Project Update: June 2022

Background: Modern rapid global industrialisation and development has led the vast network of power distribution line in all continents. Availability of electricity has become an integral part of economic and development of the country. Furthermore, the health and social well-being of societies depends upon the electricity (Chaurey et al 2004). Particularly, growing network of power lines in developing countries of Asia and Africa has hugely increased. Voltage carried from the transmission source to required places/distribution lines (Industries, households) are reduced down (medium voltage) by the transformers which consequently reduced the insulation requirement hence energized conductors wire closer to the cross arm from which are they suspended (APLIC 2006). As a result, it increases the possibility of electrocuting the large sized birds, such as raptors by simultaneously contacting two phases (Prinsen et al 2011a). The bird/raptor may get electrocuted when it touches two energised components (phase-phase) or one energised and one neutral component i.e., energized - ground (Kemper et al 2013).

Raptors along, with other birds, have been often found using the power poles for perching as well as nesting sites (Williams and Colson 1989, Blue 1996, Avian Power Line Interaction Committee [APLIC] 2006, Lammers and Collopy 2007). Power lines established in the ridge lines and in the agricultural areas at the rural have been found to be most lethal. In worldwide >70 species have appeared in power-line mortality data (Hunting 2002). Such man-made structures have reported to kill or injured significant numbers of raptors; golden eagle (Smith and Murphy 1972, Boeker and Nickerson 1975), Bonelli's eagle and eagle owl (Real et al. 1996, Rubolini et al. 2001), Harris hawk (Dwyer and Mannan 2007), black kite (Ferrer et al 1990) and Egyptian vulture (Angelov et al. 2013). Raptor electrocution problems have been recognised internationally, especially in North America and Europe and, as a result, significant precautions have been taken (APLIC 2006, Prinsen et al. 2011a, b). The electricity transmission network has largely increased in last decade in Asia; it is likely to be another anthropogenic threat to raptors (Bevanger 1998, Boshoff et al. 2011, Angelov et al. 2013). Scanty information exists regarding raptor electrocutions and collisions in Asia, though heavy mortalities of raptor population have been known in Kazakhstan (Lasch et al. 2010), Asiatic Russia (Saltykov 2012), Mangolia (Gombobaatar et al. 2004, Harness et al. 2008, 2010, Amartuvshin and Gombobaatar 2012), China (Dixon 2010) and India (Harness et al 2008). However, detailed quantitative studies on the mortalities at a regional level is still unknown. Our previous ranging study of bearded vulture and mountain hawk eagle showed that these raptors might be highly threatened by power poles and transmission lines, since bearded vultures forage over vast mountain ranges of Nepal with over 70% of their ranges lying outside the protected areas (Subedi et al 2020) and mountain hawk eagles forage often near to human settlements for easy prey (chicken) where the powerlines are laid. Most of the powerlines have been found to be laid all the way along from one forest hilltop to another where raptors often forage, get lift, and breed.

Activities conducted: We replicated a raptor electrocution survey focusing on bearded vulture and mountain hawk eagle, within their core ranges (for detail see previous update report). The surveyed places were Kaski (Thoolakharka, Dhampus, Ghandruk, Tolka, Bhadaurey, Panchase, Dipang, Puranchaur), Parbat (Deupur, Chitre) and

northern belt of Syanja (Khamaley, Rapu) district that lies in and around the periphery of Annapurna Conservation Area. The selected areas were within the home range of bearded vulture and mountain hawk eagle as shown by the satellite telemetry-based study. We also conducted the structured questionnaire survey in order to understand the public perception towards bearded vultures, information regarding on its death by different anthropogenic activities, secondary poisoning of raptors due to carnivores (especially mammals) conflict with local peoples and mapping the places that have high degree of threats to raptors.

The study was conducted from 12th April to 7th May and 15th to 19th May 2022. On 13th May 2022, local elections were held over the country (metropolitan cities, municipalities and rural municipalities), hence our work halted after 7th May and had to restart after the election was over. Two researchers were involved during the electrocution and collision survey. We walked under the power lines during the whole survey period and inspected top bottom of the pole to record the mortalities that may occur due to collision. We also searched the ground within the radius of 7.6m around the base of each pole for the presence of avian remains if got electrocution (Harness and Wilson 2001, Dwyer and Mannan 2007). Opportunistic record of avian and raptor mortalities were recorded during the study period through oral communication/interviews with the farmers, herders and local electricians. Due to topography in mid-hills, we did not survey power lines randomly or systematically. Instead, we opportunistically only poles and poles segments on publicly accessible lands. Thus, our scope of inference applies only to these types of poles, and our tally of carcasses may be biased toward human-tolerant species.

