MONITORING PHEASANTS IN THE PIPAR AREA OF NEPAL: THE 2011 EXPEDITION.

A REPORT FOR

THE WORLD PHEASANT ASSOCIATION

BY

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Abstract

Nepal provides habitat for eight pheasants and fourteen other galliforme species. These birds are heavily exploited due to direct and indirect human influences. Monitoring of Himalayan galliformes in the Pipar area of the Annapurna Conservation Area Project (ACAP) is one of the longest wildlife monitoring campaigns in the country. With support from WPA, galliformes have been surveyed in Pipar periodically since 1979.

In 2011, scientific monitoring was carried out in three existing sites. In addition, two new sites were included, with seven extra listening stations, giving a total of 20 stations. These sites and listening stations were identified based on variables such as vantage point, accessibility, aspect, vegetation cover, view points, altitude, ridge line, distance from campsite and distance between the stations.

The dawn call count technique was used for counting calling birds during the breeding season. Three visits were made to most stations on consecutive mornings, although bad weather prevented some visits from being made. Three species were recorded using this method; koklass pheasant (*Pucrasia macrolopha*), hill partridge (*Arborophila torqueola*) and satyr tragopan (*Tragopan satyra*). The analysis focused on data collected from the fives sites in 2011 plus the historical data from Pipar. Four different repeated-measures Analysis-of-Variance (ANOVA) models were built using the station, site (if appropriate), year, visit and species as predictor variables to give the following general findings:

- The most important result from the 2011 survey was that koklass pheasants were not recorded at all from the three sites on Pipar Kharka. The analysis of long-term data showed a slow, but non-significant decline in call counts until 2008, followed by a dramatic decline in 2009, leading to complete absence in 2011. Possible explanatory reasons, such as timing and abnormal weather are discussed.
- Overall in 2011, call counts for hill partridge were higher than for koklass. Historical data for this species in Pipar only extends back to 2005, but this showed a significantly lower call count in 2011 than the previous three annual records.
- Call counts from satyr tragopan were significantly higher than those from the other two species in 2011, especially in the Pipar bowl. Most importantly, there was no evidence of a decline in the Pipar bowl, either in four stations (1 – 4) from 1979, or all six stations from 2005 to 2011.

In addition to collecting quantitative data on these three species, we also recorded six other galliformes; Himalayan monal (*Lophophorus impejanus*), blood pheasant (*Ithaginis cruentus*), Himalayan snowcock (*Tetraogallus himalayensis*), rufous-throated partridge (*Arborphila rufogularis*), kalij pheasant (*Lophura leucomenalos*) and black francolin (*Francolinus francolinus*). Furthermore, a total of 152 species of birds were recorded in this survey, representing 9 orders and 29 families. Botanical and mammal records were collected on an *ad hoc* basis, but recommendations are made for future collection of these data in a more systematic way.

Different human induced threats to galliformes were identified such as caterpillar and medicinal plant collection, buffalo and sheep grazing, haphazard construction of shelter camp, bamboo (nigalo) collection, unmanaged tourism, illegal hunting and poaching. In future activities such as conservation education and extension, management of non-timber forest products, proper tourism management and monitoring on potential sites are highly recommended.

Acknowledgements

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We could not have completed this arduous expedition without the immense efforts of the guides and porters. They guided us safely throughout the forests and mountains, collected water from considerable distances and generally ensured our comfort and well-being. A special thank you to the kitchen staff, who daily treated us to different mouth watering food, always served with a smile.

