CHAPTER 4

BUNDALA LAGOON- ECOSYSTEM, PROBLEMS AND MANAGEMENT

Sri Lanka has more than twenty five wetlands which are considered as the most important wintering areas for migratory shore birds in south Asia. Bundala is one of the Sri Lankan wetland important for wintering the richest variety of waterfowl outside the Northern Province that also includes the greater flamingo, besides a large variety of dry zone terrestrial fauna. Bundala is also among the most important habitats for birds (southern-most land mass in migratory route) and other wildlife species in the entire country. Its importance led it to be declared as a Wildlife Sanctuary under the Fauna and Flora Protection Ordinance (FFPO) in 1969. It was declared as a Ramsar site in 1990. Bundala was upgraded to the state of a National Park in 1992 under the management of the Department of Wildlife Conservation. Bundala National Park is one of the three Ramsar site in Sri Lanka and is a unique coastal ‘wetland of International importance’. Till date it is the only wetland in Sri Lanka listed in the Directory of Wetlands of International Importance. The park also has remains of the ancient Magama civilization dating back to 2,400 B.C., and of the Hydraulic civilization which thrived until 1,300 A.D.

The Bundala wetlands are the system of series of five small lagoons and small man-made salt pans located in the Hambantota district in the Southern province of Sri Lanka. The five wetlands are Maha Lewaya (260 ha), Koholankala Lewaya (390 ha), Malala (650 ha), Embilikala (430 ha), and Bundala (520 ha). It is located between 6°08-6°14 North, 81°08-81°18 East. The three lagoons of Malala, Embilakala and Bundala are parts of Bundala national park while Maha Lewaya and Koholankala Lewaya are located west of the park and they are interconnected by a channel, which provides a direct link with the sea. The total area covered by these water bodies constitutes a little over one third of the Park. These lagoons are fed by surface run off, streams and rivers and inflow of sea water through the sand dunes. Malala and Embilikala are interconnected by a natural canal and are fresh to brackish. Malala lagoon has an opening to the sea, which is generally blocked by a narrow sand bar (DWLC 2005). Bundala lagoon with its own catchment area is the easternmost lagoon and has two opening to the sea. This lagoon is
Figure 4.1: Location map of Bundala Lagoons in BNP area of Sri Lanka

Source: Based on CEA, Wetland Site Report
bounded by sand dunes in the south while northern boundary has Kirinda- Hambantota main road. The intensive use of its resources today has led to its degradation and imposed great pressure that is incompatible with the aim to protect Park against further degradations.

4.1 HYDROLOGY

The most important parameter driving a wetland formation is its hydrology which also determines other two important parameters such as hydric soil and hydric vegetation (Kent 2001). The two lewayas of Maha and Koholankala are separate hydrological entity with a small catchment of about 912 ha. This results in little impact of run off on its hydrology. These two lagoons are important for salt production. Maha Lewaya is entirely used for salt production while only 25% of Koholankala is used for salt production. The two lagoons of Malala Lewaya and Embilikala Kalapuwa are also interconnected by means of a channel. The Malala Lewaya receives fresh water directly from the Malala Oya and indirectly from the Embilikala Kalapuwa. The Malala Oya is partly fed by drainage water from the Walawe multi-purpose irrigation development scheme and Badagiriya agricultural schemes (CEA 1993). Malala Oya carries drainage water and surface runoff from the Badagiriya agricultural system to the Malala lagoon. Malala and Embilikala lagoons receive fresh water from Lunugamwehera reservoir of the Kirindi Oya Irrigation and Settlement Project (KOISP). Tract 5, 6, and 7 canal provide fresh water to Embilikala lagoon. These two lagoons have fluctuation in inflow and salinity due to upstream storage and water use for irrigation purpose throughout the year.

Table 4.1: Hydrological Data for three drainage basins of the Bundala National Park

<table>
<thead>
<tr>
<th>Basin</th>
<th>Catchment (km²)</th>
<th>Volume of rainfall (MCM)</th>
<th>Discharge volume</th>
<th>Discharge % of rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malala Oya</td>
<td>404</td>
<td>434</td>
<td>74</td>
<td>17.0</td>
</tr>
<tr>
<td>Weligatta Ara</td>
<td>60</td>
<td>62</td>
<td>15</td>
<td>23.5</td>
</tr>
<tr>
<td>Kirindi Oya</td>
<td>1,178</td>
<td>1,606</td>
<td>476</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Source: DWLC, Colombo.
These discharges have nearly converted lagoons into near freshwater reservoir. It has also recorded variation in the water level between about +1 msl to about +2.2 msl. Embilikala lagoon has smaller catchment but lower salinity due to two reasons. First, excess water from the KOISP is channeled to the Embilikala lagoon and second, it is located further away from the sea thus leading to less sea water intrusion.

Diagram 4.1: Drainage system in Bundala Area


The Bundala lagoon outlet is generally blocked by sand barrier and the saltern and the largest part of the lagoon is separated from this outlet by an earthen bund. It receives storm water and excess irrigation channels commencing at the Weeriwala tank which itself is fed by Kirindi Oya Right Bank (RB) channels. These irrigation channels feed minor tanks and paddy fields in the north and north-eastern parts of the catchment area of the Bundala lagoon. An artificial opening has been carried out through the sedimentary sand- stone barrier (the dune ridge) from the lagoon towards the sea to evacuate water from the lagoon so as to avoid flooding of the salterns. This opening also gets blocked and needs breaching either manually or mechanically, especially in rainy season when rising water cause flooding in the upstream region (Ejik 2001).
4.2 CLIMATE

These lagoons are situated in the hot and dry climate with average annual rainfall of 1,074 mm. Highest average monthly rainfall occurs in November (190 mm). Rainfall mostly occurs in inter-transition period between the first inter-monsoonal period (March-April) and the south-west monsoon (May-September). The mean annual temperature is about 27°C with mean maximum and mean minimum temperature of 30°C and 24°C respectively (Piyankarage 2002). The lagoons are fringed by narrow strips of marsh land and are surrounded by slightly undulating terrain covered with scrub and degraded scrub forest.

4.3 GEOLOGY AND GEOMORPHOLOGY

The park area is made up of Vijayan complex. It is occupied by granite and gneiss and coastal belt contains a thin band of basal Ferruginous gravel deposits of the Quaternary age (Piyankarage 2002). Bundala National Park is divided into three relief features: the beach and sand dunes, outer coastal plains with lagoons and inner coastal plains. The sand dunes have a width of 50 to 300 m and rises on an average up to about 15 m elevation. It is broadest at Bundala Wellagangoda. The seaside slope of the sand dune is vegetation free, windswept while it gets stabilized at some places by Spinifex and Ipomea pes-caprae vines. The inland side of the dunes is vegetated with bush and trees normally showing lesser the effect of wind on their canopies. At several places there are rocky outcrops of the Vijayan complex (DWLC 1999).

These coastal lagoons were originated due to sea level rise in the Holocene period due to submergence by the sea, in the form of bays. In due course of time sand transport by streams and rivers formed sand dunes which are more or less continuous. The landside part of sand dunes drops abruptly towards lagoon. Lagoons bed consists of crystalline rock and land in between lagoon is of Miocene and post-Miocene origin consisting of fossil shells. The inner coastal plain is higher in elevation, steeper in relief and has absence of lagoons.
4.4 SOILS

Park Soils in beach and sand dunes consist of reddish-brown in color and the outcrops of elevated coastal rock have red latosol soil. The outer coastal plain with the lagoons is dominated by the post-Miocene coastal/marine alluvium with fossil shell deposits. Gently sloping land surrounding the lagoon have sandy soil on the top and clayey below. The inner coastal plain soils are poorly drained on flat surface to imperfectly drain on gently sloping lands.

4.5 FLORA

Bundala wetlands consist of salt marsh, mangrove, brackish water lagoon, fresh water holes and tanks, sea shore, streams and saltern. Lagoons are dominated by phytoplanktons like blue green algae such as Microsystis, Nostoc and Oscillatoria, while Embilikala and Malala abound in Hydrila. The Salt marsh is periodically inundated areas adjoining the lagoons having herbaceous salt tolerant plants like Salicornia brachiata and Halosarcia indica. Lagoon surrounding consists of very small and degraded patch of mangrove, consisting of single species- Lumnitzera racemosa. Bundala saline water holes and tanks harbours a few species of sedges, Cattail (Typha angustifolia), Hornwort (Ceratophyllum demerum) and pondweed (Najas marina). Sand dunes all along the coast show unique type of vegetation having capacity to withstand wind and dessication. The seaside part of sand dunes have species like Spinfex littoreus, Ipomoea pescaprae Azima tetracantha, Crinum spp. Dichrostachys cinerea and Crateva religiosa. The landside part doesn’nt has such capabilities. Some of the species are Cassia auriculata, Diospyros ferrea, Borassus flabelifer, Azima tetracantha, vernonia zeylinica, ranthium coromandalicum, Opuntia dellenii, Salvadora Persica Randia dumatorum and Randia malabarica (Bambaradeniya 2001). The gentle sea shore vegetation is the most widespread belt of coastal cover. This vegetation is found away from tide and wave action. They support carpet of densely growing creepers and small shrubs. Some of the species are Spinfex littoreus, Ipomoea pescapre, and Evolvulus alisinoides.
Figure 4.2: Bundala National Park Area

Source: Based on CEA wetland site report
4.6 FAUNA

The lagoons within the park are among the most important wintering ground for migratory shore birds in the country. More than 20,000 shorebirds are seen at a time which includes some rare species like Black-necked Stork (Ephippiorhynchus asiaticus). This park is also the wintering ground for Greater Flamingo (Phoenicopterus ruber), the last resort in Sri Lanka. The White-bellied Sea-Eagle (Haliaeetus leucogaster) and Brahminy Kite (Haliastur indus) are breeding residents. The Greater Flamingos are very sensitive to changes in salinity levels in lagoon which affects quality and quantity of food supply (Bambaradeniya 2001).

