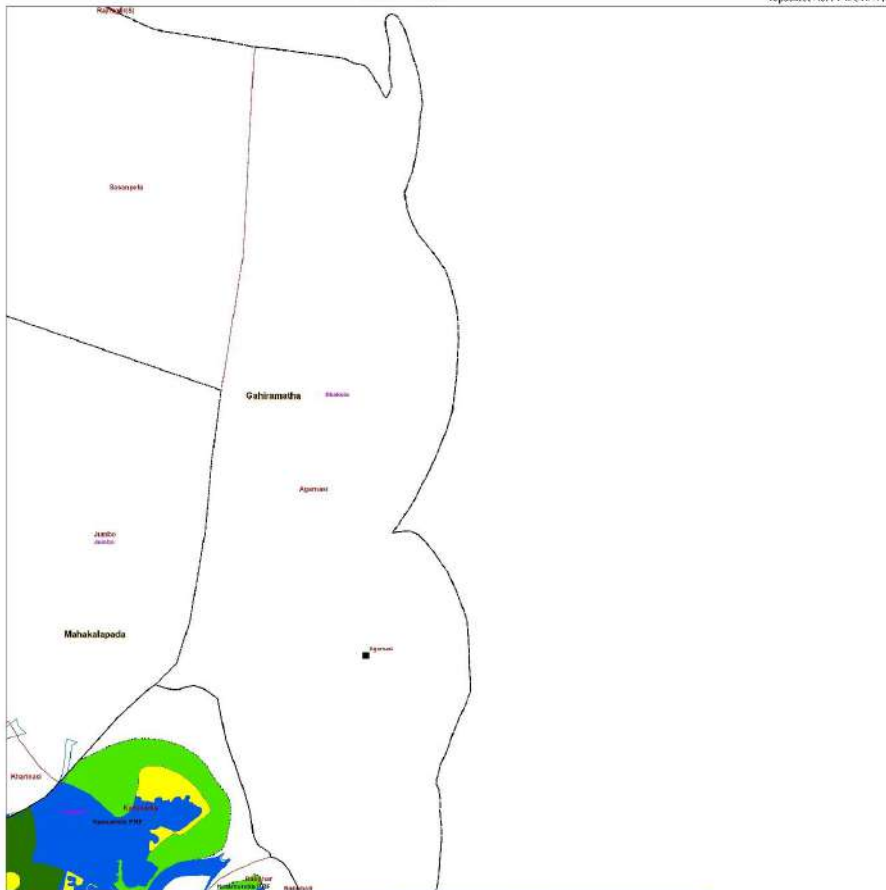
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers
SCALE - 1:25,000



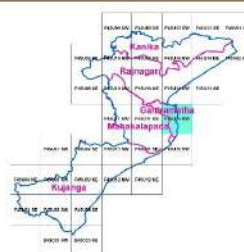
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LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW - HANY, 1986



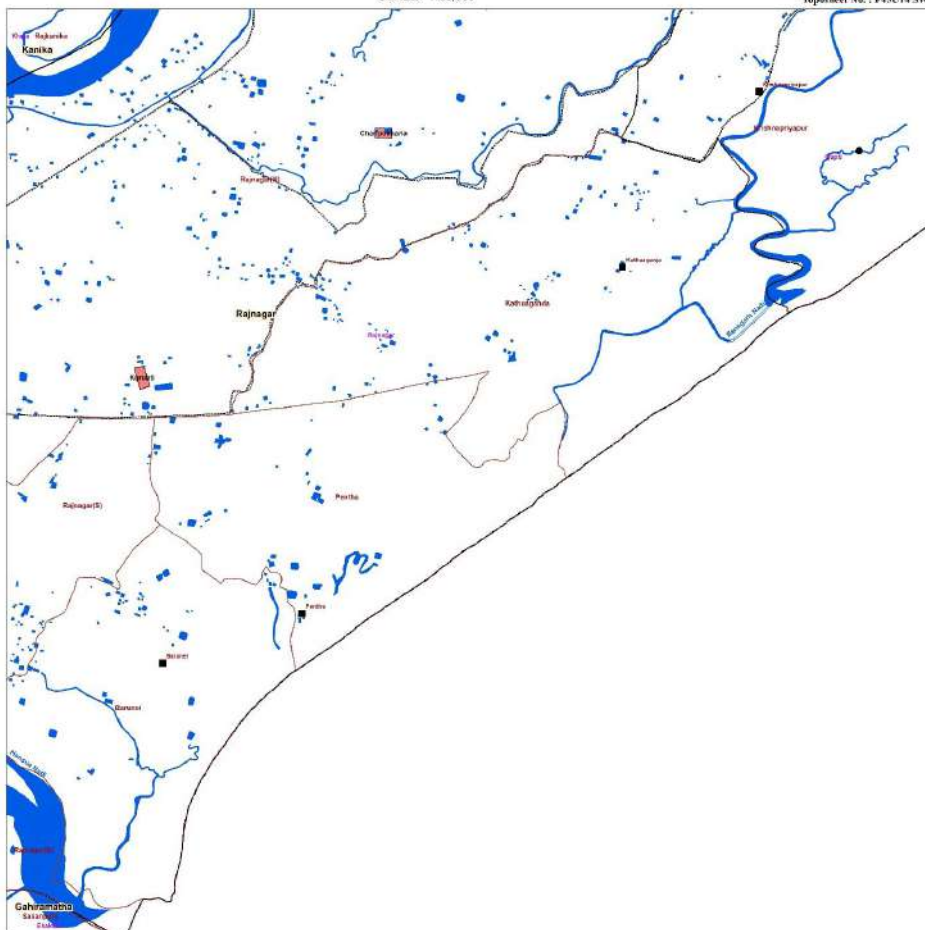
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

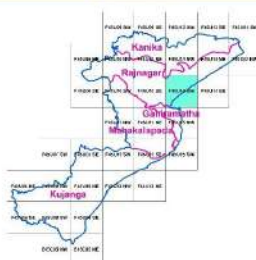
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LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	■ SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MY, 2016



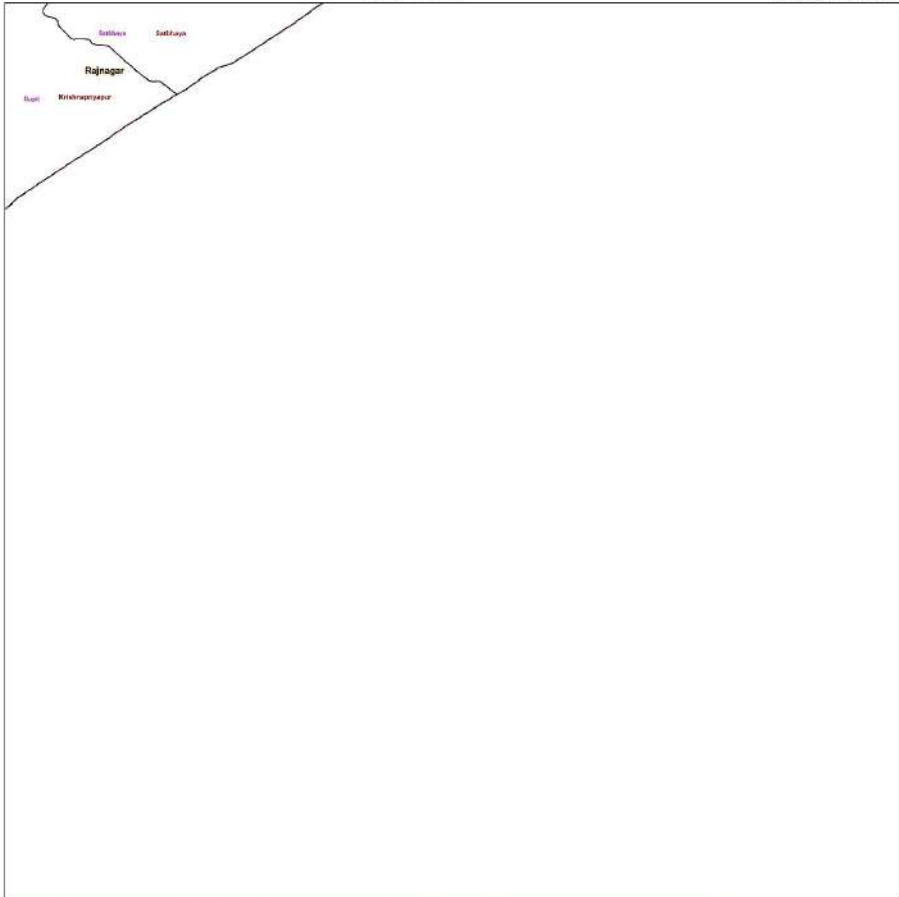
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT. OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers
SCALE - 1:25,000



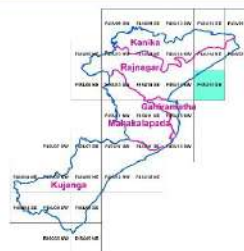
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LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	■ SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-II, MAY, 2010



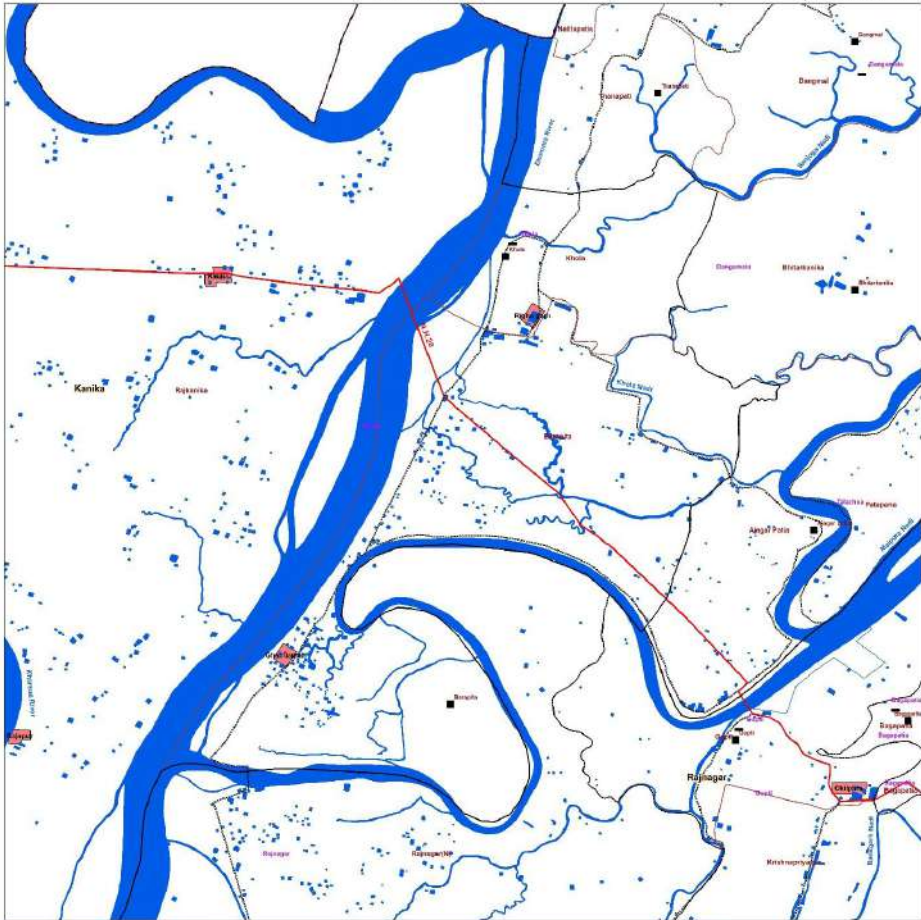
ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

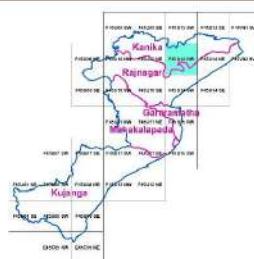
Toposheet No.: 148U14 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	 ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MX, 2016



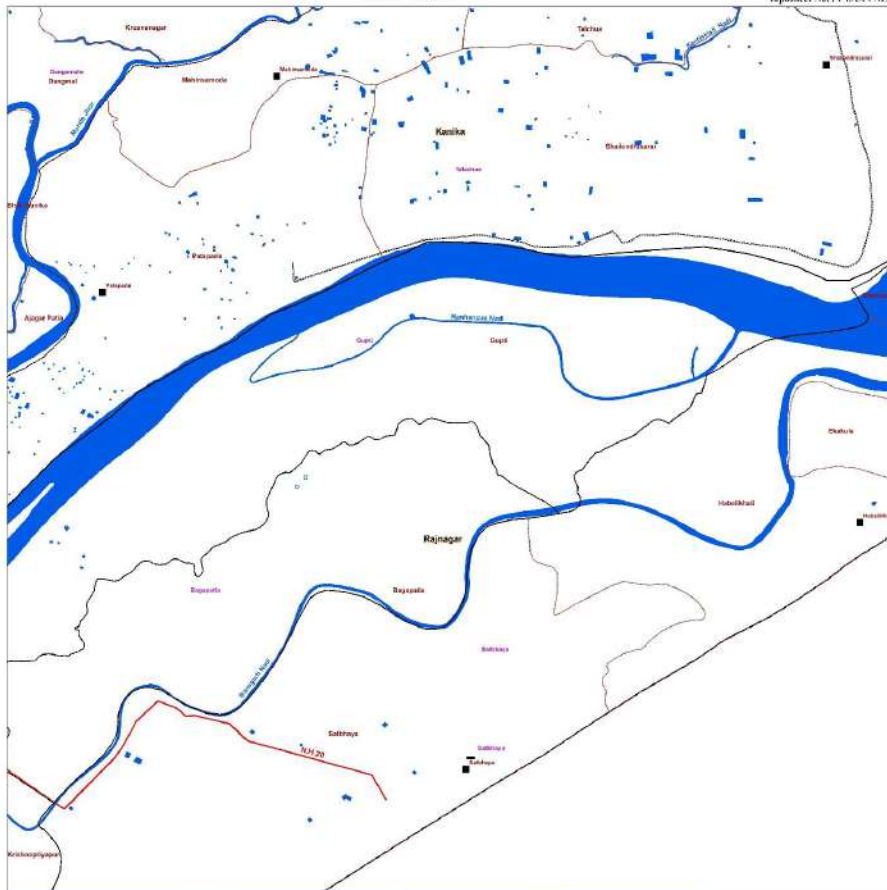
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers
SCALE - 1:25,000



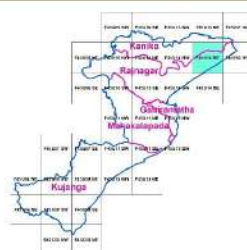
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LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	■ SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



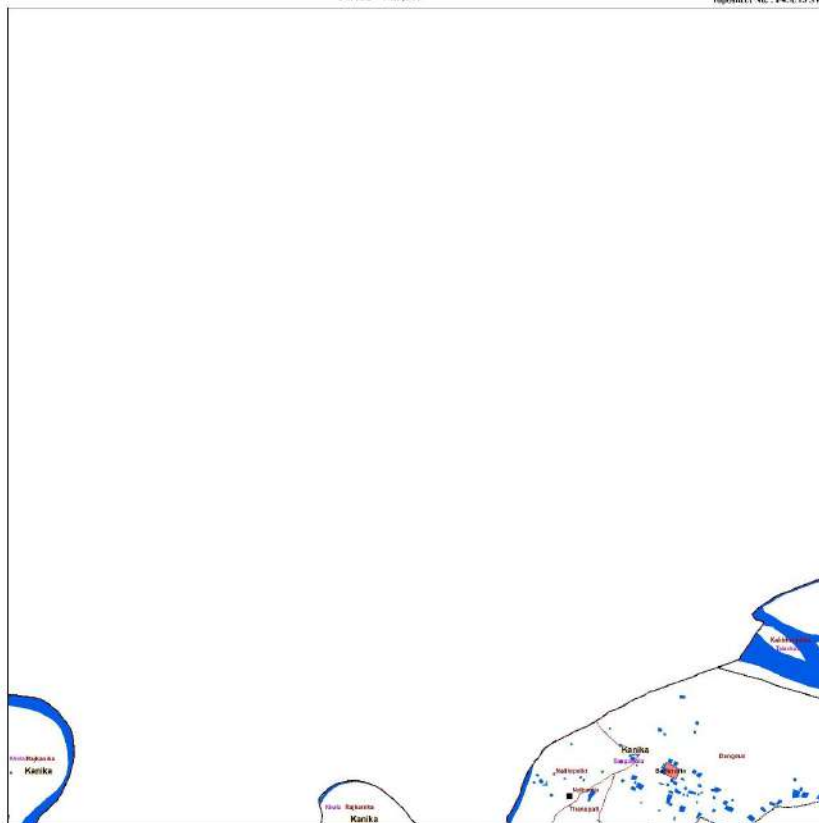
SOURCE : WORLD VIEW JUNE, 1961



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

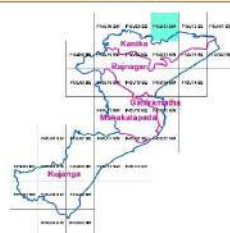
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SCALE - 1:25,000

Toposheet No. : F45U13 SW



INDEX MAP

- LEGEND**
- | | |
|---|--|
|  VERY DENSE FOREST |  SETTLEMENT |
|  MODERATELY DENSE FOREST |  NATIONAL HIGHWAY |
|  OPEN FOREST |  STATE HIGHWAY |
|  DEGRADED FOREST |  MAJOR/DISTRICT ROADS |
|  NON-FOREST |  OTHER ROADS |
|  RIVER/WATER BODIES |  RAILWAY |
| DIVISION BOUNDARY | |
|  RANGE BOUNDARY |  DIVISION H.Q. |
|  SECTION BOUNDARY |  RANGE H.Q. |
|  BEAT BOUNDARY |  SECTION H.Q. |
|  FOREST BLOCK BOUNDARY |  BEAT H.Q. |
|  SANCTUARY BOUNDARY | |



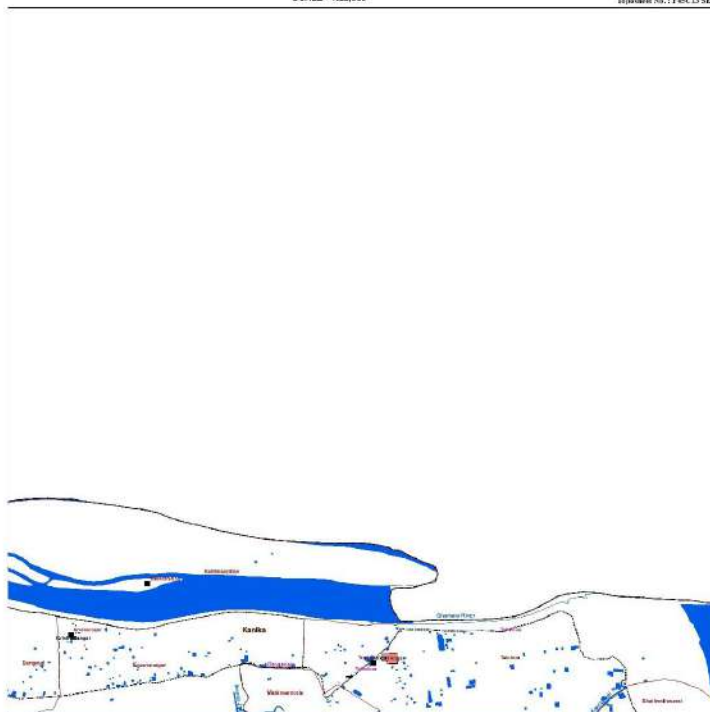
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ODISHASPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

SCALE - 1:25,000

Top sheet No. : F45L13 SE



INDEX MAP

	VERY DENSE FOREST		SETTLEMENT
	MODERATELY DENSE FOREST		NATIONAL HIGHWAY
	OPEN FOREST		STATE HIGHWAY
	DEGRADED FOREST		MAJOR DISTRICT ROADS
	NON-FOREST		OTHER ROADS
	RIVER/WATER BODIES		RAILWAY
	DIVISION BOUNDARY		ADMINISTRATIVE LOCATIONS
	RANGE BOUNDARY		▲ DIVISION H.Q.
	SECTION BOUNDARY		■ RANGE H.Q.
	BEAT BOUNDARY		■ SECTION H.Q.
	FOREST BLOCK BOUNDARY		■ BEAT H.Q.
	SANCTUARY BOUNDARY		



SOURCE : WORLD BANK, 2014



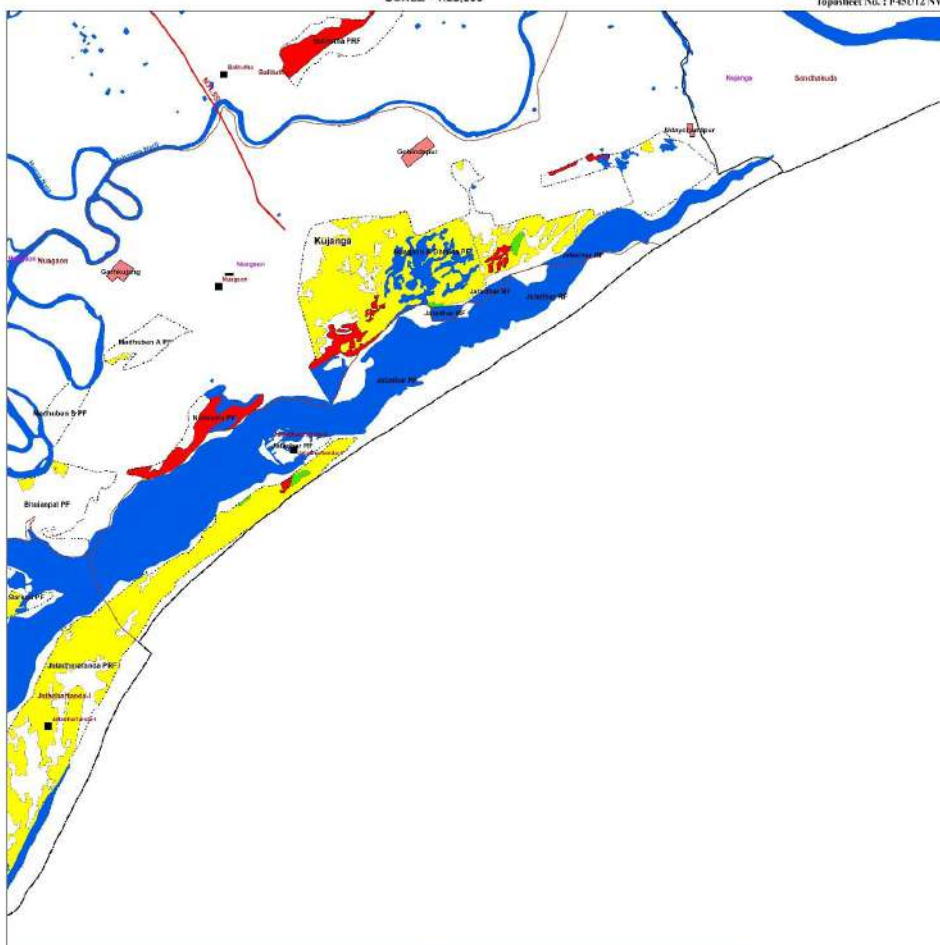
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

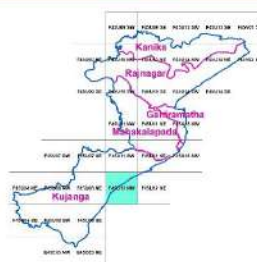
Toposheet No. : F45U12 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	 ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-II JUN, 2016

ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



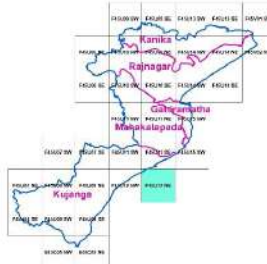
Toposheet No. : F 45U12 NE



LEGEND

	VERY DENSE FOREST		SETTLEMENT
	MODERATELY DENSE FOREST		NATIONAL HIGHWAY
	OPEN FOREST		STATE HIGHWAY
	DEGRADED FOREST		MAJOR DISTRICT ROADS
	NON-FOREST		OTHER ROADS
	RIVER/WATER BODIES		RAILWAY
	DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS  DIVISION H.Q.  RANGE H.Q.  SECTION H.Q.  BEAT H.Q.	
	RANGE BOUNDARY		
	SECTION BOUNDARY		
	BEAT BOUNDARY		
	FOREST BLOCK BOUNDARY		
	SANCTUARY BOUNDARY		

INDEX MAP



SOURCE : WORLD VIEW-4 MX, 2016



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

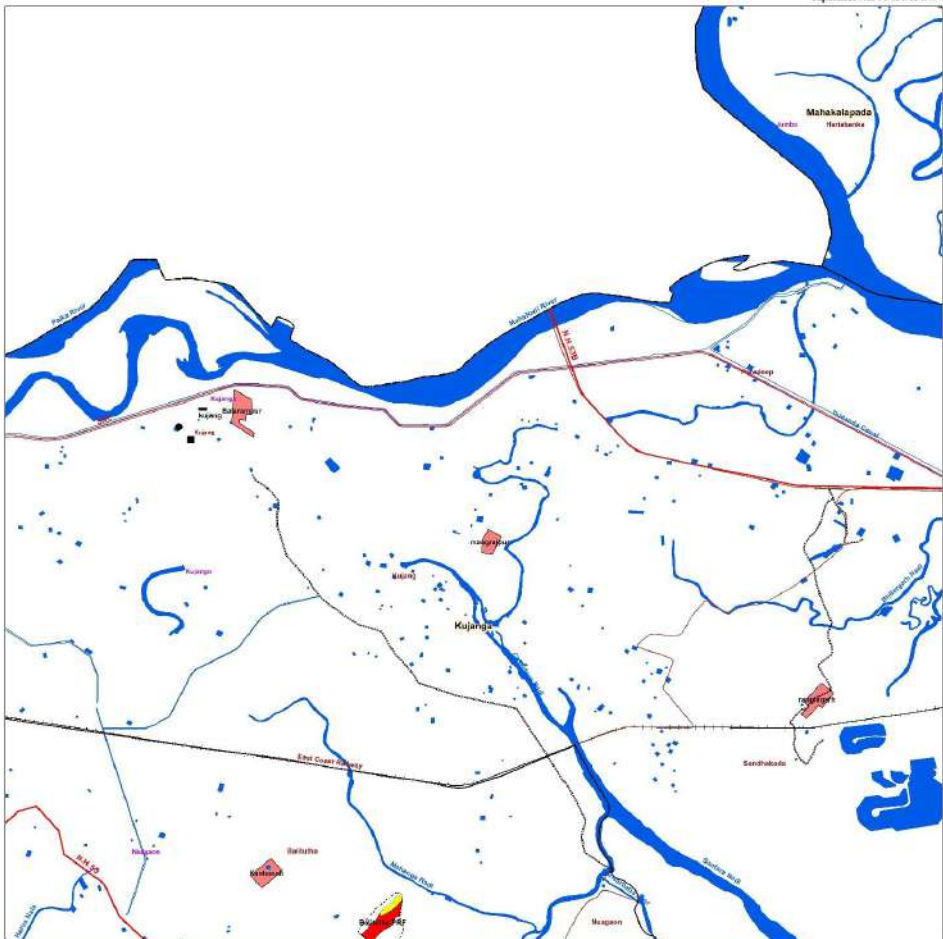
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



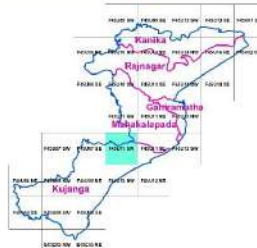
Toposheet No. : F45U11 SW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE: WORLDVIEW-2 MX, 2014



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

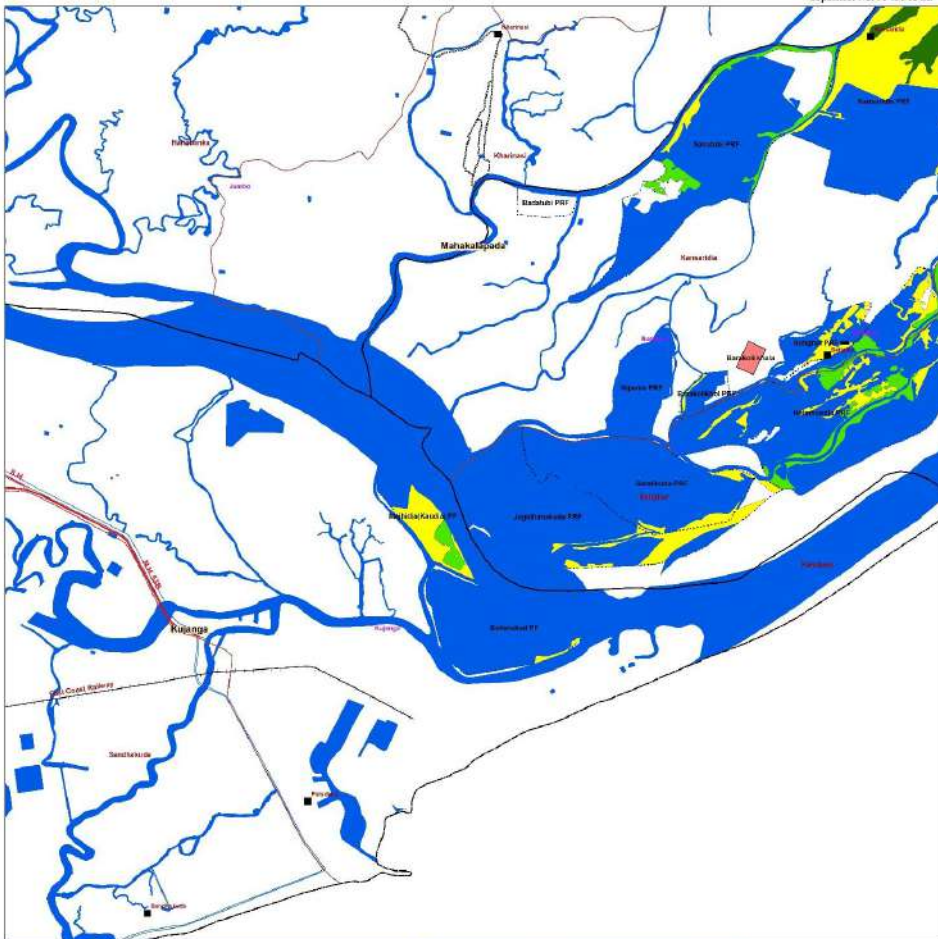
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



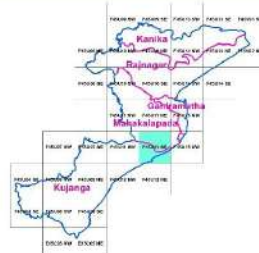
Toposheet No. : F45U11 SE



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	DIVISION H.Q.
SECTION BOUNDARY	RANGE H.Q.
BEAT BOUNDARY	SECTION H.Q.
FOREST BLOCK BOUNDARY	BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2/13XN, 2014



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



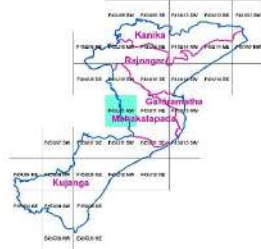
Toposheet No. : F4SU11 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MX, 2016



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

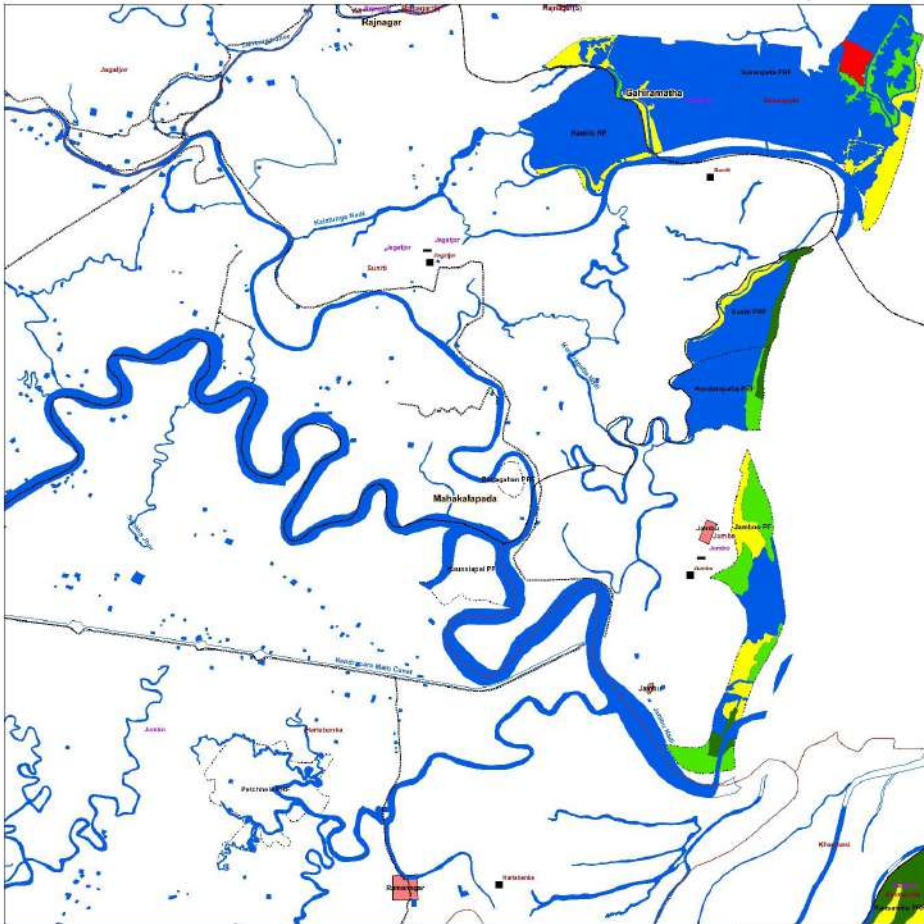
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



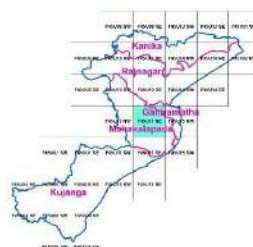
Toposheet No. : F4SU11 NE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MX-546



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

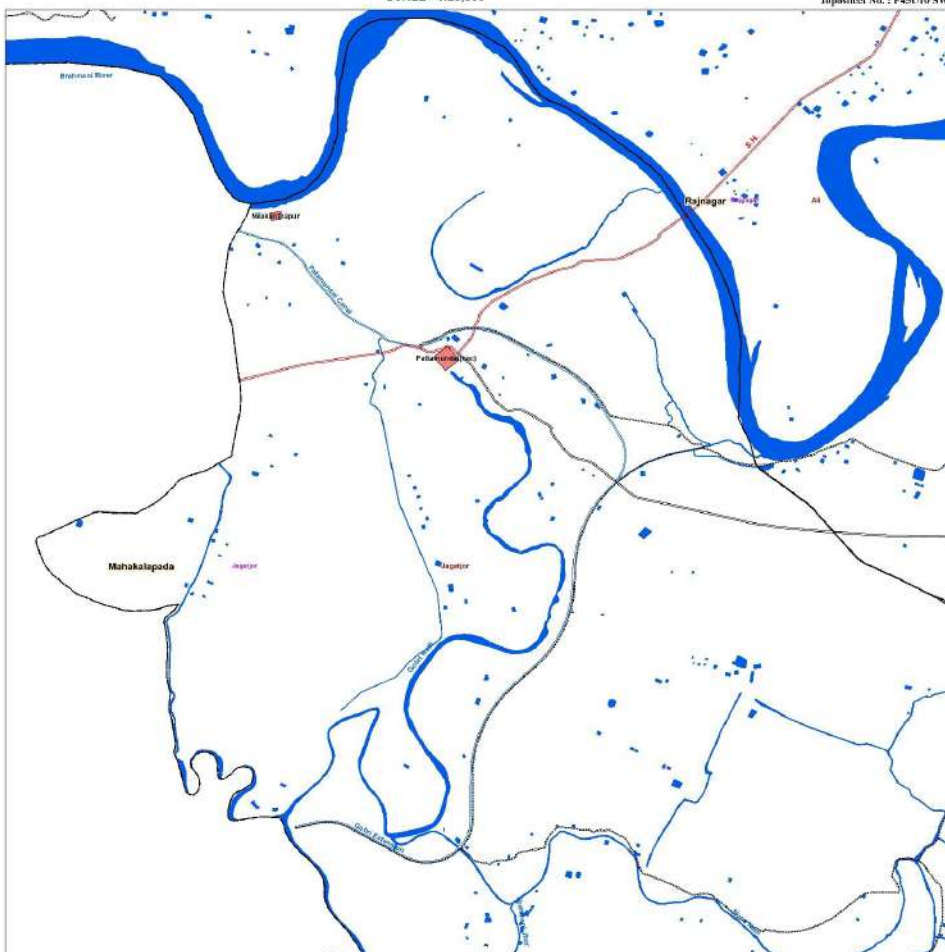
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers



SCALE - 1:25,000

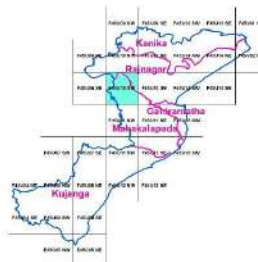
Toposheet No. : P45U10 SW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-3 MS, 2016



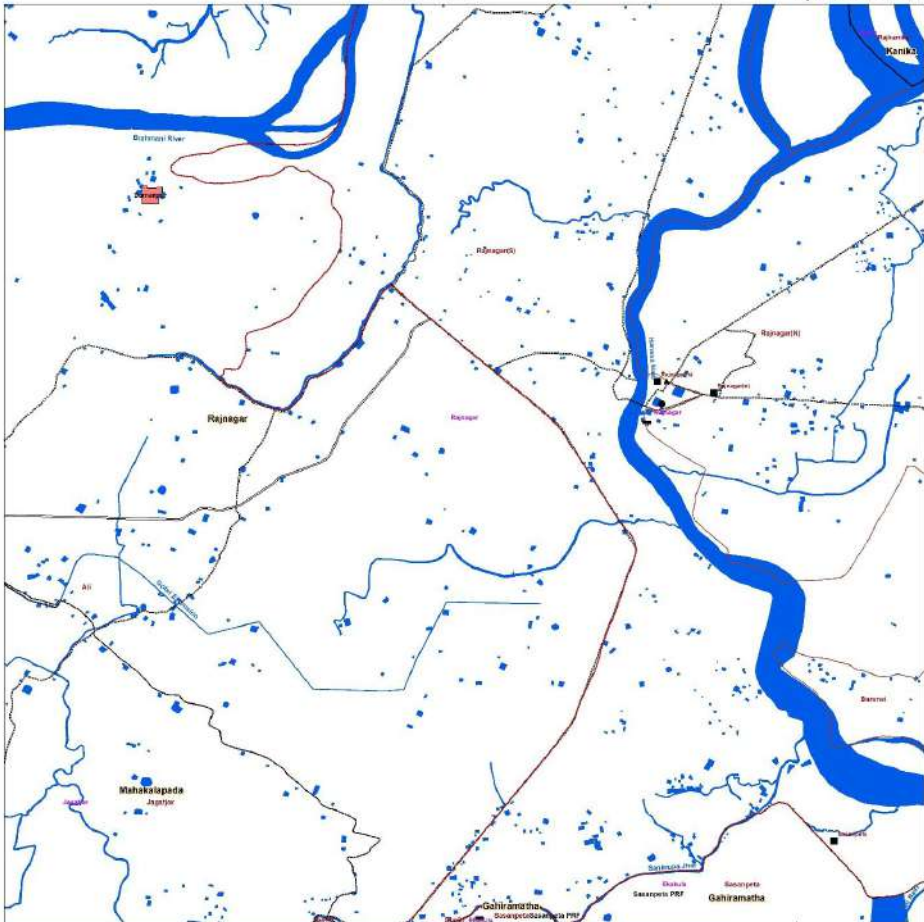
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT. OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

Toposheet No. : F45U10 SE



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	— SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 JUN, 2016



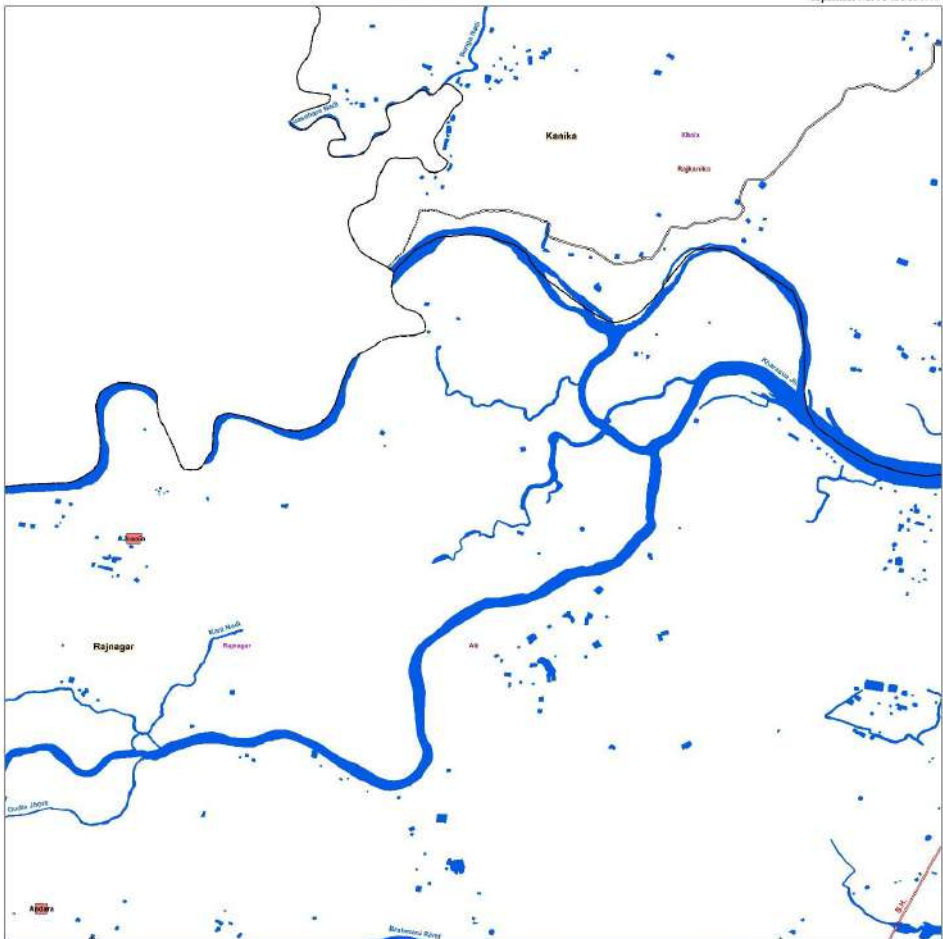
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

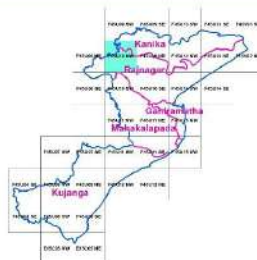
Toposheet No. : F45U10 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	 ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-III, JAN. 2014

ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BIL. BANESWAR

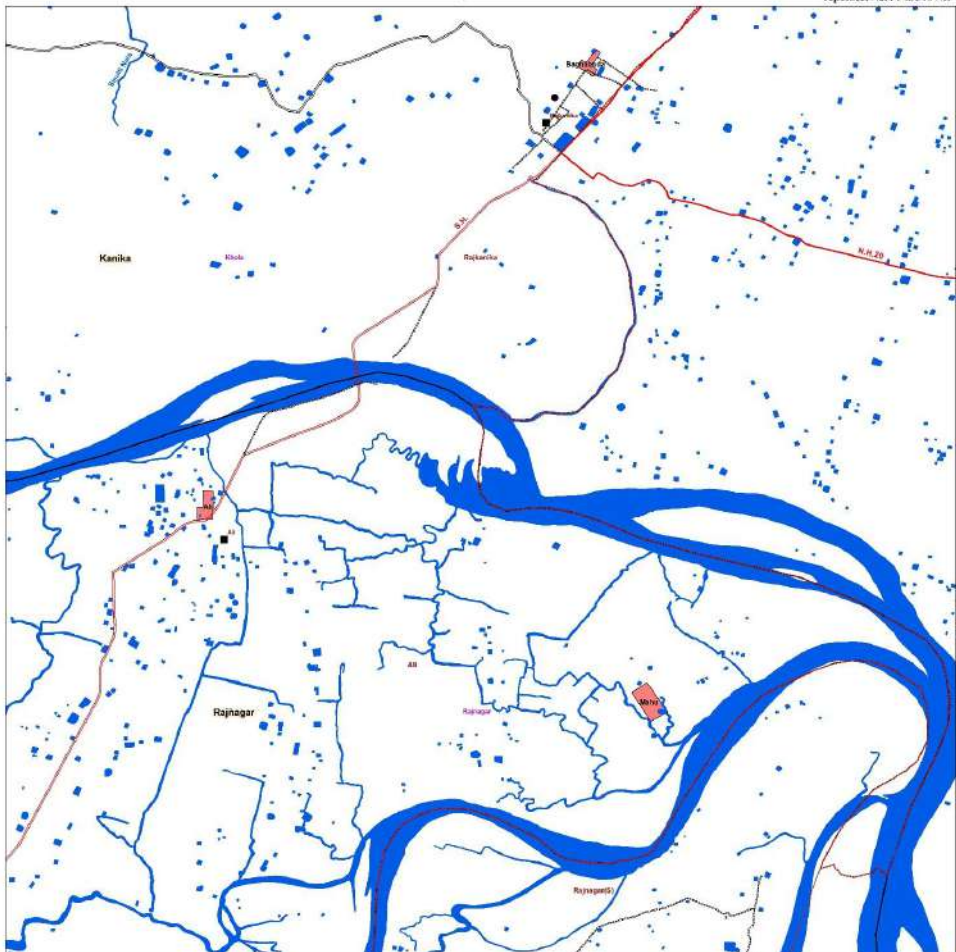
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



Topsheet No. : F4SU19 NE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-1 MIN. SRS



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

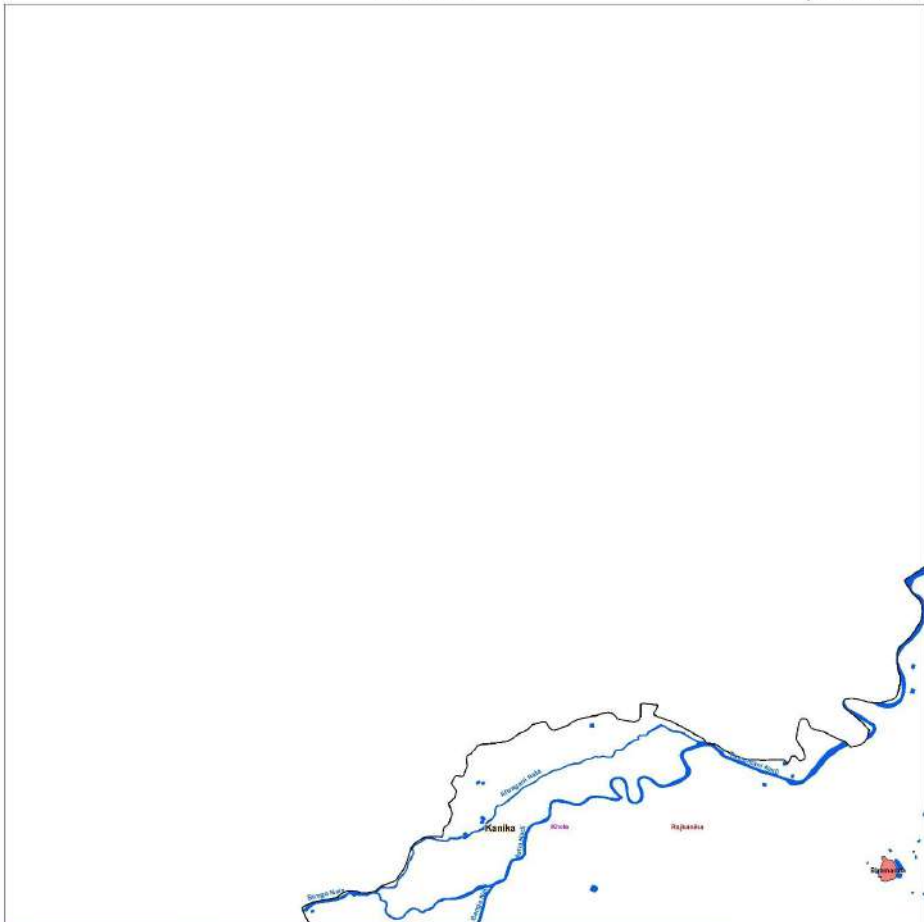
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



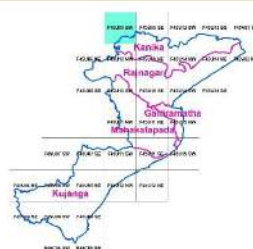
Toposheet No. : F45U09 SW



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	— SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

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SOURCE : WORLD VIEW-II MX, 2014



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

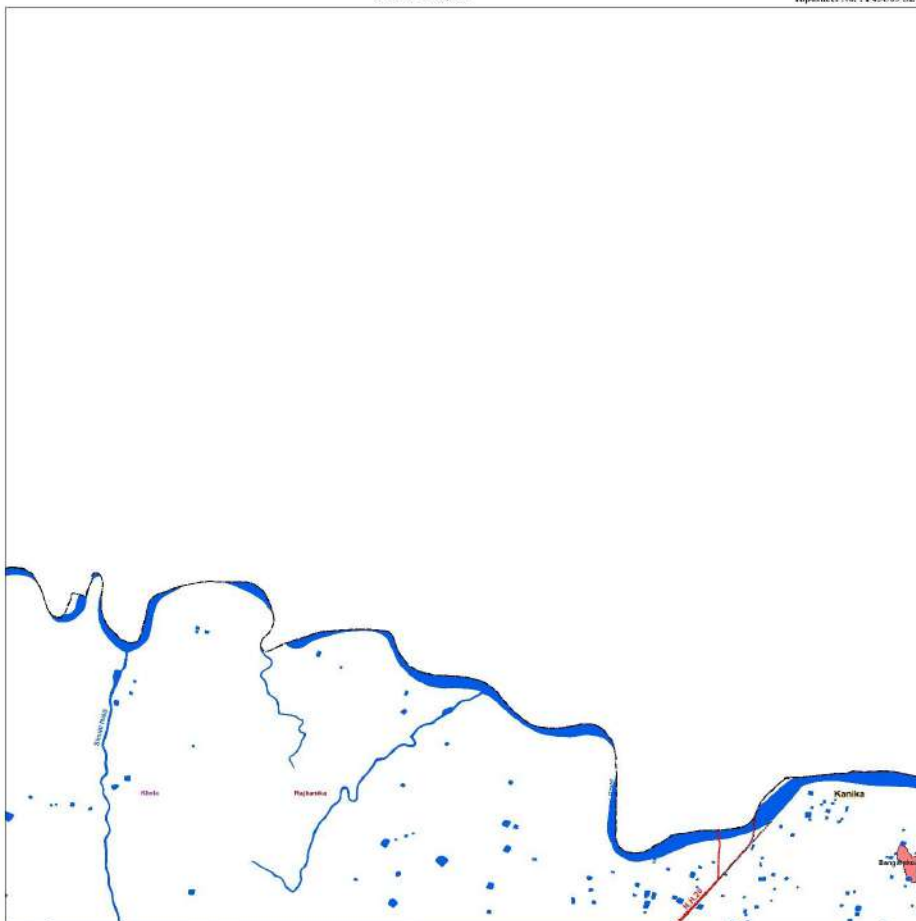
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



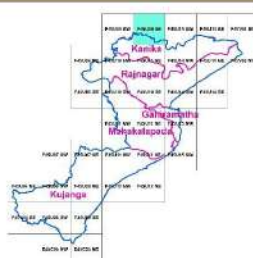
Toposheet No. : F45L09 SE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MX, 2016



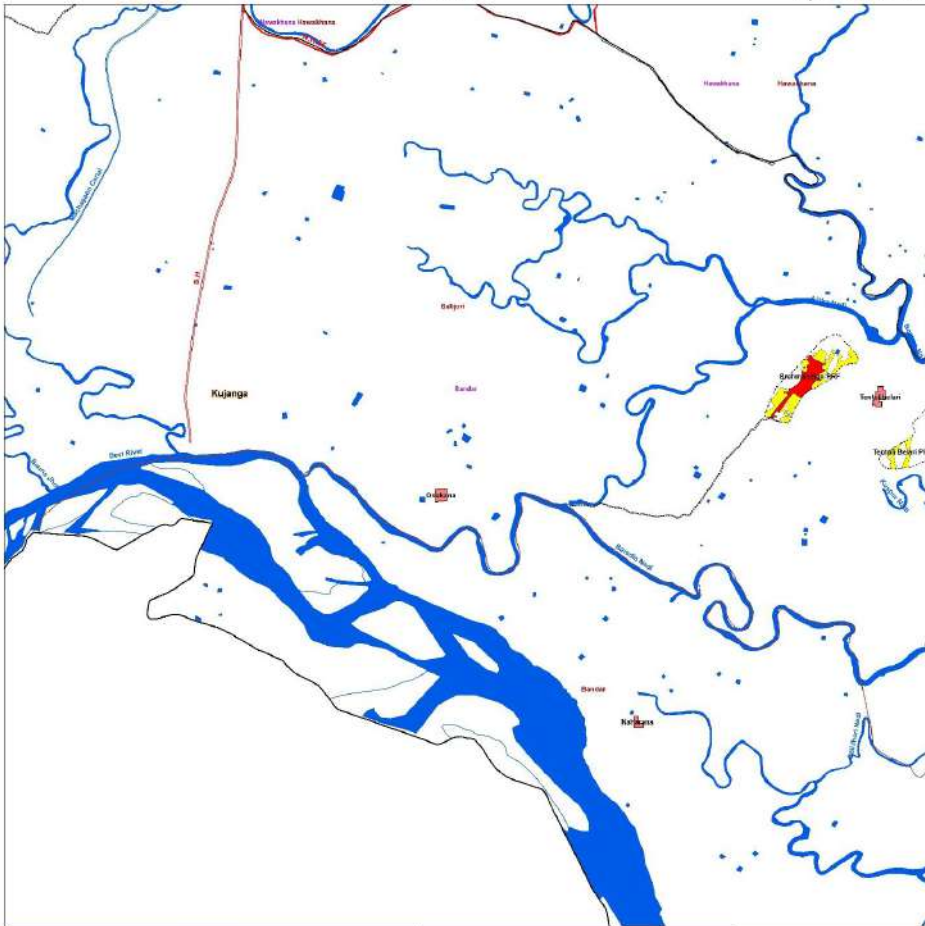
ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000

Toposheet No. : F45U08 SW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 M/S, 2018



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

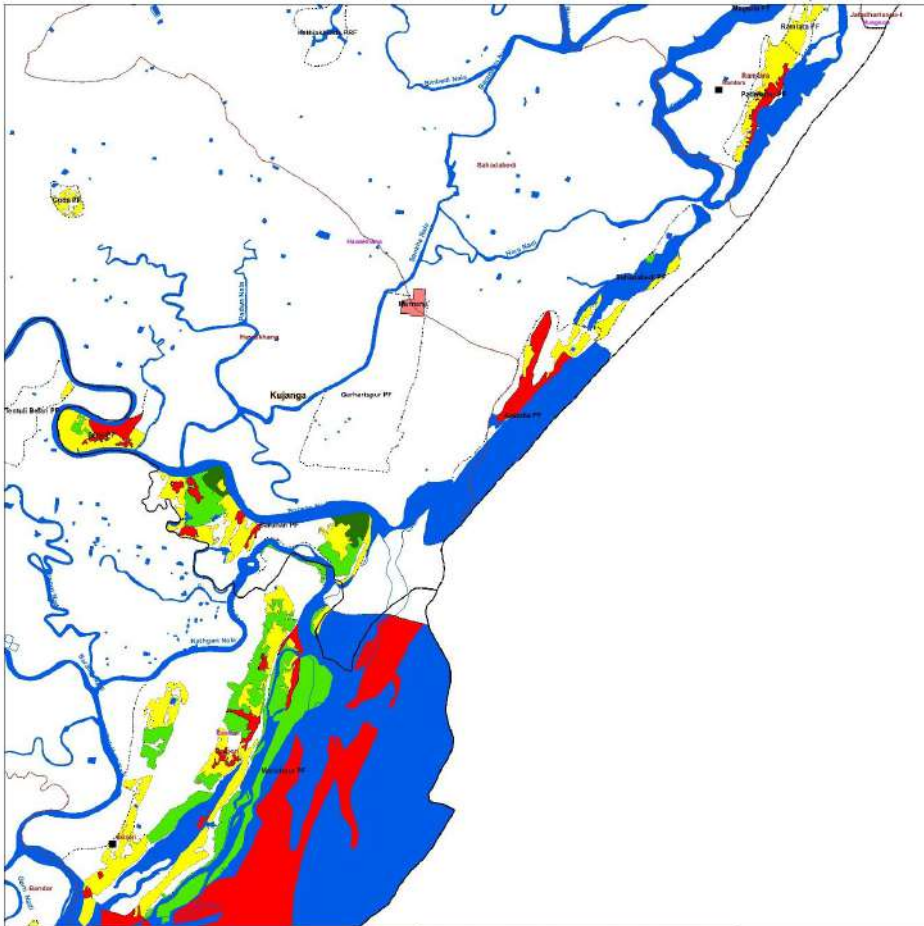
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



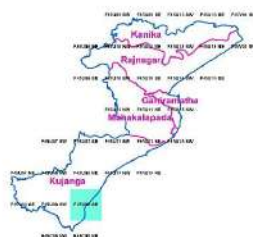
Toposheet No. : F45U.08 SE



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	■ SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-II MN, 2018



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

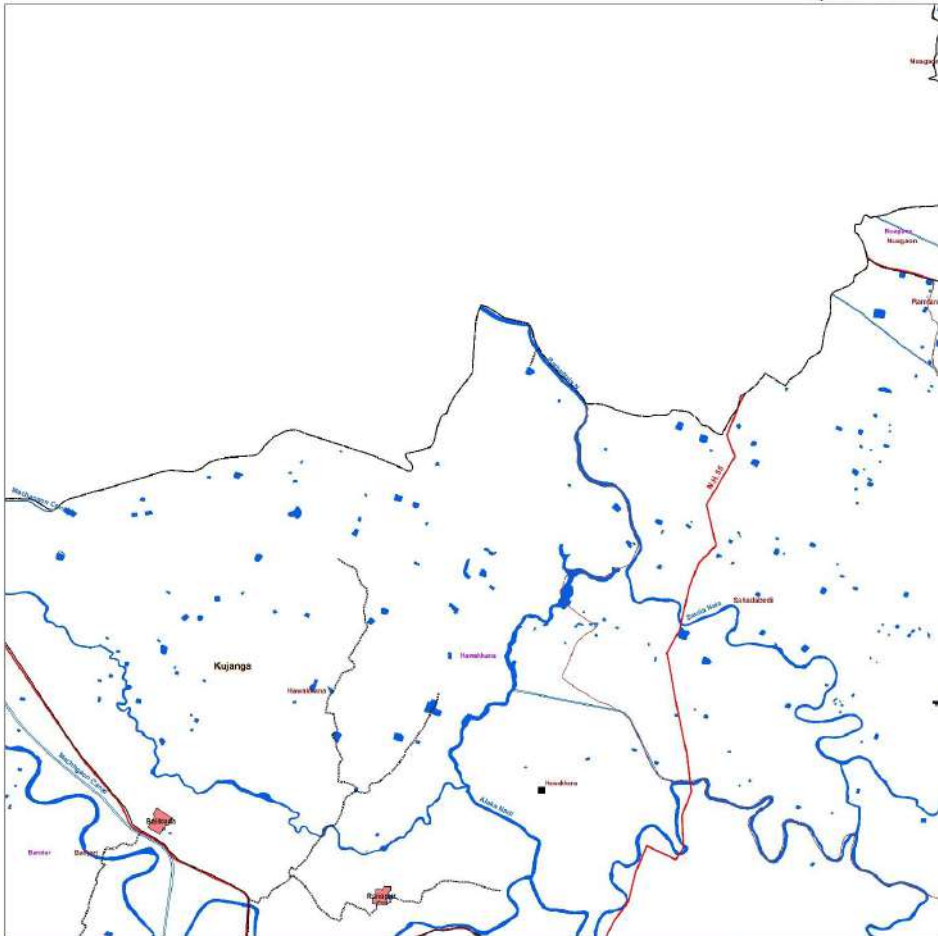
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



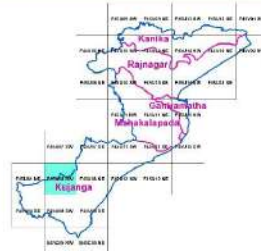
Toposheet No. : F45U88 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-II MN, 2016



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

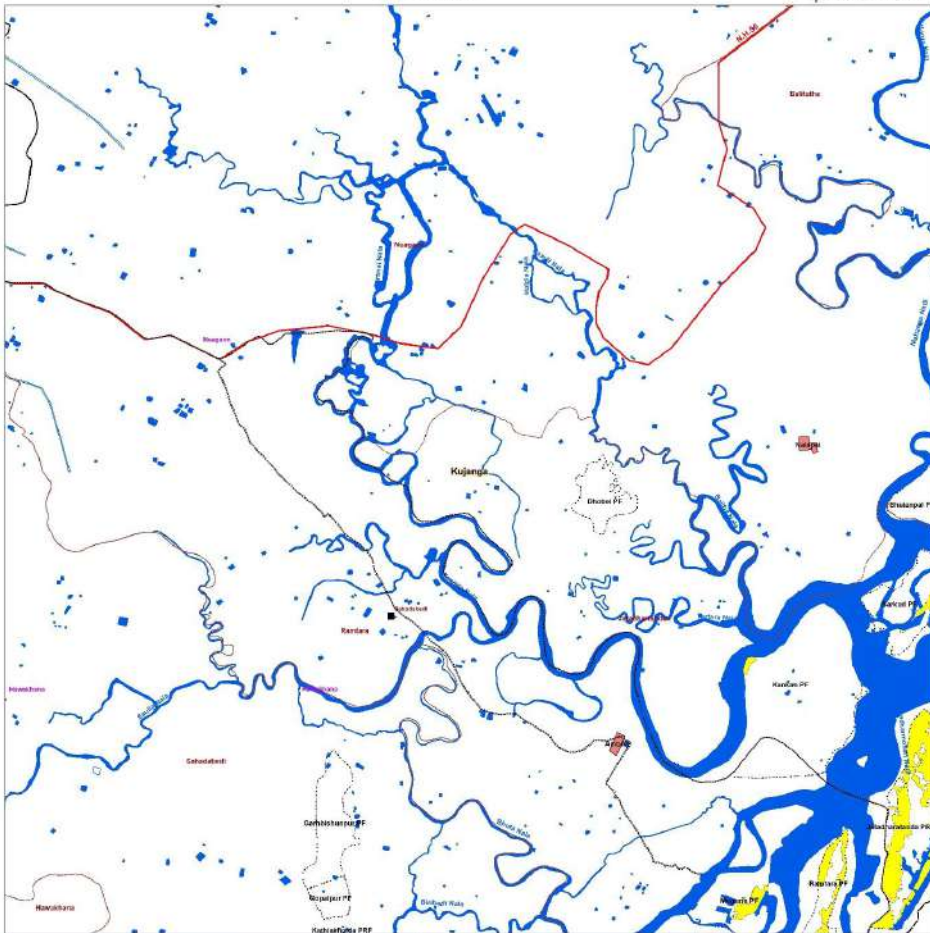
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



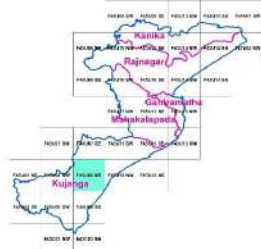
Toposheet No. : F45I/08 NE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MAX, 2011



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT. OF ODISHA, BHUBANESWAR

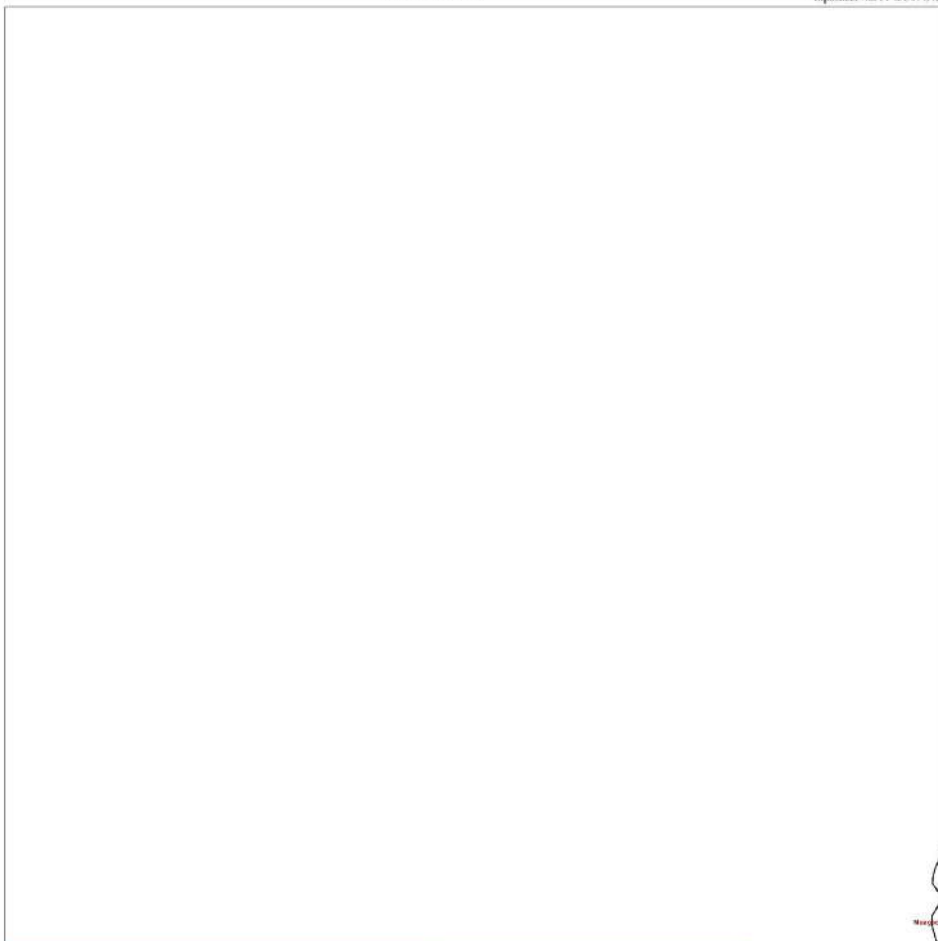
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



Toposheet No. : F45U07 SW



LEGEND

	VERY DENSE FOREST		SETTLEMENT
	MODERATELY DENSE FOREST		NATIONAL HIGHWAY
	OPEN FOREST		STATE HIGHWAY
	DEGRADED FOREST		MAJOR DISTRICT ROADS
	NON-FOREST		OTHER ROADS
	RIVER/WATER BODIES		RAILWAY
	DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS	
	RANGE BOUNDARY		DIVISION H.Q.
	SECTION BOUNDARY		RANGE H.Q.
	BEAT BOUNDARY		SECTION H.Q.
	FOREST BLOCK BOUNDARY		BEAT H.Q.
	SANCTUARY BOUNDARY		

INDEX MAP



SOURCE : WORLD VIEW-II MIX, 2015

ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

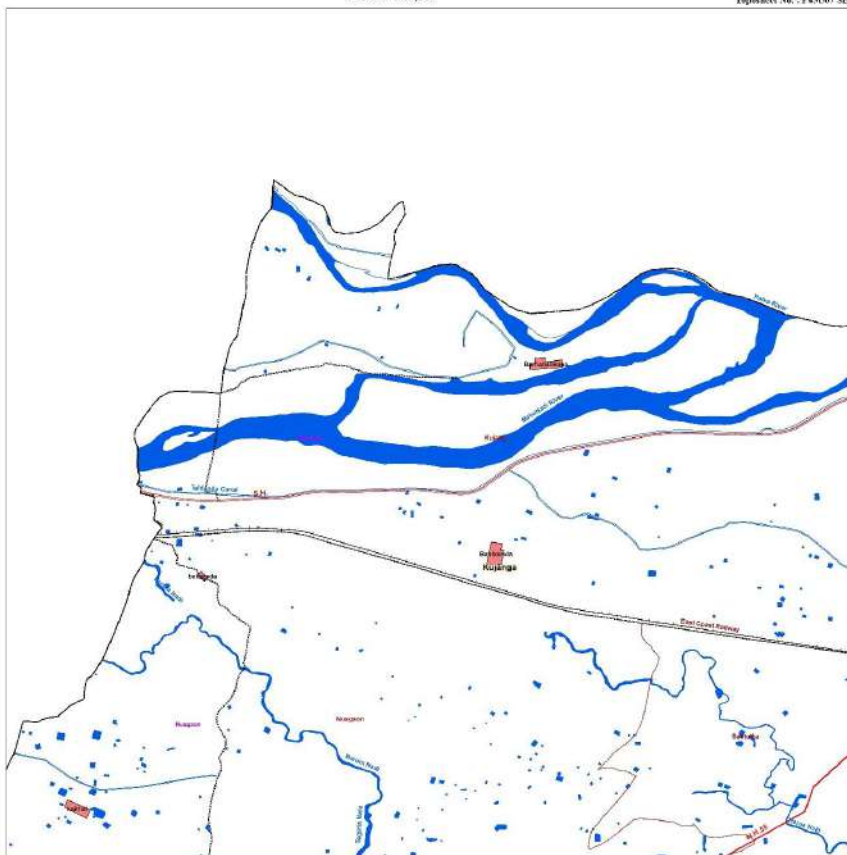
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



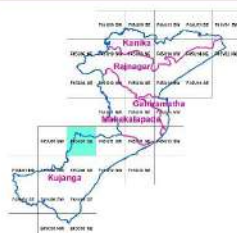
Toposheet No. : F45107 SE



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	■ RANGE H.Q.
BEAT BOUNDARY	■ SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-4/10X, 2014



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT. OF ODISHA, BHUBANESWAR

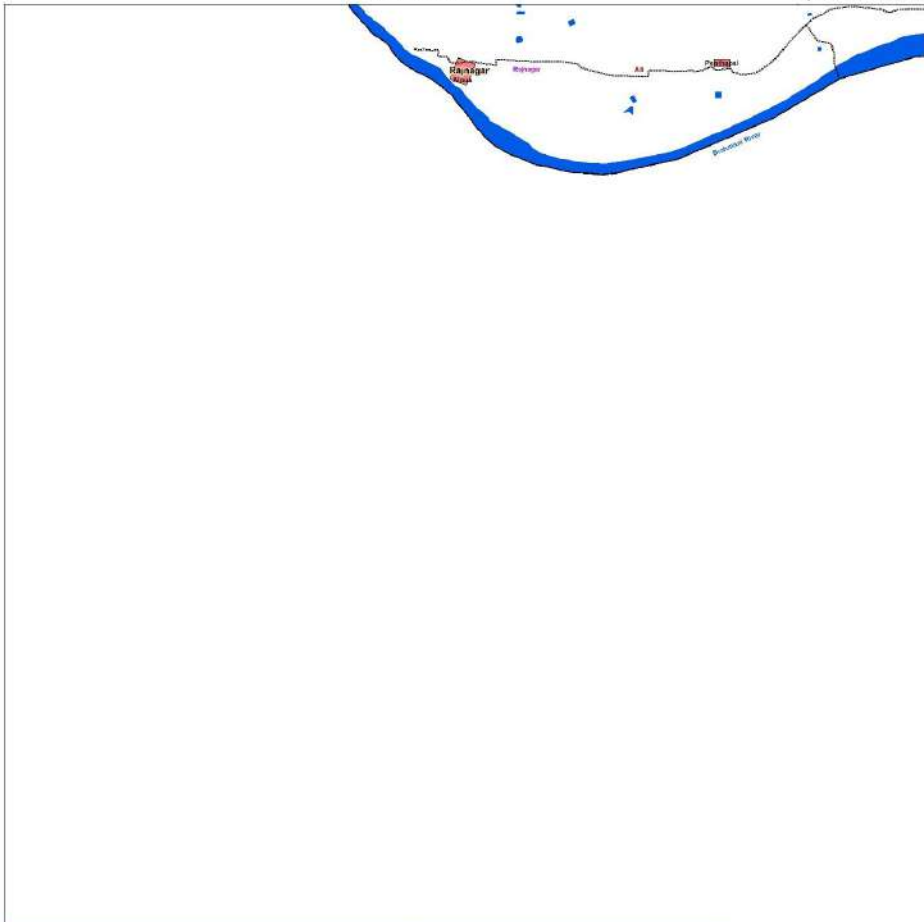
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



Toposheet No. : F45U06 SE



LEGEND

VERY DENSE FOREST	SETTLEMENT
MODERATELY DENSE FOREST	NATIONAL HIGHWAY
OPEN FOREST	STATE HIGHWAY
DEGRADED FOREST	MAJOR DISTRICT ROADS
NON-FOREST	OTHER ROADS
RIVER/WATER BODIES	RAILWAY
DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
RANGE BOUNDARY	▲ DIVISION H.Q.
SECTION BOUNDARY	● RANGE H.Q.
BEAT BOUNDARY	— SECTION H.Q.
FOREST BLOCK BOUNDARY	■ BEAT H.Q.
SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-2 MAY, 2016



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

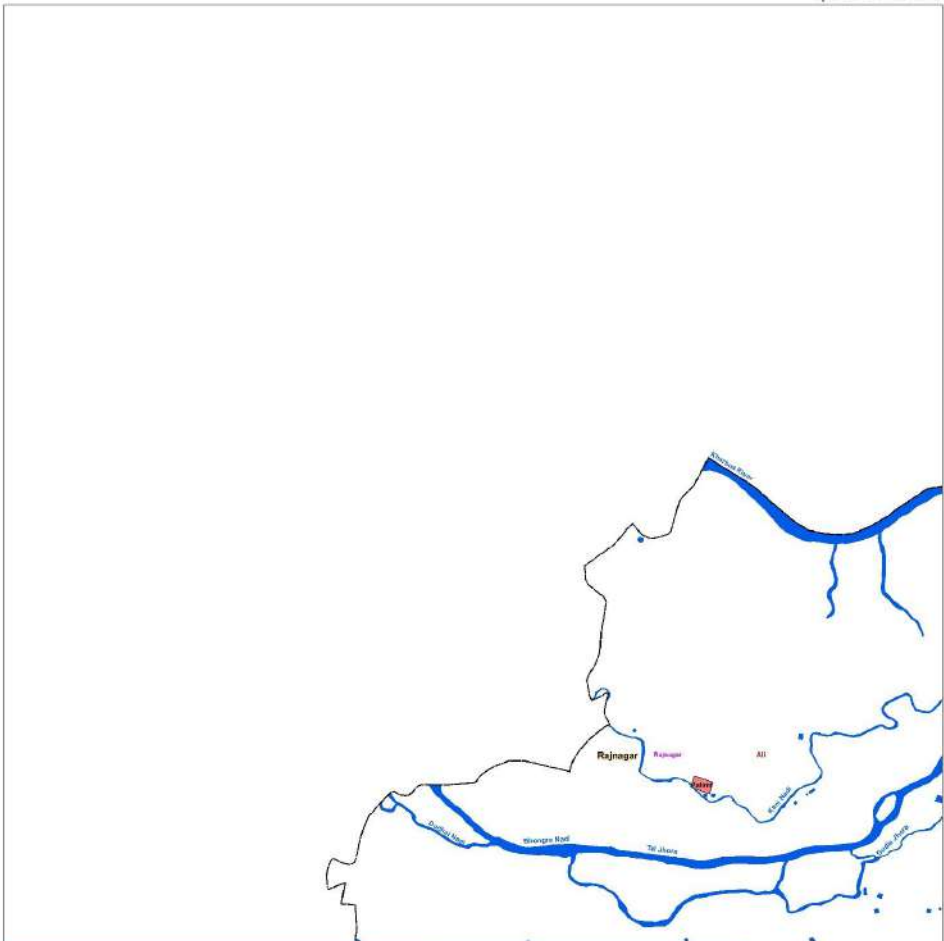
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



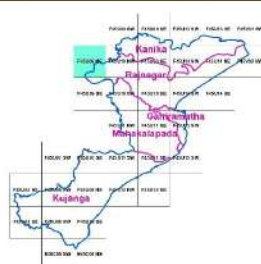
Toposheet No. : F45U06/NE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-II MX, 2014

ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



Toposheet No. : F45U04 SE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE : WORLD VIEW-11 MN, 2014



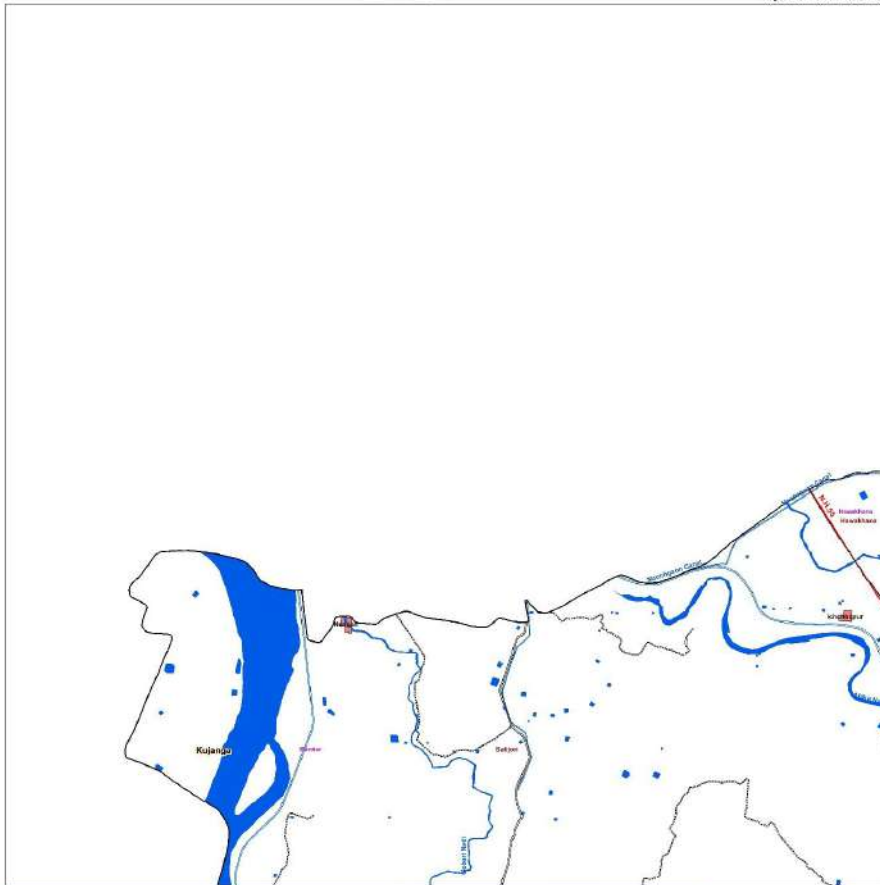
ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT OF ODISHA, BHUBANESWAR

FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers
SCALE - 1:25,000



Toposheet No. : F42UB4 SE



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
 RIVER/WATER BODIES	 RAILWAY
 DIVISION BOUNDARY	ADMINISTRATIVE LOCATIONS
 RANGE BOUNDARY	 DIVISION H.Q.
 SECTION BOUNDARY	 RANGE H.Q.
 BEAT BOUNDARY	 SECTION H.Q.
 FOREST BLOCK BOUNDARY	 BEAT H.Q.
 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE: WORLD VIEW-III, 2015



ODISHA SPACE APPLICATIONS CENTRE
(DEPARTMENT OF SCIENCE & TECHNOLOGY)
GOVT OF ODISHA, BHUBANESWAR

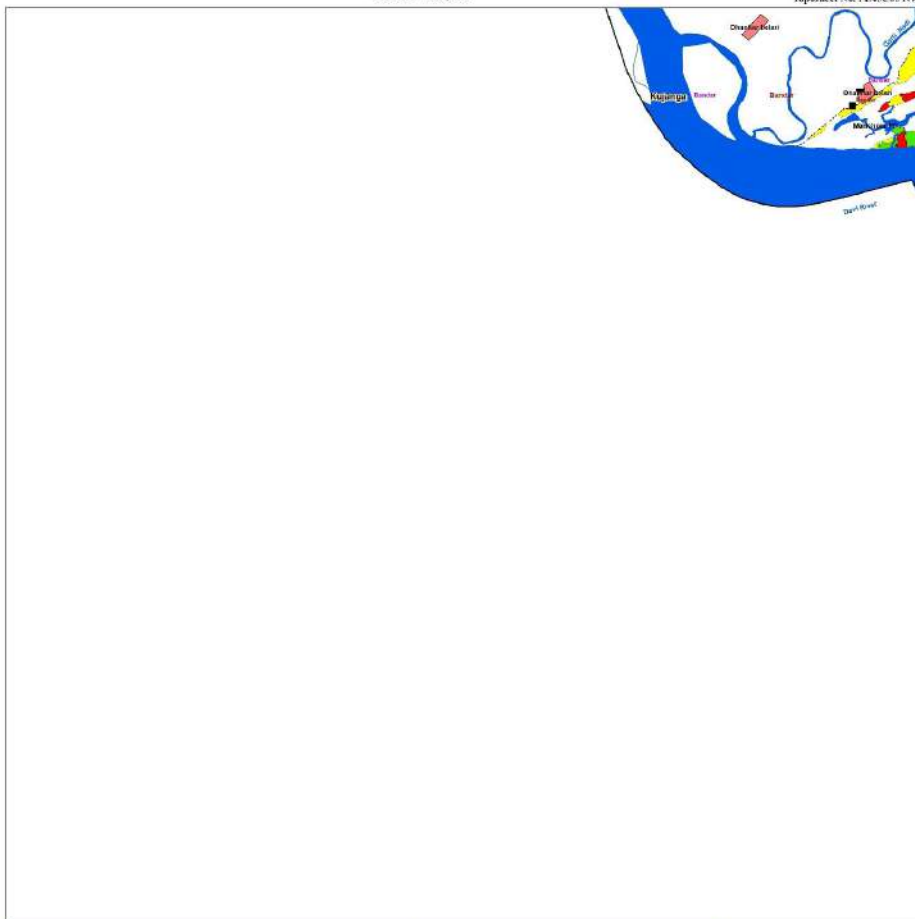
FOREST DENSITY MAP OF RAJNAGAR WILDLIFE DIVISION

0 1 2 3 4 Kilometers

SCALE - 1:25,000



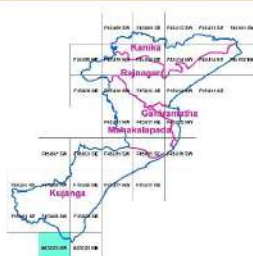
Toposheet No.: E45C05 NW



LEGEND

 VERY DENSE FOREST	 SETTLEMENT
 MODERATELY DENSE FOREST	 NATIONAL HIGHWAY
 OPEN FOREST	 STATE HIGHWAY
 DEGRADED FOREST	 MAJOR DISTRICT ROADS
 NON-FOREST	 OTHER ROADS
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 SANCTUARY BOUNDARY	

INDEX MAP



SOURCE: WORLD VIEW-III MX, 2016



ODISHA SPACE APPLICATIONS CENTRE
DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVT. OF ODISHA, BHUBANESWAR

ANNEXURE - X

AUCTION SALE OF CASHEW CROP FOR THE YEAR 2007 -08 to 2018-2019.OF MANGROVE FOREST DIVISION (WILDLIFE) RAJNAGAR

DL. No/ Year	Location	Highest Bid amount in Rs.	Amount In cluding Tax
44 of 2006-07	Jatadhar- Tanda PRF	50,300/-	
44 of 20 07-08	-do-	27,000/-	34,425/-
01 of 20 08-09	-do	31,700/-	40,418
1 of 2009-10	-do-	1,23,500/-	1,57,463/-
42 of 2010-11	-do-	20,000/-	
32 of 2011-12	-do-	2,00,900/-	2,28,022/-
3 of 2012-13	-do-	1,40,100/-	180,029/-
32 of 2013-14	-do-	2,53,000/-	20,000/- Plus 2,51,9752
19 of 2014-15	-do-	1,28,000/-	1,37,600/-
42 of 2015-16	-do-	1,33,000/-	1,33,000/-
06 of 2016-17	-do-	1,62,000/-	1,56,000/-
			1,62,000/-
01 of 2017-18	-do-	1,78,000/-	
03 of 2018-19	-do-	16,05,000/-	14,50,000/-



Annexure-XIA

List of VSS Kujang WL Range , Rajnagar WL Division						
Sl. No.	Name of the Section	Name of the VSS	Name of the Village	Name of the G.P	Name & Status of Forest land	Area in ha assigned to VSS
	Kujang WL Range					
1	Nuagaon	GadaKujang-A	Bayanalkandha	GadaKujang	Madhuban (A) P.F.	20.00
2	Nuagaon	GadaKujang-B	Polanga	GadaKujang	Madhuban (B) P.F.	20.00
3	Nuagaon	GadaKujang-C	Bhuyanpal	GadaKujang	Bhuyanpal PF	50.00
4	Borikina	Ramatara	Ramatara	Padmapur	Ramatara PF	20.00
5	Borikina	Sahadabedi-A	Sahadabadi	Padmapur	Sahadabedi PF	60.00
6	Hawakhana	Sahadabedi-B	Sahadabadi	Padmapur	Sahadabedi PF	60.00
7	Borikina	Naupala	Naupala	Kusupur	Salio PF	20.00
8	Borikina	Amarpat	Amarpat	Kusupur	Salio PF	20.00
9	Bandar	Balijore	Balijore	Baramundali	BalijoreRev. Forest	42.90
10	Bandar	Bandara	Bandara	Baramundali	Rev. Forest	51.00
11	Bandar	Baradia	Baradia	Baramundali	Rev. Forest	50.00
	Total (11 No.)					413.90
	Division Total (23 Number)					653.90



Annexure-XIB

VSS List of Mahakalapada Range, Rajnagar WL Division						
Sl. No.	Name of the Section	Name of the VSS	Name of the Village	Name of the G.P	Name & Status of Forest land	Area in ha assigned to VSS in Ha
	Mahakalapada Range					
1	Jamboo	Jamboo South	Jamboo	Jamboo	Jamboo PRF	20.00
2	Jamboo	Jamboo North	Jamboo	Jamboo	Jamboo PRF	20.00
3	Jagatjore	Suniti West	Suniti	Suniti	Suniti PRF	20.00
4	Jagatjore	Kalatunga	Kalatunga	Gagua	Kantilo RF	20.00
5	Jagsatjore	Radhiakansara	Radhia&Kansar	Badhi	Rev. For.	20.00
6	Jagatjore	Jagatjore	Datapur&Kantilo	Suniti	Suniti PRF	20.00
7	Jamboo	Kandarapatia	Kandarapatia	Jamboo	Kandarapatia PF	20.00
8	Jamboo	Jamboo East	Jamboo	Jamboo	Jamboo PF	20.00
9	Jamboo	Suniti East	Suniti	Suniti	Jamboo PF	20.00
10	Barunei	Ratapanga	Ratapanga	Gagua	Ratapanga PF	20.00
11	Barunei	Bhopal	Bhopal	Gagua	Bhopal PF	20.00
12	Jamboo	Petchhela	Petchhela		Petchhela PRF.	20.00
	Total (12 No)					
						240.00



The Odisha Gazette

EXTRAORDINARY
PUBLISHED BY AUTHORITY

No.1367, CUTTACK, THURSDAY, JULY 18, 2024/ASADHA 27, 1946

LABOUR & ESI DEPARTMENT

NOTIFICATION

The 18th July, 2024

No. 5308— LESI-LL1-III-0081-2017/LESI— Whereas, certain proposals to revise the minimum rates of wages payable to 89 Nos. of category of employees employed in scheduled employment were published as required under clause (b) of sub-section (1) of Section 5 of the Minimum Wages Act, 1948 (11 of 1948) in the Extraordinary issue of the *Odisha Gazette* No. 565 dated the 13th March, 2024 under the notification of the Government of Odisha in the Labour & Employees' State Insurance Department No. 2278—LESI-LL1-III-0081/2017/LESI., dated the 13th March, 2024, inviting objections and suggestions from all persons likely to be affected thereby within a period of two months from the date of publication of the said notification in the *Odisha Gazette*;

And, whereas, the Advisory Board appointed under section 7 of the said Act, has been consulted and the representations received within the period so specified in respect of the said proposal have been duly considered by the State Government;

Now, therefore, in exercise of the powers conferred by clause(b) of sub-section (1) of Section 3 read with Section 4 and sub-section (2) of Section 5 of the said Act and in supersession of all previous notifications issued in this regard, the State Government do hereby revise the minimum rates of wages payable to Unskilled, Semiskilled, Skilled, Highly Skilled categories of employees employed in 89 employments as mentioned in the Schedule to this notification in the whole of the State of Odisha to Rs.450.00, Rs.500.00, Rs.550.00 and Rs.600.00 per day respectively, with effect from the date of publication of this notification in the *Odisha Gazette*. The revised minimum rates of wages shall consist of the rates of wages as set out in column (4) of the Schedule to this notification and payable to the categories of employees as mentioned

in column (3) thereof. In addition to the said rates of wages, Variable Dearness Allowance (VDA) as admissible shall be declared at half-yearly interval i.e. on the 1st April and the 1st October of the year, at the rate of Rs. 2.60 paise per point rise in All India Consumer Price Index Number for Industrial Workers (base 2016-100) as may be notified by the Labour Commissioner, Odisha.

