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***Review Paper***

# Biodiversity Conservation and Management: Tools and Techniques

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## Abstract

*The review paper focuses on the different types of biological diversity found on ecosystems and loss of biodiversity and species richness of ecosystem and various causes of the loss of biological diversity due to anthropogenic as well as natural processes and mentioned the different tools and techniques and advanced sciences and basic sciences interactive studies for biodiversity databases creation, database management and interpretation for biodiversity conservation and management were studied. Various institutions and organizations launched different programs and working independently as well as simultaneously for the assessment, preservation and sustainable development of biodiversity.*

**Keywords:** Biodiversity, geo-informatics, biodiversity-informatics, conservation.

## Introduction

"Biological diversity" is defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Various taxonomists and conservationist in their study find out that estimation and nomenclature of known species found on earth is a very hard work[1,2]. But there are few organisms which have nearly complete information about their species, total numbers for e.g. Birds and Higher Plants. The estimation provided by the global biodiversity assessment there is 1.75 million species which are known out of existing species around 13 to 14 million. Nomenclature and classification of 1.75 million known organisms is a very vast work, but it is very essential for the easily comparative study and sharing of biodiversity information in between different groups, organizations involved for biodiversity conservation and other issues impacts on biodiversity. For the solving the problem of such hard task more than 5000 experienced taxonomist worldwide[2]. Estimation provided by UNEP-WCMC there are 270,000 species of vascular plants and 52,000 animals (Vertebrates). Wetlands are most useful ecosystem and also life support of different types of the biodiversities residing in it and also a source of living for millions of people which live near the wetlands and obtained their living by wetlands based businesses. The wetland are also are beneficial for the sustainable development. India's wetlands have diversity having such as, lakes, ponds, marshy, and also are useful for the balance of flooding and drought conditions, and also a support of various nutritive resources essential for life[1,3]. It is necessary to conserve the tropical forest which accompanies 45% of vascular plants and also riches in biodiversity and it is also hotspots for biodiversity[4]. There is great interference made by Peoples which have destroyed the species by cutting, fire burning, habitat destruction and use of different types of pesticides and chemicals, transformations of forests in other types of vegetation, industrial development, urbanization which impacted on the different types of biogeochemical and hydrological cycles and caused climatic changes. Study told that the deforestation is spreading at a rate of 15.17 million ha per year and also pointed out that the about 5-10% of tropical forest species will be extinct within next 30 years due to anthropogenic interference which will transform the land-cover. In an important study, find out that there is a great correlation between the threat of vulnerability and endemism rates of species due to narrow geographic species. Expanding population and its burden and improper management of resources leads to overuse cause extinction of floral and faunal diversity. In view of the above biodiversity and issues; many programs at global and local level have been launched under the goals for preservation and sustainable biodiversity developments. The investigations have been suggested the interdisciplinary mode of the study which encompass environmental issues, socioeconomic, climatic and also other which is beneficial for the depth understanding of biodiversity and various factors which impacts on it. Professionals' studying of biodiversity conservation and management requires a simplest tools and techniques and understanding of biodiversity processes.

## Causes of Biodiversity Loss

**Natural and anthropogenic factors:** there are several natural factors and as well as anthropogenic activities which controls and governs biodiversity in natural habitats. Changes in the disturbances severity such as intensity, frequency, or pattern may results as impacts on biodiversity[4]. Due to water-logging forests become more susceptible towards the climatic factors such as wind throw, drought, etc. Anthropogenic interferences

are complex in terms of large-scale transformation of lands in other types of lands which not much more on forest but it may changes the biodiversity due habitats changes and developments of different environment which will not supportive for previous species. These processes such as burning of vegetation, grazing ,cutting of trees for building purposes, collection of various types of products such as seeds, flowers, nuts, fruits (non-timber products) and also other product such as bark, latex, branches, foliages or whole individuals make susceptible the ecosystem towards the destruction of habitats and losses of biodiversity of forests which undergoes the activities mentioned above[4].

**Changes in areas:** the different types of the forests occupied in several areas converted to another types in the form of non forest or another types of vegetations or transformed into non-forest areas.

**Fragmentation of areas:** Due to the fragmentation of the occupied areas of forests may changes in mosaic pattern and modification in the patches which are connected across the landscape areas.

