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Human-elephant conflict in Bangladesh; causes and intensity of fatalities.

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Natural Resources Management

Submission date: May 2013

Supervisor: Eivin Røskaft, IBI

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A small elephant family group in an open place in the forest (Photo: Amir)



A solitary bull elephant resting under a tree during the mid of the day (Photo: Amir)



Dedicated to

My late mother Amena Khatun

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Executive Summary

The intensity of human-elephant conflict is fast growing in tropical and subtropical countries. Why such a sudden increase in human and wildlife conflict? This question is not because researchers have become more interested but because people want to know the reason for this human and wildlife conflict and what kind of solutions can be mitigated to solve this life hazardous conflict. The main purpose of my research was to record the level of human and elephant conflict in Bangladesh, has it been increasing gradually or been stable during the years 1972 to 2012? In addition, I wanted to evaluate the intensity of the conflict in relation to regions, locations, occupation of victims, time of the day, sex and age of the victims. Number of attacks gradually increased from 2000 to 2012. Before 2000 human and elephant conflict intensity was under control but after this year the number of attacks increased yearly. Overexploited forest resources, has explored more fragmented elephant habitats, out broken the land price and displaced more people. These are the fundamental causes of human and elephant conflict after 2000. Furthermore, lack of alternative livelihood opportunities near forests, corruption by forest staff and officers, weak forest and wildlife management laws are all indirectly induced to soar up the intensity of the conflict between people living close to forests and wild elephants. The conflict intensity rate was different between the Northwestern and Southeastern regions of Bangladesh due to different topography, location and size. Since the Southeastern region is very large and hillier than the Northwestern region, the elephant infestation rate was higher in this region. The most significant numbers of casualties happened during the winter and rainy season due to the cropping season. A significant higher number of deaths and injuries occurred during the night and early morning because elephant are more active due to their nocturnal behavior. Farmer was facing a higher rate of attacks than other occupations, and those living close to forests. A significant higher number of attacks occurred at forest edges than other locations. Male experienced more attacks than females and older age groups more attacks than other age groups. Moreover, number of attacks was higher by elephants in groups than by single elephants. Group attacks were most frequent in settlements and crop fields whereas single attacks occurred inside forests. During attacks, elephants mostly used both the leg and the trunk. Conflict related injuries were the main responsibility for elephant deaths.

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1.1. Introduction

Conflicts between humans and wildlife is not only a local or regional issue, but must be considered a global raising issue. All kind of life is, directly or indirectly, dependent on natural resources including landscapes, water, forests etc, but the human being is a dominant natural resources user who prevents other living organisms from using such resources. It is, however, possible to maintain a steady stable state in nature between resource users and providers if natural resources are used in a sustainable way. In that case, human beings can play a significant role to protect and maintain natural resources as a prime source for other organisms. However, today human beings must be considered a major threat to other organisms. Harmonic co-existence between human beings and other organisms might represent a stable environmental condition. Wildlife must be considered a high value associated with resources controlling forest ecosystem services. In fact, natural resources scarcity, especially forest resources, encourage the increasing conflict between humans and wildlife. Dominant wildlife such as large herbivores and carnivores must be considered the main threats to human life and as such they are one of the most important causes of such a conflict (Wellem et al., 1998). For example, Asian elephants (*Elephas maximus*) and Bengal tiger (*Panthera tigris*) are regarded as the human lives threatening wildlife in Bangladesh. Likewise rhinos in Nepal and lions in Tanzania are considered the most dangerous wildlife in the respect of human lives (Packer et al., 2007; Gurung & Gossow, 2004). People attitudes to wildlife depend on how risks or fear influence human lives instead of their recreational or ecological value (Røskaft et al., 2007). Large herbivores are mostly involved in crop raiding and property damage whereas large carnivores are engaged in livestock depredation. However, both large herbivores and carnivores must be regarded as serious threats to human life. Not only is their lives threatened, but also fear from large carnivores and herbivores may be the sources of danger of human lives as well (Sarker, 2010; Røskaft et al., 2003). Although small rodents, primates and medium sized carnivores cause more damage to human property than large animals, large animals are usually blamed for conflict related damages (Cumming et al., 1990). Conflict raising issues and mitigation strategies are mainly discussed under political ecological perspectives which directly or indirectly link up with natural resources utilization, access and control priority (Robbin, 2012). Natural forests are the most eminent resources near local communities, villagers and indigenous people who frequently live near such resourceful areas. Natural forests hold a significant amount of wild

animals. Wild animals get shelter, food and breeding facilities in natural forests. If natural forests are demolished wild animal's life will be hampered and will be facing threats from many sides. On the other hand, local communities, villagers and indigenous people livelihood opportunity will be blocked due to their dependency on forest resources. Directly or indirectly people living close to forests and wildlife are crucially intertwined with forest resources. If the stable condition of a forest is jeopardized, both sides will face a terrible condition on the aspect of survival. The human overpopulation pressure, national and international market values, bad governance and lack of awareness are the causes of disappearing forests in Bangladesh. The high consumption and utilization rate of forest resources have created paucity of forest resources and consequently a result from this is different levels of conflict. Different degrees of conflict may be occurring among villagers, communities and individual members of the society. There is an option to mitigate the conflict among community members if they change their forest dependent livelihood. Moreover, there is no alternative way to exist near elephants without changing the utilization of forest resources. Although the conflict between people and wildlife is common in many parts of the world due to natural resources scarceness, elephants presently suffer a high risk of going extinct. As local people and wild animals such as elephants share the same forest resources for their survival, such forest resources play a vital role for the protection of different lives. When forest resources are continuously depleted all kind of life will be threatened. Humans are mainly responsible for the scarcity of forest resources due to their unsustainable consumption of such resources. The wild animals or any kind of organisms are not responsible of the depletion of forest resources because their lives are maintained by ecological processes. Population density, abundance, and distribution basically depend on availability of resources under natural conditions. It is true that natural damage may be recovered in a natural way but anthropocentric severe damage is not possible to recover. The human beings are the main responsible for creating human and wildlife conflicts.

In many Asian and African countries elephants are considered as a flagship species which influence people to promote conservation activities. Human and elephant conflict is a very common problem in many tropical and subtropical regions due to forest resources insufficiency. If possible an increased conservation effort to reduce human and elephant conflict might benefit both sides (de Silva & de Silva, 2007; Walpole & Linkie, 2007). Human-elephant conflict is a dangerous problem in many Asian and African countries because the conflict directly threatens

human lives, damage properties and crops are lost. Not only human-elephant conflict but any kind of conflict ends up with huge losses. Since the elephant is a valuable and environmental friendly resource, our need is to protect the elephant and reduce the conflict.

Only two elephant species exist in the world, the first is the African elephant (*Loxodonta africana*) and the other the Asian elephant (*Elephas maximus*). African elephants are found in 37 African countries including four regions Central Africa, East Africa, South Africa and West Africa (Blanc et al., 2007). According to ANCF, (2006) around 300,000 to 600,000 African elephants are distributed over the 37 African countries whereas, 44,000 Asian elephants are distributed across 13 Southeast Asian countries. In some African countries such as Zimbabwe, Tanzania, South Africa and Botswana the elephant population are increasing whereas; in Asia the elephant population is decreasing dramatically. Presently, the Asian elephant is considered as a critical endangered species in many countries while the African elephant status is counted as a near threatened species (IUCN, 2000). According to Fogging, (2003) elephants in both continents are dramatically declining due to a result of an extreme human and elephant conflict. African elephants are stronger and larger than Asian elephants but Asian elephants are more frequently involved in killing of people. Asian elephants are divided into three subspecies (Sarker & Røskaft, 2011). Sri Lankan elephant only found in Sri Lanka. Indian elephant found in India, Nepal, Bangladesh, Bhutan, Myanmar, Thailand, Malay Peninsula, Cambodia, Laos, China and Vietnam, and finally Sumatran elephant found in Sumatra and Borneo and some others Islands in Indonesia.

