Camera Trap Survey Report (Dry Season)

Department of Forests and Park Services
Ministry of Energy and Natural Resources

Background

As part of the Environment and Social Impact Assessment (ESIA) baseline study for the Gelephu-Taraythang road alignment, a comprehensive camera trap study was conducted along the proposed road site. A total of 30 camera traps were strategically installed across 15 survey grids (2 km x 2 km) to collect data on wildlife presence and their activity. This data is crucial for assessing the environmental and social impacts associated with road construction.

Camera trap data plays a significant role in the ESIA process by providing detailed understandings into the distribution and behavior of wildlife in the affected area. This information helps to:

1. **Assess Biodiversity:** By capturing images of various species, the data allows for an assessment of the biodiversity in the road alignment area. This includes identifying the presence of rare or endangered species that may be impacted by construction activities.
2. **Evaluate Wildlife Movement:** Camera traps provide data on wildlife movement patterns, which helps in understanding how the road may disrupt migration routes or daily movements. This information is critical for designing mitigation measures that minimize disruption to wildlife corridors.
3. **Identify Potential Impacts:** The data can reveal potential impacts such as habitat fragmentation or increased wildlife-human conflicts, which can inform the development of strategies to address these issues effectively.
4. **Support Mitigation Strategies:** By identifying areas of high wildlife activity or sensitive habitats, camera trap data aids in designing targeted mitigation measures, such as wildlife crossings or habitat restoration projects, to reduce the negative impacts of road construction.

The findings from this camera trap survey will be essential in mitigating the impacts of the road construction project. The data will be used to inform the planning and implementation phases, ensuring that construction activities are planned and executed in a manner that minimizes environmental and social impacts. By integrating these findings into the project design, it is possible to develop strategies that balance development needs with conservation goals, ultimately promoting more sustainable and environmentally responsible practices.

2. Methodology

2.1 Study area

The area falls through six gewogs (sub-districts) of Taraythang, Shershong, Chhuzergang, Samtenling, Gelephu and Umling. The study area encompasses diverse habitats like

subtropical forests, grasslands and warm broadleaf forests, situated across varying altitudes from 150 to 398 meters above sea level.

