

## FAUNAL DIVERSITY AND THREATS OF THE DIBRU-SAIKHOWA BIOSPHERE RESERVE: A STUDY FROM ASSAM, INDIA

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### Abstract

*The paper in an attempt to develop an inventory of faunal diversity of Dibru-Saikhowa Biosphere Reserve (DSBR) of Assam which is one of the important Biosphere Reserves of the Eastern Indian Himalaya and to highlight the threats that the BR is facing over the years so as to decisively support the need for conservation efforts. After compilation and analysis from various data sources the BR depicts the presence of 503 species of birds, 37 species of mammals, 42 species of reptiles, 17 species of amphibian, 104 species of fishes, 105 species of butterfly and 91 globally threatened faunal species, while the Soil microbial diversity in the BR is contributed by 26 soil micro-fungal forms. The rich biodiversity of the BR is under stress due to natural and human pressures. As per the recent studies, the BR has lost an area of 77.14km<sup>2</sup> due to revirine stress and 3.71km<sup>2</sup> has been encroached as per the State Forest Report.*

**Keywords:** Dibru-Saikhowa Biosphere; Eastern Himalaya; Biodiversity; Protected Area.

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### Introduction

The Dibru-Saikhowa Biosphere Reserve (DSBR), being located on the bank of mighty Brahmaputra and resting in the lap of the Eastern Himalaya, enjoys a luxurious ecosystem and shelters a number of rare and endangered faunal species, a wintering ground for many migratory birds and many other threatened faunal species of the globe. It is one of the 19 biodiversity hotspot in the world. The Dibru-Saikhowa is coroneted with the three prestigious statuses, being a Sanctuary, National Park and a Biosphere Reserve as well. The core zone of the DSBR is basically defined as the Dibru-Saikhowa National Park. Thus the need of research, development and conservation in and around DSBR is even more important than other BRs in the country.

The Dibru-Saikhowa Biosphere Reserve lies between 27°30' N to 27°45' N latitude and 95°10' to 95°45' E longitude at an average altitude of 118m above the mean sea level. It is located in Tinsukia and Dibrugarh District of Assam and the entire Reserve is located in the low laying flood plain of the mighty Brahmaputra River and Lohit River bordering the North and the Dibru River bordering the south. It was notified as a Sanctuary in 1986 and later as National Park in 1999 and as Biosphere Reserve on 28/07/1997. It extends over an area of 765km<sup>2</sup> of which a 340km<sup>2</sup> area is designated as a core zone and a 425km<sup>2</sup> area as buffer zone with 14

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fringe villages. Laika and Dhadiya are the two forest village belonging to Mishing community with 1500 household and approximate population of 10,500 people, located in the westernmost part of the Reserve. The buffer zone is inhabited by 38 villages with a total population of 13405 people (that includes Assamese, Bengali, Bihari and Tea Garden laborers). The DSBR is 40% wetland of variable sizes and 25% grassland. The water bodies within the BR are in the form of beels and chapories providing a unique habitat and supporting a rich aquatic biodiversity. Dibru Saikhowa Biosphere has tropical monsoon climate with a hot and wet summer and cool and usually dry winter and the main forest types found are moist mixed semi-evergreen forest, moist mixed deciduous forest, littoral and swamp forest, canebrakes and grasslands. The annual rainfall ranges from 2300mm to 3800mm which occurs mainly in the months of June, July, August, and September. The average coldest and warmest temperature of the area ranges from 7 to 34°C. The river Brahmaputra has a major contribution maintaining the biodiversity of the BR. The River has hundreds of tributaries and the extensive flood water has given rise to the promotion of permanent marshes which are an important habitat for a varied aquatic fauna. More than 3000 such marshes are scattered in the whole Brahmaputra valley. The riverine tract of Brahmaputra river and its basin hosts rich and unique biodiversity and has been identified as Important Bird Area by BNHS and Birdlife International in 2004.

