

Ecology, Wild Life Conservation and Management

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EBH Publishers (India)
Guwahati-1

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ISBN: 978-93-83252-90-9

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First Published in 2017 by

EBH Publishers (India)

an imprint of Eastern Book House

136, M.L. Nehru Road, Panbazar

Guwahati-781 001, Assam (India)

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Email : easternbookhouse@gmail.com.

www.easternbookhouse.in

Digitally Printed at Replika Press Pvt. Ltd.

Printed in India

Preface

The introduction of the semester system by the Gauhati University is a welcome step. Students' performance should be monitored throughout the semester by continuous assessment in the theory and practical courses. Evaluation of the student's performances in each theory and practical paper is based on the Internal and External Evaluation, which comprises 20 and 80% respectively. Thus, while reading the subject, it should not be read only for examination purpose but also for increasing the knowledge about Ecology, Wildlife Conservation and its management. Today ecology and its sister concern environmental studies has been made compulsory to all streams of students, arts, science and commerce at undergraduate level.

To make the subject easier for study, the book has been taken out with the salient features:

1. The text book will serve the purpose of the students of TDC Second Semester specially Zoology Major and General courses.
2. The language has been kept simple and proper justice has been done to the prescribed syllabus, avoiding unnecessary elaboration of the topics.

Preparing a book on ecology is not an easy task as perhaps ecology is the only subject which exploded into the realm of human consciousness. Since the help of the books of various authors, internets and journals has been taken in preparing this book, no authenticity is claimed. It was my strong desire to put my years of experience of teaching and learning ecology into practice and produce a book on ecology which incorporated all relevant and updated information related to topics in the syllabus in a simple manner comprehensible to the students.

I am highly thankful to Mr. Pranab Chakraborty, Senior Sales Executive of Eastern Book House for publishing the book, without his constant inspiration and cooperation it may not be possible to publish the book.

My son Swarbhanu and Dibyajyoti and my husband Mr. Tanmoy Gupta have always supported me in many ways as possible during the completion of the book for which I shall remain ever indebted to them.

I also thankful to my dear colleague Mrs. Sanghamitra Das (Bose), Assoc. Prof. Department of Zoology, Lunding College for her constant inspiration to complete the book.

Readers or students are ultimately the best judges. Suggestions for the improvement of the book are not only welcome but greatly appreciated.

Tapashi Gupta

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Wildlife Conservation and Management

The term wildlife refers to all the plants and animals on the planet that are not domesticated by humans. Among the world's wildlife, there are many endangered species of both plants and animals. In a broader sense, wildlife includes all living organisms i.e. plants and animals in their natural habitat. In Webster Dictionary, wild life is defined as "Living things that are neither human nor domesticated, especially mammals, birds and fishes hunted by man." Gee (1964) defined the "term wildlife embraces all living creature and implies their conservation." According to Stracy (1963) the term wildlife is appropriate when dealing with the management, control and conservation of wild animal population as a whole, as distinct from the purely game animals. According to Wildlife Society, Washington, "Wildlife includes all wild vertebrates and larger invertebrates important for aesthetic, sporting, utilitarian and nuisance standpoint." The Wildlife (Protection) Act-1972 of the Government of India defines "Wild Life includes any animal, bee, butterfly, crustacean, fish and moths; and aquatic or land vegetation which forms any part of habitat." Wild Life is uncultivated and undomesticated lives including both plants and animals of a natural habitat—this could be a proper definition of wild life. Aldeo Leopod (1943) said Wild Life once fed us and saved our culture. It still yields us pleasure for leisure hours; but we try to reach that pleasure of modern machinery and thus destroy part of its value. Man has been exploiting

the nature and its resources unlimitedly for his best possible life. Today the selfish activities of modern man are unrestricted. Not only the earth, but the outer space is also disturbed by man. Thus entire biotic community along with the physical environment has been disturbed. Many wild species of plants and animals have become extinct and many other facing the danger due to overhunting and deforestation. One fourth of the land surface of our country is supposed to be covered by forests. According to Red Data Books of the IUCN (International Union for Conservation of Nature and Natural Resources), about 245 species of animals (including 139 birds) have already become extinct and nearly 600 or more species of animals and birds are leading towards extinction. This has a direct bearing on ecological balance, because many wild animals occupy a vital position in the functioning of natural ecosystem.

Aims of Wild Life Conservation

Indian wild fauna is very beautiful. In spite of rapid decline of forests, there exists rich variety of wild animals in different zones of the country. Their conservation has the following aims:

1. To protect and preserve the rare species of plants and animals from extinction.
2. To preserve the breeding stock.
3. To prevent deforestation.
4. To maintain the balance of nature.
5. To study the ecological relations of the plants and animals in natural habitat.

Importance of Conservation

Along with the topic of conservation arise a question—Why should we care about disappearing animals? The answer to such a question can be attributed to many reasons. Some of them are as follows:

Survival value: Every species plays an important role in maintaining an ecological balance among the living systems of the earth. These systems must continue to function if life is to survive. Loss of any species threatens the survival of several species inclusive of man. Man's own survival depends on his willingness and ability to cooperate with living environment. Human beings turn to nature and wildlife for spiritual, psychological, physical and cultural benefits.

From the biological point of view, wild life plays an important role in the proper maintenance of bio-geochemical cycles and food chain. They help in maintaining proper balance between the population and the environment. They have immense value as gene banks for raising resistant variety in agriculture or in animal husbandry and fishery e.g. earlier a brown plant hopper (*Nilaparvata lugens*) which has threatened the entire rice cultivation is now under control by developing a resistant variety of rice which is not susceptible to this borer.

Genetic Resources: All the domestic crops and livestock have originated from natural plants and animals. Genes from wild plant and animal can now be used to help breed better varieties by the genetic engineers. Thus wildlife is an important genetic resource for characters like disease resistance, higher production, higher ecological amplitude etc.

Scientific Value: The study of wildlife provides valuable knowledge about the life processes which has helped scientists understand the functioning and behavior of the human body. Scientists have also gained medical knowledge and discovered important medical products by studying wildlife. By studying the effects of environmental pollution on wildlife it is possible to learn how pollution affects human life.

