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Status of human-wildlife conflict in Dibru-Saikhowa National Park of Assam, India

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Abstract

Habitat shrinkage, along with the loss of quality habitat, results in a higher human-wildlife conflict throughout the world. The Dibru-Saikhowa National Park of Assam once consisted of dense semi-evergreen forests, crane brakes, moist deciduous forests, and grasslands, now facing severe anthropogenic pressure that resulted in higher human-wildlife conflict. The study conducted in four suba (sub-village) of Laika and Dodhia villages found that wild buffalo was responsible for the highest degree of conflict (39.8%), followed by elephant 35% and wild boar 23.7% during 2016-17. The Pomuwa suba encountered the highest degree (94.6%) of human-wildlife buffalo conflict, followed by Tengabari suba 68.4%, Pasidiya 65.2%, and Rikbi 10.4%, which was found statistically significant between different subas (χ^2=64.084, p≤0.05). A similar trend was also found in the case of human-elephant conflict, which was also found significant between different subas (χ^2=83.829, p≤0.05). Although the extent of conflict was comparatively less, the Tengabari suba encountered the highest human-wild boar conflict and Rikbi suba human-leopard conflicts, which were also found to be statistically significant. However, crop depredation forms the major concern of human-wildlife conflict as compared to other kinds of conflict. The overall extent of conflict indicates that the Pomuwa suba is the highest sufferer as compared with other subas. A landscape-level policy and its proper execution along with timely disbursement of ex-gratia may help in mitigating human-wildlife conflict.

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Introduction

Human-wildlife conflict (HWC) is of major concern in the world and Asia in particular due to the increase in human population and pressure on the protected areas (PAs). As per IUCN (2005), HWC is a circumstance that happens when the fundamental necessities of wildlife interfere with those of people, creating negative consequences for both communities and the wildlife population. With the increase and spread of human settlements, changing land use and natural habitats, a significant part of the world, wildlife has become more confined to small fragmented patches within a milieu of human-dominated landscapes (*McCloskey* and Spalding, *1989*; Laurance and Bierregaard, 1997). Previous studies from all over the world exhibit the seriousness of the conflict and propose that more prominent analyses of such conflicts are required to avoid viewing the issue and undermining the conservation of threatened and potentially endangered species (Distefano, 2005). Loss of functionality of PAs from encompassing area land use modification is a serious problem in developing nations. The resources, mainly forest resources, are more critical to local people living nearby PAs in the developing world as their livelihoods are often more directly reliant on the land (Hartter and Southworth, 2009).

The increasing population pressure has led to large-scale human settlement in the forest areas of the park and many cows and buffalo *khutis* for dairy have come up in the forest area. Large-scale alteration of forest lands, including woodlands and grasslands for agricultural cultivation, minimizes the habitat needed for wildlife. This has resulted in frequent conflict between humans and wildlife. In Dibru-Saikhowa National Park (DSNP), HWC is a common phenomenon that conflict occurs mainly with elephants, leopards, wild boars and wild buffaloes. Besides human habitation, the inhabitants of the villages cultivate their agricultural lands in distant areas due to the high density of livestock population. Due to the proximity of agricultural lands to the forest areas, crop-raiding incidents mainly occur before crop harvesting seasons. This has resulted in frequent conflict between humans and wildlife. As no study on this aspect has been undertaken to date, the present study aimed to find out the extent of human-wildlife conflict in and around DSNP, Assam.

## Materials and methods

Study area

The DSNP (also categorized as Biosphere Reserve) is located (27°34'0" N - 27°47'37" N   95°7'54" E - 95°35'56" E) in Tinsukia and Dibrugarh districts in eastern Assam, India (Choudhury, 2006). The park is located about 13 km north of Tinsukia town. In 1986, the Dibru and Saikhowa Reserved Forests were combined and declared as a wildlife sanctuary which later upgraded to a national park in the year 1999 (Choudhury, 2006). However, its Eco-Sensitive Zone (ESZ) was demarcated in the year 2020 with a periphery ranging from 0 km to 8.7 km from the boundary covering 658.251 km² areas (DSNP, 2020). The entire area lies at an average altitude of 118m above MSL (Kalita, 2015). The administrative boundary of DSNP is divided into two forest ranges, i.e., Guijan and Saikhowa forest range.

It falls in the Indo-Burma Global Biodiversity Hotspot (Myers *et al.*, 2000) and the Assam Plains Endemic Bird Area (Stattersfield *et al.*, 1998). The climate of Dibru-Saikhowa is tropical monsoon with a hot and wet summer and a cool and usually dry winter.

