

STATUS OF PHAYRE'S LANGUR *Trachypithecus phayrei* IN SATCHARI NATIONAL PARK, BANGLADESH

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ABSTRACT

We studied the population status of Phayre's Langur in Satchari National Park, Bangladesh, and threats to this population, from January to December 2016. We recorded 23 individuals in three groups. Group size ranged from four to 12 (mean 7.7 ± 4.0) individuals; all groups contained a single adult male, 1–4 females and 2–7 immature individuals (subadults, juveniles and infants). Habitat encroachment for expansion of lemon orchards by the Tipra ethnic community and habitat degradation due to logging and firewood collection are the main threats to the primates. Road mortality, electrocution and tourist activities were additional causes of stress and mortality. Participatory work and awareness programmes with the Tipra community or generation of alternative income sources may reduce the dependency of local people on forest resources. Strict implementation of the rules and regulations of the Bangladesh Wildlife (Security and Conservation) Act 2012 can limit habitat encroachment and illegal logging, which should help in the conservation of this species.

Key Words: Group composition, habitat encroachment, Satchari National Park.

INTRODUCTION

Phayre's Langur (Phayre's Leaf Monkey, Spectacled Langur) *Trachypithecus phayrei* (Blyth) occurs in Bangladesh, China, India and Myanmar (Bleisch et al., 2020). There are two sub-species, the Bengal Phayre's Langur *T. p. phayrei* (Blyth) and the Shan States Phayre's Langur *T. p. shanicus*, (Wroughton), both of which are Endangered globally (Roos et al., 2014). *Trachypithecus p. phayrei* is restricted to eastern Bangladesh, northeastern India (Assam, Mizoram and Tripura states) and western Myanmar (Roos et al., 2014). *Trachypithecus p. phayrei* is listed as Critically Endangered in Bangladesh as its population has declined by over 80% over the last three generations due to habitat destruction (IUCN Bangladesh, 2015). In Bangladesh, Phayre's Langurs occur in mixed evergreen forests and adjacent plantations, especially bamboo groves, in Sylhet and Chittagong districts, and Chittagong Hill Tracts (IUCN Bangladesh, 2015). They also occur in mixed-species plantations and at lower densities in monoculture teak plantations (Gupta, 1997).

Green (1978) first confirmed the presence of Phayre's Langur in Bangladesh. Gittins & Akonda (1982) extrapolated that there were 1,300 individuals in Sylhet division (northeastern Bangladesh). Khan & Ahsan

(1986) recorded 15 Phayre's Langur groups comprising 205 individuals in the north-east and south-east of Bangladesh. Molur et al. (2003) estimated that less than 100 individuals persisted in Bangladesh based on a study in only two protected areas (Lawachara National Park and Rema-Kalenga Wildlife Sanctuary) in northeastern Bangladesh. However, Ahmed et al. (2020) recorded 376 individuals of Phayre's Langur in five protected areas in northeastern Bangladesh, of which more than 150 were mature individuals. The IUCN estimates that <50 mature individuals persist in each subpopulation in Bangladesh (IUCN Bangladesh, 2015; Molur et al., 2003). However, no comprehensive surveys have yet been done in several potential habitats for Phayre's Langur in Bangladesh. Here, we report the results of the first surveys conducted to determine the group composition and age-sex structure, and to identify the principal threats to the Phayre's Langur population in Satchari National Park.

METHODS

Study area

Satchari National Park (SNP) is a small forest patch (243 ha) in northeastern Bangladesh, located ca.

130 km northeast from the capital city of Dhaka in Chunarughat Upazilla (subdistrict) of Habiganj District (Fig. 1). The word “Satchari” refers to the “seven streams” (locally called “chara”) which flow through the forest (Mukul, 2007). SNP is a semi-evergreen forest (Choudhury et al., 2004) bordered by nine tea estates, rubber plantations, agar plantations, villages, and cultivated fields (Mukul et al., 2017) and is adjacent to the international boundary with Tripura in India. The village named ‘Tiprapara’, a Tripura tribal community of about 24 households, is inside the park (Mukul, 2007), and 18 additional villages are located six to eight kilometres from the park (Mollah et al., 2004). This forest forms a part of the transition zone between the Indian subcontinent and the Indo-Chinese ecological region (Sharma et al., 2005). The area occupies the higher ridges of the northernmost extension of the Dumatila, Tipam and Surma sedimentary rocks, extending from

the Chittagong Hill Tracts through Tripura in India (Al-Razi et al., 2020). The park has undulating topography with slopes and 10-50 m hillocks, locally called *tila*, running from south to north. These slopes are composed of upper tertiary rocks in which sandstones are dominant (Mukul, 2007; Arefin et al., 2011).

