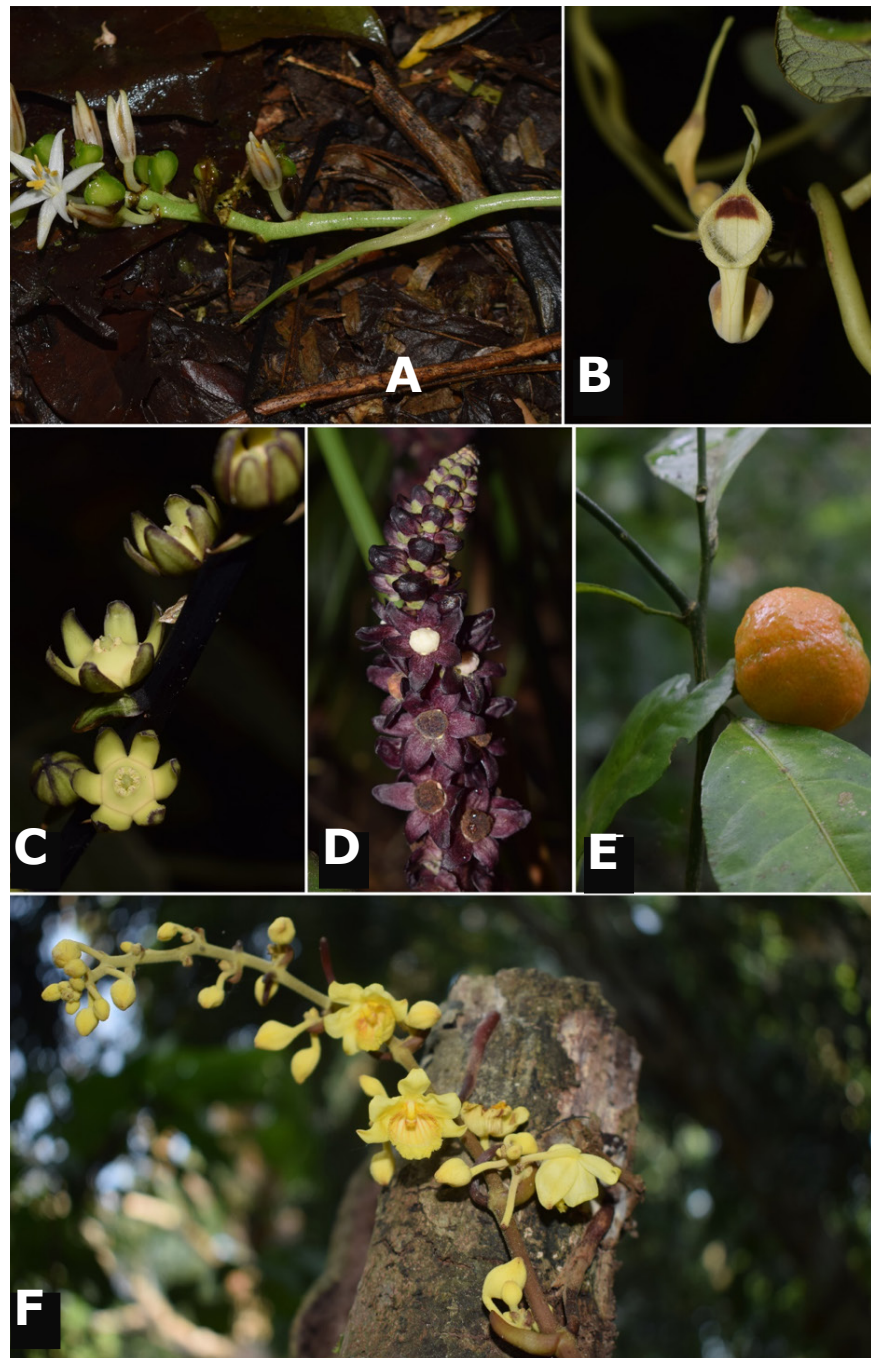


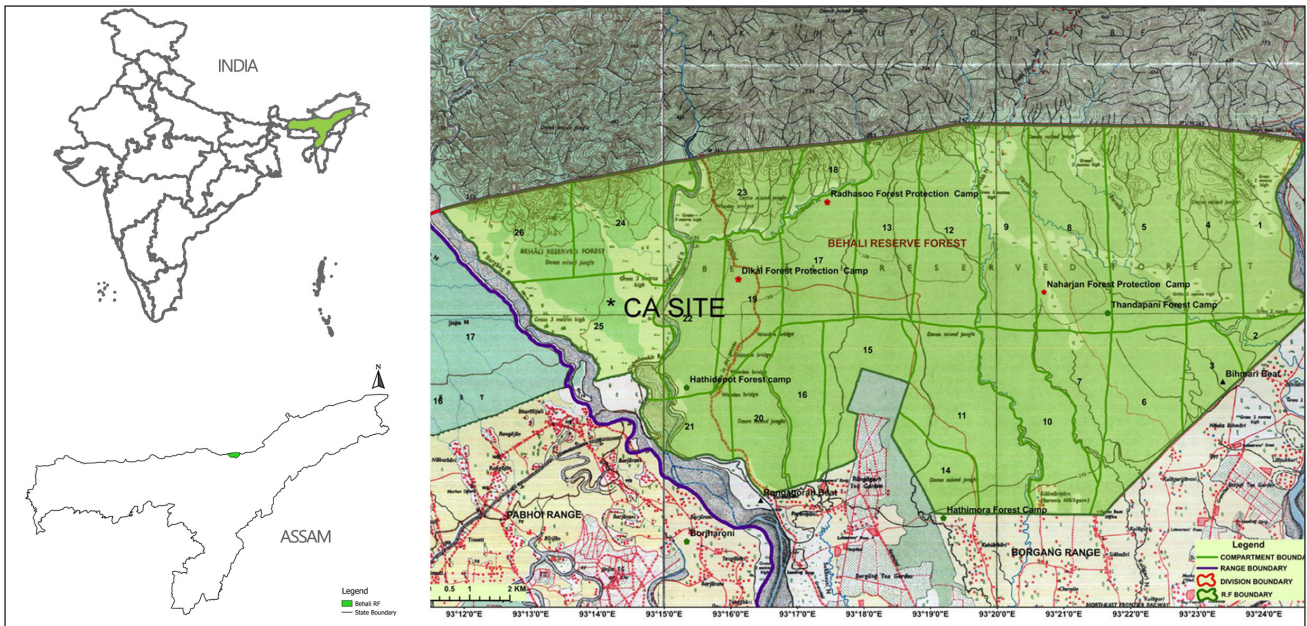
Journey of a forest towards extinction: a multi-perspective approach for the demand to declare Behali Reserved Forest as a wildlife sanctuary

Introduction

Behali Reserved Forest (BRF) declared in 1917 is the last remaining semi-evergreen forest in the Biswanath District of Assam, India (Borah & Tangjang 2020). BRF is a part of Sonitpur Elephant Reserve and declared as an Important Bird Area in 1994 and a Key Biodiversity Area in 2014. Initially, with a total geographical area of about 140 km², the dense patches in the reserved forest are now shrunk to only 60 km² due to illegal encroachment and deforestation (Sarma et al. 2009; Tiwari et al. 2017). This forest once connected the Pakke Tiger Reserve and Nameri National Park in the west, through Naduar RF, Papum RF, and Biswanath RF; to Chenglijan and Gohpur reserved forests in the east; and Kaziranga National Park in the south, creating a freeway for migration of the endangered elephants and other wildlife. However, this long belt of forests is



Some important plant species of Behali Reserved Forest: A. *Chlorophytum assamicum*; B. *Aristolochia assamica*; C. *Peliosanthes macrophylla* var. *assamensis*; D. *Tupistra stoliczkana*; E. *Citrus indica*; F. *Galeola nudifolia*. © Dipankar Borah.



Map of Behali Reserved Forest.



Behali RF as a corridor between two famous protected areas of Assam. (Source: Google Earth).

now severely fragmented, leaving a small portion intact, others diminishing into huge agricultural landscapes (Kushwaha & Hazarika 2004).

