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Shri Naveen Pattnaik, Hon'ble Chief Minister of Orissa (Centre) releasing the ENVIS Newsletter on 5th June 2008 on the occasion of World Environment Day.

Also present are (L-R), Shri S. C. Mohanty, PCCF; Shri H. S. Chahar, Principal Secretary, Forest & Environment Deptt. and Shri Bhagirathi Behera, Director, Environment-cum-Special Secretary to Govt.

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From the Director's Desk...

The Environmental Information System has been providing a base for information dissemination on issues related to State of Environment of Orissa. Publication of Newsletter is one of the components of the ENVIS Programme; other being information dissemination through web-enabled system and query services. The Centre has been responding to various queries on environmental issues.

This Newsletter presents an assessment of impact of urban growth of Bhubaneswar city on the Chandaka Wildlife Sanctuary. I would like to thank Dr. K.C. Rath, Reader in Geography, Dept. of Geography, Utkal University and Mr. Nihar Ranjan Das, Research Scholar for their efforts in collecting information and analysis with the help of Geographic Information System (GIS), Remote Sensing and Global Positioning System (GPS) technologies to prepare this Newsletter.

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State of Environment: Chandaka Wildlife Sanctuary

ABSTRACT

The Chandaka wildlife sanctuary, lying at the North western urban fringe of the Bhubaneswar city, is an ecologically sensitive area being threatened by the growth and development of Bhubaneswar along its fringe areas. The rapid spatio-temporal growth of Bhubaneswar urban agglomeration, at the cost of its fringe comprising areas of high conservation value due to ecological sensitivity have caused emerging environmental concerns, which needs proper attention. In this regard an attempt has been made to assess the degree of impact of urban growth on Chandaka wildlife sanctuary lying at the north western side of Bhubaneswar. The result of the study indicates positive changes in terms of increase in dense forest area at the north-western and central part of the sanctuary, which may be due to conservation measures taken by concerned authorities (state forest department) through past few decades. However, the result also indicates that, the eastern and southern part of the sanctuary lying adjacent to Bhubaneswar urban area has experienced the adverse effect of urban growth as the dense forest in this part of the sanctuary has been converted in to degraded forest or land with or without scrub through past few decades.

Key Words: Chandaka, Urban influence, Remote sensing, landuse/landcover change

INTRODUCTION

Chandaka-Dampara Wildlife Sanctuary is located between 85° 34' 42" E to 85° 49' 27" E longitude and 20° 12' 29" N to 20° 26' 18" N latitudes and is encompassed in Survey of India topo sheet No.73H/11, 12 and 15. It has been duly notified vide notification No.35500/FFAH dated 21.12.82 and the boundaries modified in a subsequent notification No.13482/FFAH dated 10.6.88 of Govt. of Orissa and is under the administrative control of the Chief Wildlife

Warden, Orissa. The total area of the sanctuary is 193.39 sq. Km, comprising of 7 reserved forest blocks, protected forest, 11 demarcated protected forest blocks, private lands and Govt. waste land/ forest land under the control of Revenue Department. The Chandaka wildlife sanctuary, lying at the North western urban fringe of the Bhubaneswar city (Fig. 1), is an ecologically sensitive area being threatened by the growth and development of Bhubaneswar

along its fringe areas. Nestled on Khurdha uplands of 'North -Eastern Ghats' biotic region, this sanctuary, a part of Chandaka forest division, is a relic of wildland that once extended all over Bhubaneswar. Spread over 193.39 sq.km of rolling table land and small sprawling hillocks of Khurdha and Cuttack Districts, it is a wildlife sanctuary since August 1982.