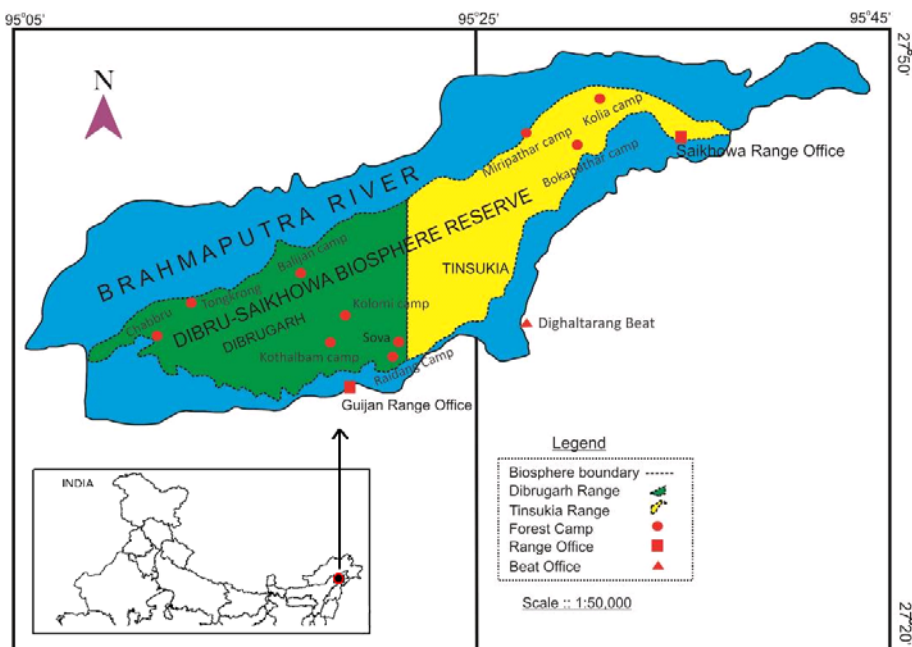


Fig. 1. Location map of Dibru-Saikhowa Biosphere Reserve, India

### Methodology

The overall idea of preparing this manuscript was to present a holistic analysis of faunal biodiversity of Dibru-Saikhowa Biosphere Reserve at one place and therefore, information regarding the faunal composition have been collected and compiled from different sources. These different sources include published research paper, articles, books, unpublished reports and other authentic online sources. The faunal biodiversity information of the BRs has also been collected from regional office Zoological Survey of India, Assam State Biodiversity Board, Forest Department, District Forest Range Office in the form of management plans etc. The collected data was analyzed thoroughly and interpreted using online sources like IUCN

Red Data Version 1.3 so as to present the data with systematic taxonomic position and global status.

## Results

### a. Faunal diversity in DSBR

A total of 808 faunal species have been found reported in different available sources, represented as follows: 503 (62.25%) species of birds, 37 (4.53%) species of mammals, 42 (5.18%) species of reptiles, 17 (2.10%) species of Amphibian, 104 (12.87%) species of fish and 105 (12.99%) species of butterflies among invertebrates (Fig. 2). There are 91 (11.26%) globally threatened faunal species reported from the DSBR. The threatened species comprise of 50 (54.94%) bird species, 18 (19.78%) mammalian species, 9 (9.89%) reptilian species and 15 (15.38%) species of fishes.

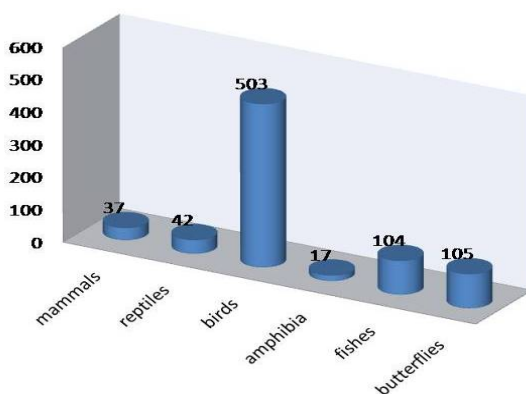


Fig. 2. Faunal Diversity of Dibru-Saikhowa Biosphere Reserve, India.