The annual rainfall ranges from 2300mm to 3800mm (Sen, 2015). The main rainy months are April-September, with its peak of monsoon reached during the months of July-August. The annual temperature of the area ranges from 7° C to 34° C, where June-July is the hottest and December-January are the coolest months. The park harbours a total of 808 faunal species, which includes 503 (62.25%) species of birds, 42 (5.18%) species of reptiles, 37 (4.53%) species of mammals, 17 (2.10%) species of Amphibian, 104 (12.87%) species of fish and 105 (12.99%) species of butterflies among invertebrates. The present study was undertaken inside the national park boundary (Fig. 1). For this, four suba (Rikbi,

Pasidiya, Pomuwa and Tengabari) were surveyed out of seven suba from forest villages of Laika and Dodhia. These two villages were considered as the forest village at the time of declaration of Dibru-Saikhowa Wildlife Sanctuary in 1986 but excluded when the forest area was upgraded into a national park (Madhusudan and Bindra, 2013). The original Laika village was further subdivided into three and Dodhia into four sub-villages or suba. Dodhia village lies on the western and southwestern part of the national park and Laika village on the northwestern part along the south bank of Brahmaputra River.
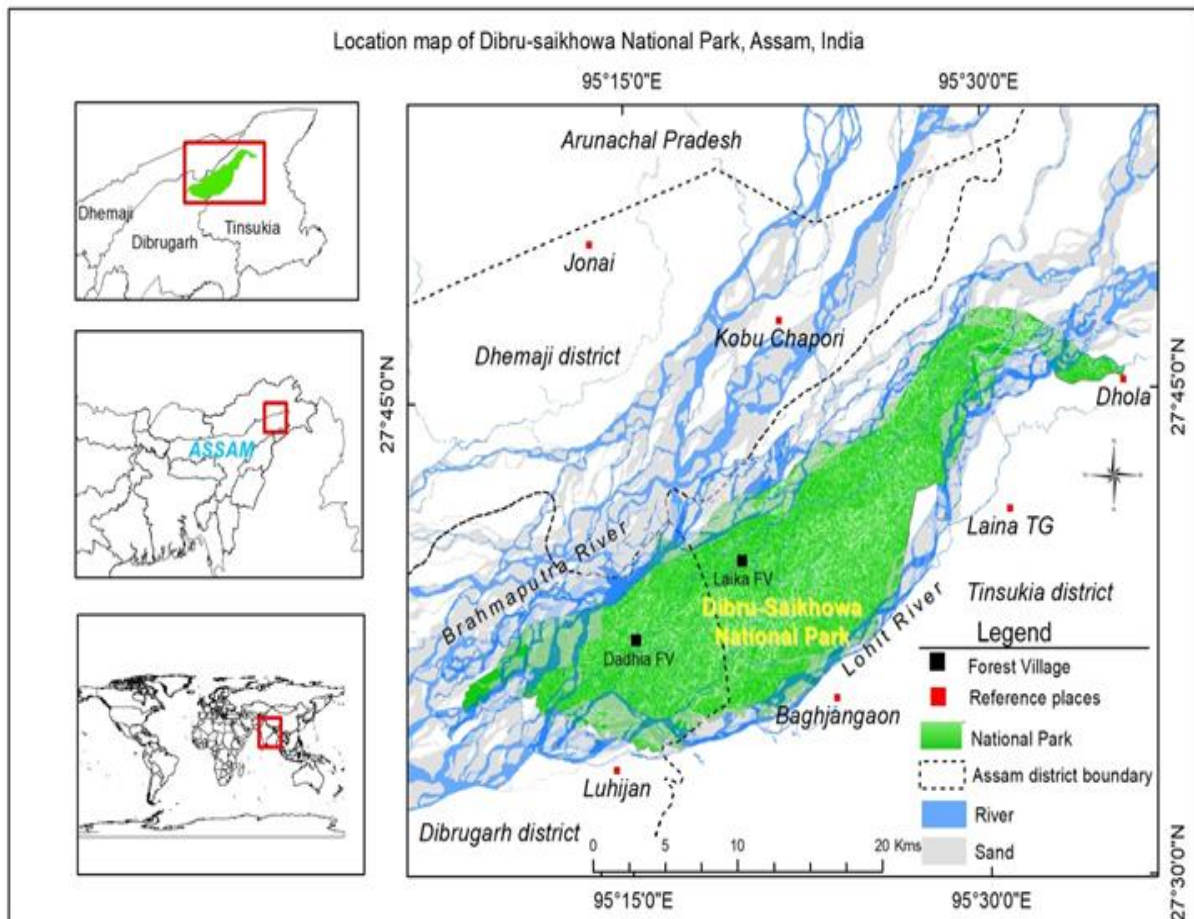
Fig. 1. Map of Dibru-Saikhowa National Park showing the locations of study villages.