BIO-DIVERSITY

Floral diversity of the sanctuary is distributed in 6 types, which include secondary moist miscellaneous semi-evergreen forests, moist Kangada (*Xylia xylocarpa*) forests, Coastal Sal forests, thorny bamboo brakes (*Bambusa bambos*), planted Teak and Eupatorium scrub. Main tree species are Kochila, Kalicha, Belo, Kangada, Giringa, Sunari, Sal, Kumbhi, Jamu, Karanja, Teak and Sidha. Common medicinal plants of the sanctuary are Duramari, Baidanka, Brudhadaraka, Bhuinlimbo, Guluchi lata, Salparni, Satabari, Bhuin-kakharu, Indrajaba, Thalkudi, Apamaranga, Kurchi, Patalgaruda etc.



Elephant is the flagship species and indicative of the potential productivity of the habitat. Leopard is in the apex of biological pyramid. Chital, Barking deer, Mouse deer, Wild pig, Common langur, Rhesus monkey, small Indian civet, Common Indian mongoose, Small Indian mongoose, Ruddy mongoose, Pangolin, Sloth bear, Ratel, Indian wolf and Hyena are other mammals of the area. Prominent birds of the sanctuary are Peafowl, Red jungle fowl, Crested serpent eagle, Great horned owl, Black headed oriole, Paradise fly catcher, Coucal and stone curlew. Among

reptiles, Rock python and Bengal Monitor lizard are quite common. Chameleon, Common skink, Indian flap shell turtle, Russel's viper, Bamboo pit viper, Common krait, Common vine snake, Kukri snake, Indian bronze back are indicative reptiles. Mugger crocodiles have remarkably adapted to large water bodies after their release. Chital or spotted deer, the most beautiful of all deer is commonly encountered in groups of 3-7 on forest roads, forest openings, grass lands, foreshore of water bodies and even near guard camps. The Zoological Survey of India (in 2002) has reported 37 species of mammals, 167 species of birds, 33 species of reptiles, 13 species of amphibians and 28 species of fishes in this sanctuary in "Vertebrate Fauna of Chandaka-Dampara Wildlife Sanctuary, Orissa" (S.K. Tiwari, J.R.B. Alfred and S.K. Dutta).

Urban Growth and its Influence on Sanctuary

Increasing population and urbanization result in the most complex process of land use and land cover changes from local to global scale. This process, in turn, has profoundly disrupted the structure and function of ecosystems. For instance, although urban areas account for only 2% of Earth's land surface, they produce 78% of greenhouse gases, thus contributing significantly to global climate changes (Grimm et al., 2000). Increasing urbanization is also thought to be an important cause of species extinction and biotic homogenization (McKinney, 2006), hydrological alterations (Paul and Meyer, 2001), and rapid loss of cropland (Lin and Ho, 2003). Thus, the relationships between urbanization and ecological effects are gaining increasing attention in recent studies.

Bhubaneswar, the capital city of Orissa state at the eastern coast of India, holds a very rich historical, cultural and religious

heritage. It is located in eastern coastal region of India within the picturesque backdrop of its fringe areas comprising of heritage sites, temples, wildlife sanctuaries and fertile agricultural land. However, though its growth and development as a big city owes a very recent past, which perhaps have been initiated in 1948 through preparation of master plan by famous city planner Otto H. Koenigsberger, it experienced a very rapid spatial as well as temporal unsustainable growth. The spatial growth of the city has ever experienced the conversion of fertile agricultural land and other land having conservation values lying in the fringe area to residential and other urban utility purposes. The ecologically sensitive areas like Chandaka wildlife sanctuary have also been influenced to a great extent by this process of urban growth of Bhubaneswar and consequent changes in landuse/landcover pattern.

The city which was planned originally for 40,000 people with an area of 1684 Ha of land is now accommodating above 7 lakhs people with an area of about 135 sq km. A yearwise comparative analysis of population figures, as given in Table. 1, indicates the rapid growth of the city over decades. The city has extended in seven different directions during the last few decades by engulfing the fringe villages and protected areas. This extension has got varied length and dimensions from the core of the original town, which has been supposed to lie at the Lingaraj temple area. From the centre of growth of the original temple town, the present town has extended maximum towards north i.e. about 22.5 km. towards village Patia. Its extension towards north-west is about 14.5 km., west 11 km., south-west 8 km., south 6.5 km and east 9.5 km. The present township of Bhubaneswar sprawls over 233 sq. km. comprising of total number of 2312 revenue villages.

