

The Eastern Hoolock Gibbon *Hoolock leuconedys* Population in Assam, India, is on the Verge of Extinction

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Abstract: The distribution of the eastern hoolock gibbon in India is restricted to the eastern part of the state of Arunachal Pradesh and the Sadiya sub-division of Assam. The Sadiya population of the eastern hoolock gibbon is the sole population of the species in the state of Assam. A survey was conducted from January to February 2019 in three of the six reserve forests of the Sadiya sub-division to investigate the status of the eastern hoolock gibbon. Data were collected using modified line-transect surveys. We recorded seven groups in three reserve forests through direct sightings. Of the 17 individuals recorded, 14 were adults, and three were juveniles or infants. The average group size of the sighted groups was 2.42, with an adult sex ratio of 1:1. We also recorded 12 groups of rhesus macaques in the area. Rapid loss of habitat resulting from encroachment and illegal felling of trees and inadequate infrastructure are the major threats to the hoolock gibbon in Sadiya. A comparison of the present demographic data with the results of a previous study indicates that, without any immediate conservation and management intervention, this single population of eastern hoolock gibbons will be extinct in the near future. An integrated management program for the forest fragments, taking hoolock gibbon as a flagship species, could ensure the survival of the biodiversity of Sadiya, and the hoolock gibbon there.

Keywords: Eastern hoolock gibbon, Sadiya, habitat fragmentation, extinction

Introduction

India has two species of gibbon: the western hoolock (*Hoolock hoolock*) and the eastern hoolock (*Hoolock leuconedys*). The seven states of Northeast India, viz. Assam, Arunachal Pradesh, Meghalaya, Manipur, Nagaland, Tripura and Mizoram support the entire gibbon population in the country. Primates are an important component of the rich biodiversity of the state of Assam. Of the 27 species of non-human primates in India, 12 species are present in Assam—Bengal slow loris *Nycticebus bengalensis*, Rhesus macaque *Macaca mulatta*, Assamese macaque *Macaca assamensis*, pig-tailed macaque *Macaca leonina*, stump-tailed macaque *Macaca arctoides*, Tibetan macaque *Macaca thibetana*, white-cheeked macaque *Macaca leucogenys*, capped langur *Trachypithecus pileatus*, golden langur *Trachypithecus geei*, Phayre's langur *Trachypithecus phayrei*, western hoolock gibbon *Hoolock hoolock*, and eastern hoolock gibbon

Hoolock leuconedys (Chetry *et al.* 2010; Singh *et al.* 2020). The western hoolock is found in all of the seven states of the Northeast, but the eastern hoolock gibbon is found in only two, Assam and Arunachal Pradesh (Chetry *et al.* 2007). Assam has always been considered a stronghold for the western hoolock (Chetry *et al.* 2007), and a number of studies have been carried out on its status and distribution there (Mohnot 1995–2001; Das *et al.* 2005; Chetry *et al.* 2007; Choudhury 2006, 2009; Kakati *et al.* 2009). Only in the last decade, however, was it known that the eastern hoolock gibbon occurred in the Sadiya sub-division of the Tinsukia district of Assam (Chetry *et al.* 2010), in the extreme eastern boundary of the state. Administratively, Sadiya is part of Assam, but the area has no land connection with any other part of the state, and Sadiya is continuous with the Lower Dibang valley district of neighboring Arunachal Pradesh. There are six reserve forests (RF) in the subdivision of the Sadiya range of Doomdooma Forest Division of eastern

Assam totalling 125.12 km² of forest—Sadiya Station North Block Reserve Forest, Sadiya Station West Block Reserve Forest, Deopani Reserve Forest, Kundil Kalia Reserve Forest, Hollogaon Reserve Forest, and Kukurmara Reserve Forest (Fig. 1). The Indo-US Primate Project first carried out an extensive primate survey in the Sadiya range in 1994 (Mohnot 1995–2001). It was followed by another survey of primates in eastern Assam and Sadiya (August 2006 to January 2007) by Sharma and Sinha (2007) but they failed to locate any gibbon groups through direct sighting. In these studies, the gibbons of Sadiya were believed to be the western hoolock gibbon. The unique geographic location of the area and most especially the discovery of the eastern hoolock gibbon *H. leuconedys* in the Mehao Wildlife Sanctuary, and its adjacent Kornu Reserve Forest in Arunachal Pradesh, however, made us question the identity of the gibbons of Sadiya (Chetry *et al.* 2007, 2008, 2010; Chetry 2009). Sadiya is continuous with the Lower Dibang Valley District of Arunachal Pradesh and, revisiting the forests there, Chetry and Chetry (2010) confirmed for the first time that the gibbons were in fact eastern, not western, hoolock. Sadiya is the only area where the eastern hoolock gibbon is known to occur in the state of Assam, but it is no longer present in the Sadiya North Block, Sadiya West Block, and Deopani reserve forests (Chetry *et al.* 2011). Chetry *et al.* (2012) surveyed the population in Sadiya in the remaining three reserve forests in March–May 2010, recording 32 individuals in 10 groups.

