Interim Report to International Elephant Foundation

PERIOD OF PROJECT: 16/2/2015–15/02/2016

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ASIAN NATURE CONSERVATION FOUNDATION
C/o CENTRE FOR ECOLOGICAL SCIENCES
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BANGALORE - 560 012, INDIA
2. List the overall and specific conservation needs this project addressed

1. Mapping elephant crossing points, and movement paths along the railway line (Siliguri–Alipurduar) passing through forests, tea gardens and agriculture in northern West Bengal, India.

2. Generate susceptibility map showing locations prone to accidents while elephants cross the railway track in order to recommend mitigation measures such as slowing the speed of trains, installing early warning electronic systems or even building elevated tracks for trains or underground passages for elephants across the track.

3. Mapping of elephant movement paths in non-forest areas, especially tea gardens, to inform policy makers about protection of such corridors.

3. Summarize the goals and objectives and describe any changes in goals and objectives from the original proposal

There have been no changes so far from the original project proposal.

4. For each objective, describe the specific actions taken to achieve that objective

**Objective 1:** Mapping of elephant crossing points, and movement paths along the railway track (Siliguri–Alipurduar) stretch of northern West Bengal.

A survey was conducted during Feb–April 2015, and the entire railway track of 161 km was covered on foot, for recording signs of elephant presence and movement across the track. Evidences were plotted on a land-use GIS map on Arc GIS online. A total of 600 evidences were found along the railway track between Siliguri and Alipurduar [Dung (du): 427 places, footprints (fp): 68 places, feeding sign (fs): 4 places, track signs (ts) 88 places, direct sighting (ds): 2 places, others (oth): 11 places. The Gulma–Sivok stretch in the west had the highest frequency at 10.0 evidences/km, followed by Chalsa–Nagrakata in the central region (5.0 evidences/km), and Rajabhatkhawa–Alipurduar (4.0 evidences/km) and Garopara–
Rajabhatkhawa (3.0 evidences/km) in the east (Table 1 & Figures 1a-g). Sites of accidents prior to and after gauge conversion are shown in Figure 2.

Table 1: Evidence of Elephant Signs along the Rail Track in northern West Bengal (Siliguri Junction–Alipurduar Junction)

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Dist (km)</th>
<th>Survey km</th>
<th>%du n=427</th>
<th>%fp n=68</th>
<th>%fs n=4</th>
<th>%ts n=88</th>
<th>%ds n=2</th>
<th>%oth n=11</th>
<th>%total n=600</th>
<th>Ev/Km</th>
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<td>9</td>
<td>5</td>
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<td>Gulma</td>
<td>Sivok</td>
<td>11</td>
<td>22</td>
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<td>14.7</td>
<td>25</td>
<td>48.9</td>
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<tr>
<td>Sivok</td>
<td>Bagarakot</td>
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<td>26</td>
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<tr>
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<td>8</td>
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<td>Oodlabari</td>
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<td>Dam Dim</td>
<td>New Mal Junction</td>
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<td>Chalsa Junction</td>
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<td>16</td>
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<td>2.2</td>
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<td>18</td>
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<td>8.8</td>
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<td>1.0</td>
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<td>Hamiltonganj</td>
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<td>Kalchini</td>
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<td>0</td>
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<td>0</td>
<td>0.2</td>
<td>0.1</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>10.2</td>
<td>3.8</td>
</tr>
</tbody>
</table>

|          | 161 | 303 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
Figure 1a. Evidence of elephant signs along the Gulma–Sivok–Bagrakote–Oodlabari stretch of railway track.

Figure 1b. Evidence of elephant signs along Oodlabari–Damdim–New Mal–Chalsa stretch of the railway track.

(Maps: Copyright @Arc GIS online ESRI)
Figure 1c. Evidence of elephant signs along the Chalsa–Nagrakata–Caron–Banarhat stretch of the railway track.

Figure 1d. Evidence of elephant signs along the Banarhat–Binaguri–Dalgaon–Mujnai stretch of the railway track.

(Maps: Copyright @Arc GIS online ESRI)
Figure 1e. Evidence of elephant signs along the Munjai–Madarihat–Hasimara–Hamiltonganj stretch of the railway track.

Figure 1f. Evidence of elephant signs along the Hasimara–Hamiltonganj–Kalchini–Garopara stretch of the railway track.

(Maps: Copyright @Arc GIS online ESRI)
Figure 1g. Evidence of elephant signs along the Garopara–Rajabhatkhawa–Damanpur–Alipurduar Junction stretch of the railway track.

Out of 9 km on the Siliguri–Gulma stretch, 2.5 km was surveyed, and the rest falls under human habitation; On the Rajabhatkawa–Alipurduar stretch, out of 11 km, 8 km up to Damanpur was surveyed, and the rest falls under human habitation) *(du = dung, fp = foot print, fs = feeding sign, ds = direct sighting, oth = others).

Figure 2. Location of accident-prone areas plotted on Arc GIS online map: (Prior to and After Gauge Conversion) 1974–2013.

