

## DEADLY TRACKS



### **A scientific approach to understanding and mitigating elephant mortality due to train hits in Assam**

Ujjal Kumar Sarma, PS Easa and Vivek Menon

Wildlife Trust of India (WTI), is a non-profit conservation organisation, committed to help conserve nature, especially endangered species and threatened habitats, in partnership with communities and governments. Its principal concerns are crisis management and the provision of quick, efficient aid to those areas that require it the most. In the longer term it hopes to achieve, through proactive reforms, an atmosphere conducive to conserving India's wildlife and its habitat..

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A scientific approach to understanding and mitigating elephant mortality due to train hits in Assam



Ujjal Kumar Sarma, PS Easa and Vivek Menon

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An Occasional Report of the Conflict Mitigation Division of the Wild Species Programme of the Wildlife Trust of India in partnership with the International Fund for Animal Welfare



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## **PREFACE**

One of the best conservation stories that the Wildlife Trust of India has in its ten years of existence is that of stopping elephant mortality for seven years on the tracks of the Delhi-Dehradun railways. Passing through the Rajaji National park, this elephant track had turned into a veritable graveyard for elephants till one dedicated field officer from our NGO worked with both the Forest department and the Railways and produced a zero-mortality record, seven years running. However, Rajaji was not the only place in India where elephants died on the tracks. Assam, Tamil Nadu, West Bengal and Jharkhand have had their share of dead elephants on railway tracks while Gujarat has had lions dying on theirs and Uttar Pradesh, tigers. Therefore, it is safe to conclude that animal-train conflict is spread across the country and needs a national application of such conservation measures that have had success in Rajaji.

To see if similar tactics will work in any other region, requires on-site field work. It is such field work that has resulted in this occasional report. Assam had just seen a spurt in elephant deaths and a quick study by the conflict mitigation division has thrown up several predictable facts but a few that are locale specific. Now, based on this more detailed work can be done to suggest ameliorative measures and if dedicated field personnel can then translate these studies into reality, the replicability of the Rajaji story can be tested and elephants may prove to be the ultimate winner.

Vivek Menon  
Executive Director

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The study was supported by our International partner, the International Fund for Animal Welfare (IFAW).



## **EXECUTIVE SUMMARY**

Railways and highways are a major source of wildlife mortality throughout the world. Railways also cause direct loss of habitat, degradation of habitat quality, habitat fragmentation, population fragmentation/ isolation and reduce access to vital habitats. In India also, a large number of wild species are being killed annually due to railways and highways.

The state of Assam along with Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura comprises the North-east India (between 21° 58' -28° N to 29° 27' N and 89° 42' to 97° 24' E). About a fifth of the known world population of the Asian elephant (*Elephas maximus*) occurs in this region.

Forest Department records show that Railway tracks are responsible for killing a number of wild animals in Assam. Available data shows that at least thirty-five elephants have lost their lives due to train hits in Assam between 1990 and May 2006. Between 1990 and 2006, except for four years, at least one elephant was killed every year by speeding trains in Assam. However, if we divide the sixteen years period from 1990 – 2005 into two, the total number of elephants killed in the first half, during 1990 – 1997 was six (0.75 per year), compared to twenty eight elephants (3.5 per year) during 1998 – 2005. This definitely indicates a considerable increase in train accidents and elephant mortality in the recent past. There were also a few incidents, when elephants were hit by train, injured but survived. Unfortunately, the details for most accidents were not available.

Owing to the problem of elephant mortality due to train hits in Assam, the Wildlife Trust of India (WTI) decided to conduct a study in Assam to

understand the issue in detail, to suggest mitigation measures and assist the local administration in solving the problem. Rapid field surveys were conducted between 27th May and 6th of June 2006. Apart from the latest site of accident, surveys were also conducted in two other areas along the railway track in Assam (Thakurkuchi and Rani- Deepor Beel) where in the past similar accidents have taken place.

In the past, WTI had conducted a study to understand and mitigate elephant mortality due to train hit in Rajaji National Park, where prior to the study 18 elephants had been killed (between 1987 and 2001). Due to conservation actions based on the report, and dedicated effort of the Wildlife Trust of India (WTI), Forest Department and Indian Railway no elephant mortality has resulted since 2003.

Data collection for the current study was broadly done at three levels. First, through field survey which also included interaction with the local people. Second, through interaction with the Forest Officials and field staff of the Forest Department. Third, through literature review and collection of secondary information.

Karbi Anglong West, Digboi and Kamrup East Forest Divisions accounted for more than 50% of the deaths during 1990 and 2006. However, the frequency of such accidents was highest in Kamrup (East), followed by Nagaon (South), Karbi Anglong (West) and Sonitpur (West).

Analysis of the elephant mortality data for different months between 1990 and May 2006 shows that eleven elephants were killed in November, the paddy ripening season in Assam. On the other hand, ten elephants were killed in July and another five in June, which is the monsoon period in the state. Records show that animals of both the sexes are vulnerable to such accidents. Out of the thirty-five elephant mortality recorded,

nineteen were females, thirteen were males, and in three cases the sex was not recorded.

Steep mounds along the track are a crucial factor to be considered. The chances of being trapped are very high for large animals like the elephant. High speed of the trains also contributes a lot to the chances of the elephant getting hit. It is also important to consider the impact of increased train frequency over the years on elephant mortality. Linked to the frequency is the factor of 'crucial time'. Though not very precise, secondary information on time of accident points out that majority of the accidents took place between dusk and dawn (6pm and 5am). Based on the observations in the field and discussions with the Forest department officials, the following actions are recommended:

**a) Sensitization of the train drivers**

Workshop should be organized for the train drivers and guards to sensitize them about the importance of protecting wild animals and observing necessary precautions while passing through forests. Feedback can also be taken from them. Any information on wildlife related accident or sighting of vulnerable animals near the track if passed on by the train drivers to the relevant authorities which in turn is conveyed to the concerned Forest Range Office may be very helpful. The personal experience of train drivers related to wildlife can also be vital.

**b) Use of signage**

Signages at both the ends of the identified stretches of critical railway track to caution the train driver should be erected immediately.

**c) Improving visibility for the train drivers**

Tall grasses along the track may be cut to enhance visibility of the train drivers. Steps can also be initiated for leveling of mounds in critical areas

which will enhance visibility of train drivers. This is also likely to provide adequate space for the elephants to avoid trains. In some cases, physical barriers like trenches, iron fences (as already being proposed by the forest department), electric fences etc may be considered to divert elephant movement, particularly from blind curves.

**d) Joint patrolling**

Forest guards of the concerned Beat along with Railway staff can be entrusted to monitor presence of elephants in the critical areas. Joint patrolling by the Forest guards of the concerned beat along with Railway staff can be the approach. While doing so, they can also regularly seek information from local people about elephant, movement.

**e) Reducing the speed of trains in critical areas**

To ensure the safety of elephants, it is imperative for the Railways to limit the speed of trains in the critical areas. However, this may not be easy to implement as most of the elephant mortalities due to train hit are outside Protected Areas.

**f) Making the sides of railway track elephant friendly**

In critical areas where diverting the elephants is not possible, steps should be taken to make the sides of the track friendly to the elephants. Often elephants after climbing up, hesitate to climb down promptly because of the steep gradient. Thus, appropriate steps can be initiated to reduce the steepness on both the sides of railway tracks at critical areas. Also, in many cases, there is not enough space for elephants to move along the track (in hilly areas) so that even in case of emergency the elephants can avoid being hit by the trains.

**g) Conservation action oriented scientific studies**

In all the areas inhabited by elephants where new railway lines are being

planned or double-tracks are being planned or laid, or gauge conversion is going on or planned, necessary safety measures based on scientific studies should be taken right in the beginning.

## **1. INTRODUCTION**

The situation facing the Asian elephant is critical. Its population has declined over the past half century to an estimated 30,000 – 50,000 animals in the wild (IUCN, 2006). Asian elephants today also have lesser natural habitat to feed and roam. Habitat destruction and fragmentation are the root causes of many conservation problems (Debinski and Holt, 2000).