The protected area includes 120 ha of primary forest and 90 ha of secondary forest (Mukul et al., 2017). An oil palm *Elaeis guineensis* Jacq. plantation was established on 24.7 ha of the protected area in the mid-1970s (Choudhury et al., 2004; Mukul et al., 2017). A total of 245 wild and cultivated plant species in 183 genera and 72 families have been recorded in the park (Arefin et al., 2011), including 86 species of herbs, 46 shrub species, 73 tree species, 37 species of climbers, and three species of epiphytes (Arefin et al., 2011). Moraceae (18 species) and Poaceae (12 species) are the dominant families (Arefin et al., 2011).

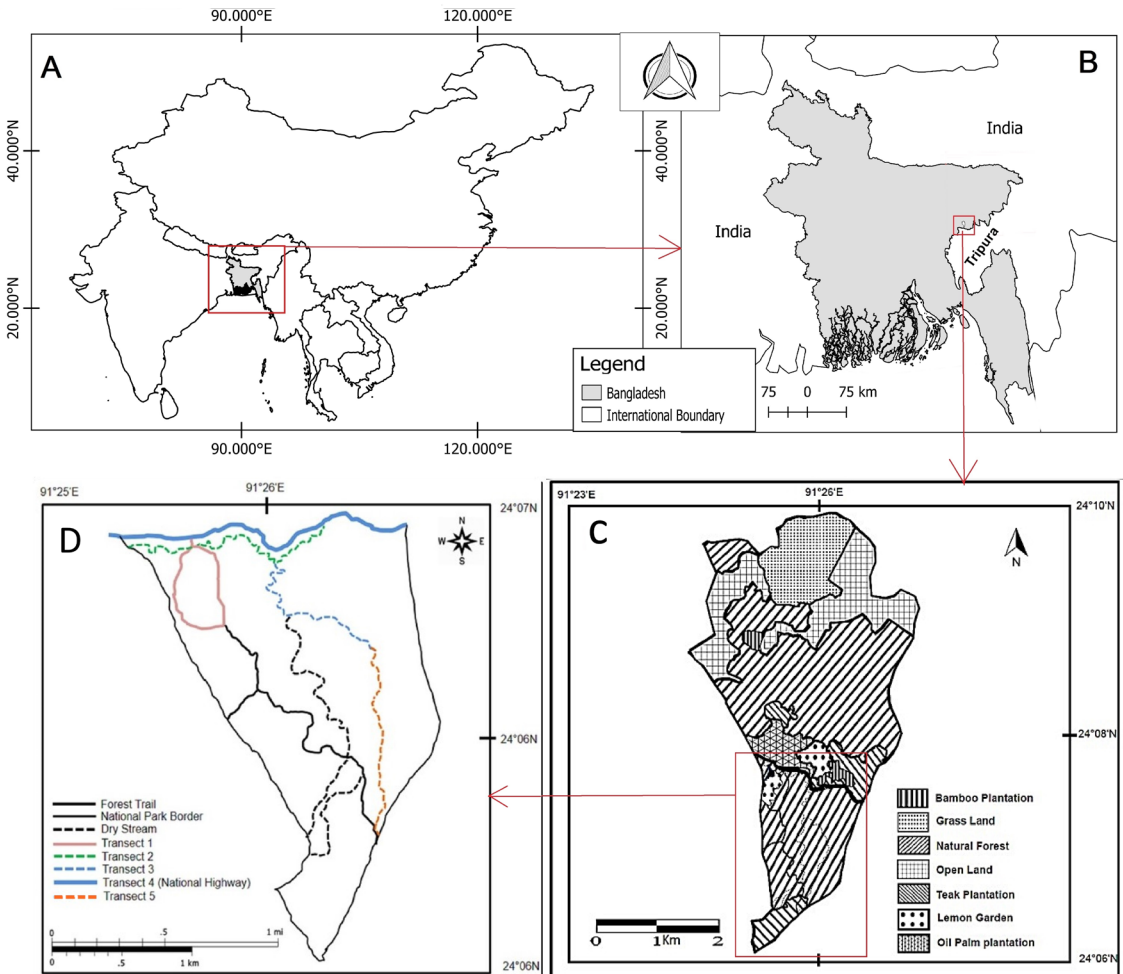


Fig. 1. Satchari National Park, and vegetation types and location of transects in the study area.