Economic Value: Timber, firewood, natural rubber, gums, resins, tannins, essential oils, spices, many drugs, silk, lac, honey, feathers, musk, ivory, leather, meat, egg, wool, milk are obtained from wildlife. Wild species provide meat for food and skin for fur. The financial value of wild species is of major importance in the economics of many nations. Trade in live as well as dead animal not only supports thousands of people but also earn foreign exchange. For example, the market price of rhino horn was 20,000 US dollar per kg in 1990. The ivory of elephants, the glands of musk deer, the antlers of deer, etc. all command high prices. Many plants have medicinal value. For example, penicillin is obtained from *Penicillium*, quinine from *Cinchona*, morphin from Opium and so on. A chemical obtained from the skeleton of shrimps and crabs may serve as a preventive medicine against the fungal infection.

Aesthetic and Recreational Value: Wild life is also important from the view point of its aesthetic and recreational value for man. Recreation and enjoyment are essential to man's health. On all continents, wildlife is becoming an increasingly important recreational asset and tourist attraction. They maintain the health of living landscape and productivity of the ecosystem.

Wildlife represents the result of many years of evolution and constitute an environmental heritage to the past, a world which once surrounded our ancestors.

Educational Value: Apart from the aesthetical ethical reasons, there are also educational arguments to preserve wildlife. Visits to sanctuaries give education to the students of schools and colleges.

Basic Causes of Extinction

Basic causes of extinction of wild animals are as follows:

1. Destruction of their natural habitat through extensive industrialization and increased urbanization.
2. Excessive hunting and killing of wild animals.
3. Poaching for purposes of meat, skin, fur, ivory, and rhino horns etc.
4. Capture and export of few species in large number.
5. Introduction of exotic species.
6. Excessive use of pesticides, fungicides and other toxic chemicals.
7. Conversion of fertile land in the desert by overgrazing of domestic animals.
8. Deforestation leading to loss of covers or shelter to wild animals.
9. Excessive use of plant wood for timber, charcoal or fire purposes.

Principles of Wildlife Conservation

Conservation of wildlife has three specific objectives-

- (i) to maintain ecological process and life supporting systems (air, water and soil).
- (ii) to preserve the diversity of species or the range of genetic material of world's organisms.
- (iii) to ensure a continuous (everlasting) use of species, in fact ecosystems, that support rural communities and urban industries.

Thus the conservation of living resources is concerned not only with the plants, animals and microorganisms but also with the abiotic factors of the environment which support them.

Conservation Strategy

The wild life conservation includes all human efforts for the wild life habitats (animals and plants) from extinction. It involves protection and wise management of wild fauna and flora, as well as, their environment. The Conservation Strategy includes:

- (i) Protection of natural habitats, through controlled exploitation of the species.
- (ii) Developing National Parks, Sanctuaries, Game reserves and Botanical gardens.
- (iii) Survival of most endangered species, through maintenance breed stock in zoological parks.
- (iv) Establishment of flora reserves and Ecosystem reserves in the country.
- (v) Protection with coordinated legislative measures. Following Wild Life acts have been made by Government bodies to protect the unnecessary killing of different animals and uprooting the plants:
 - (a) Madras Wild Elephant reservation Act, 1873
 - (b) All-India Elephant Preservation Act, 1879
 - (c) The Wild Birds and Animals Protection Act, 1912
 - (d) Bengal Rhinoceros preservation Act, 1932
 - (e) The International Union for the conservation of Nature (IUCN) 1948 which is now known as World Conservation Union (WCU) helping conservation of natural resources by providing a link between Non-governmental organizations (NGOs), Governmental Agencies and Sovereign states.
 - (f) Assam Rhinoceros Preservation Act, 1954
 - (g) Indian Board for Wildlife, 1952
 - (h) Man and Biosphere program, 1971
 - (i) Wildlife (Protection) Act 1972
 - (j) Gir Lion Project, 1972
 - (k) Tiger Project, 1973

- (l) Convention on International Trade in Endangered Species (CITES) 1976 for preventing the illegal import and export of many rare species and animal products.
 - (m) National Wildlife Action Plan, 1982
 - (n) Agenda 21, of the International Convention of Biological diversity, part of earth summit 1992, for conservation of Biological Diversity to encourage sustainable development socially, economically and environmentally in the 20th century which include role of women and indigenous people in the community for environmental protection (Mackenzie et al 1999)
 - (o) Protocol on environmental protection to the Antarctic treaty 1992, which bans all military activities and nuclear waste disposal and provides complete freedom for scientific investigation for monitoring environmental damage and reporting on the progress of species protection measure.
- (vi) Wild life can also be preserved by:
- (a) Improving the existing protected areas such as sanctuaries and National parks etc.
 - (b) Imposing restrictions and export of rare plant and animal species and their products.
 - (c) Educating public for environmental protection at all levels of education.
 - (d) Breeding in captivity: Breed the animals in captivity and then release them in natural environment e.g. Gorilla are protected like this, in National Park of Alberta. In India, Tigers and lions are protected in National parks like this. Similarly, other animals like Whooping crane, Hawaiian Goose and Arabian Gazelle are protected in different parts of the world and their numbers have been increased.
 - (e) Reintroduction of flora and fauna, which are declared in areas of natural habitat.

State Wildlife Conservation Strategy

In 2006, the Division of Fisheries and Wildlife received approval for its State Wildlife Conservation Strategy, most often referred to as the State Wildlife Action Plan (SWAP). The SWAP is a comprehensive document that will help guide wildlife conservation decision.

By providing electronic access both to the entire document and to individual chapters, conservation minded citizens will be able to easily find information that they need.

This plan represents an important effort by the Division to engage the public in a dialogue about the future of our wildlife resources. During development of the Massachusetts Plan, we sought public input and comment through presentations of a draft to the Fisheries and Wildlife Board, the Natural Heritage and Endangered Species Advisory Committee.

The Plan includes:

- A brief history of the Division and past successful efforts to conserve the biodiversity of the Commonwealth.
- A review of the landscape changes which have affected wildlife populations and sets the stage for problems we see facing these species today.
- An explanation of the process used to identify the habitats and species in the greatest need of conservation. Identifies the primary strategies needed to conserve these species and their habitats
- An recognition of the need to monitor these efforts as strategies are implemented both to ensure that time and money are providing the expected results and to determine if changing conditions require a change in strategy.