In Asia, conflict between wild elephants and people occurs to a varying extent throughout the elephant's range (Seidensticker, 1984; Sukumar, 1989). Conflict between elephants and people is a major concern for wildlife management. This issue can also threaten the viability of wild animal populations by creating a confrontational atmosphere between farmers and wildlife managers (Taylor, 1999).

Railway lines and highways have also been recorded to be major causes of wildlife mortality (Clevenger, 1997; Buckingham, 1997; Jackson, 1999), threatening wildlife populations throughout the world. Railway lines cause direct loss of habitat, degradation of habitat quality, habitat fragmentation, population isolation and reduced access to vital habitats (Jackson, 1999). In India, too, a large number of wild species are killed annually due to railway lines (Kumar, 1995; Johnsingh and Williams, 1999) and highways passing through wildlife habitat. But data maintained is very meager.

Owing to the problem of elephant mortality due to train hit in Assam, the Wildlife Trust of India (WTI) conducted a field survey to understand the issue, suggest mitigation measures and assist the local administration in solving the problem. WTI gained the expertise to understand and mitigate elephant mortality due to train hit from its experience in Rajaji National

Park, where 18 elephants had been killed between 1987 and 2001 prior to the action (Singh *et. al.*, 2001).

From the study in Rajaji National Park, two most vulnerable stretches of track were found to lie- (i) between the Motichur railway station and Motichur railway crossing near the forest range office; (ii) the Raiwala and Kansrao railway stations. Mortality due to train accidents were found to account for 45% of total elephant mortality in the three ranges of Haridwar, Motichur and Kansrao where accidents have occurred from 1987 to 2001. Mortality patterns were found to be directly related to temperature and inversely related to rainfall. Maximum mortality occurred during the summer months of high temperature and low rainfall, with a peak in May. Peak elephant mortality period in the area also coincides with the peak crop depredation period which is between March and May.

Among the factors responsible were sharp turnings that restricted visibility. Certain mounds along the track were also found to be hazardous as they trap animals on the track if they are too steep. Trains were also found to be traveling at high speed (up to 72 km/hr). Further, all the accidents occurred between 6 pm and 6 am.

Due to conservation actions based on the report, and dedicated effort of the Wildlife Trust of India (WTI), Forest and Railway department no elephant mortality has resulted since 2003.

The state of Assam along with Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura comprises the North-east India (between 21° 58' -28° N to 29° 27' N and 89° 42' to 97° 24' E). About a fifth of the known world population of the Asian elephant (*Elephas maximus*) occurs in this region (Choudhury and Menon, 2006). According

to Choudhury (1999), the elephant range extends from near western north Bengal (near the Indo-Nepal international boundary), along the Himalayan foothills up to the Mishimi Hills and the eastern Brahmaputra plains of Assam and Arunachal Pradesh. Then it takes a 'U' turn and covers eastern Arunachal Pradesh, the plains of Upper Assam and the foot of the Naga Hills. Further west, it extends up to the Garo Hills of Meghalaya through Khasi Hills, parts of the Brahmaputra plains and the Karbi plateau. Elsewhere in south, scattered populations survive (Choudhury and Menon, 2006).

On the north bank of Brahmaputra, elephant habitat extends from northern West Bengal through the Himalayan foothills and the bhabar-terai tract (called the Duar in this part of the country) touching southern Bhutan, northern Assam and Arunachal Pradesh. In eastern Assam, the range also covers part of the floodplains of the Brahmaputra and Lohit Rivers. About 7900 km<sup>2</sup> area is available to an estimated population of 2700-3000.

Elephants on the south bank of the Brahmaputra are divided into eastern, central and western populations. The eastern population is spread over Dibang valley, Lohit, Changlang and Tirap in Arunachal Pradesh, Tinsukia, Dibrugarh, Sibsagar, Jorhat and Golaghat in Assam and Mon, Tuensang, Mokokchung and Wokha in Nagaland. The population lost its contiguity with the North Bank in the seventies and the central area of South Bank in the eighties (Choudhury, 1995 & 1999). An estimated 1100-1200 elephants occupy about 4500 km<sup>2</sup> of forests in the area.

The population in the central area extends from Kaziranga National Park across the Karbi plateau, part of central Brahmaputra plains and the basin of the Diyung river to the foot of Meghalaya plateau in Assam and



Meghalaya. The extent of elephant habitat is about 5050 km<sup>2</sup> with an estimated population of 2900 – 3000.

The elephant population in the western areas is seen in parts of Assam and Meghalaya along the foot of the Meghalaya plateau covering the Garo and Khasi Hills. It covers Kamrup and Goalpara districts in Assam, and Ri-Bhoi, West Khasi Hills, East Garo Hills, West Garo Hills and South Garo Hill in Meghalaya. The seasonal range of this population also extends to areas in Bangladesh. The habitat available to an estimated 2800 – 3000 elephants is about 6850 km<sup>2</sup>.

The forest cover of north-eastern India is disappearing at a very alarming rate due to a host of factors that include logging, expansion of human population, agricultural land, and settlements, encroachment, developmental activities, viz. construction of road, rail and hydroelectric projects, mining and massive bamboo extraction and oil exploration in prime elephant habitats. Expansion of human settlements and the consequent destruction of habitat, and poaching for ivory and wild meat have resulted in the decline of the wild population (Choudhury and Menon, 2006).

In Assam, the Forest Department elephant census figures from the year 1993 to 2002 indicates a negative trend. In 1993, there were about 5524 elephants which came down to 5312 in 1997, and to 5246 in 2002 (Fig. 1)

Assam Forest Department records mention details of at least 452 elephant mortality between 1985 and 2005 due to different reasons, humans directly or indirectly being responsible for more than 50% of these mortalities (Fig. 2).

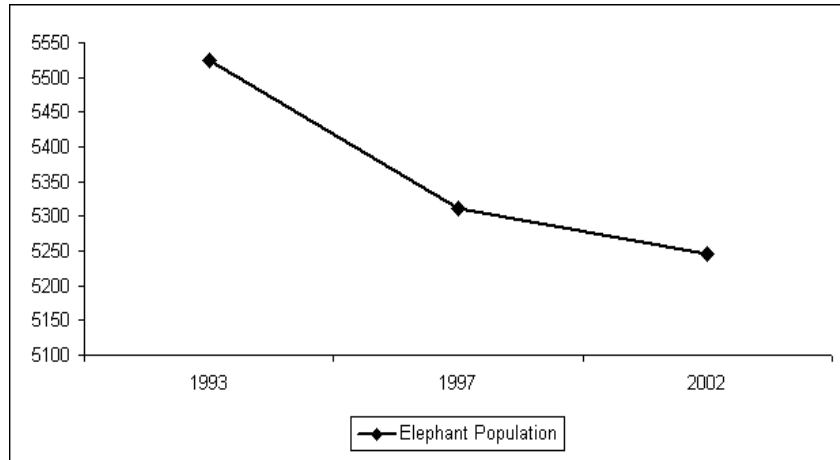


Fig.1: Trend of elephant population in Assam between 1993 and 2002

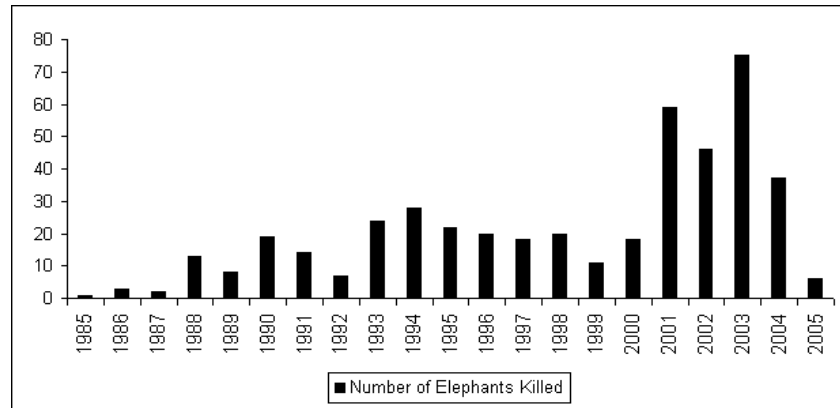


Fig.2: Elephant mortality in Assam between 1985 and 2005

## 2. IMMEDIATE ISSUE

As a response to the death of an adult male elephant which was run over by a train on 16<sup>th</sup> May 2006 between Panbari-Digaru Railway stations (near Guwahati), the Conflict Mitigation Division of Wildlife Trust of India

visited the area in May - June 2006 to collect relevant information. The objectives of this short project were to assess the circumstances which led to the death of the elephants and to identify a pattern of such mortalities. Field surveys were conducted between 27<sup>th</sup> May and 6<sup>th</sup> June 2006. Apart from the latest site of accident, rapid surveys were also conducted in two other areas along the railway track in Assam (Thakurkuchi and Rani- Deepar Beel) where similar accidents took place in the past.

