



Sarovar Saurabh

Wetland Ecosystem

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Editorial

The Salim Ali Centre for Ornithology and Natural History (SACON) brings out the second issue of SAROVAR SAURABH, an ENVIS Newsletter on wetland ecosystems, sponsored by the Ministry of Environment and Forests, Govt. of India. The major goal of the Newsletter is to share information about wetlands with various users and, to highlight conservation issues of relevance to wetland community of professionals, managers, environmentalists and other stakeholders.

This newsletter deals with the wetland inventory of Kerala using publicly available Landsat Thematic Mapper satellite data of 1990-92 period and monitoring of Samaspur wetlands of Uttar Pradesh using multi-temporal data. The above inventory of wetlands in Kerala is important because of delineation of below 56 ha wetland area. The Memorandum of Understanding between SACON and IWMI, Sri Lanka for wetland inventory is also highlighted. It is again hoped that stakeholders in wetland conservation and all other ENVIS centres can make use of these data effectively to create public awareness for further wetland conservation.

To make this effort worth while the editorial team of SARVAR SAURABH seeks active participation of its readers in terms of providing information, news, views, photographs and articles on issues of wetland conservation.

We welcome your feedback on the Newsletter and its contents.



*Salim Ali Centre for
Ornithology and Natural History*

Wetland Inventory for 1990-1992 for Kerala using Landsat Thematic Mapper data*

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Introduction

Wetlands and aquatic biodiversity is most threatened of all extant biodiversity on planet earth. In addition, the looming climate change and consequent sea level changes is a real threat for a coastal state such as Kerala. An ecological inventory of wetlands would obviously be of immediate requirement for a variety of needs ranging from conservation to possible adaptation measures for climate change. In a nation wide wetland conservation prioritization conducted by Vijayan *et al.* (2004), report that Kerala has sixty-five species of endemic aquatic flowering plants; four Critical, 16 Endangered and 17 Vulnerable species of fishes; two Endangered and one each of Vulnerable, Near Threatened and Least Concern species of freshwater turtles; and three Near Threatened species of wetland birds. It is therefore essential that a proper wetland inventory be taken up. The Salim Ali Centre for Ornithology and Natural History, Coimbatore, as a part of its ongoing Nation wide wetland work, has addressed to baseline inventory of wetlands in the country using publicly available satellite data sets. In this paper, we report results of our study on wetlands of Kerala.

Methodology

Landsat Thematic Mapper (TM) data (1990-1992) downloaded from the GLCF site was used for the present study. Landsat TM provides a reasonably quick and cost-effective means for mapping wetlands. Typically TM bands 4, 3, 2 can be combined to make FCC where band 4 represents Red, band 3 Green and band 2 Blue. The two Mid-IR bands (bands 5 and 7) are useful for vegetation and soil moisture studies. For the present study, bands 2 (0.52 – 0.6), 4 (0.76 – 0.9) and 7 (2.08 – 2.35) are proved to be beneficial in delineating wetlands along with their aquatic vegetation. Since the pixel resolution is 30 m, in principle, an area of 90 x 90 m (corresponding to 3 x 3 pixels) can be mapped. Hence, wetlands of size of 0.81 ha are possible to be mapped. This is quantum jump from the earlier nation wide reconnaissance mapping of wetlands above 56 ha at 1:2,50,000 scale by the Space Application Centre, Ahmedabad. The Landsat TM mosaics, all ancillary data sets, and the land cover product are all map-registered to UTM projection. An interactive classification approach using both supervised and visual techniques were adopted to delineate various wetland categories viz., Lakes, Ponds, Reservoirs, Mangroves, other aquatic vegetation etc., of study area. The final classified raster image was vectorized to port the data into GIS domain. Wetland area were categorized into 5 classes. These are < 56 ha, 56 - < 100 ha, 100 - < 200 ha, 200 - < 300ha, 300 - < 400 ha, 400 - < 500 ha, and > 500 ha.

* Paper published in proceedings of Kerala Environment Congress 2007, Thiruvananthapuram.