Massachusetts' Plan is organized around 22 habitat types and 257 wildlife species in greatest need of conservation. The habitat types range from large-scale habitats such as Upland Forests; to medium-scale habitats like Grasslands, to small-scale habitats such as Vernal Pools. Information for each habitat type includes

- habitat description;
- the suite of species in associated with that habitat;

- the problems and threats faced by them;
- a map showing the distribution of the habitat type across the state, when available;
- a listing of the conservation strategies needed to conserve the habitat; and
- monitoring requirements that will ensure the success of the conservation strategies.

There is also information about the 257 wildlife species in greatest need of conservation occurring in one or more of the above 22 habitat types including:

- Conservation status ranking and habitat association
- Species Life History
- State distribution and abundance
- Habitat requirement
- Conservation threats

IUCN Red List

The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1963, is the world's most important invention of the global conservation status of biological species. The International Union for Conservation of Nature (IUCN) is the world's main authority on the conservation status of species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit.

The IUCN Red List is set up on precise criteria to evaluate the extinction risk of thousands of species and sub species. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.

Major species assessors include Bird Life International, the Institute of Zoology (the research division of the Zoological Society of London), The World Conservation monitoring Centre, and many Specialist Groups within the IUCN Species Survival Commission (SSC). Collectively, assessments by these organizations and groups account for nearly half the species on the Red List.

The IUCN aims to have the category of every species re-evaluated every five years if possible, or at least every ten years. This is done in a peer reviewed manner through IUCN Species Survival Commission (SSC) Specialist Groups, which are Red List Authorities responsible for a species, group of species or specific geographic area, or in case of Bird Life International, an entire class (Aves).

The IUCN (The International Union for Conservation of Nature and Natural Resources) are also known as WCU (World Conservation Union) maintains a document called Red Data Book or Red List of taxa that are facing the risk of extinction. The basic utility of Red List is as follows:-

1. To create awareness about the importance of threatened biodiversity,
2. To provide global index about already decline of biodiversity,
3. Identification and documentation of endangered species,
4. To highlight conservation priorities and to guide in conservation action and
5. To provide information about international agreements such as the convention on Biological Diversity and convention on International Trade in Endangered Species of Wild fauna and flora (ITES).

Categories

IUCN has recognized eight Red List Categories of species. Species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

Extinct (EX) - No individuals remaining.

Extinct in the Wild (EW) - Known only to survive in captivity, or as a naturalized population outside its historic range.

Critically Endangered (CR) - Extremely high risk of extinction in the wild.

Endangered (EN) - High risk of extinction in the wild.

Vulnerable(VU) - High risk of endangerment in the wild.

Near Threatened (NT)- Likely to become endangered in the near future.

Least Concerned (LC) - Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.

Data Deficient (DD) - Not enough data to make an assessment of its risk of extinction.

Not Evaluated (NE) - Has not yet been evaluated against the criteria.

When discussing the IUCN Red List, the official term “threatened” is a grouping of three categories: Critically Endangered, Endangered and Vulnerable.

Endangered Mammalian Species of NE India

These species are represented by fewer individuals because of unfavorable factors. If the same factors continue, these species would become extinct soon, eg-Indian Rhino, Asiatic lion and the great Indian Bustard.

The endangered species or taxa are those that are in danger of extinction if the current casual factors continues to operate. The reduction of population sizes is =50% over the last 10 years. The most important factors that the responsible for rapid declination of the species are—destruction of habitat and breeding grounds, reduction of population due to predation, parasite, diseases etc. exceeds the birth rate and the drastic environmental changes, which the animals can not cope up with. At present 81 species of mammals, 38 species of birds, 18 species of reptiles and amphibians are included in the list of endangered species.

Table 9.1 The Endangered Species Found in Assam and other NE States

Serial Number	Common Name	Scientific Name
1.	One-horned rhinoceros	<i>Rhinoceros unicornis</i> (Linn.)
2.	The Indian tiger	<i>Panthera tigris</i> (Linn.)
3.	The Indian elephants	<i>Elephas maximus</i> (Linn.)
4.	The Lion	<i>Panthera leo persica</i>
5.	The clouded leopard	<i>Neofelis nebulosa</i> (Griffith)
6.	The Indian panther	<i>Panthera pardus</i>
7.	Snow leopard	<i>Panthera unica</i> (Schreber)
8.	Indian wild dog or shole	<i>Cuon alpinus</i>

9.	Barking deer	<i>Nuntiacus muntjac</i>
10.	Cheetal or spotted deer	<i>Axis axis axis</i> (Erxleben)
11.	Hog deer	<i>Axis porcinus</i>
12.	The musk deer	<i>Moschus moschus moschiferus</i> (Linn.)
13.	Indian Bison	<i>Bos gaurusgaurus</i> (H.Smith)
14.	Asiatic wild Buffalo	<i>Bibalus bibalis</i>
15.	Wild Boar	<i>Sus cristatus</i>
16.	Wild Ass	<i>Equus hemionis</i>
17.	Hispid hare	<i>Caprolagus hispidus</i>
18.	Pigmy Hog	<i>Sus salvanius</i> (Hodgson)
19.	Pangolin	<i>Manis crassicaudata</i>
20.	Golden Langur	<i>Presbytis geei</i>
21.	Hoolock gibbon	<i>Hylobates hoolock</i> (Harlan)

Wildlife management attempts to balance the needs of wildlife with the needs of people using the best available science. Wildlife management can include game keeping, wild life conservation and pest control. Wildlife management has become an integrated science using disciplines such as mathematics, chemistry, biology, ecology, climatology and geography to gain the best results.

Wildlife conservation aims to prevent the loss in the earth's by taking into consideration ecological principles such as carrying capacity, disturbance and succession and environmental conditions such as physical geography, pedology and hydrology with the aim of balancing the needs of wildlife with the needs of people. Most wildlife biologists are concerned with the preservation and improvement of habitats although reinstatement is increasingly being used. Techniques can include reforestation, pest control, nitrification and denitrification, irrigation.

India was probably the first country to enact a Wild Life Protection Act. The Wild Birds and Animal Protection Act was passed in 1887 and repeated in 1912. For game protection in the states, in 1927, Forest Act XVI was enacted. Indian Board for Wild Life was established in 1952 and this was followed by setting up of Wild Life Boards in different states. Government of India enacted a comprehensive legislation "**Wild Life (Protection) Act, 1972**" with the objective of effectively controlling poaching and illegal trade in wildlife and its derivatives. This has been amended recently (January, 2003) and punishment and penalty for offences under the Act have been made more stringent.

