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Raj Kumar Mahtolia IFS
Govt of West Bengal, India

Some important Biosphere Reserves in India (based on the UNESCO Man and the Biosphere (MAB) Programme list)

1. **Nilgiri Biosphere Reserve**

2. **Gulf of Mannar Biosphere Reserve**

3. **Sundarban Biosphere Reserve**

4. **Nanda Devi Biosphere Reserve**

5. **Nokrek Biosphere Reserve**

6. **Pachmarhi Biosphere Reserve**

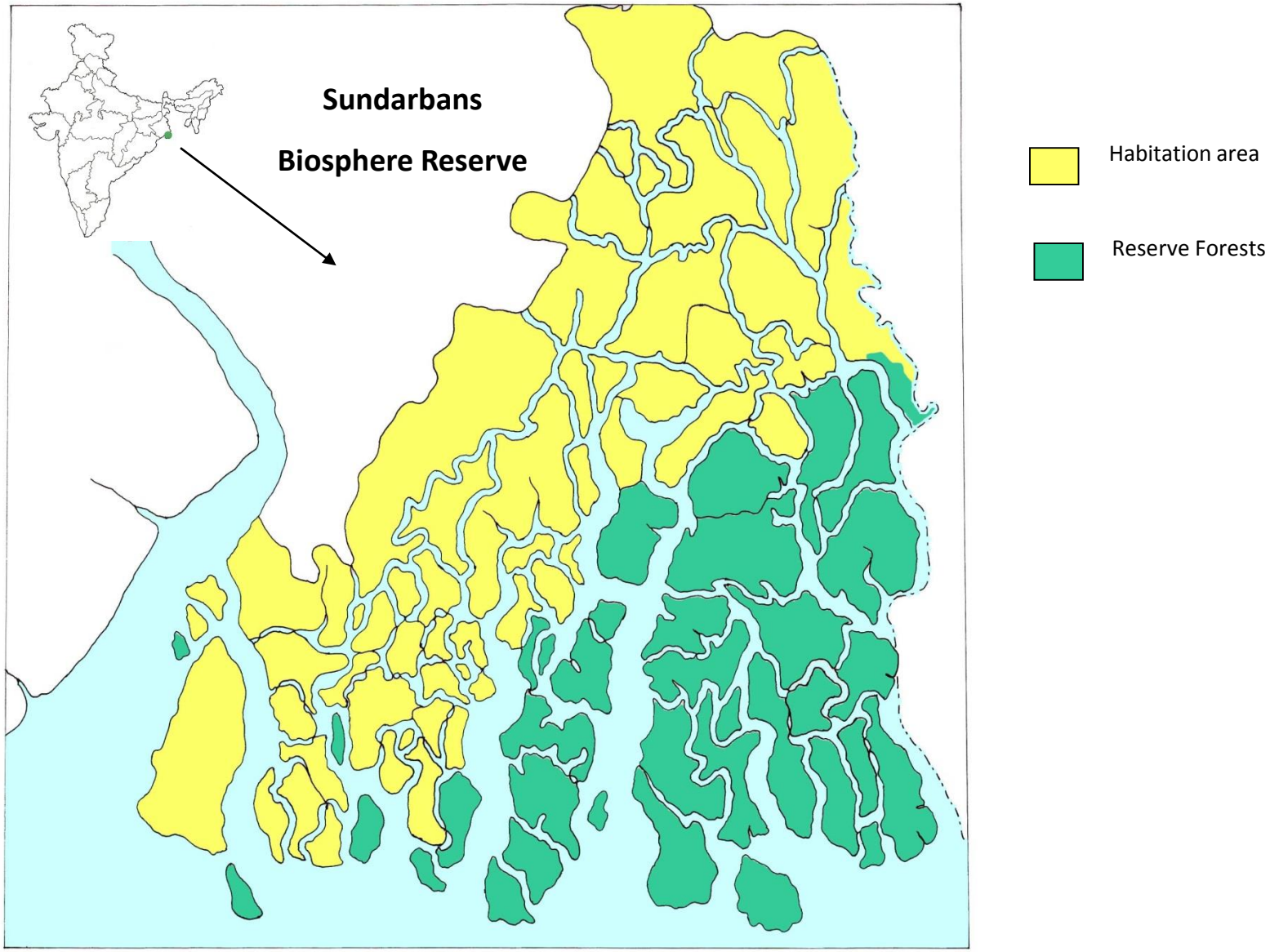
7. **Simlipal Biosphere Reserve**

8. **Achanakmar- Amarkantak Biosphere Reserve**

9. **Nicobar Islands**

Three Functions of Biosphere Reserves

Sundarban Biosphere Reserve of India



Map: Sundarban Biosphere Reserve

INTRODUCTION

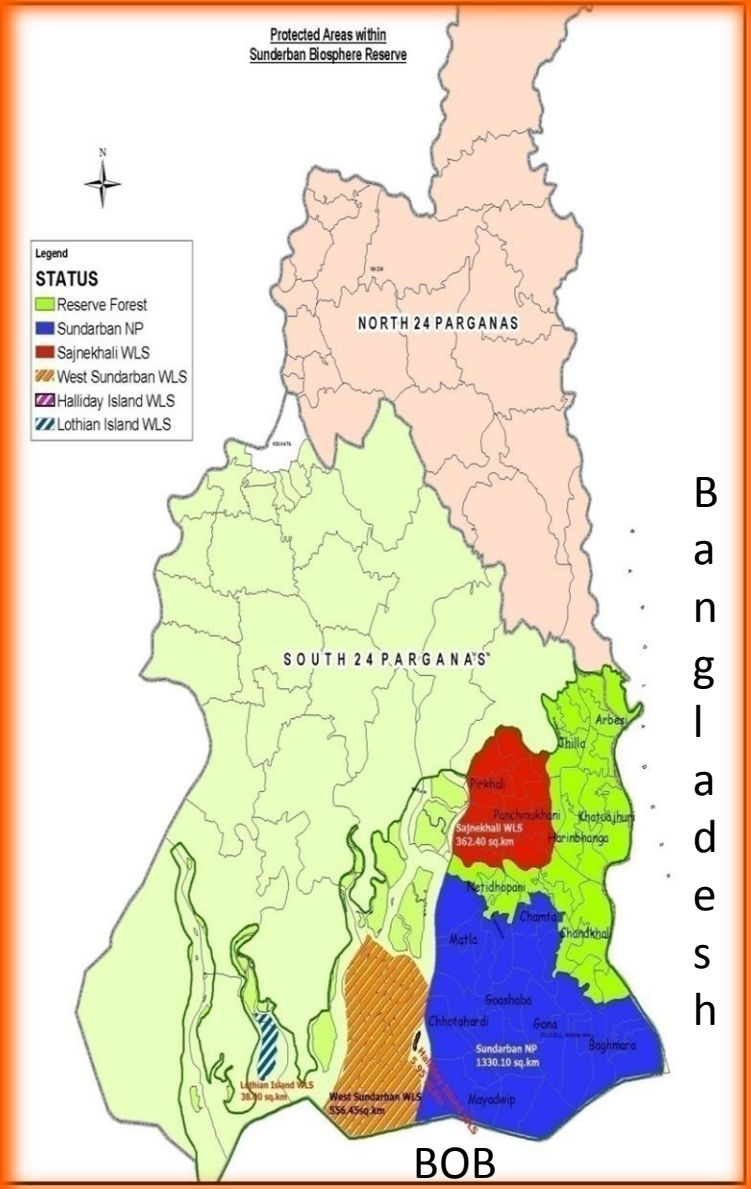
•Indian Sundarban located in the sea-land interphase region of the Ganga-Brahmaputra deltaic complex lies between 21° 30' 2" to 22° 10' 27" N and 88° 10' 0" E within the districts of North and South 24-Paraganas of West Bengal.

•It covers an area of 9630 Sq km south to the Dampier-Hodge line (Dampier-Hodge line is a imaginary one which separates the deltaic influence area of 24 Pargana district).

•It is the largest and most remarkable sheltered part of the wet coastal ecosystem in India.

•The vast deltaic region regularly receive saline tidal thrust from the Bay of Bengal twice a day and is also bathed with continuous flow of fresh water of Ganga-Brahmaputra river system.

