HUMAN – PRIMATES CONFLICT IN BANGLADESH: A REVIEW

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ABSTRACT

Human-primates conflict is an important issue for the conservation of primate biodiversity globally. We reviewed research papers that have been published over the last 20 years on Bangladesh regarding the human-primates conflicts. We also identified primate species are involved in conflict, crop damage preference by primates and local peoples' perceptions towards primates. Our study suggests that three species (Rhesus macaque *Macaca mulatta*, Capped langur *Trachypithecus pileatus*, and Common langur *Semnopithecus entellus*) are mostly involved in the conflict with humans. Crop damage is the main cause of human-primates conflict in Bangladesh. Decreasing of forest covers and increasing of human settlements in and around the forests are responsible for enhancing conflict with the non-human primates. Moreover, people's aggressive behaviors are responsible to cause primates to conflict with humans. People perception mostly towards the non - forested primate species are more aggressive than forested primate, this is due to economic damages to the local people by primates. The progress of research regarding human-primates conflict indicates that after 2011, researchers are more concerned with human-primates conflict research than in or before 2001. This concerned attention of researchers about human-primates conflicts indicates that in Bangladesh these types of conflict may increase in the future.

Key words: Human-primates conflict, crop damage, Bangladesh.

INTRODUCTION

The interaction between primate and people is referred to as human-primates conflict, which has a negative impact on the resources, habitats of both primate and people (Hill *et al.* 2002; Hockings and Humle 2009; Khatun *et al.* 2013; Hill 2018). The most common example of human-primate conflict is crop damage by primates, where local people are mostly subsistence farmers (Hill 1998). Anthropogenic activities around primates' habitats and transformation their habitats to agricultural fields are contributing for the emerging of human-primates conflicts (Khatun *et al.* 2013). At present, human-primates conflict is considered as a major issue for the conservation of primates and one of the greatest challenges to protect biodiversity globally (Hill *et al.* 2002). Human-primate conflicts are increasing around the world due to invading in primates habitats by people and the scarcity of food for primates (Hill and Webber 2010). Although it is one of the major issues for the primates conservation, but still researchers are searching a best way for co-existence of primates and human with minimal conflict.

Most of the human-primates conflict has been studied in Africa, for instance in Kenya, Uganda and Congo as well as South East Asian countries such as India, Nepal and Bhutan (Hill 1998; Hill *et al.* 2002; Hill and Webber 2010; Choudhury 2014). About 50% of South Asian primates species are distributed in Bangladesh but there are few published papers available on human-primates conflicts mostly in non-forested areas. For instance, Khatun *et al.* (2013) studied common langur (*Semnopithecus entellus*) conflicts with humans in Jashore, while Ahsan and Uddin (2014) and Uddin and Ahsan (2018) reported human rhesus-monkey (*Macaca mulatta*) conflicts in Narsingdi. But we argue for more research based on the present status of primates, conflict species, crop damage intensity, damage preference as well as people's perceptions. These would give a complete picture of human-primates conflict in Bangladesh. Following this, government organization and NGOs (non-government organizations) can develop an adaptation and mitigation of conflicts plan for the conservation of primates and reducing conflicts in Bangladesh.

So, our aim of this study is to compile the published papers of human-primates conflict in Bangladesh over the last 20 years and also to (i) identify the species of primates face conflict with human, (ii) locate conflict areas, (iii) damage of crops by primates, (iv) people's perception towards primates, and (v) overall status of conflict in the country.

Status, distribution and non-human primates involved conflicts in Bangladesh: In South Asia, 22 species of primates are known to occur in the forested, non-forested and urban areas (Molur *et al*. 2003). In Bangladesh, 10 of

22 species of South Asia are found in mixed evergreen forest, deciduous forest, mangrove forest, urban areas and suburban areas (Ahsan 1984). Primates consist of 7% of the total 138 species of mammals in Bangladesh (IUCN Bangladesh 2015).