Offences pertaining to hunting of endangered species and altering of boundaries of protected areas

For offences relating to wild animals (or their parts and products) included in schedule-I or part II of Schedule- II and those relating to hunting or altering the boundaries of a sanctuary or national park the punishment and penalty have been enhanced, the minimum imprisonment prescribed is three years which may extend to seven years, with a minimum fine of Rs. 10,000/-. For a subsequent offence of this nature, the term of imprisonment shall not be less than three years but may extend to seven years with a minimum fine of Rs. 25,000. Also a new section (51 - A) has been inserted in the Act, making certain conditions applicable while granting bail:

‘When any person accused of the commission of any offence relating to Schedule I or Part II of Schedule II or offences relating to hunting inside the boundaries of National Park or Wildlife Sanctuary or altering the boundaries of such parks and sanctuaries, is arrested under the provisions of the Act, then notwithstanding anything contained in the Code of Criminal Procedure, 1973, no such person who had been previously convicted of an offence under this Act shall be released on bail unless -

- (a) The Public Prosecutor has been given an opportunity of opposing the release on bail; and
- (b) Where the Public Prosecutor opposes the application, the Court is satisfied that there are reasonable grounds for believing that he is not guilty of such offences and that he is not likely to commit any offence while on bail”.

In order to improve the intelligence gathering in wildlife crime, the existing provision for rewarding the informers has been increased from 20% of the fine and composition money respectively to 50% in each case. In addition to this, a reward upto Rs. 10,000/- is also proposed to be given to the informants and others who provide assistance in detection of crime and apprehension of the offender.

At present, persons having ownership certificate in respect of Schedule I and Part II animals, can sell or gift such articles. This has been amended with a view to curb illegal trade, and thus no person can now acquire Schedule I or Part II of Schedule II animals, articles or trophies except by way of inheritance (except live elephants).

Stringent measures have also been proposed to forfeit the properties of hardcore criminals who have already been convicted in the past for heinous wildlife crimes. These provisions are similar to the provisions of 'Narcotic Drugs and Psychotropic Substances Act, 1985'. Provisions have also been made empowering officials to evict encroachments from Protected Areas.

Offences not Pertaining to Hunting of Endangered Species

Offences related to trade and commerce in trophies, animals articles etc. derived from certain animals (except chapter VA and section 38J) attracts a term of imprisonment upto three years and/or a fine upto Rs. 25,000/-.

Wildlife conservation is the wise use, regulation, and restoration of wild life and their habitats, especially in relation to endangered and vulnerable species. All living non-domesticated animals, even if bred, hatched or born in captivity, are considered wild animals. Wildlife represents all the non-cultivated and non-domesticated animals living in their natural habitats. Our world has many unique and rare mammals, birds and reptiles. However the pressure of growing population in different parts of the world has led to the increasing need of using land for human habitations and agriculture. This has led to the reduced habitat of many wild animals.

Wildlife Conservation Introduction favoured with a unique geographical location and varied landforms, India is home to about one third of known life forms in the world. There are over 500 species of mammals and 2060 species of birds that are truly Indian.

Rapid growth of human and livestock population since the turn of the century and the consequent pressure on land due to development have taken an increasingly heavy toll on the country wilderness. One of the major threats facing wildlife is the destruction of its habitat through human development activities: agriculture, urban settlements, roads, dams and mines, have all contributed to the loss of habitat. Another problem is the fragmentation of the ecosystem into parcels too small for wildlife to use. In recent years illegal trade in ivory, horns, hides, feathers and organs has brought many species to the verge of extinction. This century alone India has seen the extinction of many species, among them the hunting leopard (cheetah) and the white winged wood duck.

The numerous threats facing our wildlife have created awareness for

the urgent need for conservation. It has become clear by now that wildlife is an important biological, economic and recreational resource that has to be maintained through careful management. Conservation in this context is understood as a philosophy and policy of managing the human use of environment so that it may meet the needs and aspirations of present and future generations. One of the basic principles of wildlife conservation involves providing adequate natural food and shelter to maintain population of each species in a given habitat. For this purpose the government has created and developed national parks and sanctuaries where threatened species can be preserved. Other conservation measures involve research and studies of wild animals and their habitat, their biological requirements, census operations, improvement of habitat.

Wildlife Management and Conservation Principles

The wildlife manager's job is to maintain the number of animals in a habitat at or below the habitat's carrying capacity so that no damage is done to the animals or to their habitat.

In a sense, a wildlife manager's task is similar to a rancher's. Just as a rancher limits the number of animals in a cattle herd to a level that the habitat can support, wildlife managers try to keep the number of animals in balance with their habitat. In addition to looking at the total number of each species in a habitat, wildlife managers also monitor the breeding stock—the correct mix of adult and young animals needed to have a healthy population.

To manage a habitat, wildlife managers must consider historical trends, current habitat conditions, breeding population levels, long-term projections, and breeding success. With that knowledge, wildlife managers have a variety of practices they use to keep habitats in balance.

Table 9.2 Wildlife Sanctuaries and National Parks of NE Region with special references

Serial No.	Wild life Sanctuaries	District	Major wildlife
1.	Gibbon wildlife sanctuaries	Jorhat	Elephant, Hoolock gibbon
2.	Garampani	Golaghat	Elephant, Hoolock gibbon
3.	Padumoni	Tinsukia	Tiger, elephant, monkey
4.	Laokhowa	Nagaon	Rhinoceros
5.	Pabitara	Morigaon	Rhinoceros
6.	Chakrasila	Dhubri	Golden langur, elephant, barking deer.

7.	Kachugaon Guma	Kokrajhar	Tiger, deer, monkey
8.	Burachapari	Sonitpur	Pigmy hog, migratory birds.
9.	Nambor	Karbi Anglong	Elephant, pig.
10.	Baonadi	Darang	Whistling teal, pigmy-hog.
11.	Sonai-rupai	Sonitpur	Elephant, caped langur
12.	Pabha Sanctuary	Lakhimpur	Tiger, wood pecker, elephant, wild buffalo
13.	Deepor beel	Kamrup	Fish, migratory birds
14.	Bordoipam Bilmukh	Lakhimpur	Fish, migratory birds.
15.	Panichiling Bird sanctuary	Sibsagar	Fish, migratory birds, wild duck.
16.	Kaziranga National park	Golaghat & Nagaon	One-horned rhinoceros, tiger, elephant.
17.	Manas National park	Kokrajhar, Chirang, Baksa, Udalguri, and Darrang	Assam Roofed Turtle, Hispid Hare, Golden Langur and Pygmy Hog. Manas is famous for its population of the Wild water buffalo.