The number of wild elephants in India, Myanmar and Thailand are overall not bad compared to the other eight countries where Indian elephants are found. In India, the estimated wild elephant number is around 23,900 to 32,400 individuals and distributed over a 200,000 km² fragmented habitat (Kempf & Santiapillai, 2000). This number is higher than in any other Asian country. The elephant of Assam and Meghalay provinces in India frequently migrate to Bangladesh. In Myanmar, the forest habitat condition is good and human-elephant conflict rate is lower than in the neighboring countries Bangladesh and India. The total land area in Myanmar is 676,000 km² and 50 % of the land area is covered by forests while 4 % is designated to protected areas (Kyaw & Cho, 2004). The estimated number of wild elephants in Myanmar is around 4,000 to 6,000 (Kyaw & Cho, 2004). The Arkan province of Myanmar is close to the Southeastern part of

Bangladesh. Huge numbers of Myanmar elephants frequently migrate to Bangladesh's Southeastern border forest areas. The wild elephant condition in Thailand is also good and the comparable forest condition is well. According to Stewart-Cox & Ritthirat, (2007) the estimated wild elephant numbers in Thailand is around 3,000 to 3,500 scattered over 60 protected areas. Without these countries, the Asian elephant population would not have been viable in the Southeast Asian belt countries where elephant populations are fighting for survival. Massive urbanization and an expanding landscape transformation are the core reasons behind the drastic decline in elephant populations in some Southeast Asian countries. A newly installation of barbate erected wire fences among some Asian countries is an increasing issue of concern due to isolated trans-boundary migratory elephants that remain in small pockets. If the Asian elephant loose the scope to continue with gene flow among different geo-political locations, a dramatic stochasticity will immediately occur. In Bangladesh, wild elephants are found in evergreen and semi-evergreen forests mostly in hilly areas. According to Chakraborty, (1996) local and trans-border migratory wild elephant numbers were around 195 to 234 individuals in Bangladesh in the year 1990. An estimate by IUCN, (2004a) was around 178 individual wild elephants in the year 2000. The wild elephant population size fluctuates between 150 to 200 individuals as estimated in the year 2010 (Sarker & Røskaft, 2011). In Bangladesh, wild elephants are divided into two groups- one local migratory and another cross-border migratory. Cross-border migratory wild elephants mainly come from India and Myanmar. They use trans-border routes as a corridor for their movements. Local migratory elephants also follow a specific route or corridor for their movements. Indian elephants use the West Bengal and the Sherpure border corridors for their movements. This corridor is limited to Northwestern parts of Bangladesh. Another corridor is the Myanmar-Teknaf corridor which link with four regions in Bangladesh including Teknaf, Chaunoti, Bashkhali and Rangamati. There is no link between the Indian and Myanmar cross-border corridor. Now, the Indian and Myanmar governments have established a strong fence between the corridors which is interrupting the elephant movements. On the contrary, the elephant habitat condition in Bangladesh is worsen and continuously diverted into several forms of farm land used by people in an unsustainable way. As described by Akhter & Sarker, (1998) the documentary Bangladesh forest department manage 1.46 million ha (10%) forests out of 2.52 million ha (17%) total forests including protected and reserved forests. Wild elephants mostly inhabit evergreen and semi evergreen hilly areas which range is delimited to a 67,000 ha area

under five forest divisions including Cox's bazaar, Chittagong, Chittagong hill tracts, Mymensingh and Sylhet. But during the British colonial period (1757-1947) wild elephants were available in both hilly and non hilly forest areas. Most of the Chittagong hill track's forest area was managed by the tribal authority. Bangladesh forest department had no authorization on the Chittagong hill tracks forest except reserved and protected forests according to the British forest law. Three types of forests where wild elephant are available including reserved, protected and hill tracts are mostly infested by human unsustainable activities. Basic requirement for wild elephants are water bodies, brows species as fodder, corridors and shelter space have been destroyed discriminately. Although the wild elephant population size has almost been stable over the last 30 years, the forest resources have not been stable due to overexploitation by people (Sarker & Røskaft, 2011). Over the last 30 years, unrecovered and unexpected forest resources have deteriorated and consequently ended up in an extreme level of human and elephant conflict. For this reason, the human elephant conflict in Bangladesh is being considered the most concerning and fast growing issue. In Bangladesh, wild elephants are considered as a human killer and agricultural pest. It is rare to escape from an elephant attack without any cost. When an elephant attacks on a crop field a lot of destruction happens especially during the crop season when farmers suffer by serious reduction of income coming from agricultural crops (Banskota & Sharma, 1995). Most fatal attacks occur during the crop season. The rate of and intensity of deaths, injuries and damage are increasing due to degradation, fragmentation and loss of elephant habitats. As elephants maintain large home ranges for foraging and movements, shrinkage of home range size force elephants to be engaged in different conflict situations (Yeager & Miller, 1986). Presently therefore, revenge killing rate accelerate dramatically on elephants. Forests near people and newly established settlers both legal and illegally try to grasp more forest related resources. As such critical endangered elephants try hard to continue to exist behind the survival pressure from nature. By considering, the environmental and ecological value, there is no alternative way to protect wild elephants considering them as environmental friendly wildlife. Broad range participation by local communities, elephant researchers, governmental and non governmental authorities can form a cooperative framework for the purpose of wild elephant protection. A good understanding and long term commitment to the protection of natural resources can be helpful when regarding the reduction of the conflict between humans and wildlife.

1.2. Study species

Both African and Asian elephants maintain herds as a sign of social cooperation. An elephant herd is formed through a matriarchic relationship similar to other social groups of animals. The oldest and more active female is normally the leader. Usually, when a male member is coming to the adolescence stage he separates from the herd and goes to a solitary life (Lee & Eltringham, 1991). Normally two or more bulls join together and form an unstable group for a certain period of time. A bull elephant is more aggressive and dangerous than an elephant herd. The elephant is nocturnal who maintain large home ranges and contains a corridor movement foraging behaviour. As elephants maintain a large home range, they frequently visit different patches of habitats within their home range with a specific time interval. Elephant gestation period is usually longer than other animals. The duration of gestation period is around 25 months from mating to birth. When an elephant herd contains calves they become more aggressive. All members in a herd take their responsibility to ensure the safety of a newly born calf. According to Wittemyer et al., (2007) the herd formation is by matriarch relatives including mother, sisters, cousins and their offspring. An adult Asian elephant demand around 150 Kilo food per day, it may therefore be impossible for elephants to collect this amount due to their depleted habitat condition. Some viral, bacterial and parasitic diseases are also responsible for the reduction of the population size of the Asian elephant. In Bangladesh, both Buddhist and Hindus consider the elephant as a symbol of luck and wisdom.