•This intertidal dynamic ecosystem along with inter mixture of fresh and saline water flow creates very specialized habitat for biodiversity.



The area declared as Sundarban Biosphere Reserve on March 29th 1989	
Total Area	9630 Km2
Core Area	1692 Km2
Buffer Area	2233 Km2
Transition Area	5705 Km2

Salient Features

- Number of Islands :102
- Number of Inhabited Islands : 54
- Number of Mouzas : 1080
- Number of Inhabited Mouzas : 1064
- Number of Districts : 2
- Number of Police Stations : 16
- Number of Blocks : 19
- Number of GPs : 140

Salient Features

- **Inhabited Area : 4,493 Sq. Km.**
- **Reserved Forest Area : 4,263 Sq. Km.**
- **Tiger Forest Area : 2,585 Sq. Km.**
- **River Area : 657 Sq. Km.**
- **Length of River Embankment : 3,500 Sq. Km.**
- **Total Cultivable Area : 3,105 Sq. Km.**

UNIQUENESS OF SUNDARBAN

- Sundarban is the largest contiguous mangrove patch (along with Bangladesh) on globe.
- It is the only mangrove tiger-land on globe.
- It represents the largest mangrove diversity globally with 84 plant species.
- It has been included in the World Heritage list in 1989.
- It has been included in UNESCO Man and Biosphere network in 2001.
- It constitutes 63% of total Indian Mangrove area and entire Eastern Indian Fishery is dependent on the input from Sundarban.
- Sundarban save the Calcutta and suburbs from the rage of annual high gales from the sea.