The houses of Mishing communities (Chang ghar in Assamese) near to river bank shifted at certain intervals due to river erosion and heavy siltation, mainly by the Brahmaputra River and other tributaries. The majority of the people from Laika and Dodhia belong to a missing community with few families of tea tribes. In 1951-52, there were 75 households in Laika Forest Village, and in 1956-57, Dadhia FV were 90 households. In 2011, about 406 households were comprised of 2669 population size in Laika forest village and 570 households comprising 3379 population bion in Dodhia Forest Village (DCOA, 2011), which increased to 578 households with a population of 3022 in Laika FV and 956 households with a population of 3843 in Dadhia during 2019 (DSNP, 2019).

Methodology
The primary socio-economic data were collected from selected *suba* (neighborhood according to local Assamese language) of Laika and Dodhia villages dominated by missing indigenous communities present in the core area of the national park.

The primary data collected from each selected *suba* broadly includes the various aspect of human-wildlife conflicts like species involved in the conflict, crop depredation and cattle lifting, injury, and deaths.

In a sensitive protected area like DSNP, the collection of socio-economic data was challenging. At the initial stage, an informal discussion was held with the village head about the study, and accordingly, during the early morning, a village crier walked around the village and an announcement was made for a community level meeting at the residence of the village head during the evening hour (Nojang and Jensen, 2020). The majority of the local people of each *suba* had agreed on the study and were allowed to carry out the data collection. Unfortunately, they did not allow for random sampling rather forced to visit every family of *suba*.

The primary data were collected through a structured schedule from three *suba* of Laika village and one *suba* of Dodhia village (Mathers *et al.*, 2007). GPS (Garmin 64s) was used to record the positional latitude and longitude of each family house for more authentications of the data during the field study. The chi-square test was used to test the significant difference at p<0.05 level among different variables. Data was analysed with the help of SPSS (version 20) to compute the results.

Results

Species involved in the conflict

The study found that elephants (*Elephus maximus*), leopards (*Panthera pardus)*, wild boar (*Sus scrofa*), and wild buffalo (*Bubalus arnee*) are the species involved in human-wildlife conflict. Interestingly, wild buffalo was found for the highest degree of conflict (39.8%), followed by elephant 35% and wild boar 23.7%. However, very occasional cases of conflict were done by leopards (0.7%) and primates (0.1) (Fig. 2). There was a significant difference between the species involved in the conflict as depicted by the chi-square test (χ^2=36.545, p≤0.05).

Table 1. Overall status of human-wildlife conflict (HWC) in the study area.

Name of Suba	Number of families lived in each Suba	Experienced in human-wildlife conflict	
		No. of families	%
Rikbi	115	30	26.1
Pasidiya	279	188	67.4
Pomuwa	462	446	96.5
Tengabari	155	112	72.3
Total	1011	**776**	

Status of human-wild Asian water buffalo conflict

The wild buffaloes are very ferocious and often reported to chase the villagers once they encounter them. Since a higher number of wild buffalo populations are there in the eastern and central parts as there are large patches of grasslands, the villages which are located at the eastern periphery received a comparatively higher degree of human-wild buffalo conflict. Wild buffaloes also often entered into the agriculture areas mainly for paddy fields and raided crops. It was found that out of a total of 1011 families of four suba, 437 families of Pomuwa suba encountered the highest degree (94.6%) of conflict, followed by Tengabari suba 68.4%, Pasidiya 65.2%, and Raiki 10.4% (Fig. 3). Statistically, the extent of human-Asiatic wild buffalo conflict differs between different subas under the study (χ^2=64.084, p≤0.05).

Human-elephant conflict

As the entire forest patch is highly degraded due to continuous illegal felling and encroachment by the local people for their livelihood resulted in a higher degree of human-elephant conflict (HEC) in the study area. It was found that the degree of conflict with elephants was highest in Pomuwa (96.5%), victimized 446 families followed by 69.0% with 107 families in Tengabari, Pasidiya 34.4% with 96 families, and Rikbi village 10.4% with 10 families respectively (Fig.4).

A significant difference in the HEC between different subas was also observed (χ^2=83.829, p≤0.05).

Human-wild boar conflict

Human-wild boar conflict (HWBC) was reported from all the study villages. Wild boars often come out of the

