



Recognizing and Rewarding Best Practice in Management of World Heritage properties



**Submitted by
State Party: India**

**To
UNESCO World Heritage Centre**

February, 2012



Innovations in management of human-tiger conflicts and management of Outstanding Universal Values (OUVs) in Sundarbans World Heritage Site, India

Submitted by

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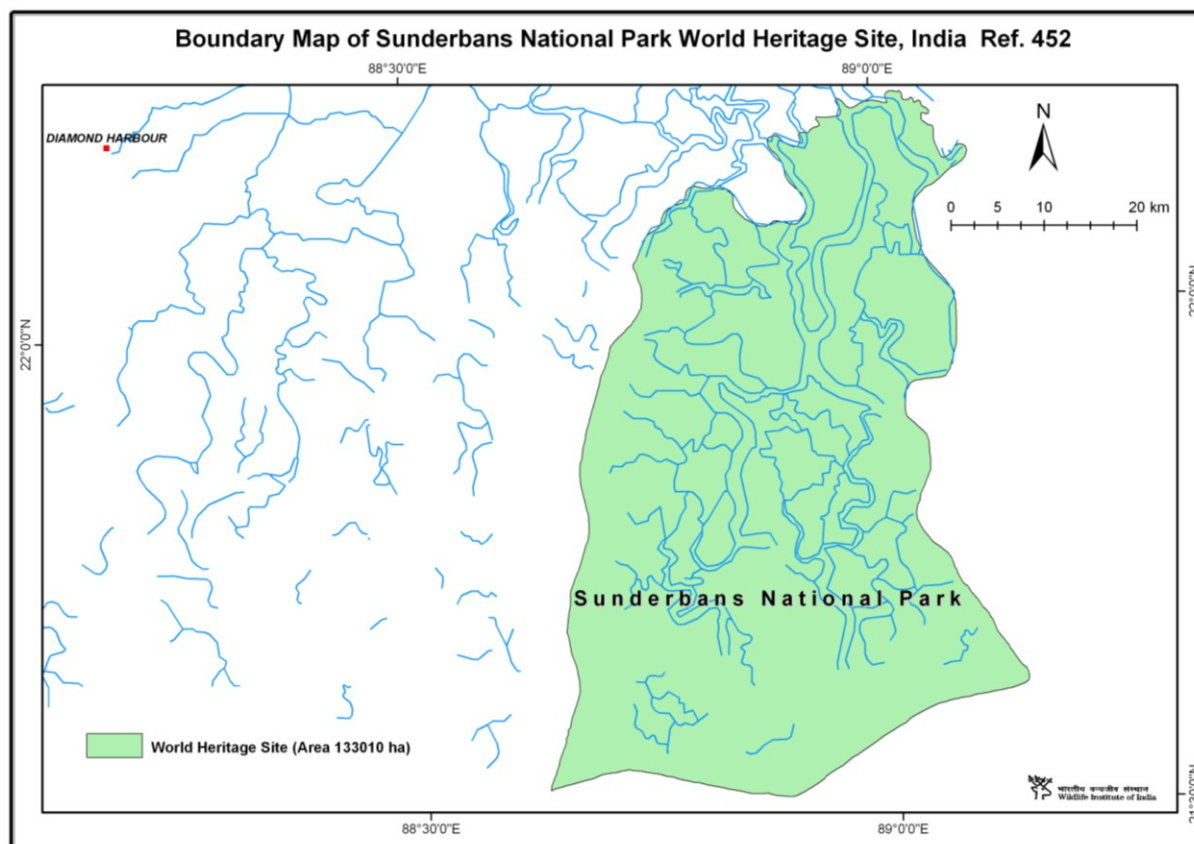
State Party: INDIA

World Heritage property: SUNDARBANS NATIONAL PARK, INDIA

Brief description of the property:

The property lies south-east of Kolkatta in the State of West Bengal and forms part of the Gangetic Delta, which borders on the Bay of Bengal. The Sundarbans, covering ca. 10,000 km² of mangrove forests and water, are part of the world's largest delta formed from sediments deposited by three great rivers viz. the Ganges, Brahmaputra and Meghna, which converge on the Bengal Basin.