SCHEDULE

Sl. No.	Name of the Employment	Category of Employees	Revised minimum rates of wages per day
(1)	(2)	(3)	(4)
1. Agriculture		Unskilled Semi-skilled Skilled Highly skilled	Rs. 450.00 Rs. 500.00 Rs. 550.00 Rs. 600.00
2. Agarbati and Candle making Worker's Establishments			
3. Automobile servicing, repairing garages and Workshops			
4. Ayurvedic and Unani Pharmacy			
5. Bakeries and Confectionaries including Biscuit making			
6. Bamboo Forest Establishment			
7. Brass and Bell Metal Industry			
8. Carpet Weaving Industry			
9. Cashew processing establishments			
10. Cement pipe making and allied products industry			
11. Ceramic and Pottery Industry			
12. Chemical Industry			
13. Cinema Industry and Film Production			
14. Clay Pottery			
15. Coir Industry			
16. Collection of Sal Seeds			
17. Construction or maintenance of Dams, Embankments, Irrigation Projects and Sinking of wells and tanks.			
18. Construction or maintenance of roads or in building operations			
19. Contingent and Casual Employees in Government and other establishments, Courier and Cargo Services			
20. Cotton Ginning and Pressing Industry			
21. Dispensary of Medical Practitioner in any establishment of Medical Consultant or in any Chemical or Pathological Laboratory, Private Nursing Homes, Private Medical College Hospitals, Super Specialty Hospitals, Clinic, Laboratory etc.			
22. Distilleries			
23. Domestic Workers (shall be calculated as per hours of work)			
24. Electricity transmission, generation and distribution			
25. Employment in NGO and Voluntary Social Organization			
26. Employment in laying of underground Cables, Electric lines, Water supply lines and under Cable Operators.			
27. Finishing and Dying of yarn and fabrics, Painting, Knitting and Embroidery			
28. Fisheries and Sea food Industry			
29. Forest produce such as Genduli gum, Mahua making of coal and resin.			
30. Foundry Industry with or without attached machine shop			
31. Glass Industries			
32. Gold and Silver Ornaments and Articles of artistic design			
33. Graphite Industry including Beneficiation			
34. Handloom and Hosiery			
35. Hotels, Eating Houses and Restaurants			
36. Ice Factory and Cold Storage			
37. Jute Industry and Jute Twine Industry			
38. Kendu Leaf Collection			
39. Khadi Village Industries including manufacture of Khandasari and other products			
40. Laundry including Dry-washing			
41. Leather Industry			
42. Liquefied Petroleum Gas manufacture and distribution			

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(1)	(2)	(3)	(4)
43.	Local Authority	Unskilled Semi-skilled Skilled Highly skilled	Rs. 450.00 Rs. 500.00 Rs. 550.00 Rs. 600.00
44.	Manufacture of Brush and Brooms		
45.	Manufacture of Coke and Burning Coals		
46.	Manufacture of Cold drinks, Soda and other allied products		
47.	Manufacture of Electrical Bulbs and all allied electrical equipment		
48.	Manufacture of matches, fireworks and explosives		
49.	Manufacture of nails and pins		
50.	Manufacture of paints and varnishes		
51.	Manufacture of plastic products including toys		
52.	Manufacture of Radio by assembling with parts		
53.	Manufacture of ropes		
54.	Manufacture of Utensils including Aluminum and Hindalium products		
55.	Metal Industry(except the cottage and village scale units)		
56.	Major or Minor Engineering Industry including Sponge, Secondary Steel, Rolling Mills, Ferro Alloys, Metal Industries (employment less than 50 persons)		
57.	Motor body building		
58.	Minor Ports		
59.	Non-teaching staff of Private Educational Institution including ITI & Training Institute, Coaching Centre.		
60.	Oil Mill		
61.	Paper and Cardboard Industry		
62.	Petrol and Diesel Oil Pumps		
63.	Pharmaceutical Industry		
64.	Power loom Industry		
65.	Printing Press, DTP Centre and Offset Printing Press		
66.	Private Road Transport		
67.	Private Security Agencies and Private Security Services		
68.	Public Health Engineering		
69.	Public Motor Transport		
70.	Readymade Garments Industries including Mechanized Trade of Readymade Garment Industry		
71.	Refractory Industry		
72.	Regulated markets, Marketing Societies, Co-operative Societies and Banks.		
73.	Rice Mill, Flour Mill, Dal Mill, Chuda mill and Masala Mill		
74.	Rubber and Rubber Products Industry		
75.	Salt Pans		
76.	Saw Mills		
77.	Shops, Commercial Establishments, Salon, Beauty Parlour, Spa, massaging centre, Xerox shop, STD booth, tent house, newspaper hawkers and newspaper establishments.		
78.	Siali leaf pluckers and Sal leaf pluckers		
79.	Soap and Detergent Manufactory		
80.	Social Forestry		
81.	Spinning Mills		
82.	Stone breaking or Stone crushing		
83.	Tamarind collection		
84.	Tile and Brick Making		
85.	Timber Trading (excluding felling and sawing)		
86.	Timber Trading (including felling and sawing)		
87.	Tobacco (including Bidi making) Manufactory		
88.	Trunks, Suitcase and Bucket manufactory		
89.	Wood works and furniture making industries		

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Explanation:—For the purpose of this notification—

1. The minimum rates of wages are all inclusive rates including the basic rates, the cost of living allowances and the cash value of the concessional supply if any of essential commodities.
2. The daily minimum rates of wages shall be inclusive of wages payable for the weekly day of rest.
3. The minimum rates of wages are applicable to the employees employed by contractors also.
4. The minimum rates of wages for disabled persons shall be same as payable to the workers of the appropriate category.
5. There shall not be any discrimination between male and female workers in the matters of payment of minimum wages in any category of employment.
6. (a) “Unskilled work” means work which involves simple operation requiring little or no skill or experience on the job.
(b) “Semi-skilled work” means work which involves some degree of skill or competence acquired through experience on the job and which is capable of being performed under the supervision or guidance of a skilled employee and includes un-skilled supervisory work.
(c) “Skilled work” means work which involves skill or competence acquired through experience on the job or through training as an apprentice or in a technical or vocational institute and the performance of which calls for initiative and judgment; and
(d) “Highly Skilled work” means work which calls for a high degree of perfection and full competence in the performance of certain tasks, acquired through intensive technical or professional training or practical work experience for long years and also required for workers to assume full responsibility for the judgment or decisions involved in the execution of these tasks.
7. An adult employee shall work for eight hours per day excluding half an hour of rest.

By Order of the Governor
CHITHRA ARUMUGAM
Principal Secretary to Government

Annexure-XIII
SOCIOECONOMIC PROFILE OF VILLAGES OF MANGROVE FOREST DIVISION (WILDLIFE),
RAJNAGAR

A

Name of Block/ ULB	Geogra phical area in Sq. km	House holds	No. of villag es	Area under crop in Ha	Area under Kharif crop in Ha	Consump -tion of fertilizer per Ha in Kg	No of Agril cooperative Societies	Fish production in MT	Livestoc k hospitals Dispensa ries	No of Post offices	No of Primary Schools	No of Secondary Schools	Coll eges	Hos pital s (All)
KENDRAPADA DISTRICT														
Aul	224.45	27274	132	4891	5836	72	11	475.00	8	35	98	43	4	39
Mahakalpara	490.57	40995	223	4857	4673	65	24	6884.70	11	41	150	45	4	29
Pattamundai	258.66	31330	148	14305	11993	55	16	580.40	10	37	128	47	4	36
Rajkanika	263.49	24523	168	4055	4356	61	16	637.48	5	20	120	36	4	29
Rajnagar	346.25	28174	310	4005	4301	63	14	2906.83	9	22	126	29	4	32
Pattamundai NAC	2.54	6233							2	2	18	4	2	3
JAGATISINGHPUR DISTRICT														
Balikuda	291.36	37856	237	12987	5593		21	3391.08	2	32	144	43	4	38
Erasama	384.34	33703	210	4168	5724		16	6226.24	1	7	158	36	3	30
Kujanga	225.03	38443	173	11515	4134		18	35440.08	1	38	112	44	7	41
Nuagaon	120.80	18878	90	3750	2434		6	799.62	1	11	73	19	3	17
Paradeep Municipality	23.35										11	10	1	1

B

Name of Block/ ULB	No of PDS shops	No of tube wells	No of piped water projects	No of women SHG	No of AWCs	No of BPL families	No of job cards issued
KENDRAPADA DISTRICT							
Aul	95	1527	21	1111	225	14466	16824
Mahakalpara	95	1906	17	2282	311	14012	30215
Pattamundai	98	1654	26	1098	278	14823	19890
Rajkanika	79	1425	21	1221	211	13717	18655
Rajnagar	78	1778	23	1236	171	13908	16896
Pattamundai NAC	34	153	25				
JAGATSINGHPUR DISTRICT							
Balikuda		1464	35	1480	244	15170	30324
Erasama		1571	28	1393	239	12474	27967
Kujanga		1702	32	1210	343	11693	24295
Nuagaon		1048	19	1065	119	7307	10549
Paradeep Municipality							



ANNEXURE – XIV

SANCTIONED STAFF STRENGTH OF MANGROVE FOREST DIVISION (WL)

Sl No.	Category of the Post	Scale of the Pay	Grade Pay	Sanction strength
1	2	3	4	5
5	DFO / Dy-Dir., STR/Dy CF	15600-39100	6600	1
8	ACF / Asst. Dir. *	15600-39100	5400	3
	TOTAL GRADE -A			4
9	VAS	9300-34800	4600	1
11	Forest Ranger(A.D)	9300-34800	4600	1
12	Forest Ranger(H.M)	9300-34800	4600	1
13	Forest Ranger(Range)	9300-34800	4600	5
14	Forest Extension Supervisor(FEO)	9300-34800	4600	1
	TOTAL GRADE -B			9
25	Head Clerk	9300-34800	4200	1
29	Junior Accountant	5200-20200	2400	5
32	Jr. Steno	5200-20200	2400	1
33	Dy. Ranger *	5200-20200	2400	3
34	Forester(A.D)	5200-20200	2000	1
35	Forester(C.H)	5200-20200	2000	1
36	Forester(H.M)	5200-20200	2000	11
37	Forester(Section)	5200-20200	2000	15
39	Lunch Sarang	5200-20200	2000	2
40	Lunch Man	5200-20200	1900	1
49	Junir Clerk(Divisional)	5200-20200	1900	6
53	Driver(L.V)	5200-20200	1900	2
56	Lunch Driver	5200-20200	1900	2
64	Forest Guard(A.D/H.M)	4440-7440	1650	6
65	Forest Guard(Beat)	4440-7440	1650	45
66	Forest Guard(C.H)	4440-7440	1650	2
	TOTAL GRADE -C			104
71	Office Peon including B. Garden	4440-14680	1500	1
74	BangalowChoukidar	4440-14680	1500	1
83	Sea Cunny	4440-14680	1600	1
84	Khalasi	4440-14680	1500	1
85	Boat Man	4440-14680	1500	5

93	Watcher	4440-14680	1500	1
	TOTAL GRADE -D			10
	GRAND TOTAL (A+B+C+D)			127



ANNEXURE – XV

**LIST OF DIVISIONAL FOREST OFFICERS WORKED IN MANGROVE FOREST DIVISION
(WILDLIFE), RAJNAGAR**

WILDLIFE CONSERVATION DIVISION, CHANDBALI		
Sl. No.	Name of the Divisional Forest Officer	Period
01	Shri C.B. Mohanty O.F.S(I)	- 24.02.1980
02	Shri L.N. Choudhury, O.F.S(I)	24.02.1980 -01.01.1982
03	Shri N.C. Bose, I.F.S	01.01.1982-30.01.1982
04	Shri L.N. Choudhury, O.F.S (I)	30.01.1982-20.04.1983
05	Shri S. K. Mishra, O.F.S (I)	20.04.1983-31.07.1987
06	Shri N. C. Mohanty, O.F.S	31.07.1987-10.08.1987
07	Shri B.N. Nayak, O.F.S (I)	10.08.1987 - 14.11.1990
MANGROVE FOREST DIVISION (WILDLIFE), RAJNAGAR		
08	Sri B.N. Nayak, O.F.S (I)	14.11.1990 - 20.10.1993
9	Shri S.K. Chadha, I.F.S	20.10.1993 - 29.10.1993
10	Shri A.K. Mohapatra, I.F.S	29.10.1993 - 07.11.1993
11	Shri S.K. Chadha, I.F.S	07.11.1993 - 07.08.1994
12	Shri AsishMohapatra, I.F.S	07.08.1994 - 27.08.1994
13	Shri K.R. Singh, I.F.S	27.08.1994 - 03.10.1994
14	Shri AsishMohapatra, I.F.S	03.10.1994 - 19.09.1995
15	Shri A.K. Mishra, O.F.S (II)	19.09.1995 - 05.10.1995
16	Shri AsishMohapatra, I.F.S	05.10.1995 - 06.09.1996
17	Sri B.N. Nayak, O.F.S (I)	06.09.1996 - 28.02.1998
18	Shri L.K. Dash, O.F.S (I)	28.02.1998 - 19.08.1998
19	Dr. P.R. Karat, I.F.S	19.08.1998 - 05.02.2001
20	Shri A.K. Nayak, I.F.S	05.02.2001 - 16.05.2004
21	Shri SudarsanPatra, O.F.S	16.05.2004 - 06.06.2004
22	Shri Ajaya Kumar Jena, O.F.S (I)	06.06.2004 - 12.12.2007
23	Shri P.K. Behera, O.F.S (I)	12.12.2007 - 25.01.2010
24	Shri Manoj Mohapatra, O.F.S (I)	25.01.2010 - 01.02.2010
25	Shri P.K. Behera, O.F.S (I)	01.02.2010 - 04.08.2010
26	Shri Manoj Mohapatra, O.F.S (I)	04.08.2010 - 16.08.2013
27	Shri Kedar Kumar Swain, O.F.S-A (S.B)	16.08.2013 - 12.09.2013
28	Shri TrilochanDebata, O.F.S-A (S.B)	12.09.2013 - 21.10.2013

29	Shri Kedar Kumar Swain, O.F.S-A (S.B)	21.10.2013 - 06.02.2015
30	Sri BimalPrasanna Acharya, O.F.S-A (S.B)	06.02.2015 - 26.08.2019
31	Sri BikashRanjan Dash, O.F.S-I (S.T.S)	26.08.2019 – 18.06.2021



Article

Use of Hyperion for Mangrove Forest Carbon Stock Assessment in Bhitarkanika Forest Reserve: A Contribution Towards Blue Carbon Initiative

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Abstract: Mangrove forest coastal ecosystems contain significant amount of carbon stocks and contribute to approximately 15% of the total carbon sequestered in ocean sediments. The present study aims at exploring the ability of Earth Observation EO-1 Hyperion hyperspectral sensor in estimating aboveground carbon stocks in mangrove forests. Bhitarkanika mangrove forest has been used as case study, where field measurements of the biomass and carbon were acquired simultaneously with the satellite data. The spatial distribution of most dominant mangrove species was identified using the Spectral Angle Mapper (SAM) classifier, which was implemented using the spectral profiles extracted from the hyperspectral data. SAM performed well, identifying the total area that each of the major species covers (overall kappa = 0.81). From the hyperspectral images, the NDVI (Normalized Difference Vegetation Index) and EVI (Enhanced Vegetation Index) were applied to assess the carbon stocks of the various species using machine learning (Linear, Polynomial, Logarithmic, Radial Basis Function (RBF), and Sigmoidal Function) models. NDVI and EVI is generated using covariance matrix based band selection algorithm. All the five machine learning models were tested between the carbon measured in the field sampling and the carbon estimated by the vegetation indices NDVI and EVI was satisfactory (Pearson correlation coefficient, R, of 86.98% for EVI and of 84.1% for NDVI), with the RBF model showing the best results in comparison to other models. As such, the aboveground carbon stocks for species-wise mangrove for the study area was estimated. Our study findings confirm that hyperspectral images such as those from Hyperion can be used to perform species-wise mangrove analysis and assess the carbon stocks with satisfactory accuracy.

Keywords: blue carbon; hyperspectral data; mangrove forest; carbon stock; Bhitarkanika Forest Reserve; regression models; machine learning

1. Introduction

Mangrove forest coastal ecosystems provide several beneficial functions, both to terrestrial and marine resources [1,2]. Mangrove forests contain significant amount of carbon stocks and are one of

the sources of carbon emissions [3]. Coastal habitat contributes more than half of the total carbon sequestered in ocean sediments, only 2% of the total carbon is sequestered by coastal habitat [4]. Mangroves provide essential support to the ecosystem, thus, their decline also results in socio-economic loss. Previous studies demonstrated the existence of mangrove forests in several countries (about 120 in total) including tropical as well as sub-tropical ones, with coverage of 137,760 km² across the earth [5]. Recently, Hamilton and Casey (2016) provided key information concerning mangrove forest distribution worldwide. The total mangrove area in India is 4921 km², which comprises about 3.3% of global mangroves [6]. Due to their valuable contribution in biomass, carbon sinks as well as numerous other benefits for biodiversity of mangrove forests ecosystem are considered as a valuable ecological and economic resources worldwide [7,8].

Resources are declining and continuously limiting in its spatial extent due to human induced as well as natural factors which is putting pressure with every passing time [9], thus, the rapid altering of the composition, structure, and behavior of the ecosystem and their capability to deliver ecosystem services is declining [10–12]. This decline happens at a fast rate by 0.16% to 0.39% annually at global level [13]. It is estimated that mangroves store 1.23 ± 0.06 Pg of carbon globally sequestered from coastal ecosystem is one of the integral parts of the global carbon circulation [14]. Annually, around 131–639 km² of mangrove forests are being destroyed; in terms of overall carbon loss, it goes up to 2.0–75 TgCyr⁻¹ [13].

Valiela et al. [15] demonstrated that mangrove forests in tropical countries are the most threatened ecosystems. The major threat is the conversion of mangrove forests in other land use types and categories, such as aquaculture, coastal development, construction of channels, agriculture, urbanization, coastal landfills, and harbors, or deterioration due to indirect effects of pollution [1,16]. Allen et al. [17] described about the impact of natural threats on mangrove forest which includes sea level rise, tropical storm, insects, lightning, tsunami affected [18], and climate change. Yet, those are considered as minor threats, as the mangrove forest degradation rate is much less because of natural causes than anthropogenic factors. Several studies have provided evidence of the decline of mangroves population, which are already critically endangered [15] or approaching the state or verge of extinction in some of countries where these eco-sensitive fragile ecosystems exist (data demonstrated that approximately 26 are listed where mangrove are in grave situation out of a total 120 countries) [12,19]. It is therefore imperative to monitor mangrove forests for their biodiversity, biomass, and carbon stocks at regular time intervals to provide suitable database and help in conservation strategies. There are critical studies [20–22] the mangrove forest ecosystem and its biodiversity in India [23], where authors stressed on the importance of mangrove forests [24] and conservation priorities [21]. Some authors also demonstrated the degradation of mangrove and their impact [20,23–25]. There have been several published studies that focused on assessing the blue carbon stored in the mangroves around the world and in India; yet, a species-wise blue carbon analysis with significant accuracy is missing. Species-wise blue carbon analysis can be used to evaluate the impact of global climate change on different types of mangrove species and can also help in ecosystem services and policy makers to accurately evaluate the ecological as well as economical trade off associated with the management of mangroves ecosystem.

Blue carbon is nothing but the carbon stored and captured in coastal and marine ecosystems in different forms globally, such as biomass and sediments from mangrove forest, tidal marshes, and seagrasses. About 83% of global carbon is circulated through oceans. A major contribution is through coastal ecosystems [4] such as mangrove forests in form of biomass and carbon stocks [26]. Thus, blue carbon stock assessment of tropical regions, especially mangrove forests, is an issue for global change research [27], in order to effectively manage such ecosystems to reduce loss of biomass and carbon stock. Therefore, these ecosystems provide an exceptional candidate for research such as carbon change mitigation program such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation) in third world countries or developing countries [28–30] and Blue Carbon studies around the coastal regions in the world [31,32]. The coastal line covers a large area, which can be surveyed at a high temporal resolution with a very cost-effective way through remote sensing approach and is able to generate databases for each of the mangrove forest sites. Use of technologies such as Remote

Sensing is crucial as a tool for assessing and monitoring mangrove forests, primarily because many mangrove swamps are inaccessible or difficult to field survey [33].

Previous work by the authors as well as other researchers has allowed assessing the biomass of the several mangrove plant species and has provided the biomass of species individually. Chaube et al. [34] employed AVIRIS-NG (Airborne Visible InfraRed Imaging Spectrometer Next Generation) hyperspectral data to map mangrove species using a SAM (Spectral Angle Mapper) classifier. Authors identified 15 mangrove species over Bhitarkanika mangrove forest, reporting an overall accuracy (OA) of 0.78 (R^2). They also concluded that the hyperspectral images are very useful in discriminating mangrove wetlands, and having a finer spectral and spatial resolution can be crucial in investigating fine details of ground features. Kumar et al. [35] used the five most dominant classes of mangrove species present in Bhitarkanika as training sets to classify using SAM on Hyperion hyperspectral images, and archived an OA of 0.64. Ashokkumar and Shanmugam [36] demonstrated the influence of band selection in data fusion technique; they performed classification using support vector machine and observed that factor based ranking approach shown better results (R^2 of 0.85) in discriminating mangrove species than other statistical approaches. In another study, Padma and Sanjeevi [37] used an identical algorithm by integrating Jeffries-Matusita distance and SAM to map the mangrove species within the Bhitarkanika using Hyperion Image with an OA of 0.86 (R^2 value).

Presently, the spatial distribution maps of mangroves are generated using Earth Observation (EO) Hyperion datasets [26]. Table 1 illustrates the wetland research, which employed several algorithms for the assessment using various data types. Identifying different species in a mangrove forest is a fundamental yet difficult task, as it requires a high spatial and spectral resolution satellite images. To identify different species within the study area, EO-1 Hyperion hyperspectral data is currently acquired and field-sampling points are taken to generate the endmember spectra. This study demonstrated the use of vegetation indices (in this paper NDVI (Normalized Difference Vegetation Index) and EVI (Enhanced Vegetation Index)) for estimating carbon stock within an area with a significant accuracy. Presently, the field inventory data were incorporated with the hyperspectral image to derive the carbon stock. Three different NDVI and EVI based models were used to determine the total blue carbon sequestered by each species within the study area.

In purview of the above, this study aimed at evaluating the net above ground carbon stocks present at Bhitarkanika mangrove forest ecosystem, particularly with relevant field inventory and remote sensing approaches.

Table 1. Showing the recent studies in mangrove classification and mapping using different techniques.

Technique Used	Datasets	Study Location	Ref.	Year
Maximum Likelihood Classifier (MLC)	Aerial Photographs	Texas, USA	[38]	2010
MLC and The Iterative Self-Organizing Data Analysis Technique (ISODATA) algorithm	Landsat, Radar Satellite (RADARSAT), Satellite Pour l'Observation de la Terre (SPOT)	Vietnam	[39]	2011
MLC	IKONOS	Sri Lanka	[40]	2011
Unsupervised	Landsat and The Linear Imaging Self Scanning Sensor (LISS-III)	Eastern coast of India	[41]	2011
Sub-Pixel	Moderate Resolution Imaging Spectroradiometer (MODIS)	Indonesia	[42]	2013
Spectral Angle Mapper (SAM)	Hyperion	Florida	[34, 43]	2013
Neural Network	Landsat	Global	[44]	2014
Object based	Landsat	Vietnam	[45]	2014

Table 1. Cont.

Technique Used	Datasets	Study Location	Ref.	Year
Object based	Advanced Land Observing Satellite (ALOS) Phased Array type L-band Synthetic Aperture Radar (PALSAR)/ Japanese Earth Resources Satellite 1 (JERS-1) Synthetic Aperture Radar (SAR)	Brazil and Australia	[46]	2015
Hierarchical clustering	Hyperspectral Imager for the Coastal Ocean (HICO) and HyMap	Australia	[47]	2015
Tasseled cap transformation	Landsat	Vietnam	[48]	2016
NDVI	Landsat	Vietnam	[49]	2016
MLC	IKONOS, QuickBird, Worldview-2	Indonesia	[50]	2016
Object based Support Vector Machine	SPOT-5	Vietnam	[36, 51]	2017
Iso-cluster	Landsat	Madagascar	[52]	2017
Random Forest	Landsat	Vietnam	[53]	2017
K-means	Landsat	West Africa	[54]	2018
Decision Tree	Landsat	China	[55]	2018
Data Fusion	ALOS PALSAR & Rapid Eye	Egypt	[56]	2018
	Compact Airborne Spectrographic Imager (CASI) and Bathymetric Light Detection and Ranging (LiDAR)	Mexico	[57]	2016
Structure from Motion (SfM) Multi-View Stereo (MVS) Algorithm	Unmanned Aerial Vehicle (UAV)	Australia	[58]	2019
Hybrid decision tree/ Support Vector Machine (SVM)	Hyperspectral	Galapagos Islands	[33]	2011
Hierarchical cluster analysis	Compact Airborne Spectrographic Imager (CASI)	South Caicos, United Kingdom	[59]	1998
Feature Selection Algorithm	CASI	Galeta Island, Panama	[60]	2009
SAM	Airborne Imaging Spectrometer for Applications (AISA)	South Padre Island, Texas	[61]	2009
SVM	Earth EO-1 (Earth Observation) Hyperion	Bhit arkanika National Park, India	[35]	2013
MLC & Hierarchical neural network	CASI	Daintree river estuary, Australia	[62]	2003
Object based Classification	UAV based Hyperspectral Image	Qi'ao Island, China	[63]	2018
SAM	Airborne Visible/Infrared Imaging Spectrometer (AVIRIS)	Everglades National Park, Florida, USA	[64]	2003
SAM	EO-1 Hyperion	Talumpuk cape, Thailand	[65]	2013
Pixel based and Object based classification	CASI-2 (CASI-2)	Brisbane River, Australia	[66]	2011
SAM	Airborne Visible/Infrared Imaging Spectrometer—Next Generation (AVIRIS-NG)	Lothian Island and Bhitarkanika National Park, India	[34]	2019

2. Materials and Methods

2.1. Study Area

Our study site is located in the Kendrapara district of Odisha, India, which lies between $20^{\circ}41'36.70''$ and $24^{\circ}45'28''$ N latitude and $86^{\circ}54'17.29''$ and $86^{\circ}92'8.96''$ E longitude (as shown in Figure 1). Geographically, it covers an area of around 41.05 Km² of which mostly low-lying (10–25 m above mean sea level) covered with dense mangrove forests. The Bhitarkanika Forest Reserve is a protected forest reserve with a unique habitat and ecosystem. About two-third of the Bhitarkanika Forest Reserve is covered by the Bay of Bengal, and this estuarial region (lies within Bramhani-Baitarni) is a predominant inter tidal zone. Bhitarkanika Forest Reserve is home to a diverse types flora and fauna including some endangered species; it is the second largest mangrove forest in India formed by the estuarial formation of Brahmani-Baitarni, Dhamra, and Mahanadi rivers [67].

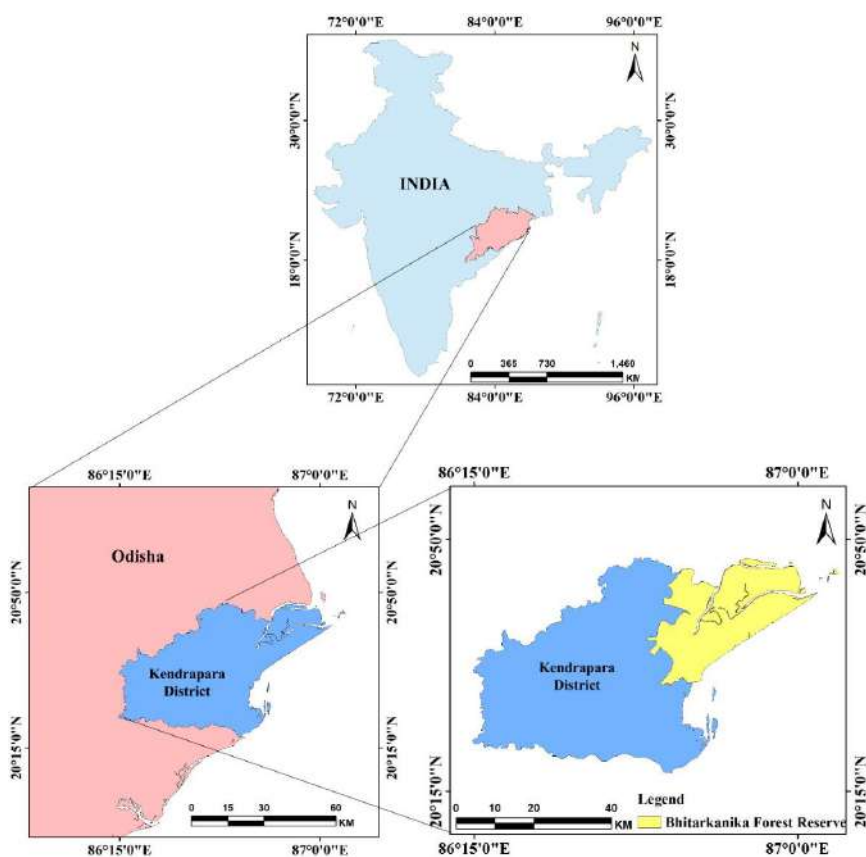


Figure 1. Location map of the Bhitarkanika Forest Reserve, Odisha India.

The study area comes under the humid sun-tropical climatic region broadly having three seasons namely, summer in which the temperature reaches up to 43 °C, winter in which the temperature goes down to as low as 10 °C, and the rainy season in which this region faces flash floods and frequent cyclones between the months of June to October. The Bhitarkanika Forest Reserve was chosen for the present study because it contains variety of heterogeneous species. In our work, the 10 most dominant mangrove species (as shown in Table 2) were identified and used for further analysis.

Table 2. In-situ measurements of different mangrove species in the Bhitarkanika forest reserve.

	Species	Tree Height (m)	Diameter at Breast Height (DBH) (cm)	No of Trees	Wood Density (g/cm ³)	Stem volume (m ³)	Biomass (t. ha ⁻¹)	Carbon stock (t. C ha ⁻¹)
1	<i>Excoecaria agallocha</i> L.	18.45 ± 2.11	20.14 ± 2.56	11	0.49	6.46	222.74 ± 11.17	104.68 ± 5.24
2	<i>Cynometra iripa</i> Kostel	17.23 ± 1.62	16.54 ± 4.39	10	0.81	3.70	231.43 ± 29.09	108.77 ± 13.67
3	<i>Agaveceras corniculatum</i> (L.)	15.03 ± 1.82	22.17 ± 2.81	9	0.59	5.22	262.44 ± 13.84	123.34 ± 6.50
4	<i>Heritiera littoralis</i> Dryand ex Ait.	18.17 ± 2.17	17.21 ± 2.56	10	1.06	4.22	339.13 ± 23.85	159.39 ± 11.21
5	<i>Heritiera fomes</i> Buch.-Ham.	12.35 ± 1.03	18.83 ± 2.94	12	0.88	4.13	287.66 ± 12.81	135.20 ± 6.02
6	<i>Xylocarpus granatum</i> Koenig	14.13 ± 2.01	27.52 ± 4.28	5	0.67	4.20	379.64 ± 38.10	178.43 ± 17.90
7	<i>Xylocarpus mekongensis</i> Pierre	15.38 ± 1.98	20.28 ± 3.40	8	0.73	3.97	162.13 ± 26.30	76.20 ± 12.36
8	<i>Intsia bijuga</i> (Colebr.) Kuntze	12.29 ± 1.38	26.69 ± 4.90	9	0.84	6.18	196.92 ± 32.78	92.55 ± 15.40
9	<i>Cerbera odollam</i> Gaertn.	12.24 ± 1.86	28.56 ± 5.05	6	0.33	4.70	355.36 ± 24.69	167.01 ± 11.60
10	<i>Sonneratia apetala</i> Buch.-Ham.	11.25 ± 1.67	21.85 ± 4.06	10	0.53	4.22	351.14 ± 23.14	165.03 ± 10.87
	Average						278.86 ± 23.57	131.06 ± 11.08

2.2. EO Data Acquisition

EO-Hyperion images (L1Gst) were obtained over the study area from the United States Geological Survey (USGS). The specifications of Hyperion sensor are illustrated in Table 3. Hyperion has a spatial resolution of 30 m and 242 spectral bands covering 356 nm to 2577 nm wavelengths. The Hyperion data strip passing over Bhitarkanika Forest Reserve is shown in Figure 2. Out of the 242 spectral bands, 46 bands are considered as bad bands (including 1–7, 58–78, 120–132, 165–182, 185–187, and 221–242 bands), and thus, these were not considered in further analysis. Bad bands have a high amount of noise caused by the water absorption in atmosphere, band overlaps, and lack of proper illumination. The performed image pre-processing includes noise removal and cross track illumination correction. In addition, atmospheric correction has been applied to remove atmospheric noises using the FLAASH (Fast Line-of-sight Atmospheric Analysis of Hyper Spectral-cubes) module in ENVI (v. 5.2) software [68]. After completing this step, endmember extraction was performed for each of the targeted species using the final Hyperion reflectance image and the in-situ GPS (Global Positioning System) locations.

Table 3. Hyperion Data Description

Satellite Data	EO-Hyperion
Path/Row	139/45
Spatial Resolution	30 meters
Flight Date	31 December 2015
Inclination	97.97 degree
Cloud Cover	<5%

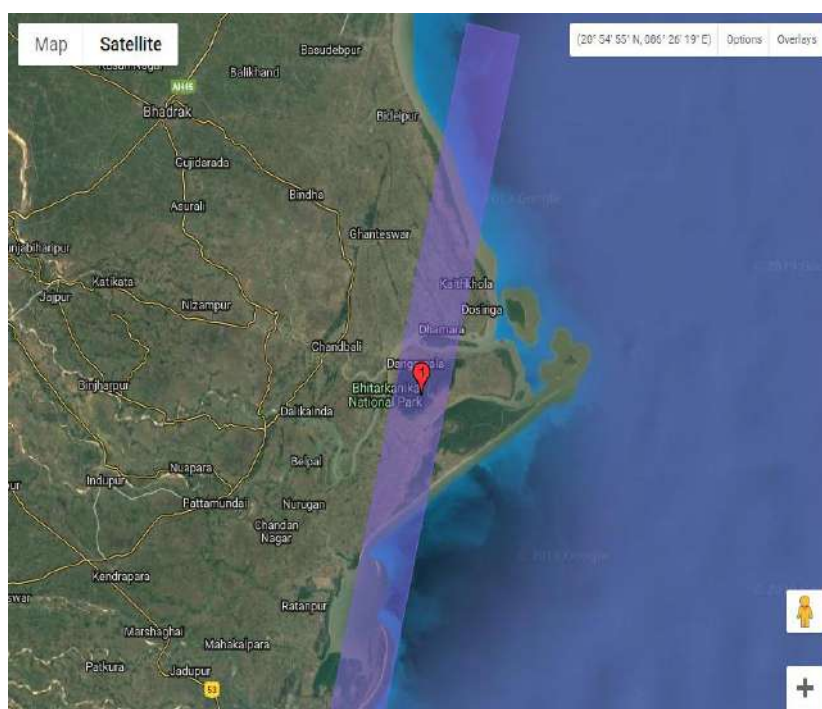


Figure 2. Footprint of Hyperion data available for the Bhitarkanika Forest reserve; it illustrates the region covered for Hyperion data for conducting the present study.

2.3. Field-Inventory Based Biomass Measurement

Field sampling was undertaken during 2015 for the study site. The foremost steps are the prior knowledge of the mangrove plant species; their location and its structure were essential for collecting the sample data for geospatial analysis. Random and the most homogenous patches within the Bhitarkanika Forest Reserve were selected for the field survey to measure tree height, number of samples (trees), Diameter at Breast Height (DBH), and total number of species within the plot.

As the study site selected is 36.42 km² falling within the range of Hyperion data strip (Figure 2). Hyperion image has limited coverage over the Bhitarkanika forest range, and for this reason, a region was selected that falls within the area covered by the Hyperion field of view. The samples were collected by making a 90 × 90 m² grid and it is further divided into nine equal 30 × 30 m² sub-grids, i.e., 90 sub-grids were examined. The most homogenous grid was taken into consideration. This process was then repeated to identify the 10 most homogenous mangrove plant species within the study area and samples were collected using GPS and Clinometer. The field data records the vegetation parameters using GPS in multiple directions. The number of tree species was counted within the plot in random sampling design in the Bhitarkanika Forest Reserve [69]. An overview of the methodology implemented is available in Figure 3. These major species were identified for the study site and their spectral profile was extracted using EO-1 Hyperion dataset. Total area covered by these species was 36.42 km² (see Figure 2). Non-vegetative regions were masked out from the study region.

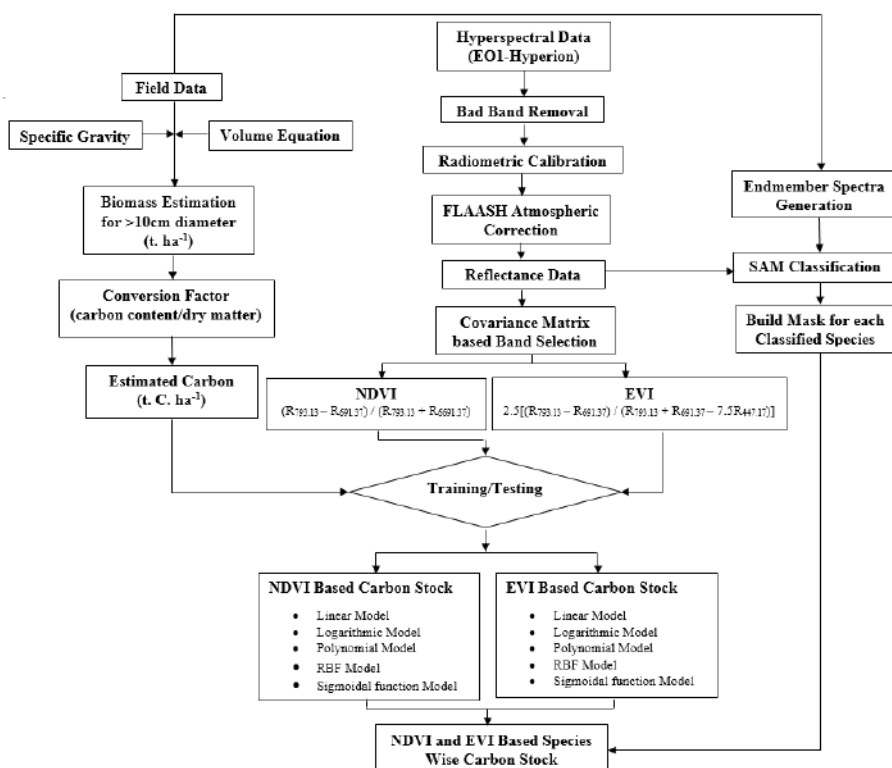


Figure 3. Flowchart providing an overview of the methodology implemented where NDVI stands for Normalized Difference Vegetation Index, EVI stands for Enhanced Vegetation Index and RBF for Radial Basis Function.

The Spectral Angle Mapper (SAM) supervised classification algorithm was used for the land use/cover classification using ENVI software [70,71]. SAM is a physically-based spectral classification algorithm, according to [72] that calculates the spectral similarity between a pixel spectrum and a reference spectrum as “the angle between their vectors in a space with dimensionality equal to the number of bands” [72]. SAM uses the calibrated reflectance data for classification and thus relatively insensitive to illumination and albedo effects. End-member reference spectra used in SAM were collected directly from acquired hyperspectral images. SAM compares the angle between reference spectrum and each pixel of an image in n-D space [72–74]. This ‘spectral angle’ (α) is calculated as:

$$\alpha = \cos^{-1} \frac{(t \cdot r)}{(\|t\| \|r\|)} \quad (1)$$

where α is the angle between reference spectra and endmember spectra, t is the endmember spectra, and r is the reference spectra.

A thorough and detailed investigation was performed to develop a criterion to estimate different species and determine variety of communities present in that ecosystem. To perform the sampling, firstly, the area is sub-divided into homogeneous patches or units, and furthermore, the samples were taken within these homogenous patches. The total number of transect sampling units to determine the allowable error was calculated using (Chacko, 1965) as follows:

$$N = \frac{t(CV)^2}{E^2} \quad (2)$$

where N is the total number of samples, t is the Student’s (t -statistics) value at a 95% significance level, CV is the coefficient of variation (in %), and E is the confidence interval (in mean %).