Avifauna contributes to the maximum of 248 genera and 503 species, belonging to 19 order and 68 families. The order *Passeriformes* contributes with 232 (46.12%) spp. followed by order *falconiformes* with 47 (9.43%) spp., *charadriiformes* with 41 (8.23%) spp., order *Anseriformes* with 31 (6.22%) spp., *ciconiiformes* with 25 (5.02%) spp., order *Piciformes* with 19 (3.81%) spp., *coraciiformes* and *gruiformes* with 17 (3.41%) spp. each, *cuculiformes* with 16 (3.21%) spp., **columbiformes** with 15 (3.01%) spp., *strigiformes* with 14 (2.81%) spp., *galliformes* with 7 (1.40%) spp., *Apodiformes* with 6 (1.02%) spp., *Pelecaniformes* with 5 spp., order *Psittaciformes* with 4 spp., *caprimulgiformes* with 3 spp., *isoetales* with 2 spp. and 1 spp. each from the *podicipediformes* and *trongoniformes* order.

The 37 mammalian species reported belong to 32 genera, 22 families and 11 orders. The highest number of species, 12 (3.33%) is represented by the order *Carnivora*, followed by the order *Rodentia* with 6 (16.21%) spp., *Primate* with 6 (16.21%) spp. and order *Cetartiodactyla* also with 6 spp., while the rest of the orders, *Insectivora*, *Cetacea*, *Chiroptera*, *Pholitoda* *Perisodactyla*, *lagomorpha* and *Proboscidea* are contributing with only 1 species each. The dominant families contributing with the maximum number of species are *Sciuridae*, *Felidae*, *Cercopithecidae*, *Cervidae*, *Herpestidae* and *Canidae*. The families *Bovidae*, *Elephantidae*, *Equidae*, *Suidae*, *Platanistidae*, *Viverridae*, *Ursidae*, *Hylopatidae*, *Lorisidae*, *Manidae*, *Talpidae*, *Soricidae*, *Pteropodidae*, *Mustelidae* and *Leporidae* are contributing with at least 1 species.

The 42 species of *Reptiles* belong to 2 orders and 10 families. The order *Squamata* exhibits a maximum species of 31 (73.8%) while the order *Testudine* contributes with a total of 11 (26.19%) species. The family *Colubridae* exhibit a maximum number of species of 19

(45.23%), followed by the family *Geomydidae* with 7 (16.66%) spp. family *Trionychidae* with 4 (9.52%) species and 2 (4.76%) species each by the family *Gekkonidae*, *Varanidae* and *Typhlopidae*, while the family *Viperidae* contributes with only 1 (2.3%) species.

The *Amphibian* fauna exhibits a total of 10 genera and 17 species belonging to 5 families, *Order Anura*. The dominant genera contributing with the maximum number of species are *Fejervarya*, *Hylarana*, *Polypedates* and *Chiromantis*. The Family *Dicroglossidae* contributes with a total species of 6 (35.29%), *Rhacophoridae* with 5 (29.41%) species, *Ranidae* with 4 (23.52%) species while the family *Microhylidae* and *Bufo* are contributing with only 1 (5.88%) species each.

A total of 64 genera and 104 species of fish fauna belonging to 29 families and 11 orders were reported on the reserve. The family *Cyprinidae* exhibited a maximum number of species of 34 (32.69%), followed by the family *Bagridae* with 13 (12.5%) species, family *Channidae* with 7 (6.73%) species, family *Sisoridae* with 5 (4.80%) species. The dominant genera are *Chanda*, *Labeo*, *Puntius*, *Mystus* and *Barilius*. The order *Cypriniformes* is represented by 39 (37.5%) species, followed by the order *Siluriformes* with 33 (31.73%) species, *Perciformes* contributes 20 (19.23%) species, *Synbranchiformes* with 3 species while the orders *Osteoglossiformes* and *Mugiliformes* are contributing with only 2 species each and the last 5 orders, *Anguilliformes*, *Archeopulmonata*, *Beloniformes*, *Clupeiformes* and *Tetradontiformes* are contributing with at least 1 species each.