1.3. Problem statement

Human and elephant conflict is a major problem in some parts of Bangladesh where wild elephants are mostly found. Every year many people are injured or killed by elephants in Bangladesh (Sarker & Røskoft, 2011; IUCN, 2004c). Some dominant reasons are evident behind this increase including illegal entrances into forests for resources collection, illegal settlements and extreme agricultural practices near forest edges. The over human population pressure in this country encourages people to adopt illegal ways of survival. Poor people are being driven from their original places due to lack of alternative livelihoods, lack of land and are persuaded to illegally build their houses near forests. New illegal settlers and previous existing communities are both vulnerable to elephant attacks due to their locations near forests. Human and elephant conflict occur basically in some specific locations including settlements near forests, agricultural

fields near forests and forest edges. Wild elephants frequently raid villages nearest forests for the purpose of searching food due to food shortage inside the forest. Overexploitation of forest resources by new settlers and inherited local communities are the prime reason for the elephant food crisis inside the forests. During a raid in the forest edge or near forest crop land result in a conflict with high intensity and the ultimate result are more deaths and injuries. In that case, elephants occasionally face deaths or injury. Remarkable number of deaths and injuries are possessed during direct conflicts between humans and elephants . In Bangladesh, most elephant historical corridors are being blocked due to the excessive pressure from newly build up infrastructure, expanding farming activities as well as illegal encroachment by local people. A viewpoint from both sides indicates that the human being is the key indicator for such a conflict rather than the elephant.

1.4. Research Objectives

The aim of my study was to;

- ❖ Record total number of elephant attacks resulting in deaths and injuries during the period 1972 to 2012.
- ❖ Identify year, season, time of day, region and location when most elephant attacks result in deaths and injuries as well as elephant deaths.
- ❖ Identify gender, age group and occupational status of humans who are most vulnerable to elephant attacks.
- ❖ Identify the main causes of elephant mortalities and discuss the conservation status of wild elephants.

2. Materials and Methods

2.1. Study Area

Data were collected in two regions (Figure 1); one is the Chittagong hilly Southeastern region including four study areas; 1) Rangamati forest, 2) Bashkhali forest, 3) Chaunti wildlife sanctuary, and 4) Teknaf Game Reserve. The second region Sherpur forest area, lays in the Northwestern part of Bangladesh near the Indian border. Wild elephants mainly enter into Bangladesh through two cross-border corridors near Teknaf and Sherpur from Myanmar and India (Figure 2). According to IUCN, (2004a) these 15 internal corridors are linked up with the main corridors in the Southeastern part of the country. Teknaf cross-border corridor is linked up with Bandarban, Chaunti, Bhaskhali and Rangamati forest area, while the Sherpur cross-border corridor runs between the Northwestern part of Bangladesh through Korigram via Mymensingh to Sylhet division along with the Indian west Bengal, and Assam provinces of India (Figure 2) (Choudhury, 2007). The trans-border migratory Asian elephants frequently visit these two countries (Feroz et al., 2004). The wild elephants in Bangladesh are mainly found in these two regions however, there is no link between these two regions (Figure 1).



Figure 1. 1) Sherpur, 2) Rangamati, 3) Bashkhali, 4) Chaunti and 5) Teknaf study sites of human elephant conflict in Bangladesh.

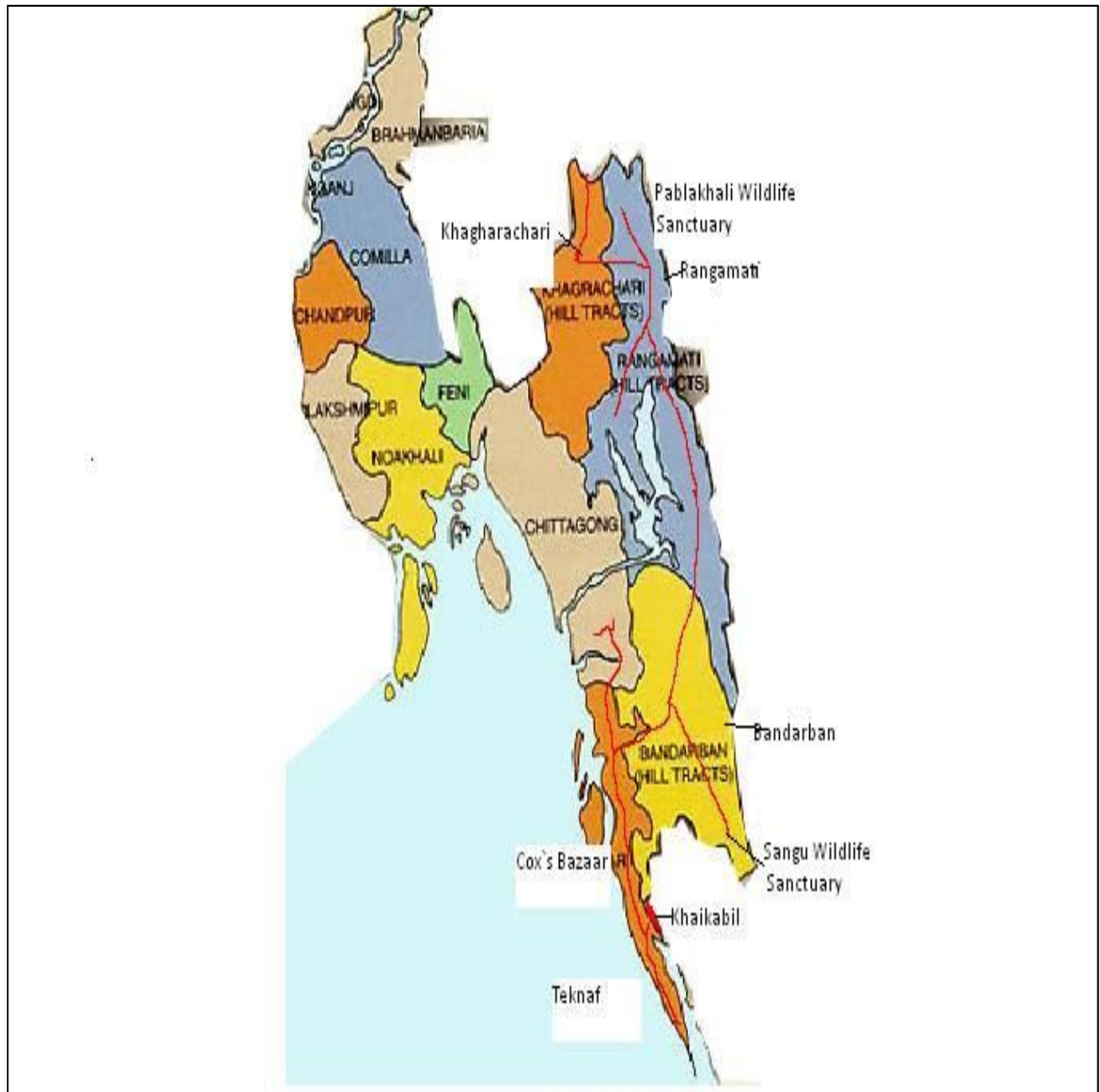


Figure 2. *Elephant movement corridors (red lines) in Southeastern part of Bangladesh.*

2.1.1. Ragamati Forest Area

Ragamati forest area is the largest and divided in two types of forests; one hill tract forest and another governmental forest. Both are evergreen and semi evergreen hilly forests. The Government has no authorization on the hill tracts forest. The indigenous people in the hill tracts are controlling and maintaining these types of forests over generations according to their inherited rights and access. The trans-border migratory elephants are basically entering Chittagong in the north forest division through Teknaf and Bandarban corridors (Sarker & Røskaft, 2010a). The river Kornopoli is disconnecting the two parts of the Rangamati forest area. The trans-border migratory elephants come from Teknaf forest area to Rangunia forest by following the link corridor which passes through the Dudpokoria, Komolchari, Kuruchia, Sukbilush, Padua, Bangalhali, Doungnala, Kotalia and Rangunia forest parts. These forest parts are furthermore linked to the Kapti forest part. The trans-border migratory elephants first enter into Bandarban hill tracts from Teknaf forest area and then follow Dudpokoria to the Rangunia corridor. When elephants are reaching the Rangunia forest part they turn back because of the Kornopoli river barrier. This main corridor is also divided into several sub-corridors which is networking the whole forest part. In the hill tract forest area, the local migratory elephant herds are frequently travelling from Publakhali forest area to Subolong forest area through a corridor which passes through Chorakhali, Mahila, Golshakhali, Rangipara, Ghonomor, Bhashinadam, Koshomchari and Shilkata. This main corridor is divided by several sub-corridors linking all forest parts. This corridor connects the Kapti lake southern part. There is no corridor linking the Kapti lake northern part. The local migratory elephant herds frequently use this corridor. Local people claim that local migratory elephants visit this corridor on a monthly basis. The middle of Rangamati forest area furthermore contains a corridor which links to the Khagrachari forest area and another with the Bandarban forest area. Elephants from the Mazorum part of India and Arkan part of Myanmar can travel upto the middle part of Rangamati by these two corridor connections.