**Habitat change and Loss of species:** changes in the habitats may changes the characteristics of the species and also communities transform to another types community due to different habitat conditions. Some anthropogenic interference impacts directly losses of species. If any species which works as a mediator for other species if die due to anthropogenic interferences will cause loss of certain other species.

**Dispersal/migration and Reproduction:** Anthropogenic interference may impacts on the landscapes capacity to provide a suitable platform for dispersal or migration pattern. Reproduction process may become rapid, direct and dramatic consequences[5].

**Regeneration/succession and Trophic dynamics:** logging have a clear results that it can change the mature and old forest and replacement with early successive species, Trophic dynamics refers the interaction of different species form at various Trophic levels of food chain which includes pollination, predation, and herbivore Each Trophic levels in food chain impacts on other Trophic level hence impacts on Trophic dynamics may be affected.

**Ecological dynamics and Local extinction:** Ecosystem processes such as ecological niche, food chain, food webs may involves the several types of the species of plants, animals, microorganisms and other which make a typical interactive complexes and impacts on each other in different ways and also it is not necessary that all the complex forming species involve in the functioning of ecosystem process should present. But in ecosystem the dominant species may be in a key role to determine the extinction or presence of a species in future which are dependent on the other species.

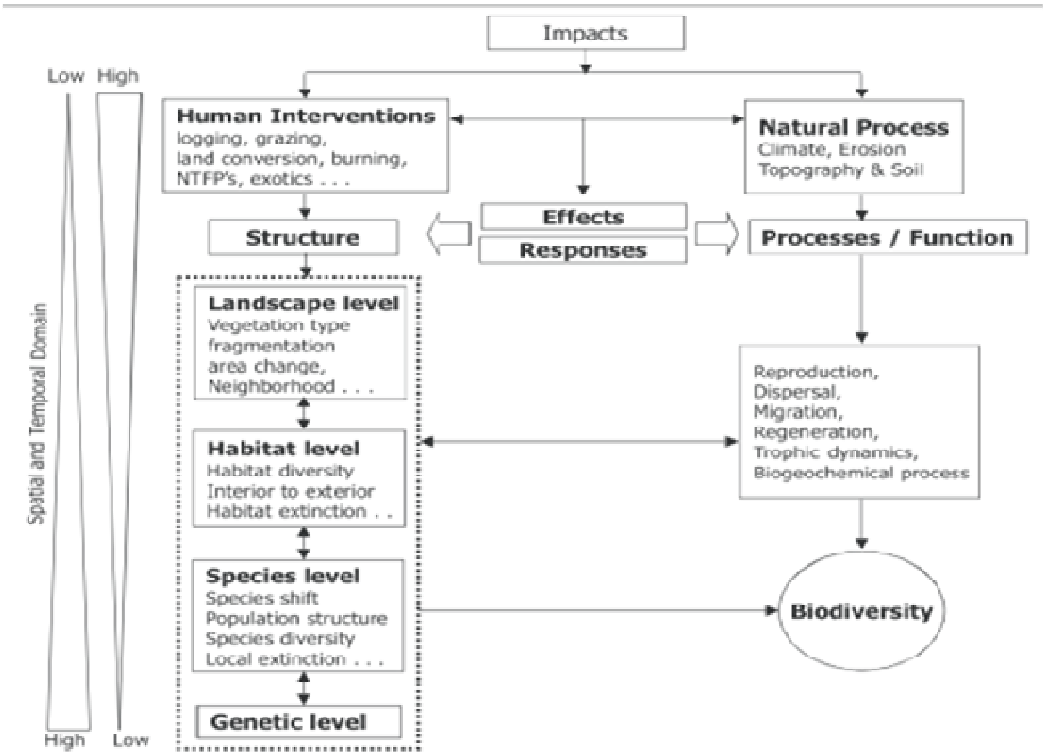


**Figure-1**
**Causes of Biodiversity Loss[4]**

## Methodology

Different types of the secondary databases, databanks, tools and techniques which work complementary for interdisciplinary research for data generation, database management, conservation studies, phylogeny, taxonomy of the living biodiversity were available on webs were used are mentioned below in sub points.