A short overview of biodiversity

The biodiversity that this forest holds cannot be summed up in a few words. Remaining unexplored for

nearly a century, the BRF has now produced wonders. Around 308 plant species including 37 orchids (Borah et al. 2020a), 52 mammals, 282 birds, 23 snakes, 11 turtles, 11 lizards, 12 amphibia, and 275 species of butterflies are reported so far from this forest (Upadhyaya & Bordoloi 2016–17). This region has been neglected for decades

in terms of exploratory scientific research activities, but in recent years, three new plant taxa, including several interesting floral records have been found in the forest which has suddenly brought hope and enthusiasm for support in alert locals.

The richness of this small forest patch can be gauged from the fact that it is inhabited by some of the threatened, schedule listed (WPA 1972; IUCN 2021) and endemic mammals (Table 1) and other wildlife: Rufous-necked Hornbill *Aceros nipalensis*, Wreathed Hornbill *Aceros undulatus*, White-winged Duck *Asarcornis scutulata*, Great Hornbill *Buceros bicornis*, Woolly-necked Stork *Ciconia*



Aerial view of the semi-evergreen forests of Behali. © Dipankar Borah.

episcopus, Lesser Adjutant *Leptoptilos javanicus*, River Tern *Sterna aurantia*, Red-headed Vulture *Sarcogyps calvus*, Southeastern Asian Box Turtle *Cuora amboinensis*, Keeled Box Turtle *Cuora mouhotii*, Black Pond Turtle *Geoclemys hamiltonii*, Tricarinate Hill Turtle *Melanochelys tricarinata*, Indian Softshell Turtle *Nilssonina gangeticus*, Indian Peacock Softshell Turtle *Nilssonina hurum*, King Cobra *Ophiophagus hannah*, Burmese Python *Python bivittatus*, and Black Softshell Turtle *Nilssonina nigricans* (Upadhyaya & Bordoloi 2016–17). Among the reported butterflies, 20

butterflies are termed as 'rare' by Kehimkar (2016): Small Green Awlet *Burara amara*, Orange Awlet *Burara harisa*, Brown Pied Flat *Coladenia agni*, Swinhoe's Flat *Celanorrhinus zea*, Green-striped Palmer *Pirdana major*, White Dragontail *Lamproptera curius*, Lesser Jay *Graphium evemon*, Great Blue Mime *Papilio paradoxa*, Moth Butterfly *Liphyra brassolis*, Moore's Cupid *Shijimia moorei*, Hewitson's Dull Oakblue *Arhopala oenea*, Yellow Disc Tailless Oakblue *Arhopala perimuta*, Bifid Plushblue *Flos diardi*, White Banded Royal *Dacalana cotys*, Mandarin Blue *Charana mandarinus*,

Silver Royal *Ancema blanka*, Malayan Nawab *Polyura moori*, Blue-striped Palmfly *Elymnias patna*, Unbroken Sergeant *Athyma pravara*, and Painted Courtesan *Euripus consimilis*.

The BRF has an enormous potential of being a major butterfly tourism hotspot both for butterfly enthusiasts and researchers alike.

The recently discovered plant species *Aristolochia assamica*, *Chlorophytum assamicum*, and *Peliosanthes macrophylla* var. *assamensis* are only found in this region and are considered endemic to northeastern India, of

which the latter two are so far known only from this forest (Borah et al. 2020a).