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Expedition group photograph taken at Kharpani

Introduction

Taxonomically, pheasants represent the family Phasianidae of the order Galliformes. Out of 51 species of pheasants of the world (Fuller and Garson, 2000), Nepal has six Himalayan pheasant species: cheer pheasant *Catreus wallichii*, Himalayan monal *Lophophorus impejanus*, satyr tragopan *Tragopan satyra*, blood pheasant *Ithaginis cruentus*, koklass pheasant *Pucrasia macrolopha* and kalij pheasant *Lophura leucomenalos*. It also has two lowland pheasants; red junglefowl *Galus galus* and blue peafowl *Pavo cristatus*. Nepal provides habitat for 14 other galliforme species, which include partridges, francolins, snowcocks and quails, out of the 869 species that have been recorded so far in the country (Bird Conservation Nepal, 2009). Nepal has paid great attention to pheasant conservation. The National Parks and Wildlife Conservation Act (1973) has classified three Himalayan pheasants; cheer pheasant, Himalayan monal and satyr tragopan as protected birds among nine protected birds of Nepal. The Himalayan monal is also the national bird of Nepal.

The Annapurna Conservation Area (ACA), the largest protected area of Nepal, is situated in west central Nepal. Due to the wide range of climatic conditions and altitudinal gradient, ACA supports 22 forest types with 1140 plant species confined to sub-tropical and temperate zones of the Himalayan region (KMTNC 1997). It is the only protected area of Nepal where six Himalayan pheasant species are recorded (Inskipp 1989, Baral and Inskipp 2005). Under the jurisdiction of the National Trust for Nature Conservation (NTNC), ACA is a model of integrated conservation and development for its landscape features and biodiversity. Pipar is situated on the south of the Annapurna mountain range in ACA and has been an area of interest for WPA since 1976, when it was first established as a special area for pheasants and informally declared as a reserve. The reserve holds five pheasant species and seven other galliformes species (Table 1). Ecological studies on pheasants began in the 1970s and were followed by additional surveys of pheasants, avifaunal diversity and general ecology (see Lelliott and Yonzon, 1980; Tamarkar and Lelliott, 1981; Picozzi, 1987; Yonzon, 1987; Howman and Garson, 1993; Kaul and Shakya, 1998, Mahato et al 2006). Since 1979, population surveys of satyr tragopan and koklass pheasant, in particular, have been conducted in the area. This is the longest running regular bird population monitoring scheme in Nepal. The present study yields call counts of three galliformes; satyr tragopan, koklass pheasant and common hill partridge and checklists of birds and mammals in Pipar area.

Table 1. Galliformes of Pipar

Name	*Scientific Name*	*Habitat*	*Threatened Status*
Satyr Tragopan	*Tragopan satyra*	Moist evergreen forest with dense undergrowth, (–2100) 2500 to 3800m altitude	NT/IUCN, VU/Nepal, CITES III for Nepal.
Blood Pheasant	*Ithaginis cruentus*	Bamboo clumps, forests or scrub of rhododendron, birch and juniper between 3200 to 4400m	CITES II
Himalayan Monal	*Lophophorus impejanus*	Rocky and grass covered slopes in summer and forests between winter in (–2500) 3300 to 4750m	CITES I
Kalij Pheasant	*Lophura leucomelanos*	All types of forests with dense undergrowth in 245 to 3050 (–3700m)	
Koklass Pheasant	*Pucrasia macrolopha*	Conifer, oak and Rhododendron forest in 2680 to 3200 (–3500)m	
Tibetan Snowcock	*Tetraogallus tibetanus*	Rocky slopes and alpine meadows in (–3650) 4500 to 5000	CITES I
Himalayan Snowcock	*Tetraogallus himalayensis*	Rocky slopes and alpine meadows in 4250 to 5500 (–5900)	
Chukor	*Alectoris chukar*	Open rocky or grassy hills; dry terraced cultivation between 2100 to 3960 meter	
Hill Partridge	*Arborophila torqueola*	Broadleaved evergreen forest between 1830 to 3200 (3550)	
Rufous throated Partridge	*Arborophila rufogularis*	Broadleaved evergreen forest mainly 1450 to 1830 (250–2050)	
Tibetan Partridge	*Perdix hodgsoniae*	Semi desert, rock and scrub slopes 3700 to 4100 (–5000)	
Snow Partridge	*Lerwa lerwa*	Rocky and grassy slopes with scrub, (–3050) 4000–5000	

Objectives

The objectives of this study were to:

- Carry out call count surveys from existing calling stations.
- Establish new calling stations in existing sites and carry out call counts.
- Establish new sites to extend the geographical range and altitude and carry out call counts.
- Create birds species lists.
- Test relocation of botanical transects and plots.
- Identify potential sites for future monitoring.
- Patrol the forest and maintain an official presence.