### **3. METHOD**

Data collection was broadly done at three levels. First, through field survey, which also included interaction with the local people. Second, through interaction with the Forest officials and field staff of the Forest Department. Third, through literature review and collection of secondary information.

Based on the secondary information, the investigator identified three areas of concern (critical sections) in Kamrup district, where elephants were seen crossing the track in the past and have also got killed due to train hits. The investigator walked along the railway track in each of the three identified railway segments. Presence of elephant dung, foot mark, feeding sign etc were also recorded along the track (Fig. 3).

Information on turnings, mounds / slope, availability of water and fodder for the elephants (including crop fields) in the areas adjoining the track were also collected. Approximate speeds of certain trains were also measured at the three critical sections. Discussions with Forest Department Officials and field staff were centered around the questions on mortality of elephants due to trains, possible reasons for these

accidents, seasonal movements of elephants in the concerned areas and measures already taken to reduce the mortality on the tracks. Interactions with the local people were to collect information on crop cultivated, crop raiding by elephants, elephant group size and their observations on elephant deaths due to train hits.

Secondary information was collected from the Office of the Principal Chief Conservator of Forest (wildlife), Assam, as well as from the media on elephant mortality in general in the state, with particular emphasis on those due to train hit.

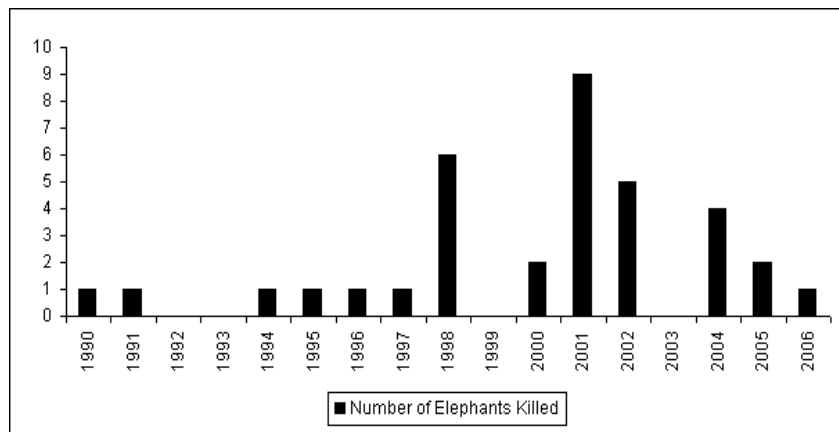


Fig.3: Elephant mortality due to train hit in Assam between 1990 and May 2006

#### 4. ELEPHANT MORTALITY DUE TO TRAIN HIT IN ASSAM: PATTERNS AND POSSIBLE REASONS

At least thirty-five elephants have lost their lives due to train hit in Assam between 1990 and May 2006 (Table 1). There were also a few incidents, when elephants were hit by train, but survived with injury. Unfortunately, the details for most of these were not available.

Table 1 Elephant mortality due to train hit in Assam between 1990 and May 2006

Date	Forest Division	Details
20/03/1990	Karbi Anglong (West)	1 Female
15/07/1991	Darang West	1 Female
1/10/1994	Sonitpur West	1 (sex not recorded)
9/10/1995	Sonitpur West	1 Female
13/11/1996	Sonitpur West	1 Male
6/11/1997	Karbi Anglong (West)	1 Male
11/7/1998	Karbi Anglong (West)	5 Females and 1 Male
15/09/2000	Nagaon (South)	1 Female
12/11/2000	Digboi Division	1 Male
22/08/2001	Kamrup	1 Female and 1 (sex not recorded)
15/11/2001	Digboi Division	5 Females and 2 Males
22/05/2002	Nagaon (South)	2 Females
17/06/2002	Kamrup (East)	1 Male
24/06/2002	Kamrup (East)	1 Male
5/12/2002	Nagaon	1 Female
20/06/2004	Kamrup (East)	1 Male, 1 Female and 1 (sex not recorded)
9/7/2004	Goalpara	1 Male
4/7/2005	Nagaon (South)	1 Male
24/11/2005	Kamrup (East)	1 Male
16/05/2006	Kamrup (East)	1 Male
Total		35 Elephants

#### 4.1 Patern of elephant mortality

Between 1990 and 2006, except for four years, at least one elephant was killed every year by a speeding train in Assam (Fig. 3).

However, if we divide the sixteen years period from 1990 to 2005 into two (leaving out the year 2006 from analysis, since more than half of the year still remains), the total number of elephants killed in the first half, during 1990 – 1997 was six (0.75 per year), compared to twenty eight elephants (3.5 per year) during 1998 – 2005. This definitely indicates considerable increase in train accidents and elephant mortality in the recent past. The number of elephant mortality in a given year was also high during the period.

#### 4.2 Divisionwise elephant mortality

Karbi Anglong West, Digboi and Kamrup East Forest Divisions accounted for more than 50% of the deaths during 1990 and 2006 (Fig. 4).

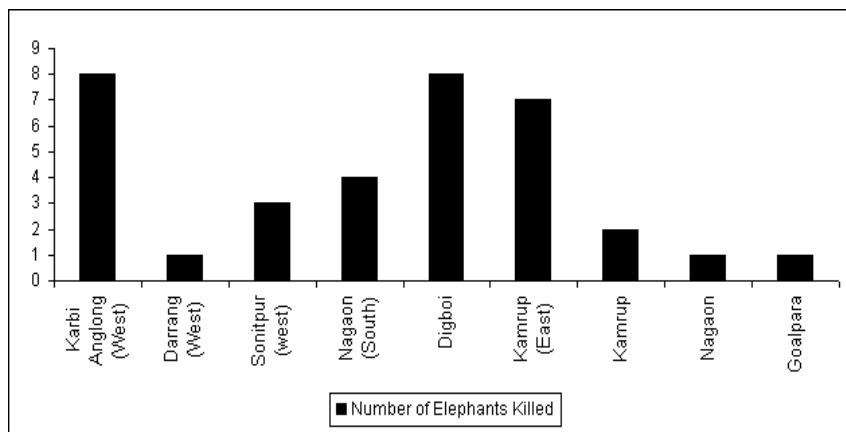


Fig.4: Elephant mortality due to train hit in different Forest Divisions between 1990 – May 2006

However, the frequency of such accidents was highest in Kamrup (East), followed by Nagaon (South), Karbi Anglong (West) and Sonitpur (West) (Fig. 5). The frequency of accident is important since it both the numbers of such occurrence, and also reflects on the probability factor of accidents.

