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**CURRENT STATE OF BIODIVERSITY INFORMATION IN INDIA AND NEED FOR AN  
INTEGRATED BIODIVERSITY INFORMATION SYSTEM**

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## CURRENT STATE OF BIODIVERSITY INFORMATION IN INDIA AND NEED FOR AN INTEGRATED BIODIVERSITY INFORMATION SYSTEM

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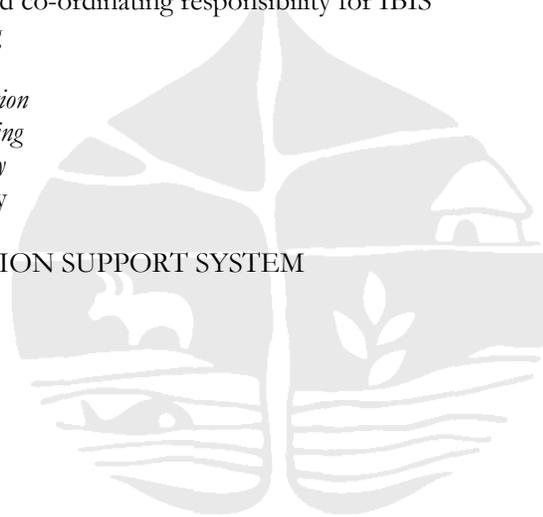
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## **EXECUTIVE SUMMARY**

Information on biodiversity is essential to make appropriate decisions leading to better conservation of biological resources. As biodiversity is an all encompassing topic, the task to collect, store and disseminate such information is enormous. Although some information on various aspects of biodiversity exists, but the same is patchy, unorganised and not on a structured database format and in most cases not web-based. Information systems like ENVIS could be better organised and strengthened by establishing an Integrated Biodiversity Information System to cater to the information needs. IBIS should be a web-based system, integrating all existing information systems and database. It is essential that all ENVIS Centres should start appropriate database development on the subject area for which the organisation was identified as an ENVIS centre and these databases are made available on the web through a link with IBIS. Establishing a National Biodiversity Conservation & Monitoring Centre as an autonomous body, either under the newly created National Biodiversity Authority (NBA) or under Ministry of Environment, Forests & Wildlife will be fundamental to proper running of IBIS besides providing enormous networking working opportunities with organisations already involved in biodiversity conservation and monitoring.



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## CURRENT STATE OF BIODIVERSITY INFORMATION IN INDIA AND NEED FOR AN INTEGRATED BIODIVERSITY INFORMATION SYSTEM (IBIS)

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### 1. INTRODUCTION

Concerns for the conservation of biodiversity were made apparent almost a decade back during the Earth Summit in 1992. These concerns and deliberations during the Summit were able to put biodiversity conservation as an all-encompassing conservation activity. Although a great deal of time was spent on fixing the responsibility for the present state of biodiversity, some far-reaching agreements were made. The Agenda 21 and the Convention of Biodiversity were key outcomes. One of the key commitments under the Convention for each contracting party was to develop a national level biodiversity strategy and action plan. Development of a National Biodiversity Strategy and Action Plan (Article 7 of Agenda 21 of CBD) initiated by the Ministry of Environment, Government of India is a step in that direction. However there is an immediate need to incorporate and develop protocols for collection, monitoring, and dissemination of information through a national network under NBC and IBIS (Integrated Biodiversity Information System). Developing appropriate policies for long-term protection and sustainable use of biodiversity is urgently needed. In this direction the Biodiversity Information System would prove extremely valuable hub to do this. This will be a significant contribution to global efforts to seek and distribute information for effective biodiversity conservation.

The Convention on Biological Diversity (CBD) places high premium on sustainable use of biological resources and equitable sharing of the benefits derived from the use of genetic resources. The convention stresses on the national action (Burhenne-Guilmin & Glowka 1994) in identifying a party's biological capital, developing and implementing a national biodiversity strategy. To achieve this, biodiversity concerns need to be included into national decision making. And to do this the first step would be to acquire information essential for making such decisions (Javed 2000).