In this article, we report on a second survey of the Sadiya hoolocks in the three reserve forests that still have

them—Kundil Kalia, Hollogaon, and Kukurmara—nine years later and using the same methods to check on their numbers and status.

Methods

Study area

The Sadiya subdivision is located at 95°40'1"E, 27°45'02"N, covering an area of 789.95 km² (Fig. 1). The area is a flat plain, gradually sloping from north to south. The vegetation has been described as Assam valley tropical wet evergreen forest (Champion and Seth 1968). The forests in the study area have an upper canopy of *Michelia champaca*, *Shorea assamica*, and *Terminalia myriocarpa*. The middle canopy is dominated mostly by *Vatica lanceaefolia* and *Mesua ferrea*, along with *Bombax ceiba*, *Terminalia belerica*, *Canarium resiniferum*, *Terminalia chebula*, *Eugenia jambolana*, *Sapium baccatum*, *Dillenia indica*, and *Bischofia javanica* (Chetry *et al.* 2012).

Survey: Direct method

We carried out the population survey in the Sadiya range from January to February 2019. We used a modified line transect method (Burnham *et al.* 1980; NRC 1981) depending on the habitat and the forest condition. The transects were laid in a stratified random arrangement in order to cover all representative areas of the park (Mueller-Dombois *et al.* 1974; Kent *et al.* 1994). Three observers walked through existing forest trails and occasionally outside of the forest, covering an average of 10–12 km per day, and