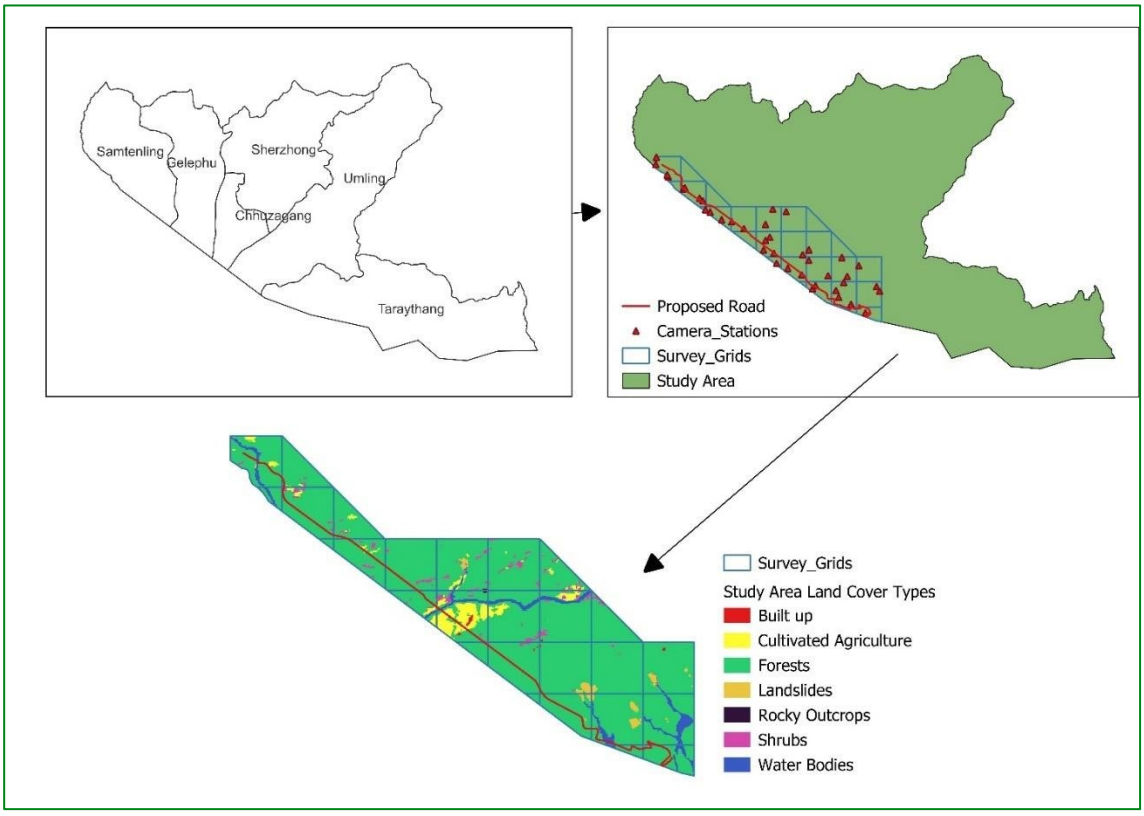

Figure 1. Map of camera trap study area

2.1.1 Climatic conditions

The study area is characterized by hot and humid climatic conditions with winter being moderately cool and comfortable, and summer being hot and humid, with significantly more rainfall than in winter. The average temperature in the area is around 22.4°C, ranging from a minimum of 18.6°C to a maximum of 39. 2°C. The highest rainfall occurs between May and September, peaking in July and August with levels exceeding 5000 mm.

2.1.2 Population

The population distribution across the six gewogs—Chhuzanggang, Gelephu, Serzhong, Samtenling, Umling, and Tareythang—reveal a diverse range of demographic characteristics. Gelephu is the most populous gewog, with a total of 6,457 residents. Its high population is attributed to its role as a major urban and commercial center, benefiting from its strategic location near the Indian border. Following Gelephu, Samtenling has a population of 2,801, while Serzhong has 2,707 residents. Chhuzanggang ranks next, with 2,499 inhabitants, making it the fourth most populous gewog. Umling, with 1,586 residents, is a more remote and rural area where agriculture and livestock rearing are the

primary economic activities. Lastly, Tareythang, with a population of just 351, is the least populated and most rural of the gewogs.

2.1.3 Habitat and Vegetation:

2.1.3.1 Sub-tropical Forests: Dominating much of the study area, these forests are characterized by dense, evergreen vegetation, including species like *Chukrasia tabularis, Acrocarpus fraxinifolius, Ailanthus grandis, Bombax ceiba, Duabanga grandiflora, Shorea robusta, Tetrameles nudiflora* etc. The undergrowth is rich with shrubs, ferns, and climbers, providing cover and resources for numerous animal species.

2.1.3.2 Grasslands: Interspersed within the forests and riverbanks, these areas are composed primarily of tall grasses, such as *Miscanthus spp, Imperata spp and and Saccharum spp*, which are adapted to periodic disturbances like flooding, grazing, and fires. Grasslands are crucial habitats for herbivores as well as predators.

2.1.2.4. Warm Broadleaf Forests: These habitats are composed of a mixture of deciduous and evergreen trees, such as *Alangium chinense, Alnus nepalensis, Betula alnoides, Bischofia javanica, Callicarpa arborea, Castanopsis indica, Cordia obliqua, Dendrocalamus hookeri, Dichroa febrifuga, Engelhardia spicata, Entada spp. Helicia nilagirica*. The canopy cover is moderately dense, allowing sufficient light for a diverse understory.

2.2. Expected Wildlife Species:

The area is home to a variety of wildlife species, including several common and endangered species. Mammals like the Asian elephant (*Elephas maximus*), gaur (*Bos gaurus*), and barking deer (*Muntiacus muntjak*) are expected in these habitats. Predators such as the Royal Bengal tiger (*Pathera tigris*), common leopard (*Panthera pardus*) and smaller carnivores like the common palm civet (*Paradoxurus hermaphroditus*) are also likely to be present. Bird species such as the great hornbill (*Buceros bicornis*), green magpie (*Cissa chinensis*), red junglefowl (*Gallus gallus*), Indian peafowl (*Pavo cristatus*) and various raptors are frequently observed. Reptiles, including Burmese python, monitor lizards, and several snake species, add to the area's biodiversity.