PHYSIOLOGY & CLIMATE

- **Temperature: 22° C to 38° C**
- **Rainfall : 2500 to 3000 mm**
- **Tidal level : 3-6 m**
- **Wind speed: 5-30Km/hr and occasionally, 70 to 80Km/hr**
- **Relative humidity: 70% to 90% (During Cyclone)**
- **Water salinity: 8 to 30 ppt**
- **Soil comprises of mainly coastal saline alluvium of clay, silt and fine sand.**

MANGROVES

Mangrove plants include trees, shrubs, ferns and palms. They are basically the evergreen sclerophyllous, broad-leaved trees with aerial root like pnuematophore or stilt root, which project above the mud and water in order to absorb oxygen. Production of viviparously germinated seedlings is another unique feature of this vegetation (UNESCO, 1973).

Salient Features of Mangroves

- **Mangroves are practically evergreen with thick leathery leaves designed to minimize transpiration.**

- **Root system is adapted to the peculiar conditions found in the mangrove forests such as still root in *Rhizophora* and knee roots in *Bruguiera*. *Pneumatophores* (breathing roots) are found in profusion in *Sonneratia* and *Avicennia*.**

IMPORTANCE OF MANGROVES

- **Mangroves support the conservation of biological diversity by providing habitats, spawning grounds, nurseries and nutrients for a number of animals.**

- **Several fishing and rural communities depend on the fish and shellfish in mangroves as a source of income and food security.**

- **Mangrove forests provide protection and shelter against extreme weather_events, such as storm winds and floods, as well as tsunamis. Mangroves absorb and disperse tidal surges associated with these events.**

- **Mangroves growing near the coast play an important role in carbon sequestration by acting as sink for carbon, thereby receiving considerable international attention. Mangroves are among the most carbon-rich forests in the tropics.**

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PROTECTED AREA NETWORK OF SUNDARBAN BIOSPHERE RESERVE

	Protected Area	Area in Sq. Km.	Ecologically Important Species
1.	Sundarban Tiger Reserve (includes Sundarban National park & Sajnekhali Wild Life Sanctuary)	2584.89	Royal Bengal Tiger, Estuarine Crocodile, Wild Boar, Fishing cat, mangrove species like Excoecaria agallocha, Avicennia sp, Xylocarpus sp.
a.	Sundarban N. P.	1330.10	Royal Bengal Tiger, Estuarine Crocodile, Horse- Shoe Crab
b.	Sajnekhali W.L.S	362.40	Royal Bengal Tiger, Estuarine Crocodile, Horse- Shoe Crab, Mangrove plants like Nypa fruticants, Avicennia spp., Ceriops spp., Excoecaria agallocha etc.
2.	Haliday Island W.L.S.	5.95	Rhesus Monkeys, Spotted Deer, Wild Pig
3.	Lothian Island W.L.S.	38.00	Spotted Deer, Wild Pig, Estuarine Crocodile, Rhesus Monkeys, mangrove species like Aegiceras corniculatum; Aviennia alba; Aegialitis rotundifolia; Phoenix paludosa
4.	West Sundarban W.L.S.	556.45	Royal Bengal tiger, Estuarine Crocodile, Horse shoe Crab, Mangrove plants like Nypa fruticants, Avicennia spp., Ceriops spp., Excoecaria agallocha etc.
5.	Chintamoni Kar Bird Sanctuary (Old Narendrapur W.L.S.)	0.07	Various birds, Civet Cat, Water Monitor Lizard, Jackal, Mongoose.

Biodiversity Profile of Indian Sundarban

FLORAL DIVERSITY OF SUNDARBAN		FAUNAL DIVERSITY OF SUNDARBAN	
MAJOR SPECIES	26	PROTOZOA	106
MINOR SPECIES	29	INVERTEBRATE	1104
BACK MANGALS/MANGROVE ASSOCIATES	29	HEMICHORDATA	1
TOTAL	84	VERTEBRATE SPECIES	481
FAMILY = 40 / GENERA = 60		TOTAL NO OF SPECIES	1692

Important Major Fauna

Name	Scientific Name
Tiger	Panthera tigris
Fishing Cat	Felis viverrina
Chital	Axis axis
Water monitor	Varanus salvator
Wild boar	Sus scrofa
Estuarine Crocodile	Crocodylus porosus
Gangetic dolphin	Platanista gangetica
River Terrapin	Batagur baska
Olive Ridlay Turtle	Lepidochelys olivacea
King Crab	Limulus polyphemus

Ecosystem Services of SBR

- Sundarban & its Mangroves provide significant socio-economic benefits such as timber, fish, and environmental services like fresh air & coast protection.
- It provides an outstanding nursery for fish population which is a major source of subsistence for the fringe dwellers.
- People get benefited by ecological functions of Mangroves such as providing essential habitat, spawning grounds, reproduction locations and nutrients for birds, fish, crustaceans, shellfish, reptiles, mammals besides getting various commercial species, through exploitation.
- Mangrove ecology symbiotically supports the population of honey bees resulting in economic upliftment of fringe population through honey collection.
- Mangroves protect shorelines from coastal erosion, floods, hurricanes, tsunamis & storm surges & acts as carbon sink and nutrient reservoir.

Mangrove Afforestation programme

Sundarban Biosphere Reserve has taken up an ambitious program of Mangrove Afforestation and from 1989 till date **over 15000** ha, of mangrove plantation has been created in Sundarban.