Bundala National Park also has large number of migratory birds with 58 species as winter migrants. Out of the total 197 species 139 are resident birds and rest winter migrants. The resident birds include 10 nationally threatened birds. The migratory birds stay in the park between August to April due to winter condition in the Northern Hemisphere. Large flocks of Greater Flamingoes, 1000 in numbers comes from Rann of Kachh in India. They have been found, around 350 in numbers to remain in the park year round without returning back to their native place. Greater Flamingoes use unaffected Bundala lagoon more than irrigation affected Malala and Embilikala Lagoon (Bambaradaniya 2001). Most common birding hotspot in Bundala are Embilikala lagoon northern border, southern border, Malala-Embilikala connecting channel, Malala lagoon, Bundala saltern, Bundala lagoon northern border and southern border, seasonal waterholes and grassland in Pathiraja, Kok-aria tank, No.1 tank, and Dry thorny scrubland.

The Bundala wetlands have 38 species of fish including salt water dispersants, marine forms, brackish water forms and freshwater forms. Salt water dispersants include Short finned Eel- Anguilla bicolor, marine forms include Naked head glass Perchlet - Ambassis gymnocephalus, brakish water form include Milk fish- Chanos chanos and freshwater forms like Murrel- Channa striata. Some of the abundant species in lagoons are Deep body silverbiddy (Gerres abreviatus), Otomebora mullet (Liza melinoptera) and the exotic Mozambique Tilapia.
The park is also a home of 48 species of reptiles which includes 13 species of nationally threatened reptiles. Different habitat of park harbours different species. There are marine, terrestrial, fossorial and arborial species. Marine species like marine turtles, freshwater (Flapshell turtle, mugger crocodile lissemys punctata, Crocodylius palustris), terrestrial (E.g., star tortoise, Cobra, Geocheleone elegans), fossorial ( E.g., Skinks, Common Blind Snake –Ramphotyphlops braminus) and arboreal (E.g., Geckoes, Green Vine Snake – Ahaetulla nasutus) habitats. Bundala national park has the largest reptiles in Sri Lanka; the two species of crocodiles (Crocodylus palustris and C. porosus), the Indian Python (Python molurus) and the Leatherback turtle (Dermochelys coriacea). The serpents here include three highly venomous species in Sri Lanka; the Cobra – Naja naja, Russell’s viper – Daboia russellii and Saw-scaled Viper – Echis carinatus (Bambaradaniya 2001).

Bundala has also 15 species of amphibians which is almost 25% of the total amphibian species recorded in Sri Lanka. The amphibians include toads, narrow-mouthed frogs, common aquatic frogs and tree frogs. It has 32 species of mammals. Elephant, Grey langur, Black-naped hare and water buffaloes are most commonly found here.

4.7 COMMUNITY PROFILE OF BUNDALA NATIONAL PARK

Bundala National Park lies in Hambantota district, which is one of the poorest regions. Villages surrounding BNP in Tissamaharama, Weeravia and Hambantota DS divisions are the most underdeveloped areas in the administrative divisions. Livelihood of these village communities include paddy cultivation, cattle rearing, fishing (lagoon & coastal) and labour work in salterns. Traditional employment like prawn harvesting in lagoons, turtle egg collection, slaughter of turtle for flesh and shells for traditional crafts have been controlled through law enforcement. Non timber forest product is not being harvested inside the Park.

Surrounding areas of the park have growth rate of 11 % in family and 18 % in population which is higher than the average rate of population growth. For country growth rate is 4 % for family and 6 % for population. So, this area is witnessing a significant rise in population growth rate. The infrastructure improvement in this area especially in Hambantota- Tissamaharama has contributed to increase in value of the land in the
Roadside and business activity have grown. This increased demand for the land would have negative impacts on the BNP, in the form of business and residences along the main road sharing boundary with BNP. The new boundary demarcation along the main road from Hambantota to Tissamaharama, has excluded land area where settlement are established. This area has been used by the locals for establishing guest houses, boutiques and hotels for tourists. These people could encroach on the BNP land and also could exert pressure on the BNP. Land area of about 20 acres on the BNP limits is owned by Divisional Secretary of Hambantota. The Divisional Secretary of the area had allocated the land for a Tsunami housing programme in 2005. DWC has intervened and got the court order to stop the construction of houses (DWLC 2007).

Table 4.2: Population and poverty data in the bordering villages

<table>
<thead>
<tr>
<th>Villages</th>
<th>Families</th>
<th>Population</th>
<th>% of poor families in villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundala</td>
<td>196</td>
<td>739</td>
<td>24.4%</td>
</tr>
<tr>
<td>Pallemalala</td>
<td>428</td>
<td>1498</td>
<td>23.59%</td>
</tr>
<tr>
<td>Julgamuwa</td>
<td>285</td>
<td>985</td>
<td>81.66%</td>
</tr>
<tr>
<td>Bandagiriya</td>
<td>385</td>
<td>1407</td>
<td>40.77%</td>
</tr>
<tr>
<td>Yahangala W</td>
<td>308</td>
<td>1156</td>
<td>33.76%</td>
</tr>
<tr>
<td>Siriyagama</td>
<td>292</td>
<td>1262</td>
<td>17.12%</td>
</tr>
<tr>
<td>Koholankala</td>
<td>438</td>
<td>1540</td>
<td>32.42%</td>
</tr>
<tr>
<td>Magama</td>
<td>281</td>
<td>1395</td>
<td>40%</td>
</tr>
<tr>
<td>Andaragasyaya</td>
<td>542</td>
<td>2381</td>
<td>30.25%</td>
</tr>
<tr>
<td>Nedigamvila</td>
<td>332</td>
<td>1185</td>
<td>45.78%</td>
</tr>
<tr>
<td>Konvelena</td>
<td>349</td>
<td>1645</td>
<td>58.45%</td>
</tr>
<tr>
<td>Vijayapura</td>
<td>268</td>
<td>1041</td>
<td>52.61%</td>
</tr>
<tr>
<td>Saliyapura</td>
<td>286</td>
<td>1509</td>
<td>26.92%</td>
</tr>
<tr>
<td>Gonagamuwa</td>
<td>278</td>
<td>1285</td>
<td>61.88%</td>
</tr>
<tr>
<td>Tissapura</td>
<td>646</td>
<td>2529</td>
<td>24.45%</td>
</tr>
</tbody>
</table>
Currently main livelihood activities undertaken by surrounding communities are paddy cultivation, cattle rearing, fishing and as labourer in salterns. In agriculture, paddy cultivation is most important and most of the paddy land is situated in higher elevations of the wetland area of the BNP. Water availability has not been affected for the paddy lands by conservation plan, so there is no conflict presently for water between required for agriculture and paddy cultivation and water requirement of the Bundala Park. Currently paddy land of about 5 acres in Bundala village has been moved within the BNP boundary, and the rest of the paddy area has been excluded from the BNP by the gazette notification of 2004 (DWLC 2007).

Irrigation water used from paddy land and run off water from the surrounding paddy fields supplied by Lunugamvehera irrigation system are diverted through lagoons and collected in Embilikala and Malala lagoon. This has resulted in siltation and dilution of brackish water of lagoon, disturbing the BNP management plan. The surrounding villages are extensively dependent on livestock rearing. Hambantota district has largest number of livestock in the country so people are dependent directly or indirectly on livestock rearing. It provides employment to around 2500 people. Bundala National Park is used for cattle grazing and this is a major concern for park management (DWLC 2007). There is large scale grazing by stray cattle which has been trained to enter the Park in the morning and return home in the evenings. They compete for fodder with wildlife; destroy grasses, spreads diseases to wildlife residents, lagoon pollution and siltation from cattle dung with runoff water, and affecting value of national park and decrease of aesthetic value of the park to the visitor (DWLC 2007).

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
<th>Households</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeravila</td>
<td>223</td>
<td>772</td>
<td>57.84%</td>
</tr>
<tr>
<td>Weligatte</td>
<td>48</td>
<td>264</td>
<td>58.82%</td>
</tr>
<tr>
<td>Rambukwewa</td>
<td>410</td>
<td>1525</td>
<td>27.65%</td>
</tr>
<tr>
<td>Kirtipura</td>
<td>120</td>
<td>552</td>
<td>23.33%</td>
</tr>
<tr>
<td>Yahangala E</td>
<td>351</td>
<td>1220</td>
<td>35.05%</td>
</tr>
<tr>
<td>Total</td>
<td>6097</td>
<td>25890</td>
<td></td>
</tr>
</tbody>
</table>

Source: DWLC, Colombo
Fishing is one of major livelihood opportunities for surrounding communities. Lagoon fishing is an important activity for some family while some engages in both lagoon as well coastal fishing. Three lagoon areas namely Bundala, Malala and Embilikala and five coastal fishing areas related to BNP are used for fishing purposes. Lagoon fishing has increased in the border villages. Presently there are around 365 families have engaged in lagoon fishing and generated employment for 1200 people.

**Table 4.3: Number of fishing families**

<table>
<thead>
<tr>
<th>Villages</th>
<th>Coastal Fishing Families</th>
<th>Lagoon Fishing families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundala</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>Magama</td>
<td>10</td>
<td>04</td>
</tr>
<tr>
<td>Siriyagama</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Welgatte</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>Uda Malala</td>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>Pallemalala</td>
<td>60</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>364</td>
</tr>
</tbody>
</table>

Source: DWLC, Colombo

Fishing is likely to increase as boat distribution after Tsunami has increased number of boats plying into the lagoons which is likely to be used for fishing in near future. Unauthorized entry of fishing families have been reported despite law enforcement by BNP. Even in the night fishing is taking place by the village fisherman of Pallemalala and Bundala who enter the lagoon from roadside.