forest areas in groups to the agricultural fields for raiding crops and vegetables. Wild boars were reported to raid potatoes and vegetables. It was observed that Tengabari suba encountered the highest conflict incident with wild boar (63.9%), followed by 47.0% in Pasidiya, 43.1% in Pomuwa, and 9.6% in Rikbi (Fig. 5). HWBC between different subas also differs statistically (χ^2=37.317, p≤0.05).
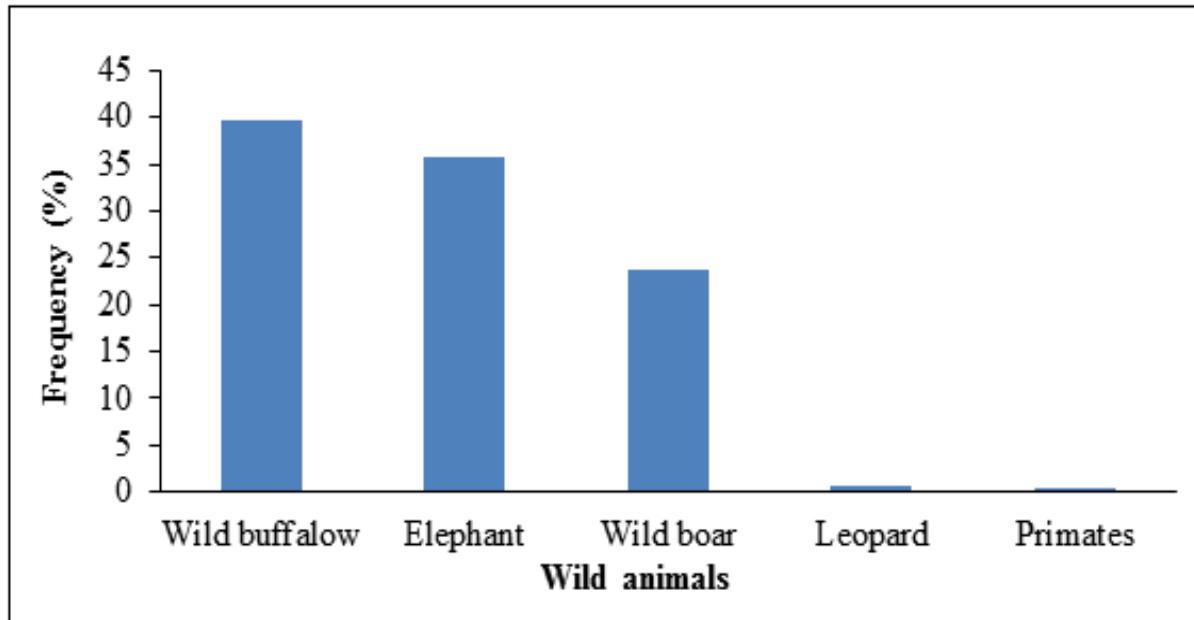
Fig. 2. Species involved in the conflict in the study area.

Human-leopard conflict

In Dibru-Saikhowa NP, the conflict between humans and leopards (HLC) was low as compared with other wild animals. Occasionally, leopard kills cattle from the villages during the night. As the forest patch is comparatively bigger, there is an available prey base like deer, monkeys, etc. Hence the intensity of cattle lifting by a leopard is comparatively less. However, few cattle lifting cases (like a cow, domestic buffalo, goat, etc.) were reported, which were preyed on during grazing inside the forest. Leopards generally avoid coming into human settlement areas except for some isolated houses that have such experience. Out of 1011 families in four selected suba, only 13 families reported conflict with leopard. As Rikbi is located near the forest areas, more conflict with the leopard was reported as compared to Pasidiya (Fig. 6). The Chi-square test also revealed a significant difference in HLC between different subas under study (χ^2=6.250, p≤0.05).
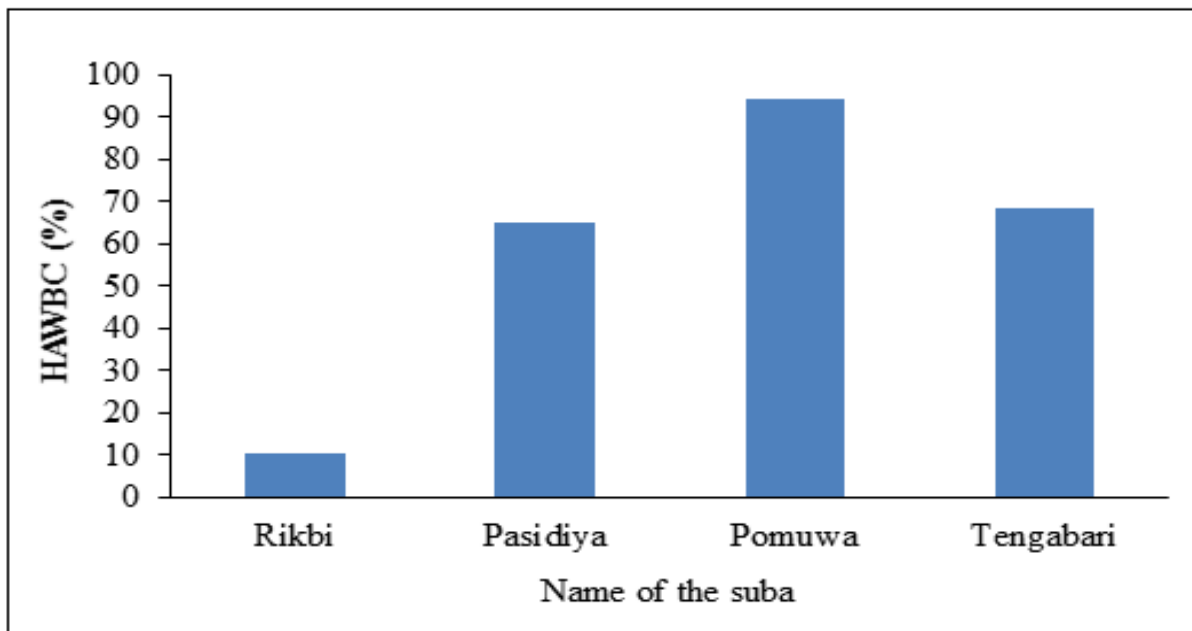
Extent of conflict