2.1.2. Bashkhali Forest Area

The Bashkhali forest area is a part of the Chittagong south forest division. This forest area is a kind of isolated forest pocket surrounded by dense human settlements. This forest area is divided into four forest parts including Pouichari, Naupora, Chambol and Jaldi. This forest area is linked

to the Chaunti forest area. Elephant herds frequently travel into this area. Elephants enter this area from Chaunti Wildlife Sanctuary. First they enter the Pouichari forest part from Chaunti wildlife sanctuary and then follow the connecting corridor which passes through Pouichari to Jaldi. The trans-border migratory elephant herds come here from the Arkan forest part of Myanmar through Teknaf and Chaunti corridors. After foraging, browsing and routine movements they go back by following the same incoming route.

2.1.3. Chaunty Wildlife Sanctuary

This wildlife sanctuary is more famous and important because it contains more diversified wildlife (IUCN, 2004b). It is a part of the Chittagong south forest division and Bashkhali forest area. Chaunty was established as a Wildlife Sanctuary in 1986 under the Wildlife preservation act (1974) and protected area is 77.64 km² (Sarker & Røskaft, 2010a). This protected area contains a crucial link corridor between Teknaf and Bashkhali forests. Elephant herds enter this protected area through the Teknaf- Chaunty- Bashkhali main corridor. In the Chaunty forest area elephants move through a link corridor of Harbang-Aziznagor-Chaunty range-Chaunty beat. This link corridor is a part of a main joint corridor. Local people is claiming that the number of Trans-border migratory elephant herds increase during the crop season.

2.1.4. Teknaf Game Reserve

Teknaf Game Reserve is a part of the south Cox's bazaar forest division and has a link with Cox's bazaar north forest division. This game reserve encompasses 116.15 km² area and ten forest parts including Raikong, Saplapur, Shilkhali, Maddyani, Dakhin-nilla, Matabhanga, Rajachara, Ledha, Dumdumia and Teknaf (Sarker & Røskaft, 2010b). In addition, Innani and Himchari are parts of Teknaf game reserve. The Cox's bazaar north forest division includes Okhia, Lama, Thanchi, Idgur, Fashiakhali, Dulahazra and Kutakhali. Teknaf forest area is close to Arkan forest area of Myanmar and Naf river bank. Most wild elephant herds come from Myanmar through Khikabil near Thumro-Arkan border. This place joint the Teknaf forest area with Arkan forest area near the north Naf river bank with a short corridor. Khikabil trans-border corridor link up with three majors Bangladeshi internal corridors. The first corridor starts from Khaikabil and run through Thumro, Balokhali, Innani, Himchari, Whykong Saplapur, Nilla, Rajachara and Teknaf. The second corridor starts from Khikabil and passes through Balokhli,

Ukhia, Ramu, Chakaria and Chaunty. The third corridor starts from Khikabil and runs through Thumro, Kalichara, Lama, Thanchi, Alikodam and Dudpokoria. A branch corridor has developed from the second corridors of Chakaria forest part and run through Chakaria, Idgor, Fashikhali, Dulahazra, Khutakhali. When Trans-border migratory elephant herds pass the Khaikabil border they are divided into three groups and follow three main corridors. These three corridors exist in Cox's bazaar south and north forest division, Chittagong south forest division and some parts of north forest division.

2.1.5. Sherpur Forest Area

The Sherpur forest area is a part of Mymensingh forest division. The Mymensingh forest division involves with three regions including Nalitabari, Kurigram district and Durgapur region (IUCN, 2004a). This Northwestern forest area is close to the Indian Meghalaya border. In Bangladesh from Kurigram via Sherpur upto Sylhet it involves a hilly and rugged topography belt similar to the Indian Maghalaya region (Choudhury, 2007; Islam, 2006). These locations are the trans-border line between Bangladesh and India. Wild elephants mainly come from Maghalaya region in India to the Nalitabari and Zinigathi forest area in Bangladesh. Rangti, Modotila, Gazni are parts of Zinighati remarkable for wild elephants. The trans-border migratory elephant herds continuously move between Sherpur and Maghalaya. The forest condition in Bangladesh is deteriorated and there are no appropriate habitats for elephants. Most trans-border migratory elephant herds are therefore aggregated between border lines.

2.2. Methodology

Because elephants only live in hill type forests in Bangladesh data collection was sometimes complex and risky. We therefore had to avoid any kinds of abnormal situations. The five study areas were frequently visited from mid June to mid of August 2012 for the purpose of collecting data by directly field visits and using questionnaires. Before the field work, I collected data about humans and elephants conflict from secondary sources including previous published and unpublished research papers, documents in the forest department, and from daily national and local newspapers. Collected information was from the years 1972 to 2012.

During fieldwork, five local guides from five study sites were selected to assist in data collection during field work. Furthermore, two research assistants were also recruited to help with data

collection. Forest guards and local people support and cooperation were also used to ensure security during data collection. Security is of great importance when doing forest related research in Bangladesh. Tribal extremists, Rohingya refugee extremists, forest pirates and smugglers use forest areas as comfortable shelter places. A researcher's life without appropriate security protection might therefore be threatened in the forest area during research work by such criminals.

Questionnaire based interviews were taken from a victim's family member or victim's relatives. We differentiated between human death or injury as well as an elephant's death as a result of the conflict situation. Major injuries such as a broken hand, a broken leg or backbone, as well as serious injuries in the body were counted as an injury related case. Since dwellers near forests are well known with elephant casualties' related information, the family of the victim was consulted only when a victim was dead. After an incident, many victim families moved to another settlement; in such cases data was collected from relatives of the victim. Cross examine processes were applied to justify and ensure the quality of the collected data. Frequently we visited the forest along with the interview to identify the location of the incident. Furthermore, focus group discussions were organized with local community leaders, forest officers and local government representatives to exchange opinions about the purpose of elephant conservation and conflict reduction perspectives.

2.3. Data analyses

The collected raw data was sorted based on their importance and usability to make the analyses easier. Data were coded and digitalized to ensure easy analyses. SPSS software version 19.00 (IBM, USA) was used to analyze data (Cooke, 1992). As the data was not normal distributed, non-parametric chi square tests were normally adopted. During chi square tests, a significance level of $P = 0.05$ was used.