The invertebrate fauna is represented by 73 genera and 105 species of butterfly belonging to 5 families and order *Lepidoptera*. The family *Nymphalidae* dominates by contributing with 45 (42.85%) species, followed by the family *Lycaenidae* with 21 (20%) spp., *Pieridae* with 17 (16.19%) spp., *Papilionidae* with 15 (14.28%) spp., and *Hesperiidae* with 7 (6.7%) spp. While soil microbial diversity of the BR is comprised by 26 soil micro-fungal forms, species like *Aspergillus*, *Penicillium* and *Rhizopus* are the most common ones.

There are 50 (9.9%) species of globally threatened avifauna reported in the BR. The avifaunal species that are winters visitor or migrant in the BR include *Anser indicus*, *Tadorna ferruginea*, *Anas crecca*, *Tringa nebularia*, *Sturnus vulgaris*, *Monticola rufiventris*, *Anthus roseatus*, *Phylloscopus fuscatus*, *Turdus ruficollis*, *Sylvia curruca*, *Phylloscopus coronatus*, *Seicercus castaniceps*, *Seicercus burkii*, *Niltava sundara*, *Bradypterus seebohmi*, *Calidris subminuta* etc. Among the 11 turtle species recorded, a total of 8 (19.04%) species were globally threatened and 15 fish species are found globally threatened.

The DSBR supports a variety of floral elements, comprised of 680 species of plants, belonging to 464 genera and 143 families, all represented by 511 species of *dicotyledonous* plants and 169 species of *monocotyledons* plants. There are more than 25 species of orchids

## Discussion

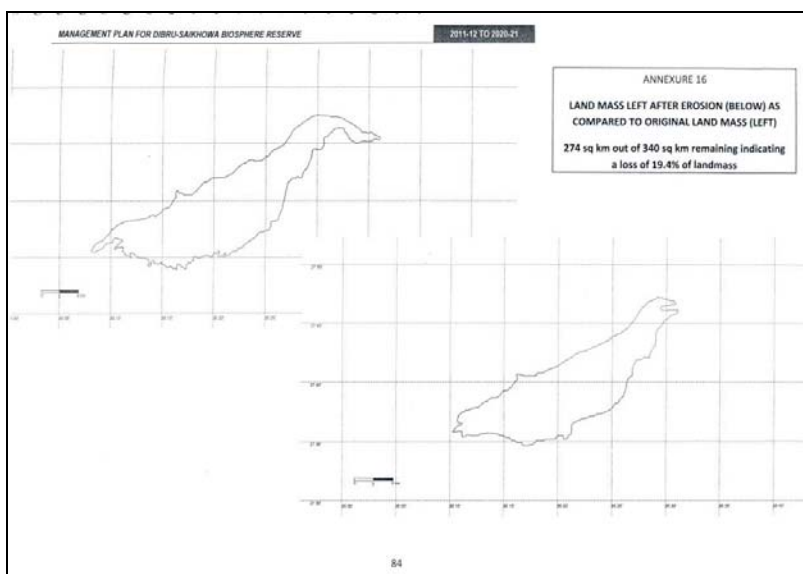
The DSBR is the proposed Ramsar site and falls in the course of two major international fly-ways of migratory birds. The area is known as a major haunting grounds of the globally threatened White-winged Duck *Cairina scutulata*, Black-breasted Parrotbill *Paradoxornis flavirostris* and Marsh Babbler *Pellorneum palustre*. The DSBR shelters a small population of feral horses as well. Some of the key fauna of the DSBR includes Asian Elephant *Elephas maximus*, Tiger *Panthera tigris*, Leopard *P. pardus*, Sloth Bear *Melursus ursinus*, Slow Loris *Nycticebus coucang*, Pigtailed Macaque *Macaca nemestrina*, Rhesus Macaque *M. mulatta*, Assamese Macaque *M. assamensis*, Capped Langur *Trachypithecus pileatus*, Barking Deer *Muntiacus muntjak*, Hog Deer *Axis porcinus*, Flying Squirrel *Petaurista* sp., Gangetic River Dolphin *Plantanista gangetica*, Monitor Lizards *Varanus bengalensis*, *V. salvator*, various turtles including *Kachuga sylhetensis*, snakes including Indian Cobra *Naja naja* and Indian Rock Python *Python molurus*. Assam Roof Turtle *Kachuga sylhetensis* etc. The avifauna of the BR was extensively studied, specifically by Choudhury [1-5], Kazmierczak & Allen [6],

Dwivedi [7], Allen [8] and Talukdar [9]. The DSBR has been surveyed and studied several times in the recent years and its rich faunal resources have been reported by various authors, namely primates and other higher mammals by Choudhary [4, 10-12].

