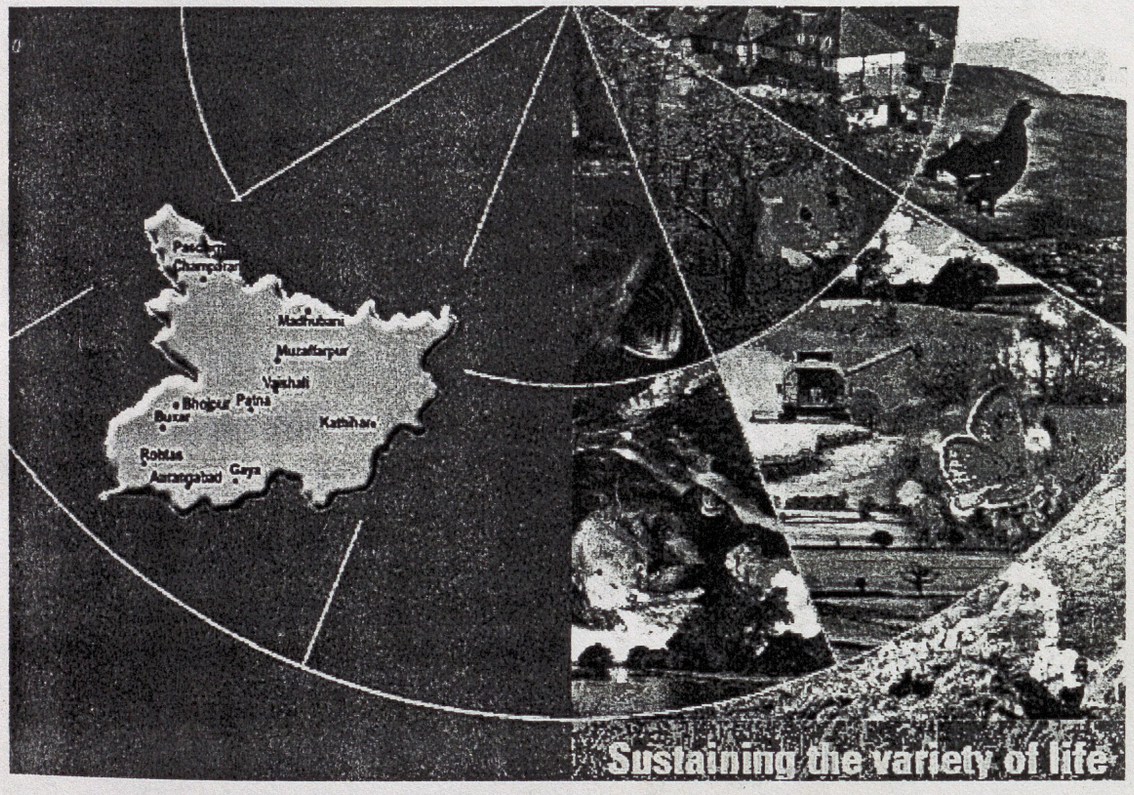
BIODIVERSITY STRATEGY AND ACTION PLAN FOR THE STATE OF BIHAR



DEPARTMENT OF ENVIRONMENT & FORESTS,
GOVT. OF BIHAR, PATNA

Biodiversity Strategy and Action Plan for the State of Bihar

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PREFACE

In pursuance of the UN Convention on Biological Diversity in June 1992, a draft for the National Biodiversity Strategy and Action Plan (NBSAP) for the conservation and sustainable and equitable use of Biodiversity and biological resources was published in October 2002 by MoEF, Govt. of India. This would serve as the main instrument for the implementation of conservation of biological diversity (CBD) at the National level. Article 6(b) specifically mandates the integration of Biodiversity Conservation and sustainable use into various sectors. India's NBSAP process envisaged the formulation of action plans at the State level also. In a unique move, MoEF, Govt. of India, asked a non-governmental body "**Kalpavriksha**", New Delhi, to prepare the NBSAP on behalf of the Government.

Similar to the Central Government, the Department of Environment & Forests, Govt. of Bihar decided to request an independent agency namely **Centre for Environment & Nature Conservation**, Department of Zoology, Patna University, to carry out the technical co-ordination and prepare the Biodiversity Strategy and Action Plan for the State of Bihar. While formulating the State level Strategy and Action Plan, the attempt from the very beginning has been to be participatory in nature with open-ness to all points of views of interest groups reaching out to a large number of local level organizations, NGOs, academicians and scientists, government officers of different departments, the private sectors and others who have stake in biodiversity. A two-day workshop on Biodiversity Strategy and Action plan for the State of Bihar was organized on 22nd and 23rd Jan 2004 in the Deptt. of Geology Auditorium, Patna University by the State Deptt. of Environment & Forests, Govt. of Bihar with the local support of Prof. R.K. Sinha, Deptt. of Zoology, P.U. The opening welcome address was given by Sri B.A. Khan, Chief Wildlife Warden, Govt. of Bihar, Patna followed by the introduction theme by Prof. P.C. Bhattacharjee, Deptt. of Zoology, Gahauti University. The workshop was attended by large number of Faculty Members of different universities, NGOs, Government officers, etc. The inputs of the workshop have been incorporated in the Action Plan. In short, efforts have been towards decentralizing the planning as far as possible and proceed upwards from the grass root level. Media outreach has also been one of the important components of the State Action Plan.

(S.S. Verma, I.A.S.)
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Centre for Environment & Nature Conservation, Department of Zoology, Patna University, Patna.

BIODIVERSITY CONSERVATION National Strategy and Action Plan

Part 1. Conditions and Provisions for Developing A National Strategy for Biodiversity Conservation

INTRODUCTION

1. What is Biodiversity?
2. Biodiversity Importance Internationally and in India
3. India's participation in multilateral conventions.
4. The Biodiversity Convention and India
5. Draft proposal for National Biodiversity Conservation Strategy and Action Plan

1. What is Biodiversity?

The term biological diversity or biodiversity is a comparatively new one and as such is not as yet widely known. In brief, the term refers to the variety of all life on earth, plants animals and micro-organisms, the genes they contain and the ecosystems they form. Biodiversity is not a static concept but recognizes the inter-relatedness of all parts of the biological world. It is often considered at three levels: *diversity of species* - the diversity of all plants and animals, including fungi and micro-organisms; *genetic diversity* - the variety of genetic material within species; and e*cosystems diversity* - the variety of ecosystems (e.g. mountain forests, steppe or savannah, deserts etc.). Together these three form the components of biodiversity.

Biodiversity is a source of significant economic, aesthetic, health and cultural benefits which form the foundation for sustainable development. However, there is general scientific consensus that the world is rapidly becoming less biologically diverse in terms of genes, species and ecosystems. The reason for this is clearly anthropogenic. The scale of human impacts on biological diversity has been increasing exponentially primarily because of worldwide patterns of consumption, production, trade; agricultural, industrial and settlements development; and human population growth.

Neither the economic nor the ecosystem value of biodiversity is as yet well understood. In particular, there is insufficient knowledge of the interdependence of species within ecosystems and the impact of the extinction of one species on others. As the world enters the 21st century, reducing the rate of biodiversity loss and conserving still existing biodiversity as the basis of sustainable development remain major global challenges.

2. Biodiversity Importance Internationally and in India

Biological diversity is a vital resource for human beings, both for the global community and for each nation. It is at the heart of economic productivity and livelihood today and its conservation and rational use is an absolute necessity to achieve sustainable development. In addition, its protection and maintenance is an insurance policy for future generations - even forms of life that may appear to provide no human benefit now may become important as conditions change over the coming centuries.

From both wild and domesticated components of biodiversity, humanity derives all of its food and many of its medicines and industrial products. Economic benefits from wild species alone make up an estimated 4.5% of GDP of industrialized countries such as the USA. For less developed countries this proportion can be much higher. The current commercial value of domesticated plant and animal species is even greater - for example in India agricultural production accounts for up to 45 % of GDP. Many benefits, particularly in less developed countries, may not be well represented in purely economic terms but are nonetheless critical for peoples livelihoods. For example, in Ghana three out of four people look to wildlife for most of their protein and for almost 80% of people in developing countries traditional medicines from the wild form the basis of primary health care. Even in modern pharmaceuticals, around one-fourth of prescriptions contain active ingredients extracted from plants and this probably represents only a small proportion of potentially useful substances not yet discovered.

Biological diversity in its totality forms the living biosphere in which human beings, along with all other species, inhabit and depend upon for their survival. In the remote past, human actions were trivial when set against the dominant processes of nature. This is no longer true and as the human race approaches the close of the 21st Century it is clear from threats of climate change, desertification, land degradation, etc., that at both at national and global level we are using up and destroying the very basis of our future survival.

India is a land of physical, ecological, biological, social, cultural and linguistic diversity. Since ages, the people of India have had close linkages with nature. They believed that each individual life form is a part of a system in close relation with other system. It is also of interest that what are possibly the world's first recorded conservation measures were enacted in India in the 3rd century BC during the reign of emperor Ashoka.

The ethos of conservation is engrained in India's cultural heritage. In the past, the subsistence, life-styles of different groups of peoples were shaped by their natural surrounding. In different parts of the country people adopted different ways of sustainable use of natural recourses. The cultural diversity of the Indian people helped to maintain a range of biological diversity and also increased the natural diversity by the introduction of selective species. In doing so, the people in different parts of the country have evolved appropriate conservation and management approaches based on their culture, religion, ethics and traditions. For example, the unique tradition of marinating sacred groves has been responsible for preserving islands of biological diversity in various parts of the country. The protection of biological diversity is important not for only cultural, historical or scientific reasons but also for vary practical reasons.

An attempt is being made to outline the physical features and the richness of biological diversity in India and also the factors leading to its loss, conservation measures, follow-up action and future priorities for conservation.

How come we are so rich in Biodiversity? Well, for one reason, our large geographical area and the location of the country in the tropics do provide us with abundant ecological niches for the occurrence and survival of various biodata. For Example:

1. High-mountains: snow (alpine) regions; high streams: altitudinal distribution of flora and fauna.
2. Hot (Thar) and cold (Lathak) deserts.
3. Highly fertile river vallies; Indogangetic plains; Terai regions; variety of crops in the field, gardens, orchids etc.
4. Deccan plateau: Western and Eastern Ghats; moist and deciduous forests; etc.
5. Seventy five hundred kilometer long coastline; Sunderban-the largest delta in the world and the mangroves.
6. Marine life; vertical degression of sea-shelves; Islands and their insular biological wealth, deep sea on the east (Way of Bengal), the west (Arabian sea) and in the south the Indian Ocean.

3. INDIA'S PARTICIPATION IN MULTILATERAL CONVENTIONS

Participation and Leadership

India is a signatory and participant in the following international conventions that involve or impact upon the conservation management of biodiversity and tropical forest resources. India tends to be an active participant in those Conventions that it endorses. India has played a leadership role in framing and promoting implementation of the provisions of various international conventions such as the United Nations Convention to Combat Desertification (UNCCD) that may have direct effects on key economic and environmental issues and interests.

Convention on International Trade in Endangered Species (CITES)

Since India became a party to CITES on 18th October 1976 it has provided data annually to the CITES secretariat on the trade of endangered species through its CITES Management Authority.

World Heritage Convention

India ratified the World Heritage Convention in 1977. India has five registered World Heritage Sites.

These sites are:
- Kaziranga National Park
- Keoladeo National Park
- Manas National Park
- Sundarbans National Park
- Nanda Devi National Park

Ramsar (Wetlands) Convention

India has been a contracted party on 1 February 1982. India now has six designated sites covering some 192,973 hectares of important wetlands. These official Ramsar sites are:

- Chilka Lake
- Keoladeo National Park
- Wular Lake
- Harike Lake
- Loktak Lake
- Sambhar Lake
- Kabar Lake

North Indian wetlands

This region includes the wetlands on the Gangetic plains, together with the coastal and freshwater wetlands of Rajasthan and Gujarat. It supports more breeding Sarus Cranes (on shallow wetlands and associated agricultural land) and Indian Skimmers (on the vast system of rivers) than any other region, and the scattered lakes and reservoirs also provide habitat for non-breeding flocks of Sarus Crane and significant numbers of breeding and wintering Pallas's Fish-eagles. The 'central population' of Siberian Crane winters in the region, but has declined to near extinction in recent years. The swampy wetlands of northern India, particularly in Bihar, were once the stronghold for Pink-headed Duck, a species which may now be extinct, although it could possibly survive in the more inaccessible parts of its former range.

CURRENT STATUS OF HABITATS AND THREATENED SPECIES

The vast Gangetic plains are densely populated and utilized throughout. The natural wetlands there have been greatly modified by drainage, irrigation and encroachment for agriculture and development over many centuries. Despite these changes, some extensive, rich wetlands remain, and this region is remarkable for the degree to which wildlife is able to coexist with man in wetland and agricultural areas, linked to the Hindu philosophical tradition. The region also includes extensive coastal wetlands in Gujarat, and freshwater lakes and reservoirs in Gujarat and Rajasthan, vitally important for both wildlife and man in these arid states. Huge numbers of water birds occur, including several threatened species, but significant recent declines are linked to wetland drainage, unsustainable exploitation for fuel and fodder, increased agricultural intensification and use of agrochemicals, human disturbance and hunting. Many of the major tributaries flowing into the Ganges have been dammed for hydropower and irrigation schemes, which have created some new wetlands, but are negatively affecting the habitat of riverine birds.

WETLAND EXPLOITATION

The vegetation bordering wetlands provides vital feeding, shelter and nesting sites for many water birds, but it is commonly cut or burnt, for example to make thatch and other grass products. The tall trees used by Pallas's Fish eagle, storks and other water birds as nest sites are sometimes felled for timber, fuel and fodder. Mud removal (for construction) and clearance of aquatic vegetation further

reduce habitat availability, although moderate cutting or grazing of vegetation is essential to keep shallow wetlands from becoming overgrown. In general an ample border of natural vegetation, including tall trees, should be maintained around wetlands. Potential eyries for Pallas's Fish-eagle need to be protected from cutting and disturbance. The planting of nest trees or provision of artificial nesting platforms should be undertaken for this species carefully sited to avoid disturbance and persecution.

DEVELOPMENT (URBAN, INDUSTRIAL, ETC.)

Wetland habitat is being lost because of the constant spread of villages and industry. The mining of banks and beds of wetlands and rivers for sand, gravel and stones causes disturbance, lowers food supply and reduces nesting habitat for birds. Intensive dredging regimes destroy river islands, contributing to the decline of the Indian Skimmer. Excavation of sand for nearby lime and brick industries has caused siltation at several sites. These activities need to be controlled when they are damaging wetland habitat, especially inside protected areas.

DISTURBANCE

Wetlands are intensively used and disturbed by large numbers of fishermen and hunters, for transportation and by local people for bathing, etc. The large number of people and cattle visiting the fringes of wetlands increases the risk of eggs and chicks being trampled. Wetland reserves need to be patrolled to minimize disturbance in the more sensitive areas, particularly during the breeding season. Outside protected areas, human disturbance needs to be controlled at Pallas's Fish-eagle eyries, Indian Skimmer colonies and Sarus Crane nesting and roosting areas, possibly by designating these sites as local sanctuaries where human activities can be regulated (e.g. by guarding during the breeding season).

POLLUTION/PESTICIDES

Wetlands are affected by air- and water-borne industrial pollutants, agrochemical run-off (causing eutrophication) and municipal waste from adjacent towns, and diminishing water supplies mean that many wetlands are less frequently flushed by pulses of clean water. Pesticides are used in the cultivation of water chestnut (see above) and other crops.

Large water birds and raptors are usually predators or scavengers, and they are thus particularly vulnerable to build-up of toxic chemicals. The use of pesticides (such as dieldrin and aldrin) or fertilizers should be strictly controlled, especially in areas close to important wetlands, and traditional organic agricultural practices encouraged wherever possible.

HUNTING AND PERSECUTION

Ducks are hunted with shotguns or nets in northern India, either for food or sport, and in some regions storks are also targeted. Even the Sarus Crane, once immune from persecution because of traditional beliefs, is increasingly affected by the removal of its nests or eggs by rice farmers who consider it an agricultural pest. Efforts are needed to control hunting, including by patrolling wetland protected areas and intercepting illegal hunters, and by monitoring and controlling the sale of water birds as food in markets, particularly in Bihar and other areas where large-scale hunting is a problem. Measures are required to minimize conflicts between Sarus Cranes and local people, including setting aside small areas of uncultivated wetland and grassland for nesting (see above), and education programmes stressing the threatened status of this species and the traditional relationship between cranes

and man. An award scheme to recognize as **'Sarus Protectors'** those farmers who have provided suitable habitat on their land has proved successful in maintaining the traditional religious links between farmers and cranes, and in increasing the participation of local people in crane conservation; this approach should be used more widely.

INADEQUATE DATA ON THREATENED BIRDS

Surveys are required to identify key feeding and roosting areas for Sarus Crane, and along rivers to locate Pallas's Fish-eagle eyries and Indian Skimmer colonies, and to determine what measures are required for the protection of these sites. The effects of dams and irrigation schemes on the flow regimes in the regions' rivers should be studied to determine how to prevent flooding of active Indian Skimmer colonies. Although it is probably extinct, searches should be made for Pink-headed Duck, principally in its former strongholds in Bihar, including analysis of satellite images to locate potentially suitable areas of seasonally flooded swamps on riverine floodplains. This region is the global stronghold for Sarus Crane, but it is being affected by changing agricultural practices and the loss of natural wetlands.

Convention on Biological Diversity (CBD).

India signed the Convention on Biological Diversity on 5th June 1992, ratified it on 18th February 1994 and brought it into force on 19th May 1994. The terms of the convention are being used to provide a framework for the sustainable management and conservation of India's natural resources, under the terms of the **Biodiversity (Conservation and Regulation) Act** submitted as a bill to Parliament in May 2001. Currently India is funding preparation of a **National Biodiversity Strategy Action Plan** through a consortium of government agencies, NGOs, and academic and private sector experts.

United Nations Convention to Combat Desertification (UNCCD).

India signed the Desertification Convention on 14 October 1994, ratified it on 17 December 1996, and brought into force on 17 March 1997. India has been an active supporting member of the convention. In August 1996, India hosted the first Regional Conference on the Implementation of the United Nations Convention to combat Desertification to prepare the ground for the preparation of the Convention's Regional Action Programme for Asia.

4. The Biodiversity Convention and India

In the past, biodiversity protection was not a significant concern in the development programmes of most countries. In recent years, however, that has begun to change as a widening understanding and appreciation of the problems faced in the world and importance of biodiversity in that context has developed. Today, the protection of biological diversity has become a recognized priority on the global agenda and thus also within the development goals and plans of nations.

A key step in this direction is the Convention on Biological Diversity, which was signed at the 1992 UN Conference on Environment and Development (Rio Earth Summit) by 156 countries. It entered into force as International Law in 1993 and by the end of 1995, nearly 120 nations had ratified the convention, including India. The central objectives of the convention are:

- *to conserve the diversity of the Earth's biological resources, whether terrestrial or aquatic, including plants, animals and micro-organisms*
- *to ensure that countries use their biological resources in ways that are sustainable in agriculture, forestry and fisheries*
- *to promote the fair and equitable sharing of genetic resources and the benefits that result from them.*

The convention requires governments to take action to ensure that their management and development of natural resources is consistent with the protection and sustainable use of biodiversity. This involves assessing national economic structures and policies to determine how to build economic arrangements, which promote conservation and sustainable use. In addition the Convention stipulates that the Parties to the Convention - i.e. those countries whose legislative bodies have agreed to be bound by the treaty - must take a number of actions, including:

- *Development of national strategies for conservation and sustainable use of biological resources*
- *Promotion of public education and awareness*
- *Establishment of training and research programmes*
- *Provide due recognition of biodiversity issues during development via the Environmental Impact Assessment process (EIA)*
- *Promotion of technical and scientific co-operation between parties.*

5. National Biodiversity Conservation Strategy and Action Plan (Draft proposal)

In response, Ministry of Environment & Forest, Government of India published a draft proposal on National Biodiversity Strategy and Action Plan of India in 2002. The Action Plan set out an ambitious vision, which established the goals, principles and objectives for conserving biodiversity.
The Action Plan has highlighted the economic value of biodiversity for food, clothing and medicines. It has identified the values of ecosystems such as wetlands for waste water treatments, and flood plains and coastal dunes for natural flood and erosion control. It has declared that it is in society's interests to maintain the genetic diversity of wild plants and animals as a gene pool for future discoveries and applications. The Plan has responded to the Convention's emphasis on the sustainable use of biodiversity by identifying the ways in which society can and should work in harmony with nature.
It has stressed that consideration of the implications for biodiversity should be integrated into all sectors of economic and social activity, as an important component of sustainable development and as a principal measure of its success.

Flood plains provide natural defenses. Development planning for such areas should sustain their natural processes. In pursuance of the Action Plan, the identification of particular species and habitats, for which targeted action plans has to be prepared, which would serve as a focus for policy change and resource allocation and as a means to identify trends and measure achievements. The plan also aims to bring about a fundamental change in attitudes and policies, recognizing that the quality of the country's biodiversity, wherever it occurs, is an indicator of sustainable development.

Purpose and Scope: The purpose of the national biodiversity strategy is to provide an overall unified policy and planning framework for the management of biodiversity resources in the country. All future activities in this field should therefore fit within this agreed framework. The creation of the

strategy will provide clear direction for national planning and also a mechanism for ensuring well targeted and effective programme / project development. In addition, it will provide donors with a clear framework within which to provide assistance. By necessity the scope of the biodiversity s trategy i s limited to those issue with direct relation to biodiversity conservation and use in the country. Indirect issues, such as water management, though they may be of critical importance to biodiversity, are not specifically addressed as these fall under the coverage of other sectorial plans / programmes.

The structure of this document. The document consists of **five parts** and **three appendices**.

The first part: ***Conditions and Provisions for Developing National Strategy for Biodiversity Conservation includes: an introductory section detailing the international context, a section outlining the socio-economic and land use background; a section summarizing the status and value of biodiversity in India; and a final section describing the legislative and institutional context for its protection and sustainable use.***

The second part: ***the Biodiversity conservation strategy includes a brief analysis of previous information, and then a description of the national goals, objectives, means to achieve them.***

The third part: ***the National Biodiversity Conservation Action Plan, elaborates on the strategy described above and includes details of concrete actions required to achieve objectives, and a timetable for actions.***

The fourth part : ***Action Plan for Biodiversity for the state of Bihar, which contains, Historical Background, geomorphic status, forest cover and green belts, wetlands and swamps, important rivers and the different aspects affecting the biodiversity of the state with annexures of flora and fauna and Biodiversity Act.***

The fifth part: ***Bihar Biodiversity strategic challenges and options with recommendations***

The national strategy and action plan is being prepared, using a multi-disciplinary, integrated and participatory approach. The project involves government and public sector stakeholders from: forestry, protected areas, agriculture, water management, scientific community, state planning and NGOs.

A project co-ordinator has been appointed; who, under the overall supervision of the Steering Committee, managed a multi-disciplinary team composed of specialists/professionals from the above and other biodiversity relevant organizations. This broad based representation ensures that the biodiversity strategy has been developed on a multi-sectorial basis and thus should become a part of the mainstream efforts of the government to achieve sustainable development.

6. Present Scenario of Biodiversity in India

India has an estimated 8.1% of the world's total biological diversity contained within about 2.4% of the earth's area. India has an estimated 12.5% of the world's plant and microorganism species, and about 6.7% of the world's animal species. India's terrestrial biota is extremely diverse, and includes floristic and faunal elements from the 3 of the world's 7 major biogeographic realms: Palaearctic, Afro tropical, and Indo-Malayan. India is also becoming increasingly important for biodiversity conservation

in Asia as the last refuge for formerly common and wide ranging species of birds and mammals that have been largely or entirely extirpated from most areas of their range outside of India (e.g., lion, tiger, Asiatic elephant, Indian rhino). The majority of the country is associated with three principal terrestrial life zones (biomes): tropical humid forests, tropical dry/deciduous forests, and tropical/subtropical deserts. India's rich biodiversity heritage includes two of the world's 18 designated biodiversity "hot spots" (i.e., Eastern Himalayas, Western Ghats). India has 26 recognized endemic centres of plant biodiversity that support nearly a third of all known species of flowering plants. Montane glaciers, alpine tundras, high deserts, tropical rainforests, subtropical savannas, great rivers, vast coastal mangrove forests, coral reefs, coral atolls, cold mountain deserts, hot lowland deserts, and temperate and subtropical wet and dry woodland ecosystems - India's biodiversity spans all of these diverse and distinctive ecosystems, and more. A substantial portion of India's biodiversity consists of organisms that are restricted to this country, and found nowhere else. India has approximately 45,000 native plant species representing about 7% of the World's flora, of which about 1 in every 6 species (5150) are endemic or restricted in their distribution to India proper. Of these endemic plant species, 2532 species are found in the Himalayas and adjoining regions, with another 1782 species in peninsular India. As estimated the number of plant species over 45000 which are categorized in different taxonomic division including over 15000 flowering plants. For lower plants are: 64 Gymnosperm, 2843 Bryophytes, 1012 Pteridophytes, 1940 Lichens, 12480 algae and 23000 fungi.

Some 4900 species of flowering plants are endemic to the country (141 genera distributed over 47 families). Among the endemic species 2532 species are found in the Himalayas and adjoining areas, followed by 1782 species in peninsular India. About 1500 endemic species are facing various degree of threat.

The faunal wealth is equally diverse. The total number of animal species is estimated at 81000, representing about 6.4% of the world's fauna. India's animal diversity includes over 5000 mollusks and 57000 insects besides other invertebrates. There are 2546 fish; 204 amphibians; 428 reptiles; 1228 birds and 372 mammals. The extant of endemism is very high, about 62%.

- *Very little is as yet known about the extent diversity of microorganism particularly of bacteria and viruses.*
- *As regards to marine habitat it is expected to harbor vast living resources of mollusks, crustacea, fish, turtles and planktons.*

Of the 372 mammals found in India, 44 are endemic species whose range is confined entirely to within Indian territorial limits. There are 58 bird species endemic to India, most of which are found in areas of high rainfall and tropical rainforest habitats. They are located mainly in eastern India along the mountain chains where the monsoon shadow occurs, in the Western Ghats of southwest India, and the Nicobar and Andaman Islands. Four endemic mammal species of global conservation significance are found only in tropical forest regions the Western Ghats. Endemism in the Indian reptilian and amphibian fauna is relatively high. Approximately half of the reptiles found in India are endemic species (188 of 390 species), as are more than half of its amphibian species (122 of 204 species). Eight of the resident amphibian genera are not found outside of India. The freshwater fish fauna includes 2546 species.

Table: - 1 Species endemism and endangered ratings

Category	Total known species	Endemic species	Threatened & Endangered
Plants	**45000**	**5150**	**1236**
Birds	**1228**	**58**	**73**
Reptiles	**390**	**188**	**16**
Amphibians	**204**	**122**	**3**
Freshwater Fishes	**2546**		**4**
Mammals	**372**	**44**	**75**

Agricultural biodiversity

Plants

India is one of the 12 major centers of origin for cultivated plant species. India's agricultural biodiversity is extremely high, with 166 crop species and 320 wild relatives present. India's agricultural biodiversity in both plants and animals has declined markedly in recent years. The varietal diversity of India's rice crop, for example, has declined from about 30,000 varieties historically to approximately a dozen major varieties at the present day.

Table: - 2 Genetic erosion in crop genetic diversity

Crop	Country	Number of varieties
Rice	Sri Lanka	Down from 2000 varieties in 1959 to 5 major varieties in widespread cultivation at present
Rice	India	30,000 varieties formerly; 75% of production now comes from less than 10 varieties

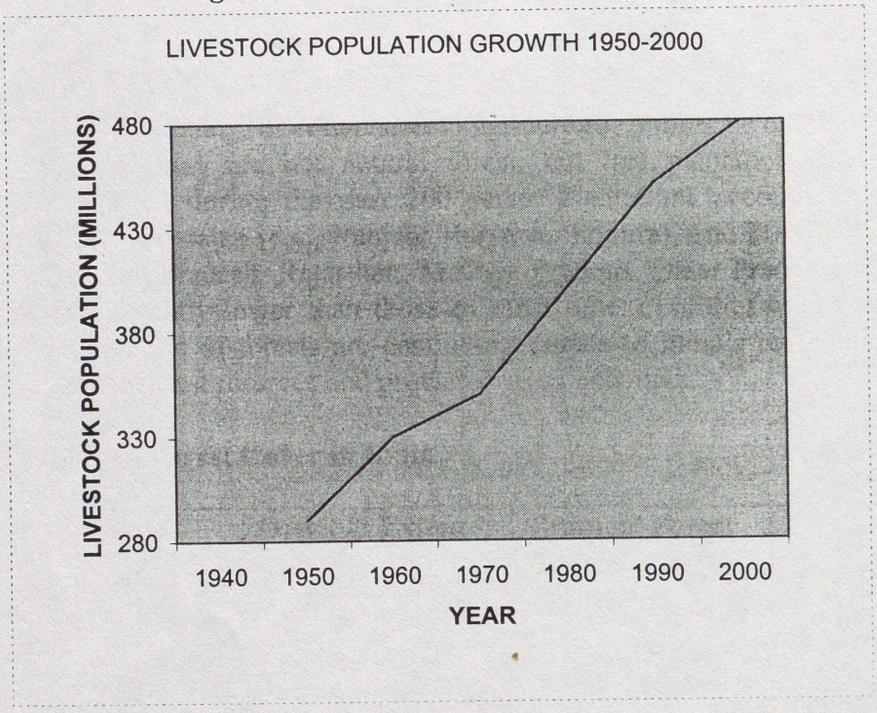
Table: - 3 Wild relatives of important crop and medicinal plant species in India

Crop	Number of wild relatives
Cereals and Millets	51
Fruits	109
Spices and condiments	27
Legumes [peas, lentils]	31
Vegetables	54
Fibre crops	24
Oil seeds	12
Medicinal plants	3000
Others	26

Animals

India supports large populations of the wild progenitors of some important domesticated animals (chicken, pig, water buffalo, yak, donkey), as well a large number of traditional breeds of most major livestock species (cattle, horse, ass, sheep, goat, camel). India's livestock diversity and abundance is both a blessing and a curse, however, in terms of its effects on landscapes, vegetation, and wildlife. Livestock populations in India have nearly doubled over the past 50 years, with correspondingly increased impacts on grazing systems. Between 1951 and 1991, goat populations increased from 47 million to 110 million while cattle populations from 290 million to 445 million. Livestock grazing heavily impacts most of India's forests; approximately 30% of fodder consumed by livestock comes from forest areas. Overgrazing degrades soils, prevents regeneration of forest trees, contributes to soil erosion, degrades riparian zones, and contributes to the desertification of arid lands. India's present livestock population is about three times greater than the country's estimated sustainable carrying capacity. Overgrazing impacts are widespread and increasing throughout India.

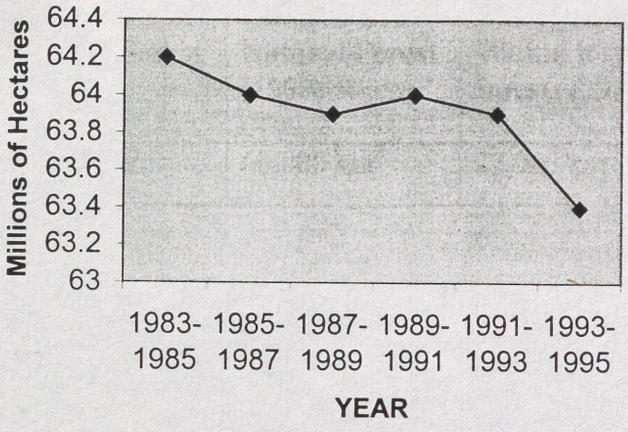
Fig:-1 Livestock Populations in India



TROPICAL FOREST RESOURCES

India's tropical forests have been intensively exploited for centuries. Most of India's original forest cover is now gone, and the only remaining large areas of intact forest are those within protected areas and Forest Reserves. Only about 1% of India's original dense forest habitats remain intact, and more than half of India's few remaining large tracts of intact natural forest ("frontier forests") are threatened by

Fig:-2 FOREST DECLINE IN INDIA 1983-1995



disruption from illicit logging, mining, or conversion to agriculture. It must be emphasized that much if not most of India's forests today are not natural forest, but tree plantations and late-succession "*plantation forests*" established during the past 200 years. Plantations account for 80-90% of the existing forest cover in several states (e.g., Punjab, Haryana, Tripura), and 20-40% in several others (Karnataka, Sikkim, Himachal Pradesh, Rajasthan, Madhya Pradesh, Utaar Pradesh). Although India's rates of deforestation are presently lower than those of most other countries within the region, large scale conversion and degradation of forests are continuing threats to India's remaining forest habitats both inside and outside of the forest reserves and protected areas networks.