Results

The district of Ernakulam tops with 20.26% of the total state's wetland extent followed by Alappuzha (15.8), Trishur (12.99) and least by Wayanad (0.8). Except Thiruvantahapuram and Wayanad, all other districts showed wetland under >= 500 ha category. To the maximum extent throughout the Kerala state wetlands are mostly distributed under the category of < 56, 56-< 100, 100-< 200 and >=500 ha categories. The inventory is 20 percent higher than reported by space Application centre, Ahmedabad, (*Garg et al.* 1998) in its nation wide inventory using coarse resolution satellite data. The study by the department of the Fisheries (2002) that there are 47378 wetlands of the size 0.02 hectares and above. The total area is estimated to be 724.79 sq.kms. Figure-1 shows the percentage of wetland distribution in 14 districts of Kerala. The classified wetland map of 6 districts are given below (Figs. 2-7)

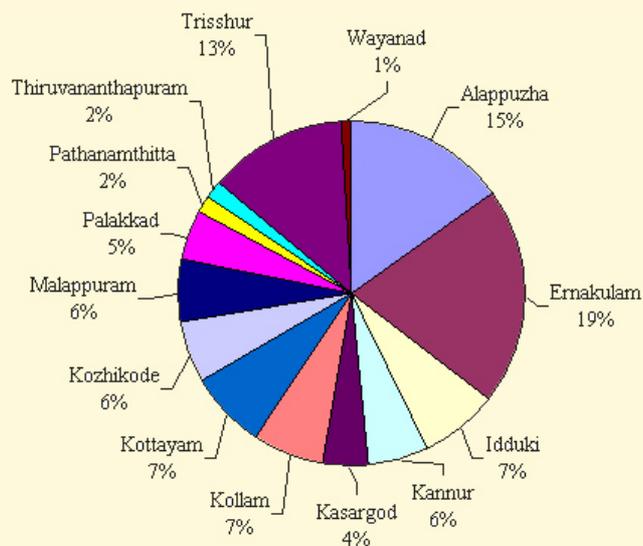


Fig 1. Distribution of Wetlands in Kerala

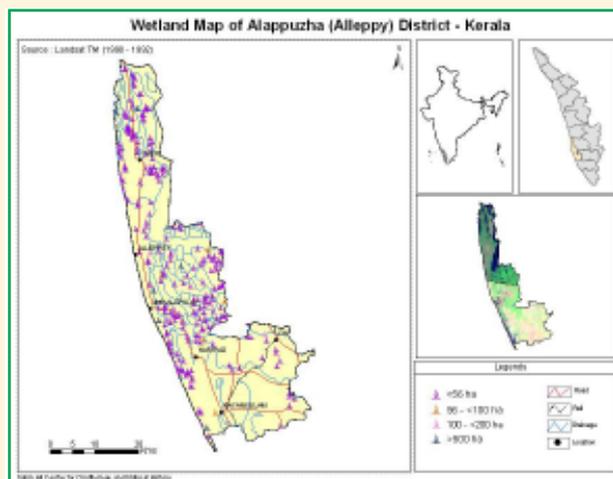


Fig 2. Classified wetland map of Alappuzha District

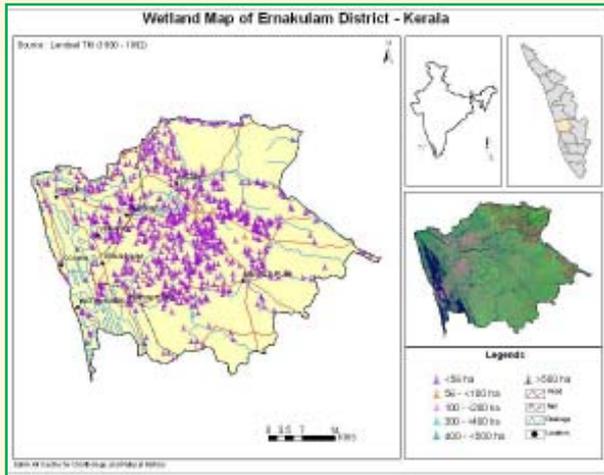


Fig 3. Classified wetland map of Ernakulam District

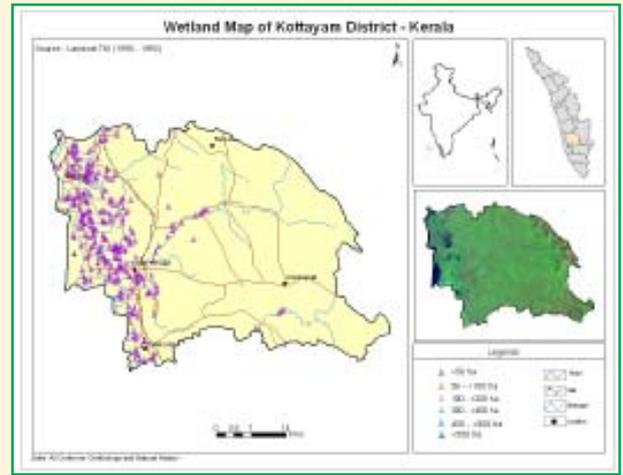


Fig 6. Classified wetland map of Kottayam District

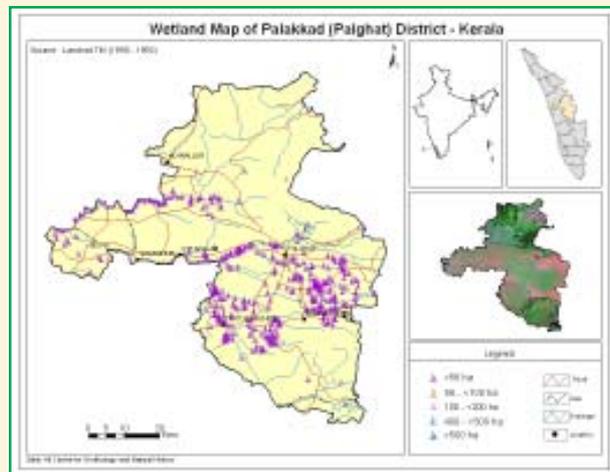


Fig 4. Classified wetland map of Palakkad District

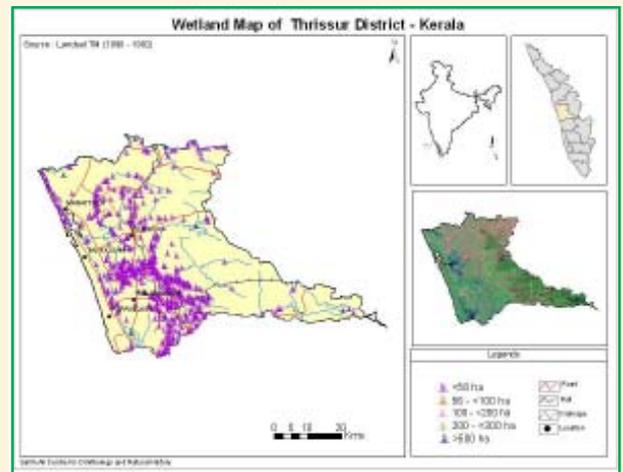


Fig 7. Classified wetland map of Thrissur District

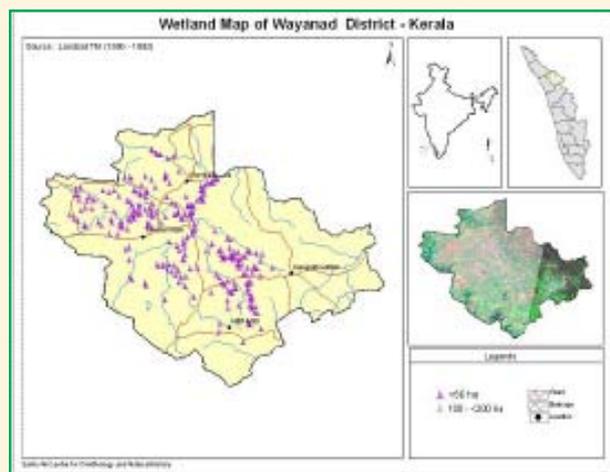


Fig 5. Classified wetland map of Wayanad District



Landscape of Kumarakom Heronry

Courtesy: Lalitha Vijayan

Conclusions

The study reported is first of its kind for entire Kerala and forms an important bench mark wetland study. An added advantage of the present digital data set is its ready GIS compatibility and with other digital data for future monitoring and assessment. The study provides a scenario of wetlands in Kerala state for 1990–92 period and forms a legacy digital data set for the entire state. Needless to emphasize, any further analysis of wetland status for any reference year would be useful in relation to the results reported. However, since no further classification of wetlands is made in this study, further work is required to