The highest elevation of the study area was 2488 m asl and the lowest was 693 m asl. In total, we record 723 power lines and 24 high transmission lines of 220Kv during the whole study period (Dhampus – 132, Deupur – 99, Ghandruk + Tolka – 70, Bhadaurey – 62, Chitre – 51, Panchase – 59, Rapu – 56, Dipang – 150, Puranchaur – 68). Six hundred and ninety (93.7%) of power poles were made up of metal, 32 (3.3%) were made up of concrete and 16 (2.1%) were of wooden materials. Out of 747 power poles and high transmission lines, 458 lines have metal as cross-arm materials while 289 power lines did not have any cross-arm materials, they were connected with the insulators of the pole while moving to another power poles. We found six types of cross-arm types; the most common power poles were vertical followed by cross-sectional triangular types while the least were mix configuration of cross sectional + horizontal (Table 1).

Table 1: Cross arm types of configurations of power lines and high transmission lines in the study areas

SN	**Cross arm types**	**Number**	**Percentage (%)**
1	Cross-sectional Triangular	251	33.6
2	Horizontal Configuration	78	10.4
3	Cross-sectional Triangular + Horizontal	4	0.5
4	Cross-sectional Triangular + vertical	32	4.3
5	Horizontal + Vertical	64	8.6
6	Vertical	318	42.6
	Total	**747**	**100**

All the cross-sectional triangular configuration are "simple I" types. Out of 78 horizontal power poles, 52.7% were" simple I" types of horizontal configuration and 42.3% were "simple H" configuration. The vertical cross-arm types had "double circuit, angled struts - 7.5%" and "the three phases on one side, single circuit – 92.5%" configurations. We found seven anti-electrocution devices (perch deterrent insulators) in seven vertical arrangements of "double circuit, angled struts". We recorded 11 cases of mortalities (10 birds and one mammal) during the study. These records or mortalities are new cases which have occurred after the previous survey. Out of 10 birds, nine were non-raptors, one was raptor (Table 2).

Table 2: Checklist of birds and mammals that died due to electrocution and collision

SN	**Species**	**No. of deaths**	**Family**	**Status**
Raptors				
1	Himalayan Vulture	1	Accipitridae	Near Threatened
Non-raptors				
2	Large-billed Crow	4	Corvidae	Least Concern
3	Jungle Myna	2	Sturnidae	Least Concern
4	Barn Swallow	1	Hirundinidae	Least Concern
5	Sparrow species	1	Passeridae	Least Concern
6	Unid Bird	1		
Mammals				
1	Rhesus Monkey	1	Cercopithecidae	Least Concern

In this survey, we also conducted a structured questionnaire survey with the key informants (farmers and herders) to understand people's perception towards bearded vulture and other raptors, human-wildlife conflict and threatened hotspots for the raptors. The survey was conducted from 12th April to 7th May 2022. Out of 146 questionnaires from the key informants, all respondents were found to be traditional farmers, however 78.08% (n=114) were full-time farmers while 21.92% (n=32) were part-time. On a gender basis, 57.53% were female (n=84) and 42.47% male (n=62). 68.49% of respondents were Khas/Aryas, 30.82%% were Mongol tribal people (Gurung, Magar, Tamang) and 0.68% were Janajati (Newar). Most of the respondents were between the age of 46 – 60 and few were aged 61+ (Fig 1).