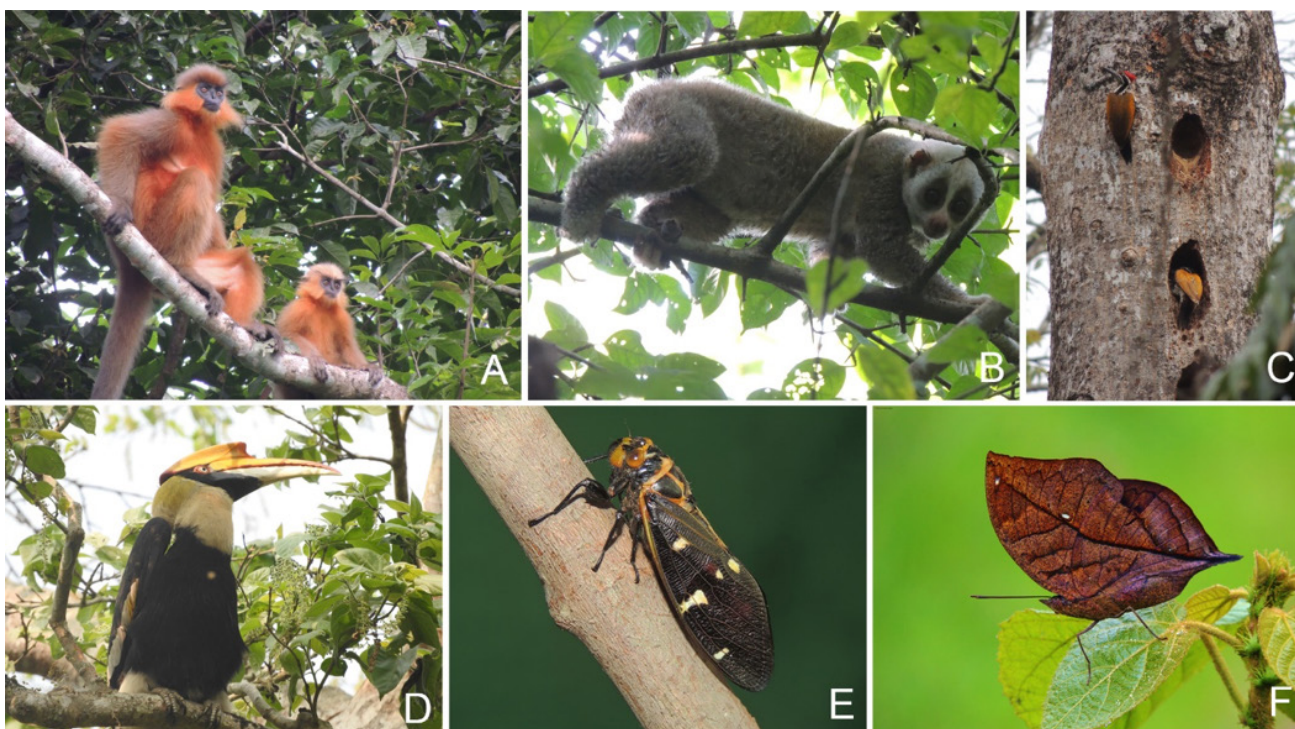
The studies on biodiversity and vegetation structure (Borah et al. 2021) in BRF enriches the floristic wealth of Assam, emphasizing the richness of these semi-evergreen patches in the northern boundary of the state, which are one of the last known representatives of such forests in Assam. Moreover, this forest provides a variety of micro and macro habitats for a varied number of life forms, many of which still remain unexplored.

Archaeological Significance
BRF is also a storehouse of many archaeological relics that provide it a merit of historicity. One of the ancient towns of 14th century built by Boro-barahi kings remains hidden in its dense vegetation. Sculptured palaces, tanks, stone boundary walls, among others can be seen dispersed till now. A heritage that not only evokes legends among the locals but also seeks protection as a part of scattered rich history of the region. Also, a rampart named Rajgarh is one of the many garhs which runs through the BRF, built by the

Ahom king Swargadeo Pratap Singha.

The most attractive historical ruin, Maidam Pukhuri, unaccounted for several decades, is also located in the natural territory of BRF; findings there include a tank built between early 9th to 14th centuries and stone bound borders covering an area of 0.26 ha that remain till this date.

Forest-People Relationship
This forest has an immersive relation with the ethnic communities secured in a collective conscious. These indigenous communities



Some key faunal representative elements of Behali Reserved Forest: A. Capped Langur; B. Bengal Slow Loris; C. Greater Golden-back Woodpecker; D. Great Hornbill; E. *Cicada Balinta octonotata*; F. Orange Oak-leaf. © Parixit Kafley and Ranjit Kakati.