Income from coastal fishing is seasonal. some communities get access to the coastal fishing areas of BNP through seaside. Outside fisherman also engage themselves in turtle poaching and turtle egg collection. Fishing is interfering in the management of the BNP as reports of turtle killing, crocodile killing, and bird poaching has been reported. Increased demand of fish in the market has led to overfishing and thus affecting lagoon ecosystem. The regulatory measures imposed by BNP are not adhered by fisherman. There has been some improvement in the ecosystem of lagoon in recent times due to
steps taken by Hambantota Divisional Secretariat. Cleaning of malala lagoon with the help of UNDP-GEF assistance has shown positive results. Improvements like removal of invasive plants in the outer boundary of the lagoon, removal of garbage in the lagoon, release of fish in the lagoon and construction of sluice gate to the canal are some work done on the lagoon. Construction of sluice gate aims at managing the water level of the lagoon preventing the flush off of the influx of rainwater to the sea during rainy season. This sluice gate construction has led to change in the water quality of Malala lagoon to turn more fresh water. The natural flush off taking place yearly in the rainy season from the lagoon mouth is now disturbed due to construction of the canal and the sluice gate. This change in the water could impact on the lagoon ecosystem and the diversity of the water life in the lagoon (DWLC 2007).

In traditional livelihood practices turtle egg collection is practiced in unnoticed manner while timber or firewood collection is controlled by law enforcement. Commonly, about 100 families are engaged in firewood collection for domestic use. The conservation management plan has stopped the sand mining and shell mining which were the traditional livelihoods of the villages of Bundala, Pallemalala and Weligatta. People engaged in this vocation have engaged themselves in alternative vocations.

4.8 THREATS TO ITS ENVIRONMENT

Bundala wetlands are facing a range of problems in recent times. Some of these problems are arising out due to degradation of wetlands itself, while others as a result of degradation in the surrounding Bundala national park area. There are several anthropogenic and biological factors for this deterioration. These factors are habitat deterioration, direct exploitation of species, prolonged drought and spread of invasive alien species.

Habitat deterioration of Bundala lagoon are due to shell mining, discharge of irrigation water into the lagoon, driving of vehicles off the recommended tracks, release of sludge from Bundala lagoon, damage caused by driving motor vehicle in sensitive areas and death of Manikara Hexandra trees in the arid zone forest. Shell mining has resulted in the degradation of scrubland areas. It’s performed for its use as house construction lime,
selling for chicken feed supplement and for ceramic industrial use. Fossil shells are extracted from beds found just beneath the ground surface. It’s shifted, washed and either sold as shells or burned and sold as lime, mainly to Ceramic Corporation. This activity use to be environmentally destructive because it disturbs the soil structure destroys the vegetation cover and leads to increased soil erosion and is aesthetically undesirable. Department of Wildlife and Conservation has checked it to some extent through frequent raids and legal actions (DWLC 2005).

Irrigation water discharge is another reason for the lagoons habitat deterioration in current situation. Ancient irrigation practices didn’t have that destructive effect as it is by current practices. Agriculture is the most important economic activity in upstream of Bundala wetlands. Irrigation in the surrounding paddy land was through five ancient tanks (i.e. Debarawewa, Pannegamwawewa, Tissawewa, Weerawilawewa, and Yodawewa) which are fed by Kirindi Oya. The drainage water was diverted back to the Krindi Oya minimizing the possible impacts of drainage on the Bundala lagoon system (Piyakaraje 2002). Kirindi Oya Irrigation and Settlement Project (KOISP) increased the irrigable land area from 4,200 ha to 10,450 ha. The areas irrigated by the Right Bank main canal are tract 1, tract 2, tract 5, tract 6 and 7. The excess drainage water from tract 5, tract 6 and tract 7 is discharged into Embilikala lagoon. The Malala lagoon received fresh water through Malala Oya. The Right Bank Main Canal extention into Badagiriya tank, which was earlier fed by Malala Oya has increased its capacity to irrigate agricultural lands.

The excess irrigation water from this tank is diverted into Malala Oya (Badagriya drainage) that discharges into the Malala lagoon. Increased water discharge has resulted into significant decline in salinity levels. Reduced salinity level has effected prawns breeding potentiality negatively along with other aquatic fauna. Residues of fertilizer and pesticides used in agriculture upstream and brought by drainage system have changed the character of wetland ecosystems. Malala and Embilikala lagoons were mesotrophic eutrophic for nitrate and hypertrophic eutrophic for phosphates. The perceived impact of drainage water from tract 5, 6, and 7 of the Lunugamwehera Right Bank and the Badagiriya irrigation schemes on Bundala wetlands are; decline in shrimp and fish population, change in trophic status, extinction of species and changes to habitat
Figure 4.3: Areas of elephant migration and its impact areas

Source: Adapted from DWLC PAMWCP, 2007
diversity, economic and social impacts due to reduction in eco-tourism and fishery and loss of genetic stock (Piyankarage 2002). Sludge deposition by Bundala salt company into Bundala lagoon has also affected its water quality. This has led large number of fish dead and reduced the bird diversity.

Tourism has also affected its environment as private vehicles driven by tourists often drive off the track, damaging small vegetation and animals. Sand dunes in particular are affected.

Direct exploitation is another threat which includes poaching, felling of trees, fishing etc. Poachers come in disguise manner, as fisherman and poach water birds. The public road inside the park boundary makes regulation difficult. Poachers also collect turtle eggs along the coastline (DWLC 2007). This coastline has five types of turtles laying out here.

Turtle egg poaching by both human and animal is a major problem. Turtle conservation programme is under way since 2001 in collaboration with peripheral communities which has reduced human predation but wild boar predation is still going. Volunteers have been employed to patrol coast stretches but habituated animal has not been able to stop.

Felling of trees is another problem in boarder areas. Timber species like Manikara hexandra, Drypetes sepiara and Tamirandus indica are some of the trees subjected to illegal extraction in these areas.

Fishing activities carried in the lagoon continues without any regulatory mechanism. Cattle grazing are another problem. Around 3000 to 4000 cattle and more than 5000 buffaloes roam around in the Park presently. Cattle and buffaloes pose threat to wild herbivores such as deer and elephants, by competing for food resources. Dung washing and urine accumulation in lagoon has resulted into increase in nitrate percentage in lagoon water. This has led eutrophication. Soil erosion due to treading is significant in dry season. These lead to growth of invasive Prosopis. Alien species like Prickly cactus (Opuntia Dillanii) and Mesquite (Prosops Juliflora) have spread throughout the park displacing native plants and wildlife habitats. They have been fund to co- occur, with Prosopis dominating the canopy and Opuntia occupying the undergrowth. Native plants such as Salvadora Persica and Cassia Auriculata have been displaced by spread of mesquite (DWLC 2007).
Figure 4.4: Impact areas of Cattle grazing in nearby areas of Bundala National Park

Impact areas of cattle grazing

Legend
- boundary
- wetland
- land area released by 2004 gazette
- scrub
- paddy
- built-up area
- forest
- secondary cattle grazing areas
- Primary cattle grazing areas
- sand

Source: Adapted from DWLC PAMWCP, 2007
There is the report of Palu tree (Manikara Hexandra) die back in last few years. These are of different size categories. Plant disease and pathogens like Ganoderma infection and tree canker are the most important reason. High Nitrogen content in leaves, threat imposed by invasive plant species and animal activities seem to act as pre-disposing factor and favor the occurrence of plant diseases in the area. In addition, prevailing demographic and environmental stochastic ties may encourage plant disease outbreak and spread (DWLC 2007).

Its beach is subjected to large scale drift pollution as a result of existing ship lane offshore. Ships plying offshore unload waste and oil, eventually washing ashore along the beach. Garbage washed ashore from town and brought by fisherman are some other problem being faced by the lagoon.

Another problem being faced by this Park is due to unplanned land use practices. Banana and paddy cultivation in its surrounding area has resulted into increased raid by the elephants and other wild herbivores, which are in turn harassed by peasants.

Varying impact of recent Tsunami has been observed in the wetlands environment. Sand dunes and its associated floral varieties and scrubland have been affected at varying levels. Ipomea pescapre and Spinifex littorina communities have been badly affected to the extent of three fourth of their cover. Kirindi Oya river mouth has observed destructions of coastal scrubland. Mangroves have been destroyed in the Bundala National park. Sand bars formed across river mouth have been breached by tsunami waves and has penetrated deep inside the lagoons. Malala lagoon in particular has been affected where large number of fishes died. Bundala National Park and Bundala village were protected by sand dunes which are 8 meter high and 50 to 300 meter wide. In fact sand dunes protected as well as absorbed much of tsunami energy (Wickramagamage and Ram Alagan).

Illegal entry for shell mining and poaching is the main infringements in Bundala National Park. Lack of staff necessary to manage is the major problem in law enforcement.
Table 4.4: Illegal detection figure from 1998 to 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Shell mining</th>
<th>Turtle egg collection</th>
<th>Poaching</th>
<th>Plant Destruction</th>
<th>Encroachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>02</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>05</td>
<td></td>
<td>02</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>2000</td>
<td>04</td>
<td></td>
<td>02</td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>2001</td>
<td>01</td>
<td>01</td>
<td>02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>02</td>
<td></td>
<td>02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>01</td>
</tr>
</tbody>
</table>


The future Development issues like settlement of persons in block 3 and 4 by Kirindi Oya Irrigation and Settlement Project (KOISP) or the Lunugamvehera project are planned. It is proposed to be annexed to the Park. Other development programmes like, in the north, the Walawe Left bank Project will bring cultivation and land use changes to the border along the main road. Similarly the planned Ruhunupura Mega City Project, inclusive of Harbour, Oil refinery, industrial city and major township developments will fill in the land area, north of the present road. All these activities are likely to make Bundala more isolated and subject to greater pressures of anthropogenic actions (DWLC 2005). In spite of these entire problem Bundala National Park is high on the agenda of tourist, both foreigner and inland tourist. It earns annual revenue of Rs 6 million. The Park has still the potential to revive a substantial part of its coastal wetland. This needs cogent and steadfast restorative management, backed by enhanced staff, infrastructure and investments. It is in this respect that some restorative effort has been carried out in the past and is still being carried.
Figure 4.5: Possible areas for encroachment’s, settlements and road development in BNP

Legend
- road development pressure
- main road
- wetland
- land area released by 2004 gazette
- proposed boundary area for acquisition
- pressure area for encroachment
- pressure of housing
- boundary 1

Source: Based on DWLC, PAMWCP map, 2005
The GEF project and subsequently ADB project had following objectives:

1. To conserve physical environment, biodiversity and archeological values of the Bundala coastal wetland ecosystem.

2. To effectively manage the scrub-grass habitat and conserve its flora and fauna in a manner as not to adversely influence the values of coastal wetland.