3: Results

3.1. Deaths and injuries caused by elephants:

Table 1: *Frequencies of human deaths and injuries caused by elephant attacks in relation to region, year, season, time of day, occupation, location, gender and age group. All statistics are with Chi-square tests.*

Variable	Deaths		Injuries		²	df	P
	N	%	N	%			
Region							
Sherpur	18	72	7	28			
Rangamati	63	69.2	28	30.8			
Bashkhali	36	85.7	6	14.3			
Chaunty	20	87	3	13			
Teknaf	36	83.7	13	16.3	7.687	4	.104
Year							
1989-1992	11	84.6	2	15.4			
1993-1996	9	81.8	2	18.2			
1997-2000	10	100	0	0			
2001-2004	25	69.4	11	30.6			
2005-2009	57	76	18	24			
2009-2012	61	77.2	18	22.8	4.789	5	.442
Season							
Winter (Dec-Feb)	53	74.64	18	25.36			
Summer (Mar-May)	31	79.49	8	20.51			
Rainy (Jun-Aug)	48	76.29	15	23.80			
Autumn (Sep-Nov)	41	80.39	10	19.61	7.548	11	.753
Time							
Morning	37	80.4	9	19.6			
Noon	13	76.5	4	23.5			

Afternoon	14	73.7	5	26.3			
Evening	21	91.3	2	8.7			
Night	88	73.9	31	26.1	3.729	4	.444
Occupation							
Farmer	89	80.2	22	19.8			
Gardener	1	33.3	2	66.7			
Labor	13	76.5	4	23.5			
Fuel wood collector	15	78.9	4	21.1			
House wife	21	63.6	12	36.4			
Businessmen	4	66.7	2	33.3			
Student	9	90	1	10			
Others	21	84	4	16	9.302	7	.232
Location							
Forest inside	41	77.4	12	22.6			
Forest outside	14	93.3	1	6.7			
In settlements	50	68.5	23	31.5			
On roads	20	76.9	6	23.1			
Forest edges	47	83.9	9	16.1	6.789	4	.147
Gender							
Male	141	80.1	35	19.9			
Female	31	67.4	15	32.6	3.381	1	.066
Age group							
Juvenile	33	82.5	7	17.5			
Youth	25	71.4	10	28.6			
Adult	55	76.4	17	36.6			
Old	60	77.9	17	22.1	1.352	3	.717

Although there was a statistically significant difference in number of elephant attacks between regions ($\chi^2 = 67.3$, $df = 4$, $P = 0.000$), there was no statistically significant difference between frequencies of deaths and injuries among the different regions (Table 1). The highest number of deaths and injuries were found in Rangamati region (Table 1), whereas, the lowest number was found in the Sherpur region (Table 1). Sherpur is the only region in the Northwestern part of Bangladesh where elephants are mainly found. The second highest number deaths and injuries were found in the Teknaf region (Table 1).

Number of attacks on humans increased significantly during the study period ($\chi^2 = 139.0$, $df = 5$, $P = 0.000$, Table 1). Although frequencies of deaths and injuries varied from year to year it did not vary statistically significantly between years (Table 1). The frequency of deaths per attack was 77.2 % ($N = 224$), while 22.8 % of elephant attacks resulted in injury. The first death and injury caused by elephant attacks was recorded in Rangamati in the year 1989.

Bangladesh is a very colorful country and contains six diversified seasons, however, four seasons are dominant; winter (December - February), summer (March - May), Rainy (June - August) and autumn (September - November). The elephant attack rates varied statistically significantly among seasons ($\chi^2 = 10.5$, $df = 3$, $P = 0.01$). However, the frequencies of deaths and injuries did not vary significantly among the four seasons (Table 1). The highest number of deaths and injuries were recorded during winter ($N = 71$) and the lowest numbers of deaths and injuries occurred during summer ($N = 39$). During the rainy season ($N = 63$) and autumn ($N = 39$) deaths and injuries were moderate (Table 1).

A statistically significant difference in attack frequencies was found between the different times of the day ($\chi^2 = 165.6$, $df = 4$, $P = 0.000$). Most deaths and injuries occurred during night and a lower rate at noon. In addition, deaths and injuries were moderate during morning, afternoon and evening (Table 1). However, there was no statistically significant relationship between time of the day and frequencies of deaths and injuries (Table 1).

There was no statistically significant difference between frequencies of death and injuries in relation to different occupations (Table 1).

Location refers to the distance between the settlement and the forest. There was a statistically significant difference between distances to the forest and elephant attacks ($\chi^2 = 49.9$, $df = 4$, $P =$

0.000) but there was no statistically significant difference between frequencies of deaths and injuries among locations (Table 1). Most attacks occurred at forest edges and settlements (Table 1).

More males (N = 146) than females (N = 46) were attacked by elephants ($\chi^2 = 76.13$, $df = 1$, $P = 0.000$). However, there was only an almost statistically significant difference between frequencies of deaths and injuries and gender (Table 1) (males 80.1 % deaths & 19.9 % injured; females 67.4 % deaths & 32.6 % injured).

There was no statistically significant difference between age groups and frequencies of deaths and injuries caused by elephants (Table 1). Moreover, number of elephant attacks at different age groups was statistically significant ($\chi^2 = 24.89$, $df = 3$, $P = 0.000$). The old and adult people were more vulnerable than juvenile and young people (Table 1).

3.2. Attacks in relation to single or group elephants:

Single attacks occurred mainly by bull elephants. The frequencies of single and group elephant attacks differed statistically significant among different regions and time of the day (Table 2), and an almost statistically significant difference was found among regions (Table 2). More group attacks were found during night time and early morning.

There was no statistically significant difference between single and group elephant attacks between different year periods ($\chi^2 = 2.416$, $df = 5$, $P = 0.789$).

Table 2: *Frequencies of single and group attacks by elephants in relation to region, year, season, time of day, occupation, location, gender and age group. All statistics are with Chi-square tests.*

Variable	Single attack		Group attack		²	df	P
	N	%	N	%			
Region							
Sherpur	5	20	20	80			
Rangamati	32	35.2	59	64.8			
Bashkhali	24	57.1	18	42.9			
Chaunty	15	65.2	8	34.8			
Teknaf	32	74.4	11	25.6	30.007	4	.000
Year							
1989-1992	6	46.2	7	53.8			
1993-1996	7	63.6	4	35.4			
1997-2000	5	50	5	50			
2001-2004	20	55.6	16	44.4			
2005-2009	35	46.7	40	53.3			
2009-2012	35	44.3	44	55.7	2.416	5	.789
Season							
Winter (Dec-Feb)	38	53.5	33	46.5			
Summer (Mar-May)	19	48.7	20	51.3			
Rainy (Jun-Aug)	25	39.7	38	60.3			
Autumn (Sep-Nov)	26	51.0	25	49	2.789	3	.424
Time							
Morning	19	41.3	27	58.7			
Noon	12	70.6	5	29.4			
Afternoon	9	47.4	10	52.6			

Evening	16	69.6	7	30.4			
Night	52	43.7	67	56.3	9.465	4	.050
Occupation							
Farmer	54	48.6	57	51.4			
Gardener	1	33.3	2	66.7			
Labor	9	52.9	8	47.1			
Fuel wood collector	13	68.4	6	31.6			
House wife	15	45.5	18	54.5			
Businessmen	1	16.7	5	83.3			
Student	5	50	5	50			
Others	10	40	15	60	6.714	7	.459
Location							
Forest inside	30	56.6	23	43.4			
Forest outside	8	53.3	7	46.7			
In settlement	25	34.2	48	65.8			
On road	16	61.5	10	38.5			
Forest edge	28	50	28	50	9.274	4	.055
Sex status							
Male	87	49.4	89	50.6			
Female	20	43.5	26	56.5	.518	1	.472
Age status							
Juvenile	17	42.5	23	57.5			
Youth	14	40	21	60			
Adult	34	47.2	38	52.8			
Old	43	55.8	34	44.2	3.293	3	.349

No statistically significantly variation in elephant attack rate was found between different seasons in Bangladesh (Table 2).

No statistically significant variation was found in relation to group and single elephant attacks in relation to different occupational status of people (Table 2).