Table: - 4 Forest Cover in India

Total Land area	Original Extent of Forest Cover	Tropical Forest Cover (original)	Tropical Forest Area Remaining
2,970,000 km^2	2 2,400,000 km^2	445,000 km^2	40,000 km^2

Less than 20% of India's remaining natural forest cover has never been logged. Large-scale logging, conversion and degradation of forests is a continuing threat to India's remaining dense forest habitats, both inside and outside of reserves and protected areas. Directly and indirectly, urbanization and industrialization are becoming increasingly important drivers of forest loss and degradation. Overall forest cover (including both natural and plantation forests) declined by approximately 21% over the twenty-year period between 1975 and 1995. During the decade between 1980 and 1990, India's natural forests declined by more than 6% from 551,000 km2 ha in 1980 to 517,000 km^2 ha. Natural forest extent declined by an estimated 3% between 1990-1995 (WRI 2001). Recent data indicate a potentially alarming trend: India lost nearly 5% of its remaining dense forests during the subsequent 2-year period between 1995 and 1997(CSE 1999). Despite on recent government ban on logging, the illicit felling and sale of trees continues in some areas of the country.

Extent of India's Unlogged Natural Forests circa 1980

Table: - 5

Unlogged Natural Forest (1980)	Undisturbed Natural Forest (1980)	Unlogged tracts Within logged forests (1980)	Unlogged Forest in Protected Areas (1980)
572,000 km^2	60,000 km^2	22,000 km^2	68,000 km^2

COASTAL AND MARINE BIODIVERSITY RESOURCES

Coastal habitats are often subjected to relatively greater pressure from development because of the higher concentrations of human populations often associated with coastal regions. Tropical mangrove forests are a particularly critical ecological and economic resource due to their role in linking terrestrial and marine ecosystems, high standing crop biomass, high productivity, and importance as nursery grounds for commercial and subsistence fishery resources. India's mangrove ecosystems support 225 species of crustaceans (shrimp, prawns, crabs, etc.), 105 species of fish, and 20 species of shellfish. No major government initiative to protect marine resources has been undertaken thus far. India's tropical mangrove forests have been reduced from an estimated original area of 14,000,000 ha to about 3,500,000 ha at the present time. Mangrove forest cover along India's coastline has been reduced by an estimated 26-44%. Major threats to mangrove forests include logging (for fuel wood, timber, and woodchips), livestock grazing, and conversion to agriculture and aquaculture (shrimp and fish farming). The Sunderbans of India and Bangladesh are the world's largest and most biologically important mangrove forest (420,000 ha). The Sundarbans is home to 64 species of mangroves and numerous threatened and endangered species, including the Ganges dolphin and the black finless porpoise, and the earth's largest surviving population of Bengal tigers. India's portion of the Sunderbans is under partial protection as a Tiger Reserve, while the Bangladesh portion remains subject to unregulated exploitation. Coral reef ecosystems are the most highly productive and species-rich of all marine ecosystems. India has about 19,000km^2 of coral reef habitats in its coastal and island regions. The rich and diversified fisheries and shellfish resources of coral reefs are heavily exploited, and the reef "bedrock" itself is mined for use in industrial lime and cement manufacture.

INLAND WATERS: THE MISSING LINK

Aside from the direct biodiversity links of inland waters to freshwater and estuarine floras and faunas, inland watersheds have inextricable ecological links to the forested upland areas of watersheds, the agricultural and urbanized landscapes through which they flow, and the coastal and marine ecosystems that they feed into. Management interventions that affect the quantity, quality, or flow-rates of water in surface drainages and aquifers have both direct and indirect effects on biodiversity.

Effect of excess water extraction

Water withdrawals from rivers and aquifers for agricultural, urban, and industrial uses directly affect the distribution and abundance of surface water and exert both direct and indirect effects on the biodiversity of upland, wetland, and aquatic ecosystems. Damming and channelization of rivers can radically alter aquatic and riparian ecosystems and result in the loss of native plant and animal species (including but not limited to fish, waterfowl, and aquatic mammals) dependent on natural flow and flooding regimes. Of particular concern in this regard are aquatic species such as the Ganges dolphin that are restricted in distribution to particular rivers or drainage systems.

Experiences in India and elsewhere around the world have demonstrated that the negative effects of large river dams are not limited to direct impacts on wildlife and riparian vegetation within the immediate precincts of dams and their associated man-made lakes: such projects may also have severe and devastating impacts on human communities living in the vicinity of, and far upstream and downstream from, major dam projects. These impacts are often related in part to the effects of dams on resident fish populations, because of their impacts on the availability of spawning grounds, nursery habitats, seasonal feeding habitats, and upstream and downstream migratory patterns. Urban and industrial water withdrawals, and the degradation of river systems by wastewater-transported sewage and industrial pollutants, are severely impacting most of India's major and minor river systems. Agricultural runoff carries heavy loads of silt, fertilizers, and pesticides into rivers. Livestock concentrations along riparian zones result in destruction of riparian vegetation, erosion of stream banks, excessive nutrient loads, and high levels of fecal bacterial contamination. Religious practices contribute significantly to the pollution of waters in areas where large numbers of human and animal remains, or religious effigies and offerings, are ritually immersed in lakes or rivers. The pollution of watersheds, rivers, coastal and marine ecosystems by toxic chemicals, heavy metals, pesticides, and sewage present serious and growing threats to biodiversity and human health throughout most of India.

Effect of Urbanization and industrialization

Urbanization and industrialization are expanding and increasing throughout India, paralleled by an ongoing decline in the quality of urban environments within the country. Water and air pollution levels are extraordinarily high, and still rising. India's larger cities rank high among the world's most polluted cities with Delhi, Mumbai, and Chennai ranking among the top ten, with several others not far behind. Earthquakes and extreme weather events, droughts and flooding overwhelm and disrupt existing sewage and effluent control and treatment capabilities, contribute to further breakdowns in operational capacity, and divert available funding from investment in new facilities and technologies to the repair and maintenance of existing and already overburdened infrastructure.

Effect of Air pollution

There is little direct information available on the primary or secondary impacts of air pollution from India's cities and industries on forests and biodiversity within the region, but experience from other areas around the world clearly demonstrates the adverse impacts of airborne pollution on biodiversity. These include the acidification and sterilization of lake and river ecosystems by acid rain, and the smog poisoning of forest vegetation by aerosol chemicals and particulates within areas located downwind from major urban and industrial centers.

MAJOR THREATS TO BIODIVERSITY AND TROPICAL FORESTS

Overview

The rich biodiversity of India's terrestrial and aquatic habitats is under severe threat owing to habitat destruction and over-exploitation of forest, freshwater, and marine resources. Habitat conversion to agriculture, deforestation, and encroachment of human populations are major problems for protected areas and forest reserves in many parts of the country. Urban and industrial pollution of river systems is destroying aquatic ecosystems and actively threatening human heath in many regions of India. Outside of the cities, human impacts are correspondingly high and yet still increasing apace. Rural communities are typically heavily dependent upon harvests of forest and non-cultivated plant resources for fulfilling their energy and material needs (fuel, construction materials, medicines, tools, utensils, commodities, etc.). Activities severely impacting habitats both outside and inside reserve areas include overgrazing by livestock, fuel wood and fodder collection, wildlife poaching, and medicinal plant harvesting.

More than one quarter of India's population lives within 100km of the coastline, and there is correspondingly heavy pressure on coastal landscapes and ecosystems for agricultural land, fisheries, and forest resources. Threats to coastal and marine biodiversity include logging and conversion of mangrove forests, over-fishing of freshwater and marine fish and shellfish species, by-catch mortality among noncommercial fish and animal species, fishing net and gear disruption of seafloor habitats, and coral/limestone mining. Siltation from agriculture and industry is heavily impacting reefs along India's coastlines. Over-harvesting of ornamental corals and mollusks are a serious problem in the shallow, near-shore coastal reef systems.

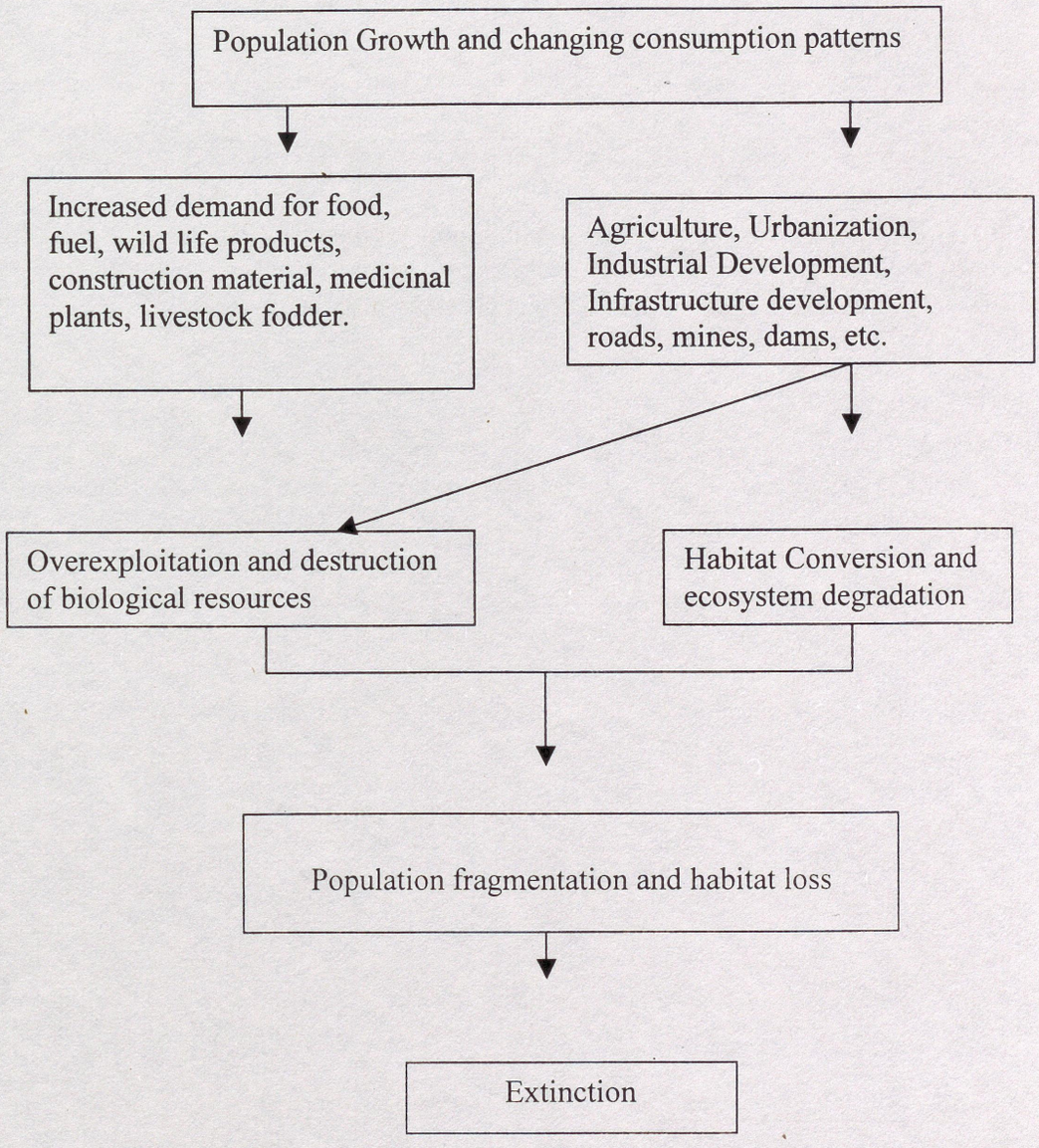
Some 23 animal species, including the cheetah and Lesser One-Horned Rhinoceros, have already become extinct in India. According to the IUCN Red list of threatened plants, 19 species are extinct and 1236 species are threatened. Of these "threatened" plant species, 41 plants may already be extinct in the wild. Another 152 species are considered endangered, 251 species are rare, and 102 are vulnerable. Many more are species are threatened with a similar fate unless there is increased protection from illegal hunting and exploitation, and government and private sector efforts at habitat conservation are continued and expanded.

Agents of Change

Destruction of tropical forests and the erosion of biodiversity is largely tied to conversion for agriculture, infrastructure development projects (dams, and road and canal construction), and large-scale mining for coal and minerals. It is estimated that India has lost 4.7 million hectares of forest land to non-forestry purposes since 1950. While 0.07 million ha of forest land has been illegally encroached upon, 4.37 million ha has been subjected to cultivation, 0.52 million ha given to river valley projects, 0.14 million ha to industries and townships, 0.06 million ha for transmission lines and roads; and the remainder for miscellaneous purposes. Coal mining, particularly in the State of Bihar, has been linked with destruction of key travel corridors and breeding grounds of the Bengal tiger. The majority of India's power is generated by burning coal.

Pesticide Impacts:

The indiscriminate and improper use of pesticides in agriculture may be a threat to both biodiversity and human health in India. India permits the use of pesticides whose use has been banned by the United States and many other countries. Aerial spraying of pesticides can directly contaminate surface water sources and result in the poisoning of non-cultivated vegetation, non-target species of plants and animals, and people residing in and around sprayed agricultural areas. A recent report in the *Hindustan Times* cited possible adverse effects of pesticide exposure on villagers residing in an area of Kasargode subject to the aerial spraying of Endosulfin on cashew plantations. High rates of cancer, epilepsy, mental illness, and respiratory disease were reported among local residents. A local medical doctor was quoted as saying, " Within days of spraying even small birds and flies were found dead. At the time of spraying they put up a notice warning villagers to cover all sources of water. But how could they cover the two rivers that were the main source of drinking water?"



HUMAN-WILDLIFE CONFLICTS

Livestock Competition

Apart from the primary loss of wildlife due to agriculture and industrial development and urbanization, there are numerous other problems contributing to the loss and endangered status of plant and animal species. Competition from livestock and the degradation of ecosystems from overgrazing are chronic problems throughout the rural areas of India, which despite its high human population densities still supports about one cow for every three of its human inhabitants. India has an estimated 480 million head of livestock (not including pigs) including 300 million cattle and buffaloes, 175 million sheep and goats, 2 million horses, plus hundreds of thousands of donkeys, camels, and yaks. Changes in habitat availability and habitat quality are leading to declines in primary food species for wildlife species such as elephants, tiger, gaur, and deer.

INDIA'S TOTAL LIVESTOCK (Approx. 480 MILLIONS excluding Pigs)

Table: - 6

Cattles & Buffaloes	300 Millions
Sheep & Goats	175 Millions
Horses	2 Millions
Others (Donkeys, Camels, Yaks, etc.)	About 3 Millions

Rapidly expanding human and livestock populations impose a double burden on India's biodiversity and tropical forest resources. The increases in fuel wood and fodder requirements of rural populations, and increased livestock grazing in forests take a heavy toll on forest and biodiversity resources.

Wildlife Depredations

Human-wildlife conflicts are a major problem in areas where elephants, tigers, and lions live in close proximity to human settlements and stray outside reserve areas, which in India means nearly everywhere these species are still to be found. India has Asia's largest remaining populations of elephants and tigers, and the world's only remaining population of Asiatic lions. Elephants destroy crops, while tigers and lions prey upon livestock, and all of these species cause human fatalities. Crop raiding elephants are responsible for extensive damage to houses, property, and croplands and numerous human deaths. India supports approximately 28,000 wild and 3800 domesticated elephants, more than half of the world's remaining population of this species. Wild elephants are still present in some of India's most densely populated areas, and approximately 200 people are killed by elephants in India every year. In densely populated South Bengal, the resident elephant population of only 73 elephants killed 46 people in 1998 and 48 people in 1999. Communities in turn retaliate against elephant depredations by injuring and killing elephants using whatever means are available, including shooting, poisoning, and electrocution. Chronic crop-raiders and elephants that habitually attack and kill humans ["rogue elephants"] may be tracked down and killed by wildlife or forest officers. The management of elephant populations is complicated by the fact that the ranges of individual elephants and elephant herds often include areas lying within two or more state or district jurisdictions. Elephants sometimes end up being chased back and forth across state lines by officers of adjacent jurisdictions, with the result that elephant-human conflicts are not resolved but merely temporarily exported into neighboring

districts. Experience in West Bengal has shown that this type of disturbance increases rather than decreases human elephant conflicts, property loss, and human fatalities.

Over-harvesting and Poaching of Plants and Wildlife

Poaching for the international trade in wildlife and plant products has emerged in recent years as a major driver of the local and regional decimation and extinction of wildlife species. The pet and aquarium trade, the Ayurvedic and Chinese traditional medicine markets, trophy, specimen and biological curio markets are driving burgeoning domestic and international markets for India's wild plant and animal species. Birds, butterflies, beetles, orchids, medicinal plants, and numerous other kinds of both animals and plants are being illegally harvested and traded in India, often for illicit export by international dealers. The Chinese traditional medicine (CTM) trade in particular provides a strong and growing commercial market for a bewildering variety of animals, from snakes and scorpions to tigers, rhinos, elephant, and bears. Poaching pressures are unevenly distributed among species involved the CTM trade since certain selected high-value species such as bears, tigers, and rhinos are more intensively targeted than species with lower market values which may be taken more or less opportunistically by hunters.

In a parallel process, the over-harvesting of plants for traditional medicines has become a serious threat to many plant species used in traditional Indian *Ayurvedic* medicine. The vast majority of India's people either lack access to modern clinical treatment facilities or prefer the use of traditional herbal medicines to modern allopathic therapies. Plants are also being commercially harvested to feed a growing international market for medicinal plants and plant products used in traditional Ayurvedic and TCM medicines. Over-harvesting of medicinal plants is aggravated by a combination of a growing human population and shrinking availability of habitat for medicinal plants, the majority of which are not cultivated and must therefore be harvested from wild populations.

LEGISLATIVE AND POLICY ENVIRONMENT

Legislation

There is no existing overarching biodiversity conservation and protection legislation regulating India's biodiversity and natural resources as provided for within the Convention on Biological Diversity. India's **Wildlife (Protection) Act of 1972** is the primary existing legislative framework for biodiversity conservation in India. While the Wildlife (Protection) Act deals specifically with wildlife protection and conservation, the act does not have exclusive authority and there are numerous other laws including the **Environment (Protection) Act of 1986** that affect biodiversity conservation at various levels. The Forest Conservation Act of 1980 was enacted to check the diversion of forest lands to other uses by requiring prior approval of any proposed diversion action. The protected areas expansion catalyzed by the 1972 Wildlife Act was further strengthened by a number of internationally-supported national conservation efforts, notably Project Tiger, initiated in April 1973 by the Government of India with support from WWF and the Crocodile Breeding and Management Project, launched in April 1975 with technical assistance from UNDP/FAO. While providing for the establishment and regulation of National Parks and Wildlife Sanctuaries, the Wildlife Act failed to recognize the needs of local communities and the importance of grassroots support for wildlife protection in terms of planning, decision-making, and resource management. The active engagement of local communities in the fight against poaching, illegal hunting, and timber felling was not promoted under the Wildlife Act. The lack of active community

participation in wildlife management is regarded as a major impediment to broadening the present scope of biodiversity conservation within India, given that India's system of protected areas provide coverage to only 4.5% of India's geographical area, while much of India's biodiversity lies outside the PA (protected areas) network. Efforts are currently underway to create such legislation.

The Ministry of Environment and Forests in 1997 released the draft version of a **Biodiversity (Conservation and Regulation) Act**, which was introduced as a bill to the Parliament in May 2001. Similarly, an inter-ministerial committee has been set up for working on issues relating to intellectual property rights while the Ministry of Agriculture has drafted the **Plant Variety Protection and Farmers' Rights Act** to provide protection of intellectual property for domesticated plant and animal genetic diversity resources. The **Biodiversity** bill introduced before Parliament in May 2001 provides for control and regulation of access to India's biological resources for commercial purposes, and provides for the creation of a National Biodiversity Authority and state biodiversity regulatory boards. A potentially important issue concerns the bill's proposed restrictions on foreign research and commercial access to India's biological resources. Under this Bill, (which was patterned upon the provisions of the 1992 UNCED Convention on Biological Diversity) all foreign individuals, associations and organizations would be required to seek the prior approval of a National Biodiversity Authority to access any biological resource, or the results of research occurring in India, for any use. Biological resources as defined within the bill include "plants, animals and microorganisms, or parts thereof, their genetic material and byproduct for actual or potential use or value, but do not include human genetic material". Items exported as commodities would be exempted from the provisions of the Act. The Bill would require all Indian citizens to seek the prior approval of the Authority prior to the transfer of research results relating to any biological resource to any person who is not an Indian citizen. Indian citizens, local people and communities will have free access to biological resources for use within the country, for any purpose. The Authority's prior approval would be required in order to file for any patents or intellectual property rights on inventions based on biological resources from India. The Authority will have the power to impose conditions on patent holders to ensure a share in the benefits accruing from IPRs. This bill, if enacted, would likely have important impacts on international cooperation on biodiversity issues in India.

Policy

The current central government policy framework for the conservation and management of biodiversity and forest resources were broadened under the 1988 National Forest Policy and the 1992 National Conservation Strategy to include concerns recognizing access and usufruct rights of tribal and rural peoples to forest areas. The National Forest Policy of 1988 recognized the rights of access for local people, especially tribal people and members of disadvantaged castes, to biological resources in forests. The policy laid down several principles regarding the rights and responsibilities of local people in using these resources:

- ACCESS: Rights and concessions of tribal peoples and disadvantaged castes must be recognized and protected;

- REGULATION: Grazing and harvest rights of local peoples should controlled and related to forest carrying capacity;

- PARTICIPATION: Peoples exercising customary rights of access to forest resources should be involved in their protection.

Guidelines for the implementation of the participatory forest management practices authorized under the 1998 National Forest Policy were provided under a 1990 Notification that established qualifying criteria for access to usufruct rights on government forest lands, and provided guidelines for establishment of Joint Forest Management (JFM) partnerships between local user groups and the India Forest Department. Building upon the foundation established by the **1990 Guidelines for Participatory Forest Management,** amendments to the **Wildlife (Protection) Act** propose the establishment of two new categories of biological reserves (*community reserves* and *conservation reserves*) to supplement the existing Protected Areas categories (e.g. National Parks, Sanctuaries, Tiger Reserves, Biosphere Reserves). Although the 1988 National Forest Policy takes into account the dependence of rural peoples on forests, the policy does not address the importance of the impacts of other sectors (urbanization, energy, industrialization, agriculture, rural development) on forests and forestry activities. Perhaps more importantly, the policy is not as yet supported by legislation and implementation of the policy has been left to the discretion of state governments.

Table: -7

Legislation Impacting Biodiversity Conservation
Fisheries Act, 1897
Destructive Insects and Pest Act, 1914
The Indian Forest Act, 1927
Indian Coffee Act, 1942
Agricultural Produce (Grading and Marketing) Act, 1937
Import and Export (Control) Act, 1947
Rubber (Production and Marketing) Act 1947
Tea Act, 1953
Prevention of Cruelty to Animals Act, 1960
Customs Act, 1962
Cardamom Act, 1965
Seeds Act, 1966
Wildlife (Protection) Act, 1972 and Wildlife (Protection) Amendment Act, 1991
Marine Products Export Development Authority, 1972
Water (Prevention and Control of Pollution) Act, 1974
Tobacco Board Act, 1975
Territorial Water, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Acts, 1976
Water (Prevention and Control of Pollution) Cess Act, 1977
Coconut Development Board Act, 1979
Maritime Zones of India (Regulation and Fishing by Foreign Vessels) Act, 1980
Forest (Conservation) Act, 1980
Air (Prevention and Control of Pollution) Act, 1981
National Oilseeds and Vegetable Oils Development Board, 1983
Agricultural and Processed Food Products Export Development Authority Act, 1985/1986
Environment (Protection) Act, 1986
Spices Board Act, 1986
National Dairy Development Board, 1987
New Seed Development Policy, 1988

PROTECTED AREAS, NATIONAL PARKS, AND RESERVES

Historical Background

The protection of wildlife has a long tradition in Indian history. Sacred groves are an ancient tradition established in prehistoric times, while formal administrative protection of forests and wildlife (notably elephants) within "reserve" areas is known to date back to at least the first century B.C. in India. Religious taboos provided protection to sacred sites and totem species in prehistoric times, traditions which have been carried over in some areas into modern times. The feudal kingdoms of India (and later the Moghul Empire and British Raj), protected certain areas as royal hunting preserves and protected individual species as royal game.

As more and more land became settled or cultivated, these royal hunting reserves and sacred forest groves became increasingly important as wildlife refuges. Some of these former royal hunting reserves were subsequently established as national parks or sanctuaries in India following Independence in 1947. Examples include Gir in Gujarat, Dachigam in Jammu & Kashmir, Bandipur in Karnataka, Eravikulum in Kerala, Madhav (now Shivpuri) in Madhya Pradesh, Simlipal in Orissa, and Keoladeo, Ranthambore and Sariska in Rajasthan.

Table:-8

S.NO.	Name of Biosphere Reserve	Area	Year
1.	Nilgiri	Western Ghat	1986
2.	Nanda Devi	Western Himalaya	1988
3.	Nokrek	North-East Region	1988
4.	Great Nicobar	Southern part of the Nikobar Island	1989
5.	Gulf of Mannar	Costal region of Mannar	1989
6.	Manas	North East Manas	1989
7.	Sundarbans	Ganga-Brahamputra Delta	1989
8.	Simlipal	Deccan Plateau	1994
9.	Dibru Shaikhova	Tinsukhiya Dibrugarh	1997
10.	Dehang-Debang	North Western Region	1998
11.	Panchmadhi	Bundelkhand Plateau	1999
12.	Kanchanjungha	Sikkim- Kanchanjungha	2000
13.	Agastasya Malei	Kerala	2001

Protected Areas Network: -

Table:-9

Year	National Parks	Sanctuaries
1970	5	60
1980	69	410
1995	80	441

The first formal Protected Area in the modern sense, the Vendanthangal Bird Sanctuary in Tamil Nadu, was established about 200 years ago. The next designated reserve area, the Hailey (now Corbett) National Park, was gazetted in the 1930s. The adoption of a National Policy for Wildlife Conservation in 1970 and the enactment of the Wildlife (Protection) Act in 1972 led to a major expansion of the protected areas network, from 5 national parks and 60 sanctuaries in 1970 to 69 national parks and 410 sanctuaries in 1990. As of 1995, India had gazetted 80 national parks and 441 wildlife reserves with a combined area of approximately 150,000 km2, covering approximately 4% of India's total land area. Protected areas and wildlife reserves are widely distributed throughout mainland India and its island territories India's protected areas network has been further strengthened by a number of internationally-supported national conservation efforts such as Project Tiger (initiated in April 1973 by the Government of India with support from WWF-World Wide Fund for Nature) and the Crocodile Breeding and Management Project, (launched in April 1975 with technical assistance from UNDP/FAO). Although the absolute number of protected areas is very high, most sites are relatively small and incapable of supporting viable populations of endangered large mammals such as tigers and elephants. Wildlife, together with forestry, has traditionally been managed by the forest departments of the provincial government within each state or union territory, with the role of central government being mainly advisory. Central government authority over wildlife has been expanded over the past several decades, paralleled by a major expansion of the protected areas network. The Wildlife (Protection) Act of 1972 has provided for the creation of posts of Chief Wildlife Wardens and Wildlife Wardens in the states to exercise statutory powers under the Act. Under this Act, it is also mandatory for the states to set up state wildlife advisory boards. Secondly the inclusion of protection of wild animals and birds in the concurrent list of the constitution has proved the central government with some legislative control over the states in the conservation of wildlife. Currently, all states and union territories with national parks or sanctuaries within their jurisdictions now have wildlife agencies to manage and administer these areas.

Part 2. National Strategy for Biodiversity Conservation

Strategy Statement

1. The Protected Areas System
2. Public Awareness, Participation and Education
3. Sustainable Use
4. Justification for Strategic Priorities

In the light of the analysis of the facts mentioned in Part 1 the critical areas of the national biodiversity strategy must address in order priority, as follows.

1. The Protected Areas System

It is recognized that the currently existing protected areas system in India has limitations in regard to its overall size, representiveness, conceptual approach, financing, legal framework and management / institutions. It is also clear that India has undergone a very serious decline in its biodiversity in the past 30 years, which threatens the continued viability of ecosystems and the countries prospects for sustainable development.

To not only survive but also to expand, as is clearly necessary to meet conservation needs, the protected areas system must develop a conceptual and methodological approach, which meets new socio-economic and political realities. It must be able to justify its cost (both financially and from exclusion of other use) by providing clear benefits to national sustainable development - it must limit the extent of those costs by providing economic and social benefits to citizens of India, particularly those living in or around protected areas - and it must ensure the conservation of biodiversity and natural landscape essential for the economic, social and cultural needs of future generations.

Thus, a review, reorganization and expansion of the protected system must be carried out over a five year period (2004-2009). During this activity the guiding principles and targets should include:

- ***Use of an ecosystems approach to the creation of the new protected areas system***: The past concentration on high profile or endangered species for protected areas selection has contributed to the current unrepresentative system.

- ***A target of a protected areas system which covers a minimum of 10% of the total land area of India***: Currently, the protected areas system covers approximately 4% of the India's total land area. Though at the present time there is insufficient data available to be able to determine the exact extent of coverage necessary to achieve biodiversity conservation requirements, current levels are clearly inadequate. In the absence of this data, the international bodies recommend figure of 10% protected areas coverage should be adopted for the initial strategic planning period of 10 years.

- ***An integrated mixed use approach to protected areas expansion and development***: Since independence there has been a move away from the previous approach of total protection typified by State Reserves towards zoned and mixed land use areas within National Parks. The rationale behind this change of approach is twofold - firstly, it is recognized from both international and local experience that the expansion and maintenance of totally protected State Reserves will prove problematic in the future due to financial costs and increased demographic and socio-economic pressures - secondly, the development of mixed use protected areas, in addition to being more likely to achieve long term conservation goals, will also provide the basis for the development of models for the sustainable utilization of biodiversity which can be duplicated in the rest of the country. Thus this approach will be further developed and will form the basis for the new protected areas system. It should be emphasized that State Reserves will continue to play a key role in the system forming the core conservation zones of newly created protected areas. Likewise, Special State Reserves and other category IV areas need to be incorporated into the new system.

2. Public Awareness, Participation and Education

For the strategy to be successful it is essential that sufficient awareness and understanding of the conceptual basis, benefits and needs of biodiversity sustainable use and conservation are conveyed to all levels of the general public, particularly decision makers, local government administrators and communities close or within protected areas and the youth of the nation. In addition there is a need to encourage the participation of the public in conservation and sustainable use of biodiversity, as this will be the most effective means of engendering understanding and genuine public support for actions required to conserve biodiversity.

It is recognized that this process will take time and will be a component of a general deepening understanding and awareness of the country for environmental issues. However the strategy identifies priority actions required to begin this process including: increasing the knowledge base of decision makers; developing appropriate media and local awareness programs; revision and development of school and university curricula; and development of public participation mechanisms in protected areas.

3. Sustainable Use

Though elements of sustainable use of biodiversity resources, such as regulated hunting, collection of medicinal plants, etc., are already developed in India, the overall conceptual approach, incorporating the multitude of economic and non-economic benefits, is comparatively new. A step by step approach to the strengthening and development of sustainable use mechanisms will therefore be used starting with the strengthening and refining of existing regulatory aspects, and the development within the protected areas systems of sustainable use approaches which maybe applicable outside at a later point in time. In addition, during the initial implementation of the strategy, investigations into realistic and appropriate sustainable use options will be undertaken on the basis of available local resources and international experience in this subject area. Secondary priorities to be addressed at a later point in the strategy operational period will include the development of options identified during the initial stages. For the sake of organizational clarity, sustainable uses have been subdivided into three sub-components:

- ***Economic Use***: This includes uses such as hunting, tourism, non-timber products, etc., upon which fairly exact economic values can be assigned but in addition covers aspects such as water catchment protection and desertification prevention, which are more difficult to value monetarily but which have clear economic importance to the Nation. An extremely important point, in the context of the growing poverty in rural areas, is that sustainable use must be carried out by people at the grassroots if it is to succeed. If they are to be committed to such use they must derive direct benefits from it
- ***Scientific and Educational Use***: This component includes use of natural areas as living laboratories for scientific research which forms the basis for improved understanding, conservation and use of biodiversity resources. In addition, natural areas are the basic resource for ecological education.