Study Period & Area

General Description

The present study was conducted in the Pipar area, on the southern spur of Machhupuchhare Peak, central Nepal, about 24 km north of Pokhara, Nepal (Figure 1). The main study areas (which include Thulokhobang, Pilicho, Pipar, Korja and Khumai) cover approximately 43 km2. They fall within the ACA declared by the Ministry of Forest and Soil Conservation under the legislative Act of National Parks and Wildlife Conservation and its Regulations. This Conservation Area has been described as the most geographically and culturally diverse conservation area in the world (UNEP 1995).

Administratively these areas lie in Machhapuchhre VDC of Kaski district. Above Keruwa village the area looked relatively free of human presence but for some huts of nomadic grazers who move up with their flocks in summers. The villages adjacent to Pipar are inhabited by multiethnic communities comprising mainly Gurung, Magar, Chettri, Brahmin and the occupational cast of Kami and Damai. Besides the village of Misra which is dominated by Gurung ethnic groups, the villages of Rumja, Keruwa, Kapuche and Sadal are mostly dominated by Magar ethnic groups with small numbers of Tamang and occupational castes. Magar have migrated from the neighbouring districts like Myagdi and Parbat.

Apart from biological studies in Pipar, World Pheasant Association has supported the schools in the villages. WPA's current support for the schools in villages below Pipar is thought to have contributed to the relative lack of disturbance to the forests of Pipar (and possibly also of Santel).