Conservation methodologies, to be meaningful can take the following two forms-

- (1) In-situ conservation and
- (2) Ex-situ preservation

In-situ Conservation

This type of conservation includes conservation of plants and animals in their native ecosystem or in manmade ecosystem where they naturally occur. This type of conservation is applied only to wild flora and fauna and not to domesticated animals and plants, because conservation is achieved by protection of population in nature. It mainly aims at preservation of races with wild relatives in which genetic diversity exists and/or in which the weedy/wild forms present hybrids with related cultivars. In-situ conservation includes a system of protected areas of different categories for example, National park, Sanctuaries, Biosphere Reserves, Cultural landscapes, National monument. The In-situ conservation of habitats has received high priority in the world conservation strategy programmes, launched since 1980.

National Park

IUCN defined national park as a relatively large area -(a) where one or several ecosystems are not materially altered by human exploitation and occupation, where plant and animal species, geomorphological sites and habitats are of special scientific, educative

and recreative interest or which contain a natural landscape of great beauty and (b) where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment and (c) where visitors allowed to enter, under special conditions, for inspirational, cultural and recreational purposes.

Sanctuary

A wildlife sanctuary, similar to national park, is dedicated to protect the wildlife, but it considers the conservation of species only and also the boundary of it is not limited by state legislation. Further, in the sanctuary, killing, hunting or capturing of any species of birds and mammals is prohibited except by or under the control of highest authority in the department responsible for management of the sanctuary. Private ownership may be allowed to continue in a sanctuary, and forestry and other usages permitted to the extent that they do not adversely affect wildlife.

Biosphere Reserves

A biosphere reserve is a voluntary, cooperative conservation reserve created to protect the biological and cultural diversity of a region to promote sustainable economic development. Biosphere Reserves is undisturbed natural area, is dedicated to conservation of biological diversity and genetic integrity of plants, animals and microorganism in their totality as well as scientific study. It is a place of cooperation, education and experimentation, where scientists and managers can share research data to better understand the man's impact on nature, and where local communities, environmental groups and economic interests can work collaborately on conservation and development issues.

Biosphere Reserves are established by UNESCO (United Nations Educational, Scientific and Cultural Organization) Programme on Man and the Biosphere (MAB). The mission of the MAB programme, which established on 1974, is to achieve a sustainable balance between the conflicting goals of conserving biological diversity, promoting economic development and cultural values. Biosphere Reserves are the sites where this objective is tested, refined, demonstrated and implemented.

The Indian Government has established 17 Biosphere Reserves for India, which protect larger areas of natural habitat and often include one

or more national parks or preserves along buffer zones that are open to some economic uses. Protection is granted not only to the flora and fauna of the protected region, but also to the human communities who inhabit these regions, and their ways of life.

Seven of the seventeen Biosphere Reserves are listed in the World Network of Biosphere Reserve and MAB (Man and Biosphere) Programme.

1. Nilgiri Biosphere Reserve, 2000
2. Gulf of Mannar Biosphere Reserve, 2001
3. Sundarbans National Park, 2001
4. Nanda Devi Biosphere Reserve, 2004
5. Nokrek Biosphere Reserve, 2009
6. Pachmarhi Biosphere Reserve, 2009
7. Simlipal Biosphere Reserve, 2009

Potential Sites for Biosphere Reserves

Following is the list of potential sites for Biosphere Reserves as selected by Ministry of Forests and Environment

1. Namdapha, Arunachal Pradesh
2. Thar desert, Rajasthan
3. Little Rann of Kutch, Gujarat
4. Kaziranga, Assam
5. Kanha, Madhya Pradesh
6. North Islands of Andaman Andaman & Nicobar
7. Abujmarh, Madhya Pradesh
8. Chintapalli, Andhra Pradesh
9. Lakshadweep Islands, Lakshadweep
10. Singbhum, Jharkhand

Role of Biosphere Reserves

A Biosphere Reserve preserves—

- (a) Wild populations.
- (b) Life style of tribals.
- (c) Genetic resources of domesticated plants and animals.

Objectives of Biosphere Reserve Programme (BRP)

1. Conserve representative samples of ecosystems.
2. Provide long-term in situ conservation of genetic diversity.
3. Promote and facilitate basic and applied research and monitoring.
4. Promote opportunities for education and training.
5. Promote appropriate sustainable managements of the living resources.
6. Disseminate the experience so as to promote sustainable developments elsewhere and
7. Promote international co-operation.

Feature of a Biosphere Reserve

The special feature of Biosphere Reserve combines four major groups of objectives, which are as follows:

1. Conservation.
2. Reserch.
3. Education
4. Local involvement.

Obviously, BRP is an excellent method for implementation of World Conservation Strategy. In 1985, in the World there were 243 Biosphere Reserves in 65 countries covering an area of over 115 million hectares. Only 90 out of 193 geographical premises, the remaining 103 are still to be represented in BRP.

Biosphere Reserve include natural, minimally disturbede, man-modified and degraded ecvosystems. For management purposes, the Biosphere Reserves areas are divided into-

- 1) -Core Zone- representing natural and minimally disturbed ecosystems.
- 2) Manipulation (Forestry) Zone-These includes the man-made forests and selected felling areas.
- 3) Manipulation (Tourism) Zones- These includes area cal marked for tourism, education and training.
- 4) Manipulation (Agricultural) Zone-These includes tribal settlements and other cultivated lands and

- 5) **Restoration Zone-** These includes degraded areas selected for restoration to natural conditions.

Eco-development Programmes in the areas surrounding the Biosphere Reserves, participation of local people in the management, research, monitoring, training and education through organizing Paryavaran Kendras (Environmental Centres) are among the important features of all programmes.

The protected area to be declared as a Biosphere Reserve must represent a sum total of biological communities interacting with a single life zone where climate is similar (biome).

Projects to Conserve Wildlife

Programmes have also been launched for scientific management and use of fragile ecosystems, specific programmes for management and conservation of wetlands, mangroves and coral reef systems are also being implemented. Six internationally important wetlands of India have been declared "Ramsarsites" under Ramsar convention and eleven wetlands have been identified for intensive conservation and management. The Tura range in Garo Hills of Meghalaya is a gene sanctuary for preserving the rich native diversity of wild citrus and Musa species. Sanctuaries for Rhododendrons and Orchids have been established in Sikkim.