While performing the field sampling, a transect of 30 m $\times$ 30 m plot was laid on the most dominant patch for each species inside the protected area of Bhitarkanika forest reserve. The collected field sampling points were further distributed, and 2/3 of the samples were used for generating the models, whereas 1/3 of the samples were used for validation purpose. Table 2 has shown the field measurements of each species, e.g., scientific name, tree height, DBH, total number of trees within the sample plot, wood density of each species, biomass, and carbon stock. The trees whose girth height was below 1.32 m and DBH < 10 cm were not taken under consideration. The geographical location (latitude and longitude) was recorded using hand-held GPS. There were several mathematical equations developed and used by researchers for biomass estimation of trees [75–81]. These equations are species specific, particularly in the tropics. The general equation has been developed in modified form. It is more general in nature ([78,82,83]) and applicable in field. It is not possible to cut all the trees to estimate their biomass. Considering the mathematical terms, the models were developed by [76,77,83,84]. The model developed by [75] (1989) to estimate above ground biomass has been used in the present investigation. The literature revealed that this method is non-destructive and is the most suitable method. The biomass for each tree is calculated using the following allometric equation [76,83,85]:

$$Y = \exp[-2.4090 + 0.9522 \ln(D^2 \times H \times S)] \quad (3)$$

where Y is above ground biomass (t. ha⁻¹), D is the diameter at breast height, H is the tree height, and S is the wood density. The average wood density (S) for each species is taken from the wood density database provided by the International Council for Research in Agroforestry (ICRAF). From the acquired wood density, it was found that the wood density of *Cerbera odollam* Gaertn. was lowest (0.3349 gcm³), followed by *Excoecaria agallocha* L. (0.49 gcm³) among all. *Heritiera littoralis* Dryland ex Ait. had the highest (0.848 gcm³) wood density. The above ground carbon was calculated using the following formula to estimate biomass [83,85,86]:

$$Y = B * 0.47 \quad (4)$$

where Y is the above ground carbon stock ($t. ha^{-1}$) and B is the above ground biomass per hectare ($t. C ha^{-1}$).

The precise location of the in-situ ground control points of each species were further used to generate the spectral profile using Hyperion hyperspectral data as shown in Figure 4. The generated spectra of each species were given as an input to the SAM classifier. It is observed that *Intsia bijuga* (Colebr.) Kuntze is showing the highest reflectance among other observed species, whereas *Aegiceras corniculatum* (L.) has the lowest reflectance.

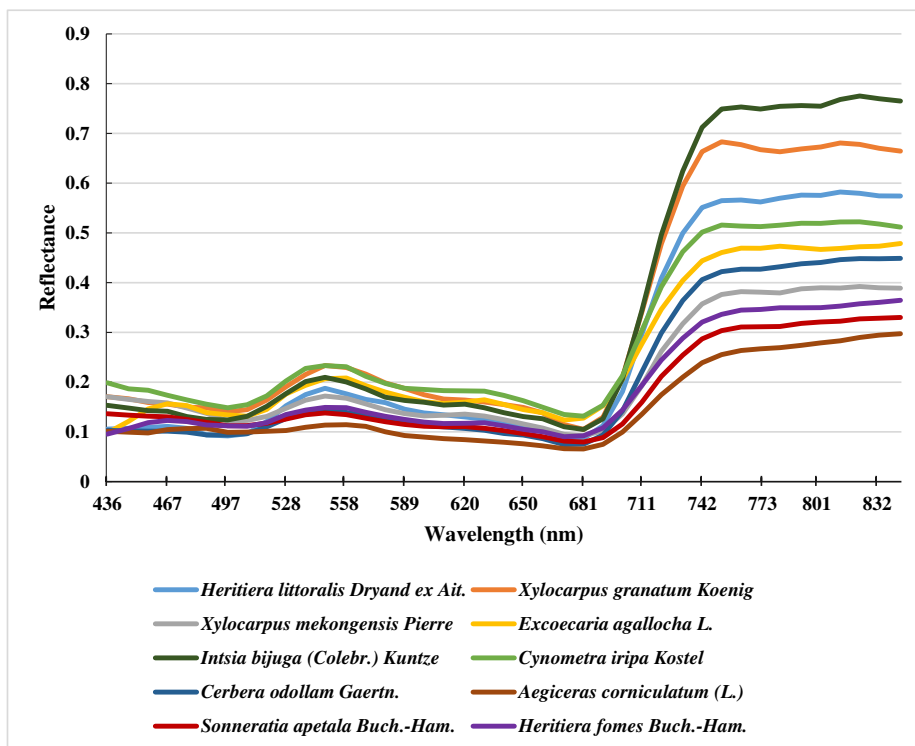


Figure 4. Spectral reflectance curve of the observed mangrove species.

2.4. Covariance Matrix Based Band Selection

Hyperspectral data are a set of hundreds of narrow bands at different wavelengths posing problems related to computational complexity, high data volume, bad bands, etc. Therefore, dimensionality reduction of hyperspectral data is considered as one of the solutions for the aforementioned issue. The dimensionality reduction technique is further classified into two groups, namely, feature extraction and feature selection. In the present study, an approach has been made to select the best band for calculation of different vegetation indices. Band selection generally involves two major steps, which are selection of criterion function and optimum band searching. The selection criterion applied in this study is the one proposed by [87], which was named Maximum ellipsoid volume criterion (MEV).

Mathematically it can be formulated as:

$$J(s) = \det\left(\frac{1}{M-1}\right) S^T S$$

where M is the number of pixels and S is the selected bands with $S = [x_1, x_2, \dots, x_n]$ and S^T is the column vector with $S^T = [x_1, x_2, \dots, x_m]^T$. Here, n and m are the number of bands and m is the number of number of pixels.

Additionally, for the band searching purpose, sequential forward search was implemented, which basically works on the principle of “down to top”. Here, the first band is defined as the band with maximum variance and the remaining band is compared one by one. While selecting the optimum band, the constant value $\left(\frac{1}{M-1}\right)$ is neglected. Thus, Equation (4) can also be written as:

$$B_k = S_k^T S_k \quad (5)$$

where B_k is the covariance matrix and $S_k = [x_1, x_2, \dots, x_k]$. Therefore, we have:

$$\begin{aligned} B_k &= S_k^T S_k \\ &= [x_1, x_2, \dots, x_k]^T [x_1, x_2, \dots, x_k] \\ &= \begin{bmatrix} x_1^T x_1 & x_1^T x_2 & \dots & x_1^T x_k \\ x_2^T x_1 & x_2^T x_2 & \dots & x_2^T x_k \\ \dots & \dots & \dots & \dots \\ x_k^T x_1 & x_k^T x_2 & \dots & x_k^T x_k \end{bmatrix} \end{aligned} \quad (6)$$

According to the rule of determination, the relation between B_k and B_{k+1} is described as:

$$\det(B_{k+1}) = \det(B_k) (a_k - d_k^T B_k^{-1} d_k) \quad (7)$$

Equation (7) was further used for determining the optimum band; the band that maximizes the value of $\det(B_{k+1})$ was termed as the optimum band. This band selection method was applied at blue, red, and near infrared bands to further calculate the NDVI and EVI indices.

2.5. NDVI and EVI

In our study, the vegetation indices of NDVI and EVI were employed, which were computed from the Hyperion hyperspectral data to assess the total above ground carbon stock using different allometric regression models [26]. The covariance matrix based band selection algorithm as per described in Section 2.4 determines the specific band for the calculation of vegetation indices. It was observed that the optimum band in NIR (Near-Infrared) region is $R_{793.13}$ (surface reflectance at 793.13 nm), in Red region, it is $R_{691.37}$ (surface reflectance at 691.37 nm), and in Blue region the optimum band is observed at $R_{447.17}$ (surface reflectance at 447.17 nm). The NIR and Red bands were used to calculate the NDVI; as shown in Equation (5), its value ranges from -1 to $+1$. The negative NDVI values shows waterbody and bare soil, whereas positive values are the green vegetation. The higher the NDVI value, the higher will the density of forest or vegetation be because of the high NIR reflectance and low Red reflectance coming from dense vegetation [88,89]. NDVI has been widely used to monitor vegetation health, density, changes, amount and condition of vegetation:

$$NDVI = \frac{(R_{793.13} - R_{691.37})}{(R_{793.13} + R_{691.37})} \quad (8)$$

EVI (Enhanced Vegetation Index) was originally developed as an improvement over NDVI; EVI is basically an optimized vegetation index that is used to enhance the sensitivity of high biomass region and it decouples the background variables as well as the atmospheric influences [90,91]. EVI is calculated as follows:

$$EVI = 2.5 * \frac{(R_{793.13} - R_{691.37})}{(R_{793.13} + 6 * R_{691.37} - 7.5 * R_{447.17} + L)} \quad (9)$$

where L is the adjustment factor, generally 1.

In the present study, both NDVI and EVI were employed to correlate the carbon stock of the Bhitarkanika mangrove forest. EVI is considered as more robust proxy of biomass and carbon stock estimation, as it has better resilience to saturation and resistant to atmospheric contamination and soil [90,92].

Five different models, linear, polynomial, logarithmic, Radial Basis Function (RBF), and sigmoidal function, were utilized for assessing carbon using hyperspectral data derived from NDVI and EVI indices. The relationship of field measured above ground carbon with the NDVI and EVI vegetation indices for all the five models were calculated. The field measured above ground carbon was trained with NDVI and EVI values retrieved from hyperspectral image in each of the five models. The 2/3 of the in-situ measurements were used for training the data, while 1/3 of the remaining data were used for testing the models.

3. Results

This section provides a concise and precise description of the experimental results for blue carbon for a mangrove forest.

3.1. Spatial Distribution of Species

This section demonstrates the species-wise carbon stock spatial distribution and overall carbon stock of the Bhitarkanika forest reserve and delivers a brief analysis on the overall results. SAM classification (Figure 5) achieved an OA of 84% and a kappa coefficient (k) of 0.81. These results indicate that SAM classification algorithm performed very well in determining the major plant species. These outputs were further taken into account and were used to derive the estimated carbon stock for each species using NDVI and EVI models and illustrating the species-wise carbon stock.

As per Table 4, it has been observed that the total aboveground carbon from EVI and NDVI derived aboveground carbon are 459.82 kt. C and 514.47 kt. C, respectively. The NDVI derived carbon is showing higher value than the EVI derived carbon because NDVI values can be influenced by the atmospheric contaminants, topography, soil, and dense biomass. These can lead to the increase in the irradiance of the NIR band and result in bias. It should also be noted that NDVI saturates in dense vegetation so that the accuracy of NDVI values differ by land use, topography, and atmospheric conditions [90,93–95]. Santin-Janin et al. [96] used non-linear model coupled with NDVI and EVI estimates to estimate the biomass and carbon stock. Wicaksono et al. [97] employed 13 vegetation indices to assess the above ground carbon of mangrove forest and concluded that the best fitted above ground carbon model for mangrove species derived from vegetation indices was EVI1 ($R^2=0.688$), whereas for below ground carbon GEMI ($R^2=0.567$) showed the best fit. Similarly, Adam et al. [95] utilized the narrow band vegetation indices with all possible band combinations using hyperspectral data for above ground biomass and concluded EVI is more robust for the assessment. Different band selections were used by them to enhance the predictive accuracy, the best three combinations for estimating EVI are (a) 445 nm, 682 nm, and 829 nm, (b) 497 nm, 676 nm, and 1091 nm, and (c) 495 nm, 678 nm, and 1120 nm.

Table 4. (a) Species-wise carbon stock derived from NDVI and (b) EVI for the Bhitarkanika forest reserve.

(a)	Species Name	Area (km ²)	Total carbon (kt. C)	Min carbon (t. C ha ⁻¹)	Max carbon (t. C ha ⁻¹)	Ave. carbon ± SD (t. C ha ⁻¹)
1	<i>Excoecaria agallocha</i> L.	3.80	52.25	68.14	258.23	143.48 ± 17.39
2	<i>Cynometra iripa</i> Kostel	3.77	42.20	55.28	226.90	115.88 ± 19.61
3	<i>Aegiceras corniculatum</i> (L.)	0.96	54.59	69.66	254.65	149.90 ± 5.57
4	<i>Heritiera littoralis Dryand ex Alt.</i>	2.07	53.08	83.76	225.30	145.55 ± 7.88
5	<i>Heritiera fomes</i> Buch.-Ham.	4.21	51.69	72.47	258.83	141.95 ± 10.60
6	<i>Xylocarpus granatum</i> Koenig	6.41	54.69	55.28	252.01	150.50 ± 15.51
7	<i>Xylocarpus mekongensis</i> Pierre	0.48	47.48	67.35	258.84	130.39 ± 12.70
8	<i>Intsia bijuga</i> (Colebr.) Kuntze	1.66	50.21	83.36	256.40	137.87 ± 12.57
9	<i>Cerbera odollam</i> Gaertn.	8.34	56.36	68.52	219.66	154.78 ± 18.39
10	<i>Sonneratia apetala</i> Buch.-Ham.	4.72	51.84	76.91	254.54	142.34 ± 22.46
	Total					
	Area (36.42 km ²)	36.42	514.47			

(b)	Species Name	Area (km ²)	Total carbon (kt. C)	Min carbon (t. C ha ⁻¹)	Max. carbon (t. C ha ⁻¹)	Ave. carbon ± SD (t. C ha ⁻¹)
1	<i>Excoecaria agallocha</i> L.	3.80	45.22	56.57	225.45	124.18 ± 10.15
2	<i>Cynometra iripa</i> Kostel	3.77	31.02	61.25	241.22	85.19 ± 26.29
3	<i>Aegiceras corniculatum</i> (L.)	0.96	44.35	63.30	222.70	121.80 ± 16.38
4	<i>Heritiera littoralis Dryand ex Alt.</i>	2.07	42.45	57.17	190.22	116.57 ± 22.72
5	<i>Heritiera fomes</i> Buch.-Ham.	4.21	47.38	55.28	229.22	130.11 ± 32.21
6	<i>Xylocarpus granatum</i> Koenig	6.41	46.90	67.66	253.04	128.78 ± 15.70
7	<i>Xylocarpus mekongensis</i> Pierre	0.48	50.60	66.66	218.84	138.95 ± 20.75
8	<i>Intsia bijuga</i> (Colebr.) Kuntze	1.66	53.10	97.24	253.40	145.83 ± 18.84
9	<i>Cerbera odollam</i> Gaertn.	8.34	48.56	61.51	209.66	133.36 ± 10.19
10	<i>Sonneratia apetala</i> Buch.-Ham.	4.72	50.19	61.05	235.54	137.83 ± 15.30
	Total					
	Area (36.42 km ²)	36.42	459.82			

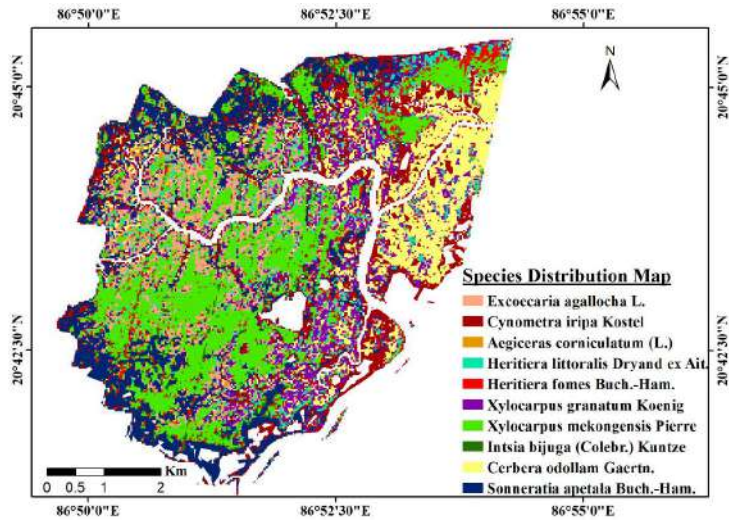


Figure 5. Distribution map of major species-wise mangrove analysis in the study site using EO-1 Hyperion.

3.2. Estimation of Carbon Stock Using Spectral Derived Indices

This section presents the carbon stock assessment for mangrove forest using different models namely, linear, logarithmic, polynomial (second degree), RBF, and sigmoidal function. All the models were trained with the EVI and NDVI generated relations with the ground measured data as well as tested with the modeled biomass and observed carbon stock as shown in Figure 6. The latter figure illustrates the performance of each model for EVI and NDVI based estimations; it can be observed that the RBF model performed better than the others.

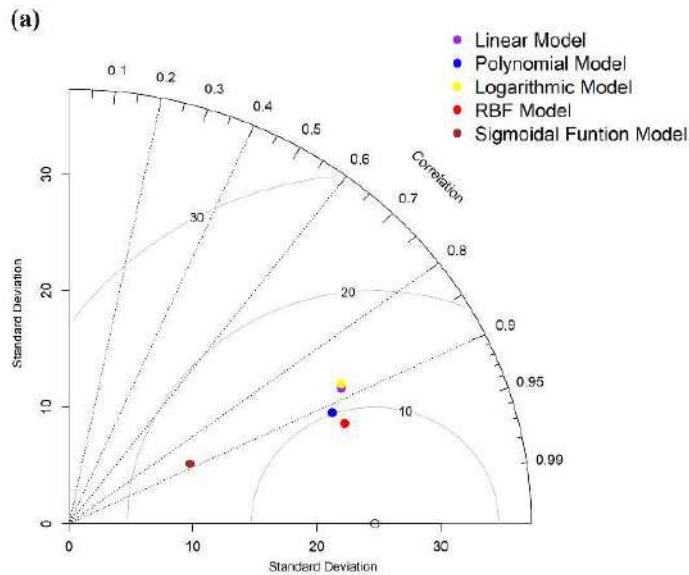


Figure 6. Cont.

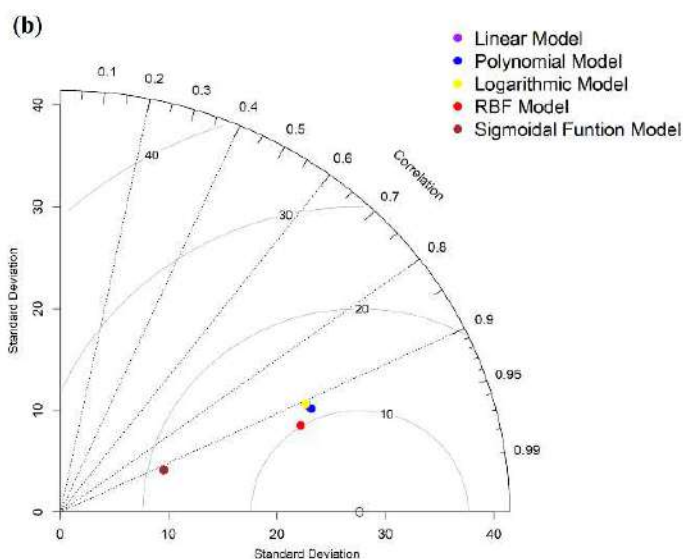


Figure 6. (a) Performance analysis of different models with EVI based carbon estimation and in-situ measurements (b) Performance analysis of different models with NDVI based carbon estimation and in-situ measurements. In both cases, the index-derived carbon estimation shows good agreement between measured and estimated carbon stock and either index could provide a good estimation. From the results EVI ($R^2 = 86.98\%$) seems to perform slightly better than NDVI ($R^2 = 84.1\%$). However, since the sample size is small (10 observations) the results are too close to say with statistical confidence that this hypothesis is true. However, the literature (see Section 3.1) indicates that this is indeed the case. The EVI and NDVI based carbon stock for each species (identified in the present study) is shown in Table 4.

According to the distributed EVI value, it has been concluded that a good amount of area is under dense coverage of forest species; moreover, it has shown higher estimation of carbon stock than NDVI. EVI varies from 0.35 to 6.9 and it is more sensitive to branches and other non-photosynthetic parts of the vegetation (parts different from leaves). EVI is more sensitive to plant parameters, as it avoids the atmospheric effects as well as the soil background. The results illustrate that EVI derived carbon varies from 27.22 to 215.35 t. C ha⁻¹ for linear, 85.39 to 236.66 t. C ha⁻¹ for log, 104.72 to 306.70 t. C ha⁻¹ for polynomial, 55.281 to 253.4 t. C ha⁻¹ for RBF and 54.068 to 363.7 t. C ha⁻¹ for sigmoidal function models (See Figure 7A–E). NDVI derived carbon varies from 111.11 to 184.14 t. C ha⁻¹ for linear, 112.53 to 187.50 t. C ha⁻¹ for log, and 109.85 to 181.57 t. C ha⁻¹ for polynomial, 55.281 to 258.84 t. C ha⁻¹ for RBF, and 46.5 to 357.17 t. C ha⁻¹ for sigmoidal function models (See Figure 7F–J). Estimated carbon is highest for EVI derived sigmoidal function model with highest carbon content up to 363.7 t. C ha⁻¹ and lowest for linear regression models reaching up to only 27.22 t. C ha⁻¹. Lowest estimated carbon for NDVI derived carbon stocks comes to be 46.5 t. C ha⁻¹ for the sigmoidal function model and highest values was observed as 357.17 t. C ha⁻¹ for the sigmoidal function model.

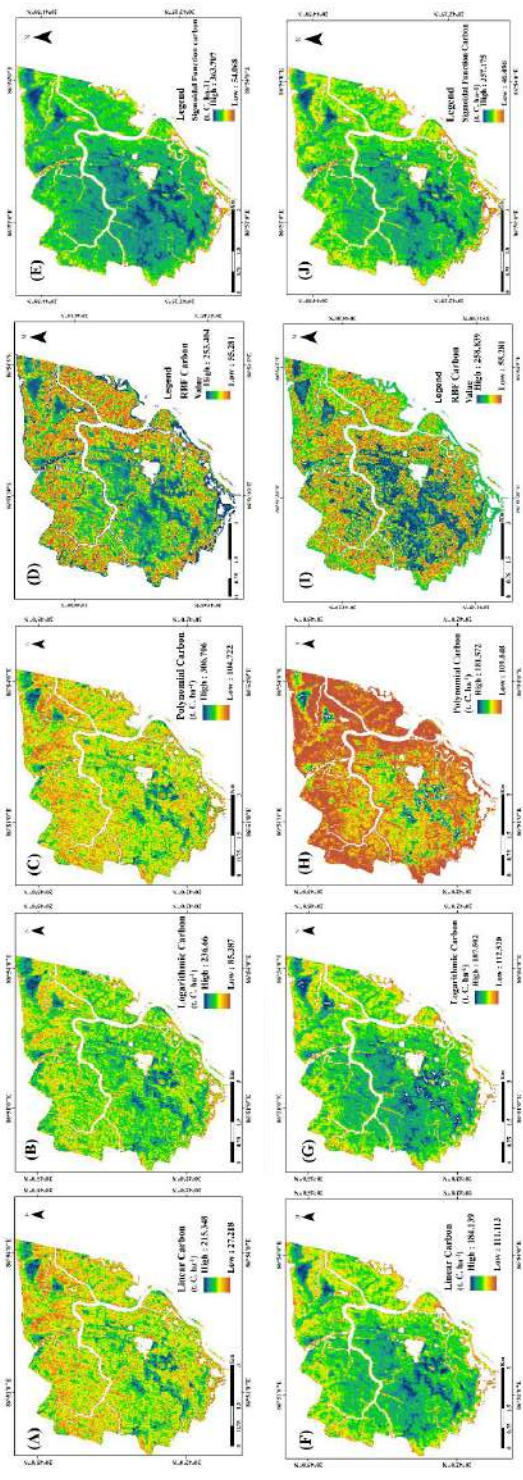


Figure 7. Estimated carbon derived for the Bhitarkanika mangrove forest reserve: from EVI and NDVI indices using different regression models. (A–E) EVI derived carbon maps and (F–J) NDVI derived carbon maps for Bhitarkanika Site for Linear, Log, Polynomial, RBF (Radial Basis Function), and Sigmoidal models, respectively.

The carbon stock values from the satellite-derived indices fall within the expected ranges for mangrove carbon stocks. NDVI values range from 0.5 to 0.65; the latter shows a healthy, dense mangrove forest in Bhitarkanika. The final interpretation result reveals that the middle northern part of the study area is showing higher biomass values ($\sim 250 \text{ t. C ha}^{-1}$). Thus, it is concluded that these regions are highly dense and stores an ample amount of blue carbon in it.

The polynomial regression model using EVI is found to be suitable for the estimation of carbon stock at the study site, with an R^2 of 0.87. EVI has shown high amount of estimated carbon ranges as it is more sensitive to biomass, and ultimately affecting the carbon estimation as compared to the NDVI and can be seen from Figure 7 and Table 4 whereas, NDVI has shown more consistent outcomes in the case of minimum and maximum estimated carbon stocks.

3.3. Species-Wise Carbon Stock Assessment

The classification results generated from SAM classifier and the covariance matrix based optimum band selection for generating vegetation indices were further used to extract the species-wise carbon stock as well as the area covered by each species in the Bhitarkanika forest reserve (see Figures 8 and 9). Figure 9 illustrates the NDVI derived carbon distribution map for each major species, while Figure 8 demonstrates the EVI derived carbon distribution map for each major species. It is also important to notice that the carbon stock of each species shows some variance, which is investigated and presented in Figures 10 and 11. Furthermore, the outcome of species-wise carbon stocks depends upon the species classification accuracies for species distribution classification maps.

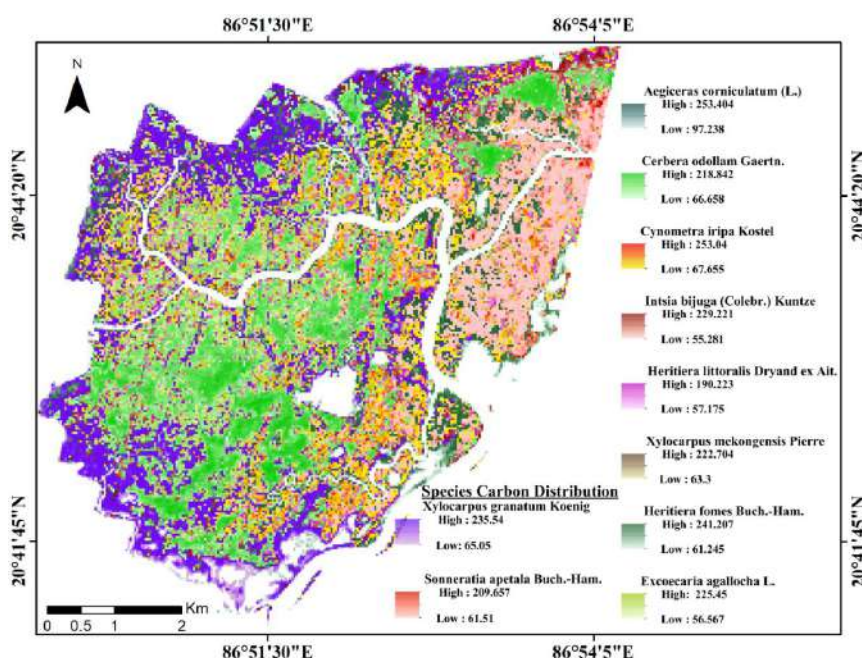


Figure 8. Species-wise estimated carbon map of the study area derived from the EVI indices.

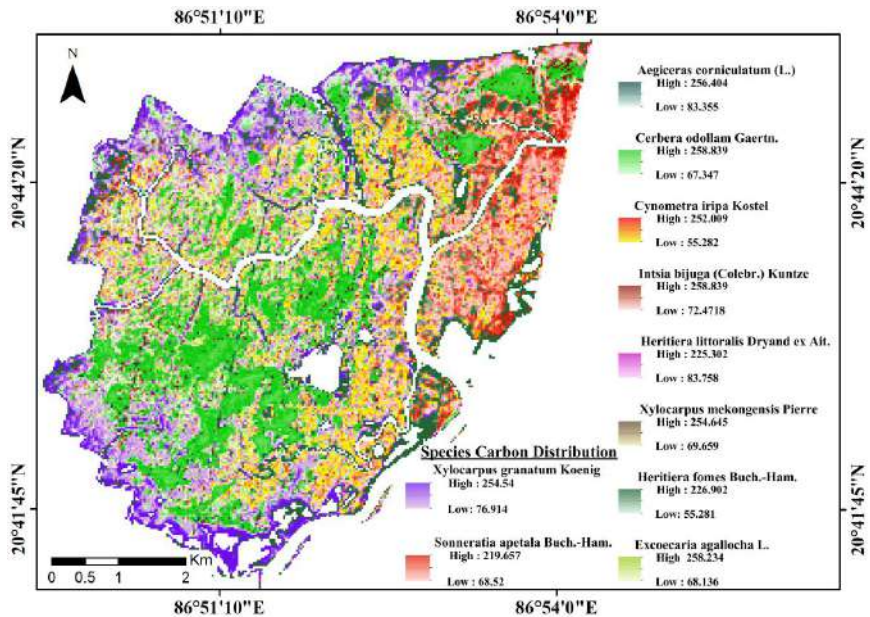


Figure 9. Species-wise estimated carbon map of the study area derived from the NDVI indices.

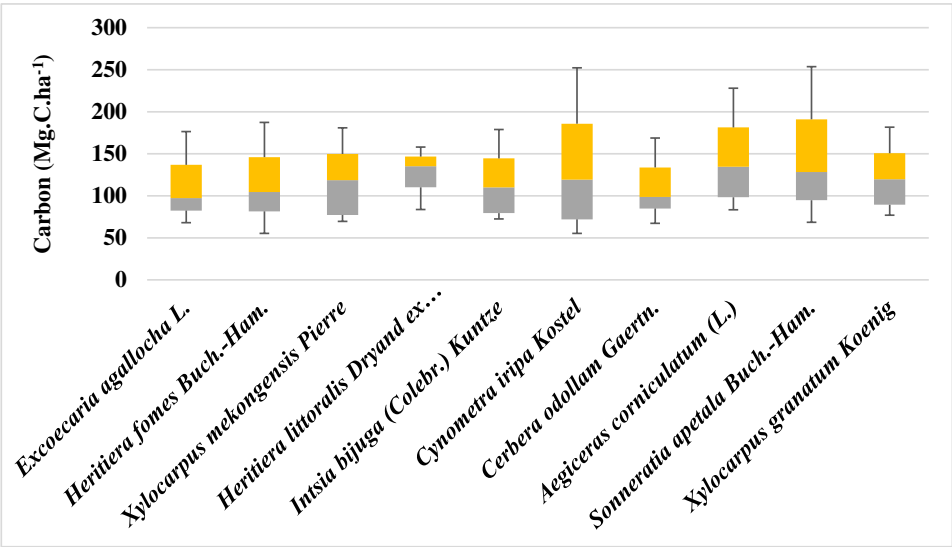


Figure 10. Box plot showing species-wise above ground carbon stock derived from NDVI.

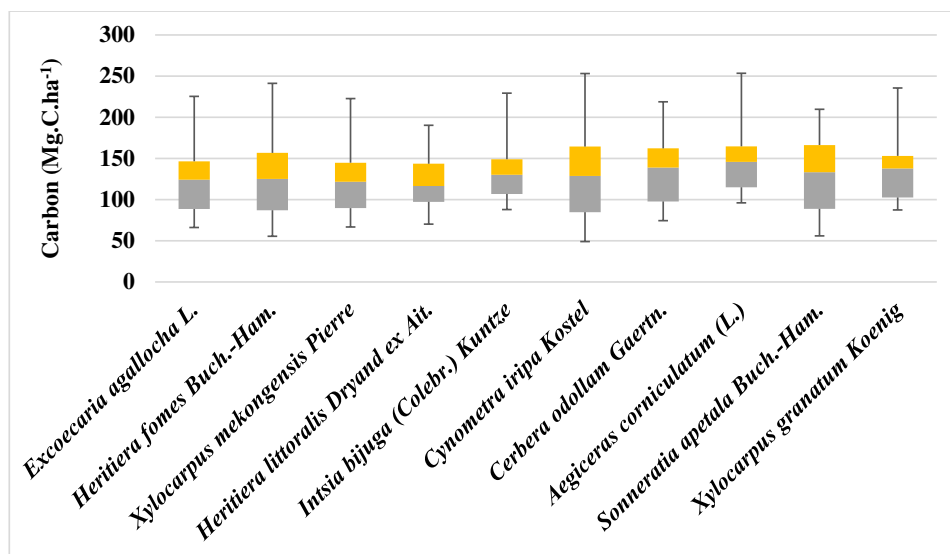


Figure 11. Box plot showing species-wise above ground carbon stock derived from EVI.

Total area covered by the major mangrove species was around 36.42 km². *Cerbera odollam* Gaertn covers the largest part of the forest, approximately 22.90% of the total area. Total estimated carbon for the EVI derived indices is 49.82 kt. C. and total carbon estimated for the Bhitarkanika forest derived from NDVI indices is 514.47 kt. C. Using EVI-derived carbon stocks, the highest contribution of carbon stock is the *Intsia bijuga* (Colebr.) Kuntze species with 53.10 kt. C (11.54%). From the NDVI derived carbon stocks, *Cerbera odollam* Gaertn seems to contribute the most with 56.36 kt. C (10.95%). Field measured carbon was recorded lowest for the species *Xylocarpus mekongensis* Pierre, which was 76.20 t. C ha⁻¹. Figure 8 shows the spatial distribution of carbon derived from EVI for each species. *Intsia bijuga* (Colebr.) Kuntze shows highest carbon content up to 253.4 t. C ha⁻¹. The highest carbon stocks as derived from NDVI were displayed for *Xylocarpus mekongensis* Pierre at 258.84 t. C ha⁻¹.

As such, while *Cerbera odollam* Gaertn covers most of the area (22.9%), differences in carbon per hectare (Carbon area density) promote *Intsia bijuga* (Colebr.) Kuntze as the highest contributing species in the Bhitarkanika forest with EVI-derived carbon stocks. This is due to the large difference between EVI and NDVI derived carbon area density for *Cerbera odollam* Gaertn (average 128.78 ± 15.702 t. C ha⁻¹ and 150.498 ± 15.51 t. C ha⁻¹). Cross-referencing with the measured values presented in Table 2 (165.03 ± 10.87167.02 t. C ha⁻¹), leads to the conclusion that the NDVI derived carbon stocks for *Cerbera odollam* Gaertn are more accurate. This conclusion is not reflective of all the species. Out of the 10 species examined, the average Carbon area density of EVI is closer to the measured value in six of them, while NDVI derived Carbon area density is more accurate in the other four. The greatest divergence between EVI and NDVI estimated carbon area densities is for *Cerbera odollam* Gaertn. Significant differences are also shown for *Intsia bijuga* (Colebr.) Kuntze and *Xylocarpus mekongensis* Pierre.

A species-wise box-plot is generated to assess the variation in different species-wise carbon stock estimated using EVI and NDVI, which is shown in Figures 10 and 11, with the minima, maxima, median, 25% quartile, and 75% quartile. The average carbon stock measured from field sampling is 131.07 t. C ha⁻¹. Average EVI derived carbon stock ranges from 77.86 t. C ha⁻¹ to 135.28 t. C ha⁻¹ and for NDVI derived carbon stock 116.57 t. C ha⁻¹ to 145.82 t. C ha⁻¹ for the Bhitarkanika mangrove forest. As such, both EVI and NDVI estimated averages are in agreement with the average carbon stock measured from the field.

4. Conclusions

Mangrove forests store a large quantity of blue carbon in plants, both in the form of biomass and as sediment in the soil. Anthropogenic activities threaten these forests nowadays due to conversion to other land use types. Such transition of forest areas is a major source of carbon emissions to the atmosphere. As such, carbon stock assessment is essential to reduce the loss of biomass in such ecosystems. Species-wise blue carbon analysis can be used to assess the impact of global climate change on different mangrove species as well as to help policy makers to accurately evaluate the ecological and economical trade off associated with the management of mangroves ecosystem. The present study aimed at demonstrating the use of hyperspectral EO data for species identification in a highly diversified mangrove ecosystem and for calculating total carbon stored. The Bhitarkanika forest in India was chosen as a study site and Hyperion hyperspectral images were used.

There have been several studies on the blue carbon stored in mangroves, however, thus far, a species wide blue carbon analysis with significant accuracy was missing. This study attempts to mitigate that gap of knowledge by estimating the above-ground carbon stocks for each of the 10 major species that were identified and found dominant in the study area.

Hyperspectral data from EO-1 Hyperion were collected and processed to extract the biophysical parameters of interest. Near co-orbital field measurements of biomass and carbon measurements were acquired for validation. The in-situ locations of mangrove species were used to generate spectral profile. The spatial distribution of the major mangrove species was identified using the SAM classification algorithm, which performed reliably well (e.g., kappa coefficient $\kappa = 0.81$). NDVI and EVI radiometric indices were calculated from the optimum bands, obtained by covariance matrix based band selection algorithm. Several models were tested to relate NDVI and EVI with carbon stocks. The RBF model performed best ($R^2 = 86.98\%$ for EVI and $R^2 = 84.1\%$ for NDVI) and was subsequently used in this study to estimate carbon stocks for the 10 dominant species and the entire study area.

Despite the significance of mangrove ecosystem and blue carbon for local as well as global climate, the drastic transformation of mangrove forests into other land use types is directly affecting the livelihood around it, which can be seen through the shortage of firewood, regular soil erosion, and decrease in fishing zones. Therefore, there should be adequate digital information about the coverage, biomass, and carbon content of the mangrove forest for quick management and planning. The present study provides evidence that NDVI and EVI indices have a very promising potential to be applied in classifying the dominant species of mangrove forests and coastal ecosystems according to their carbon content. These indices can provide adequate estimates of maximum, minimum, and average carbon content for a large area and show the spatial distribution of carbon, and thus, biomass. The above-ground carbon stocks for each species were estimated and presented in this study. For the whole study area, the carbon stocks were estimated 459.82 kt. C. from EVI and 514.47 kt. C. from NDVI.

The only limitation faced in this study was the limited availability of Hyperion data and that too covering a part of Bhitarkanika as shown in Figure 2. Using the same methodology with spectral images from different satellites could provide better coverage, and thus carbon stock estimations of different areas. Future studies could focus on different ecosystems to assess the effectiveness for this method and estimate carbon stock for different areas and ecosystems in order to provide the tools for a better evaluation of biomass and global carbon stocks; this remains to be seen.

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Annexure-XVII						
Divisional Area Statement						
Sl No	Forest Block	Area in ha	Crop Density	Growing Stock Cum / Ha	Working Circle Assigned	Overlapping
Reserved Forests						
1	Jatadhara RF	55.28	<40%	42.5	RWC / Pl, M.Imp	WL, Pr.,
Proposed RF						
2	Badatubi PRF	28.83	<35%	37.25	RWC / Pl, M.Imp	WL, Pr.
3	Bagagahana PRF	12.41	<40%	37.25	RWC, Pl	WL, Pr.
4	Balitutha PRF	84.9	<35%	37.25	RWC, Pl	WL, Pr.
5	Barakalikhola PRF	12	<35%	37.25	RWC, Pl	WL, Pr.
6	Batighar PRF	166.2	<35%	37.25	RWC / Pl, M.Imp	WL, Pr.
7	Brahmandia PRF	81.77	<40%	37.25	RWC, Pl	WL, Pr.
8	Jatadharta PRF	596.52	<35%	37.25	RWC, Pl	WL, Pr.
9	Jogidhankud PRF	392.14	<35%	37.25	RWC, Pl	WL, Pr.
10	Kathiakhola PRF	44.27	<35%	37.25	RWC, Pl	WL, Pr.
11	Nipania PRF	77.98	<35%	37.25	RWC / Pl, M.Imp	WL, Pr.
12	Petchhala PRF	259.73	<35%	37.25	RWC, Pl	WL, Pr., JFM
13	Saralikuda PRF	263.33	<40%	37.25	RWC / Pl, M.Imp	WL, Pr.
Protected Forest						
14	Akashdia PF	249.29	<30%	35	RWC, Pl	WL, Pr.
15	Barkud PF	95.36	<30%	35	RWC, Pl	WL, Pr.
16	Baruhan PF	254.73	<30%	35	RWC, Pl	WL, Pr.