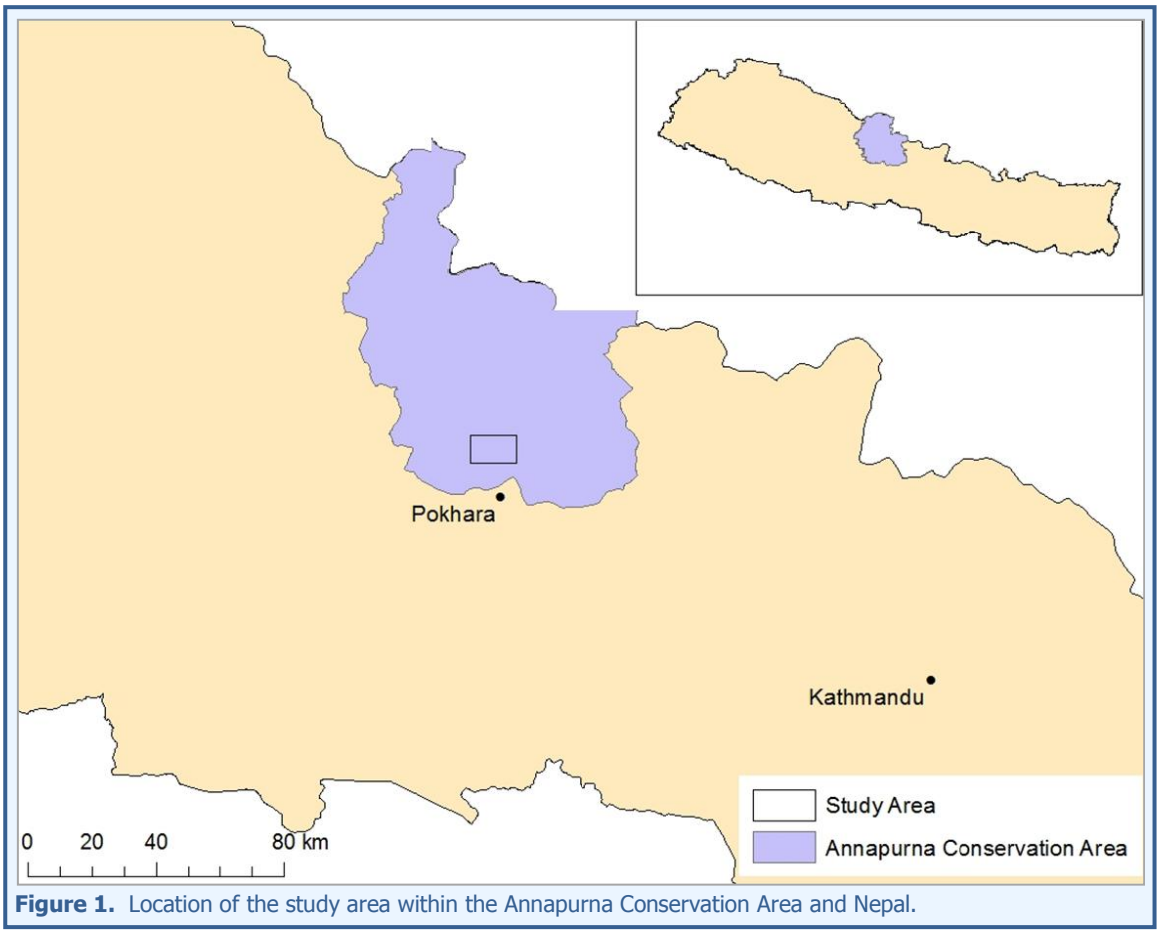


Figure 1. Location of the study area within the Annapurna Conservation Area and Nepal.