Organizations Managing Wildlife Conservation

A number of National and International organizations are actively involved in Wildlife conservation. Some of them are as follows:

BNHS: The Bombay Natural History Society (BNHS) was established by 7 residents of Bombay in 1881, which is a non-Government organization which conduct research, educational activities, field works etc., in the field of natural conservation and published a journal in the aforesaid field, by collecting information on different fauna and flora in the country. The society has published some excellent books viz. : The Book of Indian Birds (Salim Ali), The Book of Indian Animals (S.H.Prater), The Book of Indian Reptiles (J.C.Daniel) etc. Society has been carrying out various important research projects, it is affiliated to the University of Bombay and guides post graduate research leading to M.Sc and Ph.D degrees.

IBWL: The Indian Board for Wild Life (IBWL) was established in

1942, which is main advisory body to Government of India for natural conservation. IBWL is responsible for the protection of wildlife by promoting public awareness in wildlife preservation and it is responsible for setting up National Park, Sanctuaries and Zoological gardens. It also advises the Government of India in developing policies in respect to wildlife products and its uses. In different states, Boards for wildlife are now being established under the guidance of IBWL.

IUCN: The International Union for Conservation of Nature and Natural Resources (IUCN) was established in 1948 whose Head Office is situated at Switzerland. Its main objective is to promote public awareness regarding the nature conservation and researches which are scientifically based on conservation measures. It helps to develop new techniques and methods for conservation and provides assistance on a national and international level for nature conservation.

NBPGR: The National Bureau for Plant Genetic Resources has been established to protect economically important wild plant species.

WPSI: The Wild Life Preservation Society of India (WPSI) was established in 1959 in Dehradun (U.P). It is non-Government body. Its main objectives are:

1. Promote interest in conservation through Journal, Monographs, Films and Bulletins etc.
2. Impart knowledge about conservation.
3. Promote Wildlife tourism.
4. Assist in forming Wildlife Protection Act.
5. Help Wildlife administrators in maintenance and protection of National Parks and Sanctuaries.

WII: The Wildlife Institute of India (WII) was set up in 1982, by Ministry of Environment and Forests, Government of India. WIIM's aim is to develop Wildlife science and promote its application in the field according to our economic and socio-culture background, its main objectives are:

1. Train biologists and managers for protected area management and Wildlife research.
2. Conduct and coordinate applied Wildlife research, and evolve techniques relevant to the Indian situation.

3. Give training to education and extension workers to acquire skills in eliciting public support for Wildlife conservation.
4. Provide consultancy services in conservation matters to government and private agencies.
5. Create a data base leading to a National Wildlife Information System.
6. Provide conservation orientation courses.

NWAP: The National Wild Life Action Plan (NWAP) was developed in 1983 for developing strategies as well as programmes and different projects for wildlife conservation to be adopted in future. This action plan is responsible for increasing the protected the geographical areas to about 4% as against 3% at present by surveying different National Parks and wildlife sanctuaries. It is also responsible for reviewing and making amendments in Wildlife Protection Act (1972).

WWF: The World Wild Life Fund (WWF) was established in 1961 at Switzerland and launched in India in 1969 at the time of 12th General Assembly of IUCN held at Delhi. Mumbai is its headquarter in India. The WWF whose symbol is "Giant Panda" has branches in 23 countries which has taken up flora conservation project along with the IUCN. It helps to spread research knowledge for conserving plant genetic resources and economically important wild plants in some selected countries. India is one of them.

ZSI: The Zoological Survey of India (ZSI) was established in 1916 to promote survey, exploration and leading to the advancement of faunal resources with the following objectives:

1. Exploration and survey of faunal resources.
2. Taxonomic studies.
3. Status survey of endangered species.
4. Publication of results through 251 journals and of Fauna of India.
5. Maintenance and development of National Zoological collections and museums.
6. Environmental impact studies.

The head office is located in Calcutta with 36 other offices located all over India. Recently ZSI has laid special emphasis to programmes

relating to Environment, Ecology and Ethnozoology. Intensive surveys of Silent Valley (Kerala), Damodar Valley Hydel Project, Lesser cats of eastern India, Lion tailed macaque, Nilgiri langurs, and deep water fishes have added remarkable information.

National Park in North East India

The National parks in India offer plenty of opportunities to the wildlife lovers depending upon the region and geography to get a very close encounter to the nature. The wonderful thing about the national parks in India is the variation that which they are full with. Whether it is the avifauna, the flora, the aqua fauna, or experience of different wildlife activities into their natural environment by an elephant safari or taking a jeep safari, the wild adventures are just incredible!

Kaziranga National Park

Kaziranga National Park (Assamese: Kazironga Rastrio Uddan) is a national park in the Golaghat and Nagaon districts of the state of Assam, India. A World Heritage Site, the park hosts two-thirds of the world's Great One-horned Rhinoceroses. Kaziranga boasts the highest density of tigers among protected areas in the world and was declared a Tiger Reserve in 2006. The park is home to large breeding populations of elephants, wild water buffalo, and swamp deer. Kaziranga is recognized as an Important Bird Area by Birdlife International for conservation of avifaunal species. Compared to other protected areas in India, Kaziranga has achieved notable success in wildlife conservation. Located on the edge of the Eastern Himalaya biodiversity hotspot, the park combines high species diversity and visibility.

Kaziranga is a vast expanse of tall elephant grass, marshland, and dense tropical moist broadleaf forests, crisscrossed by four major rivers, including the Brahmaputra, and the park includes numerous small bodies of water. Kaziranga has been the theme of several books, songs, and documentaries. The park celebrated its centennial in 2005 after its establishment in 1905 as a reserve forest.

Climate

The park experiences three seasons: summer, monsoon, and winter. The winter season, between November and February, is mild and dry, with a mean high of 25°C and a low of 5°C. During this season, *beels*

and nallas (water channels) dry up. The summer season between March and May is hot, with temperatures reaching a high of 37°C. During this season, animals usually are found near water bodies. The rainy monsoon season lasts from June to September, and is responsible for most of Kaziranga's annual rainfall of 2,220 mm (87 in). During the peak months of July and August, three-fourths of the western region of the park is submerged, due to the rising water level of the Brahmaputra. The flooding causes most animals to migrate to elevated and forested regions outside the southern border of the park, such as the Mikir hills. However, occasional dry spells create problems as well, such as food shortages for the wildlife in the park.