classify wetlands according to user needs. We are in the process of analyzing the year 2000 TM data sets for a rapid analysis of changes in the wetland cover. Since many wetlands in Kerala are small in size, high-resolution satellite data (1-5m) may be advantageous to detect the wetland changes over a period of time. This type of change detection study would enable in identifying the status and condition of major wetlands in Kerala. Based on the change detection analysis, certain important zones can be selected for a detailed study for conservation prioritization. It is also recommended that using Cartosat-1 data of 5.8 m and pan data of Cartosat-2 with 1m resolution be used for inventory of panchayat tanks and other smaller water bodies.

Conservation Status and Monitoring of Wetlands of Samaspur Bird Sanctuary and Environs, Uttar Pradesh

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The six famous lakes known as Samaspur (Salon) wetlands in Rae Bareilly district of Uttar Pradesh, India were declared as Samaspur Bird Sanctuary in 1987 and lies between 25° 58' to 26° 01' N latitudes and 81° 21' to 81° 25' E longitudes.

Samaspur Bird Sanctuary is listed as one of the Important Bird Areas (IBAs) in India. Out of the 800 ha of total area of the sanctuary, about 370 ha is private and community lands. There are five connected lakes namely Samaspur, Mamani, Gorwa Hasanpur, Hakganj and Rohnia. The sixth lake Bissaiya is close by but not connected to the main water body but it forms a part of the sanctuary. These wetlands are included in the list of wetlands identified under national wetland conservation programme by the Ministry of Environment and Forests (MoE&F), Government of India. Each year about one-lakh birds migrate from various regions of the world like Siberia and Tibet during the months of November to March. But according to local estimates, the number of arriving birds has reduced to one fourth in last eight to ten years. This sharp decline has become a critical issue in conservation of the wetlands. Now, the sanctuary has become a tourist destination for bird lovers as well as tourists from different places of the country.