3. To ensure effective protection of the habitat, flora and fauna of the park.

4. To facilitate sustainable ecotourism with the aim of higher economic productivity for the State and local people.

5. To involve community in the development of alternative packages of eco-development measures capable of socio-economic amelioration, while eliciting their support in the restoration and enhanced conservation of the park's natural ecosystem.

**Relationship between problems and objectives**

Various problems faced by wetlands hinder the attainment of objectives set out by different plan. In an analysis of the relative gravity of these adverse relationships between the objectives and the problems, each of the five 'objective groups' identified above has been assigned a visualized value as its 'significance factor' on a scale of 1 to 6, commensurate with its relative importance.

**Table 4.5: 'Significance factor' values of Management Objectives**

<table>
<thead>
<tr>
<th>Objective group</th>
<th>Significance of Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Conservation of biodiversity of the coastal Wetland ecosystem</td>
<td>6</td>
</tr>
<tr>
<td>B Effective management of scrub-grass habitat</td>
<td>2</td>
</tr>
<tr>
<td>C Effective overall protection</td>
<td>5</td>
</tr>
<tr>
<td>D Sustainable ecotourism</td>
<td>3</td>
</tr>
<tr>
<td>E Ecodevelopment with community participation</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Adapted from GEF report
In the similar way, each of the problems has been graded on a scale of 1 to 3 for degree of hindrance it is seen to offer for each objective group. The degree of hindrance is taken as zero where no relationship is perceived to exist between an objective group and a problem. The product of multiplication of the significance factor of an objective group and the hindrance value of a particular problem for that objective group denotes the 'hindrance threat' faced by that objective group from that problem. A matrix of the hindrance values' of the different problems for different objective groups can be seen from following table.

Table 4.6: Matrix of problem vis a vis management Objectives

<table>
<thead>
<tr>
<th>S. No</th>
<th>Problems</th>
<th>Each problem graded on hindrance scale of 1 to 3 vis a vis the affected objective group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Objective</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>Boundaries not compatible with National Park status</td>
<td>2x6</td>
</tr>
<tr>
<td>2</td>
<td>Diversion of tree from five lagoon and high disturbance from salt manufacture</td>
<td>3x6</td>
</tr>
<tr>
<td>3</td>
<td>Illegal shell mining</td>
<td>2x6</td>
</tr>
<tr>
<td>4</td>
<td>Poaching of sea turtle egg</td>
<td>1x6</td>
</tr>
<tr>
<td>5</td>
<td>Cutting of native trees for firewood</td>
<td>1x6</td>
</tr>
<tr>
<td>6</td>
<td>Fishing in lagoon by local fisherman</td>
<td>2x6</td>
</tr>
<tr>
<td>7</td>
<td>Local fisherman using park beaches as bases for near shore deep sea fishing</td>
<td>1x6</td>
</tr>
<tr>
<td>8</td>
<td>Excessive freshwater flushing into Malala and Embilikala lagoons</td>
<td>3x6</td>
</tr>
<tr>
<td>9</td>
<td>Artificial openings to sea of Bundala and Malala lagoos</td>
<td>2x6</td>
</tr>
<tr>
<td></td>
<td>Problem Description</td>
<td>x1</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>10</td>
<td>Heavy livestock grazing in absence of alternative</td>
<td>2x6</td>
</tr>
<tr>
<td>11</td>
<td>Spread of exotics due to excessive livestock grazing</td>
<td>1x6</td>
</tr>
<tr>
<td>12</td>
<td>Elephants cause damage to crops and property</td>
<td>1x2</td>
</tr>
<tr>
<td>13</td>
<td>Shortage of staff undermines efficacy of protection and management</td>
<td>2x6</td>
</tr>
<tr>
<td>14</td>
<td>Utter lack of road network for protection and management</td>
<td>1x6</td>
</tr>
<tr>
<td>15</td>
<td>Utter lack of buildings for protection and management</td>
<td>1x6</td>
</tr>
<tr>
<td>16</td>
<td>Lack of vehicles and equipment undermines protection and management</td>
<td>1x6</td>
</tr>
<tr>
<td>17</td>
<td>Lack of roads and infrastructure hampers regulation of tourists excursion and undermines visitor experience</td>
<td>1x5</td>
</tr>
<tr>
<td></td>
<td>Degree of threat score of Objective groups</td>
<td>150</td>
</tr>
</tbody>
</table>

Source: Adapted from GEF report

The total of all 'hindrance values' accumulated by a problem is its hindrance score or its overall severity. The last column of the table shows 'hindrance ranking' of the different problems. Similarly, the 'degree of threat' faced by a particular objective group is indicated by the total score it has accumulated in the bottom row of the table. It's evident from the above table that Objective group A i.e. 'Conservation of the biodiversity of the coastal wetland ecosystem' is the most threatened and 'shortage of staff' which undermines all the objectives has attracted the maximum 'Hindrance score' of 40 and emerges as the severest problem. Second most important problem facing are (hindrance
score 35) two problems viz. “excessive freshwater flushing of lagoons” and “Heavy livestock grazing” which together undermine both the wetland and the scrub-grass habitats. This analysis has helped in the preparation of management plan by GEF as well as ADB.

The above table makes it clear that all those problems which directly hinder protection and management have attracted the highest ‘hindrance scores’ viz. no. 13, 8 & 10, 16, 14 and 1 & 2 respectively receiving scores of 40, 35, 34, 32 and 30. This analysis emphasizes the need of greater inputs by way of staff, infrastructure and equipment, which are woefully low at present. Habitat and community related issues are relatively more attainable, however it requires the DWLC to be able to direct the required effort and resources. It also makes the priorities discernable.

4.9 MANAGEMENT OF BUNDALA

4.9.1 Establishment and purpose of the Park

The area of BNP has been used for centuries by community living in its vicinity for their livelihood. For centuries, before the Bundala Park was declared as a sanctuary, it was used by community in the vicinities for their livelihood. The activities included slash and burn cultivation, cattle rearing, prawn and lagoon fish harvesting, collection of turtle eggs, slaughter of turtle for meat, use of coastal area for camping sites for coastal fishing, collection of non timber forest product, sand, and shell mining, coral mining, felling trees for timber and firewood and many other home based activities that contributed to the household income of the resident families of the area.

The area was declared as a Wildlife Sanctuary under the FFPO in 1969, mainly because of its diverse and abundant birdlife. This led to restriction being imposed on free access to the parkland and use of the park for their livelihood activities. The system of lagoon in the sanctuary was designated as a Ramsar Site (an internationally important waterfowl habitat), and the area was upgraded to a National Park in December 1992. With this legislation all other use activities except lagoon fishing and tourism are, conditionally, permitted. Cutting of trees for timber and firewood was completely banned, while hunting and poaching have become punishable offences with high penalties. Cultivation inside
the Park and use of land resources for residential purpose has become unlawful and the use of parkland for mobility and transport with free access has been restricted. However, enforcement of rules and regulation has not been a viable option so far due to inadequate number of posted staff, ambiguous conservation policies and management, lack of transport and equipment and low penalties which have to be paid in case of infringements. The gazette notification of 1999 included land area including village lands in BNP. The villages namely Bundala Siriyagama, Saliyapura, Vijayapura and Udupila and Gonagamuwa fell within the boundary of the BNP. Community protests and representation led the authorities to redraw the boundaries of the BNP in 2004 under gazette notification.

4.9.2 An Early history of Management

Bundala lagoons have been affected by human interference for centuries. Prior to 2nd and 3rd century freshwater used to enter into lagoons unimpeded. Rainwater used to be retained in uplands from which it was released gradually. The construction of numerous clusters of tanks and other water impounding structures, reduced inflow of freshwater into the lakes and the salinity in lagoon was increased. The collapse of ancient irrigation practices, made the tanks abandoned and the entire catchment area was covered with jungle again. Revival of the irrigation system in the recent past again altered the areas of hydrology. Large extent of forest clearing increased direct run-off which led to seasonal peak inflow into the lagoon and relatively large fluctuations in water and salinity level (CEA 1993).

Large forest clearings have taken place with the creation of large irrigation schemes such as those at Ellegala during 1925. Several administrative agencies in one way or another way are involved with the Park area at different levels. These agencies are like Southern provincial council and other local administrative authorities, Department of Wildlife Conservation, Coast Conservation Department, Fisheries department, Irrigation Department, Lanka Salt ltd etc. Most of the land in the park is State owned. This also has some privately owned lands along the Hambantota-Weligatta highway and in the eastern sector of the Park, though national Park status does not allow it. The major influencing event that has taken place outside the Park area is Kirindi Oya Irrigation and Settlement
Project (KOISP). It is second largest settlement project in the country and single largest development project in the Southern Province.

Its National Park status and 'Wetlands of international importance' restricts access, human use etc. as per the provision of the Fauna and Flora Protection Ordinance. However the practice such as salt making, residing in the saltern complex, cultivation, grazing of domesticated livestock and fishing, besides unauthorized mining of shells etc. are prevalent in the Park. The private lands which then existed should have been either excluded from the National Park or acquired. Though there exists legal provision yet the flaws and the ineffective enforcement of the law has contributed to the existing poor state of affairs.