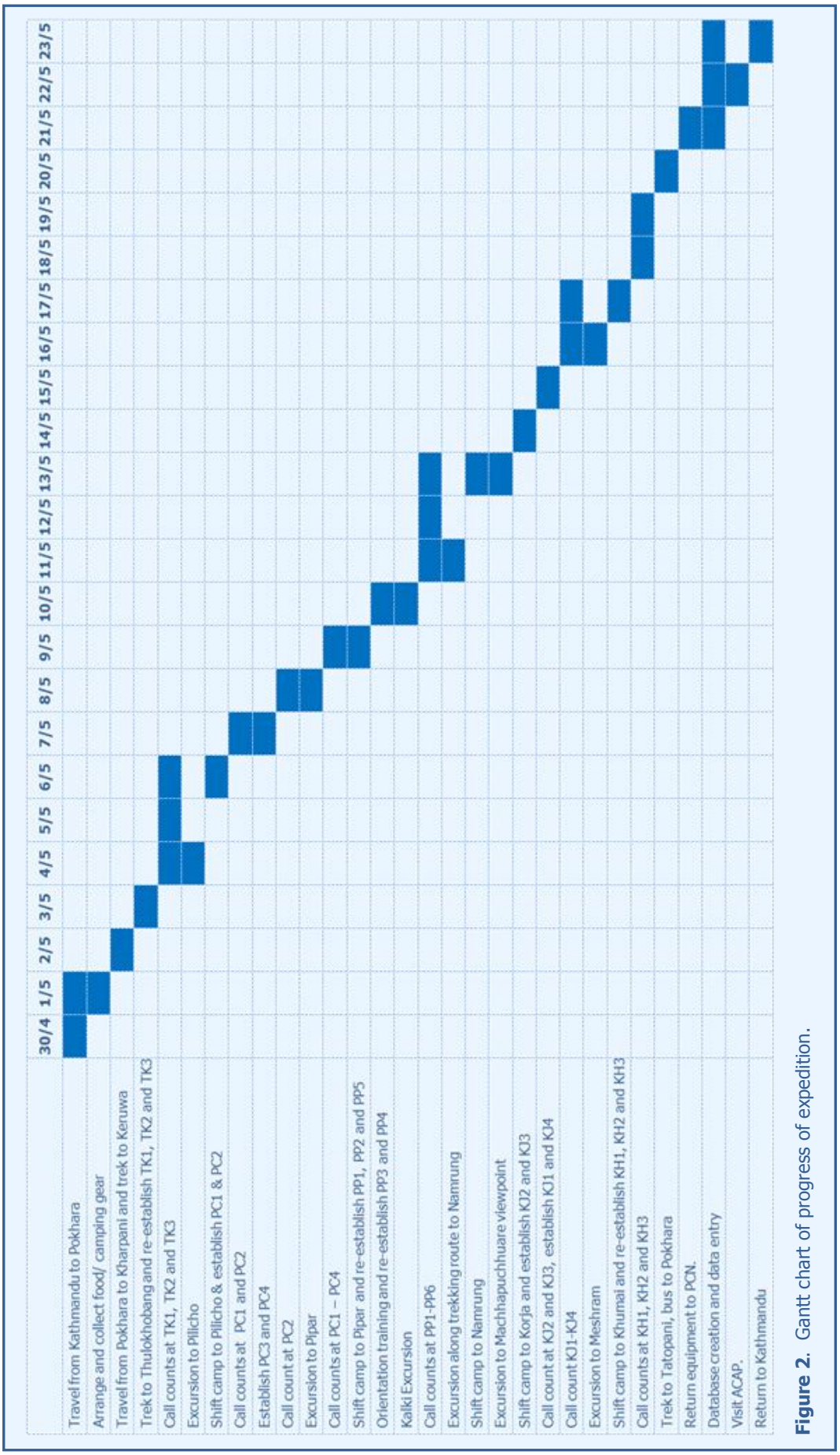


Figure 2. Gantt chart of progress of expedition.

Study Period

The 2011 expedition commenced on 29th April with meetings in Kathmandu between LP, SS, SP and WO (**Figure 2**). On 30th April and 1st May, the team (including JT, LC and SK) moved to Pokhara, where provisions were purchased and porters and guides hired.

On 2nd May the whole expedition travelled to Kharpani by bus and then walked to Keruwa for the first over-night stop. The expedition proper began on 3rd May with the ascent to Camp 1 at Thulokhobang. Five other campsites were established before the expedition returned to Kharpani and Pokhara on 20th May.

Four days were spent in Pokhara, creating a suitable database and entering field data. The expedition report was outlined during this period, with responsibility for different sections allocated to different authors. The team returned to Kathmandu on 24th May (although JT had already returned on 13th May for personal reasons). In Kathmandu, the team further developed database and mapping issues. We also visited renowned ornithologist, Dr. Hem Sagar Baral, for his comments and advice on our current survey.

Topography & Altitude

The topography of Pipar varies greatly; within an area of less than 35km^2, the altitude ranges from approximately 1200m to over 7000m. This results in steep relief and sudden changes in climate which, in turn, causes a high biodiversity. This year monitoring was concentrated within an altitudinal range from 2200m at Thulokhobang to 3600m in Korja, which are supposed to be the preferred and potential sites for most Himalayan galliformes. Most of the surveyed area was covered with forest, patchy grassland and shrubs but few of them were also covered with cliffs and rocks.

Vegetation

There are a wide variety of vegetation types within the Pipar area, including alpine grassland at the upper reaches, through scrub and birch forest, to rhododendron forest and mixed forest at lower altitudes (WPA, 2004). Information on the vegetation of the Pipar area is well described by Lelliott (1981), Picozzi (1984), and Poudyal (2005). Table 2 shows the altitudinal zonation of vegetation of Pipar.

Table 2. Different notable species recorded at different altitude level in different type of forest

Altitude (m)	*Vegetation type*	*Notable species*
Above 4000	Alpine glassland	*Nardostachys grandiflora, Neopicrorhiza scrophulariiflora, Rhododendron anthopogon, Salmi grass*
3300–4000	Birch forest	*Betula utilis, Rhododendron campanulatum, R. barbatum, Berberis asiatica and Viburnum grandiflorum*
3000–3300	Scrub	*Berberis, Viburnum and Rhododendron bushes*
2500–3300	Rhododendron Forest	*Rhdodendron arboreum, R. barbatum, R. campanulatum, Quercus semicarpifolia Betula alnoides, Acer campbelli, A. pectinatum, Sorbus cospidata, Magnolia Campbellii, Prunus cornuta, Pieris formusa, Vibernum erubescens, V. grandiflorum, V. cordifolium,*
	Mixed Forest	*Rhododendron arboreum, Alnus nepalensis, Michelia kisopa and Quercus lamellosa, Prunus cerasoides, Lithocarpus elegans, Castanopsis tribuloides,*