The Sundarbans are intersected by an intricate network of interconnecting waterways, of which the larger channels are often a kilometre or two in width and run in north-south direction. These waterways now carry little freshwater as they are mostly cut off from the Ganges, the outflow of which has shifted from the Hooghly-Bhagirathi channels progressively eastwards since the 17th century. This is due to subsidence of the Bengal Basin and a gradual eastward tilting of the overlying crust. In the Indian Sundarbans, the western portion receives some freshwater through the Bhagirathi-Hooghly river system but the portion designated as the tiger reserve is



essentially land-locked, its rivers having become almost completely cut off from the main freshwater sources over the last 600 years. The waterways in the site are maintained largely by the diurnal tidal flow, the average rise and fall being about 2.15 m on the coast and up to 5.68 m on Sagar Island.

The land is constantly being changed, moulded and shaped by the action of the tides, with erosion processes more prominent along estuaries. The deposition processes along the banks of inner estuarine waterways are influenced by the accelerated discharge of silt from seawater. About half of the Sundarbans is under water and the rest of the landscape is characterized by low-lying alluvial islands and mud banks, with sandy beaches and dunes along the coast.

The entire mangrove forests extends over an area of 4,262 km² of which 2,320 km² is forest and the rest is water, and is called Sundarbans owing to the dominance of the tree species *Heritiera fomes*, locally known as '*sundari*'. This marsh vegetation consists of elements of the Malayan Peninsular and Polynesian regions, together with some Indo-Chinese, Ethiopian and a few of the New World. These marsh vegetation is not found elsewhere except in a small part of the Mahanadi and Godavari deltas to the south-west and the Bay Islands.



The Sundarbans is the only remaining habitat in the lower Bengal Basin and is famous for a great diversity of faunal species. Some of this diversity, however, has already been lost owing to the reclamation of the broad transitional belt of habitat for agriculture, combined with the higher salinity resulting partly from the large-scale irrigation schemes in the upper reaches of the Ganges. The lost species include the Javan rhinoceros, water buffalo, swamp deer and Indian muntjac. Similarly, gharial and narrow-headed soft-shell turtle became locally extinct within the last 100 years. Fortunately, the tiger (*Panthera tigris tigris*) population is the largest in India. High human population density relative to the availability of wild prey, and the relatively high frequency of encounters with local people is probably largely responsible for the notorious man-eating habits of the Sundarban tiger. The only ungulates are wild pig (main prey species of the tiger) and spotted deer, which is often seen in association with rhesus macaque. Aquatic mammals that frequent the tidal waters include the Ganges dolphin, Indo-Pacific humpbacked dolphin, Irrawaddy dolphin and Finless porpoise.

The Sajnekhali area contains a wealth of water birds, noteworthy residents including Asian open-bill stork, black-necked stork, greater adjutant, white ibis, swamp francolin, white-collared kingfisher, black-capped kingfisher and brown-winged kingfisher. This area is important for waders, a rare winter migrant and marsh birds. The Sundarbans provide important habitat for a variety of reptiles.


Baghmara Forest Block contains the ruins of a city built by the Chaand Saudagar merchant community in approximately AD 200-300. Much later, during the Moghul Empire, Raja Basand Rai and his nephew took refuge in the Sundarbans from the advancing armies of Emperor Akbar. The buildings they erected subsequently fell to Portuguese pirates, salt smugglers and dacoits in the 17th century.

Sundarbans Tiger Reserve situated mostly within 24-Parganas (South) and partly in 24-Parganas (North) districts of West Bengal, India, is a part of famous "*Sundarbans*". It falls a little south of Tropic of Cancer between the latitude 21^o31' & 22^o31' north Latitude and 88^o10' and 89^o51' east Longitude. Out of the total forest area of 4263 sq. km of Indian Sundarbans, a total area of 2585 sq. km. has been designated as Sundarban Tiger Reserve with effect from 23.12.1973. Within this area, 1330.12 sq.km was gazetted as Sundarbans National Park in the year 1984. 1225 sq. km. area outside this zone is designated as Buffer Zone. In this area, 362.33 sq. km. has been declared as Sajnekhali Wildlife Sanctuary in 1976. The National Park area of Sundarbans Tiger Reserve was designated as the World Heritage Site by UNESCO in 1985. Later on, in 1989 India Sundarbans was declared as Sundarbans Biosphere Reserve. In 2001, it was included in Global Network of Biosphere Reserve. The site has been inscribed on the UNESCO World Heritage List under criteria (ix) and (x).