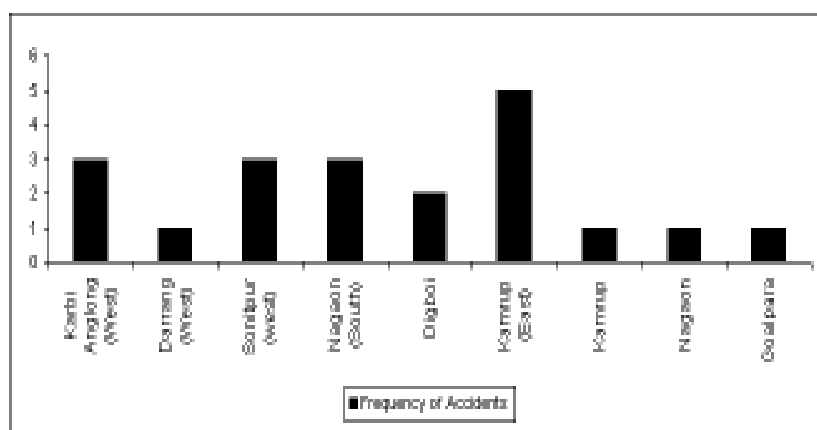


Fig.5: Frequency of elephant mortality due to train hit in different Forest Divisions between 1990 – May 2006

Table 1 indicates that no elephant mortality due to train has been reported from Sonitpur (West) since 1996 and that during 2000 – May 2006, highest number of accidents occurred in Kamrup (East), followed by Nagaon (South). The highest number of elephants killed in one particular incident is seven, which happened in 2001 under Digboi Forest Division.

### 4.3 Seasonal pattern

An analysis of elephant mortality data for different months between 1990 and May 2006 (Fig. 6) shows that eleven elephants were killed in November, the paddy ripening season in Assam. On the other hand, ten

elephants were killed in July and another five in June, which is the monsoon period in the state. Inundation of areas during the monsoon period force wild animals to move out searching for safer place.

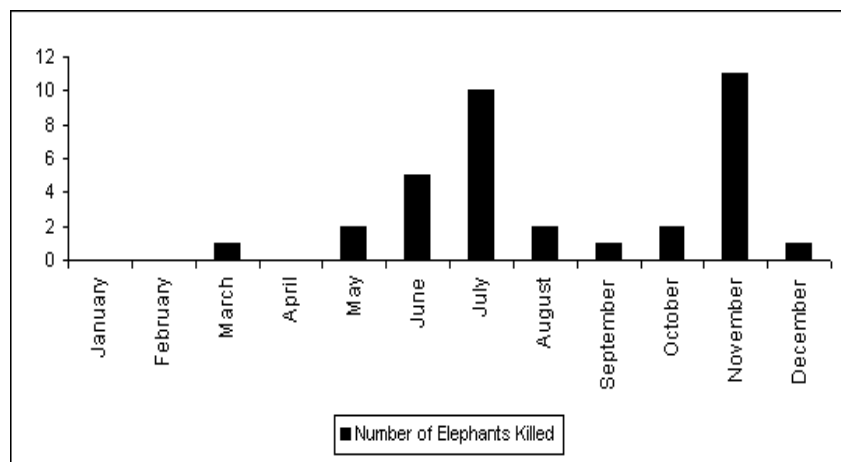


Fig.6: Seasonal pattern of elephant mortality between 1990 – 2006

#### 4.4 Co-relation to sex

Records show that animals of both the sexes are vulnerable to such accidents. Out of the thirty-five elephant mortality recorded, nineteen were females, thirteen were males, and in three cases the sex was not recorded (Fig. 7).

### 5. CASE STUDIES OF ELEPHANT MORTALITY DUE TO TRAIN HIT

Considering that Kamrup (East) Forest Division had five out of the ten elephant mortalities due to train hit, three cases were investigated to understand the circumstances in detail.



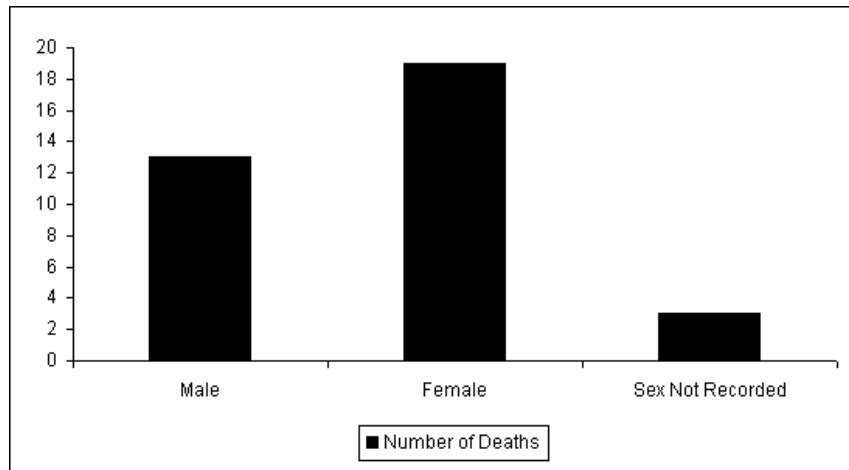


Fig.7: Mortality Vs sex of elephants killed by train hit between 1990–2006

### 5.1 Case study - 1

On 16<sup>th</sup> May 2006, between 1 AM and 3 AM a speeding goods train hit a male (*makhna*) elephant between Panbari and Digaru Railway station (Figs. 8, 9 and 10), near Guwahati (26° 10' 54.0" N and 91° 59' 19.9" E). The body of the 8 feet 1 inch, about 20 – 24 years old elephant was found lying in a paddy field near the railway track. From the drag marks on the railway track it was evident that the elephant was dragged along the track, for about fifteen to twenty meters and then thrown away from the track to the paddy field about ten feet below the track where its corpse was found (Figs. 11 and 12). The post-mortem report of the elephant has identified the cause of death as severe vital organ injury due to trauma caused by the train accident (Appendix-1).