Almost 250 species of resident and migratory birds found to be sheltered here. The important aquatic birds which frequently found are, Egrets, Painted stork, Purple Moorhen, Purple Heron, White breasted water hen, Whistling teal, Phaesant Teal, Jacana, Little grebs, Cormorants, Kingfisher, Bronzed winged Jacana, Darter, Cotton Teal, Brahmany kite, Black Drago, Green Bee Eater, Indian Sarus Crane, Pintail etc. Many of these species are placed in IUCN threatened category and occur in much higher numbers than their one percent biogeographic population threshold, calculated by the Wetlands International (2002) on the basis of total biogeographic population of water birds. The local communities are dependent on the wetlands for agriculture, grazing, fishing, ground water recharge etc. for their day-to-day activities. Large-scale poaching of birds is also major concern in the sanctuary area (Korgaonkar and Gokhale, 2006).

Introduction of exotic species deliberately or accidentally, has been a major threat to biological diversity as the introduced species have often flourished at the cost of the native species. Convention for Biological Diversity, 1992 visualize 'biological invasion of exotic species as the second worst threat after habitat destruction'. Invasive weeds are also responsible for shrinking of water bodies and becoming a severe environmental problem.

Based on recent floristic survey during 2007 in the Samaspur Bird Sanctuary, it comprised of 149 species of higher plants belong to 60 families and distributed in 129 genera. Of these total plant species, 108 were Dicots, 40 were monocots and one was pteridophyte. Poaceae is the dominant family with 28 species followed by Euphorbiaceae (9), Papilionaceae (8), Asteraceae (7) and Mimosaceae (7). Out of total plant diversity, 48 are planted species followed by dry bank species (46) and wetland hydrophytes (38). Exotic plants represent 41.6% of the total enumerated flora and rests are natural species (101 spp.). Habit-wise analysis of natural flora shows that herbs are occupying higher proportion (86.1%) with 87 species followed by shrubs (6.9%) and climbers (4%). Among the forty-eight planted species, 25 are exotic ones. The invasion of *Eichhornia crassipes*, *Typha angustata*, *Prosopis juliflora* and *Ipomoea carnea* can be considered as one of the most serious threats to the Samaspur wetlands.