17	Bhuanpal PF	129.67	<30%	35	RWC, PI	WL, Pr.,JFM
18	Boitarakud PF	227.33	<30%	35	RWC, PI	WL, Pr.
19	Dhobei PF	16.49	<30%	35	RWC, PI	WL, Pr.
20	Garbishnupur PF	101.35	<30%	35	RWC	WL, Pr.
21	Garharishpur PF	273.6	<35%	35	RWC, PI	WL, Pr.
22	Goda PF	14.14	<30%	35	RWC, PI	WL, Pr.
23	Gopalpur PF	21.71	<30%	35	RWC, PI	WL, Pr.
24	Harishpurgada PF	46.4	<35%	35	PI	WL, Pr.
25	Jatadhartanda B PF	13.35	<30%	35	PI	WL, Pr.
26	Kankan PF	404.69	<30%	35	RWC, PI	WL, Pr.
27	Kathagadi PF	46.43	<30%	35	RWC, PI	WL, Pr.
28	Kaunsiapal PF	97.1	<30%	35	RWC	WL, Pr.
29	Madhuban 'A' PF	78.11	<30%	35	RWC, PI	WL, Pr.
30	Madhuban 'B' PF	20.46	<35%	35	RWC, PI	WL, Pr.
31	Majhidia (Kaudia) PF	52.47	<30%	35	RWC	WL, Pr.
32	Marichpur PF	3379.2	<35%	35	RWC, PI	WL, Pr.
33	Muguria PF	71.91	<30%	35	RWC, PI	WL, Pr.
34	Musadia PF	15.8	<30%	35	RWC	WL, Pr.
35	Nadiakhia PF	128.96	<30%	35	RWC, PI	WL, Pr.
36	Nuagaon and DhinkiaPF	206.77	<30%	35	RWC, PI	WL, Pr.
37	Padmapur PF	1282.5	<30%	35	RWC, PI	WL, Pr.
38	Ramatara PF	23.98	<35%	35	RWC, PI	WL, Pr., JFM
39	Sahadabedi PF	638.2	<30%	35	RWC, PI	WL, Pr.,JFM

40	Salio PF	53.25	<30%	35	RWC, PI	WL, Pr.,JFM
41	Tentilibelari PF	126.78	<30%	35	RWC, PI	WL, Pr.
	Village Forest					
42	Baripara	1.00	<40%	28.5	RWC	
43	Baripara	1.00	<40%	28.5	RWC	
44	Duadia	2.00	<40%	28.5	RWC	
45	Hajipur	2.50	<40%	28.5	RWC	
46	Hajipur	1.00	<40%	28.5	RWC	
47	Kothisahi	5.00	<40%	28.5	RWC	
48	Nuagada	12.00	<40%	28.5	RWC	
49	Rangiagarh	5.00	<40%	28.5	RWC	
50	Rangiagarh	2.00	<40%	28.5	RWC	
51	Saharadiha	5.00	<40%	28.5	RWC	



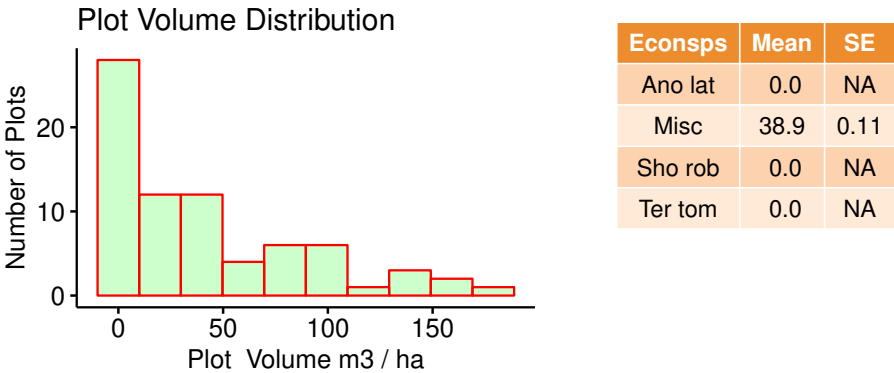
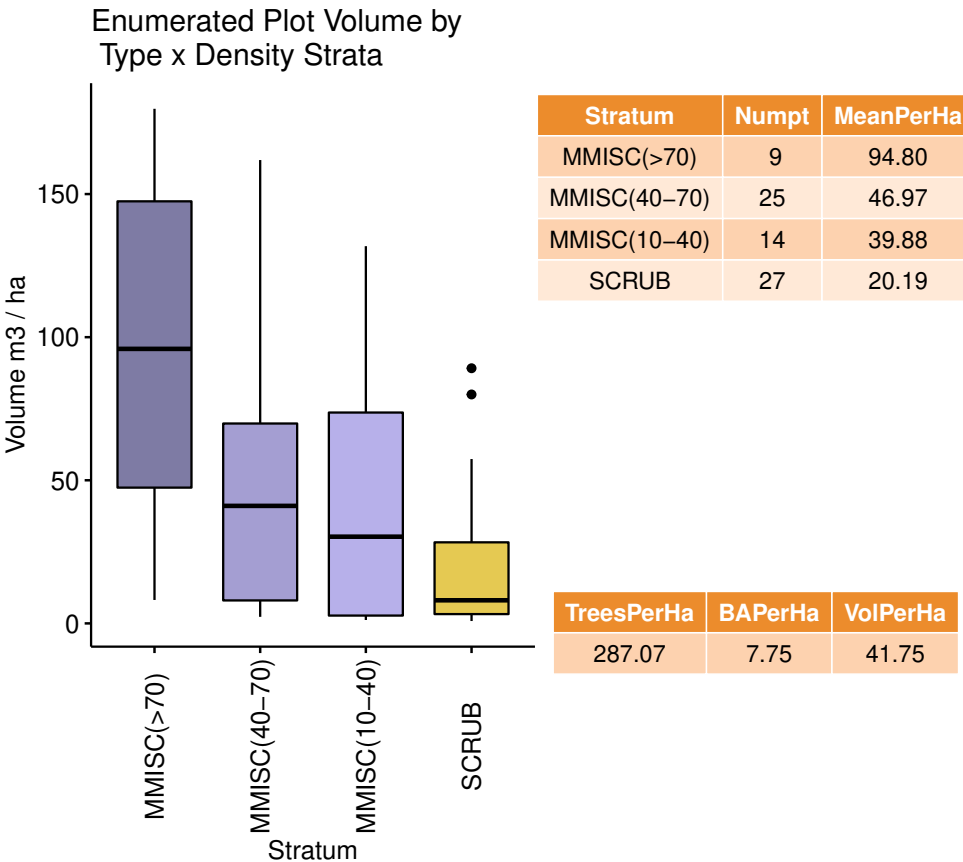
Reports for Rajnagar (WL) Forest Division

FEG

First created 2019-09-23

CHANGE LOG

- Ver 20 Sep 2019
 - updated all formats and tables
 - values before correction shown on non numbered page
 - added page numbers and ToC for figures and tables
 - Made minor corrections to table captions and numbers
 - Division name added to header
 - updated .rmd as division has only RWC



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OVERALL

NON-SFC

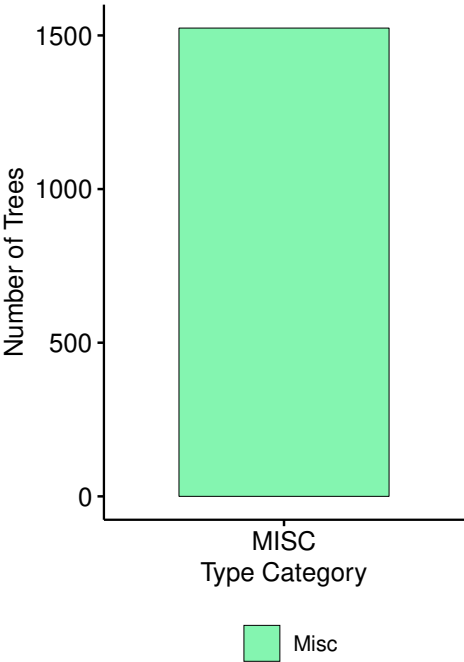
DENCLASS	SI
>70	0.260%
40-70	0.245%
10-40	0.066%
<10	0.242%

DENCLASS	SI
>70	0.260%
40-70	0.245%
10-40	0.066%
<10	0.242%

Plot Distribution

Number of trees from Inventory plots

RANGE	D1	D2	D3	D4
GAHIRAMATHA	0	1	0	1
KUJANGA	0	6	7	12
MAHAKALAPADA	0	18	7	14



Canopy Density Classes are
D1 : > 70%, D2 : 40-70%
D3 : 10-40%, D4 : <10%

Plot Status

Estimates
millions

Status	Plots	Totals
No Large Trees	63	<i>Trees</i> 1.084
1 Tree	10	<i>BArea</i> 0.03
2 – 5 Trees	2	<i>Volume</i> 0.165
		<i>Area</i> 0.003

Basal area $\text{m}^2/\text{ha}^{-1}$
Volume $\text{m}^3/\text{ha}^{-1}$
Area ha

Figure 1: Enumeration Summary

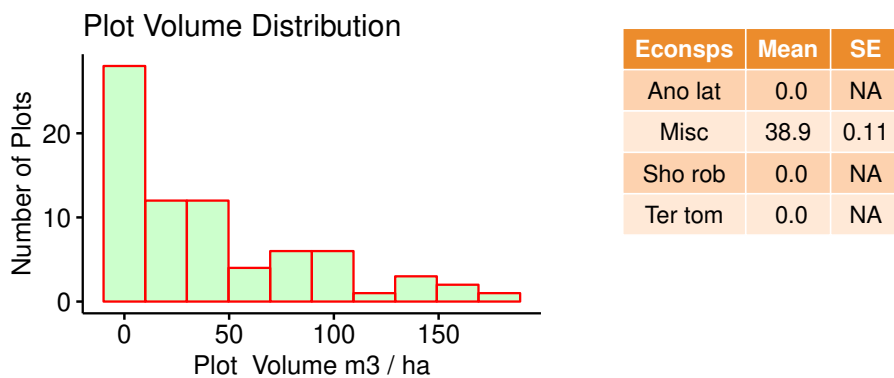
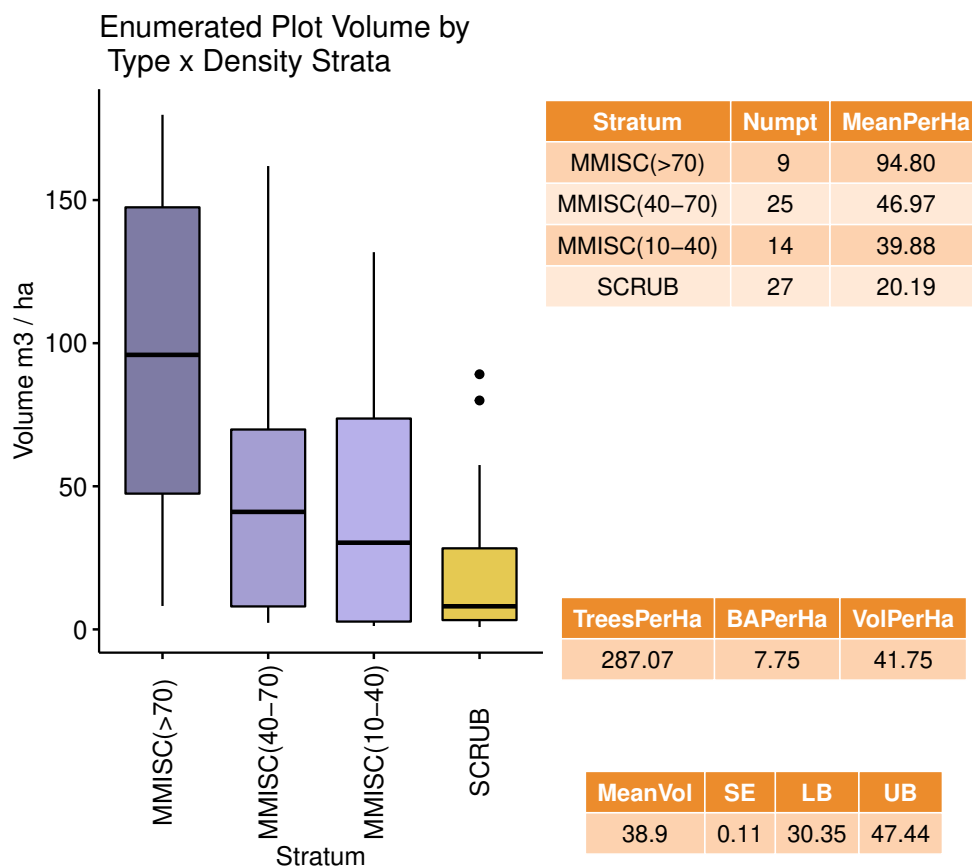


Figure 2: Estimation Summary

Table 1: Block-wise Area Statistics

RANGE	BLOCK	COMPARTMENT	Areas in ha.	
			RWC	TOTAL
GAHIRAMATHA	SASANPETA (all)	NRSC-1	843.58	843.58
		NRSC-2	483.41	483.41
		NRSC-3	309.46	309.46
GAHIRAMATHA	SASANPETA (all)		1,636.45	1,636.45
		(all)	1,636.45	1,636.45
GAHIRAMATHA	AKASDIA (all)	NRSC-49	274.41	274.41
		(all)	274.41	274.41
GAHIRAMATHA	BALITUTHA (all)	NRSC-25	112.29	112.29
		(all)	112.29	112.29
GAHIRAMATHA	BARKUD (all)	NRSC-38	107.59	107.59
		(all)	107.59	107.59
GAHIRAMATHA	BARUHAN (all)	NRSC-53	280.97	280.97
		(all)	280.97	280.97
GAHIRAMATHA	BHUIANPAL (all)	NRSC-36	160.98	160.98
		(all)	160.98	160.98
GAHIRAMATHA	BOITARAKUD (all)	NRSC-24	210.27	210.27
		(all)	210.27	210.27
GAHIRAMATHA	BRAHMANDIAN (all)	NRSC-50	65.45	65.45
		(all)	65.45	65.45
GAHIRAMATHA	DHOBEI (all)	NRSC-37	53.32	53.32
		(all)	53.32	53.32
GAHIRAMATHA	GARHARISPUR (all)	NRSC-48	254.93	254.93
		(all)	254.93	254.93

Table 1: Block-wise Area Statistics (*continued*)

RANGE	BLOCK	COMPARTMENT	Areas in ha.	
			RWC	TOTAL
	GARHBISHUNPUR	NRSC-40	83.39	83.39
		(all)	83.39	83.39
	GODA	NRSC-46	18.30	18.30
		(all)	18.30	18.30
	GOPALPUR	NRSC-43	25.91	25.91
		(all)	25.91	25.91
		NRSC-27	15.45	15.45
		NRSC-31	16.01	16.01
	JATADHAR	NRSC-34	34.80	34.80
		(all)	66.26	66.26
	JATADHARATANDA	NRSC-35	609.91	609.91
		(all)	609.91	609.91
	KANKAN	NRSC-39	489.69	489.69
		(all)	489.69	489.69
	KATHIAKHOLDA	NRSC-44	50.86	50.86
		(all)	50.86	50.86
	MADHUBAN A	NRSC-30	42.75	42.75
		(all)	42.75	42.75
	MADHUBAN B	NRSC-32	32.68	32.68
		(all)	32.68	32.68
	MAJHIDIA(KAUDIA)	NRSC-23	88.40	88.40
		(all)	88.40	88.40
		NRSC-54	800.08	800.08

Table 1: Block-wise Area Statistics (*continued*)

RANGE	BLOCK	COMPARTMENT	Areas in ha.	
			RWC	TOTAL
		NRSC-55	937.20	937.20
		NRSC-56	929.71	929.71
		NRSC-57	710.57	710.57
	MARICHPUR	(all)	3,377.56	3,377.56
		NRSC-42	120.99	120.99
	MUGURIA	(all)	120.99	120.99
		NRSC-33	65.27	65.27
	NOLIASAHI	(all)	65.27	65.27
		NRSC-26	677.32	677.32
	NUAGAON & DHINKIA	(all)	677.32	677.32
		NRSC-45	66.77	66.77
	PADMAPUR	(all)	66.77	66.77
		NRSC-41	70.12	70.12
	RAMTARA	(all)	70.12	70.12
		NRSC-47	95.34	95.34
	SAHADABEDI	(all)	95.34	95.34
		NRSC-52	80.11	80.11
	SALIO	(all)	80.11	80.11
		NRSC-51	92.91	92.91
	TENTULI BELARI		92.91	92.91
		(all)	7,674.75	7,674.75
KUJANGA		NRSC-15	32.79	32.79
		(all)	32.79	32.79

Table 1: Block-wise Area Statistics (*continued*)

RANGE	BLOCK	COMPARTMENT	Areas in ha.	
			RWC	TOTAL
	BAGAGAHAN	NRSC-8	15.78	15.78
		(all)	15.78	15.78
	BARAKOLIKHOL	NRSC-19	30.95	30.95
		(all)	30.95	30.95
		NRSC-17	67.41	67.41
	BATIGHAR	(all)	67.41	67.41
		NRSC-13	596.29	596.29
		NRSC-16	744.50	744.50
		NRSC-17	0.00	0.00
	HETAMUNDIA	(all)	1,340.80	1,340.80
	JAMBOO	NRSC-7	239.83	239.83
		(all)	239.83	239.83
		NRSC-21	351.54	351.54
	JOGDHANAKUDA	(all)	351.54	351.54
	KANDARAPATIA	NRSC-6	126.01	126.01
		(all)	126.01	126.01
		NRSC-11	738.40	738.40
		NRSC-12	719.90	719.90
	KANSARIDIA	(all)	1,458.30	1,458.30
	KANTILO	NRSC-4	200.50	200.50
		(all)	200.50	200.50
		NRSC-9	101.79	101.79
	KAUNSIAPAL	(all)	101.79	101.79

Table 1: Block-wise Area Statistics (*continued*)

RANGE	BLOCK	COMPARTMENT	Areas in ha.	
			RWC	TOTAL
	NIPANIA	NRSC-18	100.63	100.63
		(all)	100.63	100.63
	PETCHHELA	NRSC-10	187.43	187.43
		(all)	187.43	187.43
	SANATUBI	NRSC-14	460.31	460.31
		(all)	460.31	460.31
	SARALIKUDA	NRSC-20	281.52	281.52
		(all)	281.52	281.52
	SUNITI	NRSC-5	124.87	124.87
			124.87	124.87
MAHAKALAPADA	(all)		5,120.46	5,120.46
		(all)	14,431.66	14,431.66

Table 2: Canopy density strata wise distribution of Inventory Points

RANGE	Number of Sample Points By Canopy Density Class				Total
	>70%	40-70%	10-40%	<10%	
GAHIRAMATHA	0	1	0	1	2
KUJANGA	0	6	7	12	25
MAHAKALAPADA	0	18	7	14	39
(all)	0	25	14	27	66

Note:

Only points used in estimation are included

Table 3: Realized Sampling Intensity

CATEGORY	DENSITY	AREA (ha)	PLOTS	SI %
NON-SFC	>70	346.49	9	0.260%
	40-70	1,021.25	25	0.245%
	10-40	2,123.99	14	0.066%
	<10	1,117.89	27	0.242%
OVERALL	>70	346.49	9	0.260%
	40-70	1,021.25	25	0.245%
	10-40	2,123.99	14	0.066%
	<10	1,117.89	27	0.242%

Table 4: Stand Table Summary Estimated Number of Stems

RANGE	COUPE TYPE	MAJOR SPECIES	GIRTH CLASS (cm)					Total
			30-60	60-90	90-120	120-150	> 150	
GAHIRAMATHA	RWC	All Trees	29,960	6,716	3,277	697	128	40,778
			29,960	6,716	3,277	697	128	40,778
		(all)	29,960	6,716	3,277	697	128	40,778
		All Trees	305,260	73,876	34,245	7,644	1,282	422,307
KUJANGA	RWC		305,260	73,876	34,245	7,644	1,282	422,307
	(all)		305,260	73,876	34,245	7,644	1,282	422,307
		All Trees	459,778	97,270	48,745	13,348	1,979	621,120
MAHAKALAPADA	RWC		459,778	97,270	48,745	13,348	1,979	621,120
			459,778	97,270	48,745	13,348	1,979	621,120
		(all)	459,778	97,270	48,745	13,348	1,979	621,120
	(all)	(all)	794,998	177,861	86,268	21,689	3,389	1,084,204

Table 5: Block Wise Stand Table Estimated Number of Stems

RANGE	BLOCK	MAJOR SPECIES	GIRTH CLASS (cm)					Total
			30-60	60-90	90-120	120-150	> 150	
GAHIRAMATHA	SASANPETA	All Trees	29,960	6,716	3,277	697	128	40,778
		(all)	29,960	6,716	3,277	697	128	40,778
	AKASDIA	All Trees	29,960	6,716	3,277	697	128	40,778
		(all)	2,962	815	348	84	12	4,221
	BALITUTHA	All Trees	2,962	815	348	84	12	4,221
		(all)	582	160	68	17	2	830
	BARKUD	All Trees	582	160	68	17	2	830
		(all)	1,943	535	228	55	8	2,769
	BARUHAN	All Trees	1,943	535	228	55	8	2,769
		(all)	23,087	5,040	2,504	524	99	31,254
KANKAN	BHUIANPAL	All Trees	23,087	5,040	2,504	524	99	31,254
		(all)	1,185	326	139	34	5	1,688
	BOITARAKUD	All Trees	1,185	326	139	34	5	1,688
		(all)	800	220	94	23	3	1,140
	BRAHMANDIAN	All Trees	800	220	94	23	3	1,140
		(all)	4,381	1,206	514	124	18	6,244
	GODA	All Trees	4,381	1,206	514	124	18	6,244
		(all)	1,507	415	177	43	6	2,148
	JATADHARATANDA	All Trees	1,507	415	177	43	6	2,148
		(all)	72,035	19,720	8,440	2,030	292	102,517
KANKAN	All Trees	72,035	19,720	8,440	2,030	292	102,517	
	(all)	460	127	54	13	2	655	
		(all)	460	127	54	13	2	655

Table 5: Block Wise Stand Table Estimated Number of Stems
(continued)

RANGE	BLOCK	MAJOR SPECIES	GIRTH CLASS (cm)					Total
			30-60	60-90	90-120	120-150	> 150	
MADHUBAN A	All Trees		329	90	39	9	1	468
	(all)		329	90	39	9	1	468
MAJHIDIA(KAUDIA)	All Trees		11,463	2,761	1,284	286	48	15,842
	(all)		11,463	2,761	1,284	286	48	15,842
MARICHPUR	All Trees		104,431	20,717	11,000	2,163	459	138,770
	(all)		104,431	20,717	11,000	2,163	459	138,770
MUGURIA	All Trees		1,772	488	208	50	7	2,525
	(all)		1,772	488	208	50	7	2,525
NUAGAON & DHINKIA	All Trees		54,708	14,926	6,402	1,537	222	77,795
	(all)		54,708	14,926	6,402	1,537	222	77,795
PADMAPUR	All Trees		5,710	1,572	670	162	23	8,137
	(all)		5,710	1,572	670	162	23	8,137
RAMTARA	All Trees		6,043	1,664	710	171	24	8,612
	(all)		6,043	1,664	710	171	24	8,612
SAHADABEDI	All Trees		3,275	862	378	89	13	4,618
	(all)		3,275	862	378	89	13	4,618
SALIO	All Trees		7,150	1,837	819	190	30	10,025
	(all)		7,150	1,837	819	190	30	10,025
TENTULI BELARI	All Trees		1,437	396	169	41	6	2,048
	(all)		1,437	396	169	41	6	2,048
KUJANGA	(all)		305,260	73,876	34,245	7,644	1,282	422,307
	All Trees		656	181	77	19	3	935

Table 5: Block Wise Stand Table Estimated Number of Stems
(continued)

RANGE	BLOCK	MAJOR SPECIES	GIRTH CLASS (cm)					Total
			30-60	60-90	90-120	120-150	> 150	
BARAKOLIKHOL	(all)		656	181	77	19	3	935
	All Trees		3,683	1,014	432	104	15	5,248
	(all)		3,683	1,014	432	104	15	5,248
BATIGHAR	All Trees		129,677	29,284	7,447	2,139	148	168,695
	(all)		129,677	29,284	7,447	2,139	148	168,695
	All Trees		23,456	8,749	3,699	1,530	967	38,401
JAMBOO	(all)		23,456	8,749	3,699	1,530	967	38,401
	All Trees		9,161	2,522	1,076	260	37	13,055
	(all)		9,161	2,522	1,076	260	37	13,055
JOGIDHANAKUDA	All Trees		5,246	852	382	98	27	6,604
	(all)		5,246	852	382	98	27	6,604
	All Trees		260,447	48,832	33,090	8,568	656	351,594
KANSARIDIA	(all)		260,447	48,832	33,090	8,568	656	351,594
	All Trees		2,525	695	296	72	10	3,599
	(all)		2,525	695	296	72	10	3,599
KANTILO	All Trees		17,168	3,005	1,335	338	85	21,930
	(all)		17,168	3,005	1,335	338	85	21,930
	All Trees		3,463	953	407	98	14	4,936
SARALIKUDA	(all)		3,463	953	407	98	14	4,936
	All Trees		4,297	1,183	505	122	17	6,124
			4,297	1,183	505	122	17	6,124
SUNITI			459,778	97,270	48,745	13,348	1,979	621,120
MAHAKALAPADA								

Table 5: Block Wise Stand Table Estimated Number of Stems
(continued)

RANGE	BLOCK	MAJOR SPECIES	GIRTH CLASS (cm)					Total
			30-60	60-90	90-120	120-150	> 150	
(all)	(all)	(all)	794,998	177,861	86,268	21,689	3,389	1,084,204

Table 6: Range Wise Stand Table Estimated Number of Stems
(NON SFC)

RANGE	MAJOR SPECIES	GIRTH CLASS (cm)					Total
		30-60	60-90	90-120	120-150	> 150	
GAHIRAMATHA	All Trees	29,960	6,716	3,277	697	128	40,778
	(all)	29,960	6,716	3,277	697	128	40,778
KUJANGA	All Trees	305,260	73,876	34,245	7,644	1,282	422,307
	(all)	305,260	73,876	34,245	7,644	1,282	422,307
MAHAKALAPADA	All Trees	459,778	97,270	48,745	13,348	1,979	621,120
	(all)	459,778	97,270	48,745	13,348	1,979	621,120
(all)	(all)	794,998	177,861	86,268	21,689	3,389	1,084,204

Table 7: Stand Table, Compartment Wise Estimated Number of Stems (NON-SFC)

RANGE	BLOCK	COMPARTMENT COUPE	MAJOR SPECIES	GIRTH CLASS (cm)					Total
				30-60	60-90	90-120	120-150	> 150	
SASANPETA		NRSC-1	MHP-I	317	87	37	9	1	452
		NRSC-2	MHP-II	22,881	4,848	2,459	505	99	30,792
		NRSC-3	MHP-III	6,762	1,780	781	184	28	9,534
GAHIRAMATHA	(all)	(all)	(all)	29,960	6,716	3,277	697	128	40,778
		(all)	(all)	29,960	6,716	3,277	697	128	40,778
		NRSC-49	SRL-VI	2,962	815	348	84	12	4,221
AKASDIA		(all)	(all)	2,962	815	348	84	12	4,221
		NRSC-25	SRL-X	582	160	68	17	2	830
		(all)	(all)	582	160	68	17	2	830
BALITUTHA		NRSC-38	SRL-VIII	1,943	535	228	55	8	2,769
		(all)	(all)	1,943	535	228	55	8	2,769
BARKUD		NRSC-53	SRL-V	23,087	5,040	2,504	524	99	31,254
		(all)	(all)	23,087	5,040	2,504	524	99	31,254
BARUHAN		NRSC-36	SRL-X	1,185	326	139	34	5	1,688
		(all)	(all)	1,185	326	139	34	5	1,688
BHUIANPAL		NRSC-24	SRL-X	800	220	94	23	3	1,140
		(all)	(all)	800	220	94	23	3	1,140
BOJTARAKUD		NRSC-50	SRL-V	4,381	1,206	514	124	18	6,244
		(all)	(all)	4,381	1,206	514	124	18	6,244
BRAHMANDIAN		NRSC-46	SRL-V	1,507	415	177	43	6	2,148
		(all)	(all)	1,507	415	177	43	6	2,148
GODA		NRSC-35	SRL-VII	72,035	19,720	8,440	2,030	292	102,517
		(all)	(all)	72,035	19,720	8,440	2,030	292	102,517
		JATADHARATAN	(all)	72,035	19,720	8,440	2,030	292	102,517

Table 7: Stand Table, Compartment Wise Estimated Number of Stems (NON-SFC) (*continued*)

RANGE	BLOCK	COMPARTMENT COUPE	MAJOR SPECIES	GIRTH CLASS (cm)					Total	
				30-60	60-90	90-120	120-150	> 150		
KANKAN		NRSC-39	SRL-VIII	All Trees	460	127	54	13	2	655
		(all)	(all)	(all)	460	127	54	13	2	655
MADHUBAN A		NRSC-30	SRL-X	All Trees	329	90	39	9	1	468
		(all)	(all)	(all)	329	90	39	9	1	468
MAJHIDIA(KAUDIA)		NRSC-23	SRL-X	All Trees	11,463	2,761	1,284	286	48	15,842
		(all)	(all)	(all)	11,463	2,761	1,284	286	48	15,842
		NRSC-54	SRL-IV	All Trees	34,315	6,207	3,521	651	153	44,848
		NRSC-55	SRL-III	All Trees	35,328	6,856	3,697	717	156	46,754
		NRSC-56	SRL-II	All Trees	25,567	5,457	2,754	568	111	34,456
		NRSC-57	SRL-I	All Trees	9,221	2,197	1,029	227	39	12,713
MARICHPUR		(all)	(all)	(all)	104,431	20,717	11,000	2,163	459	138,770
MUGURIA		NRSC-42	SRL-VI	All Trees	1,772	488	208	50	7	2,525
		(all)	(all)	(all)	1,772	488	208	50	7	2,525
NUAGAON & DHINKIA		NRSC-26	SRL-IX	All Trees	54,708	14,926	6,402	1,537	222	77,795
		(all)	(all)	(all)	54,708	14,926	6,402	1,537	222	77,795
PADMAPUR		NRSC-45	SRL-VI	All Trees	5,710	1,572	670	162	23	8,137
		(all)	(all)	(all)	5,710	1,572	670	162	23	8,137
RAMTARA		NRSC-41	SRL-VI	All Trees	6,043	1,664	710	171	24	8,612
		(all)	(all)	(all)	6,043	1,664	710	171	24	8,612
SAHADABEDI		NRSC-47	SRL-VI	All Trees	3,275	862	378	89	13	4,618
		(all)	(all)	(all)	3,275	862	378	89	13	4,618
SALIO		NRSC-52	SRL-V	All Trees	7,150	1,837	819	190	30	10,025
		(all)	(all)	(all)	7,150	1,837	819	190	30	10,025

Table 7: Stand Table, Compartment Wise Estimated Number of Stems (NON-SFC) (*continued*)

RANGE	BLOCK	COMPARTMENT COUPE	MAJOR SPECIES	GIRTH CLASS (cm)					Total
				30-60	60-90	90-120	120-150	> 150	
KUJANGA	TENTULI BELARI	NRSC-51	SRL-V	1,437	396	169	41	6	2,048
		(all)	(all)	1,437	396	169	41	6	2,048
		NRSC-19	MHP-V	305,260	73,876	34,245	7,644	1,282	422,307
		(all)	(all)	656	181	77	19	3	935
	BARAKOLIKHOL	(all)	(all)	656	181	77	19	3	935
		NRSC-17	MHP-V	3,683	1,014	432	104	15	5,248
	BATIGHAR	(all)	(all)	3,683	1,014	432	104	15	5,248
		NRSC-13	MHP-VIII	106,008	21,660	2,849	592	85	131,193
	HETAMUNDIA	NRSC-16	MHP-IX	23,669	7,624	4,598	1,547	63	37,501
		(all)	(all)	129,677	29,284	7,447	2,139	148	168,695
	JAMBOO	NRSC-7	MHP-IV	23,456	8,749	3,699	1,530	967	38,401
		(all)	(all)	23,456	8,749	3,699	1,530	967	38,401
	JOGIDHANAKUD	NRSC-21	MHP-X	9,161	2,522	1,076	260	37	13,055
		(all)	(all)	9,161	2,522	1,076	260	37	13,055
	KANDARAPATIA	NRSC-6	MHP-IV	5,246	852	382	98	27	6,604
		(all)	(all)	5,246	852	382	98	27	6,604
		NRSC-11	MHP-VII	192,852	19,226	14,434	4,051	61	230,624
		NRSC-12	MHP-VI	67,595	29,606	18,656	4,518	595	120,970
	KANSARIDIA	(all)	(all)	260,447	48,832	33,090	8,568	656	351,594
		NRSC-4	MHP-III	2,525	695	296	72	10	3,599
	KANTILO	(all)	(all)	2,525	695	296	72	10	3,599
		NRSC-14	MHP-V	17,168	3,005	1,335	338	85	21,930
	SANATUBI	(all)	(all)	17,168	3,005	1,335	338	85	21,930
		(all)	(all)	17,168	3,005	1,335	338	85	21,930

Table 7: Stand Table, Compartment Wise Estimated Number of Stems
(NON-SFC) (continued)

RANGE	BLOCK	COMPARTMENT	COUPE	MAJOR SPECIES	GIRTH CLASS (cm)					Total
					30-60	60-90	90-120	120-150	> 150	
MAHAKALAPADA	(all)	(all)	(all)	All Trees	3,463	953	407	98	14	4,936
				(all)	3,463	953	407	98	14	4,936
				All Trees	4,297	1,183	505	122	17	6,124
				(all)	4,297	1,183	505	122	17	6,124
SUNITI	(all)	(all)	(all)	(all)	459,778	97,270	48,745	13,348	1,979	621,120
				(all)	794,998	177,861	86,268	21,689	3,389	1,084,204
				(all)						

Table 8: Stock Table Summary Estimated Volume of Trees

RANGE	COUPE TYPE	MAJOR SPECIES	(Volume in Cu. m)					Total
			GIRTH CLASS (cm)					
			30-60	60-90	90-120	120-150	> 150	
GAHIRAMATHA	RWC	All Trees	2,075	1,405	1,752	695	228	6,155
			2,075	1,405	1,752	695	228	6,155
		(all)	2,075	1,405	1,752	695	228	6,155
		All Trees	21,659	15,299	18,151	7,586	2,216	64,911
KUJANGA	RWC		21,659	15,299	18,151	7,586	2,216	64,911
		(all)	21,659	15,299	18,151	7,586	2,216	64,911
		All Trees	30,098	21,535	25,761	13,351	3,479	94,224
		RWC	30,098	21,535	25,761	13,351	3,479	94,224
MAHAKALAPADA	(all)		30,098	21,535	25,761	13,351	3,479	94,224
		(all)	53,832	38,239	45,663	21,631	5,924	165,290

Table 9: Block Wise Stock Table Estimated Volume of Trees

RANGE	BLOCK	MAJOR SPECIES	(Volume in Cu. m)					Total
			GIRTH CLASS (cm)					
			30-60	60-90	90-120	120-150	> 150	
GAHIRAMATHA	SASANPETA	All Trees	2,075	1,405	1,752	695	228	6,155
		(all)	2,075	1,405	1,752	695	228	6,155
			2,075	1,405	1,752	695	228	6,155
	AKASDIA	All Trees	219	166	182	83	20	669
		(all)	219	166	182	83	20	669
			All Trees	43	33	36	16	4
	BALITUTHA	(all)	43	33	36	16	4	132
		All Trees	144	109	119	54	13	439
		(all)	144	109	119	54	13	439
	BARUHAN		All Trees	1,586	1,058	1,342	523	179
(all)		1,586	1,058	1,342	523	179	4,689	
		BHULANPAL	All Trees	88	66	73	33	8
(all)	88		66	73	33	8	268	
	BOITARAKUD		All Trees	59	45	49	22	5
(all)		59	45	49	22	5	181	
		BRAHMANDIAN	All Trees	325	246	269	122	29
(all)	325		246	269	122	29	990	
	GODA		All Trees	112	85	92	42	10
(all)		112	85	92	42	10	341	
		JATADHARATANDA	All Trees	5,327	4,022	4,410	2,003	477
(all)	5,327		4,022	4,410	2,003	477	16,239	
	All Trees		34	26	28	13	3	104

Table 9: Block Wise Stock Table Estimated Volume of Trees (*continued*)

RANGE	BLOCK	MAJOR SPECIES	(Volume in Cu. m)						Total
			GIRTH CLASS (cm)						
			30-60	60-90	90-120	120-150	> 150		
KANKAN	(all)	34	26	28	13	3	104		
	All Trees	24	18	20	9	2	74		
MADHUBAN A	(all)	24	18	20	9	2	74		
	All Trees	812	572	681	284	83	2,432		
MAJHIDIA(KAUDIA)	(all)	812	572	681	284	83	2,432		
	All Trees	6,980	4,413	5,957	2,170	850	20,370		
MARICHPUR	(all)	6,980	4,413	5,957	2,170	850	20,370		
	All Trees	131	99	109	50	12	401		
MUGURIA	(all)	131	99	109	50	12	401		
	All Trees	4,041	3,045	3,346	1,517	363	12,312		
NUAGAON & DHINKIA	(all)	4,041	3,045	3,346	1,517	363	12,312		
	All Trees	423	320	350	160	38	1,291		
PADMAPUR	(all)	423	320	350	160	38	1,291		
	All Trees	448	339	370	169	40	1,366		
RAMTARA	(all)	448	339	370	169	40	1,366		
	All Trees	239	177	199	88	22	724		
SAHADABEDI	(all)	239	177	199	88	22	724		
	All Trees	517	378	431	188	50	1,563		
SALIO	(all)	517	378	431	188	50	1,563		
	All Trees	106	81	88	40	9	325		
TENTULI BELARI		106	81	88	40	9	325		

Table 9: Block Wise Stock Table Estimated Volume of Trees (*continued*)

RANGE	BLOCK	MAJOR SPECIES	(Volume in Cu. m)						Total
			GIRTH CLASS (cm)						
			30-60	60-90	90-120	120-150	> 150		
KUJANGA	(all)	(all)	21,659	15,299	18,151	7,586	2,216	64,911	
		All Trees	49	37	40	18	4	148	
BARAKOLIKHOL	(all)	(all)	49	37	40	18	4	148	
		All Trees	273	207	226	103	24	832	
BATIGHAR	(all)	(all)	273	207	226	103	24	832	
		All Trees	8,512	5,477	4,105	2,140	241	20,476	
HETAMUNDIA	(all)	(all)	8,512	5,477	4,105	2,140	241	20,476	
		All Trees	2,461	2,569	1,799	1,600	1,877	10,306	
JAMBOO	(all)	(all)	2,461	2,569	1,799	1,600	1,877	10,306	
		All Trees	679	514	562	256	60	2,071	
JOGIDHANAKUDA	(all)	(all)	679	514	562	256	60	2,071	
		All Trees	337	189	206	99	52	883	
KANDARAPATIA	(all)	(all)	337	189	206	99	52	883	
		All Trees	15,904	11,309	17,476	8,504	989	54,181	
KANSARIDIA	(all)	(all)	15,904	11,309	17,476	8,504	989	54,181	
		All Trees	187	142	155	71	17	571	
KANTILO	(all)	(all)	187	142	155	71	17	571	
		All Trees	1,121	656	717	342	164	3,001	
SANATUBI	(all)	(all)	1,121	656	717	342	164	3,001	
		All Trees	257	194	212	97	23	783	
SARALIKUDA	(all)	(all)	257	194	212	97	23	783	

Table 9: Block Wise Stock Table Estimated Volume of Trees (*continued*)

RANGE	BLOCK	MAJOR SPECIES	(Volume in Cu. m)					Total
			GIRTH CLASS (cm)					
			30-60	60-90	90-120	120-150	> 150	
MAHAKALAPADA	(all)	All Trees	318	241	263	120	28	971
			318	241	263	120	28	971
			30,098	21,535	25,761	13,351	3,479	94,224
		(all)	53,832	38,239	45,663	21,631	5,924	165,290

Table 10: Range Wise Stock Table Estimated Volume of Trees
(NON SFC)

RANGE	MAJOR SPECIES	(Volume in Cu. m)						Total
		GIRTH CLASS (cm)						
		30-60	60-90	90-120	120-150	> 150		
GAHIRAMATHA	All Trees	2,075	1,405	1,752	695	228		6,155
	(all)	2,075	1,405	1,752	695	228		6,155
KUJANGA	All Trees	21,659	15,299	18,151	7,586	2,216		64,911
	(all)	21,659	15,299	18,151	7,586	2,216		64,911
MAHAKALAPADA	All Trees	30,098	21,535	25,761	13,351	3,479		94,224
	(all)	30,098	21,535	25,761	13,351	3,479		94,224
(all)	(all)	53,832	38,239	45,663	21,631	5,924		165,290

Table 11: Stock Table, Compartment Wise Estimated Volume of Trees (NON SFC)

RANGE	BLOCK	COMPARTMENT COUPE	MAJOR SPECIES	(Volume in Cu. m)					Total	
				GIRTH CLASS (cm)						
				30-60	60-90	90-120	120-150	> 150		
SASANPETA	GAHIRAMATHA (all)	NRSC-1	MHP-I	All Trees	24	18	19	9	2	72
		NRSC-2	MHP-II	All Trees	1,558	1,023	1,322	504	180	4,588
		NRSC-3	MHP-III	All Trees	493	365	410	181	46	1,496
	GODA	(all)	(all)	(all)	2,075	1,405	1,752	695	228	6,155
			(all)	(all)	2,075	1,405	1,752	695	228	6,155
		NRSC-49	SRL-VI	All Trees	219	166	182	83	20	669
		AKASDIA	(all)	(all)	219	166	182	83	20	669
			NRSC-25	SRL-X	All Trees	43	33	36	16	4
		BALITUTHA	(all)	(all)	43	33	36	16	4	132
			NRSC-38	SRL-VIII	All Trees	144	109	119	54	13
BARKUD	(all)	(all)	144	109	119	54	13	439		
	NRSC-53	SRL-V	All Trees	1,586	1,058	1,342	523	179	4,689	
BARUHAN	(all)	(all)	1,586	1,058	1,342	523	179	4,689		
	NRSC-36	SRL-X	All Trees	88	66	73	33	8	268	
BHUIANPAL	(all)	(all)	88	66	73	33	8	268		
	NRSC-24	SRL-X	All Trees	59	45	49	22	5	181	
BOITARAKUD	(all)	(all)	59	45	49	22	5	181		
	NRSC-50	SRL-V	All Trees	325	246	269	122	29	990	
BRAHMANDIAN	(all)	(all)	325	246	269	122	29	990		
	NRSC-46	SRL-V	All Trees	112	85	92	42	10	341	
GODA	(all)	(all)	112	85	92	42	10	341		
	NRSC-35	SRL-VII	All Trees	5,327	4,022	4,410	2,003	477	16,239	

Table 11: Stock Table, Compartment Wise Estimated Volume of Trees
(NON SFC) (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	MAJOR SPECIES	(Volume in Cu. m)					Total
					GIRTH CLASS (cm)					
					30-60	60-90	90-120	120-150	> 150	
JATADHARATAN	(all)	NRSC-39	SRL-VIII	(all)	5,327	4,022	4,410	2,003	477	16,239
					34	26	28	13	3	104
KANKAN	(all)	NRSC-30	SRL-X	(all)	34	26	28	13	3	104
					24	18	20	9	2	74
MADHUBAN A	(all)	NRSC-23	SRL-X	(all)	24	18	20	9	2	74
					812	572	681	284	83	2,432
MAJHIDIA(KAUDIA)	(all)	NRSC-54	SRL-IV	(all)	812	572	681	284	83	2,432
					2,237	1,342	1,924	657	291	6,452
		NRSC-55	SRL-III	(all)	2,347	1,465	2,007	720	291	6,830
					1,745	1,150	1,480	567	200	5,142
MARICHPUR	(all)	NRSC-57	SRL-I	(all)	651	456	546	226	68	1,947
					6,980	4,413	5,957	2,170	850	20,370
MUGURIA	(all)	NRSC-42	SRL-VI	(all)	131	99	109	50	12	401
					131	99	109	50	12	401
NUAGAON & DHINKIA	(all)	NRSC-26	SRL-IX	(all)	4,041	3,045	3,346	1,517	363	12,312
					4,041	3,045	3,346	1,517	363	12,312
PADMAPUR	(all)	NRSC-45	SRL-VI	(all)	423	320	350	160	38	1,291
					423	320	350	160	38	1,291
RAMTARA	(all)	NRSC-41	SRL-VI	(all)	448	339	370	169	40	1,366
					448	339	370	169	40	1,366
SAHADABEDI	(all)	NRSC-47	SRL-VI	(all)	239	177	199	88	22	724
					239	177	199	88	22	724

Table 11: Stock Table, Compartment Wise Estimated Volume of Trees
(NON SFC) (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	MAJOR SPECIES	(Volume in Cu. m)					Total
					GIRTH CLASS (cm)					
					30-60	60-90	90-120	120-150	> 150	
KUJANGA	SALIO	NRSC-52	SRL-V	All Trees	517	378	431	188	50	1,563
		(all)	(all)	(all)	517	378	431	188	50	1,563
	TENTULI BELARI	NRSC-51	SRL-V	All Trees	106	81	88	40	9	325
		(all)	(all)	(all)	106	81	88	40	9	325
	(all)	(all)	(all)	21,659	15,299	18,151	7,586	2,216	64,911	
		NRSC-19	MHP-V	All Trees	49	37	40	18	4	148
	BARAKOLIKHOL	(all)	(all)	(all)	49	37	40	18	4	148
		NRSC-17	MHP-V	All Trees	273	207	226	103	24	832
	BATIGHAR	(all)	(all)	(all)	273	207	226	103	24	832
		NRSC-13	MHP-VIII	All Trees	6,872	3,929	1,471	584	138	12,992
	HETAMUNDIA	NRSC-16	MHP-IX	All Trees	1,641	1,549	2,634	1,557	103	7,484
		(all)	(all)	(all)	8,512	5,477	4,105	2,140	241	20,476
JAMBOO	NRSC-7	MHP-IV	All Trees	2,461	2,569	1,799	1,600	1,877	10,306	
	(all)	(all)	(all)	2,461	2,569	1,799	1,600	1,877	10,306	
JOGIDHANAKUDIA	NRSC-21	MHP-X	All Trees	679	514	562	256	60	2,071	
	(all)	(all)	(all)	679	514	562	256	60	2,071	
KANDARAPATIA	NRSC-6	MHP-IV	All Trees	337	189	206	99	52	883	
	(all)	(all)	(all)	337	189	206	99	52	883	
(all)	NRSC-11	MHP-VII	All Trees	11,065	4,620	7,594	4,037	100	27,415	
	NRSC-12	MHP-VI	All Trees	4,840	6,689	9,882	4,467	889	26,767	
KANSARIDIA	(all)	(all)	(all)	15,904	11,309	17,476	8,504	989	54,181	
	NRSC-4	MHP-III	All Trees	187	142	155	71	17	571	

Table 11: Stock Table, Compartment Wise Estimated Volume of Trees
(NON SFC) (continued)