4. Justification for Strategic Priorities

The above important areas have been identified as the three essential issues for India to address at this time for it to meet its sustainable development needs in this sector. Actions under this strategy will allow for meeting priority issues, such as:

- *the creation of an effective and sustainable protected areas system which is targeted at achieving representative biodiversity conservation and protection of environmental quality;*
- *increased awareness and education on biodiversity issues at all levels to ensure support, commitment and participation to actions;*
- *evaluation, assessment and development of sustainable use of biodiversity and equitable sharing of benefits.*

Protected areas development has been identified as the area of **first priority** because of the need for immediate actions to reduce rapid loss of biodiversity, to address urgent

problems facing protected areas management and to take advantage of the current momentum for reform in India.

Public awareness, education and participation have been allocated **second highest priority** mainly because it is recognized that achievements in these areas will require time. However, they are vital components for the strategies long-term success.

Sustainable use has been allocated **third priority** for two reasons: firstly, a number of issues / actions relevant to sustainable use will form components of protected areas development and public awareness, education and participation. Secondly, utilization of the full potential of biological resources is a comparatively new concept in India, as elsewhere, and one, which will initially require some evaluation and assessment before concrete action is undertaken.

Part 3. National Strategy for Biodiversity Conservation

Strategy Goal, Objectives and Outputs

1. Goal
2. Objectives and Outputs
   Objective 1: Protected Areas System
   Objective 2: Public Awareness, Participation and Education
   Objective 3: Sustainable Use of Biodiversity
   Objective 4: Regional and Local Level Biodiversity Action Plans

1. Goal

Through conservation and sustainable use, to protect and maintain India's biodiversity as a critical component for its sustainable development, for the benefit of all people of India, both present and future.

2. Objectives and Outputs

Objective 1: Protected Areas System

To establish a system of protected areas with strong legal protection and effective management which is properly representative of the range of India's ecosystems and species, and which covers at least 10% of the country.

Institutional and Legal Provisions

I. Review of the suitability and adequacy of existing institutional arrangements for administration and management of protected areas, and any changes if required.
II. Review of the legal provisions for protected areas, including the adequacy of various types of protected area status, and any changes if required.

Protected Area Management

I. Review of the adequacy of staffing, funding and equipment levels for protected area management, and any changes if required, on the basis of current experience and in

accordance with the reorganized / expanded protected areas system.

II. Improved recruitment and training procedures for protected areas staff.

Protected Areas System Reorganization and Expansion

I. Based on available data, develop maps showing national ecosystems, the location of key biodiversity areas and habitats and current status.

II. Review categories of protected areas and initiate revision/reform to best meet the current needs of India (see legal review above).

III. Through an expert consultative process, identify gaps and needs and reach agreement on selection criteria.

IV. Selection of proposed protected areas in terms of agreed criteria.

V. Appropriate consultation procedures at all levels.

VI. Complete procedures for establishment of protected areas.

Biodiversity Information System

I. Develop an appropriate system for storage and processing of relevant biological resources information, which is applicable to effective decision-making.

II. Ensure knowledge of and full access to the information system by decision makers and other interested parties.

Objective 2: Public Awareness, Participation and Education

Achieve at all levels an adequate understanding and appreciation of the full value of biodiversity to India's sustainable development and support for the efforts to adequately conserve and the Nation's biological resources.

Increased Knowledge Base of Decision Makers

I. Develop information packages and guidelines for decision makers from different sectors, particularly agriculture, production forestry and water management, on biodiversity conservation and sustainable use. Provide easily accessible and utilizable information on biodiversity issues to decision makers from all sectors.

II. Ensure a multi-sectorial representation on national, regional and local biodiversity committees, associations and relevant organizations.

Increased Public Awareness

I. Develop a media program (print, radio, television) designed to convey a broad understanding of the full value of biodiversity to India's sustainable development
II. Gain public support for major biodiversity conservation and sustainable use activities, particularly protected areas, via full dissemination of information at national and local level.
III. Develop local and community biodiversity awareness programs for areas of particularly high value / importance to biodiversity conservation and sustainable use.

Education

I. Through an expert consultative group, fully identify gaps and problems with current schools and higher education curricula.
II. Identify other ongoing activities and initiatives in the field of environmental education
III. Identify priority actions required and develop a national biodiversity education plan.
IV. Implement procedures for establishment of biodiversity education in the national education system.

Public Participation

I. Establishment of biodiversity conservation and sustainable use support / interest groups and associations at national and local level.
II. Identify and develop means and mechanisms for encouraging public participation in biodiversity conservation and sustainable use, particularly by local level support groups and communities around or within protected areas.

Objective 3: Sustainable Use of Biodiversity

Through the controlled use of biodiversity resources, achieve the maximum economic, scientific, recreational and cultural benefits for all the people of India, while at the same time ensuring the long term conservation of biodiversity and viability of ecosystems.

Sustainable Economic Use

I. Develop within the protected areas system methods and mechanisms for achieving the sustainable utilization while at the same time ensuring adequate biodiversity conservation.
II. Through an expert consultative group, identify and review the current economic use and regulation of biodiversity resources in India and the adequacy of current regulatory mechanisms.
III. Identify potential new means and mechanisms for sustainable utilizing India's biodiversity resources and the equitable sharing of benefits, particularly to rural communities.
IV. Identify priority areas requiring increased research, regulation or development
V. Make recommendations on future development of the sustainable economic use of biodiversity resources in India including principle mechanisms, revision or strengthening of regulatory systems and institutional responsibilities.

Scientific and Educational Use

I. Through an expert consultative group, review the current scientific and educational use of biodiversity, particularly within protected areas, identify principal problems and limitations, and make recommendations for maximizing benefits of such use.
II. Establish an expert scientific group to assess the importance of agro-biodiversity in India and on this basis develop a program for its conservation and use.
III. Establish an expert scientific group to assess the status of bio-technology and bio-pharmaceutical development in India and make recommendations concerning their further development.

Cultural and Recreational Use

I. Identify the current and future recreational needs of India and role protected areas and other areas of biodiversity and landscape value will play in meeting those needs.
II. Assess the implications for biodiversity of current and future recreational needs and identify methods and mechanisms for maximizing benefits while minimizing impacts.

III. Identify ecosystems and species of particular cultural significance and develop approaches that conserve features important to the national cultural heritage.

Objective 4: Regional and Local Level Biodiversity Action Plans

Within the framework of the National Biodiversity Strategy and Action Plan, carry out the creation of regional or local action plans which more specifically meet regional / local requirements and issues.

I. Form the required organizational structure by regional / local authorities, scientists, NGO and interest groups (steering committee, preparation team).
II. Prepare assessment of biodiversity situation in area including: analysis of biodiversity importance, problems and required actions.
III. On the basis of the assessment prepare realistic regional / local action plan, indicating the actions to be taken, responsible institutions / organizations, approximate financing and timetable.

2. Operational period

The strategy should be implemented on the basis of a 10-year operational period. A review of the strategy and its implementation should be undertaken after 5 years.

Part-IV- ACTION PLAN FOR BIODIVERSITY OF THE STATE OF BIHAR

INTRODUCTION:

Historical Background:

Bihar is one of the major states of the Indian Union. Many ancient civilizations in the world have evolved around magnificent rivers, but very few rivers in the world have moulded the culture, economy and personality of the people evolving on their banks as the great river Ganga. Cutting straight across Bihar from west to east, the bounteous Ganga had rendered the region so fertile and plentiful, that its natural prosperity nurtured a great fountainhead of political and cultural civilizations down the millennia.

Here, kingdom after kingdom rose and fell, leaving their indelible mark on history. Rival kings fought legendary battles, devastating the land and the people. Yet, by some strange alchemy, the same land also saw the birth of some of the most gentle and progressive religious teachers like Buddha, Mahavira and Guru Gobind Singh.

Bihar is bound on the north by Nepal, on the east by West Bengal, on the west by Uttar Pradesh and Madhya Pradesh, and on the south by Orissa.

The name **'Bihar'** is derived from **'Vihara'**, meaning monastery. Bihar has been a great religious centre for Hindus, Jains and most importantly, the Buddhists. It was at Bodhgaya in Bihar, that the Buddha sat under the **Bodhi tree**, and attained enlightenment. A descendant of the same tree still flourishes in Bodhgaya today. **Nalanda**, which was a world - **renowned Buddhist University in the 5th century AD**, is also located in Bihar. Rajgir, a pilgrimage place for Buddhists and Pawapuri, where Lord Mahavira breathed his last, are near Nalanda.

Other places of tourist interest in Bihar include Bhimbandh, famous for hot springs; Maner, a sacred Muslim shrine of Sufi Saint Hazrat Makhdoom Shah; Vikramshila, the ruins of a Buddhist university; and Sasaram, the site of the tomb of Afghan emperor Sher Shah Suri.

Bihar boasts of an enviable wealth of rural handicrafts comprising of hand - painted wall hangings, wooden stools, miniatures in paper and leaves, stone pottery, bamboo and leather goods, and appliqué work. But Bihar's most famous and fascinating indigenous art forms, by far, are its **Madhubani paintings**. This art is a strict monopoly of the women of Mithila. Done in primary colours of natural origin on paper and cloth, they narrate mythological and religious events.

The principal foodgrains of Bihar are paddy, wheat, maize and pulses. Main cash crops include sugarcane, potato, tobacco, oilseeds, onion, chillies, jute and mesta.

Present Status:

A part of Bihar was separated and formed into a new state Jharkhand on November 15, 2000. Bihar is lying approximately between 21°58'10" and 27°31'15"N latitudes and 82°19'50" and 88°17'40"E longitudes in the lower and middle Gangetic region extending 483 Km from west to east. This state embraces some of the most fertile lands of India. Bihar, squeezed in between West Bengal, Jharkhand and Uttar Pradesh, reaches

up to the Himalayas in the north and is completely land locked. Bihar is bounded on the north by Nepal, on the south by Jharkhand, on the east by West Bengal and on the west by Uttar Pradesh.

Bihar gets the worst of the cold and the worst of the heat and plenty of floods. Northern portion of Bihar is almost entirely a level tract, while the south is wooded and hilly. Bihar has a number of rivers, the most important of which is the Ganga. The river Ganga flows right across it from west to east. North Bihar is extremely fertile, the land being watered by the rivers Sarayu, Gandak and Ganga. The other rivers are the Sone, Punpun, Falgu, Karmanasa, Durgawati, Kosi, Ghaghara etc.

The state of Bihar after the partition in the year 2000, poverty in Bihar has all the more increased. In this perspective it would be advisable to discuss the causes and cure of poverty.

The causes of poverty in Bihar may be viewed in terms of certain parameters such as:

1. Overpopulation and apathy towards family planning.
2. Poor land and water management for agriculture.
3. Illiteracy.
4. Poor health care.
5. Lack of industrialization due to poor infrastructure.

In the undivided Bihar population was about 100 millions and in the truncated Bihar it is about 7.5 crores. Its land area is 94786.72 sq. km, which means that its density is 791 people per sq. km, which is quite high from the national figure. Hence, steps to reduce populations should be initiated.

Bihar has a strong agricultural base. It is bereft of mines, minerals, forests and industries but rich in fertile soil. Flood would be a boon for the state of Bihar if water could control and managed in a proper way. About 47 lack acres of land get flooded every year while 10 lack acres of land permanently remain water logged. The level of riverbed has arisen considerably due to the deposit of silt. The rivers need to be excavated along with construction of embankments and bunds along the river. Water has to be contained within the river itself and where water level rises high it has to be channalized and stored for the purpose of irrigation and fisheries.

Illiteracy in Bihar is 52.47% and this needs special attention of the policy makers. Bihar has been left with only few industries and to name a few for e.g. IOC, Barauni, three thermal powers; four distilleries; 14 sugar mills and few stone crushers and brick kilns. No heavy industries can come up in North Bihar because of the flood prone area and soil texture. Therefore it is suggested to increase the number of agro-based industries and strengthen and modernize the existing industries in Bihar.

If people's mental horizon is developed and endowed with a scientific temper many of the ills besetting Bihar like overpopulation, poor health. Illiteracy and above all poverty can be alleviated.

Cultural and Religious Diversity:

There is a great deal of Anthropological literature showing how interaction with, use of, and observation of, diversity of life forms and ecosystem have been the source of all cultural evolution and technological innovation. It would be appropriate to assert that the incredible extent of human creativity manifested throughout the history is formed on the ecosystems and natural diversity found on earth.

The cultural values in human societies are often expressed in the form of respect for symbols of biodiversity. Some species such as Peafowl are key icons of cultural heritage, while others—for examples tiger, lion, lizard, turtles and bison are integral to religious and spirituals beliefs. In Bihar, sighting of ants before monsoon indicates an early onset of rains and sighting of "**Neelkanth**"(*Corascias benghalensis*) on Vijayadashmi indicates good omen for the whole years.

A great variety of plants and animals have been used for cultural purposes, which are outside of the sphere of basic subsistence needs of food, shelter and clothing, but are yet considered to be equally important.

For example Bel (*Aegle marmelos*) for lord **Shiva**, Ashok (*Asoca indica*) for lord **Budha**, **Indra**; Peepal (*Ficus religiosa*) for lord **Vishnu**; Neem (*Azadiracta indica*) for Goddess **Shitla** etc.

Rituals in all parts of India are occasions for the use of many plants and animals. Among auspicious plants and flowers offered in temples are *Hibiscus* offered to Goddess **Kaali**, Dhatura flowers to lord **Shiva** and flowers of *Euphorbia ligularia* to lord **Rama**, Tulsi (*Oscimum sanctum*) for goddess **Lakshmi**. Sandalwood and Banana are considered sacred and used in ceremonies during auspicious occasions like marriage. Kusha grass (*Eragrostis cynasuroides*) is necessary for most religious ceremonies.

Similarly Rice and Til (*Sesamum indicum*) are used as offerings in religious ceremonies. Some animal species are termed **"Vahanas"** or vehicles of deities and are hence venerated. Important among those are the Bull of **Shiva**, the Rat of **Ganesha**, the Lion of **Durga**, the Tiger for **Iyyappa** and the Peacock for Goddess **Saraswati**. Other ritual and sacred values are attached to plant / animal species. *Mallotos philippensis* is used as **Sindoor** or **Kumkum** by women to signify their marital status.

According to the character of each festival, specific grains assume importance for use in particular festival for example "**Nag Panchami**", a day on which snakes are worshipped as symbols of fertility and probably their role in farming as controllers of rats and other pests. In "**Makar Sankranti**" Til and Gur which are of high calorific value and consumed during the coldest month i.e., 14th January all over Bihar. On the same day **"Pongal"** is celebrated in south, and **"Baishakhi"** in Punjab, **"Bihu"** in Assam. These festivals are celebrated on the occasion of post harvesting seasons.

Geomorphology:

Geomorphologicaly the state of Bihar extends from the foot of the Himalayas, called Siwaliks, in the North to the Hill ranges on the border of Jharkhand in the south and to the plateau area on the border of UP state in the West. Bihar can be Geomorphologicaly divided into three broad divisions:

1. Gangetic plans of the North and Central Bihar
2. Extension of the Himalayan foothills and the tarai region in the extreme North-west and North respectively.
3. Fringe of Chhotanagpur plateau on the Southern Border and Kaimur Plateau on South-Western border of the state.

The Gangetic plains form a part of the Indo-Gangetic fore deep region of the Indian sub-continent and seem to have been formed by earth movements of the Global dimension during Himalayan orogeny. Alluviam of this plain cover about 92000 sq.km. in the North and Central Bihar.

A generalized Geological stratigraphic succession seen on surface and observed in 5 k.m. deep bore hole (at Raxaul in East Champaran) is as follows:

AGE	FORMATION
Recent, Pleistocene Tertiary	Newer and older alluvium and laterites. Siwaliks and gravels.
Lower-Middle Jurassic	Volcanics with intertrapeans
Proferozoic	Vindhyans
Pre Cambrians (Archeans)	Metamorphics, Igneous, intrusives and Meta volcanics

Kaimur Hills: The North of Rohtas district is a low lying alluvial plane and one of the principle wheat growing tracts belonging to the Northern tract; the Southern part of it is an undulating mass of low Hills or rather a plateau known as Kaimur Hills. They are one of the ragged termination of the great Vindhyan range separated from the main mass in our state by the river Sone, on which they abut with cleft like escarpments. These are Kaimur Hills, which extends westwards into Reeva (Madhya Pradesh). The central tract consists of sandstones, shales and limestones. The predominant species was Hardwickia binata (Anjan) (Caesalpiniaceae) – timber yielding used for cartwheels, ploughs, bridges, etc.; bark- source of fiber- now vulnerable.

Rajgir Hills: It is mainly quartzite and slate and very barren not because forest will not grow on quartzite but for the lack of forest conservancy and unrestricted grazing and human interference for firewood collection. Still there is a so-called forest where one gets *Adhatoda vasica,* a medicinal plant used for treatment of Bronchitis, Asthma and fever; *Jatropha curcas(* Jangli arandi),a source of oil now being tried as a substitute for petroleum; Zizyphus *zuzuba* (ber).

Meteorology:

The maximum temperature varies between 38° to 40 ° C during month of May and June and minimum 4-6° during the period Dec. and Jan. The normal temperature through out the year lies between 35-18° C.

The annual rainfall varies between 1082 km and 1844 km. Generally April and May are the driest. The average wind speed through out the year is 5-7 m/sec. General wind pattern is:

Monsoon and post-monsoon: - North East to East
Winter and summer: - South -West and West

Its geographical location and natural features influence the climate of different parts of Bihar. For instance West Champaran forest and the Himalayan Siwaliks have important effect in the climatology of North West part of the State. Similarly North East part of the state is nearer to western extension of Darziling Himalaya.

Wetlands which occupy more than 5 % of the geographical area of the state moderate the climate.

LOCATION OF BIHAR





AREA & POPULATION:

Area: 94,163sq.km
Capital: Patna
Language: Hindi

POPULATION IN BIHAR:

1. Population (2001 Census) Provisional: -

Total	8,28,78,796
Male	4,31,53,964
Female	3,97,24,832
2. Population (0-6 Age Group)	
(i) Absolute - Persons	1,62,34,539
Male	83,75,532
Female	78,59,007
(ii) Percentage to total Population - Persons	19.59%
Male	19.41%
Female	19.78%
3. Literacy	
(i) Absolute – Persons	3,16,75,607
Male	2,09,78,955
Female	1,06,96,652
(ii) Percentage – Persons	47.53%
Male	60.32%
Female	33.57%
4. Decadal Population Growth (1991-2001)	
(i) Absolute	1,83,48,242
(ii) Percentage	28.43%
5. District With Highest Decadal Growth --- Sheohar	36.16%
6. District With Lowest Decadal Growth --- Nalanda	18.64%
7. Density of Population (Per Sq.Km.)	880
(i) Most Densely Populated District - Patna	1471

(ii)Least Densely Populated District-Kaimur 382

Administrative Units

1. **Divisons**	9
2. **Districts**	38
3. Subdivisions	101
4. CD Blocks	533
5. Panchayats	8471
6. Number of Revenue Villages	45103
7. Number of Urban Agglomerations	9
8. Number of Towns	130
(i) Statutory Towns	125
(ii) Census Towns (Non-Statutory)	5
9. Police Station: -	
(i) Civil Police Station	813
(ii) Railway Police Station	40
10. Police District: -	
(i) Civil	39
(ii) Railways	4

Governance: Districts

1. Araria	11. Gaya	21. Munger	31. Sheikhpura
2. Aurangabad	12. Gopalganj	22. Muzzafarpur	32. Sheohar
3. Banka	13. Jamui	23. Nalanda	33. Sitamarhi
4. Begusarai	14. Jehanabad	24. Nawadah	34. Siwan
5. Bhabhua	15. Katihar	25. Patna	35. Supaul
6. Bhagalpur	16. Khagaria	26. Purnia	36. Vaishali
7. Bhojpur	17. Kishanganj	27. Rohtas	37. West Champaran
8. Buxar	18. Lakhisarai	28. Saharasa	38. Arwal
9. Darbhanga	19. Madhepura	29. Samastipur	
10. East Champaran	20. Madhubani	30. Saran (Chapra)	

Governance: Divisions

S.NO.	DIVISION	DISTRICTS
1	Bhagalpur	Bhagalpur Banka
2	Darbhanga	Darbhanga Madhubani Samastipur
3	Kosi	Saharasa Supaul Madhepura
4	Magadh	Gaya Jehanabad Aurangabad Nawadah
5	Munger	Munger Lakhisarai Sheikhpura Jamui Khagaria Begusarai
6	Patna	Nalanda Patna Bhojpur Buxar Rohtas Bhabhua
7	Purnea	Purnia Araria Kishanganj Katihar
8	Saran	Saran (Chhapara) Siwan Gopalganj
9	Tirhut	West Champaran East Champaran Muzaffarpur Sitamarhi Vaishali Sheohar

AGRO-CLIMATIC RESOURCES

The state is divided into Three Agro-Climatic Zones

North Bihar Plains:
West Champaran, East Champaran, Gopalganj, Siwan, Saran, Sitamarhi, Muzaffarpur, Vaishali, Madhubani, Darbhanga, Samastipur.

North Eastern Bihar Plains:
Saharsa, Araria, Madhepura, Kisanganj, Purnea, Katihar, Begusarai, Khagaria.

South Bihar Plains:
Bhojpur, Patna, Rohtas, Nalanda, Aurangabad, Gaya, Jehanabad, Nawada, Munger, Bhagalpur.

Agriculture

S.NO.	IMPORTANT CEREALS	AREA (000,hec)	PRODUCTION
1	Rice	47.00	60.40
2	Wheat	20.60	43.30
3	Pulses	10.00	7.54
4	Maize	7.22	13.55
5	Oil Seeds	2.43	1.52

Sugarcane:

Bihar has the potential for emerging as the Sugar bowl of the country.

Area under sugarcane	0.23 million hect.
Production	11.00 million ton. ann.
Potential area for sugarcane	0.46 million hect.

Vegetables:

Second largest producer of vegetables in the country.

Total Area	0.84 million hect.
Production	8.60 million tonnes.

Fruits: One of the largest producers of fruits in the country.

Total Area:-0.28 million hect
Production:-2.85 million tones

S.NO.	IMPORTANT FRUITS	AREA (hec)	PRODUCTION (ton)
1	Mango	1,51,459	14,62,000
2	Banana	25,500	3,50,000
3	Guava	26,805	2,43,000
4	Litchi	21,375	1,91,000
5	Citrus	17,866	1,78,660
6	Pine-Apple	3,000	45,000

The State has its special land use pattern. Out of its total area, about 66.72 thousand sq.km. is under farm sector. About 60% of the cultivable land had irrigational facilities.

Under such a background, the only alternative to fall back upon for a subsidiary rural income is livestock farming.

Contribution of Livestock to Gross National Product is well recognized. About 80% of this is derived from cattle and buffaloes. However, the poultry, Duckery, Sheep rearing, Goatery and Piggery also assume immenence importance under such a situation.

Livestock production has a much larger contribution to manpower employment than agriculture and thus livestock rearing is very important in rural economy. Apart from draught animal power, milk production also helps crop production through the availability of fluid cash round the year to the farmers, which is utilized for purchase of seeds, fertilizer, etc. for their agricultural operations. Organic manure from cattle, poultry, sheep, goats or Pigs has been essential for crop production specially for vegetables and horticultural activities. Crop production alone cannot give adequate employment and a minimum level of income to the bulk of the rural population particularly in deficient rainfed areas.

Livestock Population:

According to Livestock Census 1982, Livestock population of the State is as follows: -

Table:-1

S.NO.	CLASSIFICATION OF LIVESTOCK	1982 (Fig. in lakh)
1	Cattle	
	Cross breed	0.98
	Total breedable Cows (Desi & CB)	22.93
	Total Cattle	93.92
2	Buffaloes	
	Total breedable Buffaloes	19.26
	Total Buffaloes	36.12

DOMESTICATED BIODIVERSITY:

1. Agri-diversity:

Agriculture being the important part of the economy gets the most attention in the biodiversity sector. Rice and Wheat are the staple food grains cultivated plant biodiversity may be categorized as: "the genetic variation existing among species, local land races, primitive cultivars and microbial species, that have been domesticated often including there nearest wild relatives". Bihar has great variety of wild and indigenous crops in the era of 'green revolution'. Since then many high yielding varieties were introduced at the expense of local strains. Thus, the ushering in of the green revolution in the 60's has replaced the agricultural practices with high input of intensive agriculture in Bihar, due to this change in the cropping pattern there has been a major change in the different types of crops like, rice, wheat, gram, groundnuts and pulses.

Recently, Swaminathan (1997) emphasized the concept of "**Evergreen Revolution**" which he described as "**Environmentally sustainable and socially equitable Green Revolution**". This concept somewhere definitely contains the spirit of combined protective-productive systems. Combined protective-productive systems like integration of trees into farming systems rooted in the principles of ecology, productivity, economics and sustainability are now generally referred as agro-forestry.

2. Scope of Agro Forestry in dry land/ Rain fed system: -

Agro-forestry is a low input sustainable agricultural based land management, which has potential to solve agriculture ecosystem/ agro-ecosystem, related problematic and also minimizes the risk of seasonal crops and the productivity and economic viability of lands:

1. To optimize positive interaction between various biological production components like trees/shrubs/crops.
2. Acts as an insurance against crop failure, flood and drought in dry land.

3.Benefits of the agro-forestry:

- It ensures regular income in subsistence farming.
- Reduction of soil erosion with planting deep-rooted tree crops.
- Reduction of run off by growing tree crops.
- Improvement of soil fertility.
- Prevention of nutrient loss from soil by raising multi-purpose crops
- Favorable soil temperature and solar radiation improves soil microbial activities, decomposition and nutrient cycle.
- Legumes improve nitrogen availability of the soil.
- Lesser incidence of biotic stresses (pests and diseases) due to the presence of non-host crops.
- Increased crop productivity.
- The capability to integrate a wide arrays of multipurpose woody plants and planting design within agricultural landscape, make agro-forestry a flexible and powerful tool for manipulating and capitalizing on the resultant beneficial shifts in biodiversity.
- Plant diversity or policulture can be utilized in pest management, particularly in the enhancement in the natural enemies of crop pests.

The additional advantage of growing various kinds of inter crops like root/spices crops (turmeric, ginger, mango ginger, etc.), vegetables crops (garlic, onion, tomato, chillies, radish, cucumber, spinach, coriander), fodder crops (guinea grass, para grass, berseem and hybrid Napier) and medicinal plants (lemon grass, citronella menths, khas) under agri-horti based agro-forestry system provide additional flora for sustainability of honey bees.

2. Livestock: Being one of the oldest civilizations of the World, it is not surprising that our Indian sub-continent was one of the first places to domesticate cattle, buffalo and chicken. There are two breeds of buffalo, 8 cattle, 25 goat, 28 sheep, one horse, 4 camel, and 3 indigenous poultry. About 75 to 80 % of domestic stocks are crossbreeds and the proportion of crossbreeds to pure breeds is on the rise.

3.Cultured fish species and Honeybees. Fish production is practiced mainly on small size of pond in North Bihar. Almost all the ponds and the water bodies are natural. Introduction of some potential and economically viable fast growing fish species like *Clarias batrachus, Labeo rohita, Cyprinus carpio communis, Anabas testudineus, Labeo calbasa, Cirrhima marigala, Catla catla, Mystus seenghala, Wallago attu, Rita rita, Labeo bata, Channa striatus, Channa punetatus, Channa gaehua, etc.* will give enough income for the wet land production and other water logged area.

Scope Of Apiculture

Bihar is enriched with highly diversified, abundant bee-flora and favorable ecological conditions for apiculture. It has a promising future in the state during recent trends of diversification in agriculture. If due attention is given to apiculture, it has a good scope in the state to develop as a prime-agri-horticulture and forest based rural industry. It can generate self employment to the rural and tribal families and can increase the income by producing honey and other bee-hive products like wax, royal jelly, bee venom and propolis, etc. With the development of apiculture, a number of subsidiary industries will also develop which include fabrication of bee-keeping equipments and their marketing can open new vistas for unemployed youths. Earlier due to natural occurring wild pollinators, need for managed pollination was not realized. But now due to large-scale deforestation and indiscriminate use of pesticide, the population of natural pollinators has declined and there is necessity for the propagation of hive-bees to meet pollination requirement. There exist a great potential for expansion for apiculture in the state of Bihar due to vast area of land under crops and forest plantation.

There are 4-5 honey flows in Bihar as compared to one or two in other state of India. Litchi-honey of Bihar has great demand nationally and internationally. The honey production potential 60-80 kg/hive/year which is three times higher than the national average of 20 kg and in other states Punjab (30 kg), Himachal Pradesh (35 kg), Jammu & Kashmir (40kg).

Present Status

Prior to the introduction of Italian honeybee, *Apis mellifera,* production of honey bee of *Apis cerana indica* was around 8 tones per year and there were about 130 bee- keepers having 10,000 indica colonies. After the introduction of *Apis mellifera* there has been a remarkable increase in honey production, which has reached to 4575 tones during 2003. Presently about 1.5 lakhs effective colonies exist with move than 2000 beekeepers. Among the dominant districts of bee keeping in Bihar are Muzaffarpur, Vaishali, Samastipur, Begusarai and East-Champaran. However, apiculture is becoming also popular in West-Champaran, Khagaria, Bhagalpur, Nalanda, Purnea, Saharsa, Sitamarhi, Darbhanga, Madhubani, etc.

Development Of Indian Honey Bee

Consistent and continuous efforts of Scientists of Honey bee Research and Training Center, RAU, Pusa coupled with innovative and adventurous nature of the farmers for adoption of latest technologies, *Apis mellifera* bee-keeping was popularized in the state in a short span of time.

Table 2: Development of *Apis mellifera* bee-keeping in Bihar

Year	Bee-keepers	Bee-colonies	Honey production in Tones
1988	AICRP (HB center, Pusa)	15	-
1989	8	5020	1.50
1990	23	220	6.60
1991	58	605	21.17
1992	115	1840	55.90
1993	190	4800	264.00
1994	235	12300	676.00
1995	280	35900	2333.50
1996	315	42000	2730.00
1997	360	50000	3250.00
1998	600	65000	3310.00
1999	790	82000	3400.00
2000	1015	90000	3500.00
2001	1375	100000	3890.00
2002	1510	120630	4475.00
2003	1850	125570	4850.00

Suggestions For The Development Of Apiculture

- Diversification in Apiculture is necessary to make apiculture more profitable.
- Bee-keeping should be considered as the special discipline at the level of generating technical know how. The National Bee Board recently established should govern all aspects of bee-keeping industry right from hive to market.
- To create interest in bee-keeping society should be formed at different levels of the state as well as the national level.
- Selection and breeding of queens of high yielding races for increasing honey production should be given top priority.
- Bee-colony multiplication unit should be established in each bee-keeping area/block/state from where colonies and standard equipments should be easily available to the bee-keepers at a reasonable price.
- Honey bee pollination should be encouraged among the farmers.
- There should be appropriate quality control of honey as in export market fresh, light-coloured, unifloral and liquid honey fetch good price.
- Marketing network should be formed through co-operative societies of bee-keepers to maximize price of honey at block level.

4.**Horticultural and vegetable crops:** The state of Bihar, endowed with fast fertile plain land, tropical as well as sub-tropical climate, and plenty of ground water holds a vast potential for growing large number of

horticultural crops which have been given on page 39-40. Many tropical and sub-tropical fruits and vegetables are grown in the state with great ease and success. Presently these crops cover roughly 10% of the gross cropped area. But still there is great scope for more production in this field. This could be done through utilization of the variation that exist in several important germ plasm collections. Proper care should be taken to ensure that no germ plasm is lost due to improper handling or storage conditions. As per the guidelines issued by ICAR, all the genetic stocks of fruits and vegetables in the state should be registered and conserved in the gene bank. It is also mandatory that all released/ certified/ developed varieties or parents of hybrids be conserved in the National Gene Bank at NBPGR, New Delhi.

Floriculture:

Bihar has a tremendous potentiality for growing commercial flowers viz. Rose, Gladiolus, Carnation, Tuberose, Chrysanthemum, Marigold, Jasmine etc. for cut or loose flowers production which are used for interior/table decoration and making garlands, bouquet, buttonhole, veni and extracting the essential oils. The agro-climate condition as well as the suitability of soils for growing most of the flowers is one of the best in the country. But, these flowers are produced in a very small quantity, even not able to fulfill the requirements of the state and ultimately it is brought at Patna, Muzaffarpur, Darbhanga and other cities from Kolkata, Varanasi and other cities. Unfortunately, as yet there is no realization that flowers could be a potential source of income to the farmers community and urban dwellers of Bihar. Moreover, besides Indian markets there is good scope to produce export quality flowers to get foreign exchange, reasons why Bihar should pay special attention in improving floriculture.