Topics for demonstrating best management practice:	Please indicate in this column why your World Heritage property is a best practice in relation to the topic:
<p>1. Conservation:</p> <p><i>What innovative management practices or strategies are being applied in order to ensure the conservation of the Outstanding Universal Value (OUV) of the property (e.g. better resource management, restoration and rehabilitation, addressing various man-made or natural threats and challenges, etc.)?</i></p>	<p>One of the OUVs of the site is the presence of world's largest population of Royal Bengal Tiger <i>Panthera tigris tigris</i>. This population survives amidst a 'sea of humanity'. The local communities are dependent on the natural resources and venture into the forests for fuel wood, fish and honey collection. Since fresh water is a very scarce commodity and wild prey base is not abundant, the tiger also frequently strays into villages causing losses of human life as well as injuries. It is apparent that in such a scenario the frequency of human-tiger conflicts would be high causing losses to both tiger and human populations and thereby affecting the OUV. Thus an innovative management strategy of reducing human-tiger conflicts was conceived. Man eating behaviour of Sundarbans tiger has been observed since time immemorial. A total of 3615 (Barlow, 2004) human deaths were recorded in Sundarbans, 1396 in Bangladesh, 1231 in India and 988 not specified to a particular country between the period 1881 and 2006. On the other hand, a total of 1259 tiger deaths were recorded between 1881 and 2006.</p> <p>Tiger straying into neighbouring villages has been a major management challenge. Generally, the villagers fence their houses with vegetative fencing of mainly <i>Excoecaria</i> and <i>Cerriops</i>. But over the years it was observed that this fencing did not last for more than two years and there was also a heavy toll of Mangrove species. The Site Management then decided to change this vegetative fencing with Nylon Net fencing having MESH SIZE – 4" X 4". This Nylon Net fencing was erected with <i>Avicennia</i> post at a 2m distance with the metal runner along the fencing both at the top as well as bottom. As of now, out of 70 km interface boundary of Sundarbans Tiger Reserve, 54 km. has been fenced with Nylon Net fencing with a height of 8-10 feet. As it was found sagging after a passage of time, Bamboo posts were used in place of <i>Avicennia</i> posts, which has given better results. Since 2010, the Bamboo post has also been changed into the Reinforced Cement Concrete (RCC) post in areas which</p>

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	<p>had comparatively stable soils and not the muddy ones. Approximate cost to erect nylon net using bamboo and RCC post as a support is US \$ 4000 and 10000 respectively. Although initial cost of both RCC posts are higher but maintenance cost is very less and longevity is more and ultimately it becomes cost effective.</p> <p>Erection of Nylon Net fencing along the Forest Boundary has contributed effectively in the reduction in human-tiger conflicts.</p>
<p>2. Local People:</p> <p><i>What exemplary practices are you using in order to effectively address the needs of local stakeholders within the management system for the property, and enable their full and active participation?</i></p>	<div data-bbox="831 635 1480 1125" data-label="Image"> </div> <p>The number of resource dependent human communities living around the site is high and the site management is implementing several innovative management practices. As per the 'Zonation Plan' developed for the site, the 'Core Area' has been made completely 'inviolable', and no commercial activity or resource extraction is allowed. In the 'Buffer Area', sustainable harvest of both fish and honey is allowed. Participatory measures have led to substantial reduction of 'antagonism' and increase in 'active cooperation' of local communities in site management.</p>