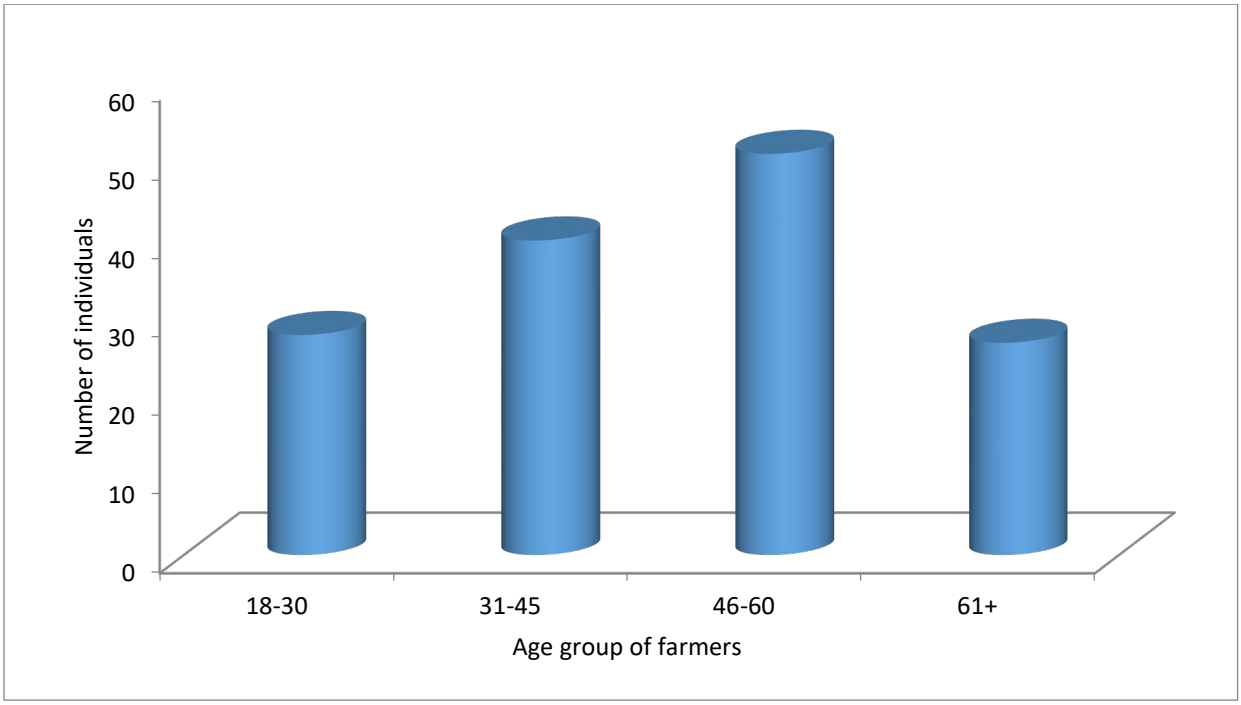

Fig 1: Categorization of age group of key-informants and numbers of respondents 88.36% (n=129) of the farmers generates less than 10% of their total income from the livestock farming, 6.85% (n=10) generates between 10% - 20%, 3.42% (n=5) generates between 20% - 40% and 0.68% (n=1) generates between 40% - 60% respectively. Out of 146 respondents, 126 key informants tamed livestock. The average goat/sheep tamed by the farmers were 6.51 ± 13.16 SD and 2.33 ± 1.58 SD for large animals (Buffalo/Cow/Horse/Mule). We also calculated the percentage of livestock loss in last 12 months (killed, stolen, diseased etc.) where 38.36% (n=56) respondents lost their livestock lesser than 1% of their total livestock, 30.82% (n=45) did not lost their livestock from above mentioned reasons while 6.85% (n=10) responded that they lost about 5 – 10% of their total livestock (Table 3).

Table 3: Loss of livestock of farmers within 12 months

Percentage of livestock loss	**Number of respondents**	**Percentage**
less than 1%	56	38.36
1- 3%	27	18.49
3 - 5%	8	5.48
5 - 10%	10	6.85
None	45	30.82

Out of 146 respondents, 50.68% (n=74) reported diseases as the main cause of livestock loss over past 5 years followed by predators (21.92%, n=32) and other unknown reasons (1.37%, n=2).

When the participants were asked about mortalities of bearded vulture and other raptors due to electrocution and collision, the majority (93.84%, n= 133) commented that they had not found or seen dead bearded vultures or other species of raptors while 6.16% (n=9) had seen/noticed/found dead bearded vultures and other raptors due to electrocution and collisions. Eight respondents noted that the mortalities of bearded vultures and raptors occurred in the last year while one respondent reported to witness electrocuted raptors 6 months ago. It was found that the four respondents had witnessed the mortalities of bearded vulture, two had witnessed two electrocuted Himalayan vultures while one respondent claimed he saw an electrocuted vulture, but he could not identify the species even though we showed him the photographs of the different species. One individual stated that they had killed predatory mammas without a permit in the last 12 months; the respondents had not killed nor seen bearded vultures being killed or persecuted. In contrast one individual stated that he has killed raptors.