1. Floriculture has an annual growth potential of about 25 – 30%.
2. Floriculture products have capacity to attract/retain a large number of progressive rural populations.
3. Floriculture is best capital incentive.
4. High demand of floriculture products in foreign market especially the Gulf States and Middle East.

Strategies for boosting floriculture:-

- Biotechnological houses, nurserymen and floriculturist to be encouraged and assisted to participate in National and International flower show, fair and festival.
- To develop efficient and economically and viable propagation technology.
- Promotional activities for International market.
- To provide technical service and training.
- Research facilities to solve the specific problems.

PROFILE: NATURAL RESOURCES

Natural Resources

Bihar lies in the tropical to sub tropical region. Rainfall here is the most significant factor in determining the nature of vegetation. Bihar has a monsoon climate with an average annual rainfall of 1200 mm.

Forests

The sub Himalayan foothill of Someshwar and Dun ranges in Champaran constitutes another belt of moist deciduous forests. These also consist of scrub, grass and reeds. Here the rainfall is above 1600 mm and

thus promotes luxuriant Sal forests in the favoured areas. The hot and dry summer gives the deciduous forests. The most important trees are *Shorea Robusta* (Sal), Shisham, *Cedrela toona*, Khair, and Semal. This type of forests also occurs in Saharasa and Purnia districts.

Fertile Land

The topography of Bihar can be easily described as a fertile alluvial plain occupying the Gangetic Valley. The plain extends from the foothills of the Himalayas in the north to a few miles south of the river Ganges as it flows through the State from the west to the east. Rich farmland and lush orchards extend throughout the state. Following are the major crops: paddy, wheat, lentils, sugarcane, jute (hemp, related to the marijuana plant, but a source of tough fibers and "gunny bags"). Also, cane grows wild in the marshes of West Champaran. The principal fruits are: mangoes, banana, jackfruit and litchis. This is one the very few areas outside China which produces litchi.

Water Resources

Water like ground and mineral resources is of great significance as it provides means of drinking water for man and animals, irrigation for agriculture, industrial uses, production of hydro-electricity, transportation and recreation etc. The importance of water is so immense that the people in ancient times worshipped it.

Bihar is richly endowed with water resources, both the ground water resource and the surface water resource. Not only by rainfall but it has considerable water supply from the rivers, which flow within the territory of the State. Ganga is the main river, which is joined by tributaries with their sources in the Himalayas. Some of them are Saryu (Ghaghra), Gandak, Budhi Gandak, Bagmati, Kamla-Balan and Mahananda.

There are some other rivers that start from the plateau area and meet in Ganges or its associate rivers after flowing towards north. Some of them are Sone, Uttari Koyal, Punpun, Panchane and Karmnasha.

There are several rivers in Bihar, which contribute a lot to the peoples of Bihar. These rivers make the water available for irrigation purpose and also help in generating the hydrothermal energy for the state. Apart from this they provide a medium for water transport, provide fishes for fishery industry and enrich the natural resources of state in many other ways.

All the above rivers have their impact on the Bihar plain. State also has non-exhaustible source of ground water, which is in use for drinking purposes, irrigation and industries.

Soil and Climate

Soil

Soil is one of the most important resources of a nation. It is the gift of nature of immense value. The most common use of the word soil is in the sense of a medium in which plants grow, although it has a different connotation at different time & place, and for persons engaged in different professions. Almost all the economic activities are directly or indirectly dependent on soil. Thus soil is backbone of agricultural and industrial development.

Soil has a number of characteristics, which may be regarded as the aggregate of the physical, chemical and biological properties. The Bihar plane consists of a thick alluvial mantle of drift origin overlying in most part. The Shiwalik and older tertiary rocks. The soil is mainly young loam rejuvenated every year by constant deposition of silt, clay and sand brought by different streams. This soil is deficient in phosphoric acid, nitrogen and humus, but potash and lime are usually present in sufficient quantity.
There are three major types of soil in Bihar:

(i) **Piedmont swamp soil** - found in northwestern part of west Champaran district.
(ii) **Terai soil** – found in northern part of the state along the border of Nepal.
(iii) **The Gangetic Alluvium** – the plain in Bihar is covered by Gangetic alluvium. It is divisible into –

Older alluvium (bhangar soil)
New alluvium (khaddar soil)

Climate

The climate of Bihar is a part of the climatic pattern of the Indian subcontinent. It enjoys a continental monsoon type of climate owing to its great distance from the sea.

The factors affecting the climate of Bihar are: -

1. It extends from 22-degree north to 27-degree latitude. Hence its location is tropical to sub tropical.
2. The Himalayan Mountains in the north have a significant bearing on the distribution of monsoon rainfall in Bihar.

Bihar joins the Ganga delta & Assam.

1. Cold weather season - December to February.
2. Hot weather season – March to May.
3. Southwest monsoon – June to September.

Retreating southwest monsoon – October to November.

FOREST COVER AND GREEN BELT: -

Highlights:

Geographical Area:	**94,163 Sq.Km.**
Notified Forest Area:	**6164.14 Sq.Km.**
Forest Area to Geographic Area:	**6.5%**
Protected Areas:	**13**
National Park:	**1**
Botanical Garden:	**1**
Sanctuaries:	**12**
Area of Protected Area:	**3320 sq Km**
% Protected Area to Total Forest Area:	**49.09%**

Total forest area, types of forest, flora and fauna: -

After bifurcation the truncated Bihar has only 6164 sq km forest area, which is only 6.5% of the total geographical area. However the state has a large extent of tree cover outside the forest in form of orchards, plantations etc. The total tree cover of the state is estimated at 9413 sq km which works out to about 10% of the geographical area of the state. The forests of Bihar can be classified into three broad categories.

The richest forest area is in West Champaran district of the state. Here the area forest is 910.514 sq km while the geographical area of the district is 5228 sq km. Thus the percentage of the forest area to the geographical area of the district is 17.4%. This includes a small patch of about 7sq km, which lies around oxbow lake Sarayaman, close to Bettiah.

In the South-west part of the state Kaimur plateau of Rohtas district has a large extent of forest. Linear length of this vegetal cover is about 75 km, which is located all along the left bank of the river Sone, upstream of Indrapuri Barrage in Rohtas district. Extension of Kaimur plateau forest is found also in southern part of Bhabhua district.

The fringe of Santhal pargana and Chotanagpur forest is found in southern part of Aurangabad, Gaya, Navadah, Sheikhpura, Jamui, Munger and Bhagalpur district.

District wise forest cover assessment (2001) by forest survey of India is as follows: -
Total Forest Area – 5720 sq. km. – 6.07%
Tree Cover – 94163 sq. km. – 10%

District wise forest cover in 2001 as assessed by Forest Survey of India is as follows: -

DISTRICT	GEOGRAPHICAL AREA (sq. km.)	FOREST COVER (sq. km.)
Araria	2830	62
Aurangabad	3305	143
Banka	3022	197
Begusarai	1918	30
Bhabhua	3381	1040
Bhagalpur	2567	21
Bhojpur	2390	11
Darbhanga	2279	23
Gaya	4976	548
Gopalganj	2033	10
Jamui	3107	637
Jahanabad	1569	4
Katihar	3057	11
Khagaria	1486	13
Kishanganj	1844	12
Lakhisarai	1356	227
Madhepura	1788	22

Madhubani	3501	15
Munger	1347	263
Muzappharpur	3172	5
Nalanda	2367	46
Nawada	2494	492
W. Champaran	5228	975
Patna	3202	34
E. Champaran	3968	24
Purnea	3229	51
Rohtas	3832	665
Saharsa	1650	11
Samastipur	2904	32
Saran	2641	15
Shekhpura	612	2
Sheohar	572	1
Sitamarhi	2071	13
Siwan	2219	5
Supaul	2432	28
Vaishali	2036	17
TOTAL	94163	5720

Forests of Champaran area:

The forest types found in Champaran are as below

- Bhabhar Dun Sal Forest
- West Gangetic Moist Mixed Deciduous Forest
- Khair Sisso Forests
- Cane Brakes
- Eastern Wet Alluvial Grass land
- Barringtonia Swamp Forests

On account of steep slope and friable geological formation, soil depth is less and vegetation is poor. Average size of the crop varies between 0.61 to 0.91 m girth. Therefore protection measures check soil erosion is essential for protection of biodiversity.

Forest can be identified into two main strata viz (i.) Sal species and (ii) Miscellaneous.

Sal stratum covers 69795.311 ha. of forest area and is 76.7% of the total area. Site quality varies from II to V. Regeneration is poor due to intensive grazing and fire. Main stratum is Shorea robusta, common associate of sal are *Terminalia, Adina, Albizzia, Bombyx*, etc.

Natural mixed deciduous forest is found in Madanpur block as edaphic formation in fresh alluvium and the tract is inundated by Gandak and its tributaries. This area is well known for Cane and Khair growth (*Acacia catechu*) besides *Dalbergia sissoo.*

The common species of animals found are *Panthera tigris, Panthera pardus, Felis chaus*, Sloth bear, blue bull, sambar, Barking deer, Spotted deer, hyena, hog deer, wild dog, etc.

Among avi fauna bustard quail, buttonquail, waders and pigeons besides jungle fowl are most notable. Gharials, crocodiles, crab, tortoises are common in marshy areas in Gandak and its tributaries. Python, Cobra, Krait, Dhamin, are the reptiles commonly seen in the area.

The entire forest area has been notified as Valmiki Wild life Sanctuary, core of which is called National Park- the only one of the state. This forest area is extension of Chitwan National Park of Nepal.

Forest of Kaimur plateau area:

Total forest area is 1596 sq.km. and is 22.13 of the Rohtas district. Here there are two types of forest cover The plateau area stands 500m above the Sone Valley and consists of an old fort, scattered houses, meager forest and agricultural land besides few ponds, which dry up in summer. Rohtas plateau extends from Rohtas in Bihar to Chittaurgarh Plateau in Rajasthan and is of same floral and faunal affinity.

Valley area forests are on sharp escarpment, which slopes towards Sone and bore the brunt of limestone mining activity. Currently all mining activities in the area have been stopped.

The main forest types found in Rohtas area are:

- Northern Tropical Dry Mixed Deciduous Forest
- Boswellia Forest
- Dry Bamboo Brakes

The main tree species found are *Adina cordifolia, Buchnania lanzan, Diospyros melanoxylon, Butes monosprerma, Pongamia glabra* etc.Trees of *Shorea robusta*, Delbergia, mahua, jamun, bahera and *Artocarpus* are also found in the area. Thorny brushes and grasses abundantly grow in the abandoned mine pits. Bamboos are in abundance.

Part of Kaimur forest has been notified as Kaimur Wildlife Sanctuary. Animals generally found in the area are Tiger, Leopard, Chital, Shambar, Bears, Hares and Peacock.

Forests on the fringe of Santhal Pargana and Chhotanagpur:

These forests extend over southern part of Aurangabad, Gaya, Nalanda, Nawada, Shekhpura, Jamui, Monghyr and Bhagalpur district and occupied total area of 2424 sq.km. of these districts. The forest types found in these areas are:

- Dry Peninsular Sal
- Northern Dry Mixed Deciduous Forest
- Northern Tropical Dry Deciduous Forest
- Boswellia Forest

The vegetation in these areas consists of Sal, Terminalia, Adina, Butea, Boswellia, Albizzia and other species. The quality class is predominantly class IV.

Forest of Munger Division are declared as a wildlife sanctuary known as the Bheembandh Wildlfie Sanctuary. The area is rich in wildlife. The species found are Tiger, Leopard, Langur, Chital, Sambhar, Bear, Wild boar etc.

Protected Areas in Bihar

Name of Park / Sanctuary	Place /District	National Park / Sanctuary
1. Valmiki National Park	West Champaran	National Park
2. Valmiki Sanctuary	West Champaran	Sanctuary
3. Bhimbandh Sanctuary	Monghyr	Sanctuary
4. Pant Wildlife Sanctuary	Nalanda	Sanctuary
5. Kaimur Wildlife Sanctuary	Rohtas	Sanctuary
7. Gautam Buddha Sanctuary	Gaya	Sanctuary
8. Udaypur Sanctuary	West Champaran	Sanctuary
9. Nagi Dam Bird Sanctuary	Jamui	Sanctuary
10. Nakti Dam Bird Sanctuary	Jamui	Sanctuary
11.Vikramshila Gangetic Dolphin	Bhagalpur	Sanctuary
12. Kanwar Bird Sanctuary	Begusarai	Sanctuary
13. Barela S.A.Z.S Sanctuary	Vaishali	Sanctuary

Valmiki Tiger Reserve:

Introduction:

Valmiki Tiger Reserve is located in the northernmost part of the West Champaran district of the Indian state of Bihar. The tract is broken and undulating, often showing highly fragile geological formations. As a result, there are steep ravines, knife-edge ridges and precipitous walls formed by landslips and soil erosion.

The great Gandak and the Masan rivers collect all the water from the numerous, tortuous tributaries. These rivers and streams keep changing course from side to side, facilitated by the erosion-prone sandy and immature soil of the banks. Seasonal rivers like Panchanad, Manor, Bhapsa and Kapan display the peculiar behaviour of erosion at one place and deposition of transported soil at another place.

The hill system is a continuation of the Shiwalik Range, largely made of imperfectly compacted and ill-formed sandstone dotted with pebbles and boulders. Owing to the fragile nature of the parent rock material, the soil produced at the foothill is immature, loose sand and display sheet. The menace is further aggravated by maltreatment of the forests by people in general, frequent fires and heavy grazing.

Conservation History

Valmiki is the 18th Tiger Reserve of the country and the second in Bihar. The core area of the Reserve was declared as a National Park in 1989. Government of Bihar had notified 464.60 sq. km. area as Valmiki Wildlife Sanctuary in 1978. Later on, in 1990, an area of 419.18 sq. km. was added to the Sanctuary. Thus, the Valmiki Wildlife Sanctuary embraces a total area of 880.78 sq. km.

Main Flora

Sal *Shorea robusta*, asan, karama, semal, khair, cane *Calamus tenuis*, jamun, *Saccharum mahua*, Piper longum (peepar).

Main Fauna

Tiger (*Panthera tigris*), leopard (*Panthera pardus)*, Rhesus macaque (*Macaca mulatta)* Common langur(*Presbytis entellus),* Jungle cat (*Felis chaus),* Wolf (*Canis lupus),* Dhole or wild dog (*Guon alpinus),* Hyena (*Hyena hyena),* Sloth bear (*Ursus melursus*), Sambhar(*Cervus unicolor*), Chital or spotted deer (*Axis axis,* Hog deer*(Axis porcinus) etc.*

Grazing: Grazing is alarmingly high in the Reserve but less so in the core area.

Fire : Fire is rare in the core area. Buffer area is highly sensitive to fire. The graziers are responsible for most of the incidents of fire. There is no reported case of natural fire. Madanpur range is the most sensitive zone because of its extensive grasslands and a thickly populated village on the fringe of the forests. Fires take place generally between mid-February to June end.

Poaching of fauna and Flora: There is no poaching in the core area. There is occasional poaching in the buffer area. However, since the northern and western boundaries of the Reserve lie along Nepal and Uttar Pradesh respectively, there is a serious problem of illegal felling and smuggling of teak and cane from Madanpur block of the Reserve to different parts of Nepal e.g. Susta, Ratanganj and Rani Nagar. Armed gangs settled in Nepal are involved in this illicit felling.

Livestock Population: Nil in the core. There are around 60,000 livestock heads in and around the Reserve causing severe damage to the flora. Most of them are unproductive. The growth rate is very high.

Others:

Rail-cum-Road Bridge: Due to the construction of Baghva-Chitauni Rail-cum-Road Link Bridge, the natural flow of Rohua and Kotaraihya streams were blocked and 1691 ha. of forest land has been inundated. This lead to 15000 trees dying in the Madanpur block in the buffer of the Reserve.

Mining/Extraction of Boulders: Government of India had given conditional clearance for three mining leases after imposing seventeen conditions. The leases were cancelled following recommendation of the state government. All mining activity inside the sanctuary has been halted following the directives of the Hon'ble Supreme Court.

DOLPHIN SANCTUARY:

The Ganges River Dolphin, (*Platanista gangetica*) occur in the Ganga and Brahmaputra, south Asia's largest river systems. It can now be considered amongst the most endangered mammals of the region. The species is no longer found in the upstream portion of their former range and numbers have been reduced where they still occur.

Water from the Himalayan catchment is essential to the lives of several hundred million people living in the Indian subcontinent. The Ganges river basins support more than 10% of the world's human population, living in communities, which are among the most economically undeveloped worldwide. The Ganges is considered holy to Hindus and millions of people conduct pilgrimages every year to bathe in the river. Degradation from industrial, agricultural, and domestic pollution and the modification of flow regimes by dams, barrages and embankments has resulted in dramatic losses of aquatic biodiversity. This suggests that these rivers may soon be unable to provide essential resources necessary for human survival.

Resources provided by living rivers are becoming in greater demand as human populations and needs increase throughout the subcontinent. River dolphins are a visible reminder of the need for the wise stewardship of freshwater resources and the species richness that they support. River dolphins require a reasonably unpolluted environment, sufficient water to move among deep pools and an adequate food supply. These are critical components of a healthy aquatic ecosystem and are also necessary for humans and other riverine species, including threatened gharial crocodilians, Asian smooth otters, and soft and hard-shelled turtles.

WWF-India convened the Indian River Dolphin Committee to facilitate co-operation between Indian researchers and highlight conservation priorities.

The focused programme of WWF-India for the conservation of Ganges River dolphin in the country aims to:

- Assess population and habitat status of the species in its distribution range.
- Identify and secure more protected areas, for the species focusing on its meta population.
- Draft the conservation strategy and management action plan for the identified stretches rich in dolphin population.
- Establish an effective Dolphin Conservation Network involving the scientists, state forest departments, NGOs etc.
- Influence decision and policy makers for favorable policy initiatives and motivate the enforcement agencies for better implementation.
- Develop and implement target Specific Education and Awareness Programme.
- Develop a strategy for international communication and fundraising.

WWF-India has recently completed the first ever-Scientific Status Survey of the species in the country namely in the state of Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal and Assam. Thus, now in a position to give an overall, first-hand estimation of dolphin population in India. Apart from the technical aspects WWF-India has also been actively carrying out the Education and Awareness activities.

Surveys have been conducted in each and every gap area rivers and the tributaries in the country. In the process 20 rivers were surveyed in six states, covering a distance of approx. 4500 Km and an estimated population of 1250 number of dolphins were recorded.

In Bihar stretch the Dolphin population is about 500 indicating the highest density population in Bihar stretch.

Conclusions:

Comparison of the results of the earlier surveys (1997-2000) and the present one is felt to safely indicate that the population of dolphins in the Main Ganga river has not undergone drastic reduction in the intervening period. However safeguards against frequent recurrences of mass killings of dolphins in few stretches must be necessarily implemented if the observed demographic stability should remain. Clearly there is a case to implement a regular, if not frequent program of field activity by conservation agencies to acquire more detailed information about the species biology. This will preclude ignorance about rapid decimation of populations and at the same time quickly and effectively increase awareness of riverside people regarding the importance of dolphin conservation.

Gross hydro-ecological changes that may occur in the stream characteristics of the Ganga river resulting from the construction of the high dam, is a major cause for concern about the future survival of the dolphin population of these river. As such the environmental impact of the High Dam needs to be critically assessed, if only to put such a long term strategy in its proper perspective.

Zoos:

Sanjay Gandhi Biological Park:

The park was established first as Botanical garden in 1969 on 34 acres of land. There after 58.2 acres of PWD land and 60 acres of land from revenue department was transferred to forest department to develop the park further. The land acquired from PWD and Revenue department was declared "Protected Forest" by the state government on 8th of March 1983.

The park has more than 300 species of trees, herbs and shrubs. It has a nursery for medicinal plants, and orchid house, a fern house, a glass house, a rose garden and a number of grass lawns.

Sanjay Gandhi Botanical Garden, Patna is the only Zoo in the state. It is classified as a large Zoo by the Central Zoo Authority and is home to Mammalian (75 species), Avian (42 species), and Reptilian (11species).

These include Tiger, Lion, Leopard, Rhino, Hippo, Crocodile, Himalayan bear, Leopard cat, Hog, Deer, Zebra, Emu, White peacock, etc. There are more than 800 wild animals in the zoo.

The Park has had great success in breeding of Rhinoceros and Hippopotamuses. The SGBP should be developed as the focal point for ex-situ conservation of endangered animals.

The park also has an aquarium. The aquarium has about 50 species of fish.

LOCATION OF BIHAR IN THE LOWER GANGETIC PLAINS:

Boons & Banes for Bihar: -

The Lower Gangetic Plains Moist Deciduous Forests lie along the confluence of two of Asia's largest rivers, the Ganges and Brahmaputra rivers, which run the length of the Himalayan foothills and drain its breadth. It once harbored impressive populations of tiger (Panthera tigris), greater one-horned rhinoceros (*Rhinoceros unicornis*), Asian elephant (*Elephas maximus*), gaur (*Bos gaurus*), swamp deer (*Cervus duvaucelli*), and Bengal florican (*Eupodotis bengalensis*). Today, the ecoregion supports one of the densest human populations on Earth, and the fertile alluvial plains have been cleared and intensely cultivated. The human activities that date back ***thousands of years have taken a very heavy toll on the natural biodiversity of the ecoregion, and many of these species have disappeared from the ecoregion.***

Location and General Description: -

The tropical moist deciduous forests represented by this ecoregion once stretched along the lower reaches of the Ganges and Brahmaputra river plains across the Indian states of Bihar, West Bengal, Assam, Uttar Pradesh, and Orissa, and most of Bangladesh. ***The southwest monsoon that sweeps in from the Bay of Bengal deluges the ecoregion with more than 3,500 mm of rainfall during the four months from June to September. Devastating cyclones sweep in from the Bay of Bengal, causing widespread flooding.***

The alluvial substrate deposited by the rivers is clayey and drains poorly, but on the more stable but flood-prone riverine flats the soil tends to be more sandy, with only local clay patches.

The vegetation is semi-deciduous; the upper canopy contains the deciduous species, and the second story is dominated by evergreen species (Puri et al. 1989). Open forests are dominated by *Bombax ceiba* in association with *Albizzia procera, Duabanga sonneratioides,* and *Sterculia vilosa*. These are early seral communities that will eventually become sal (*Shorea robusta*) forest if succession is allowed to proceed. But in most places the forests fail to reach a climax stage for various reasons-many human-caused-perpetuating the sub-climax community (Champion and Seth 1968).

In permanently wet or moist areas with fine, clayey soils and a rich humus layer, impenetrable canebrakes grow profusely in the understory. Annual fires are common, so fire-hardy species such as *Zizyphus mauritiana, Madhuca latifolia, Aegle marmelos, Butea monosperma, Terminalia tomentosa, Ochna pumila*, and several others also occur in these fire-prone areas (Puri *et al.* 1989).

Biodiversity Features: -

The ecoregion does not exhibit high levels of endemism but does harbor several threatened species. The mammal fauna consists of 126 known species, including one endemic species, a bat, *Rhinolophus mitratus* (Table 1). The mammal assemblage also includes several threatened species such as the tiger, Asian elephant, gaur, sloth bear (*Melursus ursinus*), smooth-coated otter (*Lutrogale perspicillata*), great Indian civet (*Viverra zibetha*), and four-horned antelope or chousingha (*Tetracerus quadricornis*). The ecoregion's large habitat blocks are an important contribution to conservation of the large, wide-ranging

mammals on northeastern India .The elephant population in Midnapur district is considered to be of high conservation importance.

Table 5. Endemic and Near-Endemic Mammal Species.

Family	Species
Rhinolophidae	*Rhinolophus mitratus*

There are more than 380 known bird species, although none are endemic. However, the ecoregion harbors two globally threatened species, the Bengal florican and the lesser florican (*Eupodotis indica*), as well as the threatened Pallas's fish-eagle (*Haliaeetus leucoryphus*) and swamp francolin (*Francolinus gularis*). The Indian grey hornbill (*Ocyceros birostris*) and Oriental pied-hornbill (*Anthracoceros albirostris*) are indicators of intact forests and deserve conservation attention.

Current Status: -

Despite hundreds of years of human settlement, much forest still remained until the early twentieth century. Since then deforestation has accelerated, and now the ecoregion's natural habitat borders on the verge of extinction. Only about 3 percent of the eco-region is now under natural forest, and only one large block of intact habitat (south of Varanasi) remains in this eco-region. Although more than forty protected areas are represented in the eco-region, they cover only about 3 percent of the eco-region, and more than half of these protected areas are small, being less than 100 km^2 in area.

Types and Severity of Threats: -

The dense human population is still growing rapidly. The urbanization, industrialization, and agriculture associated with this growing population and its resource and economic needs pose serious threats to the remaining forest fragments. The small, protected areas are vulnerable to this tidal wave of human growth and are inadequate to conserve the eco-region's biodiversity. Finding additional habitat for protection will be challenging. Therefore, the existing protected areas should be effectively managed and protected, and restoring critical habitat should be considered where necessary.

RIVERS OF BIHAR: -

GANGES: -

The Ganga is a major river of the Indian subcontinent, associated in myth and reality with the land and people of India as well as neighboring countries like Bangladesh.

Sources And Tributaries: -

The Gangotri Glacier, a vast expanse of ice five miles by fifteen, at the foothills of the Himalayas (14000 ft) in North Uttar Pradesh, is the source of Bhagirathi, which joins with Alaknanda (origins nearby) to form Ganga at the craggy canyon-carved town of Devprayag. Interestingly, the sources of Indus and the

Brahmaputra are also geographically fairly close; the former goes through Himachal Pradesh and fans out through Punjab and Sind (Pakistan) into the Arabian Sea. The latter courses for most of its tremendous length under various names through Tibet/China, never far from the Nepal or Indian borders, and then takes a sharp turn near the northeastern tip of India, gathers momentum through Assam before joining the major stream of the Ganga near Dacca in Bangladesh to become the mighty Padma, river of joy and sorrow for much of Bangladesh. From Devprayag to the Bay of Bengal and the vast Sunderbans delta, the Ganga flows some 1550 miles, passing (and giving life to) some of the most populous cities of India, including Kanpur (2 million), Allahabad, Varanasi, Patna, and Calcutta (14 million). Dacca, the capital of Bangladesh is on a tributary of the Brahmaputra, just before it joins the Ganga to form Padma. A large number of tributaries join and flow from the Ganges to drain the Northern part of India and Bangladesh.

The Yamuna, which originates less than a hundred miles east of the Bhagirathi, flows parallel to the Ganga and a little to the south for most of its course before merging with the Ganga at the holy city of Allahabad, also known as Triveni Sangam (literally, Three-way Junction, the third river being the mythical Saraswati which is also supposed to be an underground river). New Delhi, capital of India, and Agra, site of the Taj Mahal, are two of the major cities on the Yamuna.

The largest tributary to the Ganga is the Ghaghara, which meets it before Patna, in Bihar, bearing much of the Himalayan glacier melt from Northern Nepal. The Gandak, which comes from near Katmandu, is another big Himalayan tributary. Other important rivers that merge with the Ganga are the Son, which originates in the hills of Madhya Pradesh, the Gomti which flows past Lucknow.

Biodiversity of different floral and faunal groups of the river Ganges:-

1. **Floral Biodiversity**:-

Microbial Biodiversity of the Ganges :- Very little is known about the microbial organisms of the river Ganga and its tributaries. The bacterial load in the river Ganga has been increasing mainly due to domestic effluents (due to untreated sewage discharge) besides there are other points and non-point sources of pollution. Only few bacteria, about 25 species mostly of fecal origin have been identified in the Ganges water. Its well known that the microorganism including bacteria plays an important role in the nutrient cycle and self-purification of the river water. Some of the bacteria are good indicators of water quality and are used as an index of water quality of the river. Some of the pollution indicator species are: - *E. coli*, *S. faecalis, A. cloacae and Salmonella* species.

Fungal flora of the Ganges:- The fungi are good decomposers and can degrade most complex natural substances including some pesticides, however, certain pathogenic fungi are available in the Ganges. *Aspergillus flabus, A. fumigatus, A. niger* may cause skin infection. A total of 143 species of fungi have been recorded from the river.

Algal flora :- High number of algal flora (765 species) shows that the river condition has not depleted to a lower ebb and these primary producers are maintaining the health and productivity of the river. *Chlorophyceae, Cyanophyceae* with 264 and 237 species respectively were found to be dominant groups among the algal flora.

Macrophytes:- Though macrophytes have no significant role as primary producer of the river, they provide habitat and food security for the periphytons and also for most of the micro-invertebrates and few vertebrates in the river. However, near the barrage side, luxuriant growth of the macrophytes have been observed due to high siltation. Such growth of macrophytes adversely affects the health of the river system.

2. **Faunal Biodiversity**:-

Invertebrate fauna:- Almost all groups of invertebrates are represented in the river. The maximum biomass is that of the Molluscs. Near the outfalls only tolerant species like *Tubifex tubifex, Nais simplex,Cchironomus plumosus* are found. Among the benthos *Placopterans, Trichopterns* are usually found in the upper reaches and in a pollution free zone.

Vertebrate fauna

- **Fish**:- Among the vertebrate fauna though the number of fish species are high (378 species) . the population of most of the important fishes including the Indian major carps (*Labeo rohita, Catla catla and Cirrhinus mrigala*) have dwindled in the recent year. Still the fishes form the largest group of living natural resource of the river and serves as the largest source of fish-spawn in India.
- **Amphibia**:- No definite data is available on the amphibia (11 species of the Ganga play an important role as food of higher vertebrate and predator of lower animals).
- **Reptiles**:- Next to fishes, reptiles (27 species) have been found in the Ganga. The Crocodiles and the Gavialis are killed for the skin, whereas the others are killed for meat. The Turtles and all species of Crocodiles though have been given legal protection under Wild Life (Protection Act, 1972), the efficacy of the act is nonexistent.
- **Birds**:- Birds have been dealt in a detail in a separate list (Annexure-III).
- **Mammals**:- The well known mammal of Ganga is the Gangetic Dolphin which has been dealt earlier in detail (page-53). Indian Smooth coated Otters, *utra perspicilata,* have been sighted in the Ganga near Patna and Sultanganj. Altogether 11 species of the mammals have been recorded from different stretch of the Ganga (Aggrawal, 1991) whereas in Bihar it is only 2 species.

Impact of Dams on the Ganga: -

There are two major dams on the Ganga. One at **Haridwar** diverts much of the Himalayan snowmelt into the Upper Ganges Canal, built by the British in 1854 to irrigate the surrounding land. This caused severe deterioration to the water flow in the Ganga, and is a major cause for the decay of Ganga as an inland waterway.

The other dam is a serious hydroelectric affair at **Farakk**a, close to the point where the main flow of the river enters Bangladesh, and the tributary Hooghly (also known as Bhagirathi) continues in West Bengal past Calcutta. This barrage, which feeds the Hooghly branch of the river by a 26-mile long feeder canal. At the same time, proposals for linking the Brahmaputra to the Ganges to improve the water flow in the Ganges are hanging fire. Also, the water management problem may actually involve a number of other riparian countries such as Nepal (where there has been tremendous deforestation, leading to greater silt content It is likely that Ganga carried more water around the time of the Roman Empire, when Patna was the major port city of Pataliputra. Even in the eighteenth century the ships of the East India Company would come to call at the port city of Tehri, on the Bhagirathi, one of the main source river of Ganga.

The upper and lower Ganga canal, which is actually the backbone of a network of canals, runs from Haridwar to Allahabad, but maintenance has not been very good and my personal experience is that it probably trickles out into a small river a little beyond Kanpur.

FARAKKA BARRAGE AND ITS IMPACT:-

The Farakka Barrage is one of the most debated river management projects though for reasons which have nothing to do with either environmental or demographic reasons. Built primarily to serve the twin purpose of regulating the amount of Ganga water to flow out from the Indian territory into Bangladesh (East Pakistan then); and to ensure that sufficient water is diverted to Hooghly river to enable the regular flushing of silt at Calcutta port, the Farakka Barrage has been more often mired in controversy as India and Bangladesh have disagreed over the share of Ganga water between the two countries. While in the recent past, some efforts have been made to resolve this contentious dispute between the two nations, no thought has been spared so far on the long term impact the barrage has already caused and continues to do on an ongoing basis.