4.9.3 CEA Wetland Management Plan

Importance of Bundala National Park and its biodiversity has called for management of the Park. In 1993 Central Environment Authority (CEA) carried out Wetland Conservation Project (WCP) for Bundala National Park under the Conservation Management Plan (CMP) in close cooperation with Department of Wildlife Conservation (DWLC). CMP had three priority areas. The first priority area included activities which if not carried out, would either lead to serious further degradation of the area or seriously impede starting up of other activities (CEA 1993).

Activities included were land use and boundary survey, boundary review and signposting, review of development plans, zoning, agency and public awareness creation, staffing, equipment and patrolling. The achievement under this priority area was new (draft) boundary agreed, base map prepared, a conceptual design prepared for development of exhibition material for multipurpose Park Center. Second priority area included activities that do not prevent further degradation of marsh, nor considerably improve condition, but generally support conservation. The activity included under this was infrastructure development, Development of a buffer zone plan, revenue levying, Elephant-human conflict resolution and research. However, no achievement in this regard in plan period could be achieved. Third priority included activities that considerably improve the habitat, conditions for wildlife, and tourism potential. Actions included were
tourism development, livestock grazing control, fuel wood collection control, and vegetation control and tree planting. The achievement were only with regards to fuel wood collection in which some community awareness programme could be initiated (CEA 1993).

4.9.4 GEF funded Bundala Management Plan

CEA conducted WMP could not be implemented in totality and so GEF funded Bundala management plan was started in 1997. The management goal of GEF project were to conserve for posterity the physical environment, biodiversity and archeological values of the Bundala coastal wetland ecosystem, to effectively manage the scrub-grass habitat and conserve its flora and fauna in such a manner as not to adversely influence the values of the coastal wetland, to ensure effective protection of the habitat, flora and fauna of the park, to facilitate ecotourism and to evolve and implement with the local stakeholders participation alternative packages of measures which would ensure that while the ecosystem features are maintained the people are able to meet their bonafide biomass resource needs. In 1995 a detailed survey was conducted to remove the incompatibility brought by declaring existing sanctuary into national park. The boundary on west, north and the east was redefined, covering the entire length of the artificial boundary other than the firm southern boundary formed by the seacoast. The revised boundary would exclude all private and leased out land. It called for creation of Embilikala Nature Reserve (ENR), Bundala National Park and Weligatta Sanctuary. As fishing is not allowed in the National Park, largest water spread area (Embilikala lagoon) could be downgraded to Embilikala Nature Reserve. It was proposed to reconstitute the area in the manner that, reconstituted BNP (proposed) would have 33.24 sq km., Embilikala Nature Reserve (3.21 sq.km.) and remaining sanctuary 20.21 sq. km (DWLC 2001).

This management plan tried to address the entire area of existing, notified BNP and it’s identified zones of influence, in a pragmatic approach responsive to the ground realities. This plan thus recognized somewhat reduced area broadly confirming to the proposed, surveyed area of 1995-1996 as the area fit to be managed with the status of a national park. It called for formation of weligatta sanctuary for protection and eco-development while conservation value would not be prominent. The National park and Nature reserve
had to comprise for habitat management. The part of Bundala salt complex was to be included in habitat management zone (DWLC 2001). Three management zones were thus identified: The Habitat Management Zone (HMZ), Ecodevelopment Zone (EDZ) and Tourism Management Zone (TMZ).

Habitat Management Zone (HMZ): The entire area of the reconstituted BNP and the proposed Embilikala Nature Reserve (ENR) as well as the Bundala salt complex was included under HMZ. The two different habitat types, the wetlands and the scrub-grass bearing areas needed different treatments and thus divided into wetland sub-zone and the Scrub-grass Sub-zone.

Ecodevelopment Zone (EDZ): Its delimitation was to be guided by two main local demands viz. pastures for livestock and firewood. The post reconstitution area of the sanctuary itself would form part of the EDZ. This would expand just 2 km further beyond northern boundary of post reconstitution sanctuary and would also include scrub grass north of Koholankala lagoon. This is because the other main stakeholders are the fishermen who are mostly the residents of this area and their activities lie inside the area. This zone does not need to be defined.

The third zone the Tourism Management Zone (TMZ): Tourism need to be managed in order to increase the carrying capacity and visitor satisfaction by handling constraints with concern for conservation and is innovative in designing alternative measures. The TMZ covers most of the area between Koholankala and Bundala lagoons. This includes road network, the trail alignment and the siting of camp sites etc. to be in confirmation with strategy outlined above. Criss-crossing by a number of tracks formed by unregulated movement of tourist vehicles is a concern for park management already. Sand dunes are highly prone to erosion and its destabilization by lying off roads may cause destabilization of coast.

Habitat Management zone management measures are guided by following objectives: restoration of hydrology with respect to the freshwater inflows as well as the intake of seawater into lagoon to rehabilitate the natural salinity regime, restoration of water depth regime in the lagoon, elimination of livestock grazing from the net reduced area of the
BNP and the ENR, which constitute HMZ, and suppression of weeds and exotics in the scrub-grass habitats.

Coastal wetland sub-zone aimed at restoring the natural character of the lagoons, as far as possible and minimizing the disturbance of the beaches. Information on habitat particularly the food requirement of resident and migrant waterfowl, fish and invertebrate fauna and the environment conditions for the benthic flora and fauna is critical for management decisions. Lagoons and salterns are heavily used in the Northeast monsoon time due to food availability. Restoration of lagoon along with seasonal potential is a major factor in making management decision. The parameters like salinity of water, depth of water and contact of lagoon with sea, seasonality of water body, status of eutrophication and variation of attributes in salterns during rainy season and post-monsoon have the capacity to restore the lagoons.

The portion of Bundala lagoon under salt manufacture would have to be spared from any wildlife management intervention yet the industry needed to observe the management regulation as not to affect their work and yet necessary for salterns to discharge their conservation function. The conservation segment needed to be treated for their maintenance of optimum salinity and water depth regimes through the year. Another important requirement would be to revive their contact with the sea during NE monsoon (DWLC 2001).

In years of low rainfall Bundala shall have to receive freshwater in seasonally modulated measures which can only be ensured through pumping freshwater from Embilikala in a regulated way. The most economical and compatible manner would be to use windmill lift as is being done by the salt industry in Koholankala. The intake of seawater from the natural seepage across the sandbar formed at the artificial sea out-fall is expected to be sufficient. No intervention to augment the inflow of seawater is being proposed. It involves breaking of the natural sand bar by floods in the NE monsoon. This phenomenon has ceased to occur in all BNP lagoons including Bundala because of reduced intensity of floods from use of rainwater in the catchment and a deeper cut artificial opening to the sea. The artificial opening has been made to serve the salt industry, which has monopolized the natural sandbar, necessitating thereby another
opening for evacuation of the floodwaters. This has led to Bundala losing its natural water depth regime as well as the contact with the sea. Mouth of a natural lagoon occurs where the rock shelf separating the lagoon and sea is quite narrow and low. It enables sand bars to form on the narrow shelf by wave action giving rise to a low embankment susceptible to get breached by heavy floodwater or by fisherman. The cut for Bundala's artificial sea out fall occurs across a narrow rock shelf. A sandbar has thus formed which could be breached manually.

The Embilikala and Malala natural-link channel would be closed by an earthen embankment with an iron sluice gate so as to allow desired inflow into Malala. A new channel would also be constructed from Embilikala direct to the sea, so that water depth is maintained confirming to the present regime found favorable to the fisherman. This channel needs to have an iron sluice gate in order to control the water depth in the lagoon (DWLC 2001). Opening up the inlet from Embilikala can possibly facilitate the contact with sea. Water can be raised by a simultaneous closure of the sluice gate of the outflow channel. Contact with sea could be facilitated by manual breaching of the sandbar especially in NE monsoon period.

In Koholankala lagoon salt company has prevented entry of freshwater into the conservation segment of this lagoon by digging a wide ditch along the roadside. Purpose behind the ditch operation was to borrow earth to raise a bund to isolate the salterns and also isolate the salterns from freshwater inflow. It is important to provide an opening from this bund into conservation segment. GEF plan provides for laying an RCC pipe of 1 meter diameter in a brick or stone masonry structure after cutting the bund (DWLC 2001).

Coastal beaches spread for almost 30 km. of stretch in the reconstituted (proposed) BNP HMZ. These beaches are important turtle nesting place. Fisherman poses threats by fishing in Bundala Welgangda, Bundala Modora, Malala Modara and the stretch south of Koholankala. However it is needed to free the beaches from this disturbance. Alternative plan provides for ecodevelopment strategy. A fishing harbor is proposed to be constructed at Bundala Modara bay which could be accessed from only one road from Pallemalala. Plan provides for loan and subsidy support for acquiring near-shore going
boats as they prefer sea fishing as it is more remunerative. The fisherman living in Udamalala, Bundala and Siriyagama would be also facilitated in rehabilitation in the Pallemalala area so as to have easy daily access to the harbor. The combined impact of these measure alongwith regular patrolling would ensure integrity of over 20 km of beach in two stretches to the east and west of Bundala Modara.

Under the ecodevelopment zone the objective includes: (1) to facilitate the local fisherman as stakeholders in making sustainable use of the fish productivity in the identified lagoons in a manner not incompatible with the conservation objectives. Also to facilitate them in fishing in the near-shore waters by devising and implementing measures in a participatory manner. (2) To facilitate local cattle farmers in adopting sustainable practices, with reduced numbers of more productive livestock that sustain on alternative fodder resources created outside the park. (3) to provide alternatives for domestic energy to local people in order to wean them from cutting trees and shrubs for firewood, and (4) to ensure that the package of ecodevelopment measures in both the cases yield higher economic benefits to the identified real stakeholders pursuing these vocations for sustenance. Ecodevelopment is a strategy directed economic wellbeing of the local communities while ensuring compatibility between the conservation requirements of a Protected Area and the dependence of local communities upon the biomass resources in the PA and its ‘zone of influence’ (ZI).