RANGE	BLOCK	COMPARTMENT	COUPE	MAJOR SPECIES	(Volume in Cu. m)					Total	
					GIRTH CLASS (cm)						
					30-60	60-90	90-120	120-150	> 150		
	KANTILO	(all)	(all)	(all)	187	142	155	71	17	571	
	SANATUBI	NRSC-14	MHP-V	All Trees	1,121	656	717	342	164	3,001	
		(all)	(all)	(all)	1,121	656	717	342	164	3,001	
		SARALIKUDA	NRSC-20	MHP-X	All Trees	257	194	212	97	23	783
SUNITI		(all)	(all)	(all)	257	194	212	97	23	783	
	MAHAKALAPADA	(all)	NRSC-5	MHP-IV	All Trees	318	241	263	120	28	971
(all)			(all)	(all)	318	241	263	120	28	971	
(all)		(all)	(all)	(all)	(all)	30,098	21,535	25,761	13,351	3,479	94,224
			(all)	(all)	(all)	53,832	38,239	45,663	21,631	5,924	165,290

Table 12: Canopy density strata wise area

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)					Total
				Canopy Density Class					
				NF	<10%	10-40%	40-70%	>70%	
GAHIRAMATHA	SASANPETA	NRSC-1	MHP-I	841.78	0.00	1.80	0.00	0.00	843.58
		NRSC-2	MHP-II	356.98	19.81	59.27	47.35	0.00	483.41
		NRSC-3	MHP-III	272.43	0.00	34.38	2.65	0.00	309.46
	(all)	(all)	1,471.19	19.81	95.45	50.00	0.00	1,636.45	
			1,471.19	19.81	95.45	50.00	0.00	1,636.45	
			221.11	36.51	16.79	0.00	0.00	274.41	
	AKASDIA	(all)	(all)	221.11	36.51	16.79	0.00	0.00	274.41
		NRSC-49	SRL-VI	221.11	36.51	16.79	0.00	0.00	274.41
	BALITUTHA	NRSC-25	SRL-X	63.12	45.86	3.30	0.00	0.00	112.29
		(all)	(all)	63.12	45.86	3.30	0.00	0.00	112.29
BARKUD	NRSC-38	SRL-VIII	96.57	0.00	11.01	0.00	0.00	107.59	
	(all)	(all)	96.57	0.00	11.01	0.00	0.00	107.59	
BARUHAN	NRSC-53	SRL-V	132.72	12.52	66.96	42.96	25.81	280.97	
	(all)	(all)	132.72	12.52	66.96	42.96	25.81	280.97	
BHUIANPAL	NRSC-36	SRL-X	154.27	0.00	6.71	0.00	0.00	160.98	
	(all)	(all)	154.27	0.00	6.71	0.00	0.00	160.98	
BOITARAKUD	NRSC-24	SRL-X	205.74	0.00	4.53	0.00	0.00	210.27	
	(all)	(all)	205.74	0.00	4.53	0.00	0.00	210.27	
BRAHMANDIAN	NRSC-50	SRL-V	25.51	15.11	24.83	0.00	0.00	65.45	
	(all)	(all)	25.51	15.11	24.83	0.00	0.00	65.45	
DHOBEI	NRSC-37	SRL-VIII	53.32	0.00	0.00	0.00	0.00	53.32	
	(all)	(all)	53.32	0.00	0.00	0.00	0.00	53.32	
	NRSC-48	SRL-V	254.93	0.00	0.00	0.00	0.00	254.93	

Table 12: Canopy density strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)				Total	
				NF	Canopy Density Class				
					<10%	10-40%	40-70%		>70%
GARHARISPUR	(all)		(all)	254.93	0.00	0.00	0.00	0.00	254.93
	NRSC-40		SRL-VI	83.39	0.00	0.00	0.00	0.00	83.39
GARHBISHUNPUR	(all)		(all)	83.39	0.00	0.00	0.00	0.00	83.39
	NRSC-46		SRL-V	9.76	0.00	8.54	0.00	0.00	18.30
GODA	(all)		(all)	9.76	0.00	8.54	0.00	0.00	18.30
	NRSC-43		SRL-VI	25.91	0.00	0.00	0.00	0.00	25.91
GOPALPUR	(all)		(all)	25.91	0.00	0.00	0.00	0.00	25.91
	NRSC-27			15.45	0.00	0.00	0.00	0.00	15.45
	NRSC-31			16.01	0.00	0.00	0.00	0.00	16.01
	NRSC-34		SRL-VII	34.80	0.00	0.00	0.00	0.00	34.80
JATADHAR	(all)		(all)	66.26	0.00	0.00	0.00	0.00	66.26
	NRSC-35		SRL-VII	201.38	2.01	402.87	3.65	0.00	609.91
JATADHARATANDA	(all)		(all)	201.38	2.01	402.87	3.65	0.00	609.91
	NRSC-39		SRL-VIII	487.08	0.00	2.61	0.00	0.00	489.69
KANKAN	(all)		(all)	487.08	0.00	2.61	0.00	0.00	489.69
	NRSC-44		SRL-VI	50.86	0.00	0.00	0.00	0.00	50.86
KATHIAKHOLDA	(all)		(all)	50.86	0.00	0.00	0.00	0.00	50.86
	NRSC-30		SRL-X	40.89	0.00	1.86	0.00	0.00	42.75
MADHUBAN A	(all)		(all)	40.89	0.00	1.86	0.00	0.00	42.75
	NRSC-32		SRL-X	32.68	0.00	0.00	0.00	0.00	32.68
MADHUBAN B	(all)		(all)	32.68	0.00	0.00	0.00	0.00	32.68
	NRSC-23		SRL-X	29.71	0.00	45.80	12.89	0.00	88.40

Table 12: Canopy density strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)					Total
				Canopy Density Class					
				NF	<10%	10-40%	40-70%	>70%	
MAJHIDIA (KAUDIA)		(all)		29.71	0.00	45.80	12.89	0.00	88.40
	NRSC-54	SRL-IV		542.68	114.43	37.25	105.73	0.00	800.08
	NRSC-55	SRL-III		615.79	166.82	60.91	93.68	0.00	937.20
	NRSC-56	SRL-II		320.47	489.48	68.15	51.61	0.00	929.71
MARICHPUR	NRSC-57	SRL-I		550.60	113.15	35.66	11.16	0.00	710.57
	(all)	(all)		2,029.53	883.88	201.96	262.19	0.00	3,377.56
MUGURIA	NRSC-42	SRL-VI		110.94	0.00	10.04	0.00	0.00	120.99
	(all)	(all)		110.94	0.00	10.04	0.00	0.00	120.99
NOLIASAHI	NRSC-33	SRL-X		25.22	40.06	0.00	0.00	0.00	65.27
	(all)	(all)		25.22	40.06	0.00	0.00	0.00	65.27
NUAGAON & DHINKIA	NRSC-26	SRL-IX		336.39	33.00	303.50	4.43	0.00	677.32
	(all)	(all)		336.39	33.00	303.50	4.43	0.00	677.32
PADMAPUR	NRSC-45	SRL-VI		21.51	12.90	32.36	0.00	0.00	66.77
	(all)	(all)		21.51	12.90	32.36	0.00	0.00	66.77
RAMTARA	NRSC-41	SRL-VI		35.86	0.00	34.25	0.00	0.00	70.12
	(all)	(all)		35.86	0.00	34.25	0.00	0.00	70.12
SAHADABEDI	NRSC-47	SRL-VI		77.41	0.00	16.63	1.30	0.00	95.34
	(all)	(all)		77.41	0.00	16.63	1.30	0.00	95.34
SALIO	NRSC-52	SRL-V		25.44	16.24	34.15	4.28	0.00	80.11
	(all)	(all)		25.44	16.24	34.15	4.28	0.00	80.11
TENTULI BELARI	NRSC-51	SRL-V		84.77	0.00	8.15	0.00	0.00	92.91
				84.77	0.00	8.15	0.00	0.00	92.91

Table 12: Canopy density strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)					Total	
				NF	Canopy Density Class			>70%		
					<10%	10-40%	40-70%			
KUJANGA	(all)	(all)	(all)	4,982.28	1,098.08	1,236.87	331.71	25.81	7,674.75	
	BADATUBI	NRSC-15	MHP-V	32.79	0.00	0.00	0.00	0.00	32.79	
		(all)	(all)	(all)	32.79	0.00	0.00	0.00	0.00	32.79
	BAGAGAHAN	NRSC-8	MHP-IV	15.78	0.00	0.00	0.00	0.00	15.78	
		(all)	(all)	(all)	15.78	0.00	0.00	0.00	0.00	15.78
	BARAKOLIKHOL	NRSC-19	MHP-V	27.23	0.00	3.72	0.00	0.00	30.95	
		(all)	(all)	(all)	27.23	0.00	3.72	0.00	0.00	30.95
	BATIGHAR	NRSC-17	MHP-V	46.54	0.00	20.87	0.00	0.00	67.41	
		(all)	(all)	(all)	46.54	0.00	20.87	0.00	0.00	67.41
	HETAMUNDIA	NRSC-13	MHP-VIII	318.84	0.00	118.33	159.13	0.00	596.29	
		NRSC-16	MHP-IX	572.94	0.00	88.81	82.75	0.00	744.50	
	JAMBOO	NRSC-17	MHP-V	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		(all)	(all)	(all)	891.78	0.00	207.14	241.88	0.00	1,340.80
NRSC-7		MHP-IV	74.14	0.00	59.60	92.43	13.66	239.83		
JOGIDHANAKUDAT	(all)	(all)	(all)	74.14	0.00	59.60	92.43	13.66	239.83	
	NRSC-21	MHP-X	299.61	0.00	51.92	0.00	0.00	351.54		
KANDARAPATIA	(all)	(all)	(all)	299.61	0.00	51.92	0.00	0.00	351.54	
	NRSC-6	MHP-IV	103.05	0.00	0.00	15.98	6.98	126.01		
KANSARIDIA	(all)	(all)	(all)	103.05	0.00	0.00	15.98	6.98	126.01	
	NRSC-11	MHP-VII	282.73	0.00	85.87	238.32	131.49	738.40		
KANSARIDIA	NRSC-12	MHP-VI	270.86	0.00	293.40	4.48	151.17	719.90		
	(all)	(all)	(all)	553.59	0.00	379.27	242.79	282.65	1,458.30	

Table 12: Canopy density strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)					Total
				NF	Canopy Density Class				
					<10%	10-40%	40-70%	>70%	
KANTILO		NRSC-4	MHP-III	186.18	0.00	14.31	0.00	0.00	200.50
		(all)	(all)	186.18	0.00	14.31	0.00	0.00	200.50
KAUNSIAPAL		NRSC-9	MHP-IV	101.79	0.00	0.00	0.00	0.00	101.79
		(all)	(all)	101.79	0.00	0.00	0.00	0.00	101.79
NIPANIA		NRSC-18	MHP-X	100.63	0.00	0.00	0.00	0.00	100.63
		(all)	(all)	100.63	0.00	0.00	0.00	0.00	100.63
PETCHHELA		NRSC-10	MHP-IV	187.43	0.00	0.00	0.00	0.00	187.43
		(all)	(all)	187.43	0.00	0.00	0.00	0.00	187.43
SANATUBI		NRSC-14	MHP-V	403.01	0.00	10.84	46.46	0.00	460.31
		(all)	(all)	403.01	0.00	10.84	46.46	0.00	460.31
SARALIKUDA		NRSC-20	MHP-X	261.89	0.00	19.63	0.00	0.00	281.52
		(all)	(all)	261.89	0.00	19.63	0.00	0.00	281.52
SUNITI		NRSC-5	MHP-IV	83.12	0.00	24.36	0.00	17.39	124.87
				83.12	0.00	24.36	0.00	17.39	124.87
MAHAKALAPADA	(all)			3,368.57	0.00	791.66	639.54	320.68	5,120.46
		(all)	(all)	9,822.04	1,117.89	2,123.99	1,021.25	346.49	14,431.66

Table 13: Type strata wise area

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)		
				Forest Type Class		Total
				MISC.	SCRUB	
GAHIRAMATHA	SASANPETA	NRSC-1	MHP-I	1.80	0.00	841.78
		NRSC-2	MHP-II	106.62	19.81	356.98
		NRSC-3	MHP-III	37.03	0.00	272.43
GAHIRAMATHA	(all)			145.45	19.81	1,471.19
		(all)	(all)	145.45	19.81	1,471.19
		NRSC-49	SRL-VI	16.79	36.51	221.11
AKASDIA	(all)		(all)	16.79	36.51	221.11
		NRSC-25	SRL-X	3.30	45.86	63.12
		(all)	(all)	3.30	45.86	63.12
BALITUTHA	(all)	NRSC-38	SRL-VIII	11.01	0.00	96.57
		(all)	(all)	11.01	0.00	96.57
		NRSC-53	SRL-V	135.73	12.52	132.72
BARUKUD	(all)		(all)	135.73	12.52	132.72
		NRSC-36	SRL-X	6.71	0.00	154.27
		(all)	(all)	6.71	0.00	154.27
BHUIANPAL	(all)	NRSC-24	SRL-X	4.53	0.00	205.74
		(all)	(all)	4.53	0.00	205.74
		NRSC-50	SRL-V	24.83	15.11	25.51
BOITARAKUD	(all)		(all)	24.83	15.11	25.51
		NRSC-37	SRL-VIII	0.00	0.00	53.32
		(all)	(all)	0.00	0.00	53.32
BRAHMANDIAN	(all)		(all)	0.00	0.00	254.93
		NRSC-48	SRL-V	0.00	0.00	254.93
		(all)	(all)	0.00	0.00	254.93

Table 13: Type strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)			
				Forest Type Class			Total
				MISC.	SCRUB	NF	
GARHARISPUR	(all)		(all)	0.00	0.00	254.93	254.93
	NRSC-40		SRL-VI	0.00	0.00	83.39	83.39
GARHBISHUNPUR	(all)		(all)	0.00	0.00	83.39	83.39
	NRSC-46		SRL-V	8.54	0.00	9.76	18.30
GODA	(all)		(all)	8.54	0.00	9.76	18.30
	NRSC-43		SRL-VI	0.00	0.00	25.91	25.91
GOPALPUR	(all)		(all)	0.00	0.00	25.91	25.91
	NRSC-27			0.00	0.00	15.45	15.45
	NRSC-31			0.00	0.00	16.01	16.01
	NRSC-34		SRL-VII	0.00	0.00	34.80	34.80
JATADHAR	(all)		(all)	0.00	0.00	66.26	66.26
	NRSC-35		SRL-VII	406.52	2.01	201.38	609.91
JATADHARATANTA	(all)		(all)	406.52	2.01	201.38	609.91
	NRSC-39		SRL-VIII	2.61	0.00	487.08	489.69
KANKAN	(all)		(all)	2.61	0.00	487.08	489.69
	NRSC-44		SRL-VI	0.00	0.00	50.86	50.86
KATHIAKHOLDA	(all)		(all)	0.00	0.00	50.86	50.86
	NRSC-30		SRL-X	1.86	0.00	40.89	42.75
MADHUBAN A	(all)		(all)	1.86	0.00	40.89	42.75
	NRSC-32		SRL-X	0.00	0.00	32.68	32.68
MADHUBAN B	(all)		(all)	0.00	0.00	32.68	32.68
	NRSC-23		SRL-X	58.69	0.00	29.71	88.40

Table 13: Type strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)			
				Forest Type Class			Total
				MISC.	SCRUB	NF	
MAJHIDIA(KAUDIA)		(all)		58.69	0.00	29.71	88.40
	NRSC-54		SRL-IV	142.98	114.43	542.68	800.08
	NRSC-55		SRL-III	154.59	166.82	615.79	937.20
	NRSC-56		SRL-II	119.76	489.48	320.47	929.71
MARICHPUR	NRSC-57		SRL-I	46.82	113.15	550.60	710.57
	(all)		(all)	464.15	883.88	2,029.53	3,377.56
MUGURIA	NRSC-42		SRL-VI	10.04	0.00	110.94	120.99
	(all)		(all)	10.04	0.00	110.94	120.99
NOLIASAHI	NRSC-33		SRL-X	0.00	40.06	25.22	65.27
	(all)		(all)	0.00	40.06	25.22	65.27
NUAGAON & DHINKIA	NRSC-26		SRL-IX	307.93	33.00	336.39	677.32
	(all)		(all)	307.93	33.00	336.39	677.32
PADMAPUR	NRSC-45		SRL-VI	32.36	12.90	21.51	66.77
	(all)		(all)	32.36	12.90	21.51	66.77
RAMTARA	NRSC-41		SRL-VI	34.25	0.00	35.86	70.12
	(all)		(all)	34.25	0.00	35.86	70.12
SAHADABEDI	NRSC-47		SRL-VI	17.93	0.00	77.41	95.34
	(all)		(all)	17.93	0.00	77.41	95.34
SALIO	NRSC-52		SRL-V	38.44	16.24	25.44	80.11
	(all)		(all)	38.44	16.24	25.44	80.11
TENTULI BELARI	NRSC-51		SRL-V	8.15	0.00	84.77	92.91
				8.15	0.00	84.77	92.91

Table 13: Type strata wise area (*continued*)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)			
				Forest Type Class			Total
				MISC.	SCRUB	NF	
KUJANGA	(all)	(all)	(all)	1,594.39	1,098.08	4,982.28	7,674.75
	BADATUBI	NRSC-15	MHP-V	0.00	0.00	32.79	32.79
		(all)	(all)	0.00	0.00	32.79	32.79
	BAGAGAHAN	NRSC-8	MHP-IV	0.00	0.00	15.78	15.78
		(all)	(all)	0.00	0.00	15.78	15.78
	BARAKOLIKHOL	NRSC-19	MHP-V	3.72	0.00	27.23	30.95
		(all)	(all)	3.72	0.00	27.23	30.95
	BATIGHAR	NRSC-17	MHP-V	20.87	0.00	46.54	67.41
		(all)	(all)	20.87	0.00	46.54	67.41
	HETAMUNDIA	NRSC-13	MHP-VIII	277.45	0.00	318.84	596.29
		NRSC-16	MHP-IX	171.57	0.00	572.94	744.50
		NRSC-17	MHP-V	0.00	0.00	0.00	0.00
JAMBOO	(all)	(all)	(all)	449.02	0.00	891.78	1,340.80
	JOGIDHANAKUD	NRSC-7	MHP-IV	165.69	0.00	74.14	239.83
		(all)	(all)	165.69	0.00	74.14	239.83
	KANDARAPATIA	NRSC-21	MHP-X	51.92	0.00	299.61	351.54
		(all)	(all)	51.92	0.00	299.61	351.54
	KANSARIDIA	NRSC-6	MHP-IV	22.95	0.00	103.05	126.01
		(all)	(all)	22.95	0.00	103.05	126.01
	KANSARIDIA	NRSC-11	MHP-VII	455.67	0.00	282.73	738.40
		NRSC-12	MHP-VI	449.04	0.00	270.86	719.90
	(all)	(all)	(all)	904.71	0.00	553.59	1,458.30

Table 13: Type strata wise area (continued)

RANGE	BLOCK	COMPARTMENT	COUPE	(Area in ha)			
				Forest Type Class			Total
				MISC.	SCRUB	NF	
KANTILO		NRSC-4	MHP-III	14.31	0.00	186.18	200.50
		(all)	(all)	14.31	0.00	186.18	200.50
KAUNSIAPAL		NRSC-9	MHP-IV	0.00	0.00	101.79	101.79
		(all)	(all)	0.00	0.00	101.79	101.79
NIPANIA		NRSC-18	MHP-X	0.00	0.00	100.63	100.63
		(all)	(all)	0.00	0.00	100.63	100.63
PETCHHELA		NRSC-10	MHP-IV	0.00	0.00	187.43	187.43
		(all)	(all)	0.00	0.00	187.43	187.43
SANATUBI		NRSC-14	MHP-V	57.30	0.00	403.01	460.31
		(all)	(all)	57.30	0.00	403.01	460.31
SARALIKUDA		NRSC-20	MHP-X	19.63	0.00	261.89	281.52
		(all)	(all)	19.63	0.00	261.89	281.52
SUNITI		NRSC-5	MHP-IV	41.75	0.00	83.12	124.87
				41.75	0.00	83.12	124.87
MAHAKALAPADA	(all)			1,751.89	0.00	3,368.57	5,120.46
		(all)	(all)	3,491.73	1,117.89	9,822.04	14,431.66

ANNEXURE -XIX

Year 2016-17

DEVIATION STATEMENT

Sl. No. of deviation	Control Book Name, Form No. Page	Reference to Working Plan.		Nature of deviation requiring PCCF's Approval
		Paragraph	Nature of Prescription	
1	2	3	4	5
01	Control Book for Rehabilitation Working Circle	3.11.2 Page-386,387	Mahakalapada and Sarala Treatment Series are divided into annual coupes and the work to commence during 2016-17 as per sequence prescribed in the Working Plan.	Mahakalapada and Sarala Treatment Series due for working during 2016-17 was not worked due to : 1. Non-availability of fund. 2. Physically Area not available in most of the forest blocks due to encroachment. 3. POSCO Agitation affected working in Sarala Treatment Series.

Year 2016-17

DEVIATION STATEMENT

Sl. No. of deviation	Control Book Name, Form No. Page	Reference to Working Plan.		Nature of deviation requiring PCCF's Approval
		Paragraph	Nature of Prescription	
1	2	3	4	5
02	Control Book for Plantation (Overlapping) Working Circle	4.9.2 Page-405,406	Jatadhar and Nuagaon Planting Series are divided into annual coupes and the work to commence during 2016-17 as per sequence prescribed in the Working Plan.	Jatadhar and Nuagaon Planting Series due for working during 2016-17 was not worked due to: 1. Non-availability of fund. 2. Physically area not available due to encroachment in most of the forest blocks. 3. POSCO Agitation affected working in Nuagaon Planting Series.

				4. However plantation taken up over a total area of 207.4 Ha. in both the Planting Series out of 713.00 Ha,

Year 2016-17

DEVIATION STATEMENT

Sl. No. of Deviation	Control Book Name, Form No. Page	Reference to Working Plan.		Nature of deviation requiring PCCF's Approval
		Paragraph	Nature of Prescription	
01	02	03	04	05
03	Control Book for Mangrove Improvement (Overlapping) Working Circle	5.3 Page-412	Kujanga and Batighar Improvement Series are divided into annual coupes and the work to commence during 2016-17 as per sequence prescribed in the Working Plan.	Kujang and Batighar Improvement Series due for working during 2016-17 was not worked due to: 1. Non-availability of fund. 2. Physically area not available due to encroachment in Batighar Improvement Series. 3. However plantation taken up over a total area of 1638.056 Ha. in both the Planting Series out of 2176.60 Ha,

GOVERNMENT OF ORISSA
FOREST & ENVIRONMENT DEPARTMENT

NOTIFICATION

Dated Bhubaneswar the 18th Feb' 2020

No. FE-WL-WLF-0054-2015- 2289 / The State Government in exercising the powers conferred by sub-section-18 of the Wildlife (Protection) Act, 1972 (53 of 1972) had declared Bhitarkanika Wildlife Sanctuary vide Notification No. 6958-4F-(W)-34/75/FFAH dated 22.04.1975.

Whereas the proposal for rationalisation of boundary of Bhitarkanika Wildlife Sanctuary has been vetted by the competent authority of Government of India which have been communicated by Ministry of Environment, Forest & Climate Change, Government of India vide their letter No. F. No.6-37/2019 WL Dated 18.12.2019.

And whereas the State Government consider that the area, the limits of which have been specified in Schedules 'A' and 'B' given below including Forest lands, Waste lands off shore islands, estuaries, back waters, mud flats, river mouths, swamps, riverine island, creeks, sand bars, wet-lands and Government lands between the boundaries described in Schedule 'A' situated under the Police Station of Rajkanika, Talchua Marine, Rajnagar, Tantiapal Marine and Jamboo Marine Police Stations in Kendrapada district, is comprised within reserve forest and a part of territorial water and is of adequate ecological, faunal, floral, geomorphological natural or zoological significance for the purpose of protecting, propagating or developing wildlife.

Now, therefore, in exercise of the powers conferred by clause (b) of sub-section (1) of section 26 A of the Wildlife (Protection) Act, 1972 (53 of 1972) and with prior concurrence of the Central Government the State Government do hereby declare the aforesaid area to be a sanctuary known as "BHITARKANIKA WILDLIFE SANCTUARY" with effect from the date of publication of this notification in Odisha Gazette.

SCHEDULE-A

LOCATION - 87° 02'30" to 86° 40' 30" East longitude
 20° 17'30" to 20° 47' 30" North Latitude

NUMBER OF VILLAGES AND HUMAN HABITATIONS - 322 Villages

TOTAL AREA OF SANCTUARY - 673 Sq. Kms. which includes forest lands, rivers, creeks, estuary and backwaters.

DESCRIPTION OF BOUNDARY:

The boundary of Bhitarkanika Wildlife Sanctuary starts from Barunei Mouth (Marked as Survey Station-01). Then it moves in a northeasterly direction and runs along the coast of Bay of Bengal and meets the boundary of village Karanja, Gohipur, Teisimouza and touches Chinchiri Mouth. Then it moves along the coastline of the Bay of Bengal and touches the village boundary of Mohanpur, Gobindpur, Kanhupur, Satabhaya, Bada Gahirmatha, Sana Gahirmatha and it meets the northern most tip of Ekakula Nasi Island through back waters and estuaries of Dhamra and Mahipura river mouths in the north eastern direction. Then it further moves northwesterly direction and touches the boundary of Kantiakhai FB. Then it touches the village boundary of Tikayat Nagar then moves in northeasterly direction over **1655 Meters** and meets the district boundary of Bhadrak district. It then moves towards northwesterly direction along the upstream of River Dhamra. Then it touches the confluence point of the Rivers Brahmani & Baitarani and meet at the outer boundary of village Nalitapatia. Then it crosses the confluence point of both rivers in northwesterly direction and touches the village boundary of Laxmiprasad Dia and moves southerly along the village boundary of Nuagaon. It then touches the district boundary of Bhadrak & Kendrapara in River Baitarani then moves along the district boundary along river Baitarani and touches the village boundary of Mahurigaon. It then moves southwesterly along the village boundary of Badataila, Achinta, Gobindapur & Ganja. Then it moves in outward eastern direction touching the village boundary of Gokarneswar, Cherantapada, Kothasahi, Giria & Bansaria. It then moves southwesterly along the village boundary of Dalikanda and then moves southern direction along the River Kharasrota and then turns eastern direction in river Kharasrota along the boundary of villages of Barha Anko, Sana Anko, Jamudanda, Ichhapur, Diniari and then moves towards southern direction along the village side of village Dinari, Dhaneswarpur up to village boundary Barha Ambila. Then it moves in the south direction along the boundary of village Naladia, Ostia, Bandhapatana, Balikana, Bhagabanpur, Madhupur, Manikhandi, Balisahipatana, Pancheswar, Padini, Dhandia, Badaolara, Kiajori, Sanabadagopalpur, Garjanpur, Jagannathpur, Tamulia, Badakot, Khirkot, Tetelenga, Koilipur, Duttapur and then moves along River Hansua. Then it moves around the boundary of Sasanpeta PRF, Kantilo RF, Suniti PRF, Kandarapatia PRF, Jamboo PF through Kharanasi Creek to Sanatubi PRF, Kansaridia PRF, Hetamundia PRF and meets at Barunei Mouth at its starting point. The above proposal has been approved in principle in the 53rd Meeting of Standing Committee of National Board for Wildlife on 25.02.2019.

SCHEDULE-B

NORTH : Bhadrak District.

SOUTH : Bay of Bengal (Gahirmatha Marine Wildlife Sanctuary) and Villages of Batighar GP under Mahakalapada Tahasil

EAST : Bay of Bengal (Gahirmatha Marine Wildlife Sanctuary)

WEST : Villages to the west of Kharasrota River, Hansua River, Kharanasi River, Jamboo River

SCHEDULE-C

The GPS Pillar Coordinates of 1001 Survey Stations is uploaded in this Department Website.

SCHEDULE-D

The map of the Sanctuary after rationalization of boundary is modified accordingly as annexed herewith.

This Notification will come into effect from the date of publication in Odisha Gazette.

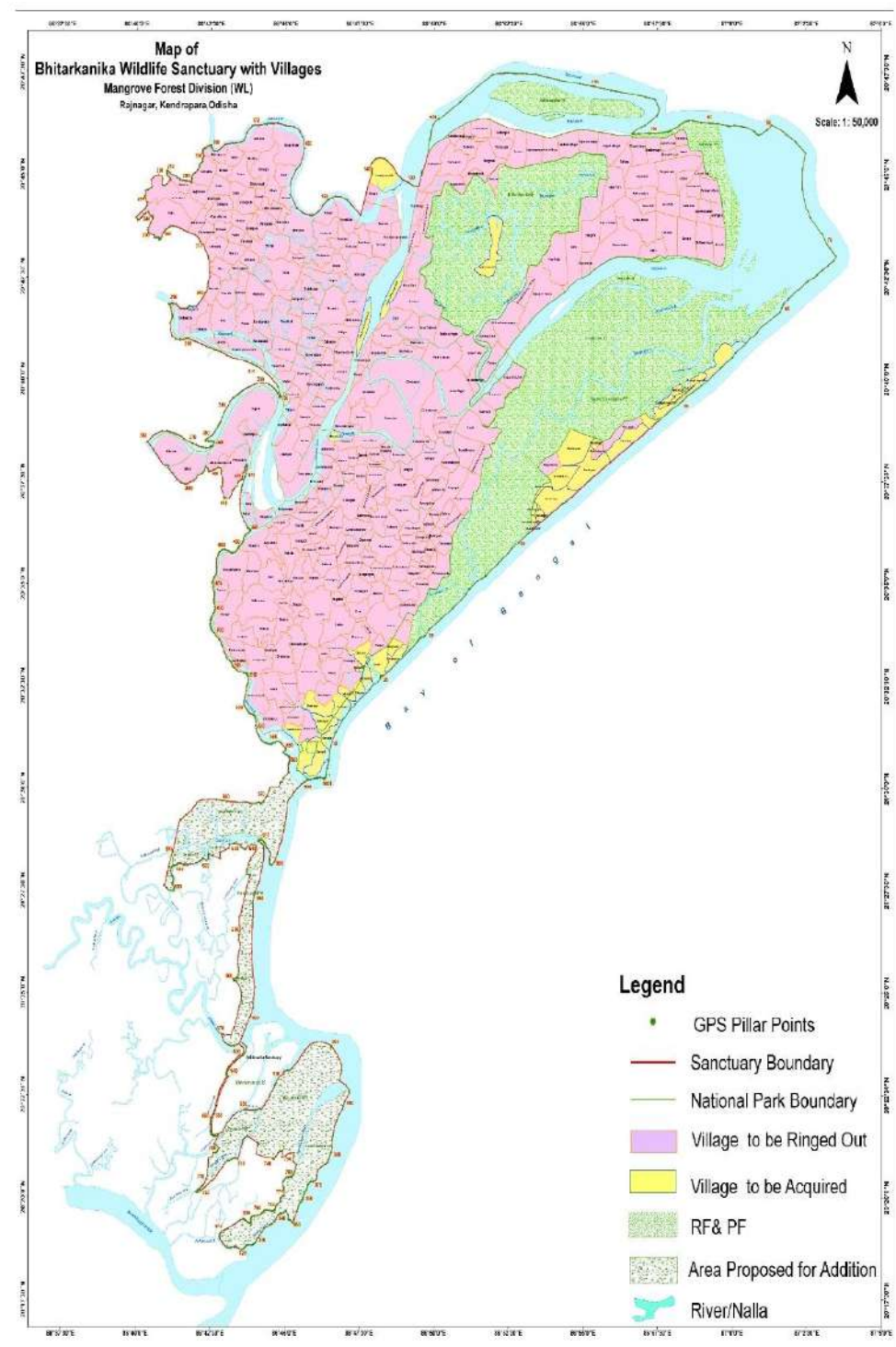
Order:- Ordered that this Notification will be published in extra ordinary issue of Odisha Gazette.

By Order of the Governor



ADDL. CHIEF SECRETARY TO GOVT.

F & E DEPARTMENT, GOVT OF ODISHA



Memo No. 2290 / F & E, Dt.

01-02-2020

Copy forwarded to the Director, Printing & Stationery, Odisha, Cuttack for information and necessary action. He is requested to publish the Notification in the extra ordinary issue of Odisha Gazette and furnish 100 copies to this Department for reference.

(Ae)

Additional Secretary to Government

Memo No. 2291 / F & E, Dt. 01-02-2020

Copy forwarded to the P.S. to Chief Minister / P.S. to Minister, F & E for kind information of Hon'ble Chief Minister / Hon'ble Minister, Forest & Environment respectively.

(Ae)

Additional Secretary to Government

Memo No. 2292 / F & E, Dt. 01-02-2020

Copy forwarded to the OSD to Chief Secretary, Odisha / PS to DC-cum-ACS for kind information of Chief Secretary / DC-cum-ACS respectively.

(Ae)

Additional Secretary to Government

Memo No. 2293 / F & E, Dt. 01-02-2020

Copy forwarded to the P.S. to Additional Chief Secretary to Government, / Additional Secretary to Govt. (AKC), Forest & Environment Department for kind information of Additional Chief Secretary to Government / Additional Secretary to Govt. (AKC).

(Ae)

Additional Secretary to Government

Memo No. 2294 / F & E, Dt. 01-02-2020

Copy forwarded to all Departments of Government for information.

(Ae)

Additional Secretary to Government

Memo No. 2295 / F & E, Dt. 01-02-2020

Copy forwarded to the Collector, Kendrapara for information and necessary action.

(Ae)

Additional Secretary to Government

Memo No. 2296 / F & E, Dt. 01-02-2020

Copy forwarded to all PCCF, Odisha / Director, Environment / all RCCF / Managing Director, OFDC Ltd. / all DFOs for information and necessary action.

(Ae)

Additional Secretary to Government

Memo No. 2297 / F & E, Dt. 01-02-2020

Copy forwarded to Diversion Section / Protection Section, F & E Department for information.



Additional Secretary to Government

Memo No. 2298 / F & E, Dt. 01-02-2020

Copy forwarded to the Head, State Portal, IT Department, Secretariat, Bhubaneswar for information and necessary action.



Additional Secretary to Government

(Guard files 10 spare copies)

Pillar No	Easting	Northing	Longitude(DMS)	Latitude(DMS)
1	476210.414881	2267248.842330	86°46' 18.64" E	20°30' 13.64" N
2	476252.107372	2267256.684080	86°46' 20.07" E	20°30' 13.90" N
3	476292.344143	2267288.227510	86°46' 21.46" E	20°30' 14.93" N
4	476314.734898	2267332.435570	86°46' 22.23" E	20°30' 16.37" N
5	476317.753817	2267362.450810	86°46' 22.34" E	20°30' 17.34" N
6	476352.103685	2267442.981640	86°46' 23.52" E	20°30' 19.96" N
7	476345.234283	2267498.816790	86°46' 23.28" E	20°30' 21.78" N
8	476400.126148	2267722.569920	86°46' 25.16" E	20°30' 29.06" N
9	476477.537614	2268085.856310	86°46' 27.82" E	20°30' 40.88" N
10	476542.682874	2268551.858200	86°46' 30.05" E	20°30' 56.04" N
11	476660.022652	2268910.745820	86°46' 34.08" E	20°31' 7.72" N
12	476888.349262	2269344.927130	86°46' 41.94" E	20°31' 21.86" N
13	477332.711926	2269951.039840	86°46' 57.26" E	20°31' 41.59" N
14	477745.567155	2270388.148110	86°47' 11.50" E	20°31' 55.83" N
15	478020.085703	2270636.326280	86°47' 20.97" E	20°32' 3.92" N
16	478457.731565	2270967.082700	86°47' 36.06" E	20°32' 14.69" N
17	478869.115261	2271294.287290	86°47' 50.26" E	20°32' 25.35" N
18	479153.455462	2271528.687340	86°48' 0.07" E	20°32' 32.99" N
19	479505.015017	2271804.755890	86°48' 12.20" E	20°32' 41.98" N
20	479528.944435	2271902.685520	86°48' 13.02" E	20°32' 45.17" N
21	479616.741574	2271896.260230	86°48' 16.05" E	20°32' 44.97" N
22	479975.635843	2272094.910930	86°48' 28.44" E	20°32' 51.44" N
23	480458.267518	2272490.923410	86°48' 45.09" E	20°33' 4.34" N
24	481210.404186	2273046.227180	86°49' 11.04" E	20°33' 22.43" N
25	481694.001566	2273469.659780	86°49' 27.73" E	20°33' 36.23" N
26	481801.264842	2273583.302880	86°49' 31.43" E	20°33' 39.93" N
27	481827.125544	2273646.474250	86°49' 32.32" E	20°33' 41.98" N
28	481888.616367	2273631.662200	86°49' 34.45" E	20°33' 41.50" N
29	481991.815471	2273656.832200	86°49' 38.01" E	20°33' 42.32" N
30	482084.633595	2273715.930560	86°49' 41.21" E	20°33' 44.25" N
31	482347.804903	2273986.884430	86°49' 50.29" E	20°33' 53.07" N
32	483050.171506	2274499.661730	86°50' 14.54" E	20°34' 9.78" N
33	483732.608531	2274962.454470	86°50' 38.09" E	20°34' 24.85" N
34	484495.990866	2275578.391730	86°51' 4.44" E	20°34' 44.91" N
35	484684.694404	2275841.550030	86°51' 10.95" E	20°34' 53.48" N
36	485364.548569	2276299.143960	86°51' 34.42" E	20°35' 8.38" N
37	485639.894499	2276414.773900	86°51' 43.93" E	20°35' 12.15" N
38	486354.497152	2276975.076600	86°52' 8.60" E	20°35' 30.40" N
39	487165.839847	2277648.567760	86°52' 36.61" E	20°35' 52.33" N
40	487580.132382	2277940.555540	86°52' 50.92" E	20°36' 1.84" N
41	488117.749541	2278310.787500	86°53' 9.48" E	20°36' 13.89" N
42	488708.074346	2278731.863490	86°53' 29.87" E	20°36' 27.60" N
43	489475.039622	2279237.118730	86°53' 56.36" E	20°36' 44.05" N
44	490131.210815	2279665.161680	86°54' 19.02" E	20°36' 57.99" N
45	490310.396463	2279742.347460	86°54' 25.21" E	20°37' 0.51" N
46	491728.906577	2280740.645770	86°55' 14.20" E	20°37' 33.00" N
47	492874.556748	2281514.316360	86°55' 53.78" E	20°37' 58.19" N
48	494141.831876	2282349.574290	86°56' 37.56" E	20°38' 25.38" N
49	495537.407499	2283279.036690	86°57' 25.78" E	20°38' 55.62" N
50	497102.870602	2284293.836800	86°58' 19.87" E	20°39' 28.65" N

51	498203.412589	2284973.078300	86°58' 57.91" E	20°39' 50.75" N
52	499329.893990	2285786.689770	86°59' 36.84" E	20°40' 17.22" N
53	500002.756890	2286252.773150	87°0' 0.10" E	20°40' 32.38" N
54	500196.057831	2286462.122860	87°0' 6.78" E	20°40' 39.19" N
55	501076.029734	2287140.235010	87°0' 37.19" E	20°41' 1.25" N
56	501440.790050	2287359.354240	87°0' 49.80" E	20°41' 8.37" N
57	501813.457108	2287704.881550	87°1' 2.69" E	20°41' 19.61" N
58	502622.213963	2288181.092010	87°1' 30.65" E	20°41' 35.10" N
59	502784.748013	2288305.410780	87°1' 36.27" E	20°41' 39.14" N
60	502903.659783	2288478.176690	87°1' 40.38" E	20°41' 44.76" N
61	503014.638343	2288659.368680	87°1' 44.22" E	20°41' 50.65" N
62	503278.240611	2288895.363500	87°1' 53.33" E	20°41' 58.33" N
63	503809.406525	2289283.100230	87°2' 11.70" E	20°42' 10.94" N
64	504392.088478	2289658.227240	87°2' 31.84" E	20°42' 23.14" N
65	504939.081167	2289980.697570	87°2' 50.76" E	20°42' 33.62" N
66	505255.667010	2290187.772700	87°3' 1.70" E	20°42' 40.35" N
67	505592.562272	2290393.280560	87°3' 13.35" E	20°42' 47.04" N
68	505919.698831	2290617.241330	87°3' 24.67" E	20°42' 54.32" N
69	506071.323647	2290805.118640	87°3' 29.91" E	20°43' 0.43" N
70	505528.662966	2291356.050750	87°3' 11.16" E	20°43' 18.36" N
71	505216.926918	2291850.792770	87°3' 0.38" E	20°43' 34.45" N
72	504555.818300	2292572.515350	87°2' 37.53" E	20°43' 57.94" N
73	504310.869088	2293063.976510	87°2' 29.07" E	20°44' 13.92" N
74	504089.563139	2293821.794440	87°2' 21.42" E	20°44' 38.58" N
75	504096.433008	2294715.551840	87°2' 21.66" E	20°45' 7.65" N
76	504287.469478	2295455.041340	87°2' 28.28" E	20°45' 31.70" N
77	503731.547286	2295935.230400	87°2' 9.05" E	20°45' 47.33" N
78	503153.881336	2296309.046850	87°1' 49.08" E	20°45' 59.49" N
79	502293.889010	2296730.242570	87°1' 19.34" E	20°46' 13.20" N
80	502031.384596	2296509.007930	87°1' 10.26" E	20°46' 6.00" N
81	501542.002045	2296274.061730	87°0' 53.33" E	20°45' 58.36" N
82	501410.232092	2296339.357070	87°0' 48.77" E	20°46' 0.49" N
83	501290.349736	2296428.881110	87°0' 44.63" E	20°46' 3.40" N
84	500886.134368	2296604.762300	87°0' 30.65" E	20°46' 9.12" N
85	500562.175817	2296683.748670	87°0' 19.44" E	20°46' 11.69" N
86	500159.956850	2296722.713520	87°0' 5.53" E	20°46' 12.96" N
87	499836.002896	2296690.060100	86°59' 54.33" E	20°46' 11.90" N
88	499759.720208	2296698.487720	86°59' 51.69" E	20°46' 12.17" N
89	499153.558654	2296791.933390	86°59' 30.72" E	20°46' 15.21" N
90	498644.179168	2296819.306820	86°59' 13.11" E	20°46' 16.10" N
91	498165.088077	2296838.341970	86°58' 56.54" E	20°46' 16.72" N
92	497701.598332	2296931.039920	86°58' 40.51" E	20°46' 19.73" N
93	497464.817276	2296919.923080	86°58' 32.32" E	20°46' 19.37" N
94	497207.981752	2296877.738600	86°58' 23.43" E	20°46' 17.99" N
95	496928.842262	2296728.786550	86°58' 13.78" E	20°46' 13.15" N
96	496680.648249	2296588.213120	86°58' 5.20" E	20°46' 8.57" N
97	496419.080339	2296469.766300	86°57' 56.15" E	20°46' 4.72" N
98	496288.298661	2296427.134490	86°57' 51.63" E	20°46' 3.33" N
99	495789.042303	2296368.345880	86°57' 34.36" E	20°46' 1.41" N
100	495189.032424	2296356.812470	86°57' 13.61" E	20°46' 1.03" N
101	494558.637251	2296337.306910	86°56' 51.81" E	20°46' 0.39" N
102	494179.778753	2296343.195620	86°56' 38.70" E	20°46' 0.58" N
103	494942.658520	2296736.107270	86°57' 5.08" E	20°46' 13.37" N