Seven plant species that are threatened in Bangladesh, *Amomum aromaticum* Roxb. (Zingiberaceae), *Aquilaria agallocha* Roxb. (Thymeliaceae), *Cymbidium aloifolium* (L.) Sw. (Orchidaceae), *Globba multiflora* Wall. ex Baker (Zingiberaceae), *Holigarna caustic* (Dennst.) Oken (Anacardiaceae), *Rauvolfia serpentine* (L.) Benth. ex Kurz (Apocynaceae) and *Stuednera colocasiodes* Hook. f. (Araceae), occur in the national park (Arefin et al., 2011). One threatened tree fern, *Cyathea gigantean* (Wall. ex Hook.) Holttum, and a threatened gymnosperm, *Gnetum oblongum* Markgr. were also recorded (Arefin et al., 2011). The most common trees are *Lagerstroemia speciosa* (L.) Pers., *Tectona grandis* L.f., *Xylia xylocarpa* (Roxb.) Taub., *Artocarpus chama* Buch.-Ham., *A. lacucha* Buch.-Ham., *Dipterocarpus* spp., *Terminalia bellirica* (Gaertn.) Roxb., *Syzygium* spp., *Ficus* spp., and several bamboo and rattan species. Of the ten primate species that occur in Bangladesh, six (Rhesus Macaque *Macaca mulatta* [Zimmermann], Northern Pig-tailed Macaque *M. leonina* [Blyth], Bengal Slow Loris *Nycticebus bengalensis* [Lacépède], Western Hoolock Gibbon *Hoolock hoolock* [Harlan], Phayre's Langur *Trachypithecus p. phayrei* and Capped Langur *T. pileatus* [Blyth]) persist in this small area (Mukul, 2007; Al-Razi, 2017). Forest villagers, local people, and tea estate labourers depend on resources such as fuelwood and illegally harvested timber from Satchari National Park for their livelihoods (Mukul, 2007; IPAC, 2009). Several wild faunal and floral species have disappeared from SNP, and many more are declining or on the verge of disappearing due to habitat destruction, poaching and over-exploitation (Bangladesh Forest Department, 2016). Livestock grazing, cane and exotic tree plantations

and visitor pressure are additional threats to this forest (Bangladesh Forest Department, 2016).

Data collection

We conducted surveys on 44 days (435 h) from January to December 2016 using the line transect method (Naher & Khan, 2018; Brockelman & Ali, 1987). We established five different transects along existing forest trails, dry streams and on the Dhaka-Sylhet highway (Table 1, Fig. 1). We repeatedly surveyed the transects (Table 1). When a langur individual or group was encountered, we recorded the time, GPS (Garmin eTrex 10) location of the observer at the time of observation (for later calculation of the precise locations of the individuals or groups), and the group size and composition, as well as signs of human disturbance such as woodcutting, grazing, logging, cultivation, bamboo collection (which was illegal), firewood collection, forest fires, and trampling. We counted all group members and classified the langurs as adult males (AM), adult females (AF), sub-adults (SA), juveniles (Juv) or infants (Inf), based on the morphological characters for each age-sex class described by Choudhury (1987), Bhattacharya & Chakraborty (1990) and Gupta (2001). Local forest guides helped identify plant species using the local Bengali name, and a botanist subsequently confirmed the English common and scientific names.

In addition to direct observation, a questionnaire survey was conducted in the study area to determine the threats to Phayre's Langur. Using a semi-structured questionnaire, we interviewed forty people who regularly visited the forest for their daily needs. For each respondent, we recorded age, sex, education

Table 1. Lengths of transects and their vegetation types in Satchari National Park.

Transect no	Transect length (km)	Type of transect	Vegetation	Group recorded	Frequency of transect walks (times/transect)
1	1.64	Human-made trail	Lemon garden, tea garden, higher canopy mixed vegetation	A	12
2	2.1	Human-made trail	<i>Bambusa</i> spp. and <i>Ficus</i> spp. dominant	A, B	9
3	1.4	Dry stream	<i>Bambusa</i> spp. dominant, dense secondary mixed forest	B	13
4	1.74	Highway	Secondary mixed forest, mixed teak forest, agarwood plantation, oil palm plantation	B	16
5	1.0	Dry stream	<i>Bambusa</i> spp. dominant and dense mixed secondary forest	C	9

status, religion, occupation, resources exploited from the forest, and quantity and frequency of exploitation of resources. Focal group discussion (FGD) and knowledge, attitude and practices (KAP) studies were performed in a tea stall in the park to collect information regarding their dependency in the forest. We also interviewed forest staff about threats to the habitat of Phayre's Langurs.