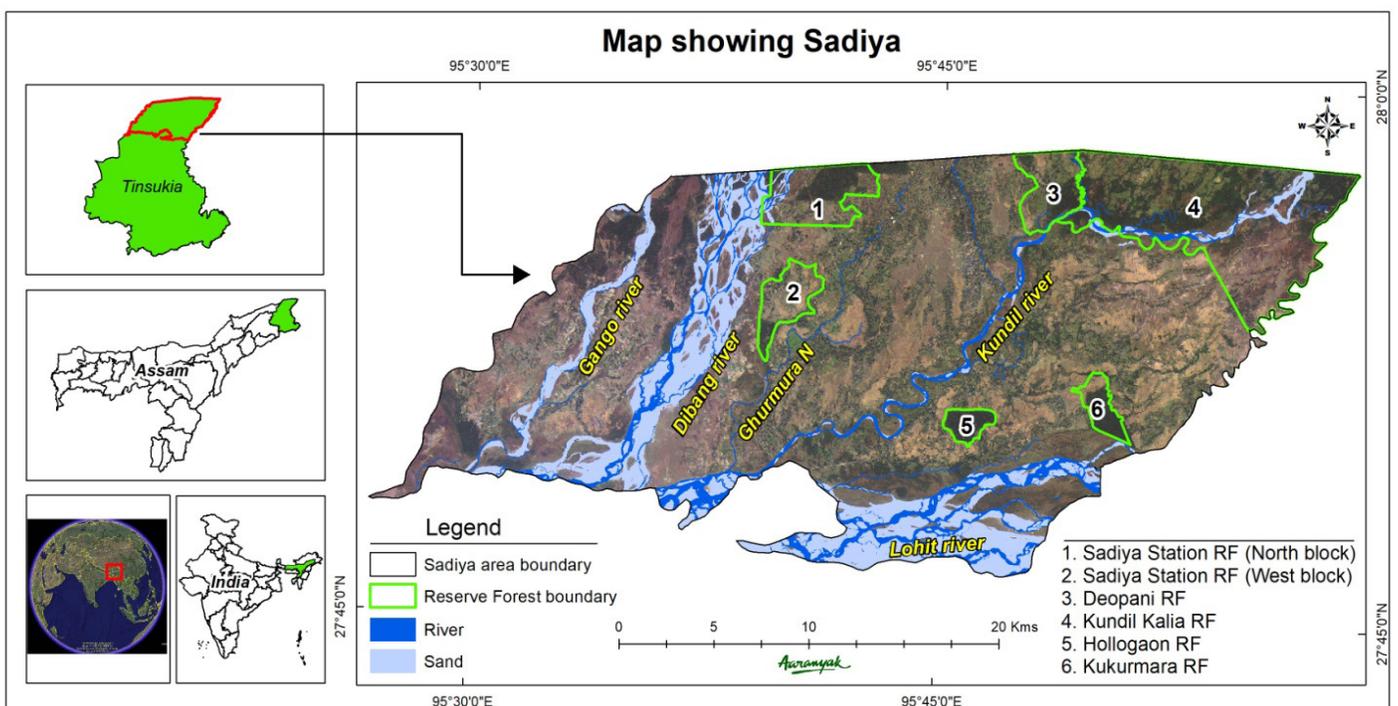


Figure 1. The Sadiya sub-division of the Tinsukia district of Assam, Northeast India, showing the location of the six reserve forests.

totaling 98 km. The transect walks were begun in the morning (06:00h) and terminated in the afternoon (15:00h). The observers walked slowly along the transect pausing every 500 m. On sighting gibbons, the GPS (Global Positioning System) location, the group structure and individual details (age, sex) and number of individuals were recorded. At 500-m intervals, and at each location where gibbons were encountered, the observers estimated the tree height and canopy cover within a 10-m radius and also took note of any evidence, and the extent, of grazing and logging in the study area.

Survey: Indirect method

We recorded hoolock gibbon calls when we were unable to see them (Call-count method). The distance to the calling gibbons was estimated and recorded, along with the time, direction, and duration of the calls and the GPS coordinates. We also recorded information on hunting and traditional beliefs through informal interviews with forest field staff, local guides and elderly people.

Results

Population status

This is the second comprehensive report on the eastern hoolock gibbon population from the Sadiya subdivision of Assam. The survey covered 98 km of transects in various parts of the reserve forests. Hoolock gibbons were found within an altitudinal range of 100–160 m. We registered 17 gibbons in seven groups, based on direct sightings from three of the reserve forests in Sadiya (Table 1, Fig. 2). Based on call-count, we established the occurrence of another four groups in the Kundil Kalia Reserve Forest (Table 2). We surveyed all of the Hallogaon and Kukurmara reserve forests but were unable do so for the Kundil Kalia Reserve

Forest due to encroachment as well as the ongoing border dispute with the neighboring state of Arunachal Pradesh.

Group size and age composition

The group structure and composition of the gibbon groups sighted are shown in Table 1. The average group size was 2.42 individuals, ranging from 2 to 4. There were five groups of two, one group of three, and one of four individuals. The adult sex ratio of the gibbons seen was 1:1, 82.35% were adults, 11.76% juveniles and 5.88% infants.

Sighting times and calling times

Of the seven groups sighted directly, six groups were recorded before 12:00 h and only one group after 13:00 h. All gibbon calls were recorded before 12:00 h: average duration 16.75 minutes, with a range of 13–21 minutes (Table 2).

Sympatric primates

During the surveys, we recorded 12 groups of rhesus macaques *Macaca mulatta* in Sadiya. Rhesus macaques were well distributed in different reserve forests, namely Hallogaon – four groups, Kukurmara – two groups, Kundil Kalia – four groups, Sadiya station North block – one group, and Sadiya station West block – one group.

Threats

Encroachment and wanton selective illegal logging appear at present to be the severest threats in Sadiya. Major encroachment for human settlements and for agriculture has led to ongoing shrinkage of the remaining forests. On the other hand, illegal felling of selective trees, such as *Uriam Bishoffia javanica*, *Simalu Bombax ceiba*, *Halakh Terminalia myriocarpa*, and *Titasopa Michelia champaca*, is causing canopy loss, breaking up the canopy and creating fragments

Table 1. Sighting records of Eastern hoolock gibbons. AM = Adult male; AF = Adult female; J? = possibly juvenile; I? = possibly infant.