Weather

Out of 18 days in the field, six days were very clear (Table 3). There was very clear weather when we worked at Thulokhobang. It became rainy and misty as we ascended to higher altitudes. It was a great opportunity to experience the heavy spring thunderstorms over the mountain ridges almost

Table 3. Weather conditions during the fieldwork period

Date	*Weather condition*
3 May	Keruwa -Thulokhobang. The weather was clear.
4 May	Thulokhobang. The weather was clear for full day.
5 May	Thulokhobang. The weather was clear.
6 May	Thulokhobang -Pilicho. Rain started at 1200 hrs. Heavy rain until 1700 hrs. In the evening the weather was clear with clear sky.
7 May	Pilicho. The weather was clear in the morning and cloudy and a small amount of rain fell in the afternoon. It was very clear in the late afternoon and in the evening.
8 May	Pilicho. There was very heavy rain and hailstones at the time when we had to go to the listening stations at dawn. Call counts were hampered for that day, although LC and WO were able to count the birds at PC2 as it was closer to our camp and the rain was stopped at 0445 hrs. It was raining as we descended to Pilicho from Pipar in the late afternoon.
9 May	Pilicho-Pipar. There was a light rain in the afternoon. We visited and observed listening stations PP1, PP2 and PP5. We could not go to PP3, PP4 and PP6 due to bad weather as they were further from our camp.
10 May	Pipar. The weather was clear in the morning and evening with a cloudy afternoon.
11 May	Pipar. There was heavy rain and hail after 1400 hrs. All members suffered during bad weather.
12 May	Pipar. Rain started as we worked on the vegetation transect. During the evening the weather was clear.
13 May	Pipar-Namrung. After 1300 hrs it rained. The rain stopped for some time and then again it continued until the evening.
14 May	Namrung-Korja. The weather was very clear in the morning but was followed by heavy rain and hail in the afternoon. The bad weather hindered the setting up of the camp at Korja. All members stayed in the dining tent for two hours. WO and LC were feeling very cold.
15 May	Korja. The weather was clear.
16 May	Korja. In the morning the weather was clear. It was thick mist between 1200 and 1300 hrs. Heavy rain then followed at 1330 hrs and again at 1515 hrs.
17 May	Korja- Khumai. Weather was clear.
18 May	Khumai. Very windy and heavy rain in the afternoon. This was the worst weather during the field trip. WO and LC's sleeping bags and mattresses were completely soaked due to gradual seepage of water inside their tent.
19 May	Khumai. The early morning was cloudy, followed by sun from 1100-1200 hrs and then light rain at 1400 hrs.
20 May	Khumai-Pokhara. The third day call count was hampered due to the rain at dawn. The weather was clear in the day.

daily. During the afternoon or in the evening, there was either rain or hail storms. Most of the afternoons were very misty. The bad weather hindered the dawn call counts for 2 mornings, first at Pilicho on 8th May and second at Khumai on 20th May. There was heavy rain at dawn during those mornings and observers were not able to visit the listening stations.

Site Descriptions

Intensive studies were conducted in five sites at Pipar forests in Annapurna Conservation Area (Figure 3). They were (1) Thulokhobang, (2) Pilicho, (3) Pipar, (4) Korja and (5) Khumai. These areas lie in the Lwang field base of ACA. The first three lie east from Bhalaudi Khola and the last two lie in the west.

Site 1 Thulokhobang (TK)

The Thulokhobang forests lie between 2200–2500m in altitude. This area is located at 28°23'40"N latitude and 83°57'55" E longitude. The area comprises mixed broadleaved forest and marks the lower range of rhododendron forest. The main species found in the mixed broad leaved forests are *Rhododendron arboreum*, *Prunus cerasoides*, *Lithocarpus elegans*, *Castanopsis tribuloides*, *Alnus nepalensis*, *Quercus* and *Macaranga* species.