Bengal slow loris (*Nycticebus bengalensis*) is Endangered primate in Bangladesh (Hasan 2015a). It is distributed in the northeast, east and southeast mixed evergreen forests of Bangladesh (Ahsan 1984, Hasan 2015a). Over the last two decades, about 50 % of the population have been declined from the Shal forest (IUCN Bangladesh 2015). Globally, there is no record of conflict with human for this species but, in Bhutan this species is listed in the national conflict management strategy (Anonymous, 2008).

Long-tailed macaque (*Macaca fascicularis aurea*) is distributed in the small mangrove patch along the Naf river estuary of Teknaf under Cox's Bazar district. This species is Least Concerned globally but Critically Endangered in Bangladesh due to the decline of its population more than 90% over the last three decades (Hasan 2015b). Habitat destruction such as clearing the mangrove forest for shrimp culture and conversion of the coastal areas for shrimp and salt farming are the main causes for reducing this species (Kabir and Ahsan 2012). Moreover, Rohingya people of Myanmar have been living in this area illegally since 1993 and their dependency on forest for their livelihood has been increasing gradually. However, no research has been conducted to the relation of illegal habitat destruction and long-tailed macaque population reduction. As local people are depending on the firewood collection from the mangroves as well as hilly areas of Teknaf Wildlife Sanctuary which enhances the competition of resources between the local people and long-tailed macaque. In fact, this species is widespread throughout its world range, but rapidly declining its population (Eudey 2008). In 2010, long-tailed macaque population is reported in two groups, consists of five and three individuals (Hasan and Feeroz 2010). But in 2012, one group consists of three individuals are reported (Kabir and Ahsan 2012). Almost 50% population has been declined just over the three years from 2010 to 2012. Moreover, it indicates that this species is facing great challenges for their food within the restricted habitat due to the competition of resources with the local people especially the firewood collectors and crab collectors. For instance, in the Borneo forest, this species destroys crops and farmlands due to clearing their habitats and food sources (Lee and Priston 2005). But in Singapore, this species is reported as playful and interactive (symbiotic) with human during the times of food provisioning by tourists (Sha *et al.* 2009). In addition, in northern India of Assam, this species is considered as a crop raiding primate (Anand and Radhakrishna 2017). In fact, the population of this species has declined from the Teknaf areas due to the alternation of habitat for shrimp culture and agriculture (Kabir and Ahsan 2012).

Rhesus macaque (*Macaca mulatta*) is a Vulnerable primate species in Bangladesh (Feeroz 2015a). This species is most widely distributed both in the forested and non-forested areas including human settlements, and it is the only primate that lives in the mangrove forest of Bangladesh (Ahsan 1984). In Bangladesh, this species is considered as one of the most conflicting primate species (Ahsan and Uddin 2014; Uddin and Ahsan 2018). Globally, especially in Asian countries, several studies indicate that this is one of the most nuisance and conflicting primate species in India, Bhutan and Nepal (Anonymous 2008; Aryal and Chalise 2013; Mazumder 2014). Stump-tailed macaque (*Macaca arctoides*) is evaluated as data deficient species in Bangladesh as its recent sighting is uncertain and may occur in the mixed evergreen forest along the Bangladesh borders with Mizoram of Indian and Myanmar (Ahsan 2015).

Assamese macaque (*Macaca assamensis*) is one of the Endangered primates in Bangladesh (Feeroz 2015b). This species is distributed in the north-east (Gazipur Tea Estate of Rajkandi forest) and south-east (Kaptai) parts in Bangladesh (Feeroz 2015b). It is first reported from Patharia hill of Sylhet (Ahsan 1984) and recently it has been reported from Baraiyadhala National Park of Chittagong (Karim and Ahsan 2016). There are no data available regarding this species ecology and conflict with humans, but presumed that this species has been declining in Bangladesh. Although in Nepal, this species is considered as crop raiding primate and conflict with humans and the major crop damages by them are paddy, maize, potato and wheat (Paudel 2017). In India, Assamese macaque is reported as a conflict primate species with human due to habitat loss mostly in the temple areas (Mehdi *et al.* 2007).