Location	Coordinates		Altitude	Time	AM	FM	J?	Inf?	Total
Hallogaon	27°50'47.1"N	95°45'15.6"E	133 m	09:30	1	1			2
Kukurmara	27°50'42.2"N	95°50'57.3"E	126 m	13:00	1	1			2
Kukurmara	27°50'42.6"N	95°50'38.9"E	120 m	10:20	1	1			2
Kundil Kalia	27°56'32.6"N	95°50'24.4"E	132 m	07:12	1	1			2
Kundil Kalia	27°57'06.5"N	95°50'07.8"E	135 m	09:15	1	1	1	1	4
Kundil Kalia	27°56'57.5"N	95°50'22.8"E	140 m	08:00	1	1			2
Kundil Kalia	27°57'06.9"N	95°51'05"E	140 m	08:30	1	1		1	3

Table 2. Records of Gibbon call counts in the Kundil Kalia Reserve Forest.

	Coordinates		Altitude	Duration (min.)
1	27°57'20.2"N	95°50'03.8"E	139 m	10:47 to 11:05 = 18
2	27°57'08.7"N	95°50'13.6"E	136 m	09:30 to 09:43 = 13
3	27°57'01.1"N	95°50'04.5"E	160 m	08:15 to 08:30 = 15
4	27°56'59.4"N	95°50'10.6"E	135 m	11:04 to 11:25 = 21

within the existing habitats. A total of 80.70 km² of 125.12 km² of forest is under encroachment (Table 3). The Kundil Kalia Reserve Forest – the largest of the six reserve forests and prime habitat for eastern hoolocks is under great pressure from encroachment not only by the local people but also people in the neighboring state of Arunachal Pradesh.

The three forests that still support hoolock gibbons are reserve forests, and hence all are vulnerable to various types of anthropogenic exploitation. This is because, unlike sanctuaries or national parks, reserve forests are not strictly protected and the current scenario of their ongoing use and destruction is a threat to the gibbons and other wildlife in the area. We also recorded exploitation for firewood and non-timber forest products (cane, bamboo, and ferns, for example), and regular livestock grazing from the fringe communities. From 1989 to 2019, there has been a significant loss

of forest cover—Kundil Kalia 39.64%, Kukurmara 6.38% and Hollogaon 0.58% (Fig. 3). Our interviews of local people revealed the absence of hunting and a lack of any awareness regarding the need for the conservation of wildlife in general and the eastern hoolock gibbon, in particular. During the surveys, we observed that there were neither staff quarters nor a forest department office for monitoring or patrolling any of the reserve forests. There were only 11 forest staff in the Sadiya subdivision to combat illegal activities in the reserve forests and along the border with Arunachal Pradesh.

Discussion

The eastern hoolock gibbon was first reported from the Sadiya sub-division of Assam by Chetry and Chetry (2010),