Creating Problems at both Upstream and Downstream: -

An alarming development has been the steady decline of the Ganga's depth. In 1975, when the barrage was commissioned, the depth of the river at the barrage was 75 feet. The depth of the river in March 1997 was only 13 feet. In effect, this means that the bed of Ganga has risen by 62 feet in the past 22 years. This alarming development has led to untold misery to the people of Bihar as the level of the bed of all rivers has risen steadily - quite often to level higher that the land close to the banks of the rivers. As a result, thousands of Chaurs (lowlands) that previously used to remain flooded only during the monsoons, now remain submerged under water for as long as ten months. The problem of constant water logging not only leads to possibilities of the outbreak of infectious diseases, but also causes unfathomed economic and social miseries on the people in these regions. The Central Water Commission in its report in 1995 stated that in the three states of West Bengal, Bihar and Uttar Pradesh, two and a half acres of land in the proximity of the Ganga remains submerged under water for most of the year. Due to this the nature of the soil becomes alkaline and already lakhs of acres of once fertile land in Bihar have now turned totally barren. The fertility of the Gangetic plain is a cruel image of yesteryears.

This problem is acute in large parts of Bihar as various other river management projects like the Kosi project and the Gandak project also suffer from the same problem of rising level of river beds. In many instances, back flow has also been reported. This is leading to large-scale inundation in rural Bihar and lakhs of people are suffering on account of faulty river management.

POLLUTION: -

The major polluting industries on the Ganga are the leather industries, especially near Kanpur, which use large amounts of Chromium and other chemicals, and much of it finds its way into the meager flow of the Ganga. Unfortunately, this is a boom time for leather processing in India, which many view as a form of eco-environmental dumping on the third world, and with the lax and lubricable implementation systems of the U.P. Government, it does not seem likely that this will go down. The World Bank report 1992, which focussed on the environmental issues, mentions the dissolved-oxygen and riverborne decomposing material at two points on the Ganga.

However, industry is not the only source of pollution. Sheer volume of waste - estimated at nearly 1 billion litres per day - of mostly untreated raw sewage - is a significant factor. Also, inadequate cremation procedures contributes to a large number of partially burnt or unburnt corpses floating down the Ganga, not to mention livestock corpses, at about one every two hours floating in Ganga.The Ganga Action Plan has been set up under the Indian Government and is attempting to build a number of waste treatment facilities, under Dutch and British support, and to collaborate with a number of voluntary organizations.

NORTH BIHAR FLOODS: -

Introduction: -

Bihar is the one of the most flood prone states of India. According to the Report of the National Commission on Floods (1980) 16.5 per cent of the total flood affected area of the country is located in Bihar while 22.1 per cent of the affected population in India lives in the alluvial plains of this state. That suggests a heavy concentration of flood-affected people over a smaller area. According to recent estimates 56.5 per cent of the flood affected people in the country belong to Bihar. Of this about 76 per cent population belongs to North Bihar which has an area of about 5.4 million hectares and a total population of about 40.6 millions (1991 census) with a population density of 754 persons per Sq. Kms.

North Bihar is interspersed with eight major river basins namely, the Ghaghra the Gandak the Burhi Gandak, the Bagmati, the Adhawara group of rivers, the Kamala, the Kosi and the Mahananda All these rivers drain their waters into the Ganga, which acts as a master drain But for the Burhi Gandak, all other rivers have their origin in Nepal. The Burhi Gandak originates from a chaur in West Champaran and has most of its catchment area in Nepal. All these rivers bring a lot of detritus with their waters as they debauch into the plains from the Himalayas which is in its nascent stage of formation and is just a loose heap of soil'.

These rivers erode the soil very easily and transport it to the plains. As the rivers descend down to the plains the velocity decreases considerably which results in the deposition of the sediments and the formation of the delta The deposited sediments act as an impediment to the river flow and the rivers cut across these deposits and carve a new path for themselves and meander. The process of the delta formation continues still and so does the meandering of the rivers and the flooding of the plains. The floods renew the fertility of the soil every year and that must have attracted the early settlers to this area which was known for its abundance of water and assured crops and hence the high population density. The Hindu scriptures are full of praise and veneration of the rivers, which are addressed to as the 'mothers of the world'.

GANDAK RIVER: It originates from the Glaciers of Southern Tibet at on altitude of 7620 m. and enter the plains of West Champaran district of Bihar at Balmiki Nagar to supply water for irrigating Western part of North Bihar through Sone, Triveni and Tirhut canals. It joins the Ganga River at Hajipur where a famous Mela takes place every year on the occasion of Kartik Poornima called **Harihar kshetra Mela**.The Gandak flows alone whole Western land of West Champaran and cause floods inundating areas consisting of Khair, Shisoo, and Cane branches. Duting Monsoon due to short lived inundation *Panthera tigris, Panthera pardus*, Jungle cat, Bison, different variety of Deers runout of Madanpur forest into captive sugarcane fields of adjoining sugar mills (Bagha, Harinagar) for shelter. Such is pathetic condition of biodiversity.

BUDHI GANDAK RIVER: It originates form Someshwar range of hills at an elevation of 300 m. And enters the plane of West Champaran district of Bihar as Sikarhna River after joining of harbora and sirria

tributaries. The total catchment area is 12180 sq km out of this about 10370 sq km area is in Bihar and rest is in Nepal. Total length of the river is 579 km. The river creates havock during July to Sept. by inundating a large tract of Kharia, Samastipur, Muzzaffarpur district. The river is well known for fresh water prawn.

BAGMATI RIVER: It originates from Sheopore range of hills at an elevation of 1500m and enters the Indian territory (Bihar) at about 2.5 km upstream rail bridge number 89 and Derbhanga-Raxaul Narkatiyaganj section. Its total catchment area up to its outfall in Ganges is 13424 sq km. Total length of the river is 589 km. It causes severe flood in Sheohar and Sitamarhi district.

ADHWARA GROUP:- a network of about ten channels, mainly in east Champaran, Sheohar, Sitamarhi, Darbhanga districts called as Adhawara group of rivulets which criss-coss the area causing alarming inundation.

A combined channel flowing southward finally falls into Baghmati just above Haya Ghat bridge in Laheria sarai. The total catchment area of these rivuletes up to out fall in Bhagmati is estimated to be 4962 sq km out of which 2365 sq km is in Nepal.

MAHANANDA: -

Its cathment lies in eastern part of Nepal Himalya and cause severe flood in Araria, kisanganj and Katihar districts.

THE KOSI: -

This river has catchment area of about 74,500 Sq. Kms. of which around 85 % is located in Nepal and the remaining portion lies in India. The river has a total length of 468Kms. of which 248 Kms is in the Indian territory. The maximum observed peak flow in the river is reported to be 25,880 Cusecs. at Barahkshetra in Nepal, and the annual average run- off is to the tune of 68,282 million cubic meters. The river carries a very heavy silt load. The average rainfall In the Indian portion of the Kosi catchment area is 1276 mm.

The Kosi debauches into the plains near Chatra in the Saptari district of Nepal and enters Bihar near Bhimnagar in the Supaul district. Notorious for its vagaries the river joins the Ganga near Kursela in Katihar district of Bihar. The floods of the river Kosi are most devastating as compared to the other rivers of Bihar. There is not an inch of land in the districts of Supaul, Saharsa, Madhepura, Araria, Kishanganj, Purnea, and Katihar over which the Kosi has not once flowed. The river has shifted westward in past two hundred years by 160 Kms. Such has been the erratic course of the river over the ages and it was known as the **'Sorrow of Bihar'**.

THE INITIATIVES ON FLOOD CONTROL: -

The British after their occupation of India tried to tame the Damodar, the **'Sorrow of Bengal'** as they had termed it, in the middle of the nineteenth century with the help of embankments and failed miserably in controlling the river. They then refrained from taming Himalayan Rivers, as their behaviour was equally unpredictable, till they left India in 1947. Despite many proposals put forward from time to time, the British did not touch the Kosi and wanted it to be left to its own devices and their legacy continued till 1953 when it

was decided to embank the Kosi after a debate of about hundred years against embanking of the river. Without going into the details of this debate, suffice here to say that when a heavily silt laden river is restrained between the embankments, the silt that accompanies the flood waters and would have spilled over a large spill area now gets restricted between the embankments, thus continuously raising the bed level of the river. This silt has fertilizing value, too, and the flood-protected countryside is deprived of this benefit because of the embankments. The ever-rising bed level of the river demands that the embankments, too, should be raised accordingly.

Secondly, the natural drainage into the river is blocked because of the embankments and the rainwater, which would have flowed into the river, on its own, stagnates outside the embankments causing water logging in the protected area. This is further aggravated by seepage through the embankments. In case a tributary joining the main river, the embankments block its passage and the tributary will either backflow into the protected area or flow parallel to the main river, outside the embankments. The main river then may be flanked by two rivers, outside both the embankments. This will spell the need for a sluice gate at the confluence of the two rivers. When constructed, such sluice gates cannot be opened during the peak rainy season for the fear that the water in the main river may spill back into the tributary. Hence sluice- gate or no sluice - gate, the flood situation in the countryside is not going to change. Also, the sluice gates are known to get jammed in the sand deposited due to the ever-rising beds of the embanked river.

Having failed with the sluice gates, the next demand is to embank the tributary also and, when attempted, a fresh problem crops up. Rainwater gets locked between the embankments of the main river and the tributary, thus, inundating areas, which were hitherto unknown to flooding. The only course left to get rid of this locked water is to pump it out into the main river or the tributary. To cap it all, no embankment can ever be guaranteed against breaching and should a breach take place, those living between the water-locked areas will meet their watery grave. Thus, it is a vicious circle and, once walked into the trap, it becomes impossible to come out. Unfortunately, it takes time to get a feel of the discrepancy of the technology and by the time this is revealed to the affected population, it is too late.

There are other factors too. Reckless construction of roads and to an extent of railway lines has also contributed to it. The construction of village roads under programmes without any regard to the drainage aspect of it, has also contributed significantly towards drainage congestion leading to enhanced floods and prolonged water logging. The canals of the Kosi and the Gandak projects have also done their bit in aggravating the situation by cutting the drainage lines, and seepage. The North Bihar plains have a ground slope of 16 Cms. to 6 Cms per Kilometer in the upper and lower reaches respectively and any obstruction to the rainwater flow is enough to create water logging.

The frequent breaches in the river embankments add insult to the injury. The prestigious Kosi embankments, too, have breached many times and their notable failures were seen in 1968, 1981, 1984, and 1987. The breach of 1984 was most serious of these accidents, which had wiped out eleven villages inundated some 196 and had rendered 4. 5 million people homeless, in the floods of 1987, there were 105 breaches on the river embankments of Bihar and the march continues.

DEPLETION OF FISH RESOURCES: -

Besides water pollution, river management projects also wreak havoc among the fishes living in these waters. These projects adversely affect the fishes, which are migratory in nature. Dams and barrages act as

barriers in their migratory paths and several species have either already become extinct or are facing extinction as they breed in a particular type of water while inhabiting in a different sort. The Farakka barrage has over the years acted as a barrier to the migration of marine fishes leading to the near absence of several popular varieties in the entire northern India. As the waters of several rivers of northern states directly or indirectly flow into the Ganga, there is a similarity in the types of fishes found in the rivers. There are many fishes (for instance prawn) that inhabit in fresh water but breed in marine water. Likewise, there are other species - like **Hilsa** - that inhabit in marine water, but have migrated upstream to breed. The Ganga once used to have plenty of Hilsa but this has changed as the fish is no longer able to breed leading to the near extinction of the Hilsa in the Ganga upstream of the Farakka Barrage.

In fact, it is not just a question of Hilsa alone, but there has been a substantial drop in the fish population on the entire Ganga. Prior to the barrage, during monsoon, there used to be a very high population of eggs and spawns in this stretch of Ganga. After catering to the local needs (there is great demand for fish in Bihar and eastern UP) a substantial amount of eggs, prawns and different varieties of fishes were sent to other states. Today barely about 25 per cent of the local demand is met by the fish caught in this stretch and for the rest, the people have to depend on fish caught in other states. According to Uday Kant Chaudhary, Chairman State Fisheries Development Board, Bihar's needs are no longer being met by the fish caught in the entire state and this has thrown open the market to multinational companies to come in and sell fish at exorbitant prices. Not only has the quality of the fish available in the state gone down, but they have also become substantially more expensive.

It has been estimated that there has been an overall decline of 75 per cent in the entire population of fish upstream of the Farakka Barrage. Large fishes, once found in abundance in the Ganga are no longer available and millions of traditional fishermen who have made their living for generations by catching fish now face destitution. What had previously been a close relationship between the fishermen and local customers have now been replaced by a cold system comprising air-conditioned trucks and ice-laden crates of fish brought in by large companies from other states like Andhra Pradesh. This not only makes the market more cash driven, but also alienates traditional fishermen from their ancestral profession in a situation where they do not have the training to do other jobs.

The Farakka Barrage has caused serious damage to land and populace both upstream and downstream of the barrage. Corrective measures are called for immediately and if not taken then there are portents of much greater havoc both to the people and to the land. A detailed inter-disciplinary team needs to be appointed that can study at length the problems that have surfaced on account of the barrage and suggest measures that can be initiated to reverse the process of the damage.

No Legal Provision for Conservation of Fishes:

Within the Sanctuaries and National parks the focus is on the deer, tiger and elephants with only explicit mention of fishing being in the Section 50 of the Wild Life Protection Act of 1972 "provided that where a fisherman residing within 10 km of a sanctuary or a national park inadvertently enters on a boat not used for commercial fishing in the territorial waters in that sanctuary or national park a fishing net on such a boat shall not be seized". No fish is listed in the schedule of the protected fishes in the Wild Life Protection Act. The fisheries act of India 1897 focuses exclusively on the management of edible fishes. The ornamental fishes through out the country are not regulated by the world wild life conservation wing of the Forest Department or by the fisheries Department.

Evidently fresh water of India has been viewed from a single perspective: that of economic production. They are to be sources of irrigation or urban-industrial water supply or of hydal power; they are to receive sewage and industrial waste; or they may produce edible fishes. In this strictly utilitarian framework there is no space for conserving the rich heritage of fresh water fish diversity of the country or for sustainable use of fish as a protein source for the weaker section of the society.

But neither of these are trivial concerns. Talwar and Jhingran's standard work on inland fishes of India list 930 species quite comparable to the diversity of inland bird species. In range of size and form they are even more diverse than the birds.

Freshwaters of India can thus boast of diversity but everywhere this diversity is on a decline. A recent study of the rivers in Pune in Maharastra concludes that as many as 17 out 110 species ever recorded from the locality have become locally extinct within the last few decades. They have identified three major sources of these extinctions:

1. Over harvesting
2. Competition by newly introduced exotic fishes and
3. Pollution.

WETLANDS AND SWAMPS:

Wetlands are natural formations cause due to natural depressions or as discarded coarse of river systems. These are locally known as '**Jheels**' in UP, '**Chaurs**' in Bihar and '**Beels**' in West Bengal.Due to meandering nature of the Gangetic river systems, many oxbow lakes are called '**Mans**' in Bihar.(fig. 1)

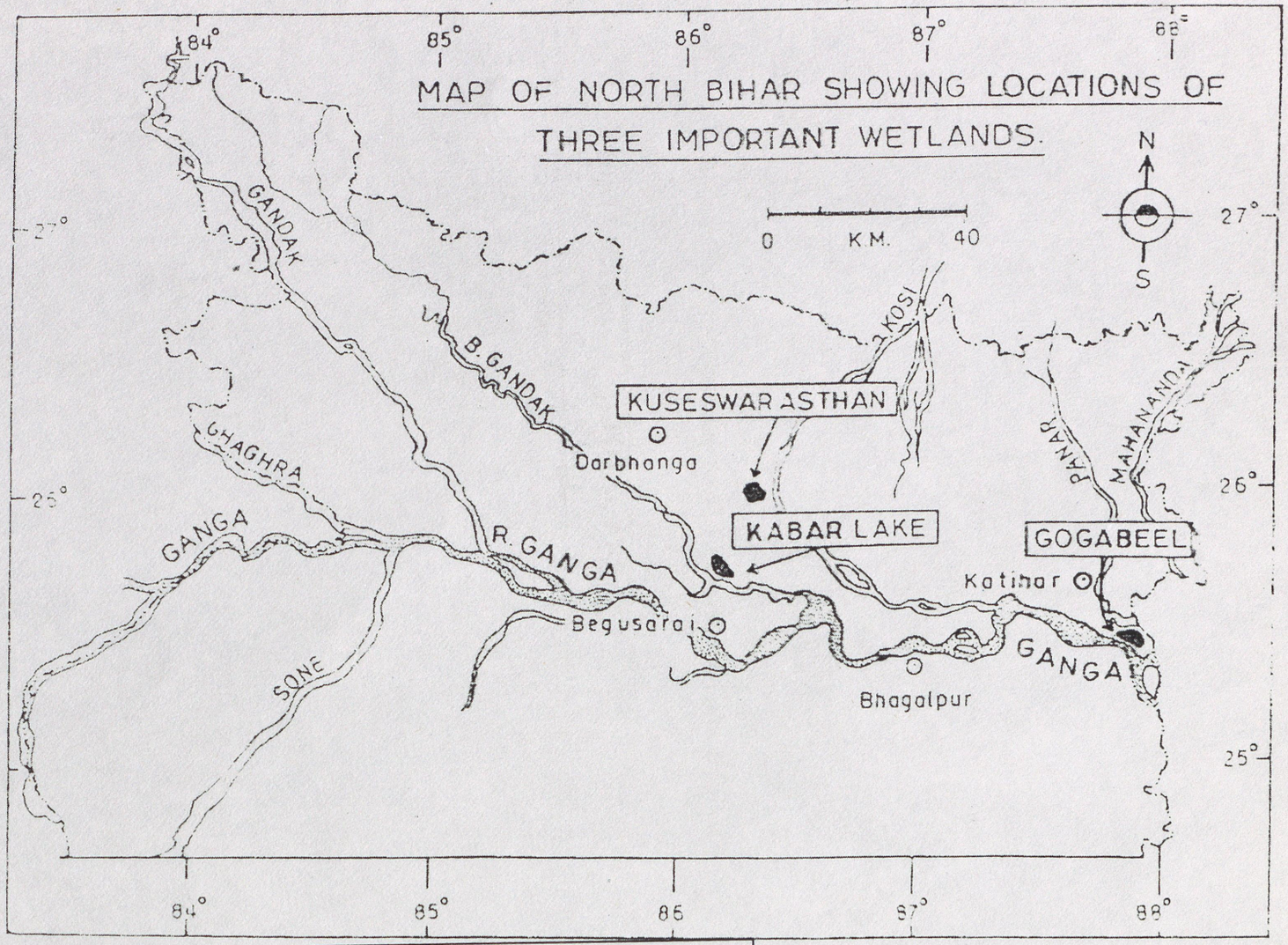

MAP OF NORTH BIHAR SHOWING LOCATIONS OF
THREE IMPORTANT WETLANDS.
N
S
0 KM. 40
84°
85°
86°
87°
88°
27°
26°
25°
GANDAK
B.GANDAK
KOSI
KUSESWAR ASTHAN
Darbhanga
KABAR LAKE
GOGABEEL
PANAR
MAHANANDA
GHAGHRA
GANGA
R. GANGA
Katihar
Begusarai
Bhagalpur
SONE
GANGA

Fig.-1

Bihar Irrigation Commission (1972) had observed that about 3.0 lakh hect. of water spread was available in Bihar which afford enormous potential for the development of inland fisheries. The water spread included about 80000 hect. of ponds and 40000 hect. of Mans and Chaurs, bulk of which lies in North Bihar.

According to one estimate critically identified areas are:

Table:-6

S No	District	Area of Waterlogged land / Marsh (Sq Km)	%age of Geographical area
1	Siwan	62.01	02.79
2	Muzaffarpur	83.96	02.65
3	Vaishali	78.16	03.83
4	Nawada	0.80	0.03

According to the report of National Commission on floods (1980) area under ponds, mans, chaurs , oxbow lakes, in North Bihar can not be less than 464.41 sq.km. Break up is as follows:

Table: -7

S.NO.	DISTRICTS	TOTAL AREA (Hect).
1	West Champaran	4,602
2	East Champaran	9,906
3	Gopalganj	997
4	Siwan	812
5	Saran	948
6	Vaishali	891
7	Muzaffarpur	2232
8	Sitamadhi	2570
9	Madhubani	2743
10	Darbhanga	3490
11	Samastipur	1216
12	Begusarai	1034
13	Saharsa	1057
14	Purnea	3448
15	Katihar	1176
16	Khagaria	3163
17	Madhepura	2176
TOTAL- 46441 hect.		

According to statistics on fisheries in Bihar 21 % of wetlands is privately owned and about 79% of the area are Govt. controlled. Fisheries dept. earns annual revenue of about Rs. 237 lacks. The average annual production is about 1800 kg. /hect. Which could be increased to 2500kg. /hect. With improved management practices.

Wetlands should be considered valuable natural resources not for agriculture and fisheries alone but more importantly as instrument of ecosystem stability in the region.

Wetlands are source of Makhana (*Euryale ferox*), Singhara (*Trapa bispinosa*) and are also sites of summer paddy on its fringe areas. Biotic components include mainly macrophytes, phytoplanktons, periphytes, zooplankton, micro-invertevrates, air breathing fishes, moluscs, crabs, and migratory as well as local birds. Some of the macro-phytes frequently spotted in Bihar's wetlands are *Eichhornia crassipes, Pistia stratiotes, Lemna minor, Woifra arrhiza, Vallisneria spirals.*

TAL AREA DEVELOPMENT IN BIHAR:-

Tal is a natural depression (about 1 lakh hectare) which is water logged for a prolonged period. Government of India has given special importance to the farmers of Tal area recently. The United Nation has declared the year 2003 as the **"Fresh Water Year"**. Such areas have also been identified for the development of aquaculture, pisciculture and aquaculture based agro-forestry system.

Crop combination in Tal areas:-

Mixed cropping may be adapted in place of sole crop to minimize the risks involved in sole cropping as follows: Lentil + Linseed, Lentil + Mustered, Lentil + Kerao (Pea), Gram + Wheat, Gram + Linseed, Gram + Coriander, Gram + Mustered, Gram + Linseed + Coriander, Gram + Wheat + Mustered, Lentil + Linseed + Pea, Lentil + Linseed + Pea + Mustered and other agro-forestry tree plantation along marginal area of aquaculture and Tal areas viz: Shisham, Kala Shisam, Jamun etc.

Diara:

The Himalayan Rivers come to the plains swollen with silt. They drop their loads as floods recede and leave behind huge tracts of lands exposed, usually adjacent or as Islands in the river. These are the "Diara" (in Bihar and Eastern U.P.) or Khaddar in western U.P. life is not safe on the Diara. Even as it builds "Diara land" on one bank, it swings around to engulf vast tract of land on the other.

Diara land is fertile as the sandy veneer recedes away from the river. Precious cereals and pulses are grown here, as well as melons pumpkins, and bottle gourd. Yet people have to be prepared to shift with the mood of the river. Life on Diara is a continuous search for place to settle. This scarcity of land is a far more dangerous opponent than the river itself. People fight and even murder each other to gain control of these shifting lands.

DIRECTORY OF WETLANDS IN BIHAR

DEPARTMENT OF ENVIRONMENT AND FOREST

GOVT. OF BIHAR

1. Total Geographical Area: 94, 163 sq. km.

2. Wetland Area:

A. Natural Wetlands: 2,24,788 Ha.
(Lakes, Bogs, Marshes, swamps, etc.)

B. Man made Wetlands: 48,607 Ha.
(Tanks, reservoirs etc.)

List of Wetlands-over 100 Ha., Arranged District wise and Alphabetically

District	Wetlands	Village/town	Latitude (N)	Longitude (E)	Area (ha)	Ecological
2	3	4	5	6	7	8
NATURAL						
1.Begusarai	Kanwar Lake	Majhaul	25° 30'	87° 40'	7000	Freshwater
2.Champaran (East) .	Kesaria Chaur	Motihari	26° 45'	85° 00'	500	Freshwater
3.Champaran (East)	Khetar	Sarotar	26° 45'	84° 45'	350	Freshwater
4.Champaran (West)	Chatia Chaur	Piparapakari	N.A.	N.A.	100	Freshwater
5. Champaran (West)	Manshi Dubey Chaur	Phulia Khar	N.A.	N.A.	125	Freshwater
6.Darbhanga	Khara, Kusheswar, Kanail, Arai Andsmigia	Darbhanga Chaurs	26" 10'	85'°54'	12,141	Freshwater
7.Muzaffarpur	Bharthua Chaur	Bhathua	26° 15'	85° 30'	125	Freshwater
8. Muzaffarpur	Bhusara Mann	Bhusara	26° 08'	85° 40'	125	Freshwater

AVIAN DIVERSITY :-

The wetlands support excellent avian diversity with enough food and habitat for nesting, roosting and breeding purposes. Approximately 230 species of birds are found in these areas. Among these birds there are number of species which are on the critical and endangered list compiled in the Red Data Book. Among 57 vulnerable species, 6 species namely like the Indian Skimmer, Greater Spotted Eagle, Lesser Kestrel, Palla's Sea Eagle, Lesser adjutant have been spotted in the Bihar. Currently there are 6 protected areas in the state.

Though there is a rich diversity in the bird's populations, there is very little data regarding numbers, breeding habits, migration patterns etc. The birds, which migrate from the different parts of the world, have been badly affected by poaching, poisoning, etc. The protected areas are also subjected to this sort of activity where birds are poached by poisoning. The rights of the local people in the protected areas have not been settled leading to a conflict between interests of the local people and their conservation. The complete list of birds of Bihar has been presented in Annexure- III.

CHECK LIST OF BIRDS-IN AND AROUND KAWAR LAKE

MIGRATORY BIRDS

SI.	Common Name	Scientific Name
1.	Great Crested Grebe	*Podiceps cristatus*
2.	Bittern	*Oolnurus slol/arls*
3.	Open bill Stock	*Anastomus oscitans*
4.	Glossy Ibis	*Plegadis falcineus*
5.	Spoonbill	*Plataloa leucorodia*
6.	Greylag Goose	*Anser anser*
7.	Barheaded Goose	*Anser Indicus*
8.	Brahminy Duck	*Tadorna ferrusinea*
9.	Pintail	*Anas acuta*
10	Common teal	*Anas crecca*
11.	Spotbill Duck	*Anas poecilorhyacha*
12.	Mallard	*Anas platyrhyachos*
13.	Gadwall	*Anas strepera*
14.	Pigeon	*Anas ponelope*
15.	Garganey	*Anas querquedu/a*
16.	Shoveller	*Anas clypeata*
17.	Red crested Poachard	*Netta rufina*
18.	Common Poachard	*Aythya ferina*
19.	White-eyed Poachard	*Aythya nyroca*
20.	Tufted Duck	*Aythya fuligula*
21.	Harrier	*Circus macxourus*
22.	Marsh Harrier	*Circus aeruginosus*
23.	Eastern Pergerine Falcon	*Falco peregrinus*

24.	Indian water rail	*Ralus agu*
25.	Spotted Crake	*Fulica atra*
26.	Coot	-----
27.	Curlew	*Numenius arguata*
28.	Golden Plover'	*Pluvialts apricaria*
29.	Common Redshank	*Tringa totanus*
30.	Green Shank	*Bringa nebularia*
31.	Green Sand Piper	*Tringa ochropus*
32.	Wood Spotted Sandpiper	*Trinsa elareola*
33.	Common Sandpiper	*Tringa hypoleueos*
34.	Marsh Sandpiper	*Tringa siagnatilis*
35.	Pintail Snipe	*Gallinago stonura*
36.	Fantail Snipe	*Gallinago galinago*
37.	Jack Snipe	*Gallinago minime*
38.	Little Stint	*Calidris minuta*
39.	Temminck's Stint	*Calidris temminckii*
40.	Brownheaded Gull	*Larus brunnicephalus*
41.	Indian Whiskered Tern	Chlidonias hybridas
42.	Common Term	*Sterna hirundo*
43.	Short eared Owl	*Asio flammeus*
44.	Swallow	*Hirundo rustica*
45.	Pale Brown strike	*Lanius collurio*
46.	Red Breasted Fly catcher	*Muscicapa parra*
47.	Grey headed Flycatcher	*Culicicapa caylonensis*
48.	Brown Chiffchaff	*Phylloscopus collybita*
49.	Black Red Start	*Phoenicurus orhruros*
50.	Indian Tree Pipit	*Anthus hodgsoni*
51.	Richards Pipit	*Anthus noresoel andiae*
52.	Grey Wagtail	*Motacilla caspica*
53.	Blue headed Yellow wagtail	*Moyacilla flava*

DROUGHT PRONE AREAS: -

The Irrigation Commission 1972 has identified 67 draught prone districts in the state having an area of 49.73 M.hectare. Subsequently, the National Commission on Agriculture, 1976 identified a few more draught prone areas with a lightly different criterion.

Criteria Adopted By CWC For Drought Identification :-

For studies, Central water Commission adopted the same criteria as followed by Irrigation Commission, 1972 i.e. drought is a situation occurring in an area: When the annual rainfall is less than 75% of the normal in 20 5 years examined. Less than 30% of the cultivated area is irrigated. Thus in comparison to total geographical area of the country (329 M.hectare) about 1/6 is drought prone.

Current Policy:-

1. Larger thrust for water shed development under Drought Prone Programme.
2. Dry land farming and water resource development.
3. Instead of capital-intensive engineering work for soil and moisture conservation
4. Encourage simple and low coast structure, which can be completed in a short time with the help of local skills.
5. Take up large-scale dry land farming demonstration.
6. Limited irrational and overexploitation of ground water resources.
7. Undertake research on the efficacy and economics of sprinklers and drip irrigation systems.
8. Construction of suitable water harvesting structures for the purpose of conservation and optimal use of surface water and recharge of underground aquifers.
9. Renovation and restoration of old tanks/farm pounds in the villages.
10. Afforestation and pasture development
11. Annual husbandry and forest development.

Status Of Irrigation Of Drought Prone Areas:-

Irrigation has proved to be the most effective drought proofing mechanism and single biggest factor in bringing about a large stability in agricultural production. The state wise irrigation status of drought prone area is given below.

It would be seen that the total geographical area of drought district is 108 M. hectare out of which 81 M. hectare is cultivable (57.4%) and gross irrigated area is 14.3M.hectare. About 23.23% of the total cropped area is irrigated in drought districts as against an all India average of 30.15%.

Table:8 Statement showing irrigation status of Drought Prone Areas in hect.

No.	STATE	DROUGHT PRONE AREA	CULTURA-BLE AREA	GROSS SOWN AREA	GROSS IRRIGATED AREA	% GROSS IRRIGATED AREA	YEAR
	A.P.	12511303	7867000	5118000	1084000	21.8	1985-86
	Bihar	4338450	11555000	2645152	1642064	62.08	1981-82
	Gujarat	12123890	9819500	8321700	1863500	22.39	1981-82
	Haryana	1658785	1254814	1891200	672900	35.58	1981-82
	J & K	1599930	235597	158879	18585	8.89	1980-81
	Karnataka	15216333	10335041	9380936	1365778	14.56	1980-81
	M P	8721952	5675766	5228941	518177	9.91	1983-84
	Maharashtra	12376705	9782000	7109279	1224944	17.23	1985-86
	Orissa	2286241	820000	---	94039	----	1983-84
0	Rajasthan	21895045	17168051	10232892	906784	8.86	1981-82
1	Tamilnadu	8409114	1480135	6909257	3427098	49.6	1981-82
2	U P	4303310	3196747	3125491	980800	31.38	1981-82
3	W B	2672080	1799627	1761455	550194	31.24	1977-81
	TOTAL	**108113138**	**80988778**	**61883182**	**14348863**	**23.23**	

PART V- BIHAR BIODIVERSITY STRATEGIC CHALLENGES AND OPTIONS

Ensuring sustainable managed natural resources and environment is an extremely daunting task fraught with diverse challenges. This will be achieved through:

- Ensuring well conserved and managed land;
- Zero percent deforestation;
- Availability of adequate and clean water resources;
- Restored and well conserved biodiversity and ecosystems;
- Low population growth;
- Preventing air and noise pollution from becoming serious problems;
- Contributing to national/global efforts to managing climate change and other national/global environmental issues;
- Incorporating environmental considerations at all stages, and enhancing the participation of the public in the planning and
- Implementation of natural resource and environmental programme.