Most single attacks were found inside forests or forest edges (forest inside N = 30 and forest edge N = 28), while most group attacks were found in settlements (N =48) however, this difference was only almost statistically significant (Table 2).

Finally no differences were found in frequencies of single or group attacks in relation to gender or age of the victims (Table 2).

3.3. Weapon used by elephants

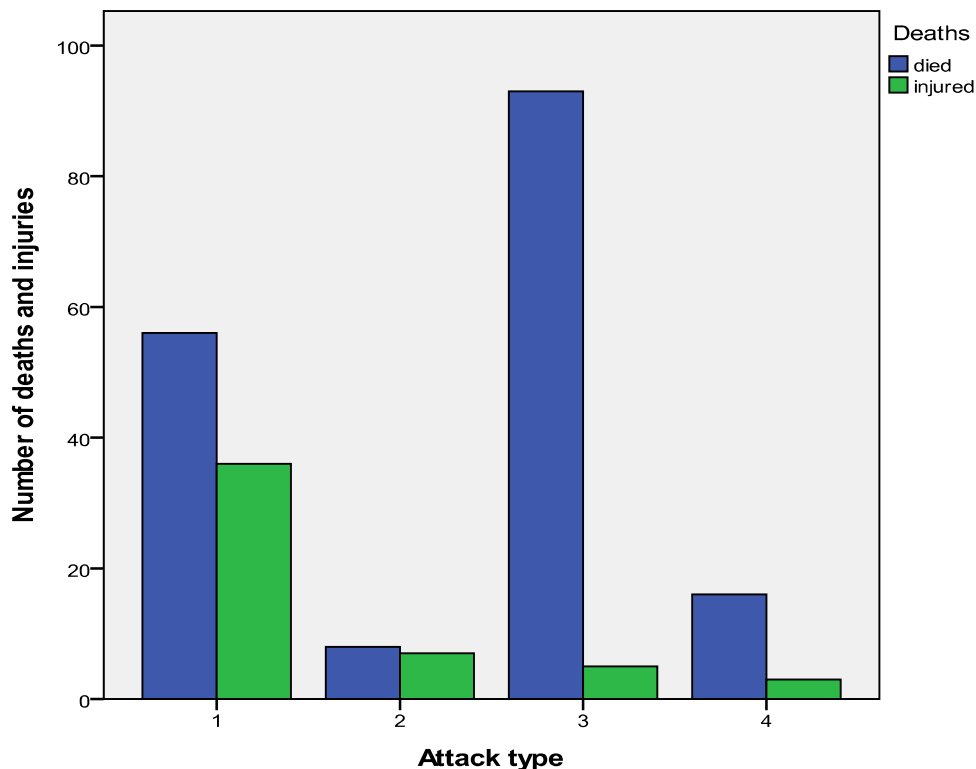


Figure 3: Number of human deaths and injuries in relation to elephant attack types (1 = trunk, 2 = leg, 3 = both trunk and leg, 4 = tusk).

Elephants used their trunk, leg or tusk as a weapon when attacking people (Figure 3). When elephants used their trunk as a weapon the result ended up in a higher frequency of deaths (Figure 3). However, when the elephants were using the leg instead of other organs the frequency of deaths decreased (Figure 3). The elephants used their leg or tusk as a weapon rarely (Figure 3). The frequency of deaths and injuries varied statistically significantly in relation to what weapon the elephant used when they attacked humans ($\chi^2 = 36.799$, $df = 3$, $P = 0.000$).

3.4. Causes of elephant deaths

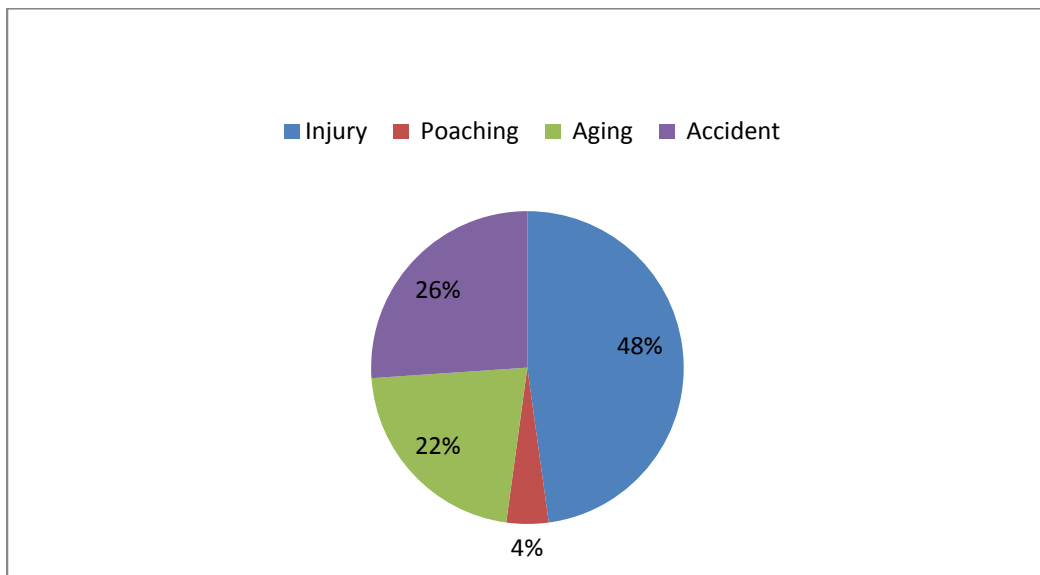


Figure 4: *Causes of elephant deaths.*

The most frequent cause of elephant deaths were injuries after human conflicts (Figure 4). The least frequent cause was poaching (Figure 4). Elephant deaths because of age or accidents were in between these two extremes (Figure 4).

4. Discussion

4.1. Demography of victims

People living close to forests are most vulnerable to elephant attacks. Such people are mostly engaged in agricultural practices, cattle ranching, forest resources collection, illegal forest wood and resources trading, gardening and guarding under the forest office (Sarker, 2010). Such farmers involved in agricultural practices and cattle ranching were the ones most frequently attacked by elephants. Farmers were however, affected by more group than single attacks during crop raiding. Elephants are entering the palatable paddy fields during the harvesting season and farmers try to protect their paddy by guarding it intensively during that time. Farmers can easily drive single elephants out from the fields whereas elephant herds are more difficult to drive out from a crop field.

Although there is a high chance of farmers to run away from the elephants when they are in the rice field, they still try to protect their crop so their family can survive. However, attacks during the crop season along with other agricultural activities such as land preparations and cattle ranching make the farmers face more elephant attacks. Forest resources collectors such as fuel wood collectors were affected more by single attacks than by group attacks. Other people including woodcutters, grazers and labors face similar attacks by elephants (Khan, 1980). When people illegally enter the forest to collect forest resources they try to avoid any kind of constraints from the forest guards. Nevertheless, bull elephants prefer to attack single persons. For this reason, single forest intruders who are busy collecting forest resources are occasionally attacked by bull elephants. The day time is the time when most such attacks happen by bulls while herds mostly attack during night.

House wives were more frequently killed by elephants than men of non forest related occupational statuses including labor, students, businessmen and others. When elephants visit a house to search for store grains is the time the women are more vulnerable according to their weaker strength and escaping ability.

Both sexes were affected by elephant attacks but the ratio between males and females was different. Males were four times more likely to be attacked than females because they were more frequently in the forests and forest edges. According to Bandaras Tisdell, (2003) 75% men, 13%

women and 12% children were killed by elephants from the total of 536 deaths between 1992 to 2001 in Sri Lanka.