It is now well understood that lack of information and inadequate measures are not the only impediments in the conservation of biological resources across the globe, but also the access to such information. While the Global Environment Facility (GEF) was created to meet the funding and infrastructure needs to protect the biological diversity, the Global Biodiversity Information Facility (GBIF) was set-up to meet the ever increasing demand of adequate information for making informed



decisions. The Convention on Biological Diversity also recognised that different countries have different levels of expertise and technology in managing information. To deal with this a Clearing House Mechanism was set up “to ensure that all governments have access to the information and technologies they need for their work on biodiversity. Working on the philosophy that “broad participation and easy access must be the top priority, the CHM is coordinated by the Executive Secretary with a mission to:

- Promote and facilitate technical and scientific cooperation, within and between countries
- Develop a global mechanism for exchanging and integrating information on biodiversity
- Develop the necessary human and technological network

This review paper is an attempt to understand the need for developing such an information system in India and how it can achieve the broader objective of biodiversity conservation with the integration of biodiversity information and technology to allow easy access and dissemination of knowledge, at local, regional and global levels. The paper reviews existing systems on various aspects of natural resource conservation in India and how they can be further strengthened so that they continue to act as valuable focal points for storage and dissemination of biodiversity information.

## 2. BACKGROUND

To protect the rich biodiversity of the country efforts were initiated nearly four decades back by declaring key areas as protected areas. The real impetus came after the enactment of Wildlife (Protection) Act of 1972. India is signatory to major international conventions including the Convention on Biological Diversity, which indicates country’s commitment towards biodiversity conservation. A network of more than 566 protected areas exists today (Rodgers *et al.*, 2000). These areas are not only meant to save tigers, elephants or rhinos but the overall biodiversity. Saving biodiversity means taking steps to protect genes, species, habitat and ecosystems. To save biodiversity is to document its composition, distribution structure and function and to understand various links to support sustainable development (Groombridge 1993). One of the weakest links in biodiversity conservation today stands out due to lack of baseline information in the form of databases (Javed 2000). This is a major handicap in developing and prioritising areas for immediate conservation actions and hence initiation of reliable database activity should be first step toward respecting CBD and achieving sustainable development (Javed 2000).



## 2.1 Existing Information Resources

In India there are several agencies which maintain information on various components of biodiversity. Among the information systems, possibly the Environmental Information System (ENVIS) set up by the Ministry of Environment is the most comprehensive in terms of its coverage. Established in 1982, by the Government of India, ENVIS is a 'Plan Programme' to provide environmental information on relevant subjects to decision-makers as well as general public. Although such centres have provided information on the subject matter to decision-makers and scientific community, it's not really available to general public. This is largely due to the nature of information, which is technical and not web-based. These agencies are responsible for collecting, collating, storing, retrieving and disseminating the information on the allotted themes. Although the MOEF is the Focal Point of this Network, ENVIS is largely decentralised in nature. At present 25 Centres (<http://www.envfor.nic.in/envvis>) cater to the ENVIS. The MOEF as National Focal Point (NFP) is also the Regional Service Centre (RSC) of UNEP's INFOTERRA for the countries in the South Asia.

The Planning Commission set up the National Natural Resource Management System (NNRMS) in early 1980s for the management and development of natural resources of the country. The NNRMS is an entity, which identifies and prioritises projects on natural resources of the country.

There are some other data sources in the country, but they are few. The International Council for Scientific Union (ICSU) established a committee on databases (CODATA) and India is represented in this annual meeting to discuss database activity in Asia and Oceania (DSAO); however this has not encouraged enough database activity in the country. The Pune based National Chemical Laboratory (NCL) maintains excellent database on micro-organism (National Collection of Industrial Micro-organism - NCIM) with about 4000 cultures. It also hosts National Centre for Biodiversity Informatics (NCBI) which provides general information on the biodiversity of the country.

The Global Mangrove Information System (GLOMIS) is a true web-based database and information system, developed by the International Society for Mangrove Ecosystem (ISME), with its India Regional Centre in Chennai., hosted by the M. S Swaminathan Research Foundation. The Mangrove Ecosystem Information Service (MEIS) is a collection of databases developed by MSSRF and caters to the GLOMIS database and information system. GLOMIS India Regional Centre maintains information on various aspects of mangrove ecosystem, particularly an extensive bibliography on mangroves.

The Indira Gandhi Conservation Monitoring Centre (IGCMC) is also one of the information systems but lacks online search and retrieval system. The IGCMC after a few years of dormancy has again



become active and is initiating activities which include developing Geographic Information Systems (GIS) based databases for protected areas, species distribution, wetlands, degraded forests and other important ecosystems. The IGCMC hopes that policy makers and planners can use such information resources in their day to day decision making and hence can act as a clearing house centre on biodiversity related issues. The National Innovations Foundation established by the Department of Science, Government of India is to promote inventiveness and creativity in the society so that the country can provide leadership in sustainable technologies. Such programmes are vital to biodiversity conservation and sharing information with agencies will achieve greater conservation benefits.

Indian Institute of Remote Sensing (IIRS) is developing a Biodiversity Information System (BIS). Though it contains various components such as Bioprospecting & Molecular Taxonomy (BPMT); Species Information System (SIS); Forest Resource Information System (FRIS) and Spatial Decision Support System (SDSS), it is more plant diversity oriented system.