Pig-tailed macaque (*Macaca leonina*) is Endangered primate species in Bangladesh (Feeroz 2015c). It is distributed in the northeast and southeast mixed evergreen and hilly forest (Ahsan 1984; Feeroz 2015c). In Bangladesh, no conflict information available on this species. But this species shows poly-specific behavior to other primates species such as rhesus monkey and also aggression in between their groups (Aziz 2013). It is one of the less studied primates in Bangladesh. Globally, this species considered as non- territorial and non-conflicting.

Common langur (*Semnopithecus entellus*) is an Endangered primate in Bangladesh (Jaman 2015). This is the only non- human primate in this country which does not occur in any forests but resides in and around human settlement areas. The distribution of this species is in the western part of Bangladesh, mainly in few pockets of the greater Jashore and Kushtia districts (Ahsan 1984, Jaman 2015). It is reported as a conflict species of primate in

Bangladesh (Khatun *et al.* 2013). In addition, globally the common langur is also considered as a conflict primate species. In India, Sharma *et al.* (2011) reported human-common langur interactions in the temple areas. But in the Nanda Devi Biosphere Reserve Forest of India, it is reported as a crop raider and crop-raiding are the main reason to conflict with reserve forest people (Arbor 2011). Moreover, in the western part of Nepal, human-langur conflict has identified due to crop damage by them as well as aggressive behavior by local people to langur (Aryal and Chalise 2013).

Phayre's leaf monkey (*Trachypithecus phayrei*) is Critically Engendered primate in Bangladesh. This species is mostly found in the mixed evergreen forest in Cox's Bazar, Chittagong Hill Tracts and Sylhet regions and its population has been declined 80% over the last three decades (Kabir 2015a). In Bangladesh, no record has been found on conflict of this species with humans. But in north-eastern India, it is reported that habitat fragmentation and increase agricultural activities resulting in increasing crop raid by this species, as farmers used to cultivate Jhum in their habitat areas (Choudhury 2014; Mazumder 2014).

Capped langur (*Trachypithecus pileatus*) is one of the Endangered primate in Bangladesh (Kabir 2015b). This species is widely distributed in the mixed evergreen forest of Dhaka (now Mymensingh), Chittagong, and Sylhet divisions (Ahsan 1984; Kabir 2015b). Over the last two decades, about 50 % of the population has been declined and from the Shal forest (IUCN Bangladesh 2015). This species is reported as a conflicting primate species in the moist deciduous forest of Tangail in Bangladesh due to crop raiding (Naher *et al.* 2017). In India, it is also considered as a conflicting primate species with human, but most of the cases are due to human interactions and loss of habitat (Medhi *et al.* 2007)

Hoolock gibbon (*Hoolock hoolock*) is another Critically Endangered primate in Bangladesh (Feeroz *et al.* 2015). They are distributed in the tropical mixed evergreen forest in the north-east and south-east of Bangladesh (Ahsan 1984, Feeroz *et al.* 2015) This species has been reduced by 95% over the last two decades in Bangladesh (IUCN Bangladesh 2015). According to Islam *et al.* (2011), there are 350 individuals of this species, but now the number is less than 250 individuals (IUCN Bangladesh 2015). This suggests the severe and quick declining the population of this species in Bangladesh. Habitat loss and fragmentation of forests are the main reasons for shrinking the population. In addition, there also exists competition for food and resources with other animals including human due to increasing firewood collection and illegal felling of trees by local people, reducing canopy continuation and as well loosing fruiting food trees of gibbon. There has no conflict record of this species with human like rhesus macaque and common

langur in Bangladesh. But the local people are alternating their habitats and decreasing their home range areas, which may trigger extermination of this from some areas, for instance, as happened in Chunati (Ahsan 1994). In Myanmar and India, habitat loss and fragmentation are the main causes to reduce this species (Kumar *et al.* 2013). But in eastern Arunachal Pradesh of India, the eastern hoolock gibbon (*Hoolock leuconedys*) is reported to be hunted due to conflict with human as well as the increasing competition of resources with humans (Kumar *et al.* 2013).