Elephant attacks varied between age groups including juvenile (age 5-19), youth (20-34), adults (35-49) and elder (50-65). Old people were attacked by elephants at higher frequencies than the other three groups. Moreover, old people were mostly attacked by single elephants whereas the second highest affected group was faced by more by group attacks. Juveniles and youth were mostly attacked by group elephants. The juvenile attack rate was higher than youth because those juveniles are mostly students and not experienced by elephant attacks while youth was more experienced and able to tackle elephant attacks. In Biligirirangans of India, 77% deaths were caused by herds and 23% of the cases were caused by bulls from a total 53 deaths (Sukumar, 2003).

4.2. Conflict intensity in different regions, locations, years, seasons and times

The Southeastern and Northwestern parts of Bangladesh are more infested by wild elephants than the nearest Myanmar part of Arkan hilly area and Indian part of Meghalaya. Human population pressure, depleted forest conditions and weak forest management are the main factors responsible for a higher human elephant conflict in Bangladesh than in India and Myanmar. Most cases of human deaths were found in Southeastern Bangladesh. The Northwestern part is a small isolated hilly pocket while the Southeastern part is a large forest area including Chittagong division, Cox's bazaar division and with three hill tracts (Ragamati, Bandarban and Khagrachari). According to IUCN, (2004a) the Sylhet region in the Northwestern part and Khagrachari in the Southeastern part are both famous for their wild elephants. However, during my field work in those places the wild elephants were absent. Rangamati and Bandarban hill tracks areas are overlapping with Chittagong and Cox's bazaar forest areas and less affected by elephant attacks in tribal oriental areas than in non tribal areas. Wild elephants mostly avoid tribal areas due to the risk of illegal hunting by those tribes whereas non tribal areas are mostly infested by wild elephants. Thus they experienced large numbers of human death. The highest number of human deaths and injuries were found in the Rangamati region due to the fact that the elephant habitat was mostly demolished by the building of a hydropower project in 1962 and the establishment of a new non tribal settlement in 1980 (Sarker & Røskaft,2010b). The second highest number of human deaths and injuries were found in the Teknaf region due the fact that to

this region contain a borderline with Myanmar. Thus maximum high number of migratory elephants enters Bangladesh in the Southeastern part through this border. The high elephant density in this region is causing more deaths and injuries. The Bashkhali and Chaunti forest regions are surrounded by dense human settlements and the few elephants entering this region is the reason for less human deaths and injuries here than other two regions.

The intensity of human-elephant conflict varies among different forest segments such as inside, edge and outside the forest. In addition, forests close to roads and settlements are mostly affected by elephant attacks. Intensity of deaths and injuries were highest in forests close to settlements, corridor enclosed settlements, and forest edges where illegal settlements were common due to short distances to forests, food scarcity inside the forest and extreme disturbances by people. The human-elephant conflict intensity rate was remarkable high near forest edges because of more agriculture related practices and illegal settlements. In addition, human-elephant conflict intensity was high inside the forests due to illegal human entrances. According to Sukumar, (1989) the Biligirirangans of Tamil Nadu, 55% of human deaths occurred inside the forest during the day while 45% of the deaths occurred in settlements at night from a total of 123 human deaths caused by elephants in India. Moreover, a weak forest management system and lack of awareness are also factors responsible for the intensity of deaths and injuries inside forests. Human-elephant conflict is increasing outside the forests due to crop raiding in the crop fields and raiding for store grains in houses (Sarker & Røskaft, 2011; Sukumar, 2006).

The frequency of elephant attacks on humans increased significantly over the study period due to more scarcity of forest resources and transforming forest land into other activities usually in an illegal way. My results show that before 2000, the conflict intensity rate was low and stable but after 2000 the conflict rate increased dramatically due to unsustainable enhanced forest related anthropocentric activities. As described by Freez et al., (2004) the number of human deaths and injuries are annually increasing drastically in Bangladesh, and much more than the nearest countries. Likewise, in India around 300 humans are killed by elephants every year (Bist, 2002). According to Lee et al, (1986) negative interactions between humans and elephants have escalated dramatically over the last 30 years. Encroachments of forest land and establishment of new illegal settlements are the dominant causes behind the increasing intensity of human

elephant conflict. Poor people are being driven out from their original land to forest land due to financial crisis, lack of livelihood opportunity and excess of land cost.

Human-elephant conflict intensity varied significantly between different seasons which mainly are due to crop availability in the field. The conflict intensity rate reached an extreme level during the winter and the rainy season due to the harvesting time of paddy (Sarker & Røskaft, 2010b; Sukumar, 1990). Ripen paddy is a palatable browser near the elephants whereas the poor farmer's family food sources depends on harvesting ripen paddy from the field. Since both the farmer and the elephant are trying to share the same agricultural resources consequents is an increased conflict resulting in deaths and injuries. The hilly area is dry during summer and elephants are searching their food close to settlements due to less availability of food in agricultural land and forests. The ultimate result is an increased conflict between humans and elephants.

Elephant attacks on humans furthermore differed significantly during the day. The most extreme level of conflict intensity occurred during the night time (Sarker & Røskaft, 2010 b). Elephant herds and bulls are more active during the night than during the day due to their nocturnal activity characteristic. During this time, the conflict is a consequence of the co-variation in activities between the elephants and humans in settlements or crop land where farmers guard their crops. When elephants attack in settlements at night on sleeping people it is more unpredictable how many people that are killed or injured as a direct result of the conflict. After foraging at night the elephants return to their resting places in the morning. The conflict intensity was higher during the morning and elephants were doing front attacks as well. In the morning people and elephants both are crossing each other during their movements and people are therefore attacked by the elephants. According to Sukumar, (2003) dusk and dawn are considered the most crucial time for more causticity during the harvesting period as well. From morning to dusk, the elephants are resting in a shady appropriate place inside the forest. For this reason, this time is a low conflict intensity time of the day.

4.3. Weapons used by elephants and human mortality

There was a strong relationship between the weapon the elephant used when attacking a human and human mortality rate. This also differed between single or group elephants. Elephant attack

style refers to elephant attacking technique during conflict. Elephants used their trunk, legs and tusks as a weapon for two purposes including offensive and defensive attacks. Offensive attack tendency was produced from more aggressiveness which links to elephant internal environment and surrounding environment. If elephants expect to be facing more trouble from the external environment at the same time as it is facing higher hormonal activities during the adolescence period, such external and internal factors may enforce the elephant to be more aggressive resulting in an offensive attack. Furthermore, defensive attacks are tendencies of avoiding conflict because the animal is holding a low level of aggressiveness as a consequence of a low external risk level. As addressed by Sukumar, (1991) a lot of factors are involved with aggressiveness when the elephant is facing a higher risk situation and deprived from access facilities. Defensive attacks were less severe than offensive attacks. Bull elephants were mostly involved in offensive attacks whereas group elephants usually practiced more defensive attacks. While a herd faces more severe attacks on people and thereby are at more risk thus elephant herds first applied defensive attacks before offensive attacks. This type of attacks mostly happens in the field during crop raiding. If an elephant herd attack occurs during the night an offensive attack is normally the case. Moreover, if a herd included one or more infants they normally performed an offensive attack to ensure the security of their infants.

The elephant mostly prefer to use the trunk as a weapon when attacking humans. This is because of this organ's easy grasping capability. However, when elephants tried to escape from humans they are normally less aggressive then they used the leg as a weapon trampling the target to avoid a potential conflict (IUCN, 2004c). When elephants used the tusk as a weapon, they normally attacked from the front and the target was pierced. When the elephant was aggressive they also used the trunk and leg together to ensure they killed the victim.