Year	Mangrove Plantation (Ha)	Year	Mangrove Plantation (Ha)
1989	636	2002	770
1990	280	2003	750
1991	645	2004	830
1992	677	2005	760
1993	715	2006	780
1994	845	2007	800
1995	347	2008	400
1996	360	2009	500
1997	440	2010	500
1998	830	2011	285
1999	400	2012	453
2000	850	2013	220
2001	1146	2014	320
		2015	430

Population Status of Major Wild animal (TIGER) in SBR

No.	Area	Year	Census done by
70 (64-90)	Sundarban Tiger Reserve	2010	Wildlife Institute of India
20 (Camera Trapping)	24 Parganas south Division	2012	World Wide Fund, India
76 (62-96)	Sundarban Biosphere Reserve	2014	National Tiger Conservation Authority & Wildlife Institute of India
110	Sundarban Biosphere Reserve	2012-2014	World Wide Fund, India

Tiger Conservation in Sundarban

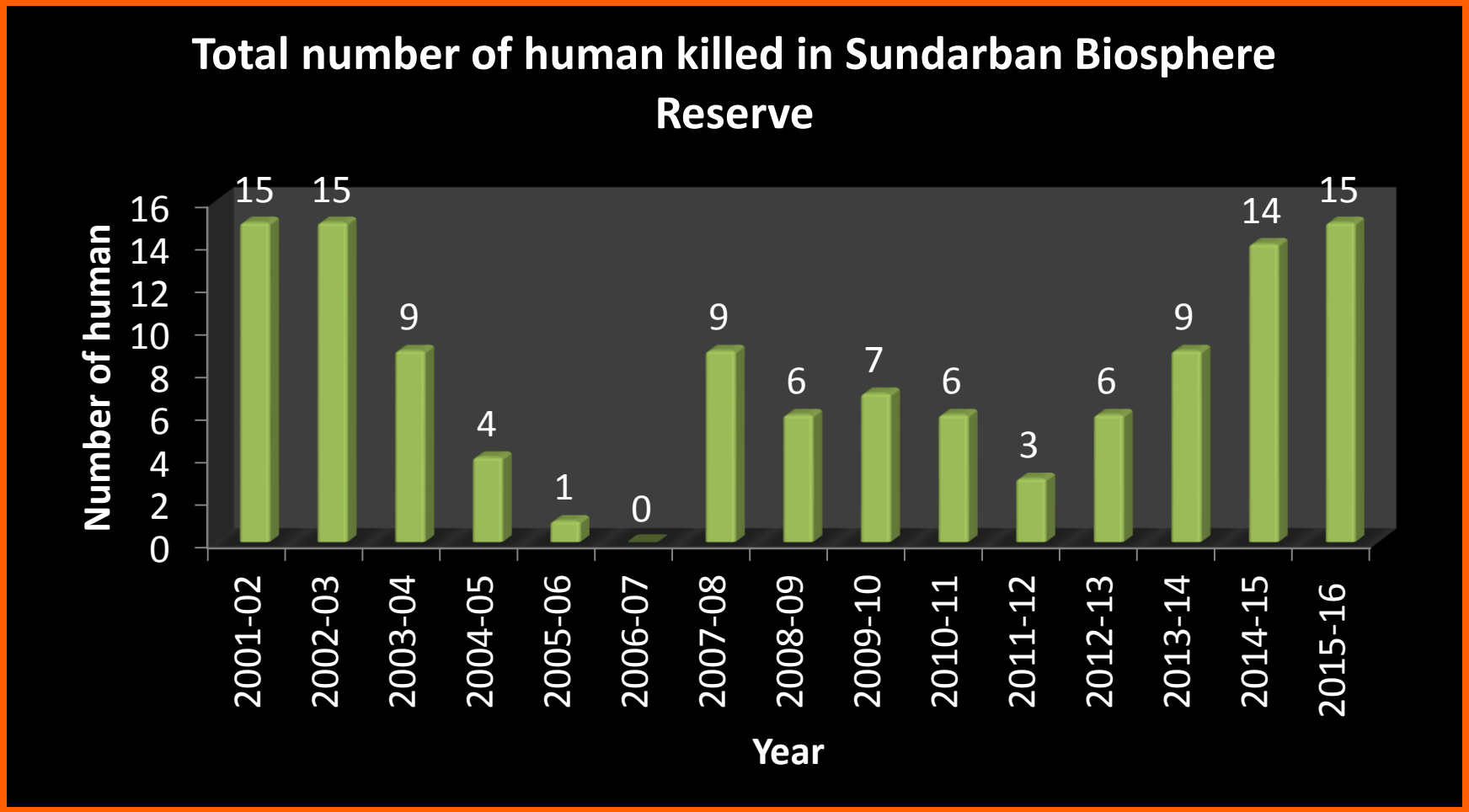
Sundarban Biosphere Reserve management has taken following steps for tiger conservation