Photo 1: Study area; Dhampus with a serene view of Annapurna Mountain Range

Photo 2: Beautiful Bhadaurey village of central west Nepal

Photo 3: Sidaney village of Panchase with a dense forest where Bearded Vulture and Mountain Hawk Eagle forage

Photo 4: Power poles laid in the agricultural land in Chitre village

Photo 5: Breeding cliff of Deupur – Parbat where Bearded Vulture breed

Photo 6: Maize grown in the agricultural field and power poles passing through the field

Photo 5: Network of horizontal configuration + vertical configuration power lines installed in the Puran Chaur

Photo 6: Simple H-frame with a strain insulator with a Double circular angular strut design high transmission line behind at Nayapul

Photo 7: Triangular configuration power lines with a simple pin-type insulator in Chitre, Parbat

Photo 8: Triangular configuration power lines with a jumper on it

Photo 9: Researcher recording the design of the power lines (Horizontal H-frame with a switch and transformer)

Photo 10: Researcher recording the sample power lines in the sloppy area

Photo 11: Electrocuted juvenile Himalayan Vulture under the power lines in Panchase

Photo 12: Recording the mortalities of Barn Swallow in the Dipang area

Photo 13: Dead Barn Swallow just under the power lines due to collision (no burn in any parts of body)

Photo 14: Questionnaire survey with the key-informants to understand the people perception towards raptors

Photo 15: Questionnaire with the local people in Ghandruk village

Photo 16: Questionnaire with the local people of Dhampus

Photo 17: Researcher Sandesh Gurung recording the types of configurations of power lines in data sheet

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Work activities

No of Researcher: Mr. Sandesh Gurung, Mr. Milan Baral and Mr. Ashok Shahi

Work date for Sandesh Guurng: 2078/12/29 – 2079/1/24, 2079/2/1- 2079/2/5, 3 days – report writing

Work date for Mr. Milan Baral – 2078/12/29 – 2079/1/24, 2079/2/1 -2079/2/5, Data entry for electrocution – 3 days, data entry for questionnaire – 7 days

Work date for Mr. Ashok Shahi – 2078/12/28 – 2079/2/2 (Including travel from Pokhara to Kathmandu and vice versa by bus)

S. No	Date	Activities	Remarks
1	12/29/2078	Electrocution and Questionnaire survey in Dhampus	
2	12/30/2078	Electrocution and Questionnaire survey in Dhampus	
3	1/1/2079	Electrocution and Questionnaire survey in Dhampus	
4	1/2/2079	Electrocution and Questionnaire survey in Dhampus and stay in Nayapul	
5	1/3/2079	Electrocution and Questionnaire survey in Deupur, Parbat	
6	1/4/2079	Electrocution and Questionnaire survey in Deupur, Parbat	
7	1/5/2079	Electrocution and Questionnaire survey in Deupur, Parbat	
8	1/6/2079	Return back to Nayapul, Parbat	
9	1/7/2079	Electrocution and Questionnaire survey in Ghandruk, Kaski	
10	1/8/2079	Electrocution and Questionnaire survey in Ghandruk, Kaski	
11	1/9/2079	Electrocution and Questionnaire survey in Tolka	
12	1/10/2079	Rain in Tolka had to stay in Tolka	
13	1/11/2079	Electrocution and Questionnaire survey in Bhadaurey	
14	1/12/2079	Electrocution and Questionnaire survey in Bhadaurey	
15	1/13/2079	Electrocution and questionnaire survey in Bhadaurey	
16	1/14/2079	Electrocution and Questionnaire survey in Bhadaurey	
17	1/15/2079	Electrocution survey in Chitre	
18	1/16/2079	Electrocution and Questionnaire survey in Chitre	
19	1/17/2079	Electrocution and Questionnaire survey in Chitre	
20	1/18/2079	Electrocution and Questionnaire survey in Panchase	
21	1/19/2079	Rain in Panchase	
22	1/20/2079	Electrocution and Questionnaire survey in Sidaney-	

		Panchase	
23	1/21/2079	Electrocution and Questionnaire survey in Khamale to Rapu, Syanja	
24	1/22/2079	Electrocution and Questionnaire survey in Rapu, Syanja	
25	1/23/2079	Electrocution and Questionnaire survey in Rapu-Syana	
26	1/24/2079	Electrocution and Questionnaire survey from Rapu to Sarketari to Pokhara move	
27	2/1/2079	Electrocution and Questionnaire survey in Dipang	
28	2/2/2079	Electrocution and Questionnaire survey in Dipang	
29	2/3/2079	Electrocution and Questionnaire survey in Dipang	
30	2/4/2079	Electrocution and Questionnaire survey in Puranchaur	
31	2/5/2079	Electrocution and Questionnaire survey in Purachaur	