2.3. Land-use types

The land-use and land-cover analysis of the study area shows a total area of **97,939.74 hectares (Ha)**, dominated by forests, which cover **96,905.87 Ha (98.94 % of the total area)**. This shows a significant portion of natural vegetation within the region. Cultivated agricultural land is much less prevalent, occupying **325.35 Ha (0.33%)**, reflecting limited agricultural activities (Table 1).

The data shows that the region is predominantly covered by forests, with other land-use types occupying much smaller portions.

Table 1. Summary of land-use type and area coverage in the study area

Land-Use/Cover class	Area (Ha)	Percentage
Built up	9.92	0.01
Cultivated Agriculture	325.35	0.33
Forests	96905.87	98.94
Landslides	79.39	0.08
Rocky Outcrops	2.84	0
Shrubs	187.14	0.19
Water Bodies	429.41	0.44
Grand Total	**97939.94**	**100**

3. Methods

3.1 Grid size and camera configuration

A grid size of 2 km x 2 km was laid out along the proposed Gelephu-Taraythang highway spanning a length of 18 km. To capture wildlife images, we used Reconyx HC500 Hyperfire camera traps. The devices were configured to capture five consecutive images per trigger, both during the day and at night, with no delay between triggers. This configuration was chosen to maximize the number of captured images and ensure comprehensive wildlife monitoring. The camera sensitivity was set to medium-high to detect even small species. These cameras, equipped with passive infrared technology, are triggered by both animal movement and body heat.

3.3 Camera installation and data collection

Within each grid, potential wildlife signs and tracks were thoroughly examined to assess wildlife activity. Camera stations were then strategically selected based on these observations to maximize wildlife captures. For each grid, two camera stations were designated, with one camera installed at each station. Camera trap was placed on either side of the trail at a height of 45-60 cm from the ground. On flat grounds, camera traps were set up at a 90^{o} to the trail but in slopy area, camera traps were positioned such that the slope of the trail is horizontal to the area of camera set-up. A specific camera ID was assigned to each camera trap.

Data collection was facilitated using the EpiCollect mobile application. The data collected included camera trap locations, habitat types, elevations, and the installation and retrieval dates of the camera traps. This data was recorded on mobile phones to ensure accuracy and ease of access.

4. Data analysis

We used camera trap data from 22 stations (individual Grids with Camera station_1 and Camera station_2, which were sorted and processed using Camera Trap File Manager (CTFM) software. The image data, extracted as a CSV file through CTFM, was analyzed using R statistical software version 4.4.1.

5. Results

5.1 Camera trap and wildlife detections

Camera traps were deployed to record the presence of terrestrial mammals, with installations beginning on August 8, 2024, and retrieval completed on October 25, 2024. Across 15 grids of 2x2 km each, we installed 30 camera traps, with the number of trap nights ranging from 2 to 77. However, total of eight camera traps were lost (Table 2).

Table 2. Summary of Camera Trap Installation and Retrieval Dates along with information on active trap nights

Grid id	Camera	Installation date	Retrieval date	Trap night	Remarks
G1	C1	08/08/2024		0	Lost
	C2	08/08/2024		0	Lost
G2	C1	08/08/2024	24/10/2024	77	
	C2	09/08/2024	29/08/2024	21	
G3	C1	08/08/2024	24/10/2024	77	
	C2	08/08/2024	23/09/2024	46	
G4	C1	08/08/2024		0	Lost
	C2	08/08/2024		0	Lost
G5	C1	14/08/2024	16/08/2024	2	
	C2	12/08/2024	25/10/2024	74	
G6	C1	13/08/2024	25/10/2024	73	
	C2	13/08/2024	25/10/2024	73	
G7	C1	27/08/2024	25/10/2024	59	
	C2	12/08/2024		0	Lost
G8	C1	28/08/2024		0	Lost
	C2	28/08/2024		0	Lost
G9	C1	12/08/2024	27/09/2024	46	
	C2	20/08/2024	24/10/2024	65	

G10	C1	09/08/2024	19/08/2024	10	
	C2	09/08/2024	24/10/2024	46	
G11	C1	12/08/2024	24/10/2024	73	
	C2	12/08/2024	13/09/2024	32	
G12	C1	12/08/2024	24/10/2024	73	
	C2	09/08/2024	24/10/2024	46	
G13	C1	09/08/2024		0	Lost
	C2	09/08/2024	24/10/2024	46	
G14	C1	09/08/2024	24/10/2024	46	
	C2	09/08/2024	26/08/2024	18	
G15	C1	09/08/2024	24/10/2024	46	
	C2	09/08/2024	10/09/2024	32	

Livestock had the highest relative abundance followed by human and elephant and the lowest was Brush tailed-porcupine, Carb-eating mongoose and Oriental pied hornbill (Table 3).