1. Large Number of Protection Camps to protect tigers

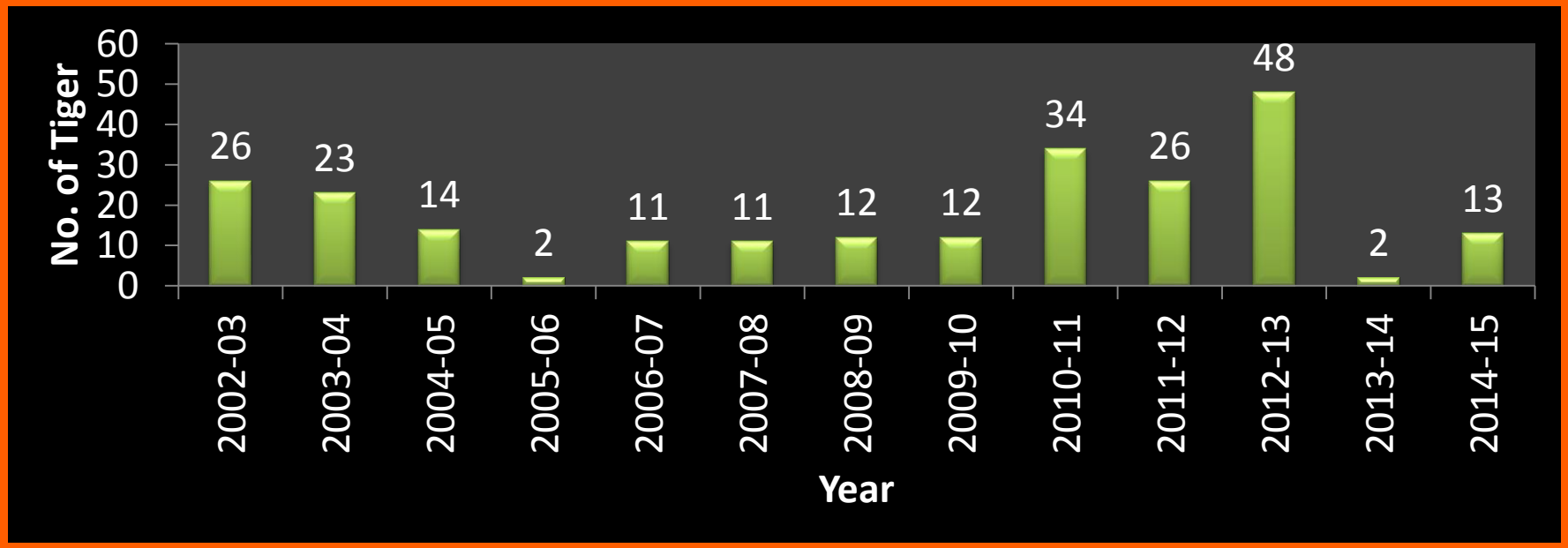
2. Nylon Net Fence, Immobilization squads to prevent tiger straying and recapturing strayed tigers

3. Research & Monitoring which includes Radio Collaring & Camera Trapping.

Total Number of Human Killed By Tiger in SBR



Total Number of tiger straying cases in SBR



Eco development activities in and around the Protected Areas

In order to develop trust between local communities & Forest Department and also to reduce the dependence of local communities on natural resources, various eco developmental activities are executed through the Joint Forest Management Committees of Sundarban Biosphere Reserve.

Brick path

Jetties

Eco development activities in and around the protected areas

Jetties

Canal

Mangrove Plantation

Crocodile breeding centre in Bhagabatpur

- The Bhagabatpur Crocodile Project in the Sundarban is home to numerous crocodiles of various age groups.
- The project was started in Bhagabatpur forest range in the year 1976.
- During the last ten years hatching success rate percentage varies from 19.8% to 48.45%.
- The aim of the project is “Sustaniable Conservation” of the salt water crocodiles and increase the efficiency in the breeding of salt water crocodile and to achieve greater success rate of about 80- 90%.
- Tourists can have a glimpse of the crocodiles from new borns to the adults in this breeding centre.

Recovery Program of Batagur Baska in Sundarban

Batagur Baska otherwise known as river terrapin is found in Sundarbans and South Eastern Countries.

Due to wide spread killing of the animal for its meat and damage of its habitat the animal has now become endangered in Sundarban and has been listed as critically endangered animal by the IUCN.

Sundaban Tiger Reserve with the help of Madras Crocodile bank Trust took the initiative in saving the endangered animal.

Breeding of the *Batagur Baska* has been successfully done at Sajnekhali. During the last three years 33 nos of hatchlings- in 2012, 56 nos in 2013 and more than 50 nos. in 2015 were produced in the breeding centre at Sajnekhali.

A regeneration protocol devised by the Madras Crocodile bank Trust is followed methodically for the regeneration of this species. Habitat survey by experts both from India and abroad have been done in the villages and the rivers in Sundarbans.

CLIMATE CHANGE – IMPACT ON THE SUNDARBANS:

THREATS

Sundarban area is cyclone-prone faces monsoon fury. The area is low lying, as a result of which changes in climate have significantly impacted the flora, fauna and the population living within. The importance factors are:

- Increasing temperature
- Rising sea-level
- Cyclones
- Rise in Salinity; Impact on Agriculture & some fresh water loving mangrove species
- Change in agricultural patterns
- Deforestation
- Pollution

Mangrove Forests and Blue carbon storage

- The capacity of mangroves, sea grasses, and salt marshes to sequester carbon dioxide from the atmosphere is being increasingly recognized at international level.