Research progress in human-primates conflict in Bangladesh: Literature survey reveals that nine research articles have been published between 2001 and 2018 on human-primates conflict in Bangladesh (Fig. 1). The first article (Miah *et al.* 2001) evaluated crop damage by wildlife including primates in the Chunati Wildlife Sanctuary and estimated the value of damaged crops. The second paper was similar to the first one regarding the crop damage by primates at Lawachara National Park (Aziz and Ferroz 2007). After 2011, people's attention has increased to the human-primate conflict and seven papers have been published during 2012 to 2018 (Fig.1). The highest number of papers was published in 2014. These published papers indicate that about 80% of research works regarding human-primates conflict were conducted after the 2011 (Fig.1). In addition, this result also suggests that people's attention and research regarding human-primates conflict are increasing in Bangladesh after 2011 than before.

Causes of human – primates conflict in Bangladesh: There are several factors to increase the human-primates conflict in Bangladesh such as increasing human population, decreasing the forest cover, increasing human settlement inside the forest areas and scarcity of food. Apart from these factors, every primates species living area has a local people's perception towards the cause of human-primates conflict, which are different according to the region and local food availability. Miah *et al.* (2001) claimed that the crop damage is the main reason to human-primates conflict in the Chunati Wildlife Sanctuary. This is due to the increasing human settlement inside the protected areas, which leading to conflict with human. Human population has increased by 10 times over the last 25 years in the Chunati Wildlife Sanctuary (Fig. 2) During 1991, the total pollution was 6,000 and at present inhabitants are over 50,000.

Therefore, due to the increase of human settlement inside the forests, 2,600 ha of forest have declining every year in Bangladesh (FAO 2015). In addition, more than 10,000 ha of forest cover have been disappeared during 2001 to 2015 and the rate of decline has been increasing every year (Fig. 3). Moreover, during 2005-2015 in the Chunati Wildlife Sanctuary 256 ha of forests have degraded and the degradation rate is 25.66%

(Islam *et al.* 2018). Declining of homestead vegetation is also responsible for human-primates conflicts (Uddin and Ahsan 2018).

Damaged crops by primates during conflict with human in Bangladesh: Globally, crop raiding is a pivotal issue for the human-primates conflict. Most of the primates (*Macaca mulatta* and *Semnopithecus entellus*) damage crops during conflict with human and their crop damage preference, damage intensity, damage of palatable and unpalatable crops, are mostly depended on the availability and scarcity of food in the conflict areas and humans aggressive behavior towards primates (Khatun *et al.* 2012; Ahsan and Uddin 2014; Beisner *et al.* 2015; Uddin and Ahsan 2018). In Bangladesh, primates damage crops which are palatable for them but only the rhesus monkey damages both palatable and unpalatable crops (betel leaf) during conflict with human (Table 1).

Table 1. Damaged crops by primates in Bangladesh.

Species	Location	Vegetation type	Palatable crops	Unpalatable crops	Sources
Macaca mulatta	Chunati Wildlife Sanctuary, Chittagong	Forest	Banana, Potato	None	Miah *et al.* (2001)
Macaca mulatta	Lawachara National Park, Sylhet	Forest	Pineapples	None	Aziz and Feeroz (2007)
Semnopithecus entellus	Keshabpur Upazila, Jashore	Homestead	27 species of crops such as papaya, vegetables, mango etc.	None	Khatun *et al.* (2013)
Macaca mulatta	Rampur Village, Narsingdi, Dhaka	Homestead	8 species of crops such paddy fields, bamboo, jackfruit etc.	Betel leaf	Ahsan and Uddin (2014); Uddin and Ahsan (2018)
Macaca mulatta & *Trachypithecus pileatus*	Madhupur deciduous forest, Tangail	Forest	Paddy, pineapples, jackfruit	None	Naher *et al.* (2017)