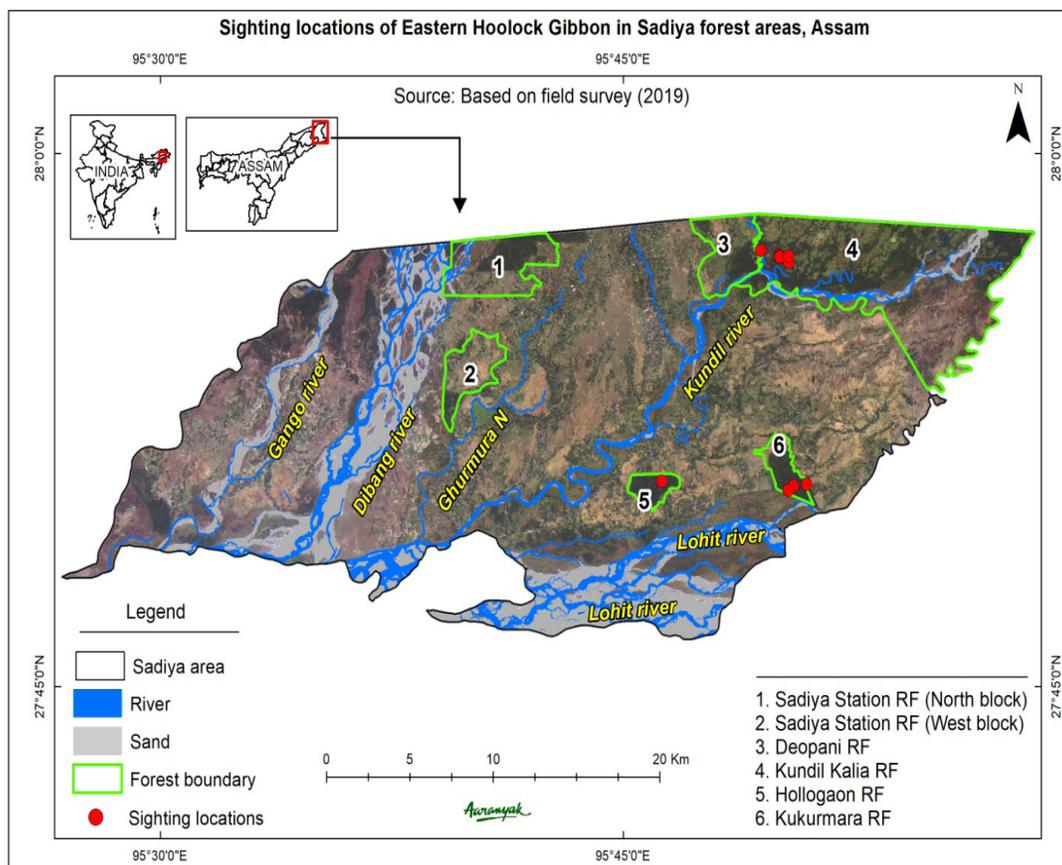
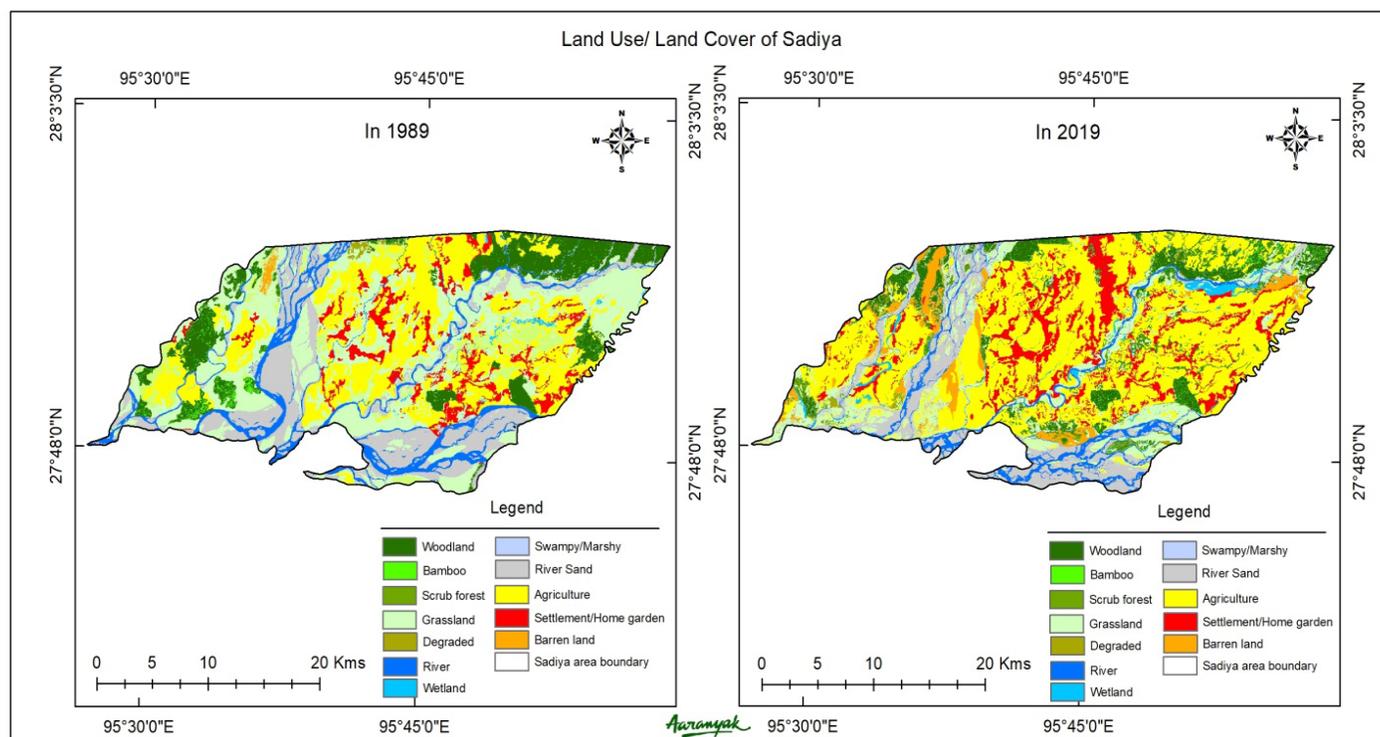
**Figure 2.** Location of eastern hoolock gibbon, *Hoolock leuconedys*, sightings.