The wetlands in the form of marshes, swamps, chapories (river islands and sandbanks) and grassland in the DSBR support quite a lot of threatened faunal species of the Globe. The grasslands, which are dominated by *Impreta cylindrical* and *Saccharum spontaneum* and the islands with a mosaic of various grass species are the ideal habitat for *Bengal florican*, nesting ground for *Swamp Partridge Francolinus gularis* and *Peafowl Pavo cristatus*. The tall moist alluvial grassland in the flood plain of Brahmaputra is also the unique habitat for endangered Great Indian one horned rhinoceros (*Rhinoceros unicornis*), pygmy hog (*Parcula salvanius*), Hispid hare etc.

**a. Threats to rich diversity and unique ecosystem of Dibru-Saikhowa BR:**

Even though the DSBR is a repository of rich faunal resources, the BR is fragile and vulnerable to innumerable threats. Flood is the major natural threat to the BR, because it can cause habitat destruction and land use change. The BR is surrounded from all sides by rivers, 10 of them, namely Bhramaputra, Nao Dihing, Lohit, Dibru, Siang, Debang, Kundli, Tengapani, Dotung and Dangori and is absorbing the brunt of annual multi-wave flood. The Brahmaputra River with its braided channels is characterized by its exceedingly large flow, enormous volume of sediment load, continuous change in channel morphology, rapid bed aggradations, bank line erosion and recession. Within 25 years (1986- 2011) a total loss of about 846 km<sup>2</sup> area has been caused by the Brahmaputra River system due to bank-line erosion [13]. The BR suffers immensely during heavy rainfall leading to frequent flooding. Flooding hits the BR on an average two to three times almost every year. Theses recurring floods change the river course causing erosion and siltation. The BR management Committee has reported that a landmass of about 66 km<sup>2</sup> has been eroded from the BR, but the area increased to 77.15 km<sup>2</sup> as per the recent records [14] due to recurring reverine stresses of Lohit-Brahmaputra, Burhi-Dangori and Dibru Rivers.



**Fig 3.** Landmass loss from Dibru-Saikhowa Biosphere Reserve due to Erosion.

The BR is also taking the burden of human dependence which is also putting pressure in many ways on the ecosystem of the BR. The number of households in the two forest villages, Dadhiya and Laika in the core region has increased from 210 (in 1951) to 1500 at present. The main source of livelihood of the community is cattle rearing, fishing and agriculture and milk production is the major activity. There are about 24 *Khutties* (Milk producing centre) in the area. A human population of more than 10,000 is depending on the surrounding forests of Dibru-Saikhowa almost for everything. Out of the total population, 71% collects firewood and other housing materials, 44% for food collection, and 29% for fishing and more than 32% of the total population pastures the cattle every day in the grassland [15]. In the recent years, the cattle population has increased many folds, which ultimately increased the pressure on the grassland itself. 38 villages in the buffer also put additional pressure on the BR. The grassland of DSBR is home for endemic bird species namely Marsh Babbler (*Pellorneum pulestre*) and Manipur Bush Quail (*Perdica manipurensis*). Raidang Grassland is one such grassland inhabited by endemic bird species Black breasted Parrot Bill (*Paradoxornis flavirostris*) and due to heavy grazing of the domestic animals, the population of the bird has been impacted [14]. Few years back the BR revealed the presence of 80 *feral horses* but as per recent study only 40 remains. According to the Assam State Forest report, about 3.7km<sup>2</sup> of the BR have been encroached and the original 0.5km<sup>2</sup> of the settlement has been expanded to roughly 5km<sup>2</sup> [15-17].