**Database Facilitation Center and Service provider:** Amsterdam University has for the taxonomic studies are a center of experts ETI (the Expert center for taxonomic identification) which have relationships on operational basis with UNESCO. It is a center which were established in year 1990 for the innovations in the field of Information and communication technology tools and techniques specially for the identification of the species and documenting the various biodiversities and for the collaboration with other institutions and internationals organizations and make a network of biodiversity experts .which will be the helpful for creating the better and efficient biodiversity information system. ETI is a versatile organization which is making the coordinated international biological resources networks and also publishing electronic identification and information system. There are also feedback steps for the assistance to develop new Information communication technology.

**The Specialized Program:** The program such as Species 2000 Program are a platform to provide the depth studies of different things such as status, classification and verification of the species and it will also provide the systematic and uniform quality indices for living organisms on earth[2]. The user of the Species 2000 service is beneficial for taxonomists and other service users which are connected through central access system can easily correlate and can check the different characteristics as well as actual hierarchy. It is also will be useful for the comparative studies of different species by arrays and checklist based on different criteria's. In the sequence of information system the World Biodiversity Information Network (REMIB) was established and also in declaration of Oaxaca has created the Biological information network in mexico[6].

## Biodiversity Assement Tools and Techniques

**The Universal Linnaeus II tool:** There are a lot of databases of the various species on the earth, it is difficult to handling. In these days the taxonomist, biostatistician, ecologists, bioinformatician, geo-informatician everyone have need of these data for interdisciplinary research for the biodiversity conservation and its issues. Easily sharing of the data to international scientific communities as well as the time to time updating of the database, processing, manipulation of the data digitization of the data is necessary. There is a great demand of the development of multifunctional tool such as Linnaeus II and other which will work to the store as well as the interpretation and processing of stored data and also need for the revolution in dissemination of the digital informatics.

**Biodiversity Informatics tool:** Biodiversity Informatics is a tool which involves the application of information technology for the biological information management, mathematical exploration of algorithms for the analytical studies and the proper interpretation of the data obtained from primary sources basis from living beings particularly of species level of the classification. Now Investigators have capacity to process the large amount of the biodiversity stored databases to analysis such as 104 or more than recorded data frequently[7]. Biodiversity informatics is a inferential tool for ecological niches and prediction of species on the basis of areas distribution, from information about existence of species, and digital electronic information are helpful for easily characterization of the landscapes ecology and also it is providing a plate-form for efficient and potent predictive inferences and geographical spatial dimension of biodiversity[7].

**Table-1**
**Examples of major information networks focusing on conservation[8]**

| |
|---|
| **Biodiversity Conservation Information System (BCIS):** is a framework for networking and conservation of biodiversities. |
| **Bird Life International (BLI):** which have expert network, database development for Threatened birds and Important Bird Areas and also publish book and web fact sheets. |
| **IUCN Red List:** it focuses on threatened species and published book on web and on CD. |
| **IUCN Species Information Service:** information system based on expert network which focus on species data sets, threat analysis, customized products. |
| **UNEP World Conservation Monitoring Centre multiple:** which works on information services, including species databases for CMS and CITES. |

**Geo-informatics tool:** Geoi-nformatics involves the different types of the tools and techniques in integrative manner for the extensive study of the mechanisms which is complex manner which controls on the spatiotemporal dynamics as well as biodiversity. There is need of synergism in between adapted measurement processes, sample design and also in technology[4]. Databases which are spatial and non-spatial in characteristics and also of different time series based are essential, which is cleared out by the discussion from biodiversity regulators. For the above need different types of the integrative tools and techniques such as GPS, GIS and RS an important complimentary system to ground-based studies. The details of various technologies for biodiversity assessment are shown below in figure-2.