Small and medium local cattle farmers has to be provided by green fodder, subsidized cattle feed and marketing together with developing pasture land in the nearby areas in the ecodevelopment zone. Three 20-25 ha fodder farms would be set up under this plan with supplemental irrigation arrangements so as to produce green and nutritive cut fodder in areas where adequate land is available. About 200 ha of selected pasture land associated with each of the fodder farm will be ameliorated with departments assistance through weed removal etc. and such pasture land would be used on rotational basis for grazing. The pasture land and fodder farm development and maintenance would be with the help of stakeholders. veterinary care of livestock, dairying assistance for collection and processing of milk and 50% subsidy for cattle feed are some of other measures in this regard (DWLC 2001). Three localities for pasture cum fodder farm are: two sites in
Koholankala–Keligama area i.e. a grass–scrub area of about 1,500 ha across Hambantota–Weligatta main road another localities is in Weligatta West where fodder cum pastureland can come up in the scrub-grass area to the east of Weligatta. Since the area would be used only to develop pastureland, it will continue to serve as the link habitat for elephants sharing their range on either side of the park boundary. It is hence justified to give up the proposal for adding this area to the park and rather use it to provide alternative to the livestock owners, so that they do not take their cattle in the park. Site specific detailed measures shall have to be worked out by the Park management using PRA based exchange of information and suggestion with the stakeholders. The park Warden has been trained in such PRA based investigations under the P.G. Diploma Course at the WII through the GEF Project (DWLC 2001). The whole package should be linked to the national dairy development programme.

To facilitate fisheries local fisherman would be involved in the development of detailed plans and the mode of implementation right up to the availing of the facilities created. The plan aims to provide identity card per family by the park warden to the fisherman inhabiting Sriyagama, Bundala Pallemalala and Udamalala for many years (over 5 years). The beneficiaries would be identified jointly by fisherman community and the park management. This card it says is not transferable and each family would be allowed only one boat at a time either in sea or in Embilikala lagoon. In Embilikala lagoon seeding by stakeholder is permitted though only 10 boats representing 10 families will be allowed at a time. All boats need to be anchored at one point earmarked by stakeholder. A fisheries harbor at Pathiraja–Bundala modara is to be constructed under the plan as one or two spurs can protect the boats from high tide and rough waves. This also would use roaster for harbor use, its accessing, and the transport of the fish-catch up to Pallemalala, will be evolved by the stakeholder group in association with the park warden.

For solving the problem of tree cutting for firewood, the plan provides for firewood extraction only for bonafide domestic use from the scrub bearing areas of the EDZ. It calls for adoption of efficient stoves and to set up dung based biogas plants for domestic energy using the subsidies available (DWLC 2001).
The plan provides for generation of employment opportunities in Habitat management operations and ecodevelopment measures involving field vegetation treatments, agricultural works and civil engineering works, with considerable employment potential for local people.

Ecotourism also helps locals as youth are employed as guide and as entrepreneurs providing excursion vehicles, selling curd to the tourists etc.

Tourism management is another significant aspect of GEF assisted management plan for BNP. Coastal wetlands along with rich fauna especially waterfowl and elephants are the major tourist attraction. Revival of coastal wetland ecosystem is the major goal. However, high ground forest-scrub-grass habitat improvement is another aim as this would improve the habitat of elephant, deer and a host of other fauna. Infrastructure development is basic for tourism development. Visitor centre was created through GEF assistance.

Plan lays down three guidelines such as creation of tourism infrastructure and organization of visitor movements to cause minimum impacts upon natural values, visitors to be better informed and development to yield some benefits to local communities in order to promote their stake in maintaining the park (DWLC 2001). Major problem faced by tourism is lack of staff facility and infrastructure.

Tourism Management Zone (TMZ) is an overlapping management zone and here it would overlap with a significant part of the HMZ. TMZ would include wetland and high ground areas between the Bundala lagoon on the east and the Koholanakla lagoon on the west. This would ensure adequate variety of habitats and afford views of land and seascape as well as the waterfowl and terrestrial fauna. This would ensure leaving out significant undisturbed segments which are needed for effective conservation.

Tourism management strategy calls for location of entrance gate for visitors to be about one km to the east of newly constructed park office cum visitor centre to facilitate road excursions and accessing of the nature trail and campsites. However, no boat ride for tourists is permitted. Another aspect is development of a campsite at Kurulawala on the southern rim of Malala lewaya and another campsite at sandbar of the Bundala lewaya. It would provide two excursion routes and at a time not more than four vehicles permitted.
on one route. It also provides for regulatory measures in case of violation i.e. Rs. 5000/ for entry without permission and disqualification in case of breach by a driver for three times. This provides for training to the local youth by senior park staff for providing guided service. This training would include proper discipline in observing birds, distance limits for birds and other animals and the manner of minimum disturbance access after sighting from a longer distance, ecological information on habitats and important aspect of bird’s behavior. This also calls for putting conservation message effectively across and disseminate on a large scale through a perspective and well organized park interpretation plan (DWLC 2001).

The GEF management plan calls for setting up of visitor center, which brings out the values of park and informs visitors appropriately for them to learn and enjoy their visit. This needs to be equipped with audio-visual programmes at the centre, printed material in the form of guidebook, brochure, poster and souvenirs. Interpretation themes like attributes of a lagoon-centered coastal wetlands, and of the impacts resulting from hydrological changes in catchment and pressure that come upon from local biomass resource dependent local communities, waterfowl diversity, wetland, forest and scrub-grass habitat map of Bundala etc.

Plan provides for promotional activities with local communities as management plan provide substantial direct employment to local people in activities like infrastructure development works, HMZ operations, and ecotourism. These activities along with ecodevelopment package would go a long way in dissuading illegal activities such as poaching, grazing etc. Number of staff has to be improved in order to increase implementation of project plan (DWLC 2001).

The excellent practice of group patrolling on foot by DWLC had abandoned with formation of BNP. The record keeping tendency which used to generate valuable information such as habitat changes, presence or absence of birds/animals, which is useful in management also got abandoned. These lead to falling apart of worthy operative system resulting in lack of protection and proper record keeping of events. The strategy defining the protection mechanisms is hence based on a realistic appraisal of cause and effect combined with the present ground situation. It also takes into account the
ecodevelopment alternatives being provided under this plan to fishermen and livestock owners, without which effective park protection and management cannot be achieved. It includes infrastructure development, equipment support and foot patrolling systems in better protection. Proper demarcation of boundary is the requisite for efficient protection which is included herein. A major backup for this also comes from the significant employment and income generating opportunities provided by management operations and ecodevelopment measures which would provide not only legitimate income sources to the neighboring communities but also, if used with proper public relation, establish human bridges with the community, which will help in apprehending the violators and the miscreants (DWLC 2001). This plan proposes for foot patrolling by 5 beat units in order to ensure proper protection.

4.9.5 ADB assisted project (PAMWCP)

The protected area management and conservation project (PAMWCP) aims to strengthen the Department of Wildlife Conservation ability to manage protected areas in accordance with management plans. Initial plan for development and implementation of such management plan was taken for the seven pilot PAs through the revision of existing management plans or development of new ones. PAMWCP is for a three year period commencing from 2005 and many of the plans are based on GEF management plan and its review.

The vision of this plan is to conserve BNP through community participation and mission is an adaptive participatory management system to conserve its biodiversity especially in reference to the wetland while providing services to visitors and communities especially in reference to conservation concepts and information on significance of wetland ecosystem. The ADB project aims to restore and manage the Bundala wetland ecosystem, to restore and manage terrestrial ecosystem, to effectively administer and protect the habitats and archeological sites of the BNP, to provide visitor services including dissemination of information on wetland ecosystems and to empower the local community to participate in and benefit from the conservation of BNP (DWLC 2005).
This plan aims at annexing new area to the Park and administers it through subdivisions of “Ranges and Beats”. Beats are at lowest level and each range will administer two or more beats. The present BNP and proposed annexed land area will be considered as one contiguous entity for administration and management; however two different perspectives for management will be taken.

This plan calls for inclusion of surrounding area of BNP into one administrative unit i.e. inclusion of Hambantota town and many other fringe settlements under park administration to make the outreach activities more meaningful. The proposed new organogram is based on changed administrative boundary and functions of BNP.

This plan has prescribed new functions in BNP in addition to the strict protection as legislated by the FFPO like establishment of a wetland conservation Education Center (WCEC) to facilitate deeper knowledge disbursement, and continue studies of the flora and fauna of the wetland system, establishment of a visitor service plan inclusive of a visitor centre with an interpretation facilities and establishment of an outreach programmes (DWLC 2005). Visitor Services (VS) and the Wetland Conservation Education Center (WCEC) will be achieved through zoning plan of the NP. Park warden office has to be strengthened with the establishment of the following divisions like protection and law enforcement, park management and wetland biodiversity conservation, visitor management community outreach division and administrative and accounts division.

Project aims at signing MoU with Archaeological Department as there are multiple interests of conservation of history, flora, fauna as well as disseminating information on the natural and cultural heritage. Another significant aspect is establishment of communication and information exchange equipment (MIS) for DWC for enhancing its institutional capacity. Reliability, integrity, accessibility and availability of information are significant concerns in most of the management Information Systems. The MIS solution includes, mainly the managerial information database and the biodiversity database. Information needs will be changed in future as DWC is in the process of restructuring and decentralization.
Figure 4.6: New boundary and areas proposed for re-acquisition to the BNP

Source: Adapted from Department of Wildlife Conservation, Colombo.
This plan aims at strengthening the law enforcement of BNP by implementing FFPO, with consideration to adaptive management and ecosystem approach for effective management. As this has large perimeters with human settlements which results in greater impact with the outside human action detrimental to biodiversity, it requires a different approach from the past.