Table 3. Reserve Forests, Encroachment and Extinction in Sadiya.

Reserve Forest	Area (ha)	Encroachment area (ha)	Presence of gibbons	Locally extinct	Year extinct
Sadiya Station North Block	2,331	720	-	+	1970
Sadiya Station West Block	541		-	+	1970
Deopani	1,620	1,200	-	+	1995
KundilKalia	7,284	6,000+	+		
Hollogaon	371		+		
Kukurmura	365		+		
	12,512 h	8,070 ha			

extending the known distribution of the species in India. In 2009, Chetry *et al.* (2012) recorded 33 individuals in 10 groups based on direct sightings in three reserve forests, Hallogaon, Kukurmura, and Kundil Kalia. In our current study, we were able to see just 17 individuals in seven groups in these three reserve forests, indicating a 48.5% decline in their numbers. The number of groups has been reduced from 26 (direct + call-count) in the previous survey to 11 in the current survey. In the current study their age ratio was 82.35% adults, 11.76% juveniles and 5.88% infants as against 63.6% adults, 21.2% juveniles and 15.2% infants in

2009 (Chetry *et al.* 2012). This 18.75% increase in the proportion of adults to immatures indicates reduced recruitment and a declining population. In the previous study (Chetry *et al.* 2012), the average group size was 3.3 individuals, with an adult sex ratio of 1:1.1. The current average size of the sighted groups is 2.42 individuals with an adult sex ratio of 1:1. In the study of Das *et al.* (2006), the average group size for the eastern hoolock gibbon was 3.37, while in Mehao Wildlife Sanctuary, Chetry *et al.* (2009) recorded an average group size of 3.14. Differences in the dispersion, abundance, and quality of food resources in the habitat influence

**Figure 3.** Land use and land cover of different reserve forests of the Sadiya, Assam.

variation in group size, but the reduced average group size as well as the variation in the age structure in the current study indicate lower recruitment. One reason for this may be the accidental death of immature gibbons while moving through the broken canopy created by the felling of trees. The Sadiya eastern hoolocks were restricted to 100–176 m above sea level, whereas in earlier studies the altitudinal range was recorded as 122–1,865 m (Groves 1971; Das *et al.* 2006; Chetry *et al.* 2010). Simalu *Bombax ceiba*, Ajar *Lagerstroemia speciosa*, Halakh *Terminalia myriocarpa* and Lata jari *Ficus maclellandii* were the dominant trees in the reserve forests.

The only other primate we recorded in these Sadiya reserve forests was the rhesus macaque, *Macaca mulatta*. We failed to find evidence of any other primate, either through direct sighting or through any secondary information.

Habitat loss and fragmentation from encroachment for settlements and farming is the principal threat to gibbons throughout their range in north-eastern India (Chetry *et al.* 2007) and is posing a major threat not only to the eastern hoolock gibbon but also to other wildlife in Sadiya. Chetry *et al.* (2011) reported that eastern hoolock gibbons had already been extirpated from the three other reserve forests in Sadiya, namely Sadiya station North Block, Sadiya station West Block and Deopani; only rhesus macaques were found there (Table 3).

The eastern hoolock gibbon population in Sadiya is the sole representative population of the species in Assam, indicating the conservation significance of this unique population. The current study indicates strongly, however, that the Sadiya hoolocks are on the verge of extinction. Without immediate, strongly focused, well designed and sustainable conservation initiatives the extinction of the eastern hoolock gibbon from Assam is inevitable. We recommend the following to safeguard this one and only population of eastern hoolock gibbon in Assam:

- Immediate steps should be taken by the Assam Forest department to stop and reverse encroachment in the Kundil Kalia Reserve Forest;
- Urgent action to curb illegal tree-felling, implementing strict laws to prevent canopy damage and loss resulting;
- Implementation of community-based conservation and awareness;
- Regular monitoring to follow demographic trends;
- Investigation of possibilities for connecting the three reserve forests with eastern hoolock gibbon populations;
- Most important, immediate action by the Assam government to convert the three reserve forests with remaining gibbon groups into a wildlife sanctuary, using the eastern hoolock gibbon as a flagship species—a timely step to ensure legal protection for the species and the wildlife of the Sadiya area.

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