## **2.2 Gaps in the information and need for an Integrated Biodiversity Information System**

The major lacuna in the area of biodiversity informatics is not only the availability of information on different taxa but also proper integration of the existing ones. Although ENVIS is a comprehensive nation-wide Environmental Information System based on the subject expertise of the concerned institutes and agencies, which act as ENVIS nodes in the country, there is no proper and standardised database structure used by the various ENVIS centres. This is typical of all the ENVIS Centres. Online search and retrieval capabilities make the whole concept of a database and information system complete, besides satisfying the users need to sort and access data according to user requirements and preferences. The Standing Committee on Bioresources and Environment (SC-B) also identified development of Environment/Forest Resources Information System (ERIS/FRIS) as one of the thrust areas for the National Natural Resources Management System under the 9<sup>th</sup> Five Year Plan.

The Biodiversity Information System (BIS) being developed by IIRS incorporates Forest Resource Information System (FRIS) which is part of the National Natural Resource Management System (NNRMS). At this point it is not clear if IIRS has been assigned the responsibility of maintaining FRIS or it's a separate entity. In case if it is a separate entity efforts should be made to prevent any duplication of effort. As BIS and various elements of this information system is already functional, it will be better if BIS can become an integral part of IBIS so that information contained in BIS can be used by IBIS. Efforts should be made to encourage existing information centres to migrate to a standard database format which is modular (contains logical group of interfaces, which allow access and retrieval from the interface repository) and querriable.



### 3. INTEGRATED BIODIVERSITY INFORMATION SYSTEM (IBIS)

Information on all aspects of Indian Biodiversity should be contained within IBIS. As IBIS would be the centre for all biodiversity related information for the country all effort should be made to make it complete. To do that it should contain information which may range from taxonomic description of species, status, distribution, current population levels, endemism and threats to human aspects of biodiversity conservation i.e. traditional knowledge and cultural practices. Conservation activities at species, habitat and ecosystem levels should figure in prominently in a relevant format. A database of all relevant organisations and individuals working for biodiversity conservation will make this system comprehensive.

General information on IBIS could be presented in static form, whereas querriable data on major aspects on Indian biodiversity can only be accessed through authorisation. This would be essential in providing necessary protection from biopiracy, while at the same time providing relevant information.

#### 3.1 The structure of the system

The Integrated Biodiversity Information System (IBIS) would be a fully integrated information management system with the capacity to collect, collate, maintain, retrieve and disseminate data to all the potential users. The proposed IBIS would be an interactive and web-based system allowing online accesses to various databases within the IBIS. Fig. 1 gives a conceptual layout of such a system. The system has five components, which are data sources, data capture, central data storage/data forms, data retrieval/dissemination and products. The conceptual layout of the IBIS is similar to systems developed by CSIRO (Commonwealth Scientific and Industrial Research Organisation) and to some extent the Hungarian Biodiversity Information System.

IBIS would heavily rely on research organisations, universities, NGOs, communities and various agencies to compile relevant information on various aspects of biodiversity conservation. The IBIS Taxon unit will capture the data on various taxa, ecosystems, and human aspects of biodiversity. Similarly the literature-based data is captured by the IBIS literature. Another key aspect of IBIS would be to maintain database of all the data in form of IBIS Metadata, whether they are published data or unpublished data sources. There is a great need to compile the Metadata

The third component involves transfer of all the captured data in form of IBIS Literature, IBIS Taxon and IBIS Metadata to a Central Data Repository (CDR). The CDR will store data on all life form and will make the same available to national and international users, which include scientists, policy makers, planners and international biodiversity groups.



The fourth component is data retrieval and dissemination. The web-based IBIS would allow interactive searching of data from IBIS Central Database and would allow users, both in country and from across the world to use the information on India's biodiversity. The Interactive Key would allow users to access various types of information on flora and fauna, their ecology, distribution, threat status and some comments on the population trends.

The IBIS Project would be responsible for the preparation of customised reports, status reports and various other project related documents, apart from allowing online access to IBIS database. The IBIS Presenter would be an attribute allowing development of multimedia CD ROM and web access.

### *3.1.1 The Architecture of the IBIS*

IBIS could be developed as a three-tiered application programme using Microsoft Visual Basic and Microsoft Visual C++ for the user-interface/client layer and middle layer and Microsoft SQL Server as the database engine. All the data of IBIS could be stored in a single integrated database. The SQL-based databases will allow all the data to be readily accessed from outside.