104	495616.433613	2297159.360080	86°57' 28.38" E	20°46' 27.14" N
105	495740.339306	2297448.996320	86°57' 32.67" E	20°46' 36.57" N
106	495525.035600	2297881.621730	86°57' 25.22" E	20°46' 50.64" N
107	494931.444050	2297997.920910	86°57' 4.68" E	20°46' 54.42" N
108	494166.245673	2298134.049900	86°56' 38.21" E	20°46' 58.84" N
109	493262.871208	2298268.688610	86°56' 6.97" E	20°47' 3.20" N
110	491930.869669	2298475.466780	86°55' 20.89" E	20°47' 9.91" N
111	491127.814552	2298587.262400	86°54' 53.11" E	20°47' 13.53" N
112	489934.772856	2298764.896050	86°54' 11.84" E	20°47' 19.29" N
113	488577.620448	2299014.615960	86°53' 24.89" E	20°47' 27.39" N
114	488046.448430	2299029.995650	86°53' 6.51" E	20°47' 27.87" N
115	487307.261416	2299044.758020	86°52' 40.94" E	20°47' 28.34" N
116	486724.828535	2299057.848310	86°52' 20.80" E	20°47' 28.75" N
117	486070.278397	2299003.867820	86°51' 58.16" E	20°47' 26.97" N
118	484152.790823	2297777.849310	86°50' 51.87" E	20°46' 47.04" N
119	482904.170663	2297005.116520	86°50' 8.71" E	20°46' 21.86" N
120	482549.463837	2296721.868490	86°49' 56.45" E	20°46' 12.64" N
121	482453.795583	2296420.448880	86°49' 53.15" E	20°46' 2.83" N
122	482374.132149	2296032.112430	86°49' 50.41" E	20°45' 50.19" N
123	482306.701367	2295502.879260	86°49' 48.10" E	20°45' 32.98" N
124	482057.114492	2294852.339510	86°49' 39.49" E	20°45' 11.81" N
125	481923.120715	2294644.228510	86°49' 34.86" E	20°45' 5.03" N
126	481918.802267	2294530.966990	86°49' 34.72" E	20°45' 1.35" N
127	481724.257997	2293970.829610	86°49' 28.01" E	20°44' 43.12" N
128	481373.945397	2294029.410480	86°49' 15.90" E	20°44' 45.01" N
129	481163.028192	2294148.672520	86°49' 8.60" E	20°44' 48.88" N
130	481070.895483	2294162.469260	86°49' 5.41" E	20°44' 49.33" N
131	480741.102694	2294299.777490	86°48' 54.00" E	20°44' 53.78" N
132	480428.341693	2294594.020230	86°48' 43.17" E	20°45' 3.34" N
133	480075.106119	2295004.184410	86°48' 30.94" E	20°45' 16.67" N
134	479920.691167	2295128.662240	86°48' 25.60" E	20°45' 20.72" N
135	479735.530210	2295224.738290	86°48' 19.19" E	20°45' 23.83" N
136	479463.711308	2295260.707100	86°48' 9.79" E	20°45' 24.99" N
137	479226.252497	2295210.612440	86°48' 1.58" E	20°45' 23.35" N
138	478960.421057	2294968.673930	86°47' 52.39" E	20°45' 15.47" N
139	479001.763654	2294751.633830	86°47' 53.83" E	20°45' 8.41" N
140	478988.387124	2294517.835980	86°47' 53.38" E	20°45' 0.81" N
141	478735.183460	2293925.095260	86°47' 44.65" E	20°44' 41.52" N
142	478544.107505	2293272.266220	86°47' 38.07" E	20°44' 20.27" N
143	478349.141258	2292687.911750	86°47' 31.35" E	20°44' 1.26" N
144	477782.485035	2293181.261760	86°47' 11.74" E	20°44' 17.28" N
145	477582.038371	2293339.528500	86°47' 4.80" E	20°44' 22.42" N
146	477210.690034	2293513.828190	86°46' 51.95" E	20°44' 28.07" N
147	476876.286364	2293527.450750	86°46' 40.39" E	20°44' 28.50" N
148	476668.110660	2293461.903960	86°46' 33.19" E	20°44' 26.36" N
149	476447.484634	2293351.610100	86°46' 25.57" E	20°44' 22.76" N
150	476125.586061	2293104.611890	86°46' 14.45" E	20°44' 14.71" N
151	475884.404816	2292828.369080	86°46' 6.12" E	20°44' 5.72" N
152	475582.694505	2292673.530760	86°45' 55.70" E	20°44' 0.67" N
153	475452.452882	2292661.660710	86°45' 51.20" E	20°44' 0.27" N
154	474970.194604	2292771.768570	86°45' 34.51" E	20°44' 3.83" N
155	474628.694548	2293017.181580	86°45' 22.69" E	20°44' 11.80" N
156	474235.710058	2293607.650460	86°45' 9.07" E	20°44' 30.99" N

157	474244.468962	2294082.981840	86°45' 9.35" E	20°44' 46.45" N
158	474559.387830	2294694.736480	86°45' 20.21" E	20°45' 6.36" N
159	474804.956519	2294923.469670	86°45' 28.69" E	20°45' 13.82" N
160	475073.614735	2295694.645070	86°45' 37.94" E	20°45' 38.92" N
161	475054.303388	2296034.377740	86°45' 37.26" E	20°45' 49.97" N
162	474797.324592	2296442.932540	86°45' 28.35" E	20°46' 3.24" N
163	474445.971260	2296672.565680	86°45' 16.18" E	20°46' 10.70" N
164	473989.242018	2296720.326920	86°45' 0.38" E	20°46' 12.23" N
165	473519.928420	2296837.267220	86°44' 44.15" E	20°46' 16.01" N
166	472989.603158	2296829.034690	86°44' 25.80" E	20°46' 15.71" N
167	472885.804515	2296785.610270	86°44' 22.22" E	20°46' 14.29" N
168	472784.267392	2296791.041040	86°44' 18.70" E	20°46' 14.46" N
169	472386.086713	2296741.340920	86°44' 4.94" E	20°46' 12.83" N
170	472033.688974	2296713.271300	86°43' 52.75" E	20°46' 11.89" N
171	471723.543646	2296384.618260	86°43' 42.04" E	20°46' 1.19" N
172	471571.930220	2296071.502480	86°43' 36.82" E	20°45' 50.99" N
173	471482.634869	2295995.285820	86°43' 33.73" E	20°45' 48.51" N
174	471357.684894	2295958.450760	86°43' 29.41" E	20°45' 47.30" N
175	470933.093836	2295919.068180	86°43' 14.73" E	20°45' 46.00" N
176	470458.050511	2295855.088520	86°42' 58.31" E	20°45' 43.89" N
177	470018.499941	2295585.372210	86°42' 43.12" E	20°45' 35.09" N
178	469845.881506	2295579.803870	86°42' 37.15" E	20°45' 34.90" N
179	469734.514774	2295627.134740	86°42' 33.30" E	20°45' 36.43" N
180	469662.126398	2295721.796460	86°42' 30.79" E	20°45' 39.51" N
181	469642.637220	2295824.810680	86°42' 30.11" E	20°45' 42.86" N
182	469428.582082	2295789.593170	86°42' 22.71" E	20°45' 41.70" N
183	469335.776655	2295718.204380	86°42' 19.50" E	20°45' 39.37" N
184	469250.110107	2295703.926630	86°42' 16.54" E	20°45' 38.90" N
185	469178.721317	2295661.093350	86°42' 14.07" E	20°45' 37.51" N
186	469150.165801	2295589.704560	86°42' 13.09" E	20°45' 35.18" N
187	469143.026922	2295454.065860	86°42' 12.85" E	20°45' 30.77" N
188	469200.137954	2295339.843800	86°42' 14.84" E	20°45' 27.06" N
189	469128.749164	2295197.066220	86°42' 12.38" E	20°45' 22.41" N
190	469121.610285	2295104.260790	86°42' 12.13" E	20°45' 19.39" N
191	469028.804858	2295032.872000	86°42' 8.93" E	20°45' 17.06" N
192	468964.554947	2294947.205450	86°42' 6.71" E	20°45' 14.27" N
193	468950.277189	2294854.400030	86°42' 6.23" E	20°45' 11.25" N
194	468871.749520	2294733.039080	86°42' 3.52" E	20°45' 7.30" N
195	468700.416424	2294611.678140	86°41' 57.60" E	20°45' 3.34" N
196	468550.499965	2294518.872710	86°41' 52.42" E	20°45' 0.31" N
197	468507.666692	2294426.067290	86°41' 50.95" E	20°44' 57.29" N
198	468507.666692	2294326.122980	86°41' 50.95" E	20°44' 54.04" N
199	468479.111176	2294154.789880	86°41' 49.98" E	20°44' 48.47" N
200	468443.416781	2294183.345400	86°41' 48.74" E	20°44' 49.39" N
201	468386.305749	2294204.762040	86°41' 46.76" E	20°44' 50.09" N
202	468200.694895	2294226.178670	86°41' 40.34" E	20°44' 50.77" N
203	467950.834130	2294247.595310	86°41' 31.70" E	20°44' 51.45" N
204	467822.334308	2294283.289710	86°41' 27.26" E	20°44' 52.61" N
205	467665.278970	2294361.817370	86°41' 21.82" E	20°44' 55.15" N
206	467572.473543	2294454.622800	86°41' 18.60" E	20°44' 58.16" N
207	467429.695963	2294490.317200	86°41' 13.66" E	20°44' 59.32" N
208	467236.946230	2294597.400380	86°41' 6.99" E	20°45' 2.79" N
209	467087.029771	2294711.622450	86°41' 1.80" E	20°45' 6.49" N

210	467051.335376	2294661.650290	86°41' 0.57" E	20°45' 4.86" N
211	467051.335376	2294568.844870	86°41' 0.58" E	20°45' 1.85" N
212	467072.752013	2294490.317200	86°41' 1.32" E	20°44' 59.29" N
213	467286.989046	2294284.402970	86°41' 8.74" E	20°44' 52.61" N
214	467229.105856	2294252.056130	86°41' 6.74" E	20°44' 51.55" N
215	466986.591104	2294058.986130	86°40' 58.37" E	20°44' 45.26" N
216	466897.119642	2294016.604920	86°40' 55.28" E	20°44' 43.87" N
217	466798.288004	2294057.342490	86°40' 51.86" E	20°44' 45.19" N
218	466820.604493	2294309.472290	86°40' 52.61" E	20°44' 53.39" N
219	466769.367251	2294427.317940	86°40' 50.83" E	20°44' 57.22" N
220	466559.294562	2294499.050080	86°40' 43.56" E	20°44' 59.54" N
221	466364.593045	2294447.812840	86°40' 36.83" E	20°44' 57.86" N
222	466149.396632	2294273.606220	86°40' 29.41" E	20°44' 52.18" N
223	466208.947654	2293954.901270	86°40' 31.49" E	20°44' 41.82" N
224	466137.558864	2293904.929120	86°40' 29.02" E	20°44' 40.19" N
225	465966.225768	2293826.401450	86°40' 23.10" E	20°44' 37.62" N
226	465806.462487	2293772.961670	86°40' 17.58" E	20°44' 35.88" N
227	465791.276281	2293575.540990	86°40' 17.07" E	20°44' 29.45" N
228	465753.310765	2293499.609960	86°40' 15.76" E	20°44' 26.98" N
229	465794.892673	2293448.040860	86°40' 17.20" E	20°44' 25.31" N
230	465901.975858	2293262.430010	86°40' 20.92" E	20°44' 29.32" N
231	465901.975858	2293133.930190	86°40' 20.93" E	20°44' 15.10" N
232	465734.328007	2292937.720320	86°40' 15.15" E	20°44' 8.70" N
233	465491.348705	2292751.689290	86°40' 6.76" E	20°44' 2.63" N
234	465257.122135	2292600.207520	86°39' 58.67" E	20°43' 57.69" N
235	465349.739400	2292455.603200	86°40' 1.88" E	20°43' 52.99" N
236	465402.254328	2292498.569960	86°40' 3.69" E	20°43' 54.39" N
237	465473.643118	2292498.569960	86°40' 6.16" E	20°43' 54.40" N
238	465566.448545	2292562.819870	86°40' 9.37" E	20°43' 56.50" N
239	465723.503883	2292719.875210	86°40' 14.79" E	20°44' 1.61" N
240	465844.864826	2292748.430720	86°40' 18.98" E	20°44' 2.55" N
241	465966.225768	2292812.680630	86°40' 23.17" E	20°44' 4.65" N
242	466009.059042	2292734.152960	86°40' 24.66" E	20°44' 2.10" N
243	466158.975501	2292634.208660	86°40' 29.85" E	20°43' 58.86" N
244	466237.503170	2292634.208660	86°40' 32.57" E	20°43' 58.86" N
245	466251.780928	2292569.958750	86°40' 33.06" E	20°43' 56.77" N
246	466130.419985	2292370.070130	86°40' 28.88" E	20°43' 50.26" N
247	465951.948010	2292105.931610	86°40' 22.73" E	20°43' 41.66" N
248	465944.809131	2292027.403940	86°40' 22.49" E	20°43' 39.10" N
249	465973.364647	2291920.320760	86°40' 23.48" E	20°43' 35.62" N
250	466073.308953	2291834.654210	86°40' 26.94" E	20°43' 32.84" N
251	466326.886450	2291770.823040	86°40' 35.72" E	20°43' 30.78" N
252	466342.711135	2291693.317100	86°40' 36.27" E	20°43' 28.26" N
253	466378.078937	2291656.589000	86°40' 37.49" E	20°43' 27.07" N
254	466477.380843	2291662.030200	86°40' 40.93" E	20°43' 27.25" N
255	466579.403350	2291660.669900	86°40' 44.45" E	20°43' 27.22" N
256	466609.329951	2291632.103600	86°40' 45.49" E	20°43' 26.29" N
257	466603.888751	2291568.169490	86°40' 45.31" E	20°43' 24.21" N
258	466674.624355	2291606.257900	86°40' 47.75" E	20°43' 25.45" N
259	466750.801160	2291686.515600	86°40' 50.38" E	20°43' 28.07" N
260	466844.661865	2291870.156110	86°40' 53.61" E	20°43' 34.05" N
261	466941.243171	2291996.664020	86°40' 56.94" E	20°43' 38.17" N
262	467018.780276	2292060.598120	86°40' 59.62" E	20°43' 40.25" N

263	467203.781087	2292147.657330	86°41' 6.01" E	20°43' 43.10" N
264	467307.163893	2292184.385430	86°41' 9.58" E	20°43' 44.30" N
265	467622.753512	2292155.819130	86°41' 20.50" E	20°43' 43.39" N
266	468037.645037	2292019.789120	86°41' 34.85" E	20°43' 38.99" N
267	468642.978573	2291800.780810	86°41' 55.79" E	20°43' 31.90" N
268	468934.082791	2291611.699100	86°42' 5.87" E	20°43' 25.77" N
269	468999.377195	2291512.397190	86°42' 8.14" E	20°43' 22.54" N
270	469153.091104	2291375.006880	86°42' 13.46" E	20°43' 18.08" N
271	469253.753310	2291166.880970	86°42' 16.95" E	20°43' 11.32" N
272	469427.871720	2290892.100350	86°42' 22.99" E	20°43' 2.39" N
273	469495.886724	2290698.937740	86°42' 25.35" E	20°42' 56.11" N
274	469569.342929	2290092.243900	86°42' 27.93" E	20°42' 36.38" N
275	469574.784129	2289892.279790	86°42' 28.13" E	20°42' 29.88" N
276	469440.114421	2289571.248970	86°42' 23.50" E	20°42' 19.43" N
277	469437.393821	2289474.667670	86°42' 23.41" E	20°42' 16.28" N
278	469375.953601	2289243.189940	86°42' 21.30" E	20°42' 8.75" N
279	469255.038038	2289134.365930	86°42' 17.13" E	20°42' 5.20" N
280	469076.083005	2288861.096760	86°42' 10.96" E	20°41' 56.30" N
281	468747.192674	2288546.716290	86°41' 59.61" E	20°41' 46.06" N
282	468573.074264	2288541.879670	86°41' 53.59" E	20°41' 45.89" N
283	468370.379517	2288574.689880	86°41' 46.58" E	20°41' 46.94" N
284	468227.255754	2288483.840200	86°41' 41.64" E	20°41' 43.98" N
285	468101.503569	2288459.657090	86°41' 37.29" E	20°41' 43.19" N
286	467837.907642	2288469.330330	86°41' 28.18" E	20°41' 43.48" N
287	467596.076516	2288657.958610	86°41' 19.81" E	20°41' 49.61" N
288	467344.572145	2288684.560040	86°41' 11.11" E	20°41' 50.46" N
289	467147.454587	2288655.817400	86°41' 4.30" E	20°41' 49.51" N
290	467238.519121	2288583.343630	86°41' 7.45" E	20°41' 47.16" N
291	467286.885346	2288508.375990	86°41' 9.13" E	20°41' 44.72" N
292	467366.689617	2288181.903970	86°41' 11.91" E	20°41' 34.11" N
293	467371.526240	2288065.825030	86°41' 12.08" E	20°41' 30.33" N
294	467253.283859	2287822.661420	86°41' 8.01" E	20°41' 22.41" N
295	467269.388117	2287527.416690	86°41' 8.59" E	20°41' 12.81" N
296	467369.642282	2287226.654200	86°41' 12.07" E	20°41' 3.03" N
297	467555.951033	2287090.027780	86°41' 18.52" E	20°40' 58.60" N
298	467820.715271	2287060.192320	86°41' 27.68" E	20°40' 57.65" N
299	468056.930481	2287065.685730	86°41' 35.84" E	20°40' 57.84" N
300	468249.198730	2287104.139280	86°41' 42.48" E	20°40' 59.10" N
301	468702.402100	2286980.538330	86°41' 58.16" E	20°40' 55.11" N
302	469345.127075	2286774.536680	86°42' 20.39" E	20°40' 48.45" N
303	469768.117126	2286650.935730	86°42' 35.02" E	20°40' 44.45" N
304	469845.024292	2286590.508730	86°42' 37.68" E	20°40' 42.49" N
305	470207.587097	2286502.614690	86°42' 50.22" E	20°40' 39.65" N
306	470561.909912	2286362.533510	86°43' 2.47" E	20°40' 35.11" N
307	471171.674683	2286186.745480	86°43' 23.56" E	20°40' 29.43" N
308	471674.318481	2286076.877930	86°43' 40.94" E	20°40' 25.88" N
309	471976.454102	2285991.730710	86°43' 51.39" E	20°40' 23.13" N
310	472091.815125	2285936.796880	86°43' 55.38" E	20°40' 21.35" N
311	472242.882874	2285895.596680	86°44' 0.60" E	20°40' 20.02" N
312	472489.054688	2285782.295720	86°44' 9.12" E	20°40' 16.35" N
313	472780.671875	2285589.026310	86°44' 19.21" E	20°40' 10.07" N
314	473207.306274	2285297.939270	86°44' 33.97" E	20°40' 0.63" N
315	473436.648071	2285058.173100	86°44' 41.91" E	20°39' 52.84" N

316	473509.620483	2284957.401490	86°44' 44.43" E	20°39' 49.56" N
317	473610.391907	2284717.635310	86°44' 47.93" E	20°39' 41.77" N
318	473672.939514	2284491.768310	86°44' 50.10" E	20°39' 34.43" N
319	473662.514893	2284457.019470	86°44' 49.75" E	20°39' 33.30" N
320	473652.478088	2284443.248720	86°44' 49.40" E	20°39' 32.85" N
321	473626.288086	2284457.216670	86°44' 48.49" E	20°39' 33.30" N
322	473594.860107	2284534.040890	86°44' 47.40" E	20°39' 35.80" N
323	473490.099915	2284684.197080	86°44' 43.77" E	20°39' 40.68" N
324	473413.275696	2284776.735290	86°44' 41.11" E	20°39' 43.68" N
325	473313.753479	2284865.781490	86°44' 37.67" E	20°39' 46.57" N
326	473198.517273	2284940.859680	86°44' 33.68" E	20°39' 49.01" N
327	472983.758911	2285049.111880	86°44' 26.25" E	20°39' 52.52" N
328	472837.094727	2285089.269900	86°44' 21.18" E	20°39' 53.82" N
329	472690.430481	2285106.729920	86°44' 16.11" E	20°39' 54.38" N
330	472295.833679	2285087.523930	86°44' 2.48" E	20°39' 53.73" N
331	471817.428894	2284919.907470	86°43' 45.95" E	20°39' 48.26" N
332	471435.054321	2284762.767270	86°43' 32.74" E	20°39' 43.12" N
333	471281.405884	2284651.023070	86°43' 27.44" E	20°39' 39.48" N
334	471227.279907	2284631.817080	86°43' 25.57" E	20°39' 38.85" N
335	471187.747271	2284588.325690	86°43' 24.21" E	20°39' 37.44" N
336	471126.011719	2284563.722900	86°43' 22.08" E	20°39' 36.63" N
337	470929.022600	2284434.785060	86°43' 15.27" E	20°39' 32.43" N
338	470741.891113	2284293.092530	86°43' 8.82" E	20°39' 27.81" N
339	470548.084717	2283989.287900	86°43' 2.14" E	20°39' 17.91" N
340	470373.484314	2283757.069520	86°42' 56.12" E	20°39' 10.35" N
341	470273.962280	2283563.263310	86°42' 52.69" E	20°39' 4.04" N
342	470186.662109	2283362.472900	86°42' 49.68" E	20°38' 57.50" N
343	470073.171875	2283222.792720	86°42' 45.77" E	20°38' 52.95" N
344	470031.267883	2283140.730530	86°42' 44.33" E	20°38' 50.28" N
345	469940.475708	2283053.430300	86°42' 41.19" E	20°38' 47.44" N
346	469842.699524	2282896.290100	86°42' 37.83" E	20°38' 42.32" N
347	469710.003296	2282782.799930	86°42' 33.25" E	20°38' 38.62" N
348	469444.610718	2282632.643680	86°42' 24.08" E	20°38' 33.72" N
349	469341.596680	2282578.517520	86°42' 20.53" E	20°38' 31.95" N
350	469285.724487	2282527.883480	86°42' 18.60" E	20°38' 30.30" N
351	469282.232483	2282503.439270	86°42' 18.48" E	20°38' 29.51" N
352	469297.946472	2282484.233280	86°42' 19.03" E	20°38' 28.88" N
353	469416.674683	2282492.963320	86°42' 23.13" E	20°38' 29.17" N
354	469477.784912	2282482.487300	86°42' 25.24" E	20°38' 28.84" N
355	469523.180908	2282458.043270	86°42' 26.81" E	20°38' 28.04" N
356	469589.529114	2282465.027280	86°42' 29.10" E	20°38' 28.28" N
357	469650.639099	2282492.963320	86°42' 31.21" E	20°38' 29.19" N
358	469682.067078	2282473.757320	86°42' 32.30" E	20°38' 28.56" N
359	469753.653320	2282454.551330	86°42' 34.78" E	20°38' 27.94" N
360	469793.811279	2282433.599300	86°42' 36.16" E	20°38' 27.26" N
361	469739.685303	2282304.395080	86°42' 34.30" E	20°38' 23.06" N
362	469685.559082	2282262.490910	86°42' 32.43" E	20°38' 21.69" N
363	469619.211121	2282245.030880	86°42' 30.14" E	20°38' 21.12" N
364	469521.434875	2282210.110900	86°42' 26.77" E	20°38' 19.98" N
365	469325.882507	2282190.904910	86°42' 20.01" E	20°38' 19.34" N
366	469074.458130	2282238.046880	86°42' 11.32" E	20°38' 20.86" N
367	468903.349915	2282272.966920	86°42' 5.40" E	20°38' 21.99" N
368	468732.241516	2282335.823120	86°41' 59.49" E	20°38' 24.02" N

369	468531.451111	2282389.949280	86°41' 52.54" E	20°38' 25.77" N
370	468337.644897	2282461.535280	86°41' 45.84" E	20°38' 28.09" N
371	468067.014282	2282588.993530	86°41' 36.48" E	20°38' 32.22" N
372	467901.144104	2282705.975710	86°41' 30.74" E	20°38' 36.01" N
373	467565.911499	2282819.465880	86°41' 19.15" E	20°38' 39.68" N
374	467450.675293	2282833.433900	86°41' 15.17" E	20°38' 40.13" N
375	467211.472900	2282905.020080	86°41' 6.90" E	20°38' 42.44" N
376	467066.554688	2282927.718080	86°41' 1.89" E	20°38' 43.17" N
377	466783.702087	2282925.972110	86°40' 52.11" E	20°38' 43.10" N
378	466652.751892	2282896.290100	86°40' 47.59" E	20°38' 42.12" N
379	466198.791077	2282718.197690	86°40' 31.91" E	20°38' 36.30" N
380	465894.986694	2282459.789310	86°40' 21.43" E	20°38' 27.88" N
381	466280.166039	2282126.035420	86°40' 34.77" E	20°38' 17.04" N
382	466411.887239	2281910.834920	86°40' 39.33" E	20°38' 10.05" N
383	466933.473539	2281384.920120	86°40' 57.39" E	20°37' 52.98" N
384	467141.242339	2281391.412820	86°41' 4.57" E	20°37' 53.20" N
385	467121.763939	2281300.514020	86°41' 3.90" E	20°37' 50.24" N
386	467407.446139	2281027.817420	86°41' 13.79" E	20°37' 41.39" N
387	467621.707639	2280774.599220	86°41' 21.21" E	20°37' 33.17" N
388	467887.911439	2280625.265420	86°41' 30.42" E	20°37' 28.33" N
389	468063.216439	2280573.323220	86°41' 36.48" E	20°37' 26.65" N
390	468232.028539	2280579.815920	86°41' 42.31" E	20°37' 26.87" N
391	468381.362439	2280651.236520	86°41' 47.47" E	20°37' 29.20" N
392	468589.131239	2280690.193120	86°41' 54.65" E	20°37' 30.48" N
393	468757.943339	2280807.063120	86°42' 0.47" E	20°37' 34.29" N
394	468861.827739	2280949.904120	86°42' 4.05" E	20°37' 38.95" N
395	469115.046039	2281053.788520	86°42' 12.80" E	20°37' 42.34" N
396	469257.887039	2281209.615120	86°42' 17.72" E	20°37' 47.42" N
397	469306.772839	2281325.163320	86°42' 19.40" E	20°37' 51.18" N
398	469426.074939	2281257.790520	86°42' 23.53" E	20°37' 49.00" N
399	469489.480839	2281138.023920	86°42' 25.73" E	20°37' 45.10" N
400	469552.886639	2281123.933720	86°42' 27.92" E	20°37' 44.65" N
401	469792.128838	2281204.705610	86°42' 36.18" E	20°37' 47.29" N
402	470067.178639	2281293.015920	86°42' 45.68" E	20°37' 50.18" N
403	470201.035439	2281243.700320	86°42' 50.31" E	20°37' 48.58" N
404	470222.170739	2281145.069020	86°42' 51.05" E	20°37' 45.37" N
405	470208.080539	2281053.482720	86°42' 50.56" E	20°37' 42.39" N
406	470306.711839	2280736.453420	86°42' 53.99" E	20°37' 32.09" N
407	470285.576539	2280468.739820	86°42' 53.28" E	20°37' 23.38" N
408	470193.990339	2280440.559520	86°42' 50.11" E	20°37' 22.46" N
409	470397.405739	2279971.424420	86°42' 57.17" E	20°37' 7.21" N
410	470397.405739	2279896.654720	86°42' 57.18" E	20°37' 4.77" N
411	470481.521639	2279952.732020	86°43' 0.08" E	20°37' 6.60" N
412	470677.792139	2279896.654720	86°43' 6.86" E	20°37' 4.79" N
413	470836.677839	2280102.271420	86°43' 12.34" E	20°37' 11.49" N
414	470902.101339	2280251.810820	86°43' 14.59" E	20°37' 16.36" N
415	471042.294539	2280410.696520	86°43' 19.43" E	20°37' 21.53" N
416	471135.756639	2280466.773720	86°43' 22.65" E	20°37' 23.36" N
417	471182.487739	2280606.966920	86°43' 24.26" E	20°37' 27.92" N
418	471247.911139	2280681.736620	86°43' 26.52" E	20°37' 30.36" N
419	471350.719539	2280737.813920	86°43' 30.07" E	20°37' 32.19" N
420	471434.835439	2280765.852620	86°43' 32.97" E	20°37' 33.11" N
421	471481.566539	2281055.585220	86°43' 34.57" E	20°37' 42.53" N

422	471575.028639	2281121.008720	86°43' 37.79" E	20°37' 44.67" N
423	471603.067339	2281177.086020	86°43' 38.76" E	20°37' 46.49" N
424	471612.413539	2281317.279220	86°43' 39.07" E	20°37' 51.05" N
425	471659.144539	2281438.779920	86°43' 40.68" E	20°37' 55.01" N
426	471730.279297	2281403.172910	86°43' 43.14" E	20°37' 53.85" N
427	471727.697876	2281302.501100	86°43' 43.06" E	20°37' 50.58" N
428	471676.071472	2281052.112490	86°43' 41.29" E	20°37' 42.43" N
429	471616.700928	2280884.326480	86°43' 39.25" E	20°37' 36.97" N
430	471547.005127	2280757.841490	86°43' 36.85" E	20°37' 32.85" N
431	471423.101501	2280455.826290	86°43' 32.58" E	20°37' 23.02" N
432	471399.869690	2280277.714900	86°43' 31.79" E	20°37' 17.23" N
433	471301.779297	2279885.353520	86°43' 28.42" E	20°37' 4.46" N
434	471304.360474	2279637.546080	86°43' 28.53" E	20°36' 56.40" N
435	471332.755127	2279356.181700	86°43' 29.53" E	20°36' 47.25" N
436	471554.749084	2278886.380490	86°43' 37.22" E	20°36' 31.98" N
437	471748.348511	2278615.341310	86°43' 43.93" E	20°36' 23.17" N
438	471787.068481	2278574.040100	86°43' 45.27" E	20°36' 21.83" N
439	471885.158875	2278519.832280	86°43' 48.66" E	20°36' 20.07" N
440	471903.228088	2278496.600280	86°43' 49.28" E	20°36' 19.31" N
441	471897.278320	2278462.859680	86°43' 49.08" E	20°36' 18.22" N
442	471796.506897	2278362.088320	86°43' 45.61" E	20°36' 14.93" N
443	471747.858704	2278341.239070	86°43' 43.93" E	20°36' 14.25" N
444	471608.863709	2278226.568300	86°43' 39.13" E	20°36' 10.51" N
445	471508.092285	2278084.098330	86°43' 35.66" E	20°36' 5.87" N
446	471490.717896	2278007.651120	86°43' 35.06" E	20°36' 3.39" N
447	471455.969116	2277924.254090	86°43' 33.87" E	20°36' 0.67" N
448	471407.320923	2277851.281680	86°43' 32.19" E	20°35' 58.30" N
449	471299.599670	2277753.985290	86°43' 28.47" E	20°35' 55.13" N
450	471234.264709	2277707.630130	86°43' 26.22" E	20°35' 53.61" N
451	471180.480713	2277657.009890	86°43' 24.36" E	20°35' 51.96" N
452	471003.262085	2277483.266110	86°43' 18.25" E	20°35' 46.30" N
453	470905.965698	2277465.891720	86°43' 14.89" E	20°35' 45.73" N
454	470801.719482	2277476.316280	86°43' 11.29" E	20°35' 46.07" N
455	470644.163846	2277534.089530	86°43' 5.84" E	20°35' 47.94" N
456	470488.980713	2277597.937070	86°43' 0.48" E	20°35' 50.00" N
457	470405.583679	2277608.361690	86°42' 57.60" E	20°35' 50.34" N
458	470266.588684	2277604.886720	86°42' 52.79" E	20°35' 50.22" N
459	470131.068481	2277507.590270	86°42' 48.12" E	20°35' 47.04" N
460	470075.470520	2277431.142880	86°42' 46.20" E	20°35' 44.55" N
461	470012.922729	2277330.371700	86°42' 44.05" E	20°35' 41.27" N
462	469946.900085	2277167.052490	86°42' 41.78" E	20°35' 35.96" N
463	469943.425293	2276850.838930	86°42' 41.68" E	20°35' 25.67" N
464	469946.900085	2276628.446900	86°42' 41.81" E	20°35' 18.44" N
465	469922.575928	2276506.826290	86°42' 40.98" E	20°35' 14.48" N
466	469842.653687	2276399.105100	86°42' 38.22" E	20°35' 10.97" N
467	469769.681519	2276315.708130	86°42' 35.71" E	20°35' 8.25" N
468	469703.658875	2276169.763310	86°42' 33.44" E	20°35' 3.50" N
469	469689.759277	2276096.790890	86°42' 32.96" E	20°35' 1.13" N
470	469717.558289	2275898.723080	86°42' 33.93" E	20°34' 54.68" N
471	469755.781921	2275784.052120	86°42' 35.26" E	20°34' 50.96" N
472	469800.955322	2275697.180300	86°42' 36.83" E	20°34' 48.13" N
473	469821.804504	2275599.883730	86°42' 37.55" E	20°34' 44.97" N
474	469780.106079	2275353.167480	86°42' 36.13" E	20°34' 36.94" N

475	469783.580872	2275273.245480	86°42' 36.25" E	20°34' 34.34" N
476	469800.955322	2275175.948910	86°42' 36.86" E	20°34' 31.18" N
477	469853.078491	2275005.680110	86°42' 38.67" E	20°34' 25.64" N
478	469849.603516	2274918.808290	86°42' 38.55" E	20°34' 22.82" N
479	469821.804504	2274838.886110	86°42' 37.60" E	20°34' 20.21" N
480	469773.156311	2274769.388490	86°42' 35.92" E	20°34' 17.95" N
481	469738.407471	2274699.891110	86°42' 34.73" E	20°34' 15.69" N
482	469648.060730	2274533.097110	86°42' 31.62" E	20°34' 10.26" N
483	469606.362305	2274425.375920	86°42' 30.18" E	20°34' 6.75" N
484	469588.987915	2274286.380920	86°42' 29.59" E	20°34' 2.23" N
485	469592.462891	2274213.408510	86°42' 29.72" E	20°33' 59.86" N
486	469609.837280	2274119.586910	86°42' 30.32" E	20°33' 56.80" N
487	469637.636108	2274015.340700	86°42' 31.29" E	20°33' 53.41" N
488	469696.709106	2273928.468690	86°42' 33.33" E	20°33' 50.59" N
489	469800.955322	2273848.546690	86°42' 36.94" E	20°33' 48.00" N
490	469880.877502	2273768.624510	86°42' 39.70" E	20°33' 45.40" N
491	469985.123718	2273681.752690	86°42' 43.31" E	20°33' 42.58" N
492	470103.269470	2273553.182310	86°42' 47.40" E	20°33' 38.41" N
493	470207.515686	2273400.287720	86°42' 51.01" E	20°33' 33.44" N
494	470266.588684	2273296.041500	86°42' 53.06" E	20°33' 30.05" N
495	470395.158875	2272986.777530	86°42' 57.51" E	20°33' 20.00" N
496	470520.254517	2272771.335330	86°43' 1.85" E	20°33' 13.00" N
497	470565.427917	2272708.787480	86°43' 3.41" E	20°33' 10.97" N
498	470680.098694	2272597.591490	86°43' 7.38" E	20°33' 7.36" N
499	470760.020874	2272541.993530	86°43' 10.14" E	20°33' 5.55" N
500	470829.518494	2272469.021120	86°43' 12.55" E	20°33' 3.18" N
501	470857.317322	2272406.473330	86°43' 13.51" E	20°33' 1.15" N
502	470905.965698	2272333.501100	86°43' 15.19" E	20°32' 58.78" N
503	471135.307495	2272159.757320	86°43' 23.13" E	20°32' 53.14" N
504	471270.827515	2272090.259700	86°43' 27.81" E	20°32' 50.88" N
505	471510.593872	2272034.661680	86°43' 36.09" E	20°32' 49.09" N
506	471666.963318	2272003.387880	86°43' 41.50" E	20°32' 48.08" N
507	471726.036072	2271975.588930	86°43' 43.54" E	20°32' 47.18" N
508	471757.310120	2271919.990910	86°43' 44.62" E	20°32' 45.37" N
509	471778.159302	2271874.817500	86°43' 45.34" E	20°32' 43.90" N
510	471799.008484	2271756.671690	86°43' 46.07" E	20°32' 40.06" N
511	471785.109131	2271600.302310	86°43' 45.60" E	20°32' 34.97" N
512	471746.885498	2271503.005920	86°43' 44.28" E	20°32' 31.81" N
513	471705.186890	2271412.659120	86°43' 42.85" E	20°32' 28.87" N
514	471680.862915	2271249.339900	86°43' 42.02" E	20°32' 23.55" N
515	471618.315125	2271030.422730	86°43' 39.87" E	20°32' 16.43" N
516	471555.767273	2270787.181520	86°43' 37.73" E	20°32' 8.51" N
517	471545.342712	2270679.460330	86°43' 37.37" E	20°32' 5.01" N
518	471559.242126	2270585.638670	86°43' 37.86" E	20°32' 1.96" N
519	471641.176352	2270473.605190	86°43' 40.69" E	20°31' 58.32" N
520	471750.360291	2270331.972900	86°43' 44.47" E	20°31' 53.71" N
521	471858.081482	2270234.676330	86°43' 48.20" E	20°31' 50.56" N
522	471955.377930	2270196.452700	86°43' 51.56" E	20°31' 49.32" N
523	472076.998474	2270172.128480	86°43' 55.76" E	20°31' 48.53" N
524	472160.395691	2270120.005490	86°43' 58.64" E	20°31' 46.84" N
525	472198.619324	2270057.457700	86°43' 59.97" E	20°31' 44.81" N
526	472226.418274	2269967.110900	86°44' 0.93" E	20°31' 41.87" N
527	472254.217285	2269845.490300	86°44' 1.90" E	20°31' 37.92" N

528	472240.783058	2269672.864330	86°44' 1.44" E	20°31' 32.30" N
529	472261.166870	2269553.600890	86°44' 2.15" E	20°31' 28.42" N
530	472271.591675	2269449.354490	86°44' 2.52" E	20°31' 25.03" N
531	472302.865479	2269379.857120	86°44' 3.60" E	20°31' 22.77" N
532	472441.860474	2269160.939880	86°44' 8.42" E	20°31' 15.66" N
533	472518.307678	2269056.693730	86°44' 11.06" E	20°31' 12.27" N
534	472587.805298	2268990.671080	86°44' 13.47" E	20°31' 10.13" N
535	472678.152100	2268928.123290	86°44' 16.59" E	20°31' 8.10" N
536	472796.297729	2268879.475100	86°44' 20.67" E	20°31' 6.52" N
537	472869.270081	2268844.726320	86°44' 23.19" E	20°31' 5.39" N
538	473004.790283	2268830.826720	86°44' 27.87" E	20°31' 4.95" N
539	473098.611877	2268830.826720	86°44' 31.11" E	20°31' 4.95" N
540	473188.958679	2268841.251280	86°44' 34.23" E	20°31' 5.30" N
541	473286.255127	2268869.050480	86°44' 37.59" E	20°31' 6.21" N
542	473373.127075	2268900.324280	86°44' 40.59" E	20°31' 7.23" N
543	473470.423523	2268973.296690	86°44' 43.94" E	20°31' 9.61" N
544	473532.971313	2268969.821720	86°44' 46.10" E	20°31' 9.50" N
545	473598.993896	2268942.022710	86°44' 48.38" E	20°31' 8.60" N
546	473748.413696	2268823.877080	86°44' 53.55" E	20°31' 4.76" N
547	473935.920215	2268674.349450	86°45' 0.03" E	20°30' 59.91" N
548	473965.508416	2268651.060540	86°45' 1.05" E	20°30' 59.15" N
549	473977.764875	2268606.937290	86°45' 1.48" E	20°30' 57.71" N
550	473965.508416	2268575.070490	86°45' 1.06" E	20°30' 56.68" N
551	473826.208750	2268495.470680	86°44' 56.25" E	20°30' 54.08" N
552	473821.385932	2268452.065320	86°44' 56.09" E	20°30' 52.67" N
553	473908.257813	2268396.467310	86°44' 59.09" E	20°30' 50.86" N
554	473926.287750	2268369.161990	86°44' 59.72" E	20°30' 49.98" N
555	474031.693291	2268339.746490	86°45' 3.36" E	20°30' 49.03" N
556	474151.806583	2268283.366790	86°45' 7.51" E	20°30' 47.20" N
557	474201.942526	2268243.382760	86°45' 9.24" E	20°30' 45.90" N
558	474205.103347	2268216.188830	86°45' 9.35" E	20°30' 45.02" N
559	474161.611750	2267979.406620	86°45' 7.86" E	20°30' 37.31" N
560	474146.288953	2267934.459750	86°45' 7.33" E	20°30' 35.85" N
561	474140.604128	2267649.138230	86°45' 7.15" E	20°30' 26.57" N
562	474152.483113	2267564.154210	86°45' 7.57" E	20°30' 23.80" N
563	473834.921710	2267283.608920	86°44' 56.62" E	20°30' 14.66" N
564	473752.822893	2267129.673640	86°44' 53.79" E	20°30' 9.65" N
565	473682.696821	2267114.280110	86°44' 51.37" E	20°30' 9.14" N
566	473593.233907	2266904.267010	86°44' 48.29" E	20°30' 2.31" N
567	473081.607614	2266901.708870	86°44' 30.63" E	20°30' 2.20" N
568	473001.896216	2266717.114060	86°44' 27.89" E	20°29' 56.19" N
569	472829.887412	2266431.831160	86°44' 21.96" E	20°29' 46.90" N
570	472662.073944	2266226.259660	86°44' 16.18" E	20°29' 40.20" N
571	472591.247829	2266170.711170	86°44' 13.74" E	20°29' 38.39" N
572	472519.759953	2266153.690240	86°44' 11.27" E	20°29' 37.84" N
573	472461.888816	2266174.115350	86°44' 9.27" E	20°29' 38.50" N
574	472412.260102	2266192.726120	86°44' 7.56" E	20°29' 39.10" N
575	472280.298304	2266163.329610	86°44' 3.01" E	20°29' 38.14" N
576	471894.327328	2266163.329610	86°43' 49.68" E	20°29' 38.12" N
577	471701.341840	2266201.087640	86°43' 43.02" E	20°29' 39.33" N
578	471189.510763	2266196.892310	86°43' 25.35" E	20°29' 39.17" N
579	470484.694198	2266264.017690	86°43' 1.01" E	20°29' 41.31" N
580	470270.732026	2266276.603700	86°42' 53.62" E	20°29' 41.71" N