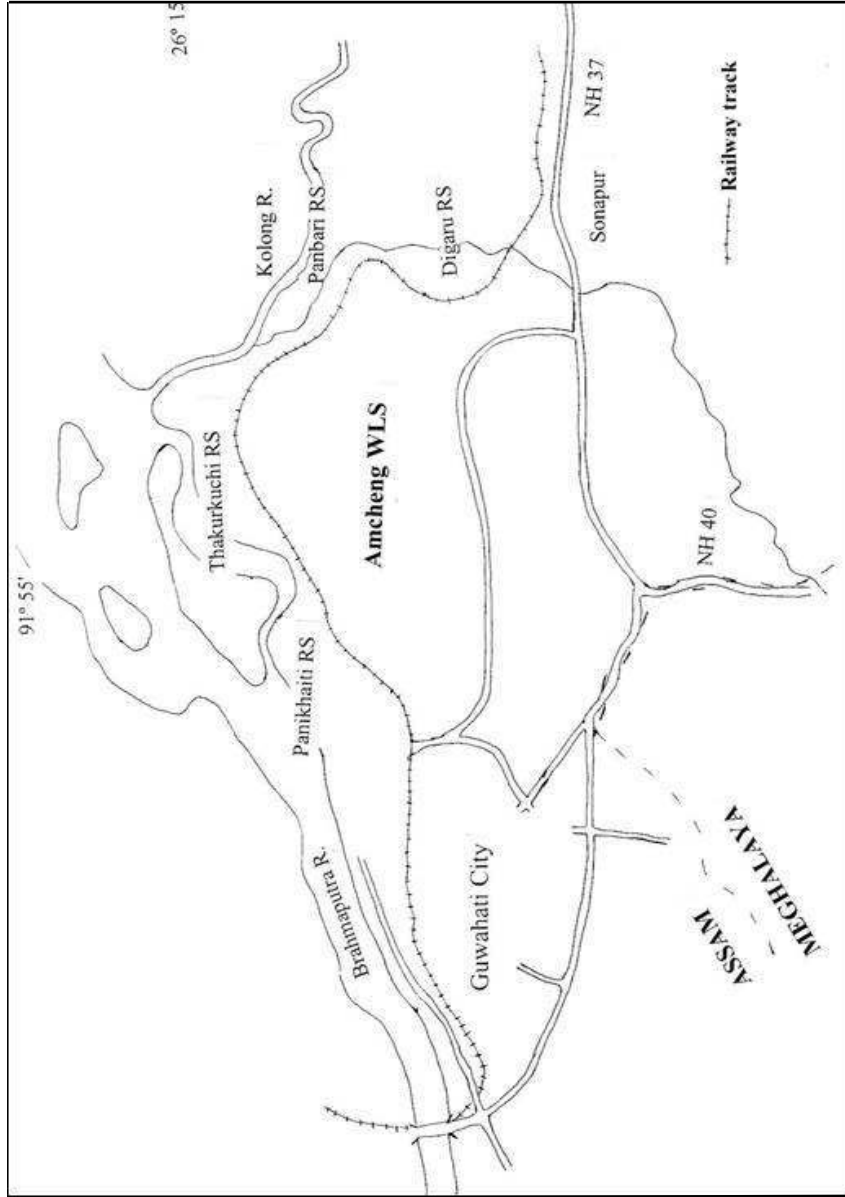


Fig.8: Amcheng Wildlife Sanctuary and adjoining areas

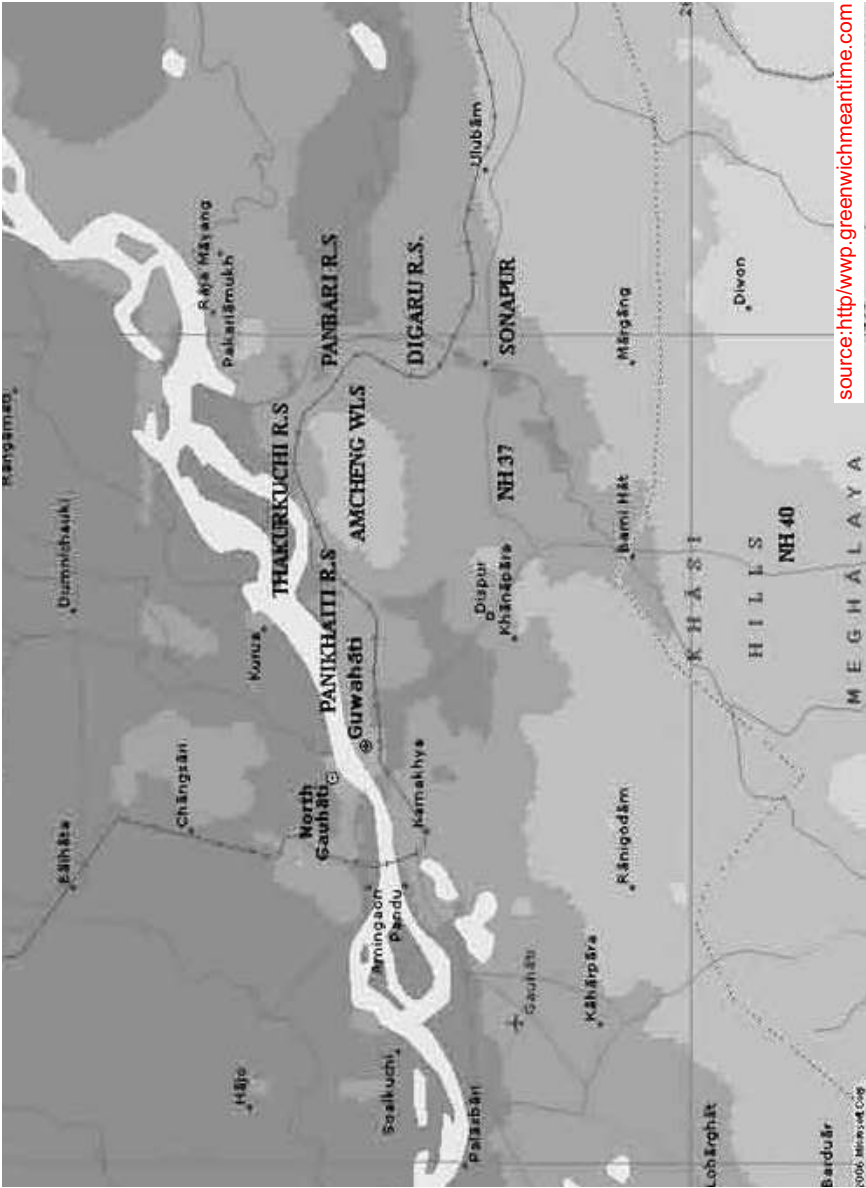


Fig.9: Amcheng Wildlife Sanctuary and adjoining areas



Fig.10: The point where the elephant was hit by a train on 16 May 2006



Fig.11: The corpse of the elephant



Fig.12: The elephant after being hit, fell from the track onto the paddy field

Field survey along the track, interaction with the field staff of the Forest Department and local people of Kurkuria village point out that elephants from adjoining Amchang Wildlife Sanctuary (WLS) cross the railway track at this section mainly to get into the paddy fields for crop raiding. However, because of the blind curves (Fig. 13) and mounds on the sides of the track, elephants are sometimes caught unaware. Moreover, the slope on the sides of the track with abrupt gradient also hampers quick elephant movement. Elephants often require time to negotiate such slopes. But the speeding trains do not allow time and elephants get hit.

Elephants chose this area to cross the railway track probably because of the paddy fields on the east side of the track. During this movement, the elephants try to avoid villages like Belguri, Ghugua etc and also the Digaru Railway station to the south and Panbari Railway station to the north, and chose this particular section to cross.



Fig.13: Turnings like this often catches the elephants unaware

These elephants are part of the larger population of South Bank – Central areas (from Kaziranga National Park across Karbi Plateau, parts of central Brahmaputra plains, and the basin of the Diyung river to the foot of Meghalaya plateau in Assam and Meghalaya). However, the population has become separated from the South Bank – Western population (from near Guwahati, through the foot of Meghalaya plateau covering the Garo and Khasi Hills) due to expansion of Guwahati City, clearing of forest for *jhum* and increased human habitation along National Highway (NH) 40, connecting the two cities of Shillong and Guwahati, in Ri-Bhoi district of Meghalaya (Choudhury, 1999). The busy NH 37 and clearing of forest and subsequent settlement on both sides of the highway has also resulted in a wide gap thus making the Amcheng elephant population an isolated one (Choudhury and Menon 2006).

## **5.2 Case study - 2**

An elephant was mowed down by a train at the Panikhaiti area on 24<sup>th</sup> November 2005. The incident took place at about 2.30 AM, when a single engine travelling on the Guwahati-Lumding section hit the pachyderm which was crossing the track between Panikhaiti and Thakurkuchi stations (26°12' 55.3" N and 91° 53' 23.3" E), 29 km east off Guwahati (Fig. 9 and 10). Field investigation divulges that a herd of elephants had strayed out of the nearby Amcheng WLS on 23<sup>rd</sup> November (Fig. 14). The local people were aware of the wandering elephants and were apprehensive. Subsequently, they had taken some precautions.



Fig.14: The part of Amcheng WLS from where the elephant herd strayed out on 23<sup>rd</sup> November, 2005

In the night, a lone elephant crossed the railway track and was trying to climb a mound, on top of which there was a hut (Fig. 15). The family after

realizing the intention of the elephant lighted fire to scare them away. On seeing the fire, the elephant gave up climbing and returned. At that very moment, a speeding railway engine approached the site. However, there was not enough space between the mound and the train (Fig. 16) and the elephant got hit. The engine dragged the elephant almost up to Thakurkuchi Railway station (about three km from the site of accident). The elephant was fatally wounded and bled profusely before succumbing to



Fig.15: The mound which the elephant was trying to climb after crossing the railway track (the hut can also be seen at the top)



Fig.16: The site where the elephant was hit by a speeding Railway engine on 24th November 2006



its injuries (Fig. 17). According to Forest Department records, the elephant was a 40 year old male.



Source: The Hindu, 25th November, 2005

Fig.17: The corpse of the elephant being removed from the Railway track

### **5.3 Case study - 3**

Three elephants were killed by a speeding train on the railway track running through Rani - Garbhanga Reserve Forest (RF) and Deepar Beel at Chakradeo village (26° 06' 29.3" N and 91° 37' 59.4" E) near Azara Railway Station (26° 06' 11.1" N and 91° 37' 04.3" N), Guwahati on 20<sup>th</sup> June 2004 (Figs. 18 and 19). The accident happened around midnight. The first to be hit by the train, speeding from Kamakhya Railway station to Goalpara town, was a female adult. The other two were a sub-adult female and a male calf.