Table 3. Summary of Camera Trap Data: Grids captured, Total Grids, Trap nights, Counts, Relative Frequency and Relative Abundance of human, livestock and wildlife species

Species	**Grids-Captured**	**Total Grids**	**Trap nights**	**Count**	**Relative Frequency**	**Relative Abundance**
Barking Deer	7	15	1127	1639	0.467	0.094
Brush Tailed-porcupine	1	15	1127	7	0.067	0.000
Crab-eating Mongoose	1	15	1127	2	0.067	0.000
Elephant	9	15	1127	2076	0.600	0.119
Gaur	2	15	1127	861	0.133	0.049
Hog Deer	1	15	1127	21	0.067	0.001
Human	12	15	1127	2598	0.800	0.149
Indian Peafowl	6	15	1127	346	0.400	0.020
Livestock	10	15	1127	9597	0.667	0.550
Sambar	4	15	1127	76	0.267	0.004
Asiatic Wild Dog	2	15	1127	38	0.133	0.002
Wild Pig	4	15	1127	191	0.267	0.011
Small Indian Civet	1	15	1127	9	0.067	0.001
Oriental Pied Hornbill	1	15	1127	2	0.067	0.000
				17463		

Table 3. Location of camera traps with information on altitude and habitat

Grid id	Camera	Altitude (m)	Habitat	Latitude	Longitude
G1	C1	229	Sub-tropical	26.876824	90.461911
	C2	218	Sub-tropical	26.87537	90.469932
G2	C1	185	Grassland	26.87331	90.49707
	C2	173	Warm broadleaf	26.87031	90.47975
G3	C1	185	Warm broadleaf	26.86182	90.49712
	C2	162	Warm broadleaf	26.85494	90.49544
G4	C1	157	Grassland	26.8526	90.50365
	C2	155	Warm broadleaf	26.86412	90.5005
G5	C1	174	Warm broadleaf	26.88245	90.51367
	C2	208	Grassland	26.88427	90.50302
G6	C1	181	Subtropical	26.84167	90.51482
	C2	150	Subtropical	26.84533	90.50591
G7	C1	150	Grassland	26.8514	90.52679
	C2	159	Warm broadleaf	26.85496	90.53183
G8	C1	174	Subtropical	26.84731	90.53175
	C2	172	Subtropical	26.83702	90.52598
G9	C1	164	Subtropical	26.82691	90.53462
	C2	154	Subtropical	26.82904	90.53705
G10	C1	210	Subtropical	26.83619	90.5471
	C2	292	Subtropical	26.8493	90.55823
G11	C1	266	Subtropical	26.82553	90.55345
	C2	250	Subtropical	26.82076	90.55559
G12	C1	265	Subtropical	26.83136	90.55965
	C2	250	Grassland	26.81558	90.56543
G13	C1	342	Subtropical	26.8357	90.56252
	C2	295	Subtropical	26.84323	90.5718
G14	C1	230	Subtropical	26.80934	90.57691
	C2	242	Subtropical	26.80963	90.57051
G15	C1	320	Subtropical	26.82489	90.58842
	C2	300	Subtropical	26.82819	90.58599
AG1	C1	398	Sub-tropical	26.9219	90.40968
	C2	350	Sub-tropical	26.91665	90.40924
AG7	C1	334	Sub-tropical	26.90775	90.41923
	C2	340	Sub-tropical	26.90915	90.41832
AG8	C1	351	Sub-tropical	26.89912	90.43127
	C2	362	Sub-tropical	26.89978	90.43259

AG14	C1	332	Sub-tropical	26.89237	90.44422
	C2	313	Sub-tropical	26.89052	90.44678
AG15	C1	294	Sub-tropical	26.88239	90.45273
	C2	313	Sub-tropical	26.88411	90.44898

With the loss of 8 camera traps, the remaining 22 camera traps captured a total of 217,714 images with the survey effort of 1127 trap nights. Majority 59.2% (n=128,711) of the images were as a result of false tigger (no images of wildlife or human or livestock) and were removed from further analysis. However, 14.3% of the images captured were of human and livestock (n=12,722). The remaining 76,281 images were of, birds, rodents and wild mammals. The wildlife captured were spread across 9 orders, 12 families and 15 species (3 EN, 1 NT, 2 VU, and 9 LC) (Table 4). (Red jungle fowl and cattle egret were put under Indian pea fowl due to low capture rate).