*Pink, is after broad gauge conversion (ABC) accidents, and Blue, is before broad gauge conversion (BBC) accident places in the map.
2. Objective 2: Generate susceptibility map showing locations prone to accidents while elephants cross the railway track in order to recommend mitigation measures such as slowing the speed of trains, installing early warning electronic systems or even building elevated tracks for trains or underground passages for elephants across the track.

We generated the following heat map on Arc GIS online after plotting evidence from the dry season survey and locations of accident spots (before and after gauge conversion) in order to identify the areas prone to accidents (Figure 3).

![Susceptibility map of accidents along railway track in northern West Bengal.](image)

Fig. 3. Susceptibility map of accidents along railway track in northern West Bengal.

# Light blue = low, Red = medium, Yellow = high intensity in susceptibility map

**Train accidents and fatalities:** The role of rail gauge conversion on accidents can be accessed from the fatalities to elephants involving trains. Eighty-two elephant fatalities were reported from 56 incidents over a 40-year period (1974–2013); of these, 27 elephants died in 26 incidents between 1974 and 2002 (@0.93 incidents/year±1.19 (n=29) and 0.90 elephant/incident ±1.11 (n=26) when metre gauge (MG) was in operation, a figure that jumped to 30 accidents with 55 fatalities after conversion to broad gauge (BG) in just ten years (2004 to 2013) (@3.0 incidents/year±02.16 (n=10) ; 1.83 elephants/incident ±2.08 (n=30) indicating a significant increase in fatalities after conversion to broad gauge.
Of the fatalities during 2004–2013, adult females constituted 29%, adult male 29%, sub-adult female 13%, sub-adult male 7%, juvenile female 5%, and calf 17%. This can be compared to the age/sex structure of the wild population in northern West Bengal Table 2). It is clear that adult male elephants have been involved in collision with trains to a significantly greater extent (29% or more than 2-fold) than their presence in the population (13%). This could be due to several reasons. Male elephants may be bolder and crossing the railway track more frequently than family groups do in the course of their daily or seasonal movement, especially in search of cultivated crops. Males may be foraging closer to railway tracks and be more prone to being hit by passing trains as happened in one instance. There was even a case of a male elephant charging an approaching locomotive and colliding with it. Elephant calves may also be more prone to collision as they may panic when a train suddenly approaches a family group trying to cross the track.

Table 2. Age class in the elephant population in northern West Bengal and killed in rail-elephant collision

<table>
<thead>
<tr>
<th>Age class</th>
<th>% Females in population</th>
<th>% Females killed in railway accidents</th>
<th>% Males in population</th>
<th>% Males killed in railway accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>33.30</td>
<td>29.00</td>
<td>12.90</td>
<td>29.00</td>
</tr>
<tr>
<td>Sub-Adult</td>
<td>11.10</td>
<td>13.00</td>
<td>12.30</td>
<td>7.00</td>
</tr>
<tr>
<td>Juvenile</td>
<td>13.50</td>
<td>5.00</td>
<td>8.80</td>
<td>0.00</td>
</tr>
<tr>
<td>Calves</td>
<td>4.10</td>
<td>5.00</td>
<td>4.10</td>
<td>8.50</td>
</tr>
<tr>
<td>Total</td>
<td>61.99</td>
<td>55.50</td>
<td>38.01</td>
<td>44.50</td>
</tr>
</tbody>
</table>

(Source: Sukumar et al. 2003)

As regards the time of accidents over a 24-h period, after broad gauze conversion it was found that a higher frequency of accidents occurred between 6.00 p.m. and 6.00 a.m. There is significant variation found among between 6.00 p.m. and 6.00 a.m the various timing ranges when we do a proportions test.

[Approximately, 65% of passenger trains run during daytime (6am to 6pm) and the rest 35% during night time (6pm -6am) in the Siliguri-Alipurduar railway stretch. We do not presently have data on goods train in this railway stretch. So we omitted the goods train accident cases and only analyzed passenger train accidents (n=28 accidents)].
3. Mapping of elephant corridor in non-forest areas, especially tea gardens to integrate two tracts of forest areas in future.

This survey will be done in the near future.

3. Summarize the goals and objectives and describe any changes in goals and objectives from the original proposal.

There are no changes in objectives and goals from the original project proposal.

5. Describe any activities that differ from the original proposed actions and explain the reason for the change

Instead of conducting surveys every month, after discussions with Prof. Raman Sukumar (Managing Trustee, Asian Nature Conservation Foundation), it was decided to carry these out during three different seasons—non-crop (January-March), maize (March/April-Jun/July) and paddy (July/Aug-November/December) seasons.

6. Conservation outcomes for elephants

Elephants cross this railway track at various places including forest and non-forest areas. Gulma-Sivok, Sivok Bagarkote, Oodlabari-Damdim, New Mal-Chalsa, Chalsa-Nagrakata, Caron-Banarhat, Banarhat-Binnaguri, Binnaguri-Dalgaon, Madarihat-Hasimara, Hasimara-Garopara, Garopara-Alipurduar have been identified as the most vulnerable places where elephants cross frequently. This can be seen from the heat map (existing accident spots, and evidences of elephant presence during the first survey). There are hardly any gaps along this track except for Bagrakote–Oodlabari, Nagrakata–Caron and Munjai–Madarihat where elephants do not cross the track often. The frequency of accidents is higher during the night than during the day time and, hence, the curtailment of the movement of trains on this stretch during night time is a possible means to reduce accidents. Some places such as Gulma–Sivok, Chalsa–Nagrakata, Madarihat–Hasimara and Kalchini–Rajabhatkhawa—Damanpur sectors need landscaping (overpass, underpass or tunnelling) and realignment of track to facilitate
train and elephant movement. After completing the seasonal surveys we will be taking up these issues with the concerned wildlife and railway authorities in order to minimise the risk of accidents to elephants.