Unlike Case Study 1 and 2, where there was not enough space for the elephants to save themselves from being hit by the train, this seems more

like the case of a train running at a very high speed, which did not give the elephants enough time to react and save their lives.



Fig.18. The dead bodies of the elephants



Source: Modified from Google Earth

Fig. 19. Satellite image of Rani - Deepar Beel area

Some believe that the elephants of the Rani-Garbhangra Reserve Forest were not used to trains when this unfortunate incident happened, as the railway track was newly laid. But now that they are used to it, there are no more such cases. This also holds good for cattle and human beings, who also got killed initially due to the new track and trains. Though the argument may be true, there still seems to be more associated reasons for such incidents not occurring in the last two years. Field survey indicates that the rising human settlements and human activities in the area, along with deforestation must have made the area less attractive to the elephants. This view was also agreed to by the villagers of Chakradeo and Matia villages, who believe that elephants usually avoid human beings, unless attracted by ripe paddy or smell of brewing of country liquor.

One of the major reasons could be the Deepor beel, the water body (also a Ramsar site) adjacent to the track. Although there was no direct sighting of elephants during the field survey, indirect evidences and interaction with local people and Forest staff indicate that elephants from Rani RF and Garbhanga RF do come to the Deepor beel. Small elephant herds (four to five individuals) are sometimes seen drinking water, playing in the water of Deepor beel and feeding on the bulbous structure of some hydrophytes (Fig. 20). Deosotal (26° 06' 46.6" N and 91° 39' 35.2" E) is one such area still being used by the elephants (Fig. 21). Unlike in the past, elephants now are more selective about their movement path and space utilization, primarily to avoid human beings.

During the month of paddy ripening (November), elephants are seen more often in the area. The older generation of villagers says that there has been a marked change in the behaviour of the elephants over the years in the area. For instance, the crop raiding elephants these days are

very difficult to be chased away. The elephants become very assertive during this season. They are no more scared of crackers, drum beating, or even fire. The increased human-elephant interface seems to have made them used to human beings and their actions.



Fig.20: Elephants have been seen eating the bulbous structure of hydrophytes in Deepar beel



Fig. 21. Foot marks of Elephants from Rani-Garbhangra Reserve Forest can be seen in the Deepar Beel area

## **6. POSSIBLE FACTORS RESPONSIBLE FOR ACCIDENTS**

### **6. 1 Ecological factors**

Analysis of secondary data indicates a positive correlation between elephant mortality due to train hit and rainfall. Field investigation and interaction with various sections of people also confirm that elephants move during high rainfall and flood, looking for safer highlands, and also fodder (in case water has inundated most of the fodder areas). As a result, movement of elephant increases in rainy season. However, it would not be fair to seek the same explanation for every incident.

Field investigation points out that elephants are attracted to ripe paddy. As evident from the Case Study 1, elephants mostly cross railway tracks to raid the adjoining paddy fields. When the raid is complete, or the elephants are chased away by the villagers, they return to Amcheng WLS. In Case Study 3, however, the elephants while raiding the crop, cross over the railway track and go towards the Deepor beel mostly for water, but sometimes also for aquatic plants. However, this movement has reduced over the years in most of the areas (except Deosotal). In Case Study 2, as pointed out by the local people the elephants in small herds (three to four) cross the railway track from Amcheng WLS to raid nearby maize fields.

Thus, crops seem to be an important factor of influence on elephant movement. Water, however, as a parameter played an important role in the elephant movement only in Case Study 3.

### **6.2 Topographical factors**

Steep mounds along the track are a crucial factor to be considered. In Case Study 2, an elephant got trapped because of the mound and was

hit by a speeding engine. The chances of being trapped are very high for large animals like the elephant. Slopes with steep gradient on the sides of railway track are also crucial. Elephants often hesitate to use such slopes, particularly if they get the apprehension that the ground is not suitable for brisk movement (Case Study 1), and they might not be able to balance their heavy bodies while climbing down the slope. Sometimes too many pebbles on steep slopes make it difficult for elephants to get a firm grip. This is where elephants try to be cautious and take time. But if a train is approaching fast, it does not give the elephant the required time to negotiate the slope safely.

### **6.3 Technical factors**

While conducting field surveys, it was noticed that trains indeed moved at high speed (about 70-80 km/hour on an average during day time). High speed does not allow the drivers to halt the train immediately or apply the brake even if they see an elephant on the track. Speeding trains also do not permit elephants to take necessary quick action to save their lives. Thus, from Case Study 1 and 3, it seems that high speed of the trains contributes much to the chances of the elephant getting hit. Moreover, the impact and subsequent damage made by a fast moving train on an elephant after being hit is severe as evident from the post-mortem report (Appendix-I) in Case Study 1. The report says that the elephant died due to severe injury to vital organs (rupture of liver, right kidney, hemorrhages in brain).

It is also important to consider the impact of increased train frequency over the years on elephant mortality. Linked to the frequency is the factor of 'crucial time'. Though not very precise, secondary information on time of accident points out that the majority of the accidents took place between dusk and dawn (6pm and 5am), when the frequency of train passing through the area is also more frequent.

Based on field investigations, as well as secondary information, the following sections of the Railway track could be considered as critical:

- Panikhaity to Digaru Railway Station
- About 6 to 7 kms before Azara Railway Station from Kamakhya Railway Station.
- Patharkhula area, near Lumding Railway Station.

However, a comprehensive list of critical areas based on more intensive field investigations needs to be prepared for all of Assam.

## **7. ADMINISTRATIVE AND TECHNICAL APPROACHES**

In view of the death of the three elephants near Deepar beel on 20<sup>th</sup> June 2004, an emergency meeting of the Forest and Railway Officers and elephant experts was held in the office of the Conservator of Forest, Central Assam Circle on 23<sup>rd</sup> June 2004 (Appendix-II). The following is the brief summary of the meeting:

- 1). It was pointed out by the Forest officials that a stretch of about 8 km in Kamakhya – Azara section, and about 12 km in the Panikhaiti – Panbari – Digaru section of the Railway track pass through the critical elephant movement area under Lumding Division of N.F.Railway.
- 2) To prevent any such accidental death of elephants in the railway track it was suggested that the speed of the train will have to be kept at a controllable limit. Though the Forest officials wanted the speed in the critical portion to be kept within 10 km/hr, the Railway officials stated that the speed limit of the train in some portion of the affected area is already being maintained at 25 km/hr.

- 3) The Conservator of Forests, Central Assam Circle, deputed two officers for showing the accident prone stretches passing through the elephant routes and requested the Chief Operation Manager, N.F Railway Head Quarter, Maligaon, vide letter FG 33/92/CAC/Elephant Depredation/Pt. Dt. 19-07-2004 to depute officers from his side also for joint verification.
- 4) The Railway authority was to take urgent necessary steps to erect the required signage on both the ends of the identified stretches of Railway track to caution the drivers accordingly.
- 5) The train drivers were to be advised by the competent Railway authority to take utmost care in the identified stretch of the Railway line to allow easy passage to the elephants. Awareness programmes in this regard was to be arranged jointly by the Forest Department and Railway authority.
- 6) The Railway authority stated that the engines are already fitted with a Steel grill/cattle guard to reduce the impact of head on collision with animals on railway tracks.
- 7) Regarding lighting of Railway line in critical areas, the Forest officials suggested that sodium vapour light should be arranged in the mentioned stretches at an interval of 100m, but the Railway authority expressed their inability to consider such a suggestion in view of the huge cost involved. However, the Forest officials requested them again to take it up with their competent authority.
- 8) It was mentioned by the Railway authority that the visibility in the curved portions of the track was little, increasing the probability of such



accidents. To circumvent such a situation, the Forest officials suggested that they explore the possibility of diverting the elephants from crossing the Railway track in the curved portion by erecting a physical barrier. For this purpose, fencing may be erected on either side of the track with the help of used iron rails, to be provided by the Railways. This they felt would guide the animals to cross the Railway track only at safer places.