Most of the naturalized exotic species were introduced from Tropical America. The invasion of threatened exotic weeds like *Eichhornia crassipes*, *Typha angustata*, *Prosopis juliflora* and *Ipomoea carnea* can be considered as one of the most serious threat to the Samaspur wetlands. During last 10 to 12 years, this problem has become pertinent. They turn out to be serious weeds in freshwater habitats, where displaces native aquatic plant and animal communities, causes substantial economic hardships and interferes with water uses.

Remote sensing technology has significant potential to aid managers in mapping and monitoring of the extent of aquatic plant infestation and prioritizing areas of plant infestation for control efforts.

To identify and monitor the changes in wetlands of the Samaspur Bird Sanctuary and surroundings, multi-temporal satellite data of 1990 (Landsat Thematic Mapper dated 17th November 1990) and 2006 (IRS P6 Linear Imaging Self Scanner III dated 17th December 2006) were used. IRS P6 LISS III data pertaining to 6th October 2006 and 21st April 2006 were used as ancillary satellite data along with ground truth.

Using time series analysis it is observed that drastic changes were occurred in wetlands (Figs. 1-4). An area 514 ha of water bodies during 1990 was reduced to 248 ha by 2006 (Table 1).

Sl.	Class	1990	2006
1	Water body	514.0	248.0
2	Marshy land	5.2	36.2
3	Aquatic vegetation	361.2	596.2
	Total	880.4	880.4

Table-1. Status of wetlands of Samaspur and surroundings (area in Ha.)

Aquatic vegetation was increased to 235 ha as compared with time period of 1990.



Fig.1 FCC of Samaspur wetland (Landsat 1990)

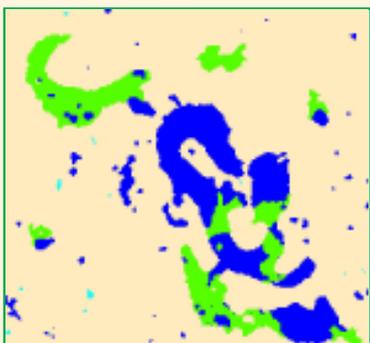


Fig.2 Classified map of Samaspur wetland (Landsat 1990)



Fig.3 FCC of Samaspur wetland (IRS P6 2006)

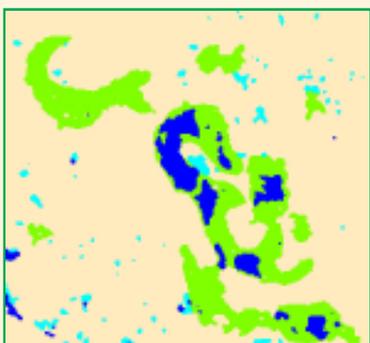
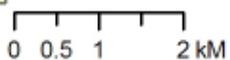


Fig.4 Classified map of Samaspur wetland (IRS P6 2006)

Legend

- | | |
|--------------|--------------------|
| Water bodies | Aquatic vegetation |
| Marshy land | Other landuse |



Conclusion

A better planning is needed for conservation of the rapidly degrading Samaspur wetlands. There are no grazing grounds in the villages surrounding the lakes. So the cattle in these villages graze inside and surrounding areas of the sanctuary. Local communities are the important stakeholders and are dependent on the wetlands for various reasons. So, the state Forest Department should share the responsibility of management and protection of the sanctuary by involving local people. Monitoring of invasion can be done through *qualitative approach* like species inventory (seasonally) and *quantitative approach* using phytosociological methods and *mapping* using ground-based methods (viz. map overlays or Global Positioning System) and high-resolution remotely sensed images.

Reference

Korgaonkar, C. and Gokhale, Y. 2006. Stakeholder analysis for conservation and management of Samaspur Bird Sanctuary, Uttar Pradesh. (<http://wgbis.ces.iisc.ernet.in/energy/lake2006/> Accessed on 12th July, 2007).