From the perusal of the information- data presented in Part-IV regarding the biodiversity of the state of Bihar the following strategic challenges and options are presented below.

STRATEGIC CHALLENGES AND OPTIONS

1. CONTROLLING LAND DEGRADATION

Strategic Challenge

The strategic challenges to controlling land degradation are: preventing soil erosion, arresting deforestation, stopping expansion of cultivation to marginal areas, ending bad agricultural practices, controlling overgrazing, and reducing over-reliance on agriculture with low productivity; preventing excess accumulation of algae (eutrophication); and encouraging properly planned infrastructure and settlements.

Strategic Options

Strategic options to controlling land degradation include:

- reviewing land policy: undertaking land reform; and harmonizing sectoral policies to facilitate the implementation of a comprehensive soil conservation programme.
- Rehabilitating degraded land
- Intensifying afforestation and agro forestry programmes.
- Implementing programme that enhances employment, opportunity for rural people to reduce total dependence on agriculture
- Enforcing land conservation aspects of infrastructural project.

2. ARRESTING DEFORESTATION

Strategic Challenge

Forests are disappearing at exponential rate annually due to dependence on subsistence agriculture; excessive selling of wood to generate income; high population growth; and dependence on wood energy.
The challenge to halting deforestation is reducing over-dependence on wood- energy and dependence on wood selling to generate income; preventing uncontrolled bush fires; discouraging customs and beliefs that do not value forestry resources; encouraging long-term perspectives in managing forestry resources; and enhancing enforcement of forestry regulations and laws.

Strategic Options

The options for arresting deforestation include:

- promoting community participation in natural resource and environmental management.
- developing consistent policies and laws to guide and enforce forest conservation;
- administering stiff penalties to offenders;
- intensifying the rural electrification program and making electricity affordable;
- finding other forms of energy;
- enhancing the effectiveness of tree planting programs;
- promoting agroforestry, commercial forest ownership, and forestry industries;
- using sustainable methods of harvesting of trees for fuelwood;
- encouraging intensive and commercial agriculture; and diversifying out of agriculture; and

3. PREVENTING DEGRADATION AND DEPLETION OF WATER RESOURCES

Strategic Challenge

The chemical contamination of stream water in urban and peri-urban areas is becoming a common problem due to improper disposal of wastes. The absence of proper biological and physical conservation in farmers' fields has led to pollution of the aquatic environment by agrochemicals such as nitrous compounds through run-off water.

Due to inadequate sanitation facilities and other sources of organic pollution, the bacteriological quality of major rivers of Bihar is poor throughout the year. Most of the rivers show faecal coliform counts in excess of 500 per 100 ml in the dry season, which is significantly above World Health Organization guidelines. Most of the population suffer from water borne diseases like diarrhea, dysentery, hepatitis, etc.

The strategic challenge is to prevent pollution of water, conserve catchment areas and improve water supply systems.

Strategic Options

Strategic options to control depletion and degradation of water resources include:

- designing proper waste disposal systems;
- dredging and rehabilitating existing dams;
- constructing multipurpose dams;
- proper management of catchment areas and river banks;
- constructing silt traps

4.WETLAND BIODIVERSITY PROTECTION

Strategic challenges

The challenge for protection of wetlands is to counter the increasing human pressure for converting these wetlands into agricultural lands, eutrophication of water due to inflow of chemical fertilizers from catchment areas, checking the uncontrolled growth of weeds that choke the ecosystem, controlling hunting of the rich avian resources, integrating the livelihood of the local people with the protection of the wetlands.

Strategic Options

- preserving the wetlands by stopping attempts to drain out these lands for agricultural purposes.
- regulating fishing in the wetlands so that there is no overexploitation of the wetland resources.
- discouraging use of chemical fertilizers in the catchment areas of the wetlands.
- preserving the rich avian biodiversity by strengthening protection measures.
- controlling the growth of obnoxious weeds.

5.DEVELOPING FISHERIES

Strategic Challenge

The challenge to managing and developing fisheries include preventing environmental degradation, increasing support capacity within government and support to the social sector; finding alternative income generating activities; increasing access to capital markets, improving stability of annual fish availability; and controlling rapid human population growth.

Strategic Options

Strategic options to managing and developing fisheries include:

- declaring river mouths as protected areas;

- restocking the lake;
- redefining fisheries rights in order to limit access;
- controlling harvesting by introducing quotas;
- improving fish breeding using artificial methods;
- human resource development;
- environmental education;
- conducting Environmental Impact Assessment of all projects that might affect promoting fisheries; and
- promoting fisheries related industries.

6.DEVELOPING THE WILDLIFE SECTOR

Strategic Challenge

The strategic challenge to be addressed in order to develop the wildlife sector is controlling poaching, restocking depleted areas, developing ecotourism and using more participatory wildlife management approaches.

Strategic Options

In order to meet the challenge, the following are strategic options:

- mobilizing financial resources for translocating of wildlife from threatened areas;
- securing protected areas to maintain diversity;
- recruiting and training additional human resources to rejuvenate the activities of the wildlife sector;
- carrying out ecological and socioeconomic surveys to determine harvestable resources which can be utilized by communities;
- broadening wildlife based income generating activities in order to yield more revenue that can be shared with adjacent communities;
- eliminating poaching by intensifying patrols and joint operation along international borders;
- occasional use of Police (Task Force) on border antipoaching patrols;
- .use of high-tech for poaching surveillance;
- involving communities and non-governmental organizations in managing protected areas;
- intensifying conservation awareness and education to increase local community appreciation of the resource.
- encourage *ex-situ* conservation by developing breeding programmes for endangered species in the Sanjay Gandhi Biological Park

7. DEVELOPING THE DOMESTICATED BIODIVERSITY

Strategic Challenge

In the recent years farmers have shifted away from biologically diverse agriculture to more homogeneous farming.

This shift has been a result of policies and programme oriented toward increasing the commercial productivity of farming system using a rather narrow definition of productivity in terms of quantity of grains, milk etc.

Such policies and programmes have ignored the importance of diversity in the lives and livelihood of farmers in providing a more stable and creative genetic base for agriculture and the bases for a holistic concept of productivity which integrates the biomass, food security and cultural needs of a community resulting in rapid extinction of indigenous domesticated species along with the traditional knowledge of their significance.

Strategic Options

- Description and evaluation of the available information on diversity of agro-ecosystems, crops, livestocks and pets.
- Identification and assessment of major threats, including perverse agricultural policies and programmes.
- Identification of critical region in Bihar for conservation action (areas with high or unique biodiversities areas with severe threats and erosions).
- Identification of the existing measures for conservation *in situ* or gaps in these majors.
- Identification of measure to integrate domesticated biodiversity, agricultural productivity, household self-security and lively hoods of farmers including appropriate changes in governmental policies and programmes.

8.RESTORING AND CONSERVING BIODIVERSITY

Strategic Challenge

Factors that threaten Bihar's biological diversity include the following:- *over-exploitation of biological resources; habitat degradation and pollution; introduction of invasive exotic species (for e.g. water hyacinth and Tilapia fish); selective pressures arising directly and indirectly from human activities and climatic change. These factors threaten biodiversity by causing among other things: loss of entire assemblages of species; loss of individual species within communities; and loss of genetic variability within a species.*

The challenge to managing threats to biodiversity comprises how to control deforestation, pollution, siltation, invasive species, overgrazing, population growth, and bush fires and prevent illegal access to biological resources and the loss of indigenous knowledge.

Strategic Options

The strategic options to preserving and managing biodiversity include:

- reviewing and enforcing policies and legislation;
- strengthening institutional and technical capacity for a more complete biodiversity database;
- undertaking research into species conservation technology;
- establishment of gene banks for preservation of indigenous strains of various species
- monitoring the export and import of biological materials;
- promoting community participation in and public awareness of biodiversity; and
- conserving endangered species and habitats.

9. DEVELOPING HUMAN SETTLEMENTS

Strategic Challenge

The migration of people from rural to urban areas in search of income earning opportunities has exacerbated the development of unplanned settlements and slum dwellers. Most of these settlements lack basic services such as potable (safe) water and proper sanitation services. Poverty has worsened the situation further as people inhabit shelters of unacceptable standards.

The strategic challenge to developing and upgrading human settlements is to plan physical development; eliminate squatting in urban areas; control unhygienic behaviour; regulate street vending and provide good housing and water.

Strategic Options

Strategic options include:

- introducing physical planning to cover all settlements;
- enforcing building codes;
- enabling the building of permanent houses;
- reviewing and enforcing policies and ordinances on settlement patterns.

10. CONTROLLING AIR POLLUTION AND MANAGING CLIMATE CHANGE ISSUES.

Strategic Challenge

Air pollution and climate change issues are currently relatively small environmental concerns. However, these can easily become serious problems if they go unchecked. ***Recently an action plan for reducing air pollution in Patna has been prepared by Bihar State Pollution Control Board.***

The strategic challenge to preventing air pollution and managing climate change issues include: monitoring emissions of hydrocarbons nitrogen oxides and carbon monoxides; proper management of hazardous substances and wastes; use of ozone friendly technology; establishing regulations and enacting legislation on air pollution; and promoting education on climate change issues.

Strategic Options

Strategic options to controlling air pollution and managing climate change issues include:

- establishing units to monitor air and noise pollution through establishing standards;
- initiating supportive legislation and fiscal incentives;
- conducting awareness campaigns on air and noise pollution and climate change;
- enhancing capacity for disaster preparedness through improving monitoring and information systems; and
- phasing out or controlling air polluting and ozone unfriendly or green House Gases emitting technology.

11.PREVENTING NOISE POLLUTION

Strategic Challenge

The challenge to preventing noise from becoming a serious problem is to deploy human resources to conduct baseline studies and initiate a program of noise prevention; providing equipment, instruments, and resources to measure noise and implement programs; conducting extensive sectorial coordination; increasing awareness of noise problems, and improving the monitoring of noise standards regulations.

Strategic Options

The activities that can lead to reduced noise include:

- establishing and strengthening institutions dealing with noise pollution;
- reviewing legislation to make noise reduction effective, creating awareness; and
- conducting baseline and periodic surveys to determine the nature and control measures for noise.

12. MANAGING HAZARDOUS SUBSTANCES (BIOMEDICAL WASTE) AND OTHER WASTES

Strategic Challenge

The strategic challenge to proper management of hazardous substances and wastes is improving laws and regulations, the institutional set-up, and infrastructure and technologies for dealing with hazardous substances and wastes.

Strategic Options

The strategic options include:

- formulating and enforcing laws, and regulations on management of hazardous substances and wastes;
- increasing financial support and human resources in institutions, and

- improving infrastructure and technologies for dealing with hazardous materials.

13.ERADICATING POVERTY AND CONTROLLING POPULATION GROWTH

Strategic Challenge

Bihar has a very high fertility rate. This is very high especially when combined with the problem of limited acceptability of family planning messages and techniques. As a result, Bihar has a very high population growth rate. Most women have a longer period of child-bearing because they marry early and do not use birth control. This happens because they spend a shorter period at school and marry immediately after school believing that they will be supported by their husbands.

The high incidence of poverty and the belief that more children are a source of prestige and security in old age lead to large families. This increases pressure on natural resources.

The strategic challenge is to reduce population growth rate and incidence of poverty.

Strategic Options:

- Increasing employment opportunities for the rural and urban population in order to reduce pressure on land, and reduce rural to urban migration.
- Making primary education compulsory to reduce illiteracy levels and discouraging early marriages.
- Promoting effective family planning programmes; and
- Implementing programme.

14. POLITICAL ADVOCACY FOR PROPER MANAGEMENT OF NATURAL RESOURCES AND THE ENVIRONMENT

Strategic Challenge

The strategic challenge to political advocacy for proper management of natural resources and the environment is increasing political will, and discouraging politicians from having economic interests in natural resources, and increasing environmental awareness that makes it possible for politicians to get tough on proper management of natural resources.

Strategic Options

Strategic options for encouraging more political advocacy for proper management of natural resources and the environment include;

- requiring every political party to recognize and implement proper management of natural resources and the environment as embodied in the constitution of India.

- establishing an autonomous environmental management authority to act as a watchdog;
- empowering local communities to manage natural resources and the environment.

RECOMMENDATIONS

1. *Protected areas development is to be enhanced and strengthened. Protected area in Bihar is 3.53% against the International target of 10% by the year 2010.*

2. *Public awareness, education and participation are to be made more effective.*

3. *Sustainable use of biodiversity is to be evolved for utilization of the full potential of biological resources.*

4. *Within the framework of National Biodiversity strategy and action plan regional/local action plans are to initiated to meet regional/ local needs.*

5. *Arresting deforestation.*

6. *Development of the wild life sectors.*

7. *Development of the domesticated biodiversity (Agribiodiversity; Livestock biodiversity and cultured fish species and honey bees).*

8. *There is no provision in the Wild Life Act to protect fishes as in the case of birds. Therefore to conserve the biodiversity of fishes, there should be incorporation of some provision in the Wild Life Act.*

9. *Controlling population growth and poverty.*

10. *To have a base line data regarding the biodiversity of Bihar, inventorization and compilation of the flora, fauna and microbes should be initiated.*

11. *To develop and maintain comprehensive and accessible biodiversity information systems linking national and local records.*

12. *To take direct measures to conserve species and habitat diversity in particular through the conservation of threatened and protected species and important sites.*

13. *Conservation of germ plasm.*

14. *To implement the Action Plan; State Biodiversity Board should be established as per Section – 22(1) of the Biological Diversity Act, (2002).*

ANNEXURE- I

Ministry of Law and Justice
(Legislative Department)

New Delhi, the 5th February 2003

The Biological Diversity Act, 2002

No. 18 of 2003

[5th February, 2003]

MINISTRY OF LAW AND JUSTICE

(Legislative Department)

New Delhi , the 5th February, 2003/Magha 16, 1924 (Saka)

The following Act of Parliament received the assent of the President on the 5th February, 2003 , and is hereby published for general information:

THE BIOLOGICAL DIVERSITY ACT, 2002

No. 18 OF 2003

[5th February, 2003]

An Act to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.

WHEREAS India is rich in biological diversity and associated traditional and contemporary knowledge system relating thereto.

AND WHEREAS India is a party to the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5th day of June, 1992;

AND WHEREAS the said Convention came into force on the 29th December, 1993 ;

AND WHEREAS the said Convention reaffirms the sovereign rights of the States over their biological resources;

AND WHEREAS the said Convention has the main objective of conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of utilization of genetic resources;

AND WHEREAS it is considered necessary to provide for conservation, sustainable utilization and equitable sharing of the benefits arising out of utilization of genetic resources and also to give effect to the said Convention.

BE it enacted by Parliament in the Fifty-third Year of the Republic of India as follows:–

CHAPTER - I

Preliminary

1. Short title, extent and commencement

(1) This Act may be called the Biological Diversity Act, 2002.

(2) It extends to the whole of India .

(3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint:

Provided that different dates may be appointed for different provisions of this Act and any reference in any such provision to the commencement of this Act shall be construed as a reference to the coming into force of that provision.

2. Definitions

In this Act, unless the context otherwise requires,–

(a) "benefit claimers" means the conservers of biological resources, their byproducts, creators and holders of knowledge and information relating to the use of such biological resources, innovations and practices associated with such use and application;

(b) "biological diversity" means the variability among living organisms from all sources and the ecological complexes of which they are part, and includes diversity within species or between species and of eco-systems;

(c) "biological resources" means plants, animals and micro-organisms or parts thereof, their genetic material and by-products (excluding value added products) with actual or potential use or value, but does not include human genetic material;

(d) "bio-survey and bio-utilization" means survey or collection of species, subspecies, genes, components and extracts of biological resource for any purpose and includes characterization, inventorisation and bioassay;

(e) "Chairperson" means the Chairperson of the National Biodiversity Authority or, as the case may be, of the State Biodiversity Board;

(f) "commercial utilization" means end uses of biological resources for commercial utilization such as drugs, industrial enzymes, food flavours, fragrance, cosmetics, emulsifiers, oleoresins, colours, extracts and genes used for improving crops and livestock through genetic intervention, but does not include conventional breeding

or traditional practices in use in any agriculture, horticulture, poultry, dairy farming, animal husbandry or bee keeping;

(g) "fair and equitable benefit sharing" means sharing of benefits as determined by the National Biodiversity Authority under section 2 1;

(h) "local bodies" means Panchayats and Municipalities, by whatever name called, within the meaning of clause (1) of article 243B and clause (1) of article 243Q of the Constitution and in the absence of any Panchayats or Municipalities, institutions of self-government constituted under any other provision of the Constitution or any Central Act or State Act;

(i) "member" means a member of the National Biodiversity Authority or a State Biodiversity Board and includes the Chairperson;

(j) "National Biodiversity Authority" means the National Biodiversity Authority established under section 8;

(k) "prescribed" means prescribed by rules made 1 under this Act;

(l) "regulations" means regulations made under this Act;

(m) "research" means study or systematic investigation of any biological resource or technological application, that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for any use;

(n) "State Biodiversity Board" means the State Biodiversity Board established under section 22;

(o) "sustainable use" means the use of components of biological diversity in such manner and at such rate that does not lead to the long-term decline of the biological diversity thereby maintaining its potential to meet the needs and aspirations of present and future generations;

(p) "value added products" means products which may contain portions or extracts of plants and animals in unrecognizable and physically inseparable form.

CHAPTER - II

Regulation of Access to Biological Diversity

Certain persons not to undertake Biodiversity related activities without approval of National Biodiversity Authority

3. (1) No person referred to in sub-section (2) shall, without previous approval of the National Biodiversity Authority, obtain any biological resource occurring in India or knowledge associated thereto for research or for commercial utilization or for bio-survey and bio-utilization.

(2) The persons who shall be required to take the approval of the National Biodiversity Authority under sub-section (1) are the following, namely:

(a) a person who is not a citizen of India ;

(b) a citizen of India , who is a non-resident as defined in clause (30) of section 2 of the Income-tax Act, 196 1;

(c) a body corporate, association or organization-

(i) not incorporated or registered in India ; or

(ii) incorporated or registered in India under any law for the time being in force which has any non-Indian participation in its share capital or management.

Results of research not to be transferred to certain persons without approval of National Biodiversity Authority

4. No person shall, without the previous approval of the National Biodiversity Authority, transfer the results of any research relating to any biological resources occurring in, or obtained from, India for monetary consideration or otherwise to any person who is not a citizen of India or citizen of India who is non-resident as defined in clause (30) of section 2 of the Income-tax Act, 1961 or a body corporate or organization which Is not registered or incorporated in India or which has any non-Indian participation in its share capital or management.

Explanation.- For the purposes of this section, "transfer" does not include publication of research papers or dissemination of knowledge in any seminar or workshop, if such publication is as per the guidelines issued by the Central Government.

Sections 3 and 4 not to apply to certain collaborative research projects

5.(1) The provisions of sections 3 and 4 shall not apply to collaborative research projects involving transfer or exchange of biological resources or information relating thereto between institutions, including Government sponsored institutions of India, and such institutions in other countries, if such collaborative research projects satisfy the conditions specified in sub-section (3).

(2) All collaborative research projects, other than those referred to in sub-section (1) which are based on agreements concluded before the commencement of this Act and in force shall, to the extent the provisions of agreement are inconsistent with

the provisions of this Act or any guidelines issued under clause (a) of sub-section (3), be void.

(3) For the purposes of sub-section (1), collaborative research projects shall-

(a) conform to the policy guidelines issued by the Central Government in this behalf;

(b) be approved by the Central Government.

Application for intellectual property rights not to be made without approval of National Biodiversity Authority

6.(1) No person shall apply for any intellectual property right, by whatever name called, in or outside India for any invention based on any research or information on a biological resource obtained from India without obtaining the previous approval of the National Biodiversity Authority before making such application.

Provided that if a person applies for a patent, permission of the National Biodiversity Authority may be obtained after the acceptance of the patent but before the seating of tile patent by the patent authority concerned:

Provided further that the National Biodiversity Authority shall dispose of the application for permission made to it within a period of ninety days from the date of receipt thereof.

(2) The National Biodiversity Authority may, while granting the approval under this section, impose benefit sharing fee or royalty or both or impose conditions including the sharing of financial benefits arising out of the commercial utilization of such rights.

(3) The provisions of this section shall not apply to any person making an application for any right under any law relating to protection of plant varieties enacted by Parliament.

(4) Where any right is granted under law referred to in sub-section (3), the concerned authority granting such right shall endorse a copy of such document granting the right to the National Biodiversity Authority.

Prior intimation to State Biodiversity Board for obtaining biological resource for certain purposes

7. No person, who is a citizen of India or a body corporate, association or organization which is registered in India , shall obtain any biological resource for commercial utilization, or bio-survey and bio-utilization for commercial utilization except after giving prior intimation to the State Biodiversity Board concerned:

Provided that the provisions of this section shall not apply to the local people and communities of the area, including growers and cultivators of biodiversity, and *vaids* and *hakims*, who have been practicing indigenous medicine.

CHAPTER - III

National Biodiversity Authority

Establishment of National Biodiversity Authority

8.(1) With effect from such date as the Central Government may, by notification in the Official Gazette, appoint, there shall be established by the Central Government for the purposes of this Act, a body to be called the National Biodiversity Authority.

(2) The National Biodiversity Authority shall be a body corporate by the name aforesaid, having perpetual succession and a common seal, with power to acquire, hold and dispose of property, both movable and immovable, and to contract, and shall by the said name sue and be sued.

(3) The head office of the National Biodiversity Authority shall be at Chennai and the National Biodiversity Authority may, with the previous approval of the Central Government, establish offices at other places in India .

(4) The National Biodiversity Authority shall consist of the following members,

(a) a Chairperson, who shall be an eminent person having adequate knowledge and experience in the conservation and sustainable use of biological diversity and in matters relating to equitable sharing of benefits, to be appointed by the Central Government;

(b) three ex officio members to be appointed by the Central Government, one representing the Ministry dealing with Tribal Affairs and two representing the Ministry dealing with Environment and Forests of whom one shall be the Additional Director General of Forests or the Director General of Forests;

(c) seven ex officio members to be appointed by the Central Government to represent respectively the Ministries of the Central Government dealing with –

(i) Agricultural Research and Education;

(ii) Biotechnology;

(iii) Ocean Development;

(iv) Agriculture and Cooperation;

(v) Indian Systems of Medicine and Homoeopathy;

(vi) Science and Technology;

(vii) Scientific and Industrial Research;

(d) five non-official members to be appointed from amongst specialists and scientists having special knowledge of, or experience in, matters relating to

conservation of biological diversity, sustainable use of biological resources and equitable sharing of benefits arising out of the use of biological resources, representatives of industry, conservers, creators and know ledge-holders of biological resources.

Conditions of service of Chairperson and members

9. The term of office and conditions of service of the Chairperson and the other members other than *ex officio* members of the National Biodiversity Authority shall be such as may be prescribed by the Central Government.

Chairperson to be Chief Executive of National Biodiversity Authority

10. The Chairperson shall be the Chief Executive of the National Biodiversity Authority and shall exercise such powers and perform such duties, as may be prescribed.

Removal of members

11. The Central Government may remove from the National Biodiversity Authority any member who, in its opinion, has-

(a) been adjudged as an insolvent; or

(b) been convicted of an offence which involves moral turpitude; or

(c) become physically or mentally incapable of acting as a member; or

(d) so abused his position as to render his continuance in office detrimental to the public interest; or

(e) acquired such financial or other interest as is likely to affect prejudicially his functions as a member.

Meetings of National Biodiversity Authority

12. (1) The National Biodiversity Authority shall meet at such time and place and shall observe s uch r ules o f procedure in regard to the transaction of business at its meetings (including the quorum at its meetings) as may be prescribed.

(2) The Chairperson of the National Biodiversity Authority shall preside at the meetings of the National Biodiversity Authority.

(3) If for any reason the Chairperson is unable to attend any meeting of the National Biodiversity Authority, any member of the National Biodiversity Authority chosen by the members present at the meeting shall preside at the meeting.

(4) All questions which come before any meeting of the National Biodiversity Authority shall be decided by a majority of votes of the members present and voting and in the event of equality of votes, the Chairperson or, in his absence, the person presiding, shall have and exercise a second or casting vote.

(5) Every member who is in any way, whether directly, indirectly or personally, concerned or interested in a matter to be decided at the meeting shall disclose the

nature of his concern or interest and after such disclosure, the member concerned or interested shall not attend that meeting.

(6) No act or proceeding of the National Biodiversity Authority shall be invalidated merely by reason of-

(a) any vacancy in, or any defect in the constitution of, the National Biodiversity Authority; or

(b) any defect in the appointment of a person acting as a member; or

(c) any irregularity in the procedure of the National Biodiversity Authority not affecting the merits of the case.

Committees of National Biodiversity Authority

13. (1) The National Biodiversity Authority may constitute a committee to deal with agro-biodiversity.

Explanation- For the purposes of this sub-section, "agro-biodiversity" means biological diversity, of agriculture related species and their wild relatives.

(2) Without prejudice to the provisions of sub-section (1), the National Biodiversity Authority may constitute such number of committees as it deems fit for the efficient discharge of its duties and performance of its functions under this Act.

(3) A committee constituted under this section shall co-opt such number of persons, who are not the members of the National Biodiversity Authority, as it may think fit and the persons so co-opted shall have the right to attend the meetings of the committee and take part in its proceedings but shall not have the right to vote.

(4) The persons appointed as members of the committee under sub-section (2) shall be entitled to receive such allowances or fees for attending the meetings of the committee as may be fixed by the Central Government.

Officers and employees of National Biodiversity Authority

14.(1) The National Biodiversity Authority may appoint such officers and other employees as it considers necessary for the efficient discharge of its functions under this Act.

(2) The terms and conditions of service of such officers and other employees of the National Biodiversity Authority shall be such as may be specified by regulations.

Authentication of orders and decisions of National Biodiversity Authority

15. All orders and decisions of the National Biodiversity Authority shall be authenticated by the signature of the Chairperson or any other member authorized by the National Biodiversity Authority in this behalf and all other instruments executed by the National Biodiversity Authority shall be authenticated by the signature of an officer of the National Biodiversity Authority authorized by it in this behalf.

Delegation of powers

16. The National Biodiversity Authority may, by general or special order in writing, delegate to any member, officer of the National Biodiversity Authority or any other person subject to such conditions, if any, as may be specified in the order, such of the p owers a nd f unctions u nder t his A ct (except the power to prefer an appeal under section 50 and the power to make regulations under section 64) as it may deem necessary.

Expenses of National Biodiversity Authority to be defrayed out of the Consolidated Fund of India

17. The salaries and allowances payable to the members and the administrative expenses of the National Biodiversity Authority including salaries, allowances and pension payable to, or in respect of, the officers and other employees of the National Biodiversity Authority shall be defrayed out of the Consolidated Fund of India.

CHAPTER - IV

Functions and Powers of the National Biodiversity Authority

Functions and powers of National Biodiversity Authority

18.(1) It shall be the duty of the National Biodiversity Authority to regulate activities referred to in sections 3, 4 and 6 and by regulations issue guidelines for access to biological resources and for fair and equitable benefit sharing.

(2) The National Biodiversity Authority may grant approval for undertaking any activity referred to in sections 3, 4 and 6.

(3) The National Biodiversity Authority may-

(a) advise the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of benefits arising out of the utilization of biological resources;

(b) advise the State Governments in the selection of areas of biodiversity importance to be notified under sub-section (1) of section 37 as heritage sites and measures for the management of such heritage sites;

(c) perform such other functions as may be necessary to carry out the provisions of this Act.

(4) The National Biodiversity Authority may, on behalf of the Central Government, take any measures necessary to oppose the grant of intellectual property rights in any country outside India on any biological resource obtained from India or knowledge associated with such biological resource which is derived from India .

CHAPTER - V

Approval by the National Biodiversity Authority

Approval by National Biodiversity Authority for undertaking certain activities

19.(1) Any person referred. to in sub-section (2) of section 3 who intends to obtain any biological resource occurring in India or knowledge associated thereto for research or for commercial utilization or for bio-survey and bio-utilization or transfer the results of any research relating to biological resources occurring in, or obtained from, India, shall make application in such form and payment of such fees as may be prescribed, to the National Biodiversity Authority.

(2) Any person who intends to apply for a patent or any other form of intellectual property protection whether in India or outside India referred to in sub-section (1) of section 6, may make an application in such form and in such manner as may be prescribed to the National Biodiversity Authority.

(3) On receipt of an application under sub-section (1) or sub-section (2), the National Biodiversity Authority may, after making such enquiries as it may deem fit and if necessary after consulting an expert committee constituted for this purpose, by order, grant approval subject to any regulations made in this behalf and subject to such terms and conditions as it may deem fit, including the imposition of charges by way of royalty or for reasons to be recorded in writing, reject the application:

Provided that no such order for rejection shall be made without giving an opportunity of being heard to the person affected.

(4) The National Biodiversity Authority shall give public notice of every approval granted by it under this section.

Transfer of biological resource or knowledge

20.(1) No person who has been granted approval under section 19 shall transfer any biological resource or knowledge associated thereto which is the subject matter of the said approval except with the permission of the National Biodiversity Authority.

(2) Any person who intends to transfer any biological resource or knowledge associated thereto referred to in sub-section (1) shall make an application in such form and in such manner as may be prescribed to the National Biodiversity Authority.

(3) On receipt of an application under sub-section (2), the National Biodiversity Authority may, after making such enquiries as it may deem fit and if necessary after consulting an expert committee constituted for this purpose, by order, grant approval subject to such terms and conditions as it may deem fit, including the imposition of charges by way of royalty or for reasons to be recorded in writing, reject the application:

Provided that no such order for rejection shall be made without giving an opportunity of being heard to the person affected.

(4) The National Biodiversity Authority shall give public notice of every approval granted by it under this section.

Determination of equitable benefit sharing by National Biodiversity Authority

21.(1) The National Biodiversity Authority shall while granting approvals under section 19 or section 20 ensure that the terms and conditions subject to which approval is granted secures equitable sharing of benefits arising out of the use of accessed biological resources, their by-products, innovations and practices associated with their use and applications and knowledge relating thereto in accordance with mutually agreed terms and conditions between the person applying for such approval, local bodies concerned and the benefit claimers.

(2) The National Biodiversity Authority shall, subject to any regulations made in this behalf, determine the benefit sharing which shall be given effect in all or any of the following manner, namely:

(a) grant of joint ownership of intellectual property rights to the National Biodiversity Authority, or where benefit claimers are identified, to such benefit claimers;

(b) transfer of technology;

(c) location of production, research and development units in such areas which will facilitate better living standards to the benefit claimers;

(d) association of Indian scientists, benefit claimers and the local people with research and development in biological resources and bio-survey and bio-utilization;

(e) setting up of venture capital fund for aiding the cause of benefit claimers;

(f) payment of monetary compensation and non-monetary benefits to the benefit claimers as the National Biodiversity Authority may deem fit.

(3) Where any amount of money is ordered by way of benefit sharing, the National Biodiversity Authority may direct the amount to be deposited in the National Biodiversity Fund:

Provided that where biological resource or knowledge was a result of access from specific individual or group of individuals or organizations, the National Biodiversity Authority may direct that the amount shall be paid directly to such individual or group of individuals or organizations in accordance with the terms of any agreement and in such manner as it deems fit.

(4) For the purposes of this section, the National Biodiversity Authority shall, in consultation with the Central Government, by regulations, frame guidelines.

CHAPTER - VI

State Biodiversity Board

Establishment of State Biodiversity Board

22.(1) With effect from such date as the State Government may, by notification in the Official Gazette, appoint in this behalf, there shall be established by that Government for the purposes of this Act, a Board for the State to be known as the (name of the State) Biodiversity Board.

(2) Notwithstanding anything contained in this section, no State Biodiversity Board shall be constituted for a Union territory and in relation to a Union territory, the National Biodiversity Authority shall exercise the powers and perform the functions of a State Biodiversity Board for that Union territory:

Provided that in relation to any Union territory, the National Biodiversity Authority may delegate all or any of its powers or functions under this sub-section to such person or group of persons as the Central Government may specify.

(3) The Board shall be a body corporate by the name aforesaid, having perpetual succession and a common seal, with power to acquire, hold and dispose of property, both movable and immovable, and to contract, and shall by the said name sue and he sued.

(4) The Board shall consist of the following members, namely:

(a) a Chairperson who shall be an eminent person having adequate knowledge and experience in the conservation and sustainable use of biological diversity and in matters relating to equitable sharing of benefits, to he appointed by the State Government;

(b) not more than five ex officio members to be appointed by the State Government to represent the concerned Departments of the State Government;

(c) not more than five members to be appointed from amongst experts in matters relating to conservation of biological diversity, sustainable use of biological r esources a nd e quitable s haring o f b enefits a rising o ut o f the use of biological resources.