RESULTS

Population and group size

We recorded the presence of 23 individual Phayre's Langurs in three groups (Table 2). Group size ranged from four to 12 individuals (mean 7.7 ± 4.0 ; Table 2;

Fig. 2). The largest group (Group A) was observed in bamboo bushes and areas dominated by *Artocarpus chama*, *A. lacucha* and *Tectona grandis*. The smallest group (Group B) was only observed near Trail Three, where *Bambusa* spp., *A. chama*, *A. lacucha* and *L. speciosa* were dominant. Group C was recorded where *T. bellirica*, *A. chama*, *Aglaia spectabilis* (Miq.) S.S. Jain & S. Bennet, *Careya arborea* (Roxb.) and *Ficus infectoria* Willd. were dominant.

Group composition

Of the 23 individuals, 43.5% were adult, and 56.5% were non-adult (subadult, juveniles and infant) individuals (Table 2). Of the non-adult population, 61.5% were subadults, 23.1% were juveniles, and

Table 2. The age-sex composition of Phayre's Langur at Satchari National Park.

Group	AM	AF	AM:AF	Adults	SA	J	I	Non-adults	Adults: Non-adults	Total
A	1	4	1:4	5	4	1	2	7	5:7	12
B	1	1	1:1	2	2	0	0	2	1:1	4
C	1	2	1:2	3	2	2	0	4	3:4	7
Total	3	7	1:2.3	10	8	3	2	13	1:1.3	23



Fig. 2. Phayre's Langur group at Satchari National Park.

15.4% were infants. In the population, the largest age-sex class was subadults (34.8%), and the smallest was infants (8.7%) (Table 2). All the groups had a single male, but the number of females ranged from one to four (mean = 2.3 ± 1.5 ; Table 2). In all groups, adult females and subadults outnumbered other age groups. Among the adult population, 30% was male, and 70% female (Table 2). Group A had the largest number of females. We recorded two neonates in Group A in early March 2016.

Threats to Phayre's Langur in the study area

The Tipra indigenous community in the national park has converted part of the forest to lemon *Citrus aurantiifolia* (Christm.) Swingle cultivation. This has fragmented the forest and impeded the arboreal movements of the Phayre's Langurs (Fig. 3). Illegal logging of tall trees (12-15m height with 45-50cm DBH) was also seen regularly in areas where forest staff patrolled infrequently. Shegun (*Tectona grandis*), a langur food and resting tree, is targeted by loggers due to strong demand for use in furniture manufacture.

Roadkill was another threat to Phayre's Langurs

in the study area. The Dhaka-Sylhet highway passes through the national park and fragments the potential primate habitat. One road accident was recorded during the study period, causing the death of an adult female with her infant.

Electrical infrastructure also threatened this species in SNP. Phayre's Langurs frequently used the power lines to cross the roads. We recorded an injury to a subadult after an accident involving an uninsulated power line which passes through the forest approaching the highway in SNP. Mortality in langurs occurred due to the short-circuiting of two electric parallel power lines connected by overhanging tails. The adult female and infant that died in the road accident were first shocked while walking on the power line and then fell to the road leading to the road accident.

Langurs and humans also compete for food in the national park. Local boys were seen collecting Jackfruit (*A. heterophyllus*) and Monkey Jack (*A. lacucha*) to sell to tourists. Monkey Jack is a favourite food of Phayre's Langurs. In June to July, ten local boys (10-12 years old) visited the forest daily and collected approximately



Fig. 3. *T. phayrei* leaping across a gap in the bamboo canopy cover as a means of avoiding the forest floor.

Table 3. Comparison of age-sex ratios of Phayre's Langur to an earlier study.

Age-sex ratios	Present study	Khan and Ahsan (1981)
Adult males to adult females	1:2.3	1:2.15
Adults to subadults	1:0.8	1:0.635
Adult females to infants	1:0.3	1:0.035
Adult females to subadults	1:1.14	1:0.93
Juveniles to infants	1:0.7	1:1.67

50 fruits each to be sold for 0.15 USD apiece.