Pomuwa has reported the highest degree (96.5%) of human-wildlife conflict followed by Tengabari 72.3%, Pasidiya 67.4%, and 26.1% in Rikbi village, respectively (Table 1). Statistically, there was a significant variation in HWC between different subas under the study (χ^2=39.649, p≤0.05).

Overall data indicates that the villagers of the study area mostly (74.5%) incurred economic loss due to a higher degree of crop damage as compared to cattle lifting (Fig. 7). The intensity of cattle lifting and death (both human and wild animal) was comparatively very less. There must be some incident of human and wild animal injury during the study period, which was not reported by the villagers. Village wise crop depredation showed that the highest (96.3% of the 445 families) crop-raiding incidents occurred in Pomuwa followed by Pasidiya (67.4% among 188 families), Tengabari (65.8% of the 155 families), and Rikbi (15.7% out of 18 families) (Fig. 8).

A statistical difference was found in the crop-raiding incidents between different subas during 2016-17 (χ^2=54.053, p≤0.05).

Fig. 3. The extent of human-Asiatic wild buffalo conflict in the study villages during 2016-2017.

The majority of fields are concentrated on the southern parts of Laika forest villages and eastern and southern parts of Dodhia forest villages. Due to annual floods, siltation took place over paddy fields, mostly in Dodhia forest village. With population pressure and siltation caused by heavy floods, new forest areas have been converted into agricultural fields. Therefore, the agricultural field, which area located in very close proximity to the forest area found to be higher crop-raiding incidents.
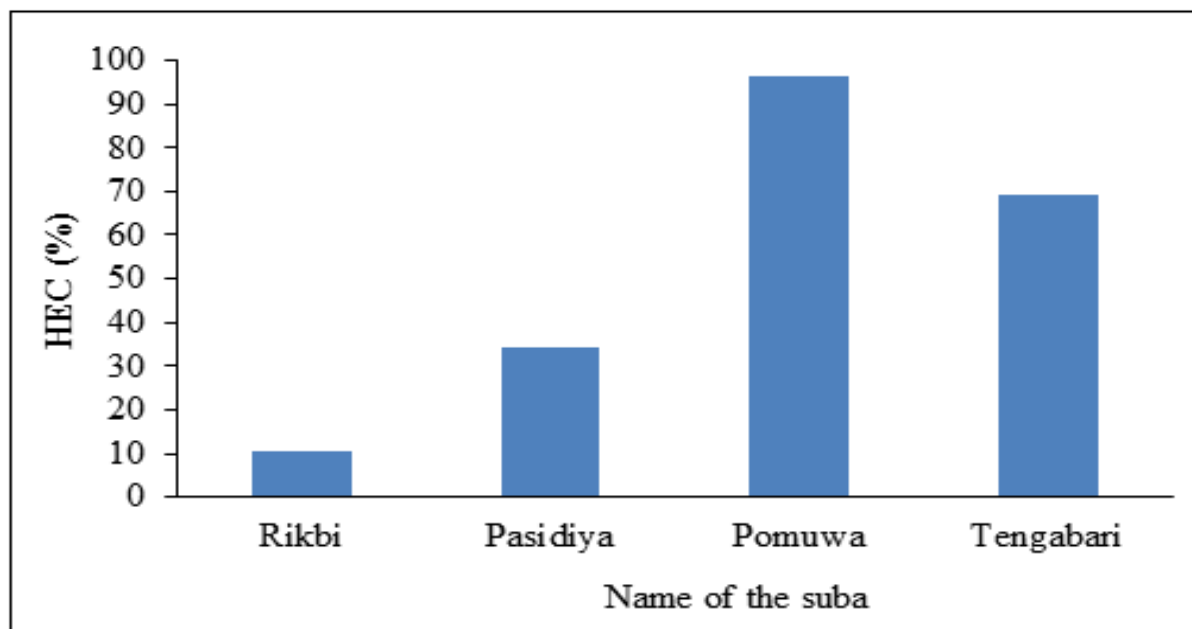
Fig. 4. The extent of human-elephant conflict in the study villages during 2016-2017.