Topics for demonstrating best management practice:		Please indicate in this column why your World Heritage property is a best practice in relation to the topic:
3.	Legal framework: <i>What special measures have you taken to ensure that the legal framework for the World Heritage site is effective in maintaining the OUV of the property?</i>	<p>The Federal Government as well as the State Government have enacted enabling policy and legal framework for effective conservation and management of the property. While the enactment of legal framework is necessary it is the successful implementation in the field that makes things change on the ground. The site management has developed an effective protection strategy and has build the capacity of its frontline staff in intelligence gathering to control the menace of poaching, especially of tiger. The '<i>informer network</i>' provides an early warning to the site management of any suspicious movement in the site for illegal harvesting of natural resources and/ or poaching.</p> <p>Over the years the site has build tremendous reputation for effective conservation and management of its wilderness resources especially the management of tiger and mangrove forests. The site was categories in the '<i>Very Good</i>' category in the Independent Management Effectiveness Evaluation carried out in 2010-2011.</p>
4.	Boundaries: <i>What innovative ways of dealing with the boundaries of the property, including for management of the buffer zone do you have in place, to effectively to manage the site and protect its OUV?</i>	<p>One of the most effective ways of managing the OUVs of a site is to adopt the approach of zonation and prescription of spatio-temporal regulations. The property is managed as a designated core zone, which is managed as an '<i>inviolable</i>' area. No commercial operations and resource extraction is allowed in the core zone. To further protect the core zone, 3 wildlife sanctuaries have been established that act as '<i>buffer</i>' to the site. The site management plan prescribes comprehensive regulations for management of both core and buffer areas in such a manner that both conservation and developmental activities are appropriately regulated. The ecological integrity of the site is well maintained by (i) Mangrove forests in Bangladesh part of Sundarbans; (ii) forests in 24 Parganas on the West; and (iii) Sajnekhali Wildlife Sanctuary in the North.</p>

<p>Topics for demonstrating best management practice:</p>	<p>Please indicate in this column why your World Heritage property is a best practice in relation to the topic:</p>
<p>5. Sustainable finance:</p> <p><i>What effective strategies have you developed and implemented to assure adequate and sustainable financial resources for implementing the management measures required to maintain the site's OUV?</i></p>	<p>Adequate and sustainable financial resources are key for implementing the management measures required to maintain the OUVs of a site. The site management has been very successful in getting adequate financial resources from the Federal as well as State Government, which have provided ca. US \$ 0.80 million and US \$ 2 million in 2010-2011. Besides this, several civil society organizations provide resources for various collaborative research and community livelihood projects. The site has been able to leverage adequate financial resources and use them for effective management of OUVs.</p>
<p>6. Staffing training and development:</p> <p><i>What approaches and strategies have you developed and implemented to assure that the human resources are adequate to manage the World Heritage property?</i></p>	<p>The site management has implemented a range of approaches and strategies for effective human resource management.</p> <p>Based on a 'Training Need Assessment', 13 thematic areas have been identified and a schedule of capacity building programme has been development for various categories</p> 