Sarus Cranes State bird of Uttar Pradesh
Grus antigone



Invasion of *Typha angustata*



Invasion of *Ipomoea carnea*



Invasion of *Eichhornia crassipes*



Paddy fields near Sanctuary



Grazing pressure in wetlands

Fostering Partnerships for Interdisciplinary Study in Wetland Systems

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The Ramsar Convention (1971) along with the other Multilateral Environment Agreements (MEA'S) in support of wetland management advocates the need for global, regional and national assessments information as a guide to policy-making. Yet in many instances the appropriate scientific information on wetland inventory is missing or incomplete particularly in the Neo-tropical and the Asian belt. In order to achieve up-to-date information on wetland mapping, inventory and assessment; the need to develop a network (or consortium) of partners to participate in a variety of nested mapping activities at various scales was felt. Towards this thought a multi-stakeholder initiative for global wetlands inventory and mapping was proposed by the FAO, through the Coastal Panel of the Global Terrestrial Observing System (C-GTOS), and IWMI, and accepted by the Ramsar Convention's Scientific and Technical Review Panel (STRP). The GWIM (Global wetland Inventory and Mapping Project) initiative has been developed in line with the requirements of the United Nations Commission for Sustainable Development for partnerships that promote sustainable development. The project currently covers the development of a comprehensive strategy and work plan to overview the current status of wetland mapping and the state of the art of methods, data and the available sensors. In addition it explores the role of automated spatial techniques to assess the extent of wetlands addressing seasonal and inter-annual changes and determination of the extent of wetland degradation and loss caused by water management and agricultural activities relative to other causes of adverse change in these ecosystems.

Furthermore, the multiple components of the project, undertook a comprehensive multiple purpose and multi-scale wetland inventory and mapping exercises using earth observation data and GIS. At the global level, the distribution of Ramsar sites has been analysed, focusing on the role and impact of agriculture activities. At regional scale; the change analyses for three wetland sites (Mohlalpeti wetland site in South Africa, Itunjabibili in Zimbabwe and Chibuto Site in Mozambique) in Africa is underway using earth systems to build scenarios through geospatial analysis of multi-layer spatial datasets. At a regional scale a partnership was initiated with the Salim Ali Centre for Ornithology and Natural History (SACON) in India to assess the importance of wetlands for agricultural and aquaculture in an inland wetland of India i.e. Lake Kolleru-a wetland sanctuary (KWS) and a Ramsar site located between west Godavari and part of Krishna district of Andhra Pradesh. In summary, the fishery activities that support livelihoods and human well-being and evaluation of the regional extent of agricultural and aquaculture activity in wetlands and provide an updated inventory database that can be used to assess the extent of spatial and temporal change in wetlands.

Additionally, at the sub-continental level (for Gujarat and Tamil Nadu) an integrated wetland cover layer was prepared jointly with SACON by combining thematic information from recently completed inland wetland database from SACON, information on cultivated wetland from GIAM [Global irrigated are mapping (www.iwmigiain.org) and GLWD {Global Lake and wetlands Database} (www.wwfus.org/science/data/globallakes.cfm)]

In Sri Lanka along with local partner, the Central Environmental Authority [key institution involved in wetland analyses and inventory in Sri Lanka] a component was developed to understand wetland dynamics and its impact on the livelihoods by skilful integrating biophysical parameters derived from earth observation data and the socio-economics parameter collected sustainable livelihood approach in a geospatial platform. Additionally, the an effective data management systems (metadata) was formats for wetland inventory and assessment in line with international standards to support the development of an interactive map server to display online interactive mapping applications and the geospatial analysis (Fig. 1) (<http://www.iwmi.cgiar.org/wetlands/index.asp>).

In summary the effective collaboration and efficient networking among organisations can profoundly contribute to the Convention's mission on the wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development all over the world.



Fig 1. Interactive web-server and the knowledge gateway for wetland information

(*Author is presently working at IWMI, Sri Lanka as a Post-Doctoral Research Scientist)

News Updates

■ Wetlands under threat, warns expert

A considerable area of the backwaters in Kerala has been lost due to reclamation for agriculture, mining, urban area development and other activities, a study on the faunal biodiversity of selected wetland ecosystems of Kerala carried out by S. Bijoy Nandan, Reader, Department of Marine Biology, School of Marine Sciences, the Cochin University of Science and Technology, has revealed. The findings of the study, presented at the ongoing Kerala Environment Congress 2007 organised by the Centre for Environment and Development (CED) here, calls for strict regulations on encroachment and reclamation of wetlands in the State.