Table 1. List of the mammalian species of BRF.

	Common Name	Scientific Name	IUCN Status	WPA Status (WPA 1972)
1.	Bengal Slow Loris	<i>Nycticebus bengalensis</i>	EN	Sch I (Part I)
2.	Rhesus Macaque	<i>Macaca mulatta</i>	LC	Sch II (Part I)
3.	Assamese Macaque	<i>Macaca assamensis</i>	NT	Sch II (Part I)
4.	Capped Langur	<i>Trachypithecus pileatus</i>	VU	Sch I (Part I)
5.	Asian Elephant	<i>Elephas maximus</i>	EN	Sch I (Part I)
6.	Red Muntjac	<i>Muntiacus muntjac</i>	LC	Sch III
7.	Sambar	<i>Rusa unicolor</i>	VU	Sch III
8.	Hog Deer	<i>Axis porcinus</i>	EN	Sch III
9.	Gaur	<i>Bos gaurus</i>	VU	Sch I (Part I)
10.	Indian Wild Boar	<i>Sus scrofa</i>	LC	Sch III
11.	Pigmy Hog	<i>Porcula salvania</i>	EN	Sch I (Part I)
12.	Tiger	<i>Panthera tigris</i>	EN	Sch I (Part I)
13.	Common Leopard	<i>Panthera pardus</i>	VU	Sch I (Part I)
14.	Indo-Chinese Clouded Leopard	<i>Neofelis nebulosa</i>	VU	Sch I (Part I)
15.	Jungle Cat	<i>Felis chaus</i>	LC	Sch II (Part II)
16.	Leopard Cat	<i>Felis bengalensis</i>	LC	Sch I (Part I)
17.	Fishing cat	<i>Prionailurus viverrinus</i>	VU	Sch I (Part I)
18.	Common Palm Civet	<i>Paradoxurus hemaphroditus</i>	LC	Sch II (Part II)
19.	Binturong	<i>Arctictis binturong</i>	VU	Sch I (Part I)
20.	Small Indian Civet	<i>Viverricula indica</i>	LC	Sch II (Part II)
21.	Large Indian Civet	<i>Viverra zibetha</i>	LC	Sch II (Part II)
22.	Yellow-throated Marten	<i>Martes flavigula</i>	LC	Sch II (Part II)
23.	Crab-eating Mongoose	<i>Urva urva</i>	LC	Sch II (Part II)
24.	Small Indian Mongoose	<i>Herpestes auropunctatus</i>	LC	Sch II (Part II)
25.	Grey Wolf	<i>Canis lupus</i>	LC	Sch I (Part I)
26.	Golden Jackal	<i>Canis aureus</i>	LC	Sch II (Part II)
27.	Wild Dog	<i>Cuon alpinus</i>	EN	Sch II (Part I)
28.	Indian Fox	<i>Vulpes bengalensis</i>	LC	Sch II (Part II)
29.	Himalayan Black Bear	<i>Ursus thibetanus</i>	VU	Sch II (Part II)
30.	Sloth Bear	<i>Melursus ursinus</i>	VU	Sch I (Part I)
31.	Hog Badger	<i>Arctonyx collaris</i>	VU	Sch I (Part I)
32.	Smooth-coated Otter	<i>Lutrogale perspicillata</i>	VU	Sch II (Part II)
33.	Eurasian Otter	<i>Lutra lutra</i>	NT	Sch II (Part II)
34.	Indian Hare	<i>Lepus nigricollis</i>	LC	Sch IV
35.	Hispid Hare	<i>Caprolagus hispidus</i>	EN	Sch I (Part I)
36.	Indian Pangolin	<i>Manis crassicaudata</i>	EN	Sch I (Part I)
37.	Chinese Pangolin	<i>Manis pentadactyla</i>	CR	Sch I (Part I)
38.	House Shrew	<i>Suncus murinus</i>	LC	-
39.	Pigmy White-toothed Shrew	<i>Suncus etruscus</i>	LC	-