Additional stressors

Firewood collectors entered the forest throughout the year to collect wood to sell. They mainly collected dry leaves and twigs for use as firewood and kindling. But they also cut live branches (young and thin branches with leaves) off of the trees and left them to dry, which reduced the connectivity of the canopy by thinning out the branches and increased the gaps in the canopy cover.

Tourism in national parks increases during winter and festivals such as Eid festival, Puja, National Independence Day, National Victory Day and other holidays. During such festivals, picnicking visitors were observed screaming, shouting and laughing loudly in the forest interior. People were also seen carrying loudspeakers and cooking food at the forest edges.

DISCUSSION

The recorded mean group size (7.7 ± 4.0) in the study area was smaller than group sizes recorded in several previous studies of Phayre's Langurs in the north-east and south-east of Bangladesh (e.g., 12.67 ± 2.46 , Khan & Ahsan, 1981; 13.67 , Khan & Ahsan, 1986; 11.44 ± 5.37 , Ahmed et al., 2020) and northeast India (12.4 individuals, Bose, 2003), but slightly larger than group sizes recorded by Green (1978) in northeastern Bangladesh (5.85 individuals).

Adults were most common age-class in all groups, followed by subadults, juveniles and infants. Almost four decades ago, Khan & Ahsan (1981) also recorded the highest percentages of females (40.4 ± 1) followed by juveniles (26.7 ± 1.9), males (18.5 ± 1.3) and infants (14.5 ± 0.5). Multi-male uni-female groups have been reported in Assam, and multi-male multi-female groups have been reported in Mizoram in India (Bose, 2003). However, no multi-male groups were found in SNP. The proportion of adult individuals (43.5%) in this national park is close to that recorded in five northeastern forests of Bangladesh (47%; Ahmed et

al., 2020). The adult sex ratio at SNP was also similar to those reported earlier in Bangladesh (Khan & Ahsan, 1981; Table 3). However, the study groups at SNP had more juveniles and infants (Table 3), which indicates that this forest is still providing suitable habitats and quality nutrition to the study groups.

Phayre's Langur density at SNP (1.2 groups/km² or 9.5 individuals/km²) was somewhat higher than in previous assessments for northeastern and southeastern Bangladesh (0.18 groups/km² or 2.42 individuals/km², Khan & Ahsan, 1986; 0.56 ± 0.48 groups/km², Ahmed et al., 2020) and north-eastern India (7.6 individuals/km², Gupta & Kumar, 1994; 0.4 groups/km², Adimallaiah et al., 2014).

In this study, groups of Phayre's Langur were recorded in habitat where *A. chama*, *A. lacucha*, *T. grandis*, *L. speciosa*, *T. bellirica*, *Aglaia spectabilis*, *C. arborea*, *F. racemosa* and *Bambusa* spp. were dominant. Previous researchers at this and other sites in Bangladesh have observed Phayre's Langurs consuming plant parts from *A. chama*, *A. lacucha*, and other *Artocarpus* spp., *T. grandis*, *Lagerstroemia* spp., *Bambusa* sp., *F. racemosa* and other *Ficus* spp. (Ahsan & Khan, 1984; Hasan, 2019; Mondal, 2019; Aziz & Feeroz, 2009). They were also frequently observed traveling in bamboos (Bose, 2003). Phayre's Langurs have also been found in forests dominated by *Ficus* sp., *A. chama* and bamboo in Assam and *Terminalia myriocarpa* Van Heurck & Müll. Arg., *F. benghalensis* L., *Bischofia javanica* Blume, *Gmelina arborea* Roxb., *Michelia champaca* (L.) Baill. ex. Pierre and *Polygala jefensis* W.H. Lewis in Mizoram (Bose, 2003). Sightings of Phayre's Langur in bamboo-dominated areas have also been reported in northeastern India (Bose & Bhattacharjee, 2002; Choudhury, 1987, 1994, 1996; Raman et al., 1995; Roonwal & Mohnot, 1977; Wolfheim, 1983) in secondary forests, plantations, primary forests, deciduous forest, and mixed forests with timber and non-timber species (Mukherjee, 1982; Groves, 2001; Molur et al., 2003; Gupta, 2001). Most records of Phayre's Langurs are from secondary forests (46%) followed by plantations (32.2%) and primary

forests (21.4%; Gupta, 1994).