The study report states that man made and natural calamities such as the tsunami had considerably eroded the biodiversity in the 'kayal' and riverine wetlands. Several stretches of the backwaters are polluted by organic and industrial effluents. Mr. Nandan also recommends the utilisation of reclaimed paddy lands in Kuttanad and Kattampally to raise an additional crop of fish during the fallow season. The rivers and lakes are biological hot spots and are to be protected as a bioserve, sanctuary or ecologically sensitive zone. Efforts should be made to curb human intervention in natural habitats and strict regulations should be enforced on the introduction of exotic species in rivers and lakes. The Kerala River Protection and Water Conservation Act and more stringent laws should be enacted to ensure the complete and integrated protection of the wetland ecosystems, the paper adds. In his presentation at the congress on Wednesday, chairman of the Kerala Biodiversity Board V.S. Vijayan said the protection of wetland systems would benefit the economy of the country in the long run. "While one hectare of forest is valued at Rs.1 lakh, the value of a hectare of wetland is Rs.7 lakh," he said. Eighteen young scientists will present their papers at the congress on Thursday. An open forum on the protection of the Vellayani Lake will also be held. Planning Board vice-chairman Mr. Prabhat Patnaik is scheduled to inaugurate the valedictory. (Source: *The Hindu* May 10, 2007)

■ Wetlands regulation in the offing

A regulatory regime for wetlands in the country on the basis of their usage is in the offing. The wetlands are to be regulated at Central, State and district levels for which separate regulatory authorities would be constituted. The State Governments have been asked to get additional documentation done by expert agencies on the criteria for regulation. "The draft report of notification for regulatory regime on wetlands is ready. However, what is needed is getting an institutional mechanism for the monitoring process," said the Union Minister of State for Environment and Forests, Namo Narain Meena, addressing a two-day national seminar on wetland conservation that began here on Wednesday under the auspices of the Social Policy Research Institute (SPRI).

The seminar had been organised to work on strategies and policy options on wetlands and their conservation with special reference to Keoladeo Ghana National Park and Sambhar Lake, two Ramsar sites in Rajasthan. "There is an urgent need to regulate the wetlands on the basis of their usage," said Mr. Meena pointing out that MoEF had initiated steps for identification of major wetlands for conservation. Mr. Meena said the number of wetlands identified as per the norms of the International Ramsar Convention, 1971, had increased to 94 covering 23 States and one Union Territory in 2006 against 27 in 2004. So far Rs.58.28 crore has been released for the conservation of wetlands while the Eleventh Five Year Plan would have it increased to Rs.90 crore, he said. Former Chief Minister S.C. Mathur, who is the founder-chairman of SPRI, presiding over the inaugural session, said the Centre was passing the buck by leaving the process of monitoring of wetlands to the States. (Source: *The Hindu* October 5, 2007)

Upcoming Events

- National Conference on Wetlands, Science and Society - An Assessment of their integration, 11-13 December 2007, Delhi

Organized by: Delhi University Botanical Society and International Society of Plant Morphologists
Contact: wetlands_dubs@rediffmail.com

- Wetlands in the 21st Century: Altered Landscapes & Changing Climates, 31 January - 1 February 2008, Oconomowoc, Wisconsin

Organized by: Wisconsin Wetlands Association
Contact: <http://www.wisconsinwetlands.org/2008conference.htm>

- Capitalizing on Wetlands International Conference 2008, 26-30 May 2008, Washington D.C.

Organized by: The Society of Wetland Scientists
Contact: http://www.sws.org/2008_meeting/

- The 8th International Wetlands Conference, 20-25 July 2008, Cuiaba, Brazil

Organized by: International Association For Ecology
Contact: <http://www.cppantanal.org.br/intecol/>

- The 11th International Conference on Wetland Systems For Water Pollution Control 2008 - India, 1-7 November 2008, Vikram University, Indore

Organized by: International Water Association
Contact: <http://www.wetland2008.org/SaveWater/>

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