Discussion

Reducing conflict between humans and wildlife is considered a top conservation priority, particularly in landscapes where high densities of people and wildlife co-exist (Treves and Karanth, 2003; Dickman *et al.,* 2010). Increased visibility for conflict incidents may be attributed to an actual increase in incidents taking place or just greater reporting by affected local people

(Dickman *et al.,* 2010.) A dearth of knowledge about conflict loss and compensation distribution contributes to the poor allocation of conservation resources (Linkie *et al.,* 2007; Macdonald *et al.,* 2008). Failure to address emerging issues with conflict losses may lead to escalation of tensions between people and wildlife and promote retaliatory actions leading to extirpations of species at the local level (Bulte and Rondeau, 2005; Martin *et al.,* 2011; Treves *et al.,* 2011).
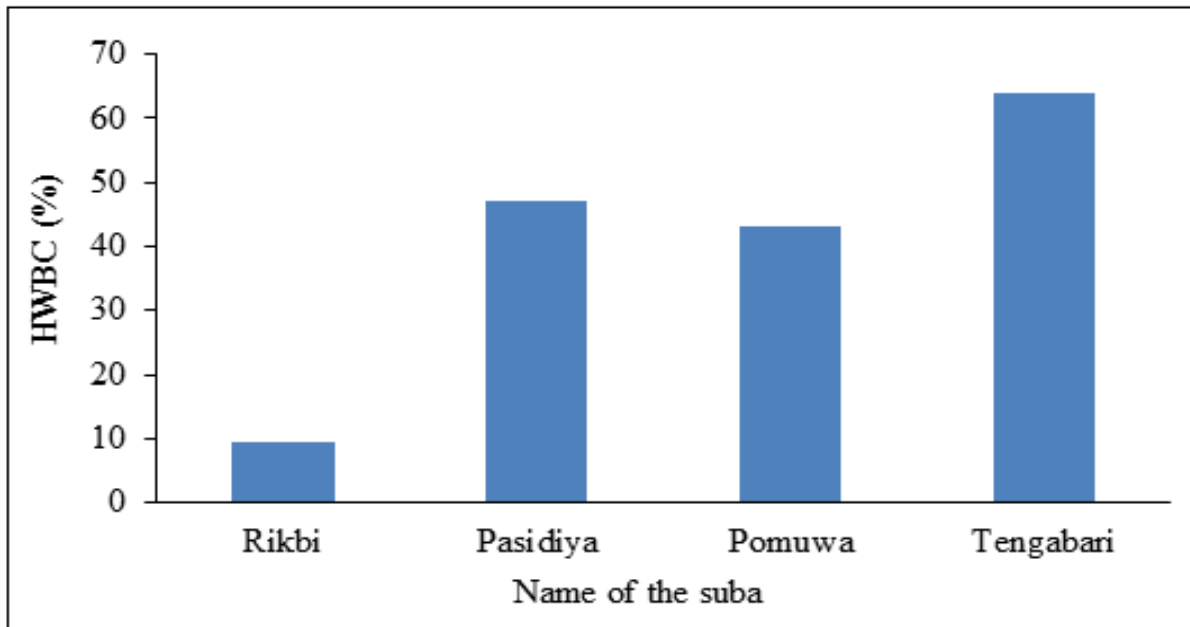
Fig. 5. Extent of human-wild boar conflict in the study villages during 2016-2017.

Crop raiding by elephants, wild boar, and wild buffalo is a common phenomenon in the study site. The people are habituated with the wildlife conflict. The human-leopard conflict is also common in some of the villages. Leopard kills their cattle's mostly cow, buffalo, and goat, which results in conflict. The human-wild boar conflict is common in the study area.
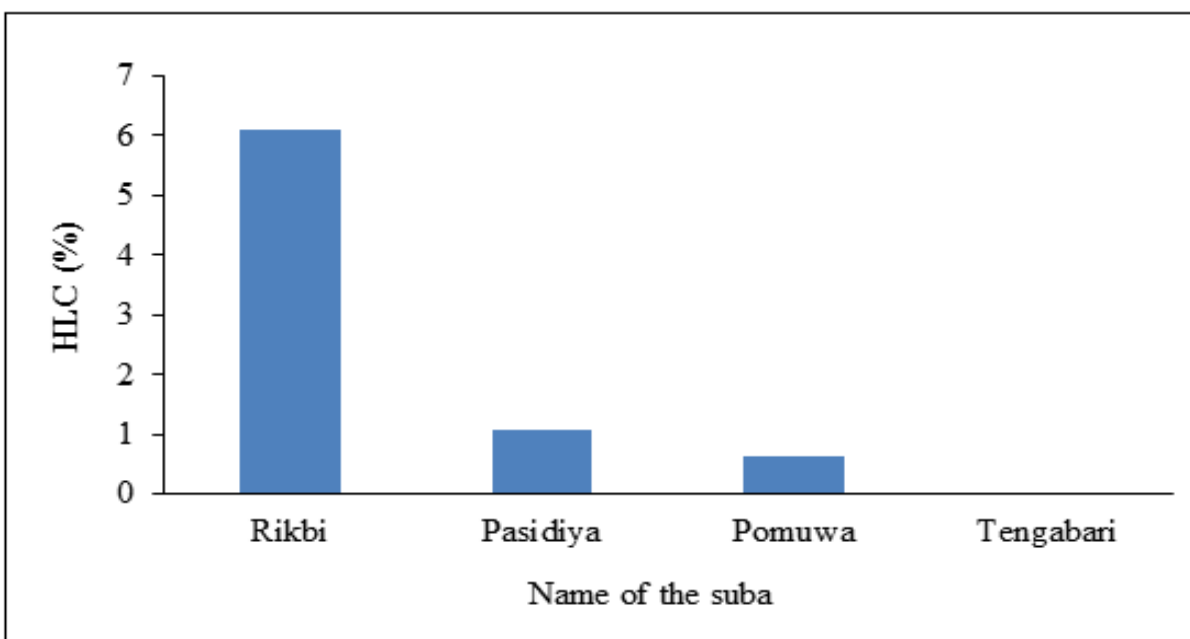
Fig. 6. The extent of human-leopard conflict in the study villages during 2016-2017.