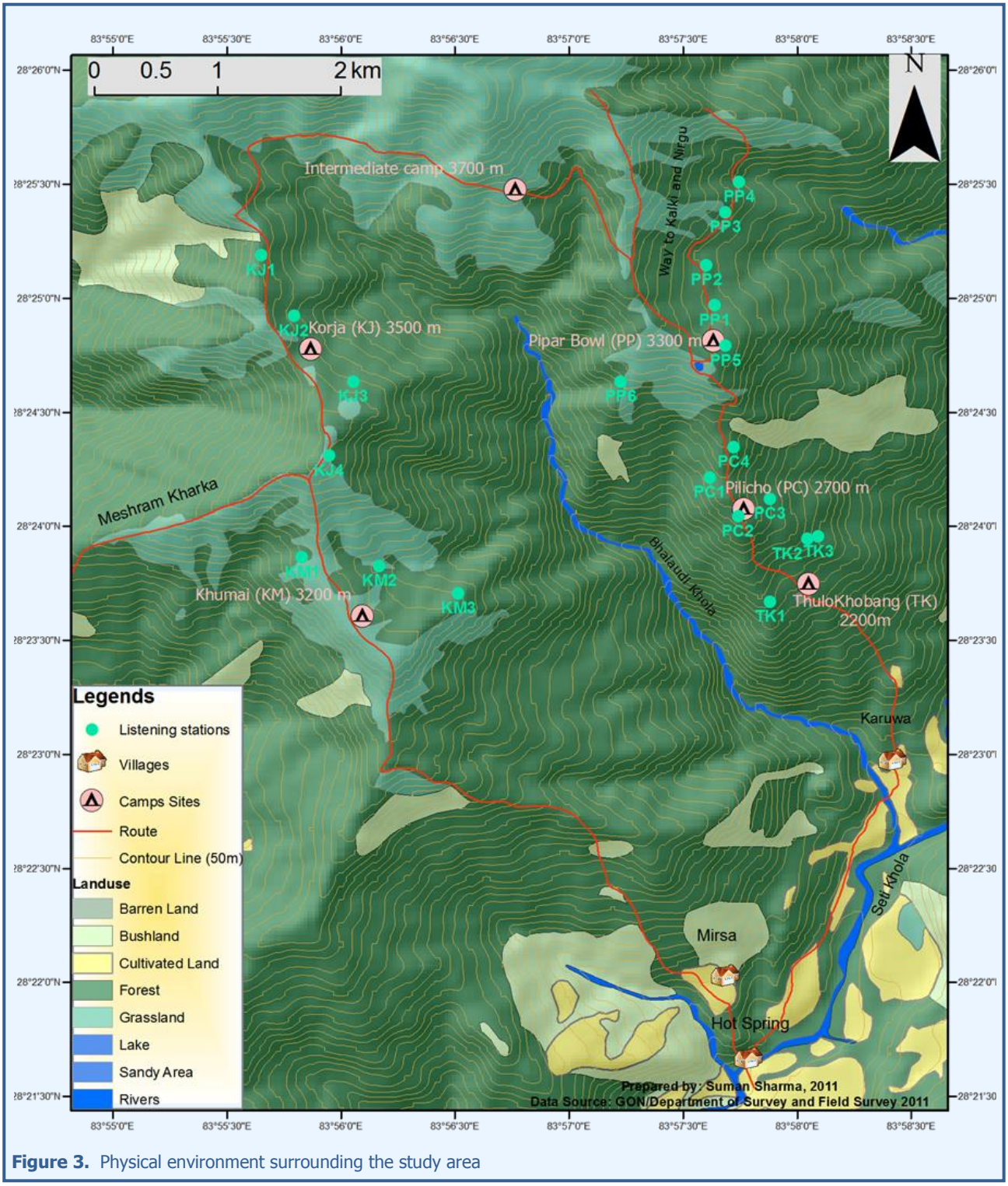


Figure 3. Physical environment surrounding the study area

Site 2 Pilicho (PC)