In Bangladesh, rhesus macaque (*Macaca mulatta*) is the most studied primate species regarding human-primates conflicts (Table 1). In the Chunati Wildlife Sanctuary, seven species of plants were identified as damaged crops by wildlife of which paddy, banana and potato are damaged by the rhesus macaques and the others by elephant and wild boar (Miah *et al.* 2001). But the people perceptions towards macaque are highly negative resulting in severe loss of population of macaque in this sanctuary. According to the local people, macaque was the most damaging animal and they destroyed repeatedly the same crops (Miah *et al.* 2001). Therefore, forest dwelling primates are less involved in damaging crops than living in the homestead vegetation in the human settlement areas (Table 1). This result indicates that in the human settlement areas, local people are more aggressive towards primates and in terns results more damage by the primates (Uddin and Ahsan 2018). But in the forested areas, the density of population (rhesus macaque) is lower than the human settlement areas, resulting in primates has less contact with the local people, as local people, use several protection measures to reduce the damage of crops, resulting less aggressive behavior towards primates.

In addition, seasonality has an important relationship with crop damaged by primates. During the fruiting season (March - July), Common langur destroys the highest amount of crops than non-fruiting season (Khatun *et al.* 2013). This is due to the availability of ripening local fruits to intrigue langur to damage more crops. Crop cultivation preference of the local farmers and crop preference of the primates is also responsible for human-primates conflict in the non-forested areas. This is indicating that if most of the crops are not the food sources for the primates, they would destroy the unpalatable crops, resulting higher aggression of local people towards primates as primates invade into the local people's property (Ahsan and Uddin 2014, Uddin and Ahsan 2018). Moreover, local people and the primate species also influence the factors relating to the causes of human-primates conflict (Khatun *et al.* 2013). For example, human-rhesus monkey conflict in the non-forested Rampur village indicates that damages of unpalatable crops are the main factor in the conflict of this area (Uddin and Ahsan 2018). But human-common langur conflict in Jashore indicates that palatable crop damage, disturbance and fears are the main factors for conflict with human in this non-forested area (Khatun *et al.* 2013).

Human aggressive behavior and local people's perception towards human-primates conflict in Bangladesh: The major challenge for the conservation of primates is to reduce the interaction between primates and humans, as both (primates species mostly living in human settlement areas) are sharing the common resources such as habitat, food, etc. But the major threat to primates is global human population (especially in Bangladesh 1200 per km sq.) that is increasing at an alarming rate from the last century, resulting in overlap of the ecological footprint of resources. And, when the local farmers are a small cultivator, they show more intense aggression than rich farmers (who has higher land area) (Khatun *et al.* 2013). In addition, the human aggression towards primates relies on the potential economic loss by primates and also primates aggression is influenced by the human behavior (Beisner *et al.* 2015). Most of the primates damage crops in the daylight. So, they have much more interaction with humans, as they are damaging like a group than other damaging animals such as wild boar. In the Chunati Wildlife Sanctuary, local people's aggressive behaviors are frightening to primates through shouting, beating bark of trees, chasing by animals such as dog, beating with wooden sticks (Miah *et al.* 2001). Moreover, in the Rampur village (under Monohordi upazila of Narsingdi district), which is a non-forested area, 60% people expressed aggression to primates by striking with sticks, 30% people showed aggressive behavior by throwing stones and 10 % claimed fear (Ahsan and Uddin 2014).

Local people's perception is very crucial for the conservation of primates in the forested and non-forested areas in Bangladesh. In addition, human and primate behavior is also responsible for the human-primates conflict (Beisner *et al.* 2015). Therefore, the local people's perception towards primates changes with culture and religion of the local people (Khatun *et al.* 2013). In India and Nepal, monkey is venerated as scared animal in Hindu culture but in China and Japan, they considered as a mythical creature of cunning and deviousness (Lee and Priston 2005; Hill and Webber 2010).