The wild boar raided the vegetables of the village people. NE India is the home to more than 10,000 wild elephants, around 25% of the world's elephant population. With the decrease in forest cover due to human population growth and developmental activities, the conflict increased; more than half of the elephants' habitat has been lost since 1950 (Choudhury, 1999). Therefore, crop-raiding by elephants is a common occurrence in and around this park-like other parts of northeast India (Das *et al.*,

2011, 2012; Bhattacharya *et al.*, 2017, 2018; Sarkar *et al.*, 2017; Choudhury *et al.*, 2019; Talukdar and Choudhury, 2020; Borah *et al.*, 2021). During the paddy season, for example, many elephants travel to the plains of Assam and remain at the edge of the forest for a few weeks. Among the *jhumiyas* (i.e., shifting cultivators) and the individuals living in the hilly areas, human-elephant conflicts occur when the elephants raid their crops, which are scattered over a large area of fields interspersed with forests.
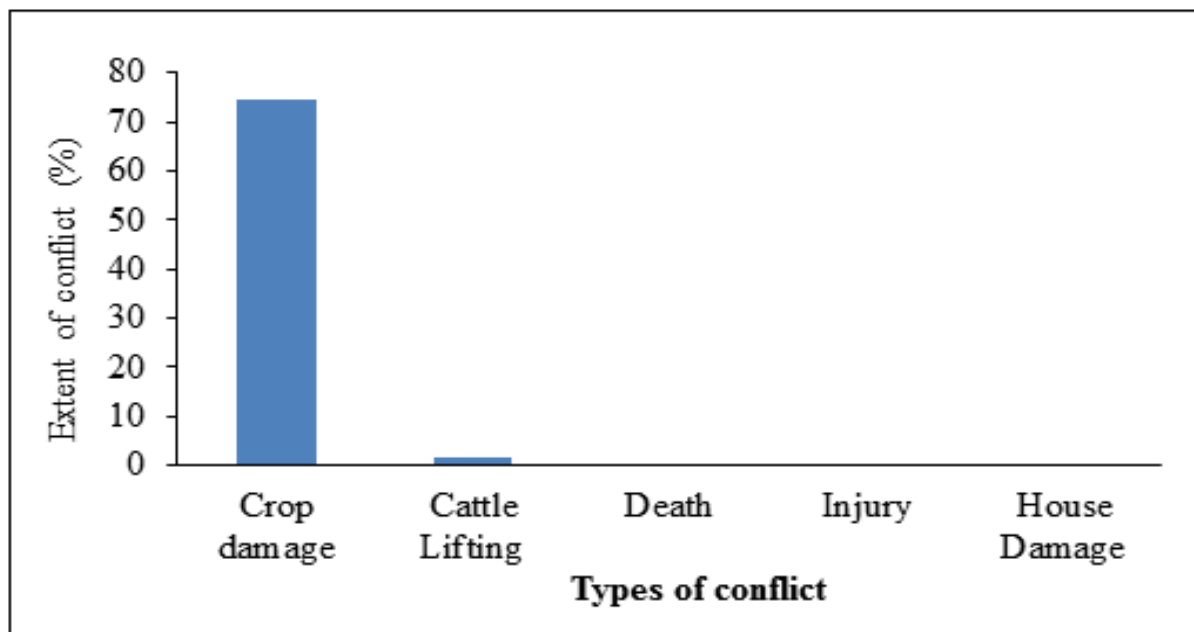
**Fig. 7.** Comparative aspects of conflict types in the study area during 2016-2017.