Infrastructural development includes establishment of wildlife village with all basic facilities to relocate park staff and other necessary equipment and amenities. It aims at controlling unauthorized entry into the PA by demarcating park boundary, strict law enforcement, ensure establishment of proper park entrance and recognising permissible activities and permit entry through one designation entrance (DWLC 2005).

**Restoration and management of wetland ecosystem**

Plan aims at water management in drought season by preparing hydrological base map and developing a 'water availability plan', constructing an overhead water tank in which water could be supplied in the tanks through natural waterways and purchasing a large water bowler.

Saltern activities is being controlled by the plan by excluding Koholankella saltern from protected area and saltern at Bundala would not be allowed to expand and DWC will control the access to the park through saltern. Plan also includes programme to manage fishing in lagoon system. The activities like directing the fisherman to offshore fishing and provide subsidies, authorize only one entrance to the park, allow fishing during stipulated period and stipulate boat landing sites in the park and discussion with fisherman in order to reach an agreement that will allow fishing to be done at Embilikala lagoon and to stop fishing at Malala lagoon are proposed. The plan calls for developing a plan to assess and manage the crocodile population to monitor the changes with time. Improvement and formalization of bird ringing programme are also proposed. Proposals include conducting the activity under supervision of qualified research officers with the use of proper technology, synthesized data and analysis, conduct staff training and linking with other national and international bird research programmes.
Plan aims at developing comprehensive turtle conservation programme. This project would include new techniques like ‘radio or satellite telemetry’ for better monitoring of turtles and provision for training and international study tours for the officers of the park that show interest in turtle conservation. This plan also proposes night patrolling in order to encourage and create enthusiasm for research activities (DWLC 2005). Establishment of cultural centre at Uooraniya with community participation is also proposed.

Research and monitoring are another aspect being emphasized by the plan. The plan calls for developing a comprehensive research and monitoring programme to assess the status of the wetland ecosystem. Among these are the changes in the aquatic vegetation in response to water quality changes, fish population changes, productivity, etc. and impact of cattle dung flowing to the water body as well as changes in habitat utilization of the water birds and other fauna etc. also require monitoring. Undertaking a biological diversity survey and collation of past research documents are also a necessity. Wetland conservation and management training programme development and implementation are another aspect which can become part of the activities of the proposed wetland conservation education center (DWLC 2005).

**Restoration and management of the terrestrial ecosystem**

Plan includes mapping of habitats and also zoning according to some specific criteria. Habitat management would include management of alien invasive species. Opuntia, Prosopis and Lantana are some important alien invasive species. A section of the area is under experimental implementation in removal and managing the AIS. Mechanical method of removal and disposing them outside the park is proposed. Prosopis’s branches and stem could be sold as fuel wood and Opuntia could be buried in the ground or burnt. Restoration of patches, in uprooted areas and preventing cattle entering into patches where the treatment is applied is included under the proposed measures. Habitat enrichment has been proposed for the AIS infected habitats of the park where AIS has been removed. For forest regeneration in AIS removed area 5ha to 10 ha area has to be taken and use of traditional knowledge and control regeneration of AIS and construction of electric fences around the patches to protect young plants from wild animals are needed. Grassland management according to this plan needs stopping cattle grazing in the
grasslands, removal of the AIS, planting indigenous grasses in exposed spaces and continuous management of grasslands to control regeneration of the AIS. Management of cattle grazing and grasslands includes stopping cattle grazing in PA and identification and provision of alternative pastures for cattle grazing after negotiating with the cattle and buffalo owners, construction of small tanks by DWC and management of pastures for three years by DWC, community outreach programme to popularize the idea and with the proposed alternative pastures, entry of cattle owners into the park will be stopped (DWLC 2005).

Visitor services and information dissemination

The plan goal is to provide an educationally enriching visitor experience for increased number of visitors with special interests in bird, turtle, crocodile and other wildlife watching while maintaining the quality of the park environment. The objectives of plan include increasing domestic tourism, improving interpretation facilities, improve and increase campsite facilities, to provide opportunities for local communities to benefit from the park, to broaden the range of visitor opportunities, to ensure that unacceptable impacts do not occur as a result of visitation and to double 2003 foreign visitation by 2008. Zoning for Visitation are proposed based upon intended intensity of use. Zoning this way would ensure protection of important conservation sites.

Table 4.7: Key to zoning: VSE plan

<table>
<thead>
<tr>
<th>Zone</th>
<th>Description</th>
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<tbody>
<tr>
<td>Zone 1</td>
<td>Special preservation: No visitation allowed (other than researchers with permits) due to ecological/archeological significance and fragility.</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Wilderness: Areas of special ecological/conservation significance, where limited visitation is allowed and no facilities will be constructed with the exception of the basic minimum (roads/trails), to provide access.</td>
</tr>
<tr>
<td>Zone 3</td>
<td>Natural environment: Areas where most visitations will be concentrated. Higher road/trail density than Zone 2.</td>
</tr>
<tr>
<td>Zone 4</td>
<td>Visitor services: Intensively used and developed visitor services zone containing visitor centre’s, vehicle parking, accommodation and larger</td>
</tr>
<tr>
<td>Park services: these areas contain park services such as housing, garages, garbage dumps etc.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Bundala Management plan, ADB pg.41

Visitor facility plan includes improvement in bird watching and wildlife viewing facilities through improved habitat management for birds, including water quality, construction of more hides, improved interpretation and involvement of visitors in the bird banding research program. New activities include turtle viewing with the joint effort with the community at Bundala village and require development of interpretation facilities, trail access and transport systems such as bullock carts. Crocodile viewing is another area for upgradation which will be developed as an activity through identification of key areas where crocodiles are likely to be seen and production of a special brochure on crocodile. Along with turtle and crocodile viewing, dolphin and whale viewing are also proposed (DWLC 2005).

Development of sand dune nature trail and study of the potential for angling in the sea and Kirindi Oya estuary is proposed in this plan. A visitor management plan would also be developed which includes establishment of hides, watchtower and viewing platforms at suitable places along with new roadway to avoid disturbance to fauna in the Embilikala and Bundala lagoons. A new access points to the park, a new road network, and reorganization of transport within the park for visitors is proposed to be developed. Plan recognizes the need to print park guide book in all languages, establish a gift shop in V.C., train and upgrade tracker skills, roadside signage etc. It provides greater opportunities to buffer zone communities through ecotourism and establishes suitable mechanisms to enable participation of buffer zone communities in park programmes to facilitate community participation and benefit transfer. A new park fee scheme and identification of resource needs including financial and human resource needs for the implementation of the VSE programmes are suggested. Wetland conservation and education center is proposed to be established to cater primarily to students and researchers. Staff training programme for WCEC and park needs would be included under this.
Community Outreach Programme

Community outreach programme refers to the active involvement of the communities living in the villages surrounding the protected areas. This is a new programme and requires a change from protection to conservation. This requires behavior and attitude of PA staff to undergo change in their interaction with the communities around and vice versa. Community Outreach activities recognizes these ground realities and conceptually move towards pro-active involvement of the community in park management as well as providing services to the community protecting them from human-animal conflict. Communities till now had the hatred feeling for park staff due to they being kept outside the park by enforcement measures. A community centered approach aims at involvement of communities in the process of PA management. This necessitates change in attitude and behavior on the part of DWC staff and communities through orientation and training on the concept of outreach and related activities for DWC staff and public awareness programme for the communities around. Social dimension to protected area management like eco-tourism, adaptive management, collaborative management and village development planning can be facilitated through outreach activities.

DWC staff will be incapacitated to perform as trainers to facilitate further capacity building. Micro-plans for the communities linking with CBOs, NGOs and other local agencies will be developed by DWC field staff through participation and collaboration. The community organization is being done on the basis of GN division under social mobilization and micro-planning process (DWLC 2005). This is expected to result in community partnership development. Community outreach programme would include involvement of community in areas like infrastructural development, habitat management, eco-tourism and other activities. Infrastructural development activities like roads, renovation and construction of buildings, construction and maintenance of electric fences are the areas that can involve communities. Habitat management activities like removal of invasive species, enrichment activities, rehabilitation of water holes are some other activities. Eco-tourism activities like participation in the sale of local products to the visitor, and training village youth as volunteer visitor guides, providing jeep,
motorcycle, camp equipment etc facilities are other participating activities for educated village youth.

Communities requirement are perceived to be accommodated in micro-planning process/village development Planning (VDP) in park management and development activities as well as improvement of livelihoods of the surrounding communities. Protected area conservation Fund (PACF), a sub project of PAM&WCP is expected to support plan arising from micro-planning process. The surrounding communities would be provided fund to develop capacities, to implement conservation driven development activities and to reduce their dependence on natural resources through implementation of micro-planning, followed by area wide development activities. Three steps are involved in micro-planning process such as, Information generation and situation analysis, preparation of the village development plan and selection of key areas for the development of proposals for funding. Village level Organization will be formed at each village level while clusters of village will form cluster level Organization (CLO) with representatives from the VLOs. This mechanism will help in strengthening of the community in a process of empowerment in addressing issues which involve management of park resources and improvement of the livelihoods of the people surrounding the PA (DWLC 2005).

Visitor facility developments outside the park involves communitys-based development are planned at Bundala Wellagangoda, at the turtle entrance to the park and close to the community. This would include a cafeteria, a community-based campsite, small ecolodge and activities like fishing in the small wetlands adjacent. Community would help in data collection as well as provide transport and guide.

Other activities taken by ADB assisted PAMWCP involves development of a comprehensive wildlife health programme for the DWC and the Parks. Objective of this plan is to prevent and control wildlife diseases in protected areas wherever practical and possible.

Information makes conservation and decision making easy and accurate. Management action requires generation, transmission, storage and retrieval of information. Park lacks
in MIS, which at present seriously affects the vital functional areas such as law enforcement, data storage, and visitor services. As a result plan includes proposal for development of MIS for the DWC, taking into consideration its future role in biodiversity conservation.