	Common Name	Scientific Name	IUCN Status	WPA Status (WPA 1972)
40.	White-tailed Mole	<i>Parascaptor leusura</i>	LC	-
41.	Indian Crested Porcupine	<i>Hystrix indica</i>	LC	Sch IV
42.	Himalayan Crestless Porcupine	<i>Hystrix brachyura</i>	LC	Sch II (Part I)
43.	Black Giant Squirrel	<i>Ratufa bicolor</i>	NT	Sch II (Part II)
44.	Red Giant Flying Squirrel	<i>Petaurista petaurista</i>	LC	Sch II (Part II)
45.	Hoary-bellied Squirrel	<i>Callosciurus pygerthrus</i>	LC	-
46.	Pallas's Squirrel	<i>Callosciurus erythraeus</i>	LC	-
47.	Himalayan Striped Squirrel	<i>Tamiops macclenlandi</i>	LC	Sch IV
48.	Indian Flying Fox	<i>Pteropus medius</i>	LC	Sch V
49.	Greater Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>	LC	-
50.	Black-bearded Tomb Bat	<i>Taphozous melanopogon</i>	LC	-
51.	Greater False Vampire	<i>Megaderma lyra</i>	LC	-
52.	Pipistrelle Bat	<i>Pipistrelle</i> spp.	-	-

inhabit around the boundaries of BRF. More than 50% of these people are dependent on the forest for either sustenance or for maintaining their ethnic identity. Borah et al. (2020b) worked on the Karbi and Munda communities residing in those fringe villages and reported a total of 100 NTFPs procured by them from the forest. Among these, many are categorized as edibles providing nutritional supplement, medicinal plants used to treat the prevalent diseases, and then plants related to their rituals and customs and several other categories. Two plants *Mesua ferrea* and *Gnetum gnemon* were also prioritized in the study as potential NTFPs which if included in effective policies can support these communities boosting their economy and help achieve a sustainable forest management through rehabilitation of degraded forest grounds. The inextricable connection between culture and the ecological diversity is an undeniable phenomenon which supports the notion that Biocultural diversity, a concept that explores close embeddedness of culture,

biology and language, amplifies in the recent times. It is emphasized that language and other cultural elements of these communities bear tremendous 'environmental knowledge' which could be endangered or wiped out completely if their habitat are lost due to their own lack of preservation related awareness or from outside forces like alluring marketing profits (Vidal & Dias 2016). The achievement of perfect balance between needful use and regeneration of forest life, especially plants, is a much sought-after prize.

Challenges

Attempts have been made by the Sonitpur forest department for the protection of this reserve but being severely understaffed, it is unable to effectively monitor the complete forest area. As a result, serious encroachment, illegal tree felling and hunting is rampant in its boundaries. From 1984 to 2021, nearly 57% of forest cover, i.e., a total 79.91 km² was lost due to these cataclysmic destructive activities (Tiwari et al. 2017; Borah & Tangjang 2020).

The northwestern and eastern boundaries were severely affected, whereas the southern boundary and western boundary did not change much due to the fact that these boundaries were continuously monitored because of their easy accessibility and were already surrounded by company tea gardens and the slopes of the river Borgang which acts as barriers. The rapidly declining forest area has posed severe threats on these species and their habitats. Blocking of the well-known elephant corridors (e.g., Kathonibari, Nasbor, and Behali) is another problem for the area, which has escalated man-elephant interactions in recent times.

Also, there are a large number of people involved in the illegal and extensive procurement of firewood. The collected piles are directly sold to the nearby hotels or brick factories; hence, the collectors are bound to provide more firewood for better profit. They cut the new branches of trees while collecting dry wood so that they could continue to find the dry firewood. Such clever plots could result in extensive deterioration of forest regeneration and affecting its structure in a very short period.

It has been a demand for several years to declare it a wildlife sanctuary by Nature's Bonyopran (A non-governmental organization working for Behali Reserved Forest), but no government so far has paid any serious attention to these worried voices (Sekhsaria 2021). Nineteen memorandums have been sent since 1996 by the NGO for its upgradation into a wildlife sanctuary, but their consequences are yet to be seen on the ground.