Table. 1: Population of Bhubaneswar

SL No	Urban & Rural Area	1971	1981	1991	2001	2006
1	BMC	1,05,491	2,19,211	4,11,542	6,58,220	8,20,200

Spatio-Temporal Changes in Chandaka Wildlife Sanctuary

In order to study the spatio-temporal development and growth of Bhubaneswar city as discussed by earlier studies as well as to investigate the spatio-temporal changes in landuse/landcover pattern of Chandaka wildlife sanctuary for assessing the impact of urban growth in fringe areas on the sanctuary it has been tried to utilize emerging technological advancements in terms of Geographical Information System (GIS) and Remote Sensing and Global Positioning System (GPS) up to their optimum extent. In this process, a landuse/

landcover layer has been developed from topographical map of Survey of India (year of survey is 1970). Another landuse/landcover layer has been developed for the year 2005 from IRS 1D LISS-III satellite image through digital cum visual interpretation technique. Then these two layers have been analyzed through overlaying technique in GIS to identify the spatio-temporal changes with area statistics.

Being close to one of the highly populated urban conglomerate on the east and cultivated plains on the north and west,

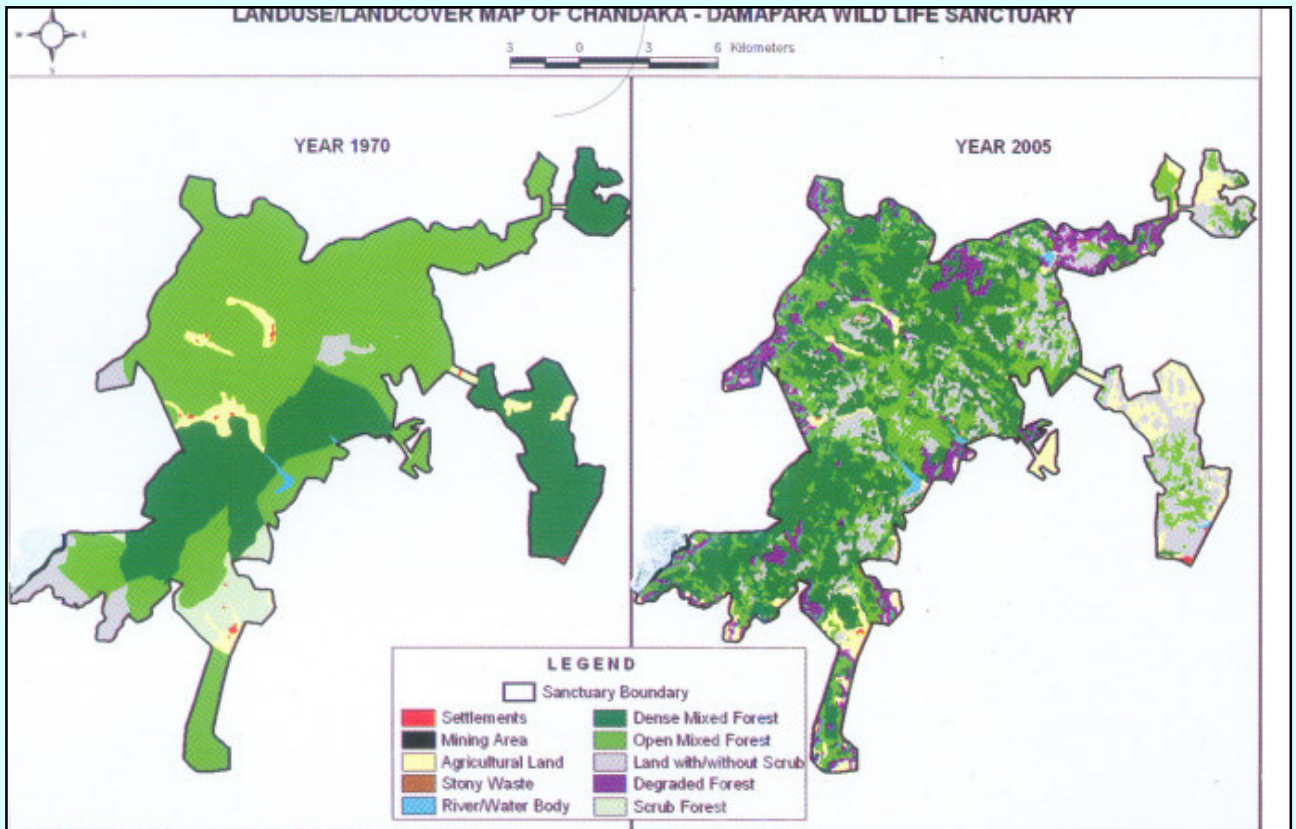
the pressure on the sanctuary for biomass needs of the surrounding population is tremendous and on the increase. Commercial interests for bamboos, poles and fire-wood intermittently make ugly appearance implicating peripheral tribals in habitat destruction. The GIS based analysis and derived area statistics, as given in Table. 2, indicates that the dense mixed forest area has increased from 30.63 % of the total area to 38.07 %. This is a very positive aspect of the sanctuary, which may be the result of rigid protection and conservation management efforts taken for last two decades. The vegetation, which was rendered bushy due to over exploitation has gained height beyond recognition. Reappearance of Sal, Bamboo, Maha limbo, Canes and a great array of plant life including medicinal plants bear testimony to the recuperating energy of nature. Further, the return of the leopard in 1991, which