**Implementation of community outreach programme**

The Bundala Management plan emphasizes on community participation and identifies certain activities to get their support. The activities identified are at different levels of implementation. Some of them have been not even initiated while others have been implemented. Implementation of these activities has not been fully integrated and in this respect visitor centre has been established though other activities such as improvements to enhance the tourism potential are yet to be implemented and a comprehensive plan is yet to be prepared. Marketing plan for the park as an eco-tourism site has not yet been initiated. Community outreach programme for including buffer zone community has been launched and has made progress regarding the establishment of community-based organizations and mobilizing them for focused activities. To mobilize the community for small projects that have been identified an awareness programme have been conducted. The habitat enrichment programme involved established CBOs and community got benefitted in terms of payments for work. Staff capacity building programme are being conducted from time to time on approach towards community participation leading to participatory management. Provisions for community awareness and training programs are made from time to time (DWLC 2007).

Activities like sand mining, shell mining and timber felling has been completely stopped by the park management. Through a combination of community consultation, law enforcement and regulation access to the park for firewood collection for selling, poaching, hunting and access to Bundala lagoon, have been mitigated to satisfactory level.

In spite of certain awareness and partnership activities undertaken to improve attitude of the community the communities' interest towards the conservation of wildlife is comparatively low. Reason for this is the lack of tangible benefits for them from the park.
Figure 4.7: Impact areas of livelihood in boundary villages around BNP

Impact areas of livelihood in Boundary villages of BNP

Source: Adapted from DWLC, Colombo
and disproportionate cost imposed on them, to prevent their access to park. Earlier to the declaration of the national park, the area had open access to the community for harnessing forest products such as fishing, fuel wood, wooden poles and fodder for livestock etc. The livelihood benefits from traditional fishing in the lagoons, livestock rearing and open ranching have been forgone due to regulation barrier for the park access. People in this area depend on fishing industry or the livestock industry directly or indirectly and therefore the livelihood constraints are significantly high.

4.9.6 Implementation of PAMWCP in BNP

Activities of ADB assisted project is in different levels of implementation. New area acquisition process to park is not completed. Land survey has been started by the survey Department. The process of land survey is slow in action and the coordination with the actors is not well established. Hambantota and Kataragama DWC offices are not well informed and their commitments for the land acquisition have not been obtained.

The goal of bringing entire park area and surroundings under one administrative unit could not materialised as Hambantota DWC unit could not be included while Weerawila DWC unit has been amalgamated under BNP management unit. Proposed organizational restructuring, strengthening of the park services, protection and conservation has not yet achieved expectation.

New management functions like visitor service center have been constructed and community has been given training in annual capacity building and community outreach programme of the conservation plan. Lagoon fishermen are being negotiated to enter coastal fishing as an alternate to lagoon fishing in the BNP though community’s concurrence is still in question. Draft plan for community education center has been prepared by BNP and forwarded to DWC but has not yet started. Community Outreach programme has been started by appointed staffs and 14 CBOs from 14 GN Divisions around BNP have been formed and financial assistance for selected projects have been planned (DWLC 2007).

Park management zonal plan has not yet been prepared however the concept is being discussed. Law has been enforced to stop trespassing, poaching, lagoon fishing and free
entry. Complete ban has been enforced on shell mining and sand mining. Despite of these steps activities such as control of lagoon fishing, and cattle grazing have not been successful. Archeological site adjacent to park has not been included under management plan. Some Assistance for MIS with IT facility has been provided. Wildlife village’s establishment is yet to start. Park staff is being provided with tool kit. The park management has started demarcation of new park boundaries but it is not completed due to community obstruction for erecting boundary stones in owner’s premises. The boundary stones are lying stocked over a period of time near office boundary. Tender for water tank construction in the park has been approved for drought relief work. Natural seawater intrusion is withheld due to sluice gate construction in the interest of lagoon fisherman (DWLC 2007). Measures have not been taken to allow seawater intrusion. Koholankala saltern has been excluded from BNP plan. Though Bundala lagoon is excluded from fishing zone yet it is taking place unnoticed/illegally, for the purpose of consumption. Other two lagoons (Embilikala and Malala) access regulation has been initiated and now park warden is authorized to regulate entry to the park resources including lagoon fishing. Possibilities for establishing crocodile viewing points for tourist attraction are under discussion in order to conserve crocodiles.

Bird-ringing programme is on-going and is assisted by a foreign expert. Turtle conservation programme is under way with the help of local youth employed in this project and discussion for developing it as focal tourist point is under way. Programmes like wetland ecosystem status survey, biodiversity survey and wetland conservation and management training have not been initiated. Removal of invasive alien species programme has been initiated with the aid of mechanical methods involving private contractors and using manual method through CBOs (Bundala Urumaya) of the area. Natural regeneration of native grass & other plant species after removal of invasive alien species is allowed. Cattle grazing in PA could not be stopped as law enforcement in this area is ineffective. VSE zoning plan has been prepared along with bird watching and wildlife viewing facilities at visitor center. Sand dune trail has not been explored, similarly turtle viewing and crocodile viewing possibility needs to be explored. Visitor management plan draft has been prepared and update is in progress. Main visitor center constructed at main entrance and park review literature is in progress along with park
guide book in all languages is being developed. Road signs have been displayed and activities under community outreach programme initiated but effective community involvement has not yet been established. Bird ringing and radio collar tracking has been initiated and funds allocated to initiate turtle tagging (DWLC 2005). Other programmes have not been implemented.

The major problem of Bundala Wetlands is freshwater discharge leading to change in the quality of lagoon water. Bundala National Park is linked to the water management in the KOISP so it should be represented in water allocation decisions. But at present there is no regulation about the volume of water to be drained in BNP. Irrigation department is responsible for water diversions to the irrigated areas and the Wildlife Department is responsible for the Bundala National Park. But there is no one responsible for KOISP drainage into BNP. PMC meeting does not include wildlife department representative. The two meet only at provincial meetings. However these meeting does not bring about any decision about water allocation and only provincial development issue are only discussed (Ejik 2001).

Diagram 4.2: Institutional relation diagram between Bundala National Park and KOISP

4.10 POLITICAL ECOLOGY SYNTHESIS OF CONFLICT IN THE BASIN

Some other important reason behind least progress in coastal lagoon ecosystem is that Coastal Conservation Departments mainly looks after the coast and this coast being of limited importance, strategically and economically are not given much importance for conservation. The biodiversity component is not valued much as they do not impact directly. City dwelling people who come here for safari tour were really against community involvement in decision making for the park management and community outreach programme. This had led much controversy in commencement of the ADB assisted project. The ADB assisted project was delayed due to the opposition because of vested interest involvement. Communities in the surrounding area are not very keen in following regulatory measures of the Park and its wetlands. There is an emotional separateness between community people and DWLC staff as earlier it was never ever tried to relate to the community and DWLC acted as regulatory mechanism. The staffs were more interested in fauna protection and least about the damage caused to the community. So, the co-management could not be carried out.

The lack of trust and bonding among the community and the Park staff are the main reason for least implementation of regulatory provisions earlier in the Park. Other reasons are lack of opportunities for participation in planning and implementation of park management activities and lack of economic incentive for community. Stakeholders are not part of Park management and further the management plan is not integrated with local regional development programmes. The participatory adaptive management also suffers from lack of political support and research on management and also evaluation of community based conservation (DWLC 2007). Thus the need for proper implementation of the management plan is to reduce community conflict with park staff and outsiders, and integration of policies of various departments related to drainage basin water in the area. The participatory approach initiated in the new plan will go a long way in achieving such an objective.

Community is facing several problem due to Park, such as crop damage, deaths, property damage and insecurity caused by resident and migratory elephants to the community, as a result of lack of appropriate measures to mitigate impacts, crop and home garden
damages by stray cattle in the park, depriving the community of their traditional fishing in lagoons and coast belonging to the Park through access regulation, spread of invasive plants in the park to the home gardens in the surrounding villages and interference with agricultural practices. They are also facing problem of fuel wood shortage due to restriction imposed in access to the park for fuel wood and other forest product collection. Another problem faced by community is crop damages by the park animals and birds and sub standard infrastructure facilities provided to the community due to focused attention on the park.

The conservation management plan has imposed several restrictions on the fishing community in the boundary villages but the enforcement is not effective due to lack of adherence by community. The fishing communities are fighting for their traditional fishing rights in the lagoons. They have organised themselves into fisheries societies. They have gained strong bargaining power by establishing links with the political and administrative network. Malala and Siriyagama Fisheries Society have more than 300 members.

These fishing societies can be used for conservation activities by developing links and good collaboration with the park management authorities (DWLC 2007). The Conservation Plan has also imposed restriction on coastal fishing on the surrounding fishing villages of the Park so the fishing communities find difficulties in transporting fishing boats and fishing gear to their fishing points, and they also face difficulty in transporting the days catch to the market. The communities complain that fisherman outside their locality have access to fishing point through sea and that they do not have control over the issue. The imposition of restriction will affect the income of the fishing community. Though, recently the Park office has developed a relationship with the fishing community yet the need is to develop a programme addressing a solution to the problem involving coastal fishing community.

Conclusively it can be said that Bundala wetlands management progress has been least due to the result of various factors such as fragmentation of water management among sectors and institutions. This has led to development of no comprehensive water resource policy since numerous sectoral institutions formulate water resources policies relating to
their respective sectors. Thus the coordination and communication between these organisations are minimum and responsibilities are often not clear, overlap and gaps exists. Communication between the ID (Irrigation Department) and the other stakeholders in the river basin, like the NWS&DB, the Forest Department and Department of Wildlife Conservation, also do not exist. There is a need of formulating one comprehensive water policy in such a way in which other national and sectoral institutes can be integrated vertically and horizontally. Efforts should also be made to bring coordination and bonding between community people and staff of the park for the proper management of Bundala wetlands.