**Remote Sensing and GIS tool:** Remote sensing is a technique of extracting of the information from different objects without

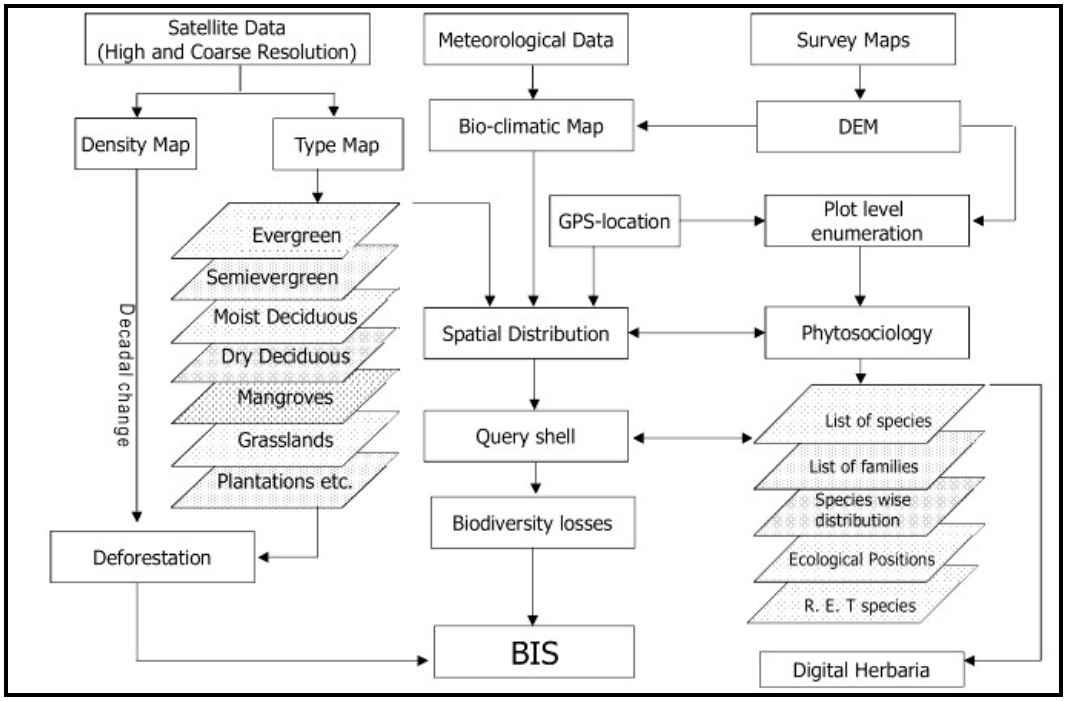


**Figure-2**
**Biodiversity Information Systems**

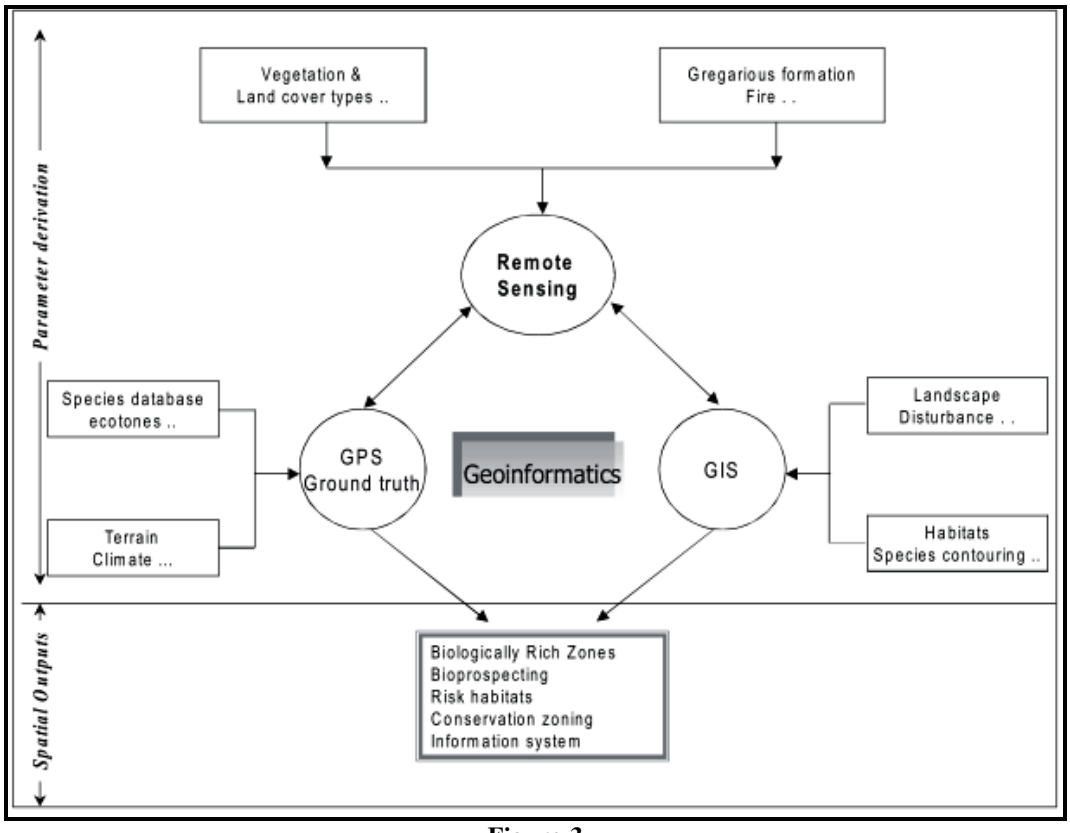


**Figure-3**
**Geo-informatics-An integrated Tool for Biodiversity Assessment**

the coming in any contact of the objects which are understudy it comprises the different disciplines such as hydrology, petrology, Biodiversity conservation ,habitats and various terrestrial and Aquatic ecosystem[1,8]. We can obtain the long term earth observation data locally and globally in constant manner with lesser time, and low labour. Remote sensing and Geographic information system are interdependent and complementary to each other. RS provides raw extracted information of local and global time scale and GIS works as store of information and analyzes and visualizes the data after processing[8] use of combination of remotely-sensed data and vector GIS data, and integration of RS and GIS has been used apparently in these days[9].

**Modeling tools:** Modeling is a mathematical technique which involves the use of applications of mathematical algorithms to generating the data and find out to inferential steps from the data's for planning the future research and providing the information and priorities for the conservations to environmental decision makers. Modeling such as niche modeling takes the information about the species occurrence, and requisite specific needs of species and conditions which will impacts on the diversity, spatial and temporal distribution of the species, characteristics of the species under different climatic conditions, impacts on the global and local economy due to loss of assets under climatic conditions, and also impacts on the health in change environmental situations[1]. By the integrating the primary databases and information of biodiversity to ecological niche modeling, the various investigators, scientists, entomologists, conservationist can revolutionize the interdisciplinary research by providing better and efficient method of prediction of global changes, prediction, analysis and spreading of pest and diseases and its management[1]. There are algorithms which is essential for the better and effective ecological modeling such as BIOCLIM, Climate Space Model, GARP, and Euclidean distance techniques[1].