So far there is no designated protected area in the upper-north bank of the state. Hence there is an immediate need for one to safeguard such biodiversity as well as to provide a safe passage for the migratory species.

Scope of Ecotourism

The forest of Behali has a potential for ecotourism too, where the major attraction would be adventurous trekking inside the dense forest under unending canopies, and birding that would prize some of the most exciting findings; also camping, discovering the exotic and delicious ethnic food culture and experiencing traditional clothing styles with the residential locals.

Some key points to consider its upgradation to a protected area

1. Home for more than 950 species, this semi-evergreen forest is worthy of attention. The importance of this forest in hosting this large sum of biodiversity as well as providing an umbrella for the eco-conscious ethnic communities is a serious matter to look up.
2. The present forest is the last patch of forest in the district which provides ecosystem services such as maintaining water cycle, nutrient cycle, carbon storage, and oxygen requirement, apart from hosting the threatened and local biodiversity. Losing this will seriously hamper all the basic necessities of neighbouring inhabitants and threaten their lives.
3. It is the only forest in Assam where three new plants were discovered for science *Chlorophytum assamicum*, *Aristolochia assamica*, and *Peliosanthes macrophylla* var. *assamensis* and the latter two are so far

only located in this forest. Also, this is the only locality in Assam with the occurrence of rare and endangered *Citrus indica*, *Galeola nudifolia*, *Pandanus unguifer*, and *Tupistra stoliczkana*.

4. White-winged Duck, Bengal Slow Loris, Capped Langur and hornbills are some of the key faunal diversities that attract tourists to visit the area. Apart from these species, several rare varieties of butterflies and birds attract seasonal tourists.

5. The northeastern part of the district comprises grasslands and riparian shrub lands of the recently extended Kaziranga National Park. This allows the migration of several animals through the river banks to this reserve forest. In fact, there is still a chance to recover the habitats for three of the large mammals (One horned Rhino, Asiatic Buffalo, and Royal Bengal Tiger) which were sighted in the reserve till the last decade.

6. Encroachment of land, burning of forests, and hunting of wildlife can still be seen in the border areas of the reserve, which is a very serious concern that brings into question the survival of the forest for more than the next five years. Almost 48% is lost, as a result only 60 km² of intact forest is left of the original notified area of 140 km².

Conclusion

With increasing pressure from humans on all the sides for their specific need and greed, the forest is shrinking very fast losing its important habitats. The local youths and some researchers with the active NGO are trying their best to create mass awareness among the people and control the felonious activities to some extent. These enthusiasts

have been trying to tackle the problem with continuous efforts of repeated surveys, proper documentation and are also trying to grab the attention of the stakeholders and policy makers through publishing research articles, sensitizing the local people and creating a citizens' movement.

However, the problems mentioned above still linger and continue to increase, coupled with the increasing human population and migration, border conflicts, open grazing and land clearing which add to the serious concern for the reserve. With increased awareness on the importance of this habitat and role of the existing biodiversity, there is a chance to save this last forest of the district and its wildlife from being completely perished in a few decades. But the initiatives are to be put into action now since we are already very late, if not too late, to salvage the remaining area of the forest from devastation.

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Dipankar Borah¹, Ranjit Kakati², Parixit Kafley³, Dhananjay Das⁴, Niku Das⁵, Sunayan Borkakati⁶, Nilim Kumar Saikia⁷ & Rupam Bhujel⁸

¹ Department of Botany, Goalpara College, Goalpara District, Assam 783101, India.

² Department of Zoology, Gauhati University, Guwahati District, Assam 781014, India.

¹⁻⁴ Nature's Bonyopran, Bedeti, Biswanath District, Assam, 784176, India.

^{1&5} Department of Botany, Rajiv Gandhi University, Rono Hills, Arunachal Pradesh 791112, India.

^{6&7} Biswanath College, Biswanath District, Assam 784176, India.

⁸ Department of English, Guwahati University, Guwahati District, Assam 781014, India.

Email: dipankarborah085@gmail.com (corresponding author)

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