- Of all the biological carbon, also termed as 'green carbon', captured in the world, over half (55%) is captured by mangroves, sea grasses, salt marshes, and other marine living organisms, which are also known more specifically as "blue carbon".

- Mangroves, salt marshes, and sea grasses form much of the earth's blue carbon sink.

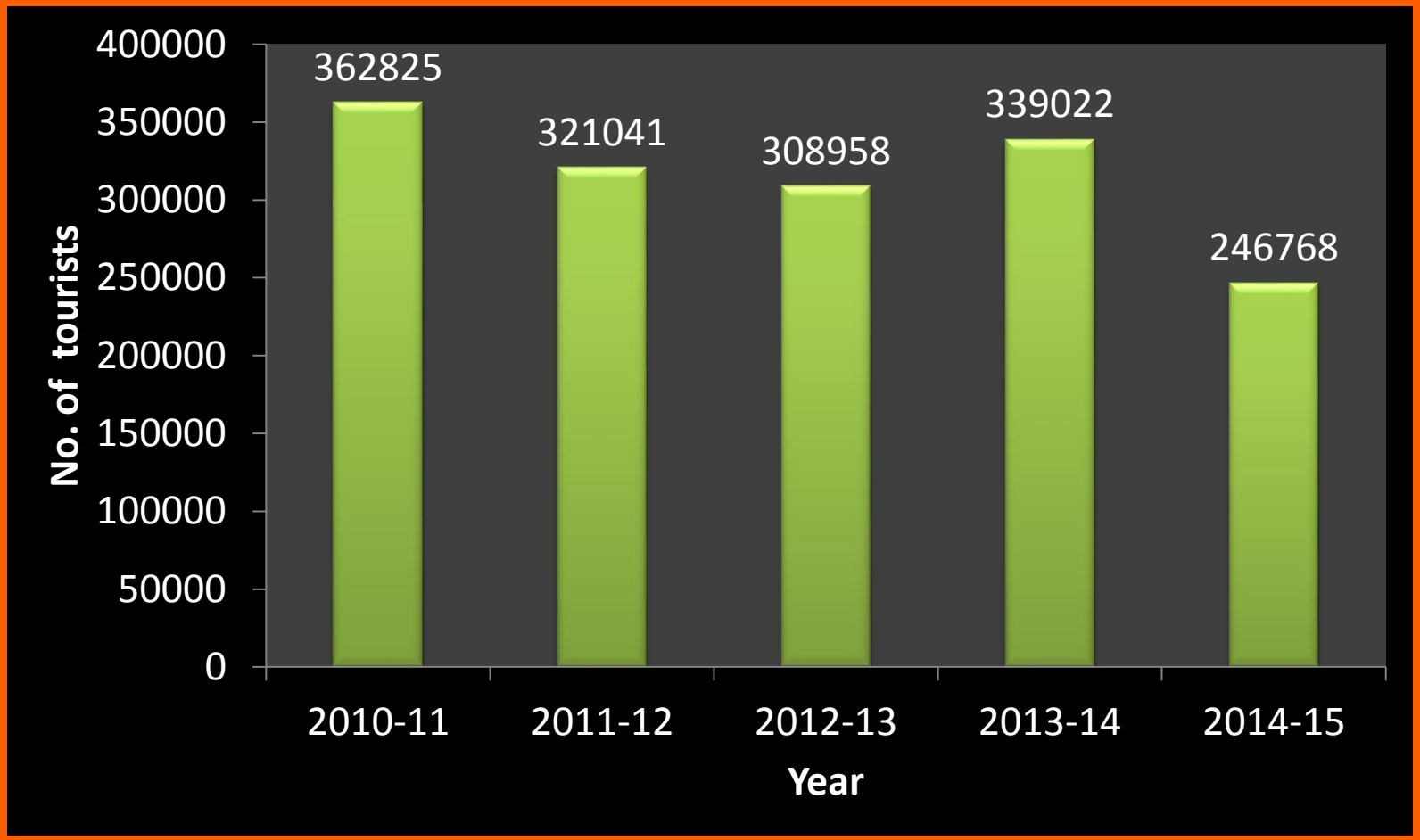
- These coastal vegetations sequester carbon far more effectively and more permanently than terrestrial forests.

- Mangrove forests store up to five times more carbon than most other tropical forests around the world.

- This ability of mangroves and other coastal vegetation to store such large amounts of carbon is, in part, due to the deep, organic rich soils in which they thrive.

Thus, mangrove forests offer a unique and highly efficient approach to climate change mitigation and adaptation.