Flora

Four main types of vegetation exists in the park. These are alluvial inundated grasslands, alluvial savanna woodlands, tropical moist mixed deciduous forests and tropical semi evergreen forests. Based on Landsat data for 1986, percent coverage by vegetation is—tall grasses-41%, short grasses-11%, open jungle-29%, swamps- 4%, rivers and water bodies-8% and sand- 6%.

There is a difference in altitude between the eastern and western areas of the park, with the western side being at lower altitude. The western reaches of the park are dominated by grasslands. Tall elephant grass is found on higher ground, while short grasses cover the lower grounds surrounding the beels or flood-created ponds. Annual flooding, grazing by herbivores, and controlled burning maintain and fertilize the grasslands and reeds. Common tall grasses are sugarcane, spear grass, elephant grass and the common reed. Numerous forbs are present along with the grasses. Amidst the grasses, providing cover and shade are scattered trees—dominant species including kumbhi, Indian goosberry, the cotton tree (in savanna woodlands), and elephant apple (in inundated grasslands).

Thick evergreen forests, near Kanchanjhuri, Panbari, and Tamulipathar blocks, contain trees such as *Aphanamixis polystachya*, *Talauma hodgsonii*, *Dillenia indica*, *Garcinia tinctoria*, *Ficus rumphii*, *Cinnamomum bejolghota*, and species of *Syzygium*. Tropical semi- evergreen forests are present near Baguri, Bimali, and Haldibari. Common trees and shrubs are *Albizia procera*, *Duabanga grandiflora*, *Lagerstroemia speciosa*, *Crateva unilocularis*, *Sterculia urens*, *Grewia serrulata*, *Mallotus philippensis*, *Bridelia retusa*, *Leea indica* and *Leea umbraculifera*.

There are many different aquatic flora in the lakes and ponds, and along the river shores. The invasive water hyacinth is very common, often choking the water bodies, but it is cleared during destructive floods. Another invasive species *Mimosa invisa*, which is toxic to herbivores, was cleared by Kaziranga staff with the help from Wildlife Trust of India in 2005.

Fauna

Kaziranga contains significant breeding populations of 35 mammalian species, of which 15 are threatened as per IUCN Red List. The park has the distinction of being home to the world's largest population of the Great Indian One-Horned Rhinoceros (1,855), Wild Asiatic Water Buffalo (1,666) and Eastern Swamp Deer (468). Significant populations of large herbivores include elephants (1,940), gaur (30), and sambar (58). Small herbivores include the Indian Muntjac, wild boar, and hog deer. Kaziranga has the largest population of the Wild water buffalo anywhere accounting for about 57% of the world population.

Kaziranga was declared a Tiger Reserve in 2006 and has the highest density of tigers in the world with a population of 86, as per 2000 census. Other felids include Jungle Cat, Fishing Cat, Leopard Cats. Small mammals include the rare Hispid Hare, Indian Gray Mongoose, Small Indian Mongoose, Large Indian Civet, Small Indian Civets, Bengal Fox, Golden Jackel, Sloth Bear, Chinese Pangolin, Indian Pangolins, Hog Badger, Chinese Ferret Badgers and Parti-colored flying squirrels. Nine of the 14 primate species found in India occur in the park prominent among them are the Assamese Macaque, Capped langur and Golden Langur, as well as the only ape found in India, the Hoolock Gibbon. Kaziranga's rivers are also home to the endangered Ganges Dolphin.

Kaziranga is a home to a variety of migratory birds, water birds, predators, scavengers, and game birds. Birds such as the Lesser White-fronted goose, Ferruginous Duck, Baer's Pochard duck and Lesser Adjutant, Black-necked Stork and Asian Openbill stork migrate from Central Asia to the park during winter. Riverine birds include Blyth's Kingfisher, White-bellied Heron, Dalmatian Pelican, Spot-billed Pelican, Nordmann's Greenshank, and Black-bellied Tern Birds of prey include the rare Eastern Imperial, Greater Spotted, White-tailed, Pallas's Fish Eagle, Grey-headed Fish Eagle and Lesser Kestrel.

Kaziranga was once home to seven species of vultures, but the

vulture population reached near extinction, supposedly by feeding on animal carcasses containing the drug Diplofenac. Only the Indian Vulture, slender-billed Vulture and Indian White-rumped Vulture have survived. Game birds include the Swamp Francolin, Bengal Florican and Pale-capped Pigeon.

Other families of birds inhabiting Kaziranga include the Great Indian Hornbill and Wreathed Hornbill, weaver birds such as the common Baya Weaver, threatened Finn's Weavers, thrushes such as Hodgson's Bushchat and Old World warblers such as the Bristled Grassbird. Other threatened species include the Black-breasted Parrotbill and Rufous-vented Prinia.

Two of the largest snakes in the world, the Reticulated Python and Indian Python, as well as the longest venomous snake in the world, the King Cobra, inhabit the park. Other snakes found here include the Indian Cobra, Monocled Cobra, Russel's Viper, and the common Krait. Monitor lizard species found in the park include the Bengal monitor and the Water Monitor. Other reptiles include fifteen species turtle, such as the endemic Assam Roofed Turtle and one species of tortoise, the Brown Tortoise. 42 species of fish are found in the area, including Tetradon.

Conservation Management in Kaziranga National Park

Kaziranga National Park has been granted maximum protection under the Indian law for Wildlife Conservation. Various laws, which range in dates from the Assam Forest Regulation of 1891 and the Biodiversity Conservation Act of 2002 have been enacted for protection of wildlife in the park. Poaching activities, particularly of the rhinoceroses for its horn, has been a major concern for the authorities. Between 1980 and 2005, 567 rhinoceroses were hunted by poachers. Following a decreasing trend for the past few years, 18 one-horned rhinoceroses were killed by poachers in 2007. Preventive measures such as construction of anti-poaching camps and maintenances of existing ones, patrolling, intelligence gathering, and control over the use of firearms around the park have reduced number of casualties.