9) As regards the deployment of railway gang men (Railway staff who checks the track regularly) and Forest guards, it was decided that a Forest and a Railway guard will be entrusted to constantly monitor the movement of elephants in the area, and then they will inform the Railway Station Master over wireless as soon as elephants are seen in the area. The Station Master will accordingly take necessary steps to caution the drivers of the train likely to pass through that area.

On 28<sup>th</sup> July 2004, a joint meeting of the Officials from the Railway Board and the Officers of the Forest Department of different states of India was held in New Delhi under the Chairmanship of the Director General of Forests, Government of India on the issue of wild elephants getting killed due to trains.

The Chief Wildlife Warden, Assam in the meeting gave details of discussion with the railway authorities in the wake of the killing of three elephants at Azara on 20<sup>th</sup> June 2004 (Appendix-II). In his reply, Director (Punctuality) Railway Board, agreed to consider various suggestions made by the forest authorities as long as they were practical. But he pointed out that reduction of speed of trains was not possible in all cases due to operational reasons.

Some of the actions expected from the Railway Board in the meeting were as follows (details in Appendix-III):

- a) In all the areas inhabited by elephants where new railway lines are being planned, or double-tracks are being laid, or gauge conversion is going on, necessary safety measures should be taken right in the beginning. The possibility of realignment of railway line should be explored wherever feasible.
- b) The Railways may limit the speed of trains passing through the sensitive sections to 20-30 kmph
- c) The Railways may appoint watchmen for patrolling critical sections and giving advance warning to the train drivers. The watchmen and drivers may be equipped with wireless sets.
- d) Steps should be taken for enhancing the visibility for train drivers along sensitive sections by removing tall grasses, leveling mounds and putting solar-light posts at appropriate places.
- e) Standardised signage for alerting train drivers should be erected at important points on the sensitive sections.
- f) The Railway authorities should remove illegal cultivation from the railway land along the tracks since it may attract wild animals near the tracks.
- g) The Railway engineers should be encouraged to try and develop methods for keeping elephants away from the railway tracks and avert accidents. They may consider using spikes on the railway sleepers in the

sensitive patches, using Anti-Collision Devices, using sensors (developed by the Konkan Railways to detect debris on the railway tracks).

h) The Railway Board may consider supplying scrap rails (mostly obtained through gauge conversion) to the forest authorities at concessional rate for erecting elephant-proof barriers.

Field investigation, however, reveals that there was apparently no follow up or actions taken by on the decisions by either party. Fast moving trains can still be seen in all the identified critical sections. Moreover, the frequencies of trains have also increased since the above meetings were held. Four more unfortunate incidents of elephant death due to train have also occurred since then (Table 1).

## **8. RECOMMENDATIONS**

Based on the observations in the field, discussions with the Forest department officials and the experience of WTI in Rajaji National Park, the following recommendations are being made:

**a) Sensitization of the train drivers**

Workshops should be organized for the train drivers and guards to sensitize them about the importance of protecting wild animals and observing necessary precautions while passing through forests. Feedback can also be taken from them.

Any information on wildlife related accident or sighting of vulnerable animals near the track if passed on by the train drivers to the relevant authorities which in turn is conveyed to the concerned Forest Range Office may be very helpful. The

personal experience of train drivers related to wildlife can also be vital. This includes information on how the animals react at the sight of a train, to a train whistle, to the engine light, during the day as well as night, in different seasons of a year etc.

**b) Use of signage**

Signages at both ends of identified stretches of critical railway track to caution train drivers should be erected immediately.

**c) Improving visibility for the train drivers**

Tall grasses along the track can be cut to enhance visibility of the train drivers. Steps can also be initiated for leveling of mounds in critical areas which will enhance visibility of train drivers. This is also likely to provide adequate space for the elephants to move out of harm's way

In some cases, physical barriers like trenches, iron fences (as already proposed by the forest department), electric fences etc may be considered to divert elephant movement particularly from blind curves.

**d) Reducing the speed of trains in critical areas**

To ensure the safety of elephants, it seems imperative for the Railways to limit the speed of trains in critical areas. However, this may not be easy to implement as most of the elephant mortalities due to train hit are outside Protected Areas.

**e) Joint patrolling**

Forest guards of the concerned Beat along with Railway staff can be entrusted to monitor presence of elephants in the critical

areas. Joint patrolling by the Forest guards of the concerned Beat along with Railway staff can be an approach. While doing so, they can also regularly seek information from local people about elephant movement.

**f) Making the sides of railway track elephant friendly**

At critical areas, where diverting the elephants is not possible, steps should be taken to make the sides of the track friendly to the elephants. Often elephants after climbing up, hesitate to climb down promptly because of the steep gradient. Thus, steps can be initiated to reduce the steepness on both sides of the railway tracks at critical areas. Also, in many cases, there is not enough space for elephants along the track (in hilly areas) so that even in cases of emergency the elephants can avoid being hit by the trains.

**g) Conservation action oriented scientific studies**

In all the areas inhabited by elephants where new railway lines are being planned or double-tracks are being planned or laid, or gauge conversion is going on or planned, necessary safety measures based on scientific studies should be taken up right in the beginning.

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## APPENDIX - I

Post mortem report of the wild elephant killed on 16th May 2006

### POST MORTEM REPORT OF A WILD ELEPHANT

Location : Body lying on the eastern side of the railway track, evidence of accident was seen on the track, a dragging mark for about 15 meters and then the mark of the elephant pushed towards the left side of the track. As per the marks, the involved train was a up train.


Species : Elephant  
Sex : Male ( Makhna)  
Approximate age : 20-24 years  
Height : 8 feet, 1 inch  
Date and hour of necropsy : 3Pm, 16.05.2006  
General health of the animal : Excellent  
External appearance : Extensive lacerated wound on the left side of the body and head, middle toe nail of left hind leg lost.


Approximate time of death : 12 hours prior to post mortem examination.

Musculo-skeletal system : Extensive myositis on the right side of the body.

Internal organs : Rupture of liver, right kidney, haemorrhages in the brain.

Cause of death : Severe vital organ injury due to the trauma caused by train accident.

  
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## **APPENDIX – II**

### **Minutes of the meeting (Guwahati, 23rd June, 2004)**

Minutes of the meeting held in the office chamber of the Conservator of Forests, Central Assam Circle, Guwahati on 23.06.2004 between the Forest officials, Railway officials and Elephant Experts.

Dr. R.D.S. Tanwar, IFS, Conservator of Forests, Central Assam Circle, (CF, CAC) welcomed the officers present and highlighted the necessity for convening the meeting of the Forest officials, Railway officials, and elephant experts in view of the recent killing of three elephants on 20.6.2004 by a train in the Kamakhya-Azara section of the BG line south of the river Brahmaputra.

It was pointed out by the Forest officials that a stretch of about 8 km in the Kamakhya-Azara section and about 12 km in the Panikhaiti-Digaru section of the Railway line passed through the elephant corridors under the Lumding Division of the N.F. Railway. All steps must be taken to prevent any accidental death of any elephant in these areas. After threadbare discussions, it was decided as follows:

1. To enable to effectively prevent any such accidental death of elephants in the railway line, the speed of the train will have to be kept at a controllable limit. Though the Forest officials wanted the speed in the corridor portion to be kept within 10 km/h, the Railway officials stated that the speed limit of the train in some portion of the affected area is already being maintained at 25 km/h. Hence, for further reduction of the speed to about 20 km/h, the matter will be referred to the competent authority. (Action: Railway Authority)