Depredation in human settlements is another major area of human-elephant conflict. Most of these conflicts, however, occur in small forest pockets, encroachments in elephant habitats, and on elephant migration routes. The conflict between man and elephant has developed simultaneously for both humans and elephants due to their growing population and consequently growing needs. Frequent invasion into each other's territory by the humans and the elephants has become a common practice in the region. It has been observed that especially during the pre-harvesting period of paddy and other crops, elephant crop-raiding and damage incidents occurred. To minimize the agricultural loss from elephant crop-raiding, the people mostly built high-rise platforms on the branches of trees and guard their agricultural fields during the night.

On the other hand, leopard management in India is facing many challenges. Leopards have highly diversified diets and are extremely adaptable to various ecological conditions (Daniel, 1996; Hayward *et al.*, 2006). This versatility allows them to thrive in a broad range of habitats, often bordering on human settlements. In recent years, the presence of leopards has been increasing in a wide range of rural and even built-up environments; forests removed from natural habitats and protected areas. Although leopards have shown a remarkable ability to live relatively peacefully close to people, conflicts can and do occur, with leopards killing livestock and, in extreme cases, people. Due to fear and anger, many affected persons retaliate by injuring and killing leopards (Karanth and Madhusudan, 2002) and demanding that authorities take action. Because Indian law prohibits

the killing of schedule-1 species, responses have been confined to removing the animal to captivity or translocation it to a new area. Holding animals in captivity is expensive and is associated with many welfare issues. The success of translocation is under much discussion as there is no available habitat and emerging data indicate that translocation may lead to an increase in serious conflicts (Athreya, 2006).
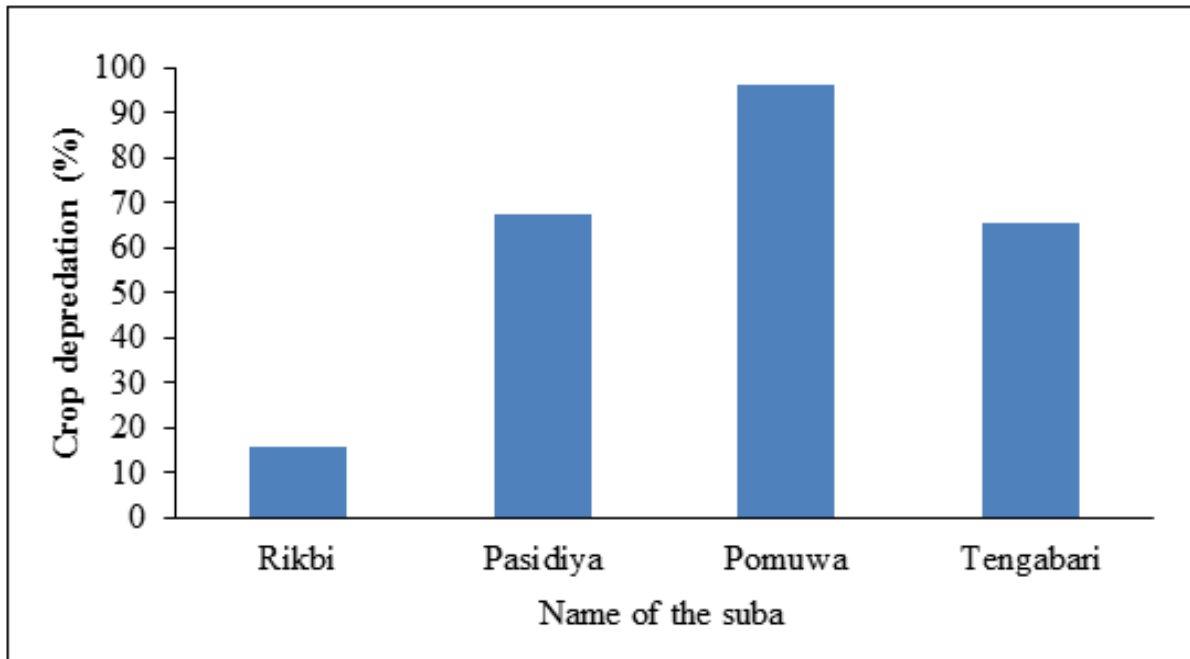
Fig. 8. Crop raiding incidents in the study villages during 2016-2017.

DSNP is the home of Asiatic wild water buffalo due to the availability of suitable habitats. The presences of tall and short grasses are the grazing grounds for the wild buffaloes. The presence of wetlands and swampy areas are best suitable for the species. In recent times human pressure in terms of poaching of the animal has drastically lowered the population of wild buffaloes. It has been observed that the presence of large numbers of small and big buffalo *khutis* in and around DSNP results in pressure on the natural habitat of the wild buffaloes.

It has been observed that a wild buffalo bull occasionally comes to these *khutis* in the attraction of female buffaloes during their mating period.

Therefore, preventing conflict and timely and prompt disbursement of compensation are the important initiative in fostering co-existence in landscapes that surround protected areas and function as critical buffers for wildlife (Madden, 2004; Defries *et al.,* 2010; Karanth *et al.,* 2010).

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