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	<p>of staff as well as for members of local Ecodevelopment Committees, the details of which are given below:</p> <table border="1" data-bbox="806 418 2016 1197"> <thead> <tr> <th>S. No.</th> <th>Type of Training</th> <th>Designation/level of participants</th> <th>Resource Person</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Animal Capture & Restraint</td> <td>FR,BO,FG,BS/BM</td> <td>DFD,AFD</td> <td>3 months</td> </tr> <tr> <td>2.</td> <td>Arms training</td> <td>FR,BO,FG,BS/BM</td> <td>State Police Academy</td> <td>Yearly</td> </tr> <tr> <td>3.</td> <td>Mob control</td> <td>FR,BO,FG,BS/BM</td> <td>State Police Academy</td> <td>Yearly</td> </tr> <tr> <td>4.</td> <td>First Aid</td> <td>FR,BO,FG,BS/BM</td> <td>Block Doctor</td> <td>Yearly</td> </tr> <tr> <td>5.</td> <td>Hospitality training</td> <td>FR, BO,FG dealing with tourists, tourist guides</td> <td>From Hospitality industry</td> <td>Yearly</td> </tr> <tr> <td>6.</td> <td>Law and related matters</td> <td>FD,DFD,AFD,FR,BO,FG</td> <td>APP and Judges</td> <td>Yearly</td> </tr> <tr> <td>7.</td> <td>Computer Application</td> <td>FD, DFD, AFD, FR, BO, Clerical staff</td> <td>Professional from a training institute</td> <td>Yearly</td> </tr> <tr> <td>8.</td> <td>Waste Management</td> <td>Local lodge owners, boat operators, FR,BO</td> <td>Expert from the concerned field</td> <td>Yearly</td> </tr> <tr> <td>9.</td> <td>Radiocollaring and Monitoring</td> <td>FD,DFD,AFD,FR,BO,FG</td> <td>Experts from WII</td> <td>Yearly</td> </tr> <tr> <td>10.</td> <td>Surveillance and intelligence gathering</td> <td>DFD,AFD,FR,BO</td> <td>Experts from CID</td> <td>Yearly</td> </tr> <tr> <td>11.</td> <td>Tourism, interpretation and conservation awareness</td> <td>DFD,AFD,FR, Tourist Guides</td> <td>Local Experts</td> <td>Yearly</td> </tr> <tr> <td>12.</td> <td>Livelihood options</td> <td>FR,BO,FPC/EDC members</td> <td>Local Experts</td> <td>Yearly</td> </tr> <tr> <td>13.</td> <td>EDC account keeping</td> <td>FR,FPC/EDC members</td> <td>Forest Range Officer</td> <td>Yearly</td> </tr> </tbody> </table> <p>The successful implementation of these programmes has helped in effective protection, conservation and development of the site.</p>	S. No.	Type of Training	Designation/level of participants	Resource Person	Frequency	1.	Animal Capture & Restraint	FR,BO,FG,BS/BM	DFD,AFD	3 months	2.	Arms training	FR,BO,FG,BS/BM	State Police Academy	Yearly	3.	Mob control	FR,BO,FG,BS/BM	State Police Academy	Yearly	4.	First Aid	FR,BO,FG,BS/BM	Block Doctor	Yearly	5.	Hospitality training	FR, BO,FG dealing with tourists, tourist guides	From Hospitality industry	Yearly	6.	Law and related matters	FD,DFD,AFD,FR,BO,FG	APP and Judges	Yearly	7.	Computer Application	FD, DFD, AFD, FR, BO, Clerical staff	Professional from a training institute	Yearly	8.	Waste Management	Local lodge owners, boat operators, FR,BO	Expert from the concerned field	Yearly	9.	Radiocollaring and Monitoring	FD,DFD,AFD,FR,BO,FG	Experts from WII	Yearly	10.	Surveillance and intelligence gathering	DFD,AFD,FR,BO	Experts from CID	Yearly	11.	Tourism, interpretation and conservation awareness	DFD,AFD,FR, Tourist Guides	Local Experts	Yearly	12.	Livelihood options	FR,BO,FPC/EDC members	Local Experts	Yearly	13.	EDC account keeping	FR,FPC/EDC members	Forest Range Officer	Yearly
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<p>7. Sustainable development:</p> <p><i>What are the effective mechanisms in place to ensure that resource use permitted in and around the World Heritage site is sustainable and does not impact negatively on OUV?</i></p>	<p>The natural resource dependence of the local communities that live adjacent to the site is high and therefore the site management has put in place a range of measures in the area of ‘<i>participative governance</i>’ to ensure valuable support of these local communities in the maintenance of OUVs. 25 Ecodevelopment Committees and Forest Protection Committees have been formed covering 32 villages and over 8500 families. Besides this, 112 Self Help Groups have been formed that include women. A number of income generating activities for the welfare of local communities are regularly implemented. The participatory governance measures along with alternative livelihood generation activities have been very successful in the maintenance of the OUVs of the site.</p>
<p>8. Education and interpretation programmes:</p> <p><i>How do the education, interpretation and awareness programmes you have developed and implemented significantly enhance the understanding of OUV of the site among stakeholders?</i></p>	<p>The Site has developed an ‘<i>Outreach</i>’ programme covering school and college going students, line departments, police and para military forces, corporate houses and media personnel through which conservation and awareness messages on natural heritage conservation are provided to various target groups at regular intervals. Street shows and village level theatre groups are very active in the site. School children are given tours to sensitize them about mangrove and tiger conservation.</p>

<p>Topics for demonstrating best management practice:</p>	<p>Please indicate in this column why your World Heritage property is a best practice in relation to the topic:</p>
<p>9. Tourism and interpretation:</p> <p><i>What innovative plans have you designed and successfully implemented to ensure that visitor management does not negatively impact on the maintenance of the property's OUV?</i></p>	<div data-bbox="813 285 1496 1197" data-label="Image"> </div> <p>Sundarbans has a very high level of visitation. In order to provide a good wilderness experience and to protect the resources, an ecotourism strategy has been developed and is being implemented in an effective manner by the site management. The entire Sundarbans has been declared as a 'No Plastic Zone' by an administrative order of the West Bengal Pollution Control Board. Waste generated at the patrolling camps and nature camps is sorted out and all recyclable wastes are sent to Kolkatta whole the other wastes is sent to an incinerator. Strict regulation and management of garbage generated by tourist boats and lodges is carried out. The site has trained and deployed 34 'Eco-guides', who accompany the visitors and provide on-site interpretation of nature and natural resources. In consonance with the Government of West Bengal Resolution No. 3841-For/DIIM-7/95 dated 25.06.1996, 25% of revenue received on account of ecotourism related activities and transportation activities are shared with Joint Forest Management Committees (JFMC) of the local communities. These innovative practices have paid rich dividends to the site.</p>