Perennial flooding and heavy rains have resulted in death of wild animals and damage to the conservation infrastructures. To escape the water-logged areas, many animals migrate to elevated regions outside the park boundaries where they are susceptible to hunting, hit by speeding vehicles, or subject to reprisals by villagers for damaging their crops. To

mitigate the losses, the authorities have increased patrols, purchased additional speed boats for patrol, and created artificial highlands for shelter. Several corridors have been set up for the safe passage of animals across National Highway-37 which skirts around the southern boundary of the park. To prevent the spread of diseases and to maintain the genetic distinctness of the wild species, systematic steps such as immunization of livestock in surrounding villages and fencing of sensitive areas of the park, which are susceptible to encroachment by local cattle, are undertaken periodically.

Water pollution due to run-off from pesticides from tea gardens, and run-off from a petroleum refinery at Numaligarh, pose a hazard to the ecology of the region. Invasive species such as Mimosa and wild rose have posed a threat to the native plants in the region. To control the growth and irradiation of invasive species, research on biological methods of controlling weeds, manual uprooting and weeding before seed settling are carried out at regular intervals. Grassland management techniques, such as controlled burning, are affected annually to avoid forest fires.

Manas National Park or Manas Wildlife Sanctuary

Manas National Park or Manas Wildlife Sanctuary is a wildlife sanctuary, UNESCO Natural World Heritage site, a project Tiger Reserve, an Elephant Reserve and a Biosphere Reserve in Assam, India. Located in the Himalayan foothills, it is contiguous with the Royal Manas National park in Bhutan. The park is known for its rare and endangered endemic wildlife such as the Assam Roofed Turtle, Hispid Hare, Golden Langur and Pygmy Hog. Manas is famous for its population of the Wild water buffalo.

Origin of the Name

The name of the park is originated from the Manas River, which is named after the serpent goddess Manasa. The Manas river is a major tributary of Brahmaputra River, which passes through the heart of the national park.

The Manas National Park was declared a sanctuary on October 1, 1928 with an area of 360 km². Manas Tiger Reserve was created in 1973.

Geography of the Park

Manas is located in the Eastern Himalaya foothills. The Park is 950

km² in area and situated at a height of 61m to 110m above mean sea level. The park is densely forested

The park area falls in five districts: Kokrajhar, Chirang, Baksa, Udalguri and Darang in the state of Assam in India. The park is divided into three ranges. The western range is based at Panbari, the central at Bansbari near Barpeta Road, and the eastern at Bhuiyapara near Pathsala. The Manas river is the main river, a major tributary of Brahmaputra river and flows through the west of the park, further it splits into two separate rivers, the Beki and Bholkaduba. Manas and five other small rivers flow through the National Park which lies on a wide low-lying alluvial terrace below the foot-hills of the outer Himalaya. The river also acts as an international border dividing India and Bhutan.

Climate: The minimum temperature is around 15°C and maximum temperature is around 37°C. Heavy rainfall occurs between May and September and the annual average rainfall is around 333cm.

Biomes: There are two major biomes present in Manas:

- (i) The Grassland biomes: pygmy hog, Indian rhinoceroses, Bengal florican, wild Asian buffalo, etc.
- (ii) The forest biomes: slow loris, capped langur, wild pig, sambar, great hornbill, Malayan giant squirrel or black giant squirrel, etc.

Flora

Vegetation: The Burma Monsoon Forests of Manas lie on the borders between the Indo-Gangetic and Indo-Malayan biogeographical realms and is the part of the Brahmaputra Valley Biogeographic Province. The combination of sub-Himalayan Bhabar Terai formation with riverine succession leading up to Sub-Himalayan mountain forest makes it one of the richest biodiversity areas in the world.

The main vegetation types are:

- Sub-Himalayan Light Alluvial Semi-Evergreen forests in the northern parts.
- East Himalayan mixed Moist and Dry Deciduous forests (most common type).
- Low Alluvial Savanna Woodland, and
- Assam Valley Semi-Evergreen Alluvial Grasslands which cover almost 50% of the Park.

Much of the riverine dry deciduous forest is at an early successional stage. It is replaced by moist deciduous forest away from water courses, which is succeeded by semi-evergreen climax forest in the northern part of the park. A total of 543 plants species have been recorded from the core zone. Of these, 374 species are dicotyledons (including 89 trees), 139 species monocotyledons and 30 are Pteridophytes and Gymnosperms.

The Park's common trees include *Aphanamixis polystachya*, *Anthocephalus chinensis*, *Syzygium cumini*, *S. Formosum*, *S. Oblatum*, *Bauhinia purpurea*, *Mallotus philippensis*, *Cinnamomum tamala*, *Actinodaphne obvata*, *Bombax ceiba*, *Sterculia villosa*, *Dillenia indica*, *D. Pentagyna*, *Careya arborea*, *Lagerstroemia parviflora*, *L. speciosa*, *Terminalia bellirica*, *T. Chebula*, *Oroxylum indicum* and *Bridelia spp.* The Grasslands are dominated by *Imperata cylindrica*, *Saccharum naranga*, *Phragmites karka*, *Arundo donax*, *D. Pentagyna*, *Phyllanthus emblica*, *Bombax ceiba*, and species of *Clerodendrum*, *Leea*, *Premna* and *Mussaenda*.

Fauna

The sanctuary has recorded 55 species of mammals, 380 species of birds, 50 species of reptiles, and 3 species of amphibians. Out of these wildlife, 21 mammals are India's Schedule I mammals and 31 of them are threatened.

The fauna of the sanctuary include Asian Elephants, Indian Rhinoceros, Gaurs, Asian water Buffaloes, Barsingha, Tigers, Leopards, Clouded Leopards, Asian Golden cat, Capped Langurs, Golden Langurs, Assamese macaques, Slow Loris, Hoolock Gibbons, Smooth-coated Otters, Sloth Bears, Barking Deer, Hog Deer, Black Panther, Sambar Deer and Chital.

The park is well known for its rare and endangered wildlife which is not found anywhere else in the world like the Assam Roofed Turtle, Hissid Hare, Golden Langur and Pygmy Hog.

Manas houses more than 450 species of birds. Manas have the largest population of endangered Bengal Florican. The major other birds includes Giant Hornbills, Jungle Fowls, Bulbuls, Brahminy Ducks, Kalij Pheasants, Egrets, Pelicans, Fishing Eagles, Serpent Eagles, Falcons, Scarlet Minivets, Bee-Eaters, Magpie Robins, Pied Hornbills, Grey Hornbills, Mergansers, Harriers, Ospreys and Herons.