Overharvesting of wild resources, poaching, timber smuggling and trapping of wild animals are also a serious threat to DSBR. Different body parts of endemic Bengal slow loris *Nycticebus bengalensis* are used as medicine to heal many diseases among the local tribes of NE India and this is causing serious threat to this particular species in the region [12]. The wetland in the BR is threatened due to anthropogenic pressure like Unsustainable levels of grazing by livestock and fishing using chemical that have adverse affect on the aquatic lives namely one of the important macrophyte *Euryale Ferox* (locally known as nikori) has been totally wiped out from the BR and commercially important *Trapa* once abundant is now restricted to some wetlands in the DSBR. Fishing nets caused hindrance to the free movement aquatic bird and other aquatic faunal species like Endangered *Gangetic Dolphin*. Another threat which may not be very serious at present but can significantly affect the ecology of the BR in longer runs is the encroachment of the land (especially the fertile river beds) by the peoples settling down within the BR. The silt is brought in during high flows/floods, blocks parts of the river channel, thereby creating semi-dry patches of land and the people living here started filling this with sand or garbage for use. This alteration in the morphology can change the character, functions, values and appearance of wetlands. In recent times, there is an increased in agricultural activities, overharvesting of thatch grasses, firewood and logging for household used and as source of income. Another threat is unsustainable sand mining from the riverbeds which is creating disturbance to aquatic life and habitat.

Impact of different existing and upcoming hydropower projects can also be considered as one of the potential threat to the diversity and ecosystem of the BR. The River Debang is one of the major tributaries of the Brahmaputra river system, contributing with about 8.5% of the annual discharge of river Brahmaputra. The Combined flow of Lohit River and Debang River meets the Brahmaputra near Kobo Chapori of Dibru-Saikhiwa Complex. The Debang River basin has a catchment area of 2775km<sup>2</sup> in the flood plains of Assam. The three large mega projects located in the close vicinity of the BR are Demwe Lower HEP (1750 MW) on Lohit River, Dibang Multipurpose HEP (3000 MW) on Dibang River and Lower Siang HEP (2700 MW) on Siang River. These three hydroelectric power projects are seriously gigantic and therefore, their impacts will also be significant. Drastic fluctuation of water during the lean period will have an adverse impact on the Gangetic dolphin's feeding and migration habit. Smaller variations in water levels result in large variations in the spread of water area leading to

submergence. The minimum discharge (6 cumec for about 18 hours in a day) during winter will affect the river ecosystem as well as the ecology of the connecting wetlands.

There is proposal for the use of 114.267ha of non-forested land falling within 10km from the boundary of Dibru-Saikhowa BR to be used for laying crude-oil and gas pipelines by Oil India Ltd. This is also another upcoming issue that will have a high impact on the biodiversity of the DSBR. There are risks during the drilling process and of leakage and spilling as well in the wetlands, which will impact the ecology of the area and the livelihood of the people living in the fringe area of the Biosphere Reserve.

#### ***b. Conservation Strategies for the DSBR under BR approach***

Keeping in mind the main objectives towards the establishment of BRs, the following strategies have been put forward for the conservation and preservation of DSBR:

- RET species: The DSBR is a home for many endemic and restricted range faunal species and the BR becomes an isolated patch of land forming an island, a “River Island”. Due to its isolated and unique location, there its prevalence of endemism and river is an effective barrier for restricted movement and dispersal of many species namely the large mammalian species and primate species. The Bengal slow loris *Nycticebus bengalensis* which is endemic to South and South East Asia is distributed in the north East Region of India only and the BR is one such critical habitat [12]. The BR is the home for many globally threatened and rare fauna. The grassland of the BR is an important habitat for Greater Adjutant, one of the rarest storks in the world, Critically Endangered Bengal Florican *Houbaropsis bengalensis* and Whitewinged wood duck, *Cairina scutulata* . It is the breeding ground for Spot-billed Pelican *Pelecanus philippensis* that survives in Assam, mainly along the Brahmaputra Valley, especially in the Dibru-Saikhowa BR.
- The grassland as the feeding and sheltering ground: Dibru-Saikhowa is among the most important wintering sites in Assam of the Black Stork *Ciconia nigra*, critically threatened *Adrea insignis* and other such global migratory avian species. The grasslands of DSBR are an important grazing ground for Asiatic wild buffalo. The alluvial grassland of the DSBR is an unique habitat of Bengal florican and supports number of globally threatened and endangered species like Great Indian one horned rhinoceros (*Rhinoceros unicornis*), pygmy hog (*Parcula salvanius*), Hispid hare (*Caprolagus hispidus*).
- Potential Corridor: The DSBR serves as a vital route for the movement of Asiatic elephant; *Elephas maximus* [18]. The Brahmaputra River islands, including the BR, could be a potential corridor for dispersing tiger and major preying site in most of the part of the Reserve [19].
- Important habitat and habitat recovery site: There are 97 locations which are identified as Important Dolphin Habitat in the whole Brahmaputra River and of which 14 are considered as threatened habitat of Ganges Dolphin *Platanista gangetica* which includes the Saikhowa Balijan and Baluchar Balijan of DSBR [20]. The BR is the prioritized site for the Conservation of critically endangered Indian Gharial *Gavialis gangeticus* [21].
- Important of Wetlands : The presence of numerous wetlands in the DSBR which are in the form of chapories, swamps, lakes, marshes and beels supporting wide range of species, as an important feeding and breeding areas for wildlife and provide a stopping place and refuge for waterfowls and other global migratory bird species as well. Maguri-Motapung beel wetland Complex is an important bird area in the DSBR [22],

has plenty of Magur (catfish), named after it and the beel has been the main source of food and sustenance for the people who live around it as well. It nourishes, sustains and protects life in myriad ways.

- The Aquatic Plants as medicine and food: About 65% of the macrophyte recorded from the DSBR has medicinal value while several are used as food namely *Euryale ferox*, *trapa*, *sagittaria* nymphoid spp. etc. and fodder also. Submerged Plants like *Hydrilla* are the oxygen generator of aquatic system, they acts water purifiers.
- The Socio-economic condition of the indigenous Mishing community inhabiting inside the BR needs to enhance for the better management of the BR.

## Conclusion

The DSBR indeed is a treasure of huge faunal wealth and the exploration of this treasure never ends. Forest exploitation is the commonest cause of habitat degradation and habitat loss. Inaccessible terrain and difficult topography can play an important role in conservation of any protected area [23], whereas the DSBR is quite accessible and therefore, the level of threats is little redundant. The people living in and around any protected area are the real custodians of the resources and hence their development needs to go parallel along with the ecosystem development, Ecotourism can play an important role. Apart from the population pressure, the DSBR is also facing the pressure of developmental activities mainly hydropower projects. Although Environmental Impact Assessment (EIA) is there to mitigate the possible impacts of any such developmental project, in actual practice it's extremely difficult to cover all the impacts and manage them under EIA only at once [24]. Thus for the protected areas, some special plans/program and task forces should be implemented. The development, sustainability and livelihood should go hand in hand for the effective conservation of natural resources. The conservation strategies mentioned above have clearly defined the major course of action for better conservation of the existing biodiversity of the DSBR and also for the integrated development for the human and wildlife within the BR. Now, interlinking the results and analysis on the species database and threats, the conservation strategies can be further restructured for better implementation.

Wetlands are the most important habitat and are crucial for the survival of most of the threatened bird species but unfortunately they are the most threatened habitats of the world and DSBR is predominantly a wetland ecosystem. Wetlands in India support around 2400 species and subspecies of birds. The Wetlands supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant which serves as food, fodder and medicines at the same time. This further stresses upon the importance for conservation and management of the DSBR. Despite being an accessible landscape the DSBR still seems to be a data deficient region when it comes to reliable database on damages caused by the seasonal floods. The BR faces potential floods every year which certainly cause some damage to the wildlife but there is no quantification of such information so far, thus further research is needed to study the DSBR.

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