## **3.2 Establishment of National Biodiversity Conservation Monitoring Centre**

To run IBIS and look after other biodiversity related issues more effectively, it is imperative that a fully dedicated biodiversity centre is established. Development of such a biodiversity information centre is a key requirement for planning biodiversity conservation. To initiate action in this direction an autonomous "National Biodiversity Conservation Monitoring Centre (NBCMC)" needs to be set-up. The main purpose of this Centre would be to deal with various issue of biodiversity conservation, from legal provisions to issues of bio-piracy, review of strategies and action plans and developing specific conservation action programme.

If proposal for NBCMC is agreed upon and the Centre is established then IBIS could run as a wing of NBCMC. In case where the setting up of NBCMC or similar entities as may have been proposed under NBSAP is not done, then IBIS can function as an autonomous unit of NBA with close collaboration with MOEF. It is essential that IBIS maintains a strong relationship with MOEF so that various ENVIS centre can work together and with far greater participation and transparency.

## **3.3 Administrative and co-ordinating responsibility for IBIS**

If a National Biodiversity Conservation Monitoring Centre is established then IBIS can function as a unit within the NBCMC (Fig. 2). To discuss the modalities of setting up such a Centre it would be



appropriate to establish a National Biodiversity Task Group, responsible for setting up the Centre. NBCMC could function as an autonomous body of NBA or with the Ministry of Environment and Forests of Government of India and will work very closely with other relevant programmes and organisations, both governmental and non-governmental. Different components of NBCMC are discussed under following:

### *3.3.1 Planning*

The planning section would be responsible for charting and planning the entire programme within the ambit of NBCMC. The planning wing over a period of time will review existing information on biodiversity conservation from time to time using IBIS as a key information provider for such an exercise. The Planning wing would also get necessary feedback from IBIS monitoring for prioritising biodiversity-related actions. Based on such need the Planning wing will also identify appropriate country based agencies/individuals to undertake such priority studies to fill the necessary gaps in information and understanding. Data from these studies would cater to the IBIS database. In case agencies are unable to find funding, the Planning will recommend the project to NBCMC Funding wing for either direct funding or facilitating the agency in procuring funds.

### *3.3.2 Funding*

The NBCMC Funding wing would largely be responsible for running the NBCMC and its various wings (Fig. 2), raising funds or facilitating funds to the top priority projects identified and recommended by the Planning wing of the NBCMC. The Information wing is largely responsible for executing IBIS and providing necessary information to various wings of NBCMC.

### *3.3.3. Information*

IBIS would also allow summarisation and make available necessary data and summary reports on key areas to the Advocacy group (cross-refer to the section below) for immediate follow up action.

### *3.3.4 Monitoring*

The monitoring wing of NBCMC is designed to monitor biodiversity situation using the IBIS and all other data sources and produce summary reports on the status of biodiversity and forward it to planning wing for further actions.

### *3.3.5 Advocacy*

Advocacy is a key feature for any programme to be successful, especially when there is a great deal of scope to make inroads in the private sector and government organisations whose activities directly or



indirectly impact the biodiversity. Establishing a partnership with the corporate house and advocating the cause of biodiversity conservation among all sectors of the society would be an essential feature of the Advocacy wings activities.

### 3.4 IBIS Functionality

The third level in the Fig.2 of NBCMC/IBIS structure is the functionality of IBIS programme. As there are many existing information systems in the country, the first thing IBIS would aim at is developing functional links with all such existing databases/information systems. To monitor and initiate conservation actions, the first step would be to build a database. In such a situation the existing database would be useful to begin with and this could be further strengthened with the proposed development of network for access and retrieval of information by network partners and those outside the network. The Nature Conservancy in USA has created nearly 87 biodiversity information centres. Known as Conservation Data Centres, these centres provide a computerised inventory on biological resources of the region.

IBIS must also encourage the existing ENVIS centres to migrate from text based information to actual database oriented information. IBIS would maintain a two-way flow of information with the ENVIS, NNRMS, IGCMC, GLOMIS and others on one side (Fig. 2).

Globally with its web-based presence IBIS would complement the Global Biodiversity Information Facility (GBIF), CBD's Clearing House Mechanism, World Conservation Monitoring Centre's database and information resources and all other national, international government organisations, NGOs, research bodies, museums and universities.

## 4. USING IBIS AS A DECISION SUPPORT SYSTEM

The use of various types of data pertaining to different aspects of distribution of taxa has been used to accurately map the distribution and assess the gaps in information using Geographical Information Systems (GIS). The BirdLife International (BLI) has used such information in identifying threatened species and prioritising areas for conservation (Stattersfield *et al.*, 1998). They have been able to chart centres of endemism using such a database.