The Tipra community inside the park and the villagers from other nearby villages depend on this forest for forest products, although most are also employed as tea labourers. Eighty percent of the local people around this forest are illiterate and depend on the forest for their livelihoods (IPAC, 2009; Mukul, 2007). Our research identified habitat alteration as the main threat to the forest caused by local people, including the Tipra community. Conversion of forest land to lemon cultivation by the tribal and local people at SNP was also reported by Hasan et al. (2018). Loss of large trees due to logging and firewood collection displaces Phayre's Langurs, and loss of canopy cover limits their movement (Gupta & Kumar, 1994). Illegal logging of large trees at SNP also causes the loss of food plants which threatens the habitat of all wild animals, including primates (Hasan et al., 2018). This species is also threatened in northeastern India by jhum cultivation (Bose, 2003; Choudhury, 2004), habitat degradation due to loss of food trees (Gupta, 1997), deforestation, habitat loss and fragmentation due to conversion of forest to plantation, encroachment into forest areas, etc. (Choudhury, 2013).

We identified road accidents, electrocution, tourist activities and seasonal fruit collection as additional threats to Phayre's Langurs. These results are in line with the results of previous studies for Capped Langur at SNP (Hasan et al., 2018) and elsewhere (Naher et al., 2017). Many mammals in Bangladesh die from vehicular collisions, as many forest areas have been bisected by roads, highways and railways (IUCN Bangladesh, 2015). For example, a previous study in SNP and Lawachara National Park in Bangladesh recorded 12 primate deaths by electrocution and 15 from vehicular collisions in five species of primates (Rhesus Macaque, Northern Pig-tailed Macaque, Capped Langur, Phayre's Langur and Bengal Slow Loris, with the most accidents involving Phayre's Langur [Al-Razi et al., 2019]). Hasan et al. (2018) reported high rates of accidents for many wild animals in SNP on the bypass road from April 2016 to March 2018, including seven individual primates (three Rhesus Macaques, two Pig-tailed Macaques and two Capped Langurs). Road casualties have also been reported for threatened Capped Langurs in Madhupur National Park (Naher et al., 2017), and Bengal Slow Lorises (Choudhury, 1992; Radhakrishna et al., 2006; Kumar and Devi, 2010; Das et al., 2015) in India. Primates have also been killed in road accidents in the Langtang National Park of Nepal (Kumar & Solanki, 2008; Regmi

& Kandel, 2008; Minhas et al., 2010). During the same period, electrocution on uninsulated power lines caused the deaths of 11 individual primates (five adult Capped Langurs, three Phayre's Langurs, two Rhesus Macaques and one Pig-tailed Macaque) at SNP (Hasan et al., 2018). Uncontrolled tourist activities can severely disturb the daily activities and ranging patterns of diurnal mammals (IUCN Bangladesh, 2015). Loud noises and other activities by protected area visitors can drive these mammals out of their home ranges (Naher et al., 2017).

Poaching of Phayre's Langurs by members of other ethnic groups has been reported in north-east India (Bose, 2003), but no hunting was recorded during the study period, and we did not observe any evidence of local people directly harming Phayre's Langurs. Local people expressed interest in participating in the conservation of this species if initiatives are undertaken. Similar interest has been shown for initiatives focused on Capped Langur (Hasan et al., 2018). The Tipra community is entirely dependent on the forest and cultivates lemons in a confined area within the national park (Mukul, 2007), causing habitat destruction. Eight tea estates surrounding the national park attract eco-tourists; however, the labourers from these tea estates are socio-economically marginalised, and depend on the forest for their fuelwood and housing materials (Mukul, 2007). Sawmills and brickfields in and around the national park accelerate forest destruction as the local people illegally collect timber poles from the park and sell them at lower-than-market prices (Mukul, 2007). The forest department should act to close these facilities. Bangladesh Forest Department should consider initiatives to encourage and support the development of alternative income sources for forest-dependent local people to reduce their dependence on destructively-harvested forest products, leading to reduced pressure on the habitat. Use of insulated power lines, maintenance of natural canopy bridges and installation of artificial canopy bridges over the roads and power lines may reduce mortality of Phayre's Langur in this area (Al-Razi et al., 2019). Involvement of local people in sustainable forest management is necessary to conserve this species as well as other wildlife in the park. Government should form partnerships with local people, NGO's and researchers to conserve Phayre's Langur and other primates in SNP.

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