581	469960.277111	2266331.143080	86°42' 42.90" E	20°29' 43.47" N
582	469482.008727	2266331.143080	86°42' 26.39" E	20°29' 43.44" N
583	469037.303037	2266305.971060	86°42' 11.04" E	20°29' 42.60" N
584	468812.563909	2266191.429260	86°42' 3.29" E	20°29' 38.86" N
585	468584.206674	2265957.758110	86°41' 55.42" E	20°29' 31.24" N
586	468185.649687	2265647.303200	86°41' 41.68" E	20°29' 21.12" N
587	467838.657955	2265429.039350	86°41' 29.71" E	20°29' 14.00" N
588	467751.622502	2265281.079080	86°41' 26.72" E	20°29' 9.18" N
589	467505.111012	2264380.776250	86°41' 18.27" E	20°28' 39.88" N
590	467344.342649	2263844.881700	86°41' 12.75" E	20°28' 22.43" N
591	467139.487411	2263305.098160	86°41' 5.72" E	20°28' 4.86" N
592	467019.113690	2262869.900870	86°41' 1.59" E	20°27' 50.70" N
593	466972.816105	2262652.302220	86°41' 0.01" E	20°27' 43.62" N
594	466889.480453	2262467.111880	86°40' 57.14" E	20°27' 37.59" N
595	467167.265961	2262263.402500	86°41' 6.74" E	20°27' 30.98" N
596	467269.749760	2262255.817810	86°41' 10.28" E	20°27' 30.74" N
597	467359.361646	2262228.662690	86°41' 13.38" E	20°27' 29.86" N
598	467413.671880	2262225.947180	86°41' 15.25" E	20°27' 29.78" N
599	467457.120067	2262253.102300	86°41' 16.75" E	20°27' 30.66" N
600	467478.844161	2262301.981510	86°41' 17.50" E	20°27' 32.25" N
601	467465.266602	2262356.291740	86°41' 17.02" E	20°27' 34.02" N
602	467383.801251	2262494.782840	86°41' 14.20" E	20°27' 38.52" N
603	467378.370228	2262562.670630	86°41' 14.01" E	20°27' 40.73" N
604	467435.395974	2262741.894400	86°41' 15.97" E	20°27' 46.56" N
605	467416.387392	2262834.221800	86°41' 15.31" E	20°27' 49.56" N
606	467348.499599	2262912.971640	86°41' 12.96" E	20°27' 52.12" N
607	467286.042830	2263122.066040	86°41' 10.79" E	20°27' 58.92" N
608	467296.904877	2263214.393440	86°41' 11.16" E	20°28' 1.92" N
609	467353.930623	2263317.582880	86°41' 13.12" E	20°28' 5.28" N
610	467451.689044	2263358.315560	86°41' 16.49" E	20°28' 6.61" N
611	467590.180141	2263396.332720	86°41' 21.27" E	20°28' 7.86" N
612	467677.076515	2263439.780910	86°41' 24.26" E	20°28' 9.28" N
613	467731.386749	2263458.789490	86°41' 26.14" E	20°28' 9.90" N
614	467872.593357	2263464.220510	86°41' 31.01" E	20°28' 10.08" N
615	468008.368942	2263409.910280	86°41' 35.70" E	20°28' 8.33" N
616	468315.221765	2263420.772330	86°41' 46.29" E	20°28' 8.70" N
617	468453.712861	2263439.780910	86°41' 51.07" E	20°28' 9.32" N
618	468741.557102	2263475.082560	86°42' 1.01" E	20°28' 10.49" N
619	468945.220479	2263540.254840	86°42' 8.03" E	20°28' 12.62" N
620	469094.573623	2263624.435700	86°42' 13.18" E	20°28' 15.37" N
621	469143.452833	2263667.883890	86°42' 14.87" E	20°28' 16.79" N
622	469351.377220	2263584.993080	86°42' 22.05" E	20°28' 14.10" N
623	469493.012405	2263636.769080	86°42' 26.93" E	20°28' 15.79" N
624	469472.473164	2263876.393570	86°42' 26.21" E	20°28' 23.59" N
625	469563.926281	2263875.165210	86°42' 29.37" E	20°28' 23.55" N
626	470154.390775	2263656.950070	86°42' 49.76" E	20°28' 16.49" N
627	470147.972683	2263958.600410	86°42' 49.52" E	20°28' 26.30" N
628	470663.178630	2264135.986750	86°43' 7.30" E	20°28' 32.10" N
629	470667.742905	2264327.686340	86°43' 7.44" E	20°28' 38.34" N
630	470970.558182	2264366.149280	86°43' 17.89" E	20°28' 39.60" N
631	471210.975838	2264324.452190	86°43' 26.20" E	20°28' 38.26" N
632	471383.284808	2264313.682880	86°43' 32.14" E	20°28' 37.92" N
633	471355.717953	2264203.533770	86°43' 31.20" E	20°28' 34.34" N

634	471581.654943	2264090.565270	86°43' 39.01" E	20°28' 30.67" N
635	471654.277547	2264106.703630	86°43' 41.51" E	20°28' 31.20" N
636	471823.730290	2264251.948840	86°43' 47.35" E	20°28' 35.94" N
637	471975.596890	2264335.221500	86°43' 52.59" E	20°28' 38.65" N
638	472190.983102	2264292.144260	86°44' 0.03" E	20°28' 37.26" N
639	472295.796627	2264241.015710	86°44' 3.65" E	20°28' 35.61" N
640	472232.056858	2264014.385420	86°44' 1.46" E	20°28' 28.23" N
641	471944.767964	2263695.175540	86°43' 51.56" E	20°28' 17.83" N
642	471815.661112	2263445.031010	86°43' 47.12" E	20°28' 9.69" N
643	471710.761795	2263170.678950	86°43' 43.51" E	20°28' 0.76" N
644	471701.543779	2262978.286230	86°43' 43.21" E	20°27' 54.50" N
645	471902.379526	2262940.907190	86°43' 50.14" E	20°27' 53.29" N
646	471688.178161	2262346.739460	86°43' 42.78" E	20°27' 33.95" N
647	471410.887581	2261305.695670	86°43' 33.27" E	20°27' 0.07" N
648	471273.274391	2261035.973820	86°43' 28.54" E	20°26' 51.29" N
649	471300.797029	2260430.475780	86°43' 29.52" E	20°26' 31.60" N
650	471251.256280	2260237.817310	86°43' 27.82" E	20°26' 25.33" N
651	471229.238170	2259995.618100	86°43' 27.08" E	20°26' 17.45" N
652	471339.328722	2259780.941520	86°43' 30.89" E	20°26' 10.47" N
653	471196.211004	2259269.020450	86°43' 25.98" E	20°25' 53.81" N
654	471174.192893	2258911.226150	86°43' 25.24" E	20°25' 42.17" N
655	471229.238170	2258773.612960	86°43' 27.15" E	20°25' 37.69" N
656	471245.751752	2258641.504300	86°43' 27.73" E	20°25' 33.40" N
657	471207.220059	2258388.296030	86°43' 26.41" E	20°25' 25.16" N
658	471091.624979	2258289.214530	86°43' 22.43" E	20°25' 21.93" N
659	470922.614810	2258256.315600	86°43' 16.60" E	20°25' 20.85" N
660	470961.628983	2258178.287250	86°43' 17.95" E	20°25' 18.31" N
661	471095.146441	2258156.034340	86°43' 22.56" E	20°25' 17.60" N
662	471135.581181	2258108.860480	86°43' 23.96" E	20°25' 16.06" N
663	471354.666423	2257761.975510	86°43' 31.54" E	20°25' 4.79" N
664	471415.523434	2257512.461770	86°43' 33.65" E	20°24' 56.68" N
665	471370.638822	2257230.505660	86°43' 32.12" E	20°24' 47.50" N
666	471276.035601	2257041.299210	86°43' 28.86" E	20°24' 41.34" N
667	471162.511736	2256625.045040	86°43' 24.97" E	20°24' 27.80" N
668	471048.987871	2256284.473450	86°43' 21.07" E	20°24' 16.71" N
669	470803.019496	2255716.854120	86°43' 12.62" E	20°23' 58.23" N
670	470218.944093	2255763.088100	86°42' 52.47" E	20°23' 59.70" N
671	470342.047290	2255498.778300	86°42' 56.73" E	20°23' 51.11" N
672	470437.850356	2255385.233920	86°43' 0.04" E	20°23' 47.43" N
673	470642.563918	2255256.192590	86°43' 7.11" E	20°23' 43.24" N
674	470794.632574	2255223.606450	86°43' 12.36" E	20°23' 42.19" N
675	470950.321911	2255241.709860	86°43' 17.73" E	20°23' 42.78" N
676	471250.838539	2255310.502820	86°43' 28.09" E	20°23' 45.04" N
677	471509.175613	2255138.700220	86°43' 37.02" E	20°23' 39.46" N
678	471523.692546	2254965.194350	86°43' 37.53" E	20°23' 33.82" N
679	471455.228408	2254862.498140	86°43' 35.17" E	20°23' 30.48" N
680	471217.061958	2254757.329620	86°43' 26.96" E	20°23' 27.04" N
681	470936.802741	2254550.986310	86°43' 17.30" E	20°23' 20.31" N
682	470669.792603	2254283.976170	86°43' 8.11" E	20°23' 11.61" N
683	470560.249983	2254150.471110	86°43' 4.34" E	20°23' 7.26" N
684	470502.055465	2253969.041140	86°43' 2.34" E	20°23' 1.36" N
685	470519.171500	2253818.420040	86°43' 2.94" E	20°22' 56.46" N
686	470183.697224	2253366.176370	86°42' 51.39" E	20°22' 41.73" N

687	469954.342362	2252767.115160	86°42' 43.52" E	20°22' 22.23" N
688	469796.874845	2252301.559020	86°42' 38.11" E	20°22' 7.08" N
689	469625.714500	2252000.316820	86°42' 32.23" E	20°21' 57.27" N
690	469584.636017	2251695.651400	86°42' 30.83" E	20°21' 47.35" N
691	469598.328845	2251387.562780	86°42' 31.32" E	20°21' 37.33" N
692	469656.523362	2251206.132820	86°42' 33.34" E	20°21' 31.43" N
693	469755.796362	2251144.515090	86°42' 36.77" E	20°21' 29.43" N
694	469865.338983	2251130.822270	86°42' 40.55" E	20°21' 29.00" N
695	470057.038569	2251206.132820	86°42' 47.15" E	20°21' 31.46" N
696	470043.345741	2251134.245470	86°42' 46.69" E	20°21' 29.12" N
697	469790.028431	2250815.887230	86°42' 37.97" E	20°21' 18.75" N
698	469905.330708	2250776.090890	86°42' 41.95" E	20°21' 17.46" N
699	470094.916771	2250600.548240	86°42' 48.50" E	20°21' 11.76" N
700	470023.020423	2250507.082990	86°42' 46.02" E	20°21' 8.71" N
701	469958.313711	2250456.755550	86°42' 43.79" E	20°21' 7.07" N
702	469874.733820	2250420.287400	86°42' 40.91" E	20°21' 5.88" N
703	469742.427751	2250422.737520	86°42' 36.35" E	20°21' 5.95" N
704	469671.374492	2250238.979090	86°42' 33.91" E	20°20' 59.97" N
705	469476.608182	2250161.980520	86°42' 27.20" E	20°20' 57.46" N
706	469462.228913	2249874.395130	86°42' 26.72" E	20°20' 48.10" N
707	469419.091104	2249622.757910	86°42' 25.25" E	20°20' 39.91" N
708	469404.711835	2249414.258510	86°42' 24.76" E	20°20' 33.13" N
709	469354.384391	2249256.086540	86°42' 23.04" E	20°20' 27.98" N
710	469246.539870	2249061.966400	86°42' 19.33" E	20°20' 21.66" N
711	469117.126445	2248925.363340	86°42' 14.87" E	20°20' 17.21" N
712	469061.883397	2248875.644600	86°42' 12.97" E	20°20' 15.59" N
713	468915.776479	2248778.239990	86°42' 7.94" E	20°20' 12.41" N
714	468852.586623	2248758.796960	86°42' 5.76" E	20°20' 11.77" N
715	468780.652648	2248703.048130	86°42' 3.28" E	20°20' 9.96" N
716	468693.160744	2248675.941380	86°42' 0.27" E	20°20' 9.07" N
717	468714.506899	2248659.346860	86°42' 1.00" E	20°20' 8.53" N
718	468764.834342	2248630.588320	86°42' 2.74" E	20°20' 7.60" N
719	468811.512657	2248616.162470	86°42' 4.35" E	20°20' 7.13" N
720	468863.883809	2248628.566160	86°42' 6.16" E	20°20' 7.54" N
721	468994.811689	2248694.719190	86°42' 10.67" E	20°20' 9.70" N
722	469255.289262	2248854.589030	86°42' 19.64" E	20°20' 14.91" N
723	469713.866129	2249177.000560	86°42' 35.44" E	20°20' 25.43" N
724	469958.313711	2249399.879240	86°42' 43.86" E	20°20' 32.69" N
725	470217.140562	2249694.654260	86°42' 52.77" E	20°20' 42.30" N
726	470468.777778	2249982.239650	86°43' 1.43" E	20°20' 51.67" N
727	470591.001569	2250046.946370	86°43' 5.64" E	20°20' 53.78" N
728	470698.362440	2250050.620220	86°43' 9.34" E	20°20' 53.90" N
729	470858.850889	2250110.803390	86°43' 14.87" E	20°20' 55.87" N
730	470964.887901	2250165.254830	86°43' 18.53" E	20°20' 57.65" N
731	471065.507167	2250154.729540	86°43' 22.00" E	20°20' 57.31" N
732	471170.127656	2250113.431980	86°43' 25.61" E	20°20' 55.97" N
733	471390.466195	2250706.023360	86°43' 33.18" E	20°21' 15.26" N
734	471491.142772	2250998.900680	86°43' 36.63" E	20°21' 24.79" N
735	471586.780643	2251088.063410	86°43' 39.93" E	20°21' 27.70" N
736	471722.175799	2251154.065770	86°43' 44.59" E	20°21' 29.85" N
737	472356.109656	2250867.016900	86°44' 6.48" E	20°21' 20.55" N
738	472383.566904	2250812.102410	86°44' 7.43" E	20°21' 18.77" N
739	472263.441442	2250372.786430	86°44' 3.31" E	20°21' 4.47" N

740	472843.475815	2250201.178630	86°44' 23.32" E	20°20' 58.92" N
741	472996.422344	2250217.386190	86°44' 28.60" E	20°20' 59.45" N
742	473282.791790	2250111.942570	86°44' 38.48" E	20°20' 56.03" N
743	473317.113351	2250118.806880	86°44' 39.66" E	20°20' 56.26" N
744	473409.781564	2250269.821750	86°44' 42.85" E	20°21' 1.18" N
745	473519.610558	2250393.379370	86°44' 46.63" E	20°21' 5.20" N
746	473619.143083	2250455.158180	86°44' 50.06" E	20°21' 7.22" N
747	473801.179880	2250504.465460	86°44' 56.34" E	20°21' 8.83" N
748	473732.528955	2250191.245620	86°44' 53.99" E	20°20' 58.64" N
749	474213.277898	2250393.666230	86°45' 10.56" E	20°21' 5.25" N
750	474456.589160	2250413.972300	86°45' 18.95" E	20°21' 5.92" N
751	474449.724848	2250197.746470	86°45' 18.72" E	20°20' 58.88" N
752	474402.419479	2250027.035790	86°45' 17.10" E	20°20' 53.33" N
753	474607.240705	2249859.785700	86°45' 24.17" E	20°20' 47.90" N
754	474556.409079	2249756.734420	86°45' 22.43" E	20°20' 44.54" N
755	474484.356040	2249516.557620	86°45' 19.95" E	20°20' 36.73" N
756	474436.320681	2249436.498690	86°45' 18.30" E	20°20' 34.12" N
757	474380.279429	2249375.120170	86°45' 16.37" E	20°20' 32.12" N
758	474326.906808	2249345.765230	86°45' 14.53" E	20°20' 31.16" N
759	474265.528294	2249332.422080	86°45' 12.42" E	20°20' 30.73" N
760	474134.320600	2249324.860960	86°45' 7.89" E	20°20' 30.47" N
761	474029.947475	2249301.139790	86°45' 4.29" E	20°20' 29.70" N
762	473930.318582	2249244.209000	86°45' 0.86" E	20°20' 27.84" N
763	473863.899320	2249144.580100	86°44' 58.57" E	20°20' 24.60" N
764	473803.913471	2249076.674040	86°44' 56.51" E	20°20' 22.38" N
765	473814.775518	2248905.596800	86°44' 56.89" E	20°20' 16.82" N
766	473858.223705	2248818.700430	86°44' 58.39" E	20°20' 13.99" N
767	473877.232287	2248748.097120	86°44' 59.05" E	20°20' 11.70" N
768	473892.845187	2248474.480440	86°44' 59.61" E	20°20' 2.80" N
769	473852.453243	2248463.986710	86°44' 58.21" E	20°20' 2.45" N
770	473775.537981	2248466.747810	86°44' 55.56" E	20°20' 2.54" N
771	473675.909088	2248356.444400	86°44' 52.13" E	20°19' 58.95" N
772	473670.853398	2248224.003370	86°44' 51.96" E	20°19' 54.64" N
773	473502.491672	2248088.227780	86°44' 46.16" E	20°19' 50.21" N
774	473440.034903	2248050.210620	86°44' 44.01" E	20°19' 48.97" N
775	473410.164275	2248014.908960	86°44' 42.98" E	20°19' 47.82" N
776	473341.440662	2247854.741760	86°44' 40.62" E	20°19' 42.61" N
777	473260.811131	2247797.668030	86°44' 37.85" E	20°19' 40.75" N
778	473228.224991	2247784.090470	86°44' 36.72" E	20°19' 40.31" N
779	473163.052710	2247781.374960	86°44' 34.47" E	20°19' 40.21" N
780	473057.147754	2247811.245590	86°44' 30.82" E	20°19' 41.18" N
781	472921.372169	2247827.538660	86°44' 26.14" E	20°19' 41.70" N
782	472818.182724	2247832.969680	86°44' 22.58" E	20°19' 41.88" N
783	472731.286349	2247816.676610	86°44' 19.58" E	20°19' 41.34" N
784	472660.683045	2247756.935350	86°44' 17.15" E	20°19' 39.39" N
785	472576.502183	2247702.625120	86°44' 14.25" E	20°19' 37.62" N
786	472497.752343	2247634.737330	86°44' 11.54" E	20°19' 35.41" N
787	472447.004486	2247601.666580	86°44' 9.79" E	20°19' 34.33" N
788	472370.123293	2247580.427090	86°44' 7.14" E	20°19' 33.64" N
789	472242.494243	2247572.280560	86°44' 2.74" E	20°19' 33.36" N
790	472158.222575	2247568.594900	86°43' 59.83" E	20°19' 33.24" N
791	472074.132518	2247550.556460	86°43' 56.93" E	20°19' 32.65" N
792	472011.675749	2247528.832370	86°43' 54.78" E	20°19' 31.94" N

793	471965.512050	2247498.961740	86°43' 53.19" E	20°19' 30.97" N
794	471938.356933	2247463.660090	86°43' 52.26" E	20°19' 29.82" N
795	471927.494886	2247409.349860	86°43' 51.89" E	20°19' 28.05" N
796	471935.641421	2247349.608600	86°43' 52.17" E	20°19' 26.11" N
797	471962.796538	2247284.436320	86°43' 53.11" E	20°19' 23.99" N
798	471943.787956	2247262.712220	86°43' 52.46" E	20°19' 23.28" N
799	471769.995207	2247276.289780	86°43' 46.46" E	20°19' 23.71" N
800	471655.943716	2247349.608600	86°43' 42.52" E	20°19' 26.09" N
801	471609.780017	2247390.341270	86°43' 40.93" E	20°19' 27.41" N
802	471555.469783	2247425.642930	86°43' 39.05" E	20°19' 28.56" N
803	471476.719944	2247431.073950	86°43' 36.34" E	20°19' 28.73" N
804	471335.513335	2247374.048200	86°43' 31.47" E	20°19' 26.87" N
805	471015.082955	2247216.548520	86°43' 20.43" E	20°19' 21.73" N
806	470697.368086	2247059.048850	86°43' 9.48" E	20°19' 16.59" N
807	470450.868456	2246934.508820	86°43' 0.99" E	20°19' 12.52" N
808	470230.300073	2246852.669960	86°42' 53.39" E	20°19' 9.85" N
809	470144.761454	2246762.379190	86°42' 50.44" E	20°19' 6.90" N
810	470118.285215	2246652.400970	86°42' 49.54" E	20°19' 3.33" N
811	470140.688187	2246517.983140	86°42' 50.32" E	20°18' 58.95" N
812	470320.557312	2246331.459330	86°42' 56.53" E	20°18' 52.90" N
813	470540.513760	2246165.813120	86°43' 4.13" E	20°18' 47.52" N
814	470649.134228	2246133.226980	86°43' 7.87" E	20°18' 46.47" N
815	470744.177138	2246135.942490	86°43' 11.15" E	20°18' 46.56" N
816	470836.504535	2246165.813120	86°43' 14.33" E	20°18' 47.54" N
817	470974.995632	2246182.106190	86°43' 19.11" E	20°18' 48.07" N
818	471086.331612	2246173.959660	86°43' 22.95" E	20°18' 47.81" N
819	471262.839872	2246103.356350	86°43' 29.04" E	20°18' 45.53" N
820	471412.193016	2246032.753050	86°43' 34.19" E	20°18' 43.24" N
821	471499.089390	2246051.761630	86°43' 37.19" E	20°18' 43.86" N
822	471514.454242	2246097.102400	86°43' 37.72" E	20°18' 45.34" N
823	471597.729934	2246176.757410	86°43' 40.58" E	20°18' 47.93" N
824	471677.384944	2246227.446960	86°43' 43.33" E	20°18' 49.59" N
825	471782.384730	2246260.033100	86°43' 46.95" E	20°18' 50.65" N
826	471959.798161	2246260.033100	86°43' 53.06" E	20°18' 50.66" N
827	472057.556582	2246274.515830	86°43' 56.43" E	20°18' 51.14" N
828	472129.970227	2246303.481290	86°43' 58.93" E	20°18' 52.08" N
829	472206.004555	2246354.170840	86°44' 1.55" E	20°18' 53.74" N
830	472278.418200	2246455.549940	86°44' 4.04" E	20°18' 57.04" N
831	472376.176621	2246578.653140	86°44' 7.40" E	20°19' 1.05" N
832	472436.823049	2246691.573170	86°44' 9.49" E	20°19' 4.73" N
833	472556.984442	2246828.027630	86°44' 13.63" E	20°19' 9.17" N
834	472723.988412	2246972.628630	86°44' 19.38" E	20°19' 13.88" N
835	472880.809212	2247086.680120	86°44' 24.78" E	20°19' 17.60" N
836	473055.959717	2247172.218740	86°44' 30.81" E	20°19' 20.39" N
837	473176.121110	2247219.061320	86°44' 34.96" E	20°19' 21.92" N
838	473318.685474	2247308.673200	86°44' 39.87" E	20°19' 24.84" N
839	473396.077558	2247414.578160	86°44' 42.53" E	20°19' 28.29" N
840	473508.907830	2247577.155190	86°44' 46.41" E	20°19' 33.59" N
841	473558.048961	2247630.391420	86°44' 48.10" E	20°19' 35.32" N
842	473628.253808	2247669.157380	86°44' 50.52" E	20°19' 36.59" N
843	473666.949850	2247687.487080	86°44' 51.86" E	20°19' 37.19" N
844	473695.462723	2247681.377180	86°44' 52.84" E	20°19' 36.99" N
845	473701.572624	2247661.010840	86°44' 53.05" E	20°19' 36.33" N

846	473848.800654	2247720.483490	86°44' 58.13" E	20°19' 38.27" N
847	473975.748577	2247802.385380	86°45' 2.50" E	20°19' 40.94" N
848	474119.076876	2247634.486510	86°45' 7.45" E	20°19' 35.48" N
849	474131.362159	2247589.440480	86°45' 7.88" E	20°19' 34.02" N
850	474131.362159	2247384.685760	86°45' 7.89" E	20°19' 27.36" N
851	474192.788573	2247380.590670	86°45' 10.01" E	20°19' 27.23" N
852	474254.214988	2247360.115200	86°45' 12.13" E	20°19' 26.56" N
853	474397.720709	2247235.463570	86°45' 17.08" E	20°19' 22.52" N
854	474464.139971	2247401.511730	86°45' 19.36" E	20°19' 27.92" N
855	474630.188125	2247781.050370	86°45' 25.07" E	20°19' 40.28" N
856	474706.095853	2247980.308150	86°45' 27.68" E	20°19' 46.76" N
857	474739.305484	2248051.471650	86°45' 28.82" E	20°19' 49.08" N
858	474810.468979	2248122.635140	86°45' 31.27" E	20°19' 51.40" N
859	474857.911309	2248193.798640	86°45' 32.90" E	20°19' 53.71" N
860	474919.586337	2248245.985200	86°45' 35.03" E	20°19' 55.41" N
861	474967.028667	2248307.660230	86°45' 36.66" E	20°19' 57.42" N
862	474981.261366	2248364.591020	86°45' 37.15" E	20°19' 59.28" N
863	475014.470997	2248445.242980	86°45' 38.29" E	20°20' 1.90" N
864	475071.401793	2248559.104580	86°45' 40.25" E	20°20' 5.61" N
865	475104.611424	2248668.221930	86°45' 41.39" E	20°20' 9.16" N
866	475185.263385	2248767.850830	86°45' 44.17" E	20°20' 12.40" N
867	475227.961482	2248848.502790	86°45' 45.63" E	20°20' 15.03" N
868	475246.938414	2248924.410520	86°45' 46.28" E	20°20' 17.50" N
869	475280.148045	2248981.341310	86°45' 47.43" E	20°20' 19.35" N
870	475365.544238	2249052.504810	86°45' 50.37" E	20°20' 21.67" N
871	475436.707733	2249095.202900	86°45' 52.82" E	20°20' 23.06" N
872	475579.205491	2249093.250100	86°45' 57.74" E	20°20' 23.01" N
873	475706.153413	2249146.486320	86°46' 2.11" E	20°20' 24.74" N
874	475759.389639	2249207.912740	86°46' 3.94" E	20°20' 26.75" N
875	475824.911147	2249568.281030	86°46' 6.19" E	20°20' 38.47" N
876	475902.717938	2249678.848580	86°46' 8.87" E	20°20' 42.07" N
877	476005.095295	2249773.035750	86°46' 12.39" E	20°20' 45.14" N
878	476316.322460	2249916.364050	86°46' 23.12" E	20°20' 49.82" N
879	476406.414534	2249969.600270	86°46' 26.22" E	20°20' 51.55" N
880	476463.745854	2250100.643290	86°46' 28.20" E	20°20' 55.82" N
881	476529.267362	2250284.922530	86°46' 30.45" E	20°21' 1.82" N
882	476628.459646	2250445.086220	86°46' 33.86" E	20°21' 7.03" N
883	476681.695871	2250625.270370	86°46' 35.69" E	20°21' 12.89" N
884	476689.886060	2250989.733760	86°46' 35.95" E	20°21' 24.75" N
885	476698.076249	2251067.540550	86°46' 36.23" E	20°21' 27.28" N
886	476726.741908	2251153.537530	86°46' 37.22" E	20°21' 30.08" N
887	476788.168323	2251419.718660	86°46' 39.32" E	20°21' 38.74" N
888	476956.067188	2251890.654500	86°46' 45.09" E	20°21' 54.07" N
889	477103.490582	2252148.645440	86°46' 50.17" E	20°22' 2.47" N
890	477316.435484	2252431.206940	86°46' 57.50" E	20°22' 11.67" N
891	477336.919472	2252512.293660	86°46' 58.20" E	20°22' 14.31" N
892	477422.315666	2252744.761070	86°47' 1.14" E	20°22' 21.87" N
893	477683.248480	2253105.322780	86°47' 10.12" E	20°22' 33.62" N
894	477683.248480	2253204.951670	86°47' 10.12" E	20°22' 36.86" N
895	477500.033051	2253448.195020	86°47' 3.79" E	20°22' 44.76" N
896	477109.323517	2253661.174930	86°46' 50.30" E	20°22' 51.67" N
897	477227.208210	2254117.144030	86°46' 54.34" E	20°23' 6.51" N
898	477244.891099	2254362.201750	86°46' 54.94" E	20°23' 14.48" N

899	476878.794453	2254964.227340	86°46' 42.29" E	20°23' 34.05" N
900	476654.047067	2255217.074810	86°46' 34.52" E	20°23' 42.27" N
901	476066.853130	2255409.788370	86°46' 14.25" E	20°23' 48.51" N
902	475826.591451	2255402.992480	86°46' 5.96" E	20°23' 48.28" N
903	475399.478698	2255274.858650	86°45' 51.23" E	20°23' 44.09" N
904	475094.398160	2255042.997440	86°45' 40.72" E	20°23' 36.53" N
905	474496.440305	2254341.312200	86°45' 20.12" E	20°23' 13.68" N
906	474227.969432	2254127.755830	86°45' 10.87" E	20°23' 6.72" N
907	474148.648492	2254133.857440	86°45' 8.14" E	20°23' 6.91" N
908	474081.530774	2254133.857440	86°45' 5.82" E	20°23' 6.91" N
909	473889.035823	2254087.516710	86°44' 59.18" E	20°23' 5.39" N
910	473430.416069	2253628.896950	86°44' 43.38" E	20°22' 50.45" N
911	473331.032650	2253468.781870	86°44' 39.96" E	20°22' 45.24" N
912	473317.515256	2253354.308570	86°44' 39.50" E	20°22' 41.51" N
913	473062.561777	2253011.161060	86°44' 30.73" E	20°22' 30.34" N
914	472561.452325	2252387.002930	86°44' 13.47" E	20°22' 10.01" N
915	472461.883563	2252418.683900	86°44' 10.04" E	20°22' 11.03" N
916	472217.487510	2252343.328450	86°44' 1.61" E	20°22' 8.57" N
917	472052.520174	2252341.291820	86°43' 55.92" E	20°22' 8.49" N
918	471753.135009	2252377.951230	86°43' 45.59" E	20°22' 9.67" N
919	471574.363822	2252375.160290	86°43' 39.42" E	20°22' 9.57" N
920	471325.894501	2252295.731570	86°43' 30.86" E	20°22' 6.97" N
921	470916.531112	2252092.068190	86°43' 16.75" E	20°22' 0.32" N
922	470586.352087	2251796.183190	86°43' 5.38" E	20°21' 50.68" N
923	470311.650881	2251371.099830	86°42' 55.93" E	20°21' 36.84" N
924	469972.979822	2251264.707690	86°42' 44.25" E	20°21' 33.36" N
925	469829.205132	2251203.089970	86°42' 39.29" E	20°21' 31.34" N
926	469733.355339	2251216.782790	86°42' 35.99" E	20°21' 31.78" N
927	469668.314408	2251285.246930	86°42' 33.74" E	20°21' 34.01" N
928	469651.198373	2251429.021620	86°42' 33.14" E	20°21' 38.68" N
929	469654.621580	2251644.683660	86°42' 33.25" E	20°21' 45.70" N
930	469634.082339	2251709.724590	86°42' 32.53" E	20°21' 47.81" N
931	469692.276856	2251969.888310	86°42' 34.52" E	20°21' 56.28" N
932	469812.089097	2252182.127140	86°42' 38.64" E	20°22' 3.19" N
933	469880.553235	2252373.826730	86°42' 40.99" E	20°22' 9.43" N
934	469959.286994	2252544.987070	86°42' 43.70" E	20°22' 15.00" N
935	470085.945649	2252983.157550	86°42' 48.04" E	20°22' 29.27" N
936	470339.262960	2253458.983310	86°42' 56.75" E	20°22' 44.76" N
937	470616.542718	2253821.843240	86°43' 6.30" E	20°22' 56.58" N
938	470602.849891	2253876.614550	86°43' 5.82" E	20°22' 58.36" N
939	470561.771408	2253927.962660	86°43' 4.40" E	20°23' 0.03" N
940	470548.078580	2253986.157170	86°43' 3.93" E	20°23' 1.92" N
941	470609.696304	2254133.355070	86°43' 6.04" E	20°23' 6.71" N
942	470839.051167	2254376.402760	86°43' 13.94" E	20°23' 14.63" N
943	471099.214891	2254592.064790	86°43' 22.90" E	20°23' 21.66" N
944	471325.146546	2254705.030620	86°43' 30.69" E	20°23' 25.35" N
945	471496.306891	2254807.726830	86°43' 36.59" E	20°23' 28.70" N
946	471609.272718	2254937.808690	86°43' 40.48" E	20°23' 32.93" N
947	471705.122512	2255163.740350	86°43' 43.78" E	20°23' 40.29" N
948	471318.300132	2255430.750480	86°43' 30.42" E	20°23' 48.95" N
949	471596.838218	2255971.867440	86°43' 39.99" E	20°24' 6.57" N
950	471887.083436	2256542.547460	86°43' 49.98" E	20°24' 25.15" N
951	472089.623302	2256965.616640	86°43' 56.94" E	20°24' 38.93" N

952	472089.623302	2257344.029520	86°43' 56.92" E	20°24' 51.24" N
953	472184.226523	2257873.807560	86°44' 0.15" E	20°25' 8.47" N
954	472051.782013	2258498.188820	86°43' 55.55" E	20°25' 28.78" N
955	471996.008916	2260052.761260	86°43' 53.54" E	20°26' 19.35" N
956	472032.801425	2260898.988980	86°43' 54.76" E	20°26' 46.88" N
957	472069.593934	2261021.630680	86°43' 56.02" E	20°26' 50.87" N
958	472069.593934	2261499.933300	86°43' 55.99" E	20°27' 6.43" N
959	472057.329765	2261732.952520	86°43' 55.56" E	20°27' 14.01" N
960	472130.914783	2262002.764260	86°43' 58.08" E	20°27' 22.79" N
961	472412.990688	2262603.708580	86°44' 7.79" E	20°27' 42.35" N
962	472603.360830	2263272.932360	86°44' 14.32" E	20°28' 4.13" N
963	472718.956174	2263808.024500	86°44' 18.28" E	20°28' 21.54" N
964	472705.158983	2264132.258490	86°44' 17.79" E	20°28' 32.09" N
965	472677.564601	2264270.230400	86°44' 16.83" E	20°28' 36.58" N
966	472608.578646	2264346.114950	86°44' 14.44" E	20°28' 39.04" N
967	472385.773804	2264471.675350	86°44' 6.74" E	20°28' 43.11" N
968	472410.681769	2264513.442860	86°44' 7.60" E	20°28' 44.47" N
969	472524.992311	2264533.613590	86°44' 11.54" E	20°28' 45.14" N
970	472583.998177	2264524.535770	86°44' 13.58" E	20°28' 44.84" N
971	472706.548821	2264438.296420	86°44' 17.82" E	20°28' 42.04" N
972	472801.865989	2264336.305910	86°44' 21.11" E	20°28' 38.73" N
973	472801.865989	2264261.278830	86°44' 21.12" E	20°28' 36.29" N
974	472897.183157	2264134.189270	86°44' 24.41" E	20°28' 32.16" N
975	473084.272661	2263944.746700	86°44' 30.88" E	20°28' 26.01" N
976	473084.272661	2263833.817350	86°44' 30.89" E	20°28' 22.40" N
977	473024.981611	2263641.221790	86°44' 28.85" E	20°28' 16.13" N
978	473024.981611	2263527.122370	86°44' 28.86" E	20°28' 12.42" N
979	473059.211437	2263424.432890	86°44' 30.05" E	20°28' 9.08" N
980	473175.413243	2263381.461340	86°44' 34.06" E	20°28' 7.69" N
981	473322.583281	2263516.367210	86°44' 39.13" E	20°28' 12.09" N
982	473482.017488	2263872.028140	86°44' 44.62" E	20°28' 23.66" N
983	473727.300883	2264497.500790	86°44' 53.05" E	20°28' 44.02" N
984	473935.791770	2265208.822640	86°45' 0.21" E	20°29' 7.17" N
985	474033.905128	2265736.181940	86°45' 3.57" E	20°29' 24.33" N
986	474079.048350	2266180.090290	86°45' 5.10" E	20°29' 38.77" N
987	474190.870008	2266396.362480	86°45' 8.95" E	20°29' 45.82" N
988	474367.436919	2266537.149390	86°45' 15.04" E	20°29' 50.40" N
989	474666.800819	2266837.492670	86°45' 25.36" E	20°30' 0.19" N
990	474885.713843	2267030.206940	86°45' 32.91" E	20°30' 6.47" N
991	475082.963306	2267128.280530	86°45' 39.72" E	20°30' 9.67" N
992	475203.683154	2267213.307700	86°45' 43.88" E	20°30' 12.44" N
993	475300.531204	2267221.804410	86°45' 47.22" E	20°30' 12.72" N
994	475476.339501	2267221.804410	86°45' 53.29" E	20°30' 12.73" N
995	475652.147799	2267265.756480	86°45' 59.36" E	20°30' 14.17" N
996	475784.004023	2267287.732520	86°46' 3.91" E	20°30' 14.89" N
997	475808.662951	2267264.717520	86°46' 4.76" E	20°30' 14.14" N
998	475842.778251	2267287.278380	86°46' 5.94" E	20°30' 14.88" N
999	475880.009434	2267298.285480	86°46' 7.23" E	20°30' 15.24" N
1000	475984.230677	2267310.778170	86°46' 10.82" E	20°30' 15.65" N
1001	476153.886903	2267277.360740	86°46' 16.68" E	20°30' 14.57" N


 Divisional forest Office,
 Mangrove Forest Division/M
 Renagar



Mangrove Forest Division (WL), Rajnagar

COMPARTMENT HISTORY

WORKING PLAN PERIOD: 2022 -23 TO 2031-32

Name of Forest Block: Jatadhar Reserved Forest

Compartment No: 01 (One Block- One Compartment)

Range: KUJANG

Mangrove Forest Division WL, Rajnagar

Range – KUJANG

Compartment History

Sl No	Description	Write up
1	Name of Forest Block	Jatadhar RF
2	Compartment no.	01 (One Block- One Compartment)
3	Area in ha (Species wise / Forest Type Wise)	Total Area: 124.26 ha, Area diverted under FC Act, 68.98 ha, Balance: 55.28 ha; Mangrove Forest – 10 ha Littoral Swamp Forest
4	Situation (Location)	Topo sheet No F45U12
5	Boundary	North: Noliasahi PF / Water body South: Jatadhartanda PRF East: Diverted Forest area West: Barkunda PF & Bhuinapal PF
6	Legal Status (RF / PRF/ DPF/ PF/ VF/)	Reserved Forests
7	Land Use (DF/ MDF/OF/Scrub Forest/ Bamboo/ Podu/ Plantation etc)	Casuarina Plantation: 45 ha, Mangrove- 10.00 Ha; Encroachment.
8	General Topography (Flat	Deep Soil, Moderately Well Drained,

	/Gentle Rolling/ hilly / very hill)	Leveled, Fine loamy and Delta area, Clay
9	Altitude (In M , AMSL) (Lower limit to upper limit)	About 3-5m AMSL
10	Aspect	Plain land
11	Gradient / Slop in Degree	Slightly sloped to Sea.
12	Configuration (Rugged / undulating/ flat etc)	Flat land
13	Rock & Geology	Deposited soil by River / Tidal wave
14	Soil (Texture, depth, permeability, drainage, surface compaction, humus, etc.)	Fine Loamy with heavy clayey. Well drained, Moderate flooding during High Flood
15	Soil Erosion (Heavy/ moderate/ mild/ no erosion)	Subject to tidal erosion,
16	Crop composition:	Casuarina Plantation, Mangrove Species: Rai, Gua, Sinduka,
17	Regeneration status	Regeneration of Gua observed – Fair to Good
18	Injury/ damage to crop, if any	Damage due to Cyclone / Tidal erosion.
19	Grazing incidence	Rare
20	Presence of bamboos	Nil

21	Presence of grasses	Moderate (Luni Grass, Mutha, Duba
22	Presence of weeds	Low – lantana camera
23	Plantation status	Casuarina Plantation 2022-23 – Good condition
24	water bodies	No
25	Drivers of degradation	Tidal erosion / Encroachment
26	Faunal sighting, if any	Spotted Deer, Wild Boar, Civet, Mongoose, Squirrel
27	Faunal traces of flagship species	. Wild Boar, Python, Painted Storks

2. Compartment Enumeration:

Sample Point No.	Area Enumerated	Sampling Method	Year of Enumeration	Result
	@0.1 ha per Point	Sample Point Method	2018-19	Furnished below

Major species	No of Trees Enumerated					Total
	30-60	60-90	90-120	120-150	>150	
	Not available in Enumeration Report					

3. Management Details:

Sl No	Description	

1	Working Plan Period	2022-23 to 2032-33
2	Author of Working Plan	Sri Bikash Ranjan Dash, IFS,
3	Working Circle	RWC, Plantation, Mangrove Imp. WC
4	Felling Series / Treatment Series	Rehabilitation Sarala Treatment series (2028-29) Jatadhar Plantation series (2022-23)
5	Periodic Block	Not Applicable
6	Sample / Research Plots/ Preservation Plots	Not available
7	Forest Type	4B/TS – 4A/L1
8	Forest cover & Change	No change

4. Details of NTFP / MAP available:

5. Tree marked for Felling:

- a) Year of marking
- b) Trees marked with Abstract.
- c) Unit calculated

6. Out Turn;

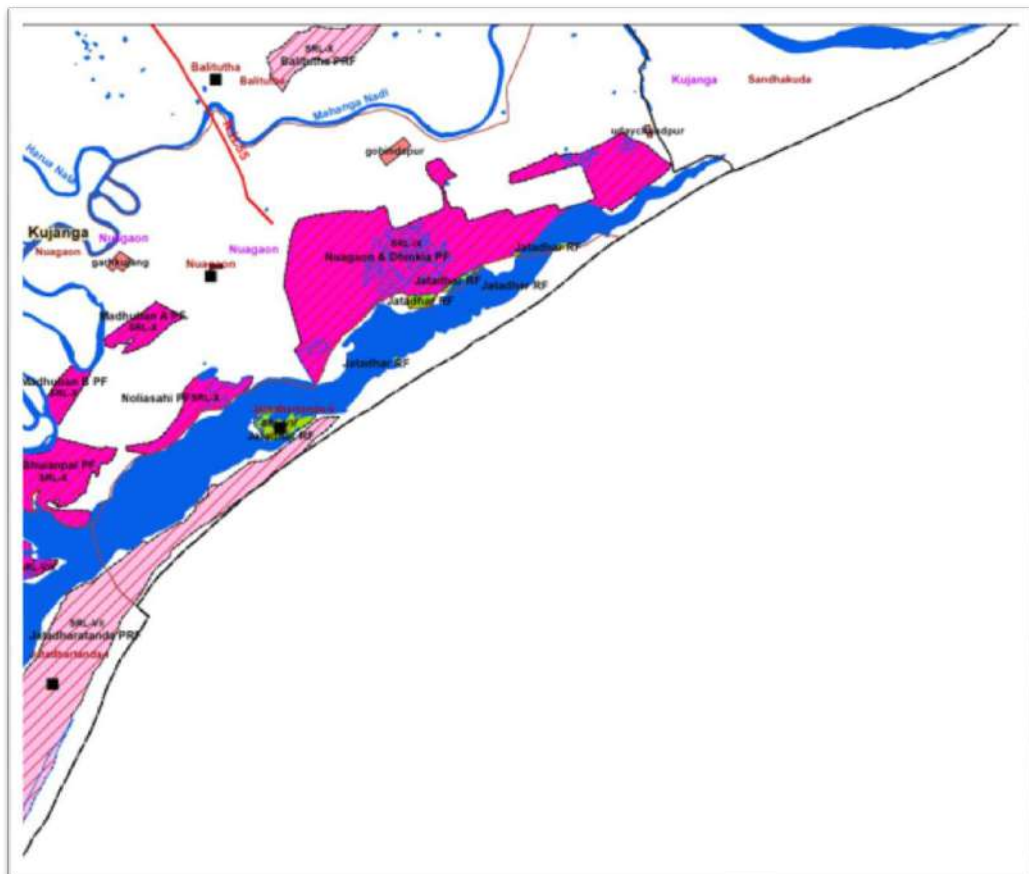
- a) Timber:
- b) Firewood
- c) Bamboo:

7. Harvesting of NTFP:

8. Compartment History:

Year	Event	General comments
2022-23		Casuarinas Plantation -10 ha
20223-24		
2024-25		
2025-26		
2026-27		
2027-28		
2028-29		
2029-30		
2030-31		
2031-32		
2032-33		

Encl: Crop Density Map:



Prepared & submitted

Working Plan Officer



THE END