India occupies a very prominent position in global space research and use of spatial technologies in better understanding its natural resources. Being a leader in the Information Technology sector, we are in a position to better integrate and operationalise spatial technologies such as GIS and remote sensing



with information technology in the effective conservation of biological diversity. IBIS and other wings of NBCMC can enormously benefit from such integration of spatial and information technologies.

The IBIS database can be used to identify and prioritise areas for immediate conservation needs and also to plan studies in those areas for which the present knowledge is inadequate. IBIS as a linked system would be a very useful system not just nationally and regionally but globally too.

## 5. FOLLOW UP PLAN

Assuming that IBIS is identified as an important activity as part of the NBSAP and some efforts are made to establish NBCMC or a similar national level structure, it would be essential to review the whole issue of natural resource management. Although a National Natural Resource Management System exists in the country, which identifies priority projects on various aspects of the natural resource management in the country, there is no mechanism developed to evaluate the existing natural resource management. Appropriate evaluation of the efficacy of policy initiatives undertaken as part of the national natural resource management is essential to prevent misallocation of human and financial resources (Chambers 1997; Bellamy *et al.*, 2001). A critical national level evaluation of the existing system to conserve natural resources and review of various policy processes that guide and control such systems would have to be undertaken. This is imperative to create enabling policy environment, allow development of frameworks and systems to achieve better natural resource conservation and management operationalising GIS and remote sensing technologies.

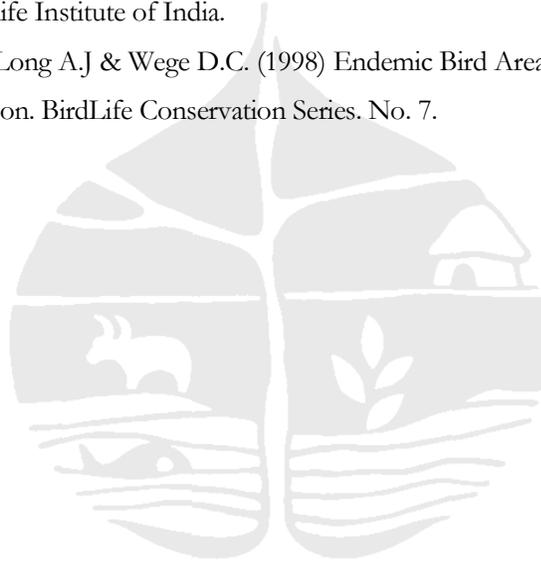
## 6. CONCLUSION

Looking at the state of information that at present is patchy, not systematic and often not on a format which allow easy storage and retrieval, the development of databases on various components of biodiversity is top priority for any nation. It is all the more significant and immediate concern in the tropics, the major centres of biological diversity. Tropical regions in spite of high diversity are information poor. Adding to this is the new development initiatives under the garb of globalisation in new and emerging market-based economies. The combined effects of all these could be catastrophic if urgent conservation initiatives are not undertaken. One such initiative would be to develop a national level centre (NBCMC) for monitoring and conservation of biological diversity. This autonomous centre would cater to developing conservation priorities based on systematic and scientific accumulation of information, its processing and analyses by the IBIS wing. The Centre would use various component of biodiversity i.e. birds, plants etc. on which information is more easily available to draw conservation priorities and initiate and strengthen reliable database activities amenable to GBIF and other relevant databases.



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## ABBREVIATIONS

IBIS-Integrated Biodiversity Information System  
NBCMC-National Biodiversity Conservation Monitoring System  
ENVIS- Environmental Information System  
NNRMS-National Natural Resource Management System  
CBD-Convention on Biological Diversity  
BLI-BirdLife International  
MOEF-Ministry of Environment and Forests  
CSIRO-Commonwealth Scientific and Industrial Research Organisation  
WWF- Worldwide Fund for Nature-India  
IGCMC- Indira Gandhi Conservation Monitoring Centre  
GLOMIS- Global Mangrove Information System  
MEIS-Mangrove Ecosystem Information Service  
MSSRF-MS Swaminathan Research Foundation  
ICSU- International Council for Scientific Union  
CODATA- Committee on Databases  
DSAO-Data Sources in Asian-Oceanic Countries  
WCMC-World Conservation Monitoring Centre  
UNEP-United Nations Environment Programme  
NBA- National Biodiversity Authority  
IIRS - Indian Institute of Remote Sensing  
BIS - Biodiversity Information System  
FRIS - Forest Resources Information System  
BPMT - Bioprospecting and Molecular Taxonomy  
SDSS - Spatial Data Support System