Ecotourism


400000
350000
300000
250000
200000
150000
100000
50000
0
No. of tourists
362825
321041
308958
339022
246768
2010-11
2011-12
2012-13
2013-14
2014-15
Year

Details of the JFMCs in Sundarban Biosphere Reserve

A total of 65 JFMCs have been formed in Sundarban Biosphere Reserve

Area	Number
Sundarban Tiger Reserve	25
24 Parganas South Division	40

Skill training of SHGs in alternative livelihood activities including inputs

Training imparted to people in SBR

2012-2013

- **No. of JFMCs- 16, No. of Women in SHG- 160**
- **Type of livelihood option given- Goat Rearing, Bird Rearing (Japanese Quail eggs), Poultry farming**
- **No. of trainings given- 2 trainings per group given by KVK, Nympith**
- **Outcome- Return on sale of goat & Egg production from poultry average Rs. 1200/- to Rs. 3000/- per persons .**

2013-2014

- **No. of JFMCs- 23, No. of Women in SHG- 754**
- **Type of livelihood option given- Fish Farming**
- **No. of trainings given- 39**
- **Type of livelihood option given- Fish Farming, Duck Farming, Poultry, Goatery**

Training imparted to people in SBR

2014-2015

No of JFMCs- 10
Type of training- Mushroom cultivation & Vermicomposting, Psciculture (52 SHG were involved)
No of JFMCs- 7
Type of training- Poultry & Duck farming
Exposure Visit to Nympith- 1 JFMC
Honey processing training- 10 people

2015-2016

No of JFMCs- 36
Type of training- Poultry & Duck farming & Nutritional Gardening (6 SHG were involved)
No. of Women in SHG- 150
Exposure Visit to Nympith & No of JFMC involved- 13

Threats to Sundarban Biosphere Reserve

Various natural, socio- cultural, economic and political influences have been affecting the biodiversity of the Reserve. Some of the major factors and their effects are:

Factors	Effect
Land reclamation by people for agriculture and human settlement	Destruction of and reduction in forest area
Construction of series of irrigation and drainage canals	Interfering the natural gradients of salinity due to changed water flows
Fishing in the rivers, canals, creeks and estuaries	Depletion in juvenile stocks of fishes, shrimps, prawns
Exploitation of mangrove for timbers and fire woods	Reducing tree cover, denudation resulting in erosion
Dumping of sewerage waste of metropolis of Calcutta	Pollution of the waterways and landmass, affect the aquatic vegetation and fauna directly

Important issues along international boundary of India and Bangladesh

The international boundary is porous in nature and miscreants use this corridor for illegal activities like:

- Fishing and crab collection using mechanised boats.
- Poaching
- Honey collection during March to May.
- Piracy.
- Cattle trafficking.
- Smuggling of different items.

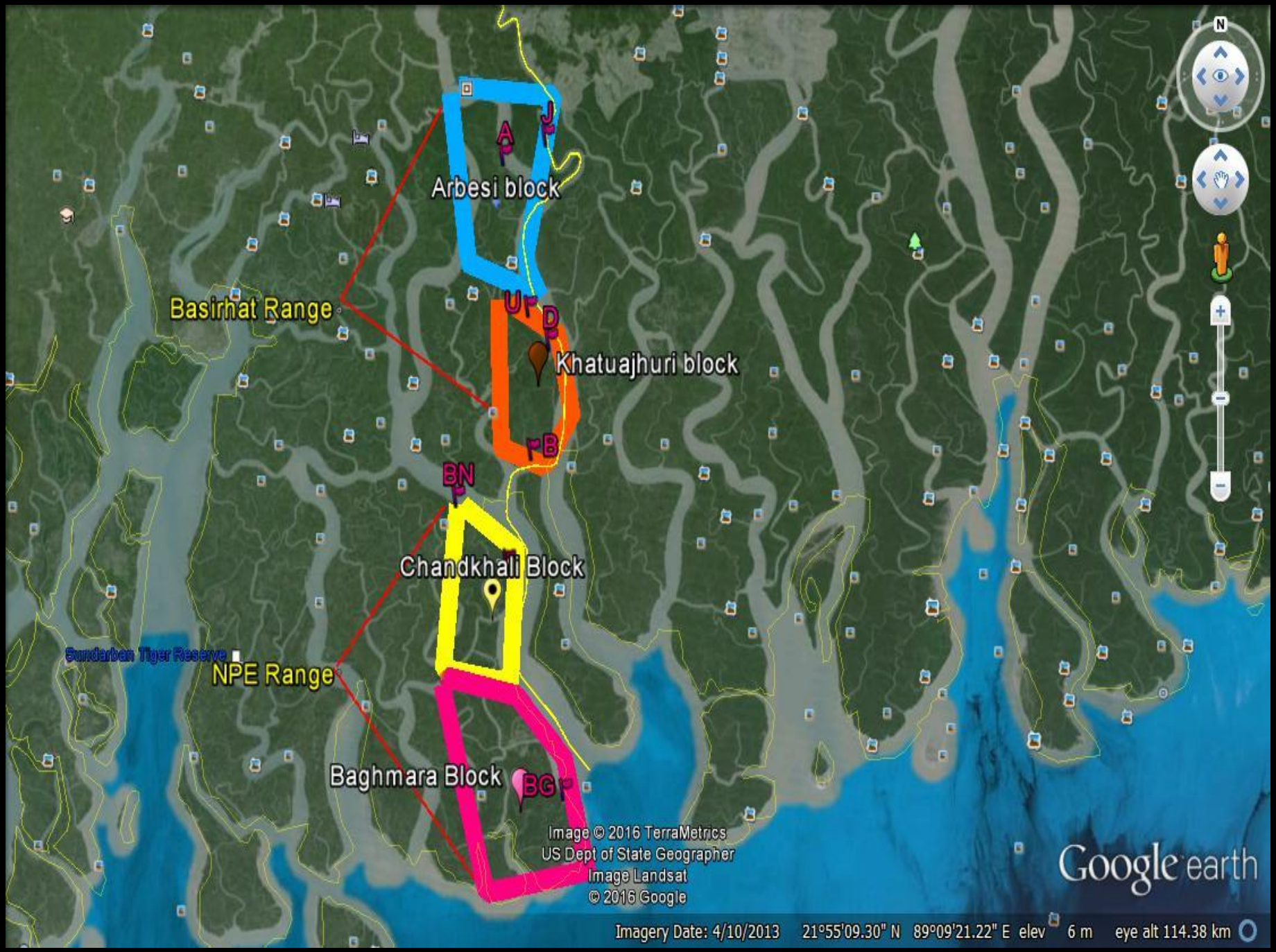
Forest Blocks of STR from North to South along Bangladesh border