7. Describe any problems discovered or occurring during this grant period.

None really until now.

8. Was your project successful? State short and long term goals that you are using to evaluate your accomplishments.

We will be able to make a judgment on these only towards the end of the study and the follow up with the authorities.

9. Based on this Project, what is the “next step” for this project and does it have implications for future conservation actions

Share the results and outcomes of the survey with forest/wildlife and railway officials and discuss with officials of the Indian government for using these results to come up with policy for operating trains in this region.

10. Provide at least one human interest story. This story should enable the reader to identify with the people, a problem, day-to-day situations, achievements or a funny or strange occurrence during the course of the project. Examples: a story about when the bull elephant put his tusk through the window of the research vehicle or the lion with a snare on his leg and the many weeks it took to find the animal

We shall do this in a later report.

11. In 500 words or less, summarize the progress and results achieved. This will be used for media and donor recruitment.

The genesis of the accidents involving elephants along this track goes back to the history of the exploitation of the dense tropical rainforests of northern Bengal beginning the mid-19th century with the advent of British rule in the country. Tea plantations were introduced in
Darjeeling and the Dooars in the 1850s and 1862, respectively, felling prime natural forest and clearing wildlife habitat. The British constructed the Siliguri–Alipurduar meter gauge railway line during 1910–1911 in order to transport the large quantities of timber that became available from land clearing. Some of the timber also went into the construction of railway sleepers. The tropical forests were gradually fragmented with the interspersion of tea gardens, paddy fields, villages, roads and the railway line.

During 2002-04, the existing metre gauge railway line was converted into a broad gauge line by the Indian Railways, thereby permitting trains to run at higher speeds and at greater frequencies. This led to a steep increase in the number of train accidents involving collision with elephants.

During the dry months (February-April) of 2015 we mapped elephant crossing points, and movement paths along railway line Siliguri–Alipurduar passing through forests, tea gardens and agriculture in northern West Bengal. GPS locations of these evidences, as well as accident locations, were plotted on Arc GIS map online. Susceptibility to accidents map was generated from these data. The problem was unfortunately not localized but widespread as seen from these maps. This would make it more difficult to find solutions to reduce accidents. A disproportionate number of accidents occurred during night time, indicating that poor visibility for train drivers and possible disorientation of elephants contributed to these accidents. Male elephants were much more prone to be hit by trains because of behavioural characteristics that made them cross railway tracks more frequently or casually, forage along tracks and even confront oncoming trains.

We will soon be surveying the first wet season evidence of elephant presence and movement corresponding to the cultivation of maize (corn) during June-July, followed by another survey during the second wet season when paddy is cultivated (November/December). We will then generate a composite accident susceptibility map incorporating evidence from all seasons.
Alongside this work, we will also be mapping elephant movement paths across tea gardens and agricultural fields between the fragmented forest patches in relating to the present alignment of the railway track.

12. In 50 words or less, summarize the progress and the results achieved. This will be used for social media.
A dry season survey was carried out of elephant presence along the Siliguri – Alipurduar Junction railway track along with mapping of locations of elephant accidents, and several vulnerable sectors were identified. There has been a steep increase in the frequency of accidents involving elephants after conversion from metre to broad gauge. Most accidents took place during night time. Male elephants were more prone to being killed by trains in view of their behavioural characteristics.

13. List all organizations associated with this project and their roles in the project.
- **International Elephant Foundation**: Main funding for this Project
- **Asian Nature Conservation Foundation**: Office and work place and field data collection
- **Centre for Ecological Sciences, Indian Institute of Science**: Office space and Internet and report writing
- **West Bengal Forest Department**: Field Permission and help in the field to carry out the study
- **Indian Railways (North Frontier Railway)**: Field permission and help in the field

*I am sending separate file by attachment*

15. Submit at least five high-resolution digital images (350 kb or over) representative of the Project as separate individual files. Please include at least one photo with an elephant in the frame that demonstrates your project activities
Fig1. Tusker elephant crossing Railway track: Corridor areas at Chapramari WLS

(Photo credit: Jasopraksah)

Fig2: Makhna elephant feeding close to Railway track:

(Photo credit Jasopraksah)

Fig3: Indian Gaur crossing Railway track

(Photo credit: Jasopraksah)
Fig4: Train passing through Forest areas at Chramari WLS

(Photograph credit Mukti Roy)

Fig5: Train passing through Forest areas at Chramari WLS

(Photograph credit Mukti Roy)

Fig6: Pass cautiously looks out for elephants:

(Photograph credit Mukti Roy)