(5) The head office of the State Biodiversity Board shall be at such place as the State Government may, by notification in the Official Gazette, specify.

Functions of State Biodiversity Board

23. The functions of the State Biodiversity Board shall be to–

(a) advise the State Government, subject to any guidelines issued by the Central Government, on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilization of biological resources;

(b) regulate by granting of approvals or otherwise requests for commercial utilization or bio-survey and bio-utilization of any biological resource by Indians;

(c) perform such other functions as may he necessary to carry out the provisions of this Act or as may be prescribed by the State Government.

Power of State Biodiversity Board to restrict certain activities

24.(1) Any citizen of India or a body corporate, organization or association registered in India intending to undertake any activity referred to in section 7 shall give prior intimation in such form as may be prescribed by the State Government to the State Biodiversity Board.

(2) On receipt of an intimation under sub-section (1), the State Biodiversity Board may, in consultation with the local bodies concerned and after making such enquires as it conservation, may deem fit, by order, prohibit or restrict any such activity if it is of opinion that such activity is detrimental or contrary to the objectives of conservation and sustainable use of biodiversity or equitable sharing of benefits arising out of such activity:

Provided that no such order shall be made without giving an opportunity of being heard to the person affected.

(3) Any information given in the form referred to in sub-section (1) for prior intimation shall be kept confidential and shall not be disclosed, either intentionally or unintentionally, to any person not concerned thereto.

Provisions of sections 9 to 17 to apply with modifications to State Biodiversity Board

25. The provisions of sections 9 to 17 shall apply to a State Biodiversity Board and shall have effect subject to the following modifications, namely:

(a) references to the Central Government shall be construed as references to the State Government;

(b) references to the National Biodiversity Authority shall be construed as references to the State Biodiversity Board;

Provisions of sections 9 to 17 to apply with modifications to State Biodiversity Board.

(c) reference to the Consolidated Fund of India shall be construed as reference to the Consolidated Fund of the State.

CHAPTER - VII

Finance, Accounts and Audit of National Biodiversity Authority

Grants or loans by the Central Government

26. The Central Government may, after due appropriation made by Parliament by law in this behalf, pay to the National Biodiversity Authority by way of grants or loans

such sums of money as the Central Government may think fit for being utilized for the purposes of this Act.

Constitution of National Biodiversity Fund

27.(1) There shall be constituted a Fund to be called the National Biodiversity Fund and there shall be credited thereto --

(a) any grants and loans made to the National Biodiversity Authority under section 26;

(b) all charges and royalties received by the National Biodiversity Authority under this Act; and

(c) all sums received by the National Biodiversity Authority from such other sources as may be decided upon by the Central Government.

(2) The Fund shall be applied for–

(a) channeling benefits to the benefit claimers;

(b) conservation a nd p romotion o f b iological r esources a nd development of areas from where such biological resources or knowledge associated thereto has been accessed;

(c) socio-economic development of areas referred to in clause (b) in consultation with the local bodies concerned.

Annual report of National Biodiversity Authority

28. The National Biodiversity Authority shall prepare, in such form and at such time each financial year as may be prescribed, its annual report, giving a full account of its activities during the previous financial year and furnish, to the Central Government, before such date as may be prescribed, its audited copy of accounts together with auditors report thereon.

Budget accounts and audit

29.(1) The National Biodiversity Authority shall prepare a budget, maintain proper accounts a nd o ther r elevant records (including the accounts and other relevant records of the National Biodiversity Fund) and prepare an annual statement of account in such form as may be prescribed by the Central Government in consultation with the Comptroller and Auditor-General of India.

(2) The accounts of the National Biodiversity Authority shall be audited by the Comptroller and Auditor-General of India at such intervals as may be specified by him and any expenditure incurred in connection with such audit shall be payable by the National Biodiversity Authority to the Comptroller and Auditor-General of India.

(3) The Comptroller and Auditor-General of India and any other person appointed by him in connection with the audit of the accounts of the National Biodiversity Authority s hall have the same rights and privileges and authority in connection

with such audit as the Comptroller and Auditor-General generally has in connection with the audit of the Government accounts and, in particular, shall have the right to demand the production of books, accounts, connected vouchers and other documents and papers and to inspect any of the offices of the National Biodiversity Authority.

(4) The accounts of the National Biodiversity Authority as certified by the Comptroller and Auditor- General of India or any other person appointed by him in this behalf together with the audit report thereon shall be forwarded annually to the Central Government.

Annual Report to be laid before parliament

30. The Central Government shall cause the annual report and auditor's report to be laid, as soon as may be after they are received, before each House of Parliament.

CHAPTER - VIII

Finance, Accounts and Audit of State Biodiversity Board

Grants of money by State Government to State Biodiversity Board

31. The State Government may, after due appropriation made by the State Legislature by law in this behalf, pay to the State Biodiversity Board by way of grants or loans such sums of money as the State Government may think fit for being utilized for the purposes of this Act.

Constitution of State Biodiversity Fund

32.(1) There shall be constituted a Fund to be called the State Biodiversity Fund and there shall be credited thereto-

(a) any grants and loans made to the State Biodiversity Board under section 31;

(b) any grants or loans made by the National Biodiversity Authority;

(c) all sums received by the State Biodiversity Board from such other sources as may be decided upon by the State Government.

(2) The State Biodiversity Fund shall be applied for-

(a) the management and conservation of heritage sites;

(b) compensating or rehabilitating any section of the people economically affected by notification under sub-section (1) of section 37;

(c) conservation and promotion of biological resources;

(d) socio-economic development of areas from where such biological resources or knowledge associated thereto has been accessed subject to

any order made under section 24, in consultation with the local bodies concerned;

(e) meeting the expenses incurred for the purposes authorized by this Act.

Annual report of State Biodiversity Board

33. The State Biodiversity Board shall prepare, in such form and at such time in each financial year as may be prescribed, its annual report, giving a full account of its activities during the previous financial year, and submit a copy thereof to the State Government.

Audit of accounts of State Biodiversity Board

34. The accounts of the State Biodiversity Board shall be maintained and audited in such manner as may, in consultation with the Accountant-General of the State, be prescribed and the State Biodiversity Board shall furnish, to the State Government, before such date as may be prescribed, its audited copy of accounts together with auditor's report thereon.

Annual Report of State Biodiversity Board to be laid before State Legislature

35. The State Government shall cause the annual report and auditor's report to be laid, as soon as may be after they are received, before the House of State Legislature.

CHAPTER - IX

Duties of the Central and the State Governments

Central Government to develop National strategies plans. Etc., for conservation, etc., of biological diversity

36.(1) The Central Government shall develop national strategies, plans, programmes for the conservation and promotion and sustainable use of biological diversity including measures for identification and monitoring of areas rich in biological resources, promotion of *in situ*, and *ex situ*, conservation of biological resources, incentives for research, training and public education to increase awareness with respect to biodiversity.

(2) Where the Central Government has reason to believe that any area rich in biological diversity, biological resources and their habitats is being threatened by overuse, abuse or neglect, it shall issue directives to the concerned State Government to take immediate ameliorative measures, offering such State Government any technical and other assistance that is possible to be provided or needed.

(3) The Central Government shall, as far as practicable wherever it deems appropriate, integrate the conservation, promotion and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

4) The Central Government shall undertake measures,-

(i) wherever necessary, for assessment of environmental impact of that project which is likely to have adverse effect on biological diversity, with a view to avoid or minimize such effects and where appropriate provide for public participation in such assessment;

(ii) to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology likely to have adverse impact on the conservation and sustainable use of biological diversity and human health.

(5) The Central Government shall endeavour to respect and protect the knowledge of local people relating to biological diversity, as recommended by the National Biodiversity Authority through such measures, which may include registration of such knowledge at the local, State or national levels, and other measures for protection, including *sui generis* system.

Explanation:-For the purposes of this section,–

(a) "*ex situ* conservation" means the conservation of components of biological diversity outside their natural habitats;

(b) "*in situ* conservation" means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated s pecies, i n t he s urroundings w here they have developed their distinctive properties.

Biodiversity heritage sites

37.(1) Without prejudice to any other law for the time being in force, the State Government may, from time to time in consultation with the local bodies, notify in the Official Gazette, areas of biodiversity importance as biodiversity heritage sites under this Act.

(2) The State Government, in consultation with the Central Government, may frame rules for the management and conservation of all the heritage sites.

(3) The State Government shall frame schemes for compensating or rehabilitating any person or section of people economically affected by such notification.

Power of Central Government to notify threatened species

38. Without prejudice to the provisions of any other law for the time being in force, the Central Government, in consultation with the concerned State Government, may from time o time notify any species which is on the verge of extinction or likely to become extinct in the near future as a threatened species and prohibit or regulate collection thereof for any purpose and take appropriate steps to rehabilitate and preserve those species.

Power of Central Government to designate repositories

39.(1) The Central Government may, in consultation with the National Biodiversity Authority, designate institutions as repositories under this Act for different categories of biological resources.

(2) The repositories shall keep in safe custody the biological material including voucher specimens deposited with them.

(3) Any new taxon discovered by any person shall be notified to the repositories or any institution designated for this purpose and he shall deposit the voucher specimens with such repository or institution.

Power of Central Government to exempt certain biological resources

40. Notwithstanding anything contained in this Act, the Central Government may, in consultation with the National Biodiversity Authority, by notification in the Official Gazette, declare that the provisions of this Act shall not apply to any items, including biological resources normally traded as commodities.

CHAPTER - X

Biodiversity Management Committees

Constitution of Biodiversity Management Committee

41.(1) Every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity.

Explanation.- For the purposes of this sub-section,–

(a) "cultivar" means a variety of plant that has originated and persisted under cultivation or was specifically bred for the purpose of cultivation;

(b) "folk variety" means a cultivated variety of plant that was developed, grown and exchanged informally among farmers;

(c) "landrace" means primitive cultivar that was grown by ancient farmers and their successors.

(2) The National Biodiversity Authority and the State Biodiversity Boards shall consult the Biodiversity Management Committees while taking any decision relating to the use of biological resources and knowledge associated with such resources occurring within the territorial jurisdiction of the Biodiversity Management Committee.

(3) The Biodiversity Management Committees may levy charges by way of collection fees from any person for accessing or collecting any biological resource for commercial purposes from areas falling within its territorial jurisdiction.

CHAPTER - XI

Local, Biodiversity Fund

Grants to Local Biodiversity Fund

42. The State Government may, after due appropriation made by State Legislature by law in this behalf, pay to the Local Biodiversity Funds by way of grants or loans such sums of money as the State Government may think fit for being utilized for the purposes of this Act.

Constitution of Local Biodiversity Fund

43.(1) There shall be constituted a Fund to be called the Local Biodiversity Fund at every area notified by the State Government where any institution of self-government is functioning and there shall be credited thereto-

(a) any grants and loans made under section 42;

(b) any grants or loans made by the National Biodiversity Authority;

(c) any grants or loans made by the State Biodiversity Boards;

(d) fees referred to in sub-section (3) of section 41 received by the Biodiversity Management Committees;

(e) all sums received by the Local Biodiversity Fund from such other sources as may be decided upon by the State Government.

Application of Local Biodiversity Fund

44.(1) Subject to the provisions of sub-section (2), the management and the custody of the Local Biodiversity Fund and the purposes for which such Fund shall be applied, be in the manner as may be prescribed by the State Government.

(2) The Fund shall be used for conservation and promotion of biodiversity in the areas falling within the jurisdiction of the concerned local body and for the benefit of the community in so far such use is consistent with conservation of biodiversity.

Annual Report of Biodiversity Management Committees

45. The person holding the custody of the Local Biodiversity Fund shall prepare, in such form and during each financial year at such time as may be prescribed, its annual report, giving a full account of its activities during the previous financial year, and submit a copy thereof to the concerned local body.

Audit of accounts of Biodiversity Management Committees

46. The accounts of the Local Biodiversity Fund shall be maintained and audited in such manner as may, in consultation with the Accountant-General of the State, be prescribed and the person holding the custody of the Local Biodiversity Fund shall furnish, to the concerned local body, before such date as may be prescribed, its audited copy of accounts together with auditor's report thereon.

Annual report, etc, of the Biodiversity Management Committee to be submitted to district Magistrate

47. Every local body constituting a Biodiversity Management Committee under sub-section (1) of section 41, shall cause, the annual report and audited copy of accounts together with auditor's report thereon referred to in sections 45 and 46, respectively and relating to such Committee to be submitted to the District Magistrate having jurisdiction over the area of the local body.

CHAPTER - XII

Miscellaneous

National Biodiversity Authority to be bound by the directions given by Central Government

48.(1) Without prejudice to the foregoing provisions of this Act, the National Biodiversity Authority shall, in the discharge of its functions and duties under this Act, be bound by such directions on questions of policy as the Central Government may give in writing to it from time to time.

Provided that the National Biodiversity Authority shall, as far as practicable, be given opportunity to express its views before any direction is given under this sub-section.

(2) The decision of the Central Government whether a question is one of policy or not shall be final.

Power of State Government to give Directions

49.(1) Without prejudice to the foregoing provisions of this Act, the State Biodiversity Board shall, in the discharge of its functions and duties under this Act, be bound by such directions on questions of policy as the State Government may give in writing to it from time to time:

Provided that the State Biodiversity Board shall, as far as practicable, be given an opportunity to express its views before any direction is given under this sub-section.

(2) The decision of the State Government whether a question is one of policy or not shall be final.

Settlement of disputes between State Biodiversity Boards

50.(1) If a dispute arises between the National Biodiversity Authority and a State Biodiversity Board, the said Authority or the Board, as the case may be, may prefer an appeal to the Central Government within such time as ma be prescribed.

(2) Every appeal made under sub-section (1) shall be in such form as may be prescribed by the Central Government.

(3) The procedure for disposing of an appeal shall be such as may be prescribed by the Central Government:

Provided that before disposing of an appeal, the parties shall be given a reasonable opportunity of, being heard.

(4) If a dispute arises between the State Biodiversity Boards, the Central Government shall refer the same to the National Biodiversity Authority.

(5) While adjudicating any dispute under sub-section (4), the National Biodiversity Authority shall be guided by the principles of natural justice and shall follow such procedure as may be prescribed by the Central Government.

(6) The National Biodiversity Authority shall have, for the purposes of discharging its functions under this section, the same powers as are vested in a civil court under the Code of Civil Procedure, 1908 in respect of the following matters, namely–

(a) summoning and enforcing the attendance of any person and examining him on oath;

(b) requiring the discovery and production of documents;

(c) receiving evidence on affidavits;

(d) issuing commissions for the examination of witnesses or documents;

(e) reviewing its decisions; dismissing an application for default or deciding it *ex parte*;

(g) setting aside any order of dismissal of any application for default or any order passed by it *ex parte*;

(h) any other matter which may be prescribed.

(7) Every proceeding before the National Biodiversity Authority shall be deemed to be a judicial proceeding within the meaning of sections 193 and 228, and for the purpose of section 196, of the Indian Penal C ode a nd t he N ational B iodiversity Authority shall be deemed to be a civil court for all the purposes of section 195 and Chapter XXV1 of the Code of Criminal Procedure, 1973.

Members, officers, etc., of National Biodiversity Authority and State B iodiversity B oard deemed to be public servants

51. All members, officers and other employees of the National Biodiversity Authority or the State Biodiversity Board shall be deemed, when acting or purporting to act

in pursuance of any of the provisions, of this Act, to be public servants within the meaning of section 21 of the Indian Penal Code.

Appeal

52. Any person, aggrieved by any determination of benefit sharing or order of the National Biodiversity Authority or a State Biodiversity Board under this Act, may file an appeal to t ' he High Court within thirty days from the date of communication to him, of the determination or order of the National Biodiversity Authority or the State Biodiversity Board, as the case may be:

Provided that the High Court may, if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal-within the said period, allow it to be filed within a further period not exceeding sixty days.

Execution of determination or order

53. Every determination of benefit sharing or order made by the National Biodiversity Authority or a State Biodiversity Board under this Act or the order made by the High Court in any appeal against any determination or order of the National Biodiversity Authority or a State Biodiversity Board shall, on a certificate issued by any officer of the National Biodiversity Authority or a State Biodiversity Board or the Registrar of the High Court, as the case may be, be deemed to be decree of the civil court and shall be executable in the same manner as a decree of that court.

Explanation.- For the purposes of this section and section 52, the expression "State Biodiversity Board" includes the person or group of persons to whom the powers or functions under sub-section (2) of section-22 have been delegated under the proviso to that sub-section and the certificate relating to such person or group of persons under this section shall be issued by such person or group of persons, as the case may be.

Protection of action taken in good faith

54. No suit, prosecution or other legal proceedings shall lie against the Central Government or the State Government or any officer of the Central Government or the State Government or any member, officer or employee of the National Biodiversity Authority or the State Biodiversity Board for anything which is in good faith done or intended to he done under this Act or the rules or regulations made thereunder.

Penalties

55.(1) Whoever contravenes or to or abets the contravention of the provisions of section 3 or section 4 or section 6 shall be punishable with imprisonment for a term which may extend to five years, or with fine which may extend to ten lakh rupees and where the damage caused exceeds tend lakh rupees such fine may commensurate with the damage caused, or with both.

(2) Whoever contravenes or attempts to contravene or abets the contravention of the provisions of section 7 or any order made under sub-section (2) of section 24 shall be punishable with imprisonment for a term which may extend to three years, or with fine which may extend to five lakh rupees, or with both.

Penalty for contravention of directions or orders of Central government, State government, National Biodiversity Authority and State Biodiversity Boards

56. If any person contravenes any direction given or order made by the Central Government, the State Government, the National Biodiversity Authority or the State Biodiversity Board for which no punishment has been separately provided under this Act, he shall be punished with a fine which may extend to one lakh rupees and in case of a second or subsequent offence, with fine which may extend to two lakh rupees and in the case of continuous contravention with additional fine which may extend to two lakh rupees everyday during which the default continues.

Offences by companies

57.(1) Where an offence or contravention under this Act has been committed by a company, every person who at the time the offence or contravention was committed was in charge of, and was responsible to, the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence or contravention and shall be liable to be proceeded against and punished accordingly:

Provided that nothing contained in this sub-section shall render any such person liable to any punishment provided in this Act, if he proves that the offence or contravention was committed without his knowledge or that he had exercised all due diligence to prevent the commission of such offence or contravention.

(2) Notwithstanding anything contained in sub-section (1), where an offence or contravention under this Act has been committed by a company and it is proved that the offence or contravention has been committed with the consent or connivance of, or is attributable to, any neglect on the part of any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall also be deemed to be guilty of the offence or contravention and shall be liable to be proceeded against and punished accordingly.

Explanation. -For the purposes of this section,–

(a) "company" means any body corporate and includes a firm or other association of individuals; and

(b) "director", in relation to a firm, means a partner in the firm.

Offences to be cognizable and non-bailable

58. The offences under this Act shall be cognizable and non-bailable.

Act to have effect in addition to other Acts

59. The provisions of this Act shall be in addition to, and not in derogation of, the provisions in any other law, for the time being in force, relating to forests or wildlife.

Power of Central Government to giver directions to State Government

60. The Central Government may give directions to any State Government as to the carrying into execution in the State of any of the provisions of this Act or of any rule or regulation or order made thereunder.

Cognizance of offences

61. No Court shall take cognizance of any offence under this Act except on a complaint made by–

(a) the Central Government or any authority or officer authorized in this behalf by that Government; or

(b) any benefit claimer who has given notice of not less than thirty days in the prescribed manner, of such offence and of his intention to make a complaint, to the Central Government or the authority or officer authorized as aforesaid.

Power of Central Government to make rules

62.(1) The Central Government may' by notification in the Official Gazette, make rules for carrying out the purposes of this Act.

(2) In particular, and without prejudice to the generality of the foregoing power, such rules may provide for A or any of the following matters, namely:–

(a) terms a nd c onditions o f s ervice o f t he C hairperson a nd m embers under section 9;

(b) powers and duties of the Chairperson under section 10;

(c) procedure under sub-section (1) of section 12 in regard to transaction of business at meetings,

(d) form of application and payment of fees for undertaking certain activities under sub-section (1) of section 19;

(e) the form and manner of making an application under sub-section (2) of section 19;

(f) form of application and the manner for transfer of biological resource or knowledge under sub-section (2) of section 20;

(g) form in which, and the time of each financial year at which, the annual report of the National Biodiversity Authority shall be prepared and the date before which its audited copy of accounts together with auditor's report thereon shall be furnished under section 28;

(h) form in which the annual statement of account shall b e p repared u nder subsection (1) of section 29;

(i) the time within which and the form in which, an appeal may be preferred, the procedure for disposing of an appeal and the procedure for adjudication, under section 50;

(j) the additional matter in which the National Biodiversity Authority may exercise p owers o f t he c ivil c ourt u nder c lause (h) o f s ub-section (6) o f section 50;

(k) the manner of giving notice under clause (b) of section 61;

(1) any other matter which is to be, or may be, prescribed, or in respect of which provision is to be made, by rules.

(3) Every rule made under this section and every regulation made under this Act shall be laid, as soon as may he after it is made, before each House of Parliament, while it Is in session or a total period of thirty days which may be comprised in one session or in two or more successive sessions, and if, before the expiry of the session immediately following. The session or the successive sessions aforesaid, both Houses agree in making any modification in the rule or regulation or both Houses agree that the rule or regulation should not be made, the rule or regulation shall thereafter have effect only in such modified form or be of no effect, as the case may be; so, however, that any such modification or annulment shall be without prejudice to the validity of a nything p reviously d one u nder t hat r ule o r regulation.

Power of State Government to make rules

63.(1) The State Government may, by notification in the Official Gazette, make rules for carrying out the purposes of this Act.

(2) In particular, and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:–

(a) the other functions to be performed by the State Biodiversity Board under clause (c) of section 23;

(b) the form in which the prior intimation shall be given under sub-section (1) of section 24;

(c) the form in which, and the time of each financial year at which, the annual report shall be prepared under section 33;

(d) the manner of maintaining and auditing the accounts of the State Biodiversity Board and the date before which its audited copy of the accounts together with auditor's report thereon shall be furnished under section 34;

(e) management and conservation of national heritage sites under section 37;

(f) the manner of management and custody of the Local Biodiversity Fund and the purposes for which such Fund shall be applied under sub-section (1) of section 44;

(g) the form of annual report and the time at which such report shall be prepared during each financial year under section 45;

(h) the manner of maintaining and auditing the accounts of the Local Biodiversity Fund and the date before which its audited copy of the accounts together with auditor's report thereon shall be furnished under section 46;

(i) any other matter which is to be, or may be, specified.

(3) Every rule made by the State Government under this section shall he laid, as soon as may be after it is made, before each House of the State Legislature where it consists of two Houses, or where such Legislature consists of one House, before that House.

Power of remove difficulties

64. The National Biodiversity Authority shall, with the previous approval of the Central Government, by notification in the Official Gazette, make regulations for carrying out the purposes of this Act.

Power to remove difficulties

65.(1) If any difficulty arises in giving effect to the provisions of this Act, the Central Government may, by order, not inconsistent with the provisions of this Act, remove the difficulty:

Provided that no such order shall be made after the expiry of a period of two years from the commencement of this Act.

(2) Every order made under this section shall be laid, as soon as may be, after it is made, before each House of Parliament.

SUBHASH C. JAIN

Secretary to the Government of India

ANNEXURE- II

STATUS OF FOREST AND COMPOSITION OF ITS FLORA :

Forest is the lifeline of every living organism in this universe. The countries development entirely depends upon its floral wealth. If there is a good green belt automatically there will be all round progress otherwise the development is impeded.

Composition Of The Flora:-

The vegetation of the state can broadly be classified into four types

1. Natural mixed deciduous forest.
2. Thorny – scrub forest.
3. Wasteland vegetation.
4. Wetlands and swamps.

Natural mixed deciduous forest (West Champaran): It is mainly confined to the forest of West Champaran. Shorea robusta (Sal) forms a principal tree species growing, as pure quiescence were regeneration has been noticed from their coppices. Other common associates are *Tectona grandis , Terminalia arjuna, Terminalia bellerica, Mallotus philippensis, Adina sessilifolia, Streblus asper, Mitragyna parvifolia, Albizia lebbeck, Diospyros melanoxylon, Bombax ceiba, Bridelia stipularis, Anogisus latifolia, Cassia fistula, Lagerstroemia parviflora, Madhuca indica and Garuga pinnata* etc.
The fresh alluvium tract is inundated by Gandak and its tributaries as such well known for cane and Khair growth.

Shrubs: Common species are *Callicarpa macrophylla, Mimosa rubicaules, Helicteris ixora, Flamingia chappar, Nyctanthus arbor-tristis, Symplocos racemosa etc.*

Climbers: Clematis gouriana, Butea parviflora, Combretum roxburghii etc.

Ferns: Species of Selaginella and Adiantun in wet and shaddy places over the tree trunks are often seen.

Orchids: Orchids,belonging to the family Orchidaceae show the greatest specialization in floral form, structure, color and fragrance to attract insects which help in pollination and preservation of the species in the forest.

Due to their beautiful flower, long keeping quality and long blooming period, orchids have become great favourites in the horticultural trade and for internal decoration. The maximum concentration of the orchid species is in North Eastern region and Western Ghats.

In Bihar only three species are available *Vanda tessellata*, *Pholidota articulata* and *Habenaria orbiculata*-threatened.

The pseudobulb of *Pholidota articulata* has the medicinal value. The paste of which is used in case of bone fracture by the tribals.

Valmiki National Park: The entire forest area has been notified as Valmiki wild life sanctuary, core of which is called National Park – the only one of the state. The forest area is an extension of Chitwan National Park of Nepal.

Thorny – scrub forest: Most commonly found in parts of Aurangabad, Gaya, Navada, Nalanda (Rajgir), Sheikhpura, Munghyr, etc.which is an extension of Santhal Pargana and Chhotanagpur forest area. Common species are *Acacia concinna, Caesalpinia bonduc, Zizyphus mauritiana, Capparis sepiaria, Flacourtia ramontshi, Aegle marmelos, Barleria cristata and Andrographis paniculata.* The forest department under social forestry has planted Eucalyptus, Sterculia and Lagerstroemia etc. as a routine exercise.

Wasteland vegetation: Almost each district in the south of Bihar has wasteland apart from the agricultural land. Common species met with are *Cassia tora, Cassia occidentalis, Sida rhombifolia, Dodonaea viscosa, Calotropis gigantia, Stachytarpheta indica, Opuntia and here and there Agave sisalana* etc.

Wetlands and Swamps: Wetlands are the natural formation caused due to natural depression or as discarded coarse of river system. These are the habitats of aquatic plants and some cash crops. Common species are Nymphaeas; Utricularia, Hydrilla, Marsilea, Smithia and Eichhornia etc. cash crops are Singhara (Trapa bispinosa) and Makhana (*Euryale ferox*).

Palm Group

Phoenix sylvestris, *Cocos nucifera* – Nariyal – planted, *Borassus flabellifer* – Tal, Cane – *Calamus tenuis* – Bettiah, Purneah

Dye yielding plants

Rubia cordifolia, Neel – *Indigofera tinctoria* found in East and West Champaran.these are the natural dye used for dyeing woolen strings and costly cotton yarns. --**Endangered:**

Substitute for Petroleum byproducts – mainly Diesel

Jatropha curcas – A member of the family Euphorbiaceae exudes good quantity of white milky juice, which is being considered as a substitute for the Diesel. Research on this particular aspect is going on in the laboratory. Govt. of India is giving incentive for its large-scale cultivation. Previously noticed in fallow land and even on the roadside of Rajgir, Gaya, (Kodarma, Tilaiya, Hazaribagh – now in Jharkhand) but at present population has been very much reduced. – Endangered.

MEDICINAL AND AROMATIC PLANTS: -

When **RISHI CHYAWAN** came under the spell of '**Kamdev**', he was 80 years old. While age was no deterrent to matrimony the body certainly was. The '**Atharva Veda**' describes now the sage of ancient days created his own version of the Viagra using the roots of Safed Musli (*Chlorophytum borivilianum*), a herb found in the jungles. It was this gooey Concoction that evolved into the popular energiser, **Chyawanprash**, named after him.

Jivaka, the great Ayurvedic physician was the son of the soil **'Shalavati'** of Rajagaha (Modern Rajgir of Bihar) who at his early age went to study medicine at **Taxilla** (Takshashila in Rawalpindi, now in Pakistan) under a world-renowned physician (Disapamokkho Vijjo) who lived there. The boy was so peculiar that he learnt much and grasped easily, understood well and did not forget what he had learnt. After the study was over, he returned to his motherland. He thoroughly studied the Vanaspati Van of Rajgir. Rajgir Hills that time had many important herbal and medicinal plants apart from economic plants. Later on he became a personal physician of Lord Budhha.

Bihar after its political and physical division has lost its majority of its forest cover, which was previously thought to be the storehouse of many medicinal and aromatic plants. What remains now still warrants the attention of the Government. Keeping this in view the Govt. of Bihar has set up a **"Aushadhih Padap Board"** in tune with 'Aushadhih Padap Board'already functioning under Ministry of Health & Family Welfare, Govt. of India. Major stress has been given by the Govt. of India to the following herbs/plants for large-scale cultivation because of their rarity in natural habitat/jungle.

1. अश्वगंधा	9. कुटकी
2. अतिश	10. मकोय
3.भूमि आमलकी	11. मूसली
4. ब्राहमी	12. पुष्कर मूल
5. चिरायता	13. सर्पगंधा
6. गुडमार	14 शतावरी
7. जपमॉसी	15 वायविडंग
8. कूठ	16. वत्सनाभ (विष)

Besides the above-approved lists of the medicinal plants by the Govt. of India other medicinal plants are on table No. – 1

The state of Madhya Pradesh is so rich in medicinal herbs that majority of the crude drugs are obtained from the medicinal herbs growing in the forest and are being supplied to M/S Baidyanath, Jhandu, Dabur & Himalayan Drugs Co.for manufacture of Ayurvedic medicines for different ailments.Now the Enterprenuars are also very much engaged in large scale cultivation of medicinal and Aromatic herbs.

ETHNOBOTANY FO RURAL AND TRIBAL SOCIETIES:

More than 70% of Indian population lives in villages. For varied reasons , the majority of rural people still use plants in the treatment of common ailments. Apart from the rural population over 67.8 million. tribal people belonging to 550 communities of 227 ethenic groups live predominantly in inaccessible or remote lap of nature. Uses of plants, p ossessing d iseases a lleviating p roperties f or m an a nd cattle has been a readily available source with them for leading healthy life. The tribal and ethenic diversity has been the main stay for conservation of many variable germplasm of primitive cultivars and land races.

BENEFITS OF CULTIVATION:

Cultivation of medicinal and aromatic plants is expected to provide for;

1. Sustained availability of fresh and genuine raw materials, especially of improved varieties to ensure quality standard products.
2. Regular and alternative source of income to farmers for amelioration of the economic conditions.
3. Utilization of wasteland and presently unusable lands.
4. Evolving of better strains and high yielding crops of suitable medicinal and aromatic plants through conventional breeding, Biotechnology and Tissue culture etc.
5. Ease the pressure on natural resources and conserve the biological and genetic diversity in medicinal and aromatic plants for posterity.