In the Chunati Wildlife Sanctuary, local people's perception towards primates has been changed due to local economy as well as valuable crops. According to them, the elephant was the most harmful animal for paddy, whereas macaque was the most harmful animal for potato (Miah *et al.* 2001). The study on human-langur conflict in Jashore reveals that local people of Hindu religion, high land holding capacity, living in the conservation priority areas are more tolerant towards primates (Khatun *et al.* 2013). But for human-rhesus monkey conflict in the non-forested areas, about 80% people claimed negative perception towards primate (Ahsan and Uddin 2014), as they are mostly relying on crops which are the primary economic source for them.
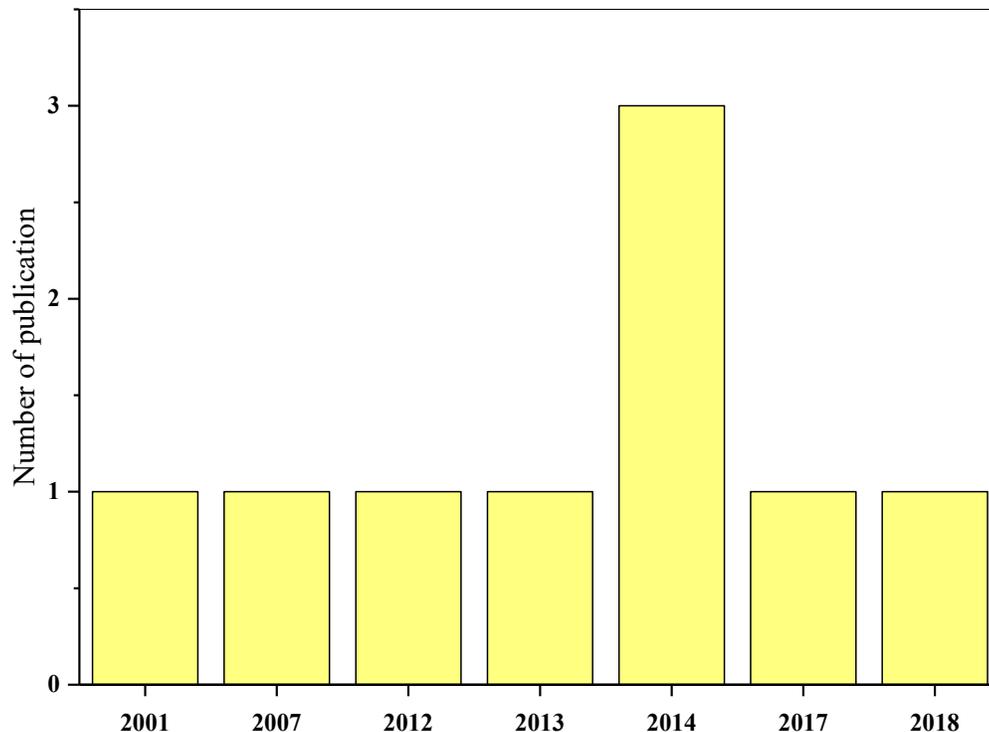