Additional comments:

The site Management is actively implementing a range of innovative management practices to secure the integrity and OUVs of the site as described above. At the same time the site has successfully implemented participatory governance. Innovative use of nylon net fencing has led to significant reduction in human-tiger conflicts.

Brief description/ summary of the best practice, including a statement on how it can be useful for other sites (max.600 words)

The major challenge in the management of human-tiger conflicts in the site is the straying of tiger into fringe villages and the rescue of the same without causing any loss/damage to either side. It is worth mentioning that site has an interface with 25 fringe villages on its north-western boundary and these villages are densely populated with human and cattle.

Many times it becomes possible for the staff and local villagers to drive the tiger back to the forest by using traditional methods of drums, crackers, fire etc. Sometimes the tiger also goes back to the forest on its own after spending some duration in these villages. These straying incidents are termed as '*Temporary Strayings*' and trap cage with live bait is sometimes also used to trap the tiger and then relocate in the forests.

In '*Permanent Strayings*', the tiger takes refuge in a cattle shed or inside any village hut, and chemical capture and tranquilization becomes the only resort to rescue the animal.

Tigers in Sundarbans stray into the neighbouring villages because they are situated in the reclaimed forest lands and in some places the boundary between the forest and agricultural land is also not distinct. Some villages have small patches of mangrove forests and the tiger enters into these forests by losing direction. Sometimes tiger swim and cross the small creeks to capture easy prey of cow and goat.

Over the years the site management has taken several actions taken to contain human-tiger conflicts by (i) stoppage of forestry operations; (ii) closure of issuance of permit for *Phoenix* and *Nypa*; (iii) digging of fresh water ponds and re-excavation annually; (iv) introduction of human face masks and clay models wrapped with energizers, which is charged to 230 Volts & 12 Volt battery source. But none of these measures have conclusively proved to be effective.







Fencing the boundaries of the vulnerable forest and villages areas by vegetative cover *i.e. Ceriops- Excoecaria* species and mechanical methods by nylon net fencing using *Avicennia* posts along the forest fringe has been found to be very effective. Both these fencings generally last for about three years. However, *Ceriops –Excoecaria* fencing is not encouraged now because it leads to a heavy toll of vegetation. Instead, the site management has introduced nylon net fencing with *Avicennia* posts. Further, to even reduce the use of *Avicennia* improvised Reinforced Cement Concrete (RCC) posts and Bamboo poles are being used. Although the initial cost of using RCC posts is high but the recurring expenditure is low.





Field observations indicate that tiger is able to negotiate the 8ft high fence by jumping over the same. Use of RCC posts and Bamboo poles can also help to erect the fence at a height of 10 – 12 ft. The normal mesh size remains as 4” X 4” to avoid any strangulation of wild animal like deer.



Presently, 54 km of forest fringes out of total 70 km has already been fenced and work on erecting the remaining fence is ongoing. As a result of this innovative management practice, the frequency of human killing and tiger straying have shown a distinct downwards trend.

Finally, please provide us, if possible, with up to ten images of the concerned World Heritage property that can be used free of rights in UNESCO publications (commercial and/or non-commercial), and on the UNESCO website. Please provide the name of the photographer and the caption along with the images (he/she will be credited for any use of the images).

S.No.	Photograph	Credit	Caption
1.		P.K. Pandit	Tiger in Sundabans
2.		Dr. Vinod B. Mathur	Mangrove Forests in Sundabans
3.		Anjan Guha	Alternate livelihood programme for local communities.
4.		P.K. Pandit	Training programme for frontline staff

5.		Anjan Guha	Mud Walk in Mangroves
6.		P.K. Pandit	Use of traditional masks for scaring the tiger
7.		Anjan Guha	Erection of nylon fence
8.		P.K. Pandit	Nylon fence with RCC posts