Table 1 **Medicinal Plants of Bihar**

Common name	Botanical name
Trees	
Chatwan	*Alistonia scholaris*
Khadir	*Acacia catechu*
Babul	*Acacia nilotica*
Neem	*Azadirachta indica*
Kuchla	*Stychnos nux vomica*
Simal	*Bombax ceiba*
Palasha	*Butea monosperma*
Amaltas	*Cassia fistula*
Amla	*Emblica officinale*
Barun	*Crataeva nurvala*
Sahjan	*Moringa oleifera*
Mahua	*Madhuca indica*
Sonpatha	*Oroxylon indicum*
Gambhari	*Gmelina arborea*
Karanja	*Pongamia pinnata*
Jamun	*Syzygium cumini*
Ganyari	*Premna integrifolia*
Arjun	*Terminalia arjuna*
Bahera	*Terminalia belerica*
Harae	*Terminalia chebula*
Mahua	*Madhuca indica*
Chmpa	*Michelia champaca*
Bel	*Aegle marmelos*
Gulchin	*Plumeria rubra*
Sita ashok	*Saraca indica*
Imli	*Tamarindus indica*
Sindiwar	*Vitex negundo*

Shrubs

Vasaka	*Adhatoda vasica*
Mamachimi	*Helicteres isora*
Kutaja	*Holarrhena antidysentrica*
Harsinghar	*Nyctanthes arboretristis*
Meethineem	*Murraya koenigii*
Kuner	*Nerium indicum*
Katsaraya	*Barleria prionitis*
Arandi	*Ricinus communis*
Chambeli	*Jasminum grandifolrum*
Kachnar	*Bauhinia variegata*
Mehandi	*Lawsonia inermis*
Kanta karanj	*Caesalpinia cristata*
Nirgundi	*Vitex negindo*

Herbs

Ak	*Calatropis gigantea*
Hodjod	*Cissus quadrangular is*
Ashwagandha	*Withania somnifera*
Babchi	*Psoralia corylifolia*
Bala	*Sida cordifolia*
Tulsi	*Ocimum sanctum*
Jangli piaj	*Urginea indica*
Paan	*Piper betle*
Bharangi B-	*Clerodendrum serratum*
Bringaraj	*Eclipta alba*
Sarapgandha	*Rauwolfia serpentina*
Banbhanta	*Solanum indicum*
Chakwad	*Cassia tora*
Satyanasi	*Argemone mexicana*
Chittrak	*Plumbago zyzlanica*

Anantamul	*Hemidesmusindicum*
Gokshur	*Tribulus terrestris*
Punamava	*Boerhavia diffusa*
Guduchi	*Tinospora cordifoUa*
Pipali	*Piper longum*
Haldi	*Curcuma longa*
Brahmi	*Centella asiatica*
Jalnimba	*Bacopa monnieri*
Kalihari	*Gloriosa superba*
Malkangani	*Celastrus paniculatus*
Kalmegh	*Andrographis paniculata*
Satawar	*Asperagus racemosus*
Dhatura	*Datura metal*
Adrak	*Zingiber officinale*
Kateri	*Solanum xanthocarpum*
Vach	*Acorus calamus*
Kiwanch	*Mucuna prurita*
Khas	*Vetiveria zizinioides*
Kulthi	*Dolichos biflorus*
Ghritkhumari	*Aloe barbedensis*
Gunja	*Abrus precatorious*
Apamarg	*Achyranthes aspera*
Ishwarimul	*Aristolochia indica*
Salpami	*Desmodium gangeticum*
Gudmar	*Gymnema sylvestra*
Mulhati	*Glycyrrhiza glabra*
Lata kasturi	*Abelmoschus moschatus*
Dudhi	*Euphorbi hirta*

Medicinal and Aromatic plants for cropping systems of Bihar

	Name of crop	Plant part used
A.	**Medicinal Plants**	
1.	*Rauvolfia serpentina* (Sarapgandha)	Underground parts
2.	*Withania somnifera* (Ashwagandha)	Underground parts
3.	*Acorus calamus* (Bach)	Underground parts
4.	*Andrographis paniculata* (Kalmegh)	Herbage shoot
5.	*Asparagus racemosus* (Satawar)	Underground parts
6.	*Gloriosa superba* (Kalhari)	Underground parts
7.	*Mucuna prurita* (Kewach)	Seeds, Roots
8.	*Urginea indica* (Ban Pyas)	Underground parts
9.	*Chlorophytum boriviallianum* (Safed musli)	Underground parts
10.	*Plantago ovata* (Isabago)	Seeds/Husk
11.	*Catharanthus rose us* (Sadabahar)	Underground parts/ Herbage
12.	*Piper logum* (Pipali)	Fruits/Roots
13.	*Jatropha curcus* (Jungli Arandi)	Seeds/Stem
14.	*Gymneme sylvestris* (Gudmar)	Herbage/Root

B. Aromatic Plants

1.	*Mentha arvensis* (Japanese mint)	Herbage
2.	*Cymhopogon winterianus* (Java citronella)	Herbage
3.	*Cymbopogon martinii* (Palmarosa)	Shoot/Flowers
4.	*Cympopogonflexuosus* (Lemon grass)	Herbage
5.	*Vetiveria zizaniodes* (Khas)	Roots
6.	*Pogostemom patchouli* (Patchouli)	Herbage
7.	*Abelmoschus moschatus* (Musakdana)	Seeds
8.	*Ocimum basilicum* (Tulsi)	Herbage
9.	*Polianthus tuberosa* (Rajnigandha)	Flowers

ANNEXURE – III

IMPORTANT RECORDED FAUNA OF BIHAR:-

PROTOZOA

1. *Leishmania donovani*
2. *Balantidium coli*
3. *Entamoeba coli*
4. *E. gingivalis*
5. *E. histolytica*
6. *Giardia intestinalis*
7. *Leishmania tropica*
8. *Plasmodium falsiparum*
9. *P. malariae*
10. *P. vivax*

PLATYHELMINTHES

Trematoda:

1. *Cercaria indica*
2. *C. indoplanorbis*
3. *Ceylonocotyle scoliocodium*
4. *Diplodiscus mahrai*
5. *Encyclometra japonicum*
6. *Fasciola hepatica*
7. *Fasciolopsis buski*
8. *Ganeo glettoides*
9. *G. tigrinum*
10. *Gigantecotyl explanatum*
11. *Meharorchis ranarum*
12. *Bivaria indicum*
13. *Parageninus westermani*
14. *Plagiorchis (Metaplagiorchis) himalayi*
15. *Pleurogenoides gastroperus*
16. *Prosotocus kashabia*
17. *P. partapus*

Cestoda:

1. *Diphyllobothrium latum*
2. *Echinococus granulosus*
3. *Hymenolepis nana*
4. *Taenia saginata*
5. *T. solium*

NEMATHELMINTHES

NEMATODA

a. Animal parasites:

1. *Ascaris lumbricoides*
2. *Camallanus cyanophlyctia*
3. *C. patania*
4. *C. thaparus*
5. *Contracaecum tricuspis*
6. *Dioctophyma renale*
7. *Dispharynx nasuta*
8. *Entarrobius vermicularia*
9. *Geongylonema verrucosum*
10. *Haemonchus contortua*
11. *Meoascaris vitulorum*
12. *Oxysomtium macintoshii*
13. *Porrocaecum anguaticolle*
14. *Procamallanus mehrai*
15. *Pseudoproleptus satenadri*
16. *Rhabodochona bosei*
17. *R. dasi*
18. *R. mazeedi*
19. *Spinitectus komiyai*
20. *Spirocamellanus chauhani*
21. *S. vachai*
22. *Spironoura stewarti*
23. *Tanqua anomala*
24. *Terranova galeocerdonis*
25. *Trichuris trichura*
26. *Wucheraria bancrofti*

b. Plant parasites & soil nematodes:

1. *Acrobeles spp.*
2. *Aphelenchoides parietinus*
3. *A. saprophilus*
4. *Aphelenchus avanae*
5. *Ditylenchus spp.*
6. *Helicotylencus digonicus*
7. *H. indicus*
8. *H. multicinctus*
9. *Hirshamanniella oryzae*

10. *Hoplolaimus indicus*
11. *Meloidogyne incognita*
12. *M. javanica*
13. *Mylonchulus spp.*
14. *Nothotylenchus bhatnagari*
15. *Panagrolaimus spp.*
16. *Paratylenchus nainianus*
17. *Pratylenchus pratensis*
18. *Pseudhalenchus anchilisposomus*
19. *P. indicus*
20. *Psilenchus spp.*
21. *Rotylenchulus reniformis*
22. *Seinura hachler*
23. *Tylenchorhynchus clarus*
24. *T. dubius*
25. *T. mashhoodi*
26. *Tylenchus butteus*

ANNELIDA

Earthworms :

1. *Drawidia nepalensis*
2. *Eutyphaous bishambari*
3. *Pheretima posthuma*

Leeches :

1. *Hirudinaria granulosa*
2. *Hirudo medicinalis*

MOLLUSCA

1. *Achatina fulica*
2. *Acrostoma veriabilis*
3. *Gvraulus convexiusculus*
4. *Indoplanorbis exustus*
5. *Lemellidena marginalis*
6. *Lymnea buteola*
7. *Parrcysia annandalii*
8. *Pila globosa*
9. *Vivipara bengalensis*

ARTHROPODA

Diplopoda :

1. *Julus* spp.
2. *Thyropygus* spp.
3. *Xenobolus* spp.

Chilopoda:

1. *Scolopendra*
2. *Scutigerella*

Crustacea:

1. *Argulus indicus*
2. *Caridina nilotica*
3. *Ichthyoxenus montanus*
4. *Ilycryptus halyi*
5. *Macrobranchium spp.*
6. *Mesopodosis orientalis*
7. *Nichollsia menoni*
8. *Palaeomon carcinus*
9. *Paratelephusa spinigera*
10. *Physocypris furfuracea*
11. *Stenocypris major*
12. *S. malcolmsoni*

Arachnida:

Scorpions :

1. *Buthus* spp.
2. *Nasobuthus temulus gangaticus*

Ticks :

1. *Dermacantor* spp.
2. *Ixodas* spp.

Mites :

1. *Acarus siro*
2. *Amblyseius nariulis*
3. *A. alatoniae*
4. *A. coccinsae*
5. *Amblyssius fallacio*
6. *A. syzygii*
7. *Aponychus corpuzaa*
8. *Phytoseus roseus*
9. *Schizotetr enychus and ropogoni*
10. *Suidasia nasbitti*
11. *Tetranychus neoceledonicus*
12. *Thyrophagus* spp.
13. *Typhlodromus homalii*
14. *Uroseius* spp.

Spiders:

1. *Argiope semula*
2. *Cyclosn moonduenais*
3. *Cytophora citriaala*
4. *Loucauga aecoracia*
5. *Morpissa calcuttenaia*
6. *M. decorets*
7. *M. tigina*
8. *Nephila maculata*
9. *Oxyopes pandae*
10. *Pardosa annadali*
11. *P. birmanica*
12. *P. sumatrana*
13. *Phidippus indicus*
14. *P. patelei*

INSECTA

Orthoptera :

1. *Acrida exaltate*
2. *Aiolopus thalassinus tamulus*
3. *Atractomorpha orenulata*
4. *Byachytrypes achatinus*
5. *B. porieniosus*
6. *Cetantops pinguis innotabilis*
7. *Chrotogonus trachypterus*
8. *Cyrtacanthacris tetarica*
9. *Euconocophalus pallidus*

10. *Eyprepocnemis alacris*
11. *Gryllotalpa africana*
12. *Gryllus bimaculatus*
13. *G. mistratus*
14. *Hieroglyphus spp.*
15. *Latana inflata*
16. *Patanga saccincta*
17. *Poekilocercus pictus*
18. *Schistocerca gregaria*
19. *S. parigrinum*
20. *Schizodactylus monostrosus*
21. *Spathosternum P. parsiniferum*
22. *Teleogryllus mitratus*
23. *Trigonocorypha crenulata*

Coleoptera :

1. *Anthia sexguttata*
2. *Aulacophora excavata*
3. *Batocera rubra*
4. *Bruchus chinensis*
5. *Cantharis spp.*
6. *Catharsius molossus*
7. *Coccinella septempunctata*
8. *Cybister confusus*
9. *C. limbatus*
10. *Cybister (Mega) tripunctatus asiaticus*
11. *Dineutes indicus*
12. *Epilachne dodecastigma*
13. *Eretes sticticus*
14. *Heliocopris bucephalus*
15. *Hispa armigara*
16. *Hydaticus vittatus*
17. *Mylabris spp.*
18. *Rhaphidopalpa foeidollis*
19. *Rhizopertha dominica*
20. *Sitophilus oryzae*
21. *Tribolium castaneum*

Lepidoptera :

1. *Acherontia styx*
2. *Acraea violae*
3. *Amoacta lineola*
4. *Antheraea mylitta*
5. *Baeris guttatus*

6. *Belenois mesentina*
7. *Bombyx mori*
8. *Cephonodes hylas*
9. *Chaerocampa alecto*
10. *C. lycetus*
11. *Chilo zonellus*
12. *Cirphis unipunctata*
13. *Catopsilia pomona*
14. *C. pyrantha*
15. *Danaus chrysippus*
16. *D. genutia*
17. *D. plaxippus*
18. *Delias aglaia aglaia*
19. *D. sucharis*
20. *Diacrisia obliqua*
21. *Ergolis merione*
22. *Euploea core*
23. *Eurema brigitta rubella*
24. *E. hecabs*
25. *Huphina nerissa*
26. *Hypclimnas missipus*
27. *Hypsa ficus*
28. *Melanitis leda*
29. *Ophideras fullonica*
30. *O. materna*
31. *Papilio demoleus*
32. *P. palytes*
33. *Philosomia cynyhia*
34. *P. ricini*
35. *Polydorus aristolochiae*
36. *Precis almana*
37. *P. hierta*
38. *P. lamonias*
39. *P. orithyia*
40. *Prodenia litura*
41. *Tryporyza incertulus*
42. *Utepheisa pulchella*
43. *Valeria valeria*
44. *Vanessa cardui*

Hemiptera :

1. *Acanthaspis angularis*
2. *Agnoscelis nubila*
3. *Belostoma indica*

4. *Chrysocoria stolii*
5. *Cimex lectularius*
6. *C. rotundatus*
7. *Conorhinus rubrofasciatus*
8. *Dysdercus koenigii*
9. *D. bingulatus*
10. *Eusarococoris ventralis*
11. *Graptostethus servus*
12. *Halys dentatus*
13. *Idiocerus atkinsoni*
14. *Kerria lacca*
15. *Leptocorisa acuta*
16. *L. varicornis*
17. *Lygaeus hospes*
18. *L. militaris*
19. *Nephotettix nigropictus*
20. *Nezara viridula*
21. *Podops limesa*
22. *Scutellera fasoiata*
23. *Sphaerodema molestum*
24. *Trionymus sacchari*

Hymenoptera :

1. *Apis dorsata*
2. *A. florea*
3. *A. indica*
4. *Campsomeriella annulata*
5. *Icaria ferruginea*
6. *Oecophylla amaragdina*
7. *Scolia affinis*
8. *S. binotata*
9. *S. quadripustulata*
10. *Vespa magnifica*
11. *V. orientalis*

Diptera :

1. *Anophelese spp.*
2. *Culex spp.*
3. *Dacus dorsalis*
4. *Melanagromyza obtusa*
5. *Musca domestica*
6. *Pachydiplosis oryzae*
7. *Phlebotomus spp.*
8. *Phytomy atricornis*

Dermaptera :

1. *Forcipula trispinosa*
2. *Labidura riparia*

Isoptera :

1. *Odontotermes assmuthi*
2. *O. brunneus*
3. *O. feae*
4. *O. gurudaspurensis*
5. *O. lokanandii*
6. *O. obesus*
7. *O. redemanni*
8. *Trinervitermes bifornis*

Odonata:

1. *Acisoma p. panorpoides*
2. *Brachythemis contaminata*
3. *Bradinophyga giminata*
4. *Ceriagrion coromondalianum*
5. *Crocothemis s. servilia*
6. *Diplacodes trivialis*
7. *Orthetrum sabina*
8. *Pantala flavescons*
9. *Pseudagrion decorum*
10. *Rhyothemis v. variegata*
11. *Tholymia tillavga*
12. *Tramea basilatus burmeistari*
13. *Urothemis signata signata*

FISH

1. *Ailia coila*
2. *Amblypharyngodon mole*
3. *Anabas scandens*
4. *Anabas testudineus*
5. *Aspidopari morar*
6. *Bagarius bagarius*
7. *Barbus spp.*
8. *Barilius spp.*
9. *Botia spp.*
10. *Catle catla*

11. *Chanda nama*
12. *Channa spp.*
13. *Cirrhinus spp.*
14. *Clarias batrachus*
15. *Clupisoma garua*
16. *Crossocheilus latius*
17. *Danio spp.*
18. *Esomus danricus*
19. *Eutropiichthys spp.*
20. *Gadusia shapra*
21. *Heteropneustes fossilis*
22. *Hilsa ilisha*
23. *Ilisha motius*
24. *Labeo spp.*
25. *Macrognathus aculeatus*
26. *Mastocembelus spp.*
27. *Mystus spp.*
28. *Nandus nandus*
29. *Noemacheilus spp.*
30. *Notopterus chitala*
31. *N. notopterus*
32. *Ompok spp.*
33. *Solmostoma bacaila*
34. *S. gora*
35. *Pama pama*
36. *Pangasius pangasius*
37. *Puntius spp.*
38. *Rasbora spp.*
39. *Rita rita*
40. *Rohtee cotio*
41. *Setipinna phasa*
42. *Schizothorax spp.*
43. *Tetradon cutcutia*
44. *Tor spp.*
45. *Wallago attu*
46. *Xenentodon cancila*

AMPHIBIA

1. *Bufo andersoni*
2. *B. melanostictus*
3. *Callula pulchra*
4. *Microphyla ornata*
5. *Rana brevicaps*

6. *R. cyanophlyctis*
7. *R. limnocharis*
8. *R. tigrina*
9. *Rhacophorus maculatus*

REPTILIA

1. *Agama minor*
2. *Atretium schistomum*
3. *Boiga spp.*
4. *Bungarus spp.*
5. *Calotes versicolor*
6. *Chabertia spp.*
7. *Chamaeleon zeylanicus*
8. *Chitra indica*
9. *Coluber spp.*
10. *Crocodylus palustris*
11. *Dryophis nasutus*
12. *Enhydris sieboldi*
13. *Eryx conicus*
14. *E. johni*
15. *Gavialis gangeticus*
16. *Gekko gekko*
17. *Geoclemys hamiltoni*
18. *Geomyda tricarinata*
19. *Hardella thurgi*
20. *Hemiductylus spp.*
21. *Kachuga spp.*
22. *Lissemys punctata*
23. *Lycodon jara*
24. *Mabuya spp.*
25. *Naja naja*
26. *Natrix piscator*
27. *Natrix stolata*
28. *Oligodon spp.*
29. *Ptyas mucosus*
30. *Python molurus*
31. *Testudo spp.*
32. *Trionyx spp.*
33. *Typhlops spp.*
34. *Varanus spp.*
35. *Vipera russelli*

BIRDS OF BIHAR

Name	Zool. Name
MARSH HARRIER	*Circus aeruginosus*
SPARROW-HAWK	*Elanu* s *caeruleus*
BLACK WINGED KITE	*Haliastur indus*
BRAHMINY KITE	*Spilornis cheela*
CRESTED SERPENT EAGLE	*Aquila pomarina*
LESSER SPOTTED EAGLE	*Milvus migrans govinda*
PARIAH KITE	*Accipiter badius*
SHIKRA	*Haliaeetus lecoryphus*
PALLAS'S FISIDNG EAGLE	*Aquila clanga*
GREATER SPOTTED EAGLE	*Milvus migrans lineatus*
BLACK EARED KITE	*Hieraaetus pennatus*
BOOTED HAWK EAGLE	*Pandion haliaetus*
OSPREY	*Circus melanoleueos*
PIED HARRIER	*Gyps benghafensis*
WHITEBACKED VULTURE	*Gatirida cristana*
CRESTED LARK	*Alauda gulgula*
EASTERN SKY LARK	*Calandrella raytal*
INDIAN SAND LARK	*Calandrella cinerea*
SHORT -TOED LARK	*Eremopterix grisea*
ASHY CROWNED FINCH LARK	*Ceryle rudis*
LESSER PIED KINGFISHER	*Pelargopsis capensis*
STORKBILLED KINGFISHER	*Halcyon smyrnensi*
WHITEBREASTED KINGFISHER	*Alcedo atthis*
COMMON KINGFISHER	*Aythya ferina*
COMMON POCHARD	*Tadorna tadorna*
COMMON SHELDUCK	*Anas crecca*
COMMON TEAL	*Anas strepera*
GADWALL	*Anas querquedula*
GARGANEY	*Anser anser*
GREYLAG GOOSE	*Anas platyrhynchos*
MALLARD	*Anas acuta*
PINTAIL	*Netta rufina*
REDCRESTED POCHARD	*Tadorna ferruginea*
RUDDY SHELDUCK	*Anas clypeata*
SHOVELLER	*Aythya fuligula*
TUFTED DUCK	*Aythyca nyroca*
WHITE EYED POCHARD	*Anas penelope*
WIGEON	*Nettapus coromandelianus*
COTTON TEAL	*Anas gibberfrons*
GREY TEAL	*Anas gibberifrons(albogularis)*
GREY TEAL Ssp.	

LESSER WHISTLING TEAL	*Dendrcygna javanica*
BARHEADED GOOSE	*Anser indicus*
SPOTBILL	*Ans poexcilorhyncha*
FALCATED TEAL	*Anas falcata*
LARGE WHISTUNG TEAL	*Dendmeygna bicolor*
PALM SWIFT	*Cypsiurus parvus*
HOUSE SWIFT	*Apus apus*
CA TTLE EGRET	*Bubulcus ibis*
LARGE EGRET	*Ardea alba*
LITTLE EGRET	*Egretta garzetta*
NIGHT HERON	*Nycticorax nycticorax*
POND HERON	*Ardeola grayii*
GREY HERON	*Ardea cinerea*
LITTLE BITTERN	*Ixobrychus minutus*
PURPLE HERON	*Ardea purpurea*
SMALLER EGRET	*Egretta intermedia*
BLACK BITTERN	*Ixobrychus flavicollis*
ASHY SWALLOW-SHRIKE	*Artamus fuscus*
STONE CURLEW	*Burhinus edicnemus*
SMALL MINIVET	*Pericrocotus cinnamomeus*
LARGE GREEN BARRET	*Megalaima zeylanica*
CRIMSON BREASTED BARBET	*Megalaima haemacephala*
LESSER SAND PLOVER	*Charadrius mongolus*
JACK SNIPE	*Gallinago minima*
EASTERN GOLDEN PLOVER	*Pluvialis dominica*
TEREK SANDPIPER	*Tringa terek*
BLACKTAILED GODWIT	*Limosa limosa*
COMMON SANDPIPER	*Aetitis hypoleucos /Tringa hypoleucos*
CURLEW	*Numenius arquata orientalis*
EURASIAN CURLEW	*Numenius arquata*
GREEN SANDPIPER	*Tringa ochropus*
GREENSHANK	*Tringa nebularia*
GREYHEADED LAPWING	*Vanellus cinereus*
LIT1'LE STINT	*Calidris minuta*
MARSH SANDPIPER	*Tringa stagnatilis*
PINTAIL SNIPE	*Ga/linago stenura*
RUFF & REEVE	*Philomaehus pugnax*
SPOTTED REDSHANK	*Tringa erythropus*
TEMMINCK'S STINT	*Calidris temminekii*
WOOD SANDPIPER	*Tringa glareola*
REDWATTLED LAPWING	*Vanellus indicus*
RIVER LAPWING	*Vanellus spinosus*

SPOTTED GREENSHANK.	*Tringa guttifer*
COMMON SNIPE	*Gallinago gallinago*
KENTISH PLOVER	*Charadrius alexandrinus*
LITILE RINGED PLOVER	*Charadrius dubius*
REDSHANK	*Tringa totanus*
YELLOW WATTLED LAPWING	*Vanellus ma/abaricus*
NORTHERN LAPWING	*Vanellus vanellus*
BLACK STORK	*Ciconia nigra*
ASIAN OPENBILL	*Anastomus oscitans*
BLACKNECKED STORK	*Ephippiorhynchus asiaticus*
PAINTED STORK	*Mycteria leucocephala*
WHITENECKED STORK	*Ciconia episcopus*
LESSER ADJUTANT STORK	*Leptoptilos javanicus*
ADJUTANT	*Leptoptilos dubius*
RUFOUS TURTLE DOVE	*Streptopelia orientalis*
GREEN PIGEON	*Treron phoenicoptera*
RING DOVE	*Streptopelis decaocto*
SPOTTED DOVE	*Streptopelia chinensis*
BLUE ROCK PIGEON	*Columba livia*
INDIAN ROLLER	*Coracias benghalensis*
INDIAN TREE PIE	*Dendrocitta vagabunda*
JUNGLE CROW	*Corvus macrorhynchos*
HOUSE CROW	*Corvus splendens*
COMMON HAWK CUCKOO	*Cuculus varius*
INDIAN PLAINTIVE CUCKOO	*Cacomantis passerinus*
KOEL	*Eudynamys scolopacea*
PIED CRESTED CUCKOO	*Clamator jacobinus*
CROW PHEASANT	*Centropus chlororhynchus*
WHITE BELLIED DRONGO	*Dicrurus caerulescens*
BLACK DRONGO	*Dicrurus adsimilis*
PEREGRINE FALCON	*Falco peregrinus japonensis*
RED HEADED MERLIN	*Falco chicquera*
COMMON KESTREL	*Falco tunúnculus*
LESSER KESTREL	*Falco naumanni*
ROSE FINCH	*Carpodacus erythrinus*
INDIAN COURSER	*Cursorius coromandelicus*
SMALL INDIAN PRATINCOLE	*Glareola lactea*
COLLARED PRATINCOLE	*Glareola pratincola pratincola*
COMMON CRANE	*Grus grus*
SARUS CRANE (ref.wii)	*Grus antigone*
WIRE TAILED SWALLOW	*Hirundo smithii*
COLLARED SAND MARTIN	*Riparia riparia*
SWALLOW	*Hirundo rustica*

GOLD FRONTED CHLOROPSIS	*Chloropsis aurifrons*
COMMON IORA	*Aegithina tiphia*
PHEASANT TAILED JACANA	*Hydrophasianus chirurgus*
BRONZEWINGED JACANA	*Metopidius indicus*
RUFOUSBACKED SHRIKE	*Lanius schach*
BROWN SHRIKE	*Lanius cristatus*
LITTLE TERN	*Sterna albifrons*
GREAT BLACKHEADED GULL	*Larus ichthyaetus*
LESSER BLACKHEADED GULL	*Larus fuscus*
BLACKBELLIED TERN	*Sterna acuticauda*
INDIAN RIVER TERN	*Sterna aurantia*
INDIAN SKIMMER	*Rynchops albicollis*
BROWNHEADED GULL	*Larus brunnicephalus*
COMMON TERN	*Sterna hirundo*
INDIAN WHISKERED TERN	*Chlidonias hybrida*
LITTLE GULL	*Larus minutus*
CHESTNUTHEADED BEE EATER	*Merops leschenaulti*
SMALL GREEN BEE EATER	*Merops orientalis*
BLUETAILED BEE EATER	*Merops philippinus*
GREY WAGTAIL	*Motacilla cinerea*
RED THROATED PIPIT	*Anthus cervinus*
WATER PIPIT	*Anthus spinoletta*
YELLOW WAGTAIL (BLACK HEAD)	*M. flava melanogrisea*
YELLOWHEADED WAGTAIL	*Motacilla citreola*
LARGE PIED WAGTAIL	*.Motacilla maderaspatensis*
VINACEOUS BREASTED PIPIT	*Anthus roseatus*
WHITE WAGTAIL	*Motacilla alba*
YELLOW WAGTAIL	*Motacilla flava*
PADDYFIELD PIPIT	*Anthus novaeseelandiae*
INDIAN TREE PIPIT	*Anthus hodgsoni*
BLACK NAPED MONARCH FLYCATCHER	*Hypothymis azura*
ORANGE HEADED GROUND THRUSH	*Zoothera citrina*
RED BREASTED FLYCATCHER	*Muscicapa parva*
ASHY WREN-WARBLER	*Prinia socialis*
LONG TAILED GRASS WARBLER	*Prinia burnesii cinerascens*
MAGPIE ROBIN	*Copsychus saularis*
PIED BUSH CHAT	*Saxicola caprata*
TAILOR BIRD	*Orthotomus sutorius*
BLACK REDSTART	*Phoenicurus ochruros phoenicuroides*
BLUE ROCK THRUSH	*Monticola solitarius*
BLUE THROAT	*Erythacus svecicus*
BLYTH'S REED WARBLER	*Acrocephalus dumetorum*
PARADISE FLYCATCHER	*Terpsiphone paradisi*

STONE CHAT	*Saxicola torquata*
INDIAN ROBIN	*Saxicoloides fulicata*
WHITE THROATED FANTAIL FLYCATCHER	*Rhipidura albicolis*
JUNGLR BABBLER	*Turdoides striatus*
BROWNROCK CHAT	*Cercomela fusca*
PURPLE SUNBIRD	*Nectarinia asiatica*
PURPLE RUMPED SUNBIRD	*Nectarinia zeylonica*
GOLDEN ORIOLE	*Orio/us orio/us*
BLACK HEADED ORIOLE	*Oriolus xanthornus*
GREY TIT	*Parus major*
LITTLE CORMORANT	*Phalacrocorax niger*
DARTER	*Anhinga rufa*
INDIAN SHAG	*Phalacrocorax fusicollis*
LARGE CORMORANT	*Phalacrocorax carbo*
LESSER GOLDEN BACKED WOODPECKER	*Dinopium bengha/ens*
DUSKY LEAF WARBLER	*Phylloscopus fuligiventer*
PIGMY WOODPECKER	*Picoides nanus*
BLACK HEADED MUNIA	*Lonchura malacca*
BLACK THROATED WEAVER BIRD	*Ploceus benghalensis*
HOUSE SPARROW	*Passer domesticus*
RED MUNIA	*Estrilda amandava*
SPOTTED MUNIA	*Lonchura striata*
WHITE BACKED MUNIA	*Lonchura punctu/ata*
WHITE THROATED MUNIA	*Lonchura ma/abarica*
BAY A	*Ploceus philippinus*
STREAKED WEAVER	*PIoceus manyar*
LITTLE GREBE	*Tachybaptus ruficolis*
GREATCRESTED GREBE	*Podiceps cristatus*
BLOSSOM HEADED PARAKEET	*Psittacula cyanocephala*
ROSE RINGED PARAKEET	*Psittacula krameri*
COMMON SANDGROUSE	*Pteroc/es exutus*
RED WHISKERED BULBUL	*Pycnonotus jocosus*
WHITE BRO\VED BULBUL	*Pycnonotus Meo/us*
RED VENTED BULBUL	*Pycnonotus cafer*
COMMON COOT	*Fulica atra*
INDIAN MOORHEN	*Gallinula chloropus*
PURPLE MOORHEN	*Porphyrio porphyrio*
WHITEBREASTED W ATERHEN	*Amaurornis phoenicurus*
BAILLON'S CRAKE	*Porzana pusilla*
BLACKWINGED STILT	*Himantopus himantopus*
AVOCET	*Recurvirostra avosetta*
PAINTED SNIPE	*Rostratula benghalensis*

CHESTNUT BELLIED NUTHATCH	*Sitta castanea*
COLLARED SCOPS OWL	*Otus baccamoena*
SPOTTED OWLET	*Athene brama*
BARN OWL	*Tyto alba*
STARING	*Aplonis vulgaris*
GREY HEADED MYNA	*Sturnus malabaricus*
JUNGLE MYNA	*Acridotheres fuscus*
ORANGE BILLED JUNGLE MYNA	*Acridotheres javanicus*
PIED MYNA	*Sturnus contra*
BANK MYNA	*Acridotheres ginginianus*
BRAHMINY MYNA	*Sturnus pagodarum*
COMMON MYNA	*Acridotheres tristis*
WHITE IBIS	*Threskiornis aethiopica*
GLOSSY IBIS	*Plegadis falcinellius*
SPOONBILL	*Platalea leucorodia*
BLACK IBIS	*Pseudoibis papillosa*
HOOPOE	*Upupa epops*
MUTE EYE	*Zosterops palpebrosa*

MAMMALS

1. *Antilope corvicapra*
2. *Axis axis*
3. *Bandicota bengalensis*
4. *B. indica*
5. *Bos gaurus*
6. *Boselaphus tragocamollus*
7. *Bubalus bubalis*
8. *Canis aureus*
9. *C. lupus*
10. *Cervus unicolor*
11. *Cuon alpinus*
12. *Cynopterus sphinx*
13. *Felis chaus*
14. *F. pennanti*
15. *Herpestes edwardsi*
16. *Hyaana hyaena*
17. *Hystrix indica*
18. *Lepus nigricollis*
19. *Macaca mulatta*
20. *Manis crassicaudata*
21. *Mellivora capensis*
22. *Melursus ursinus*

23. *Musmusculus*
24. *Myotia formosus*
25. *Panthera tigris*
26. *Pipistrellus mimus*
27. *Platinista gangetica*
28. *Presbytis entellus*
29. *Pteropus giganteus*
30. *Rattus rattus*
31. *Scotiphilus spp.*
32. *Selenarctos thibetanus*
33. *Suncus murinus*
34. *Sus scrofa cristatus*
35. *Taphozous longimanus*
36. *Tatera indica*
37. *Vulpes bengalensis*