Basirhat Range

- Arbesi block
- Khatuajhuri block

NPE Range

- Chandkhali block
- Baghmara Block


Arbesi block
A
J
Basirhat Range
U
D
Khatuajhuri block
B
BN
Chandkhali Block
Sundarban Tiger Reserve
NPE Range
Baghmara Block
BG
Image © 2016 TerraMetrics
US Dept of State Geographer
Image Landsat
© 2016 Google
Google earth
Imagery Date: 4/10/2013 21°55'09.30" N 89°09'21.22" E elev 6 m eye alt 114.38 km

Type of Cross border illegal activities

- **Illegal Fishing**
- **lllegal Honey Collection**
- **Piracy**
- **Cattle Trafficking**
- **Smuggling**

Protection measures along the International boundary

- Establishment of protection camps
- Regular patrolling in the area close to boundary.
- Joint patrolling with BSF.
- Establishment of coastal police station
- Intelligence network.

Present situation

- **There is no formal or informal channel of communication in between the Forest authorities of India and Bangladesh.**
- **Lack of patrolling in the vulnerable area due to shortage of staffs and proper infrastructure.**
- **The first Indo- Bangladesh bilateral talk on the matter held on January 28 & 29, 2016 at Indian Sundarban.**

Places of Interest in Sundarbans

Places	Description
Sajnekhali:	Famous for its rich wildlife population, is regarded as an integral part of the Sundarbans. With a checklist of over 200 species of birds, this area of 362.33 sq. km. is an ornithologist's dream come true. It is also a great place where tiger sighting is frequent.
Sudhanyakhali Watch Tower & Mangrove Park:	Sudhanyakhali Watch tower facing a sweet water ponds provides opportunity to see wildlife including tiger.
Dobanki Canopy Walk:	It is situated in the southern part of Sajnekhali Sanctuary. The Canopy Walk of about 150 meter & provides an opportunity to explore mangrove canopy.
Netidhopani:	It is at the extreme South-West tip of the tourism zone of Sundarban Tiger Reserve. The ruins of old temples belonging to 200-300 AD. and the associated folk legends lend mystery to the atmosphere.
Burirdabri Cage Trail & Mud Walk:	The eco-tourism com-plex is located at the eastern most part of the Indian Sundarbans, bordering Bangladesh. This is famous for its Watchtower, Mud-walk and Mangrove Cage Trail. One can see from watchtower Bangladesh Sundarban Forest across the river Kalindi.

Bakkhali:	**It offers a beautiful sea beach and is a place of great tourist attraction. The enthusiasts can find an interesting transition zone from coastal to mangrove vegetation.**
Bonnie Camp:	**Situated at the western part of the Indian Sundarban this camp has gained immense popularity among tourists. Splendid mangrove diversity and diverse avian fauna add colour to the camp area. Tiger sighting from the watch tower is also an added attraction for the tourists.**
Kalash Camp:	**This unique place is close to the forest. One can get a glimpse of the "Tiger Beach" where also tiger sighting is possible.**
Chulkathi Camp:	**This is the naturally created land based protection camp for the newly created west Sundarban WLS , also an important tourist attraction and a "must go" place for the tourist. The camp has the tallest watch tower and is located almost near the Bay of Bengal.**
Bhagabatpur Crocodile Project :	**It is one of the earliest initiative in India to protect the Saltwater Crocodile. Here you can see crocodiles of different age group. An interpretation center with information on Crocodiles and Brackish Water fishes of Sundarbans is also located within the Campus.**
Jharkhali:	**This is an important tourist entry point to the western part of Sundarbans. Jharkhali eco-park, tiger rehabilitation centre & a Mangrove Butterfly Garden have already come up.**

Bonnie Camp

Burirdabri

Sajnekhali

Jharkhali

THANK YOU