## Conclusion

Biodiversity is the base of life, several types of the resources necessary for life is provided by the nature in the form of biodiversity. But presently the increased demand of the resources caused the pressure on the biodiversity and their natural habitats were cleared for agricultural purposes, settlement and industrial purposes etc. which resulted loss of the biodiversity and more of the species become extinct and other are also become rare, threatened, endangered or about to go extinction in near future. There is great demand of the conservation of the biodiversity databases of the species which are either rare or about to go the extinct. In India for the conservation of the biodiversity by ecological development practices an eco-development project was launched with the help of GEF (Global Environmental Facility) and World Bank. Project focuses on the impacts of the communities on the protected areas and vice versa and also the involvement and collaborative support of local population, state and capacity building for better conservation and management of vulnerable areas[10]. There are several tools and techniques as Geo-informatics, Biodiversity-informatics, modeling, remote sensing and GIS and others advanced techniques are providing significant role for the conservation of the valuable biodiversity resources databases by sharing globally to gain the knowledge from the other organizations and countries to conserve and manage the biodiversity resources. By the generation of digital biological data sources digital library and data bank could be established. Which will be beneficial for the various investigators, conservationists and researchers which will be easily able to identify and can correct ambiguity. Various natural scientists, biologists, ecologists can obtain the details of various taxon, species and can use for their studies and it will be also attracted to policymakers towards the severity of the biodiversity losses and their impacts on human. There is a great importance to involvement and awareness of natural inhabitants of forest areas by providing economic benefits to make interest for the conservation of the biodiversity. Ecotourism has become popular tool for biodiversity conservation based on minimizing local threats to natural resource such as agriculture, contamination harvesting of wild plants and animals. Ecotourism apart from its impression on protected of wild animal and plants, has economic gain for local communities by providing large different related job categories for local people and lead them to this conclusion that for more benefit they have to protect their natural resources.

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