seemed extinct for long, further reaffirms the revival of bio-diversity.

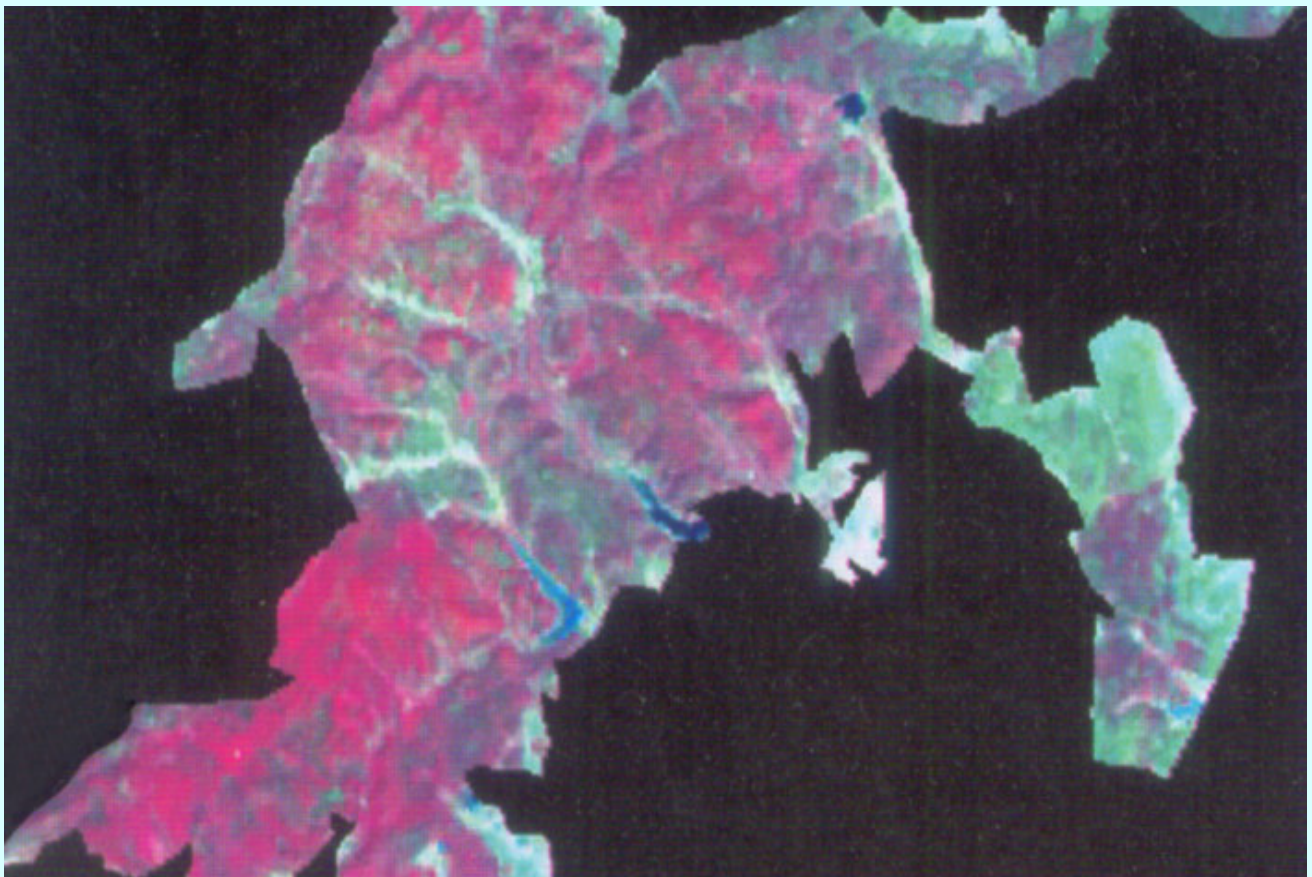
However, the total forest area of the sanctuary (including dense, open and scrub forest) was 90.27 % of the total area, which has been reduced drastically in 2005 to 62.72 %. There is also a remarkable area of 9.46 % characterized by degraded forest in 2005. As it has been very clearly presented in the maps, the positive changes (conversion of open forest to dense forest) have taken place in the interior central as well as northern part of the sanctuary, where as the adverse changes (conversion of dense forest to open forest, degraded forest or land with/without scrub) have taken place eastern part of the sanctuary. It is clear from the Fig. 1 that, this eastern part of the sanctuary touches the Bhubaneswar urban area. So it can be inferred that, the rapid growth of the city in its fringe has occurred even at the cost of areas having conservation values.

Table 2: Landuse/Landcover Area Statistics Derived in GIS

Landuse/Landcover	Area in 1970		Area in 2005	
	in Sq. Km.	in %	in Sq. Km.	in %
Settlements	0.46	0.24	0.27	0.14
Active Mining Area			0.12	0.06
Agricultural Land	7.25	3.75	15.97	8.26
Stony Waste			0.12	0.06
River/Water Body	0.49	0.26	1.00	0.52
Dense Mixed Forest	59.24	30.63	73.63	38.07
Open Mixed Forest	107.97	55.83	47.66	24.64
Scrub Forest	7.36	3.80		
Land with/without Scrub	10.62	5.49	36.32	18.78
Degraded Forest			18.30	9.46
Total	193.39	100.00	193.39	100.00



FCC SATELLITE IMAGE OF CHANDAKA - DAMAPARA WILDLIFE SANCTUARY



Conclusion

Due to rapid growth of major urban conglomerates, their fringe areas have remained under threat of unplanned and unsustainable development practices. The development activity in the fringe area is an inherent process of urban growth, which cannot be prohibited completely. However, the time has come, especially in the context of Bhubaneswar, to review the spatial growth of the city so that the development takes place without ignoring the conservation and management strategies for the areas in urban fringe having archeological, ecological and environmental or any other form of conservation values.

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