Fig. 1. Number of published research papers regarding the human-primates conflict over the last 20 years in Bangladesh (Miah *et al.* 2001; Aziz and Feeroz 2007; Khatun *et al.* 2012; Khatun *et al.* 2013; Ahsan and Uddin 2014; Shoma and Feeroz 2014; Rawshan *et al.* 2014; Naher *et al.* 2017; Uddin and Ahsan 2018).
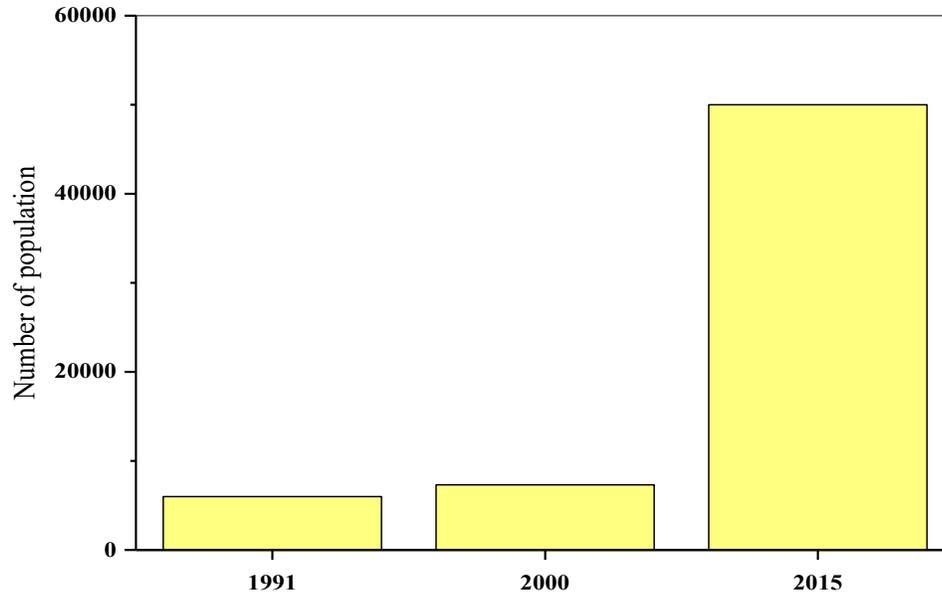
Fig. 2. Human settlement during 1991-2015 in Chunati Wildlife Sanctuary (sources: Miah *et al.* 2001; Islam *et al.* 2018).
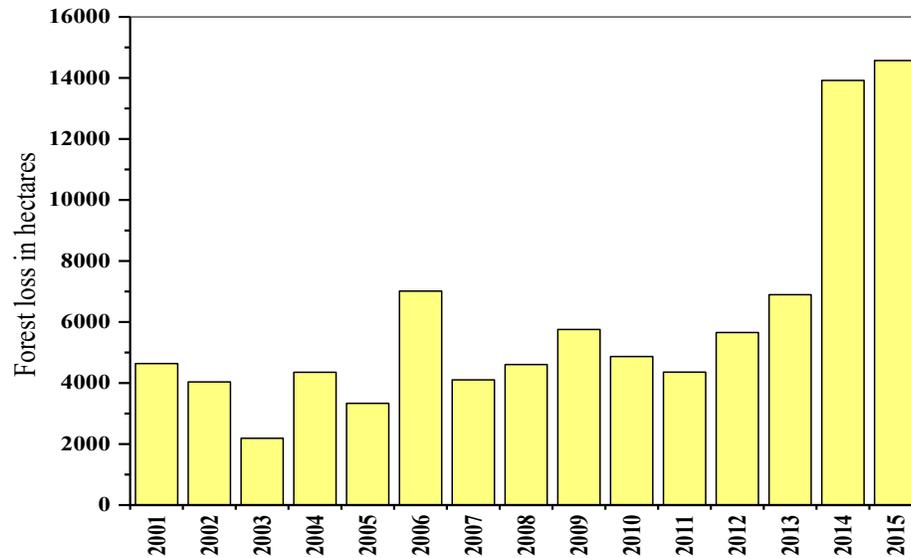

Fig. 3. The loss of forest cover from 2001-2015 (ha) in Bangladesh (> 10% canopy cover, source: http://earthenginepartners.appspot.com/science-2013-global-forest).

Conclusion: Over the last 20 years, people's attention and research regarding the human-primates conflict has been increasing in Bangladesh. Forested and non-forested areas have different causes of conflict and, local people of the non-forested areas are more aggressive than in the forested areas. Three species of primates (*Macaca mulatta*, *Trachypithecus pileatus* and *Semnopithecus entellus*) are mostly involved in conflict with human in Bangladesh. Among these species rhesus monkey (*Macaca mulatta*) is the most studied primates in Bangladesh. We suggest more future research on human-primates conflict in urban areas, as most of the studied were conducted in forest or human settlement areas. In addition, how the primates aggressive behaviors are responsible for conflicting with humans are need to be further studied. Overall, we recommend to start to develop human-primates conflict adaptation and mitigation plan for the conservation of primates in Bangladesh.

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