Table 4. Summary on taxonomic classification and conservation status of species

No.	**Order**	**Family**	**Scientific name**	**Common name**	**Dzongkha name (Bhutanese)**	**** IUCN status**
1	Artiodactyla	Cervidae	*Muntiacus muntjak*	Barking Deer	Kasha	LC
2	Probosci	Elephantidae	*Elephas maximus*	Asian Elephant	Lamche	EN
3	Artiodactyla	Bovidae	*Bos gaurus*	Gaur	Relang	VU
4	Artiodactyla	Cervidae	*Axis porcinus*	Hog Deer	Kasha	EN
5	Carnivora	Viverridae	*Viverricula Indica*	Small Indian Civet	Bja-Zig	LC
6	Carnivora	Herpestidae	*Urva urva*	Crab-eating Mongoose	Neulay	LC
7	Artiodactyla	Cervidae	*Rusa unicolor*	Sambar Deer	Shaw	VU
8	Carnivora	Canidae	*Cuon alpinus*	Wild Dog	Phaw	EN
9	Artiodactyla	Suidae	*Sus scrofa*	Wild Pig	Repha	LC
10	Galliformes	Phasianidae	*Pavo cristatus*	Indian Peafowl	MaJaa	LC
11	Galliformes	Phasianidae	*Gallus gallus*	Red Jungle fowl	Ribja	LC

12	Rodentia	Hystricidae	*Atherurus macrourus*	Asiatic Brush-tailed Porcupine	Bjithu	LC
13	Pelecaniformes	Ardeidae	*Bubulcus ibis*	Cattle Egret	NA	LC
14	Bucerotiformes	Bucerotidae	*Anthracoceros albirostris*	Oriental pied hornbill	Bja-gowo	LC

****IUCN Status**
EN: Endangered, NT: Near Threatened, VU: Vulnerable, LC: Least Concern

5.3 Habitat description for each grid location

5.3.1 Sub-tropical Forests: (Grids 01, 06, 08, 09, 10, 11, 12, 13, 14, 15)

Figure 21. Subtropical forest

Description: These grids are characterized by sub-tropical forests found at altitudes ranging from 150 to 398 meters. The sub-tropical forests have dense canopy covered with a rich diversity of evergreen and deciduous trees, shrubs, and thick undergrowth. These forests typically occur in warm, humid conditions and support a wide variety of wildlife, including insects, birds, mammals, and reptiles. The higher elevation sub-tropical forests (such as those in Grid 01 and 15) are likely to have slightly cooler microclimates compared to those at lower elevations (such as in Grid 06).

5.3.2 Warm Broadleaf Forests: (Grids 03, 04, 05, 07)

Figure 22. Warm broadleaved forests

Description: These grids predominantly feature warm broadleaf forests, found at altitudes between 155 and 362 meters. Warm broadleaf forests are characterized by a mix of evergreen and semi-deciduous trees, often with a medium-dense canopy that provides a moderate amount of shade. These forests offer diverse habitats for various species, including numerous bird species, small to medium-sized mammals, and rich insect life. The combination of warm temperatures and ample moisture in these areas makes them conducive to a variety of plant and animal species.

5.3.3 Grasslands: (Grids 02, 04, 05, 07, 12):

Figure 23. Grasslands

Description: These grids include areas of grasslands, typically found at lower altitudes (ranging from 155 to 185 meters). Grasslands are open habitats characterized by herbaceous vegetation, including grasses and other non-woody plants. They provide vital grazing areas for herbivores, as well as habitats for ground-nesting birds and various small mammals and reptiles. Grasslands can also act as transitional zones between different forest types, enhancing habitat diversity and supporting species that require mixed environments.