2. The exact stretch where the elephants are likely to cross the Railway line will be shown to the Railway authority in the field by the Forest officials at the earliest. For this purpose, one ACF to be assisted by Sri M. Baruah, Range Officer, Geetanagar Wildlife Range under Assam State Zoo Division will be entrusted by the CF, ACA. They will take it up with the Railway authority for deputing the Railway officials for taking note of the stretch in the field (Action: CF, CAC and Railway authority)
3. The Railway authority will take urgent necessary steps to erect the required signages on both the end of the identified stretches of Railway line to caution the drivers accordingly. (Action: Railway authority)
4. The train drivers will be advised by the competent Railway authority to take utmost care in the identified stretch of the Rly line to allow easy passage to the elephants. Awareness programmes in this regard will be arranged jointly by the Forest Department and Railway authority. (Action: Forest Department and Railway authority)
5. As regards steel grill/cattle guard the Railway authority stated that the engines are already fitted with the steel grill/cattle guard to reduce the impact of head on collision with wildlife on the railway tracks.
6. Regarding lighting of the Railway line falling in the elephant corridor, the Forest officials suggested that sodium vapour lights should be arranged in the said stretches at an interval of 100m, but the Railway authority expressed their inability to consider such a suggestion in view of the huge cost involved with such a project. However, the forest officials requested again to take it up with their competent authority. (Action: Railway authority)

7. It was mentioned by the Railway authority that the visibility in the curved portion of the track becomes very short increasing the probability of such an accident. To circumvent such a situation, the Forest officials suggested that they will explore the possibility of diverting the elephants from crossing the Railway line in the curved portion by erecting physical barrier. For this purpose, fencing will erecting from a distance on either side of the tract with the help of the used iron rails to be provided by the Rly authority for guiding the animals to cross only at some safer places. (Action: Forest Department and Railway authority)

8. As regards deployment of railway Gangman and Forest Guards, it was decided that a Forest Guard and a Railway Gangman will be entrusted to constantly monitor the movement of the herds of elephants in the area and they will inform the Station Master over wireless as soon as a herd is seen to be roaming in the area. The Station Master will accordingly take necessary steps to caution the drivers of the train likely to pass through that area. (Action: Forest Department and Railway authority)

Taking advantage of the meeting, Sri S.Hazarika, ACF on behalf of the Nodal Officer, "Seuj Prakalpa, Guwahati" as well as the Forest Department, Assam, requested the Railway officials also to adopt some plantation packages in the vacant and unused Railway land during the current rainy season itself.

The meeting ended with a vote of thanks to the chair.

### **APPENDIX- III**

#### **Minutes of the meeting about the death of elephants and other wild animals caused by speeding trains (New Delhi, 28.7.2004)**

1. The meeting was chaired by Shri N.K. Joshi, Director General of Forests and Special Secretary to Government of India. The other participants included the following:

- (1) Shri S.K. Tyagi, Director (Punctuality), Railway Board.
- (2) Shri K.K. Singh, P.C.C.F. (Wildlife), West Bengal
- (3) Dr. S. Thakur, Chief Wildlife Warden, Tamilnadu
- (4) Shri M.C. Malakar, Chief Wildlife Warden, Assam
- (5) Shri U.R. Biswas, Chief Wildlife Warden, Jharkhand
- (6) Shri Samir Sinha, Conservator of Forests, Uttaranchal
- (7) Shri P.P. Singh, Deputy Director, Dudhwa Natipnal Park, U.P
- (8) Dr. R.B. Lal, IGF (Wildlife)
- (9) Shri S.S. Bist, IGF & Director (Project Elephant)

2. The DGF&SS welcomed the participants. He stated the seriousness of the issue by pointing out that 17 elephants had died by trains since 1.4.1998. He mentioned that although it might not be possible to prevent all such accidents completely, yet all attempts should be made to minimize the elephant mortalities. He also pointed out that the Railways provided an important public service and, therefore, the suggestions made by the forest officers to the Railways for preventing elephant mortalities should be realistic and practical.

3. The IGF & Director (PE) presented a brief account of the action taken by the State Forest Departments and the local railway authorities in Assam, West Bengal, Jharkhand and Uttaranchal. He pointed out that some of the good work done jointly by the forest officers and the railway authorities needed to be shared with their counterparts in other states.

He also said that in certain cases, the local railway authorities expressed their inability to implement the decisions taken in view of financial or policy implications and looked for instructions from the Railway Board. He emphasized the point that such accidents posed a threat not only to the wild animals, but also to the safety of the railway passengers and often disrupted the railway traffic. Therefore, the Railway Board should take such accidents seriously.

4. The Chief Wildlife Warden (Assam) referred to his interaction with the railway authorities in the wake of the killing of three elephants at Azara station near Guwahati on 21.6.2004. He advocated speed control by trains moving through forests and use of wireless to caution the train drivers about elephant movement near railway tracks. The Chief Wildlife Warden (Tamil Nadu) suggested plantation of trees on the railway land to prevent straying of elephants on the railway tracks. The Chief Wildlife Warden (Jharkhand) favoured the use of hooters and twin-beam head lights on railway engines. The Chief Wildlife Warden (West Bengal) emphasized the implementation of the recommendations made by the expert team appointed under the instructions of Kolkata High Court. The C.F (Uttaranchal) pointed that the signages put up along the tracks and the instructions issued to the train drivers did not have any statutory value unless endorsed by the Railway Board. He informed that the railway staff were no longer available for joint patrolling with the forest staff on Haridwar-Motichur Section as agreed in the past by the local railway authorities. Deputy Director (Dudhwa National Park) pointed out that some of the railway stations within Dudhwa National Park were no longer used by the public and could be shifted out of the Park. He also pointed out that some of the trains within the park were being used to transport illicit timber.

5. Director (Punctuality), Railway Board, agreed to consider various suggestions made by the forest authorities as long as they were practical. But he pointed out that reduction of speed of trains was not possible in all cases due to operational reasons.

6. The DGF & SS suggested that the minutes of the meeting should be forwarded to the Railway Board along with a list of sites where elephants were prone to accidents and also the specific points of action expected from Railway Board.

The IGF & Director (PE) thanked the chair and all the participants before the meeting ended.

## **OTHER WTI PUBLICATIONS**

### **A. OCCASIONAL REPORTS**

**Tribal Territories:**

Impact assessment around the Jarawa tribal reserve, middle and south Andaman Islands

**Jumbo Express:**

A scientific approach to understanding and mitigating elephant mortality due to train accidents in Rajaji National Park.

**Elephant in Exile:**

A rapid assessment of the human-elephant conflict in Chhattisgarh

**Against the Current:**

Otters in the river Cauvery, Karnataka

**Silent Stranglers:**

Eradication of mimosa in Kaziranga National Park, Assam

**Living at the Edge:**

Rapid survey for the endangered Ladakh urial (*Ovis vignei vignei*) in Leh district of Ladakh Trans-Himalaya

**Search for Spectacle:**

A conservation survey of the Phayre's leaf monkey (*Trachypithecus phayrei*) in Assam and Mizoram

**Awaiting Arribadda:**

Protection of Olive Ridley turtles (*Lepidochelys olivacea*) and their nesting habitats at Rushikuliya rookery, Orissa

**Living with Giants:**

Understanding human-elephant conflict in Maharashtra and adjoining areas

**Crane Capital:**

Conservation strategy for Sarus Crane (*Grus antigone*) habitat in Etawah and Mainpuri Districts, Uttar Pradesh

**Carnivore Conflict:**

Support provided to leopards involved in conflict related cases in Maharashtra

**India at the International Whaling commission:**

A policy document on India's involvement in the IWC 1981-2003

**Sighting Storks:**

Status and distribution of Greater adjutant storks (*Leptoptilos dubius*) in the Ganga and Kosi river floodplains near Bhagalpur, Bihar

**Bait and Watch:**

Popularization of alternatives to dolphin oil among fishermen for the conservation of the Ganges river dolphin (*Platanista gangetica*) in Bihar

**Captive Concerns:**

Health and management of captive elephants in Jaipur

**Fair Concern:**

Health and management of captive elephants in Sonpur

**Ganesha to Bin Laden:**

Human-elephant conflict in Sonitpur district of Assam

**Dog and Bull:**

An investigation into carnivore-human conflict in and around Itanagar Wildlife Sanctuary, Arunachal Pradesh

**B. CONSERVATION ACTION REPORTS**

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Railways and highways are a source of wildlife mortality throughout the world. At least thirty-five elephants lost their life due to train hits in Assam between 1990 and May 2006. The frequency of such accidents was highest in Kamrup (East) Forest Division. This report throws light on the issue of elephant mortality due to train hits in Assam and provides recommendations to deal with the same.



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