The frequency of deaths was also much higher when the elephant used both the trunk and leg as a weapon. If elephant applied this technique, they first catches the target human and then hit with the upper part of the leg and then crash the target's head by the foot to ensure the death of the target. However, if the elephant used only the trunk during the attack, more injuries were the result. Finally, if the elephant applied only leg as a weapon less causality occurred. The application of only the tusk as a weapon is a rare case.

According to IUCN, (2004c) the number of attacks by using the leg and trunk together then the number of deaths increased. According to the local participants elephant attack style is almost similar now as it used to be a decade ago. Critically injured man lead a miserable life for a long time.

4.4. Elephant deaths and conservation value

We found 23 dead elephants during 1989 to 2012. In India around 200 elephant deaths are found every year (Bist, 2002). Similarly, in Sri Lanka around 150 elephant deaths are found every year due to human and elephant conflicts as well (Perea, 2009). Two causes of deaths were responsible for most elephant deaths; naturally after having reached a certain age level and secondly abnormal deaths. Abnormal deaths may be injury related deaths, accidental deaths and poaching. Injury was a dominant reason for most of elephant deaths in Bangladesh which occurred during counter attacks by humans. This type of attack is a kind of revenge attack of people on elephants. If an elephant is injured by people after an encounter, the injured elephant might gradually be driven to death by the damage caused by humans that might be more intense as time passes on. Firstly the injury might be infected and thereafter rotten and then create a permanent sore in the injured place which finally results in death. Field work observations show that elephant herds always avoid serious injured members of the herd from their social awareness.

Accidents are also important reasons for elephant deaths including falling down from the top of a hill, electrocution, trapping in mud on narrow hilly routes, death by thunderstorms and snake bites. Small mistakes by elephants and unpredictable events enforce elephants to die in this way. The highest number of elephant deaths was found in the Southeastern part of the country. Likewise, (IUCN, 2004b) showed that seven dead elephants were found in the Southeastern of Bangladesh between the years 2000 to 2001 while very few cases were found in the Northwestern part. As the elephant is considered an ecological engineer, the wild elephants play a significant role to protect the forest ecosystem. Poaching related deaths were very few because of the governmental strict rules and regulations. According to the wildlife act of 2010, r; if anybody is engaged in elephant killing, he will get lifetime sentence with financial punishment (BFD, 2012). However, there is no strong law against illegal settlements and illegal entrances into forests. Unless government implements strong law enforcement against illegal settlers and

intruders, elephant conservation effort and conflict mitigation measures will fail. Tribal people are mostly involved in elephant killing due to their food habit practice of collecting food in the wild. The socio-economical condition of people living close to forests also involves with elephant conservation efforts. Since such people usually are poor, financial aid from national and international organizations can help to enhance elephant conservation effort in Bangladesh. Extra flow of money to poor people will change their livelihood pattern and extend an alternative way for their survival.

Some socio-economical problems were found as a byproduct from the human and elephant conflict. A victim family faces negligence and criticism by neighbors as a social problem. Even some important social services are blocked after the incident. Usually, a victim family falls down to a deep financial crisis due the loss of the money earning person (Sarker, 2010). Furthermore, governmental compensation is not allowed to illegal victims according to the new law. The victim's family is therefore very poor and not able to be supported by money. Furthermore, some religious problems are also raised after a person is killed by the elephant. For instance, the neighbors consider the victim family as a great sinner family and God provided them an appropriate punishment. Superstitions and illiteracy are the main factors behind such religious negligence. In addition to those religious problems the victim's family also experiences some political problems. For example, there is a risk that the victim family will be evicted by neighbors from their home.

5. Conclusion

Human elephant conflict intensity has gone out of the level of tolerance in Bangladesh. It is presently very common to find news about human elephant conflict in daily newspapers. When attacks by elephants on humans occurs the victim families demand compensation from the nearby forest department. However, in return the forest department raises the question about illegal activities of victim families. As a result, most of the victim families fail to achieve compensation because of their forest related illegal activities. According to the new wildlife act, illegal forest intruders or settlers receive no compensation if killed by an elephant. Thus a new conflict dimension has evolved between local people and forest authorities due to the no compensation schemes and forest department's strong enforcement against illegal activities. The new dimension of compensation related conflict has demolished mutual cooperation between the

local people and the forest authorities which directly or indirectly is hampering the forest management system. The perception from local people is that they hope that both sides should be facilitated by the forest department including permission to perform illegal activities at the same time as they are compensated. However, it is not possible for forest authorities to break the new forest wildlife acts which are the most important law enforcement act for wildlife conservation. Wildlife is considered to be crucial for the survival of nature. But high illiteracy rate and selfishness influence local people to perform inflexible demands without a legal legitimacy. Furthermore, some corrupted forest officers also provide illegal activities to illegal intruders and settlers by accepting bribery which encourages the local people to continue their illegal forest related activities thereby demanding similar benefits without considering the legality of their activities. Some welfare activities including incentive programs, awareness programs and training programs by the forest department can help to reduce illegal activities by people living close to forests. If illegal activities are reduced by the local people's mind, the forest related conflict will automatically be coming to a more tolerable level. If nongovernmental and international organizations involve this type of welfare programs, the local people will be more benefited. In addition, some short or long term fruitful human elephant conflict mitigation strategies can be helpful in reducing the conflict intensity and find a more fruitful way of smooth co-existence between people living close to forests and wild elephants. The short and long-term mitigation approach will be effective when done with appropriate implementation. A successful implementation depends on several factors including mutual cooperation from the local people living close to the forest, a corruption free forest department and appropriate knowledge as well as experience about the applying approach. A short-term mitigation strategy can be an effective human-elephant conflict reducing process helping initial support of the implementation of a long-term conflict mitigation strategy. If a short-term conflict mitigation strategy is fruitful expanding the possibility and stability of a long-term conflict mitigation strategy might be fruitful. A short-term conflict mitigation strategy may be traditional or scientific or both. In many parts of conflict regions in Bangladesh, traditional methods are less effective due to long time habituation by elephants. There are many newly invented and more effective traditional and scientific short-term mitigation strategies applied in many other south Asian countries. Such effective short term strategies are; 1) elephant culling and translocation, 2) alternative livelihood, 3) installation of fences, 4) use of chili powder and chemicals, 5) geo-fence (GPS collar), 6)

trenches and walls, 7) guarding and patrolling (Sarker, 2010). Long term mitigation strategies are better than short term strategies due to more stability and ensuring permanency. Long term mitigation strategies involve a permanent solution to terminate human elephant conflict and enhance smooth co-existence between elephants and people living close to the forest. It will be effective if it is possible to restore degraded and fragmented wildlife habitats across the country. In Bangladesh, the wildlife habitat condition is bad and continuously adding different degrees of new impact factors from anthropocentric activities depleting natural forests. It is not possible to stop the human elephant conflict properly unless all kinds of hazardous activities in wildlife habitats are removed. Therefore, some fundamental forest recovery activities including the establishment of buffer zone, corridor protection, stop all forest related illegal activities and strengthen the management policy, will help to minimize the conflict to a more tolerable level (IUCN, 2004d). By considering the environmental and ecological importance of wildlife, we have to take responsibility to protect forest habitats and ensuring a disturbance free condition. As elephants are considered a flagship species in our country, so dignity, credibility identity will be rewarded if we ensure the protection of wild elephants. Some national and international wildlife protection organizations are working to conserve this species by considering its ecological value. In nature this species is considered as an ecological engineer because it plays a vital role to protect all kind of ecological services. In Bangladesh, the education of people can help to realize the crucial value carried by this species. In this situation, we must be conducting more research on our elephants in order to rescue them from extinction. If we are able to protect wild elephant habitats successful in our country, the wild elephant will be easy protected.

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