The Pilicho camp area lies in the 2700–2900m altitudinal range at approximately 28°24'00"N and 83°57'35" E . The walking distance is two hours either ascent from Thulokhobang or descent from Pipar. There is a campsite with a shelter house at an altitude of 2760m that was constructed by TAAN/ ACAP in 2010 with the purpose of promoting tourism along the Machhapuchhre model trek. The area is covered mainly with *Rhododendron arboreum* forests and *Arundinaria* species with Malinge Nigalo in the shrub layer. Other notable plant species are *Magnolia campbellii*,

Prunus cornuta, Pieris formusa, Vibernum erubescens, Berberis spp., *Rubus hypeargyrus, Arisaema griffithii* and *Arisaema nepenthoides*.

Site 3 Pipar Bowl (PP)

The Pipar bowl is a large eastward-facing concave basin on the western slopes of the upper Seti Khola valley. It is located at a latitude of 28°24'45"N and a longitude of 83°57'35"E. Studies were also carried out on the western slopes known as Pipar Kharka. Pipar Bowl is mainly covered with forests of three coexisting species of rhododendrons; *Rhododendron arboreum, R. barbatum* and *R. campanulatum*. Other notable trees and larger shrubs are *Viburnum grandiflorum, V. cordifolium, Betula alnoides, B. utilis, Acer campbelli, A. pectinatum, Sorbus cospidata, Cotoneaster frigidus* and *Lyonia ovalifolia*. The shrub layer mainly comprises *Arundinaria* species which form large stands. Other notable shrubs comprise *Piptanthus nepalensis, Rubus* and *Berberis* species. The uphill ridges are characterized by scrub and tussock grasslands.

Site 4 Korja (KJ)

Korja is a ridge approximately 3700m in altitude to the west of Bhalaudi khola, a tributary of Seti Khola. The shepherds use Korja top for summer camping. It is located at latitude 28°24'25"N and longitude 83°55'50"E. The eastern face of the hill is *Rhododendron-Betula* forests and a goth/pasture area at an altitude of 3600m. The southern face is a very steep slope having patches of forests interspersed with grasslands. We established four listening stations and carried out call counts on the eastern face between 3600 and 3700m in altitude. The area consists mainly of *Rhododendron barbatum* forests in association with *Betula utilis*. Other notable plant species are *Sorbus cospidata, Berberis, Rosa, Arundinaria* and salami grasses.

Site 5 Khumai (KM)

Khumai is an area at 3260m altitude, 3.5 km north-west of Mirsa village in the upper Seti Khola valley. It is located at 28°23'30"N and 83°56'05"E. We carried out studies on the ridge top and low gradient forest on the eastern side of the ridge. This area contains some Kharkas (goth areas) and forests like Pipar area. The notable vegetation was *Rhododendron arboreum, R. barbatum, R. campanulatum, Prunus rufa, Betula alnoides, B. utilis, Ribes takare, Rosa* and *Clematis* species. Khumai forest seemed unhealthy in comparison than that of Pipar forest, as we found that 10% - 15% of the trees had died.

Trekking Route

The circular trekking route covered approximately 21.5 kms horizontally from Kharpani, via the six campsites and back. This route involved ascent and descent of approximately 2950m (Figure 4). In addition, six daily excursions were made after the morning fieldwork from most campsites, which considerably increased the distance and altitude covered. In total, these added another 3270m of ascent and descent, giving 6620m in total. Furthermore, the walk to and from the listening stations could be up to 1.4km (PP4) with, in one case, a climb of 186m (TK3). Based on three trips to each listening station, fieldwork trips could add nearly 4000m of ascent and descent. Given that these calculations have been made at a relatively course resolution, the minor ups and downs of Himalayan trails would probably increase these values by another 10% or 20%. There is no doubt that the full expedition, plus excursions and fieldwork, required an ascent and descent of at least 12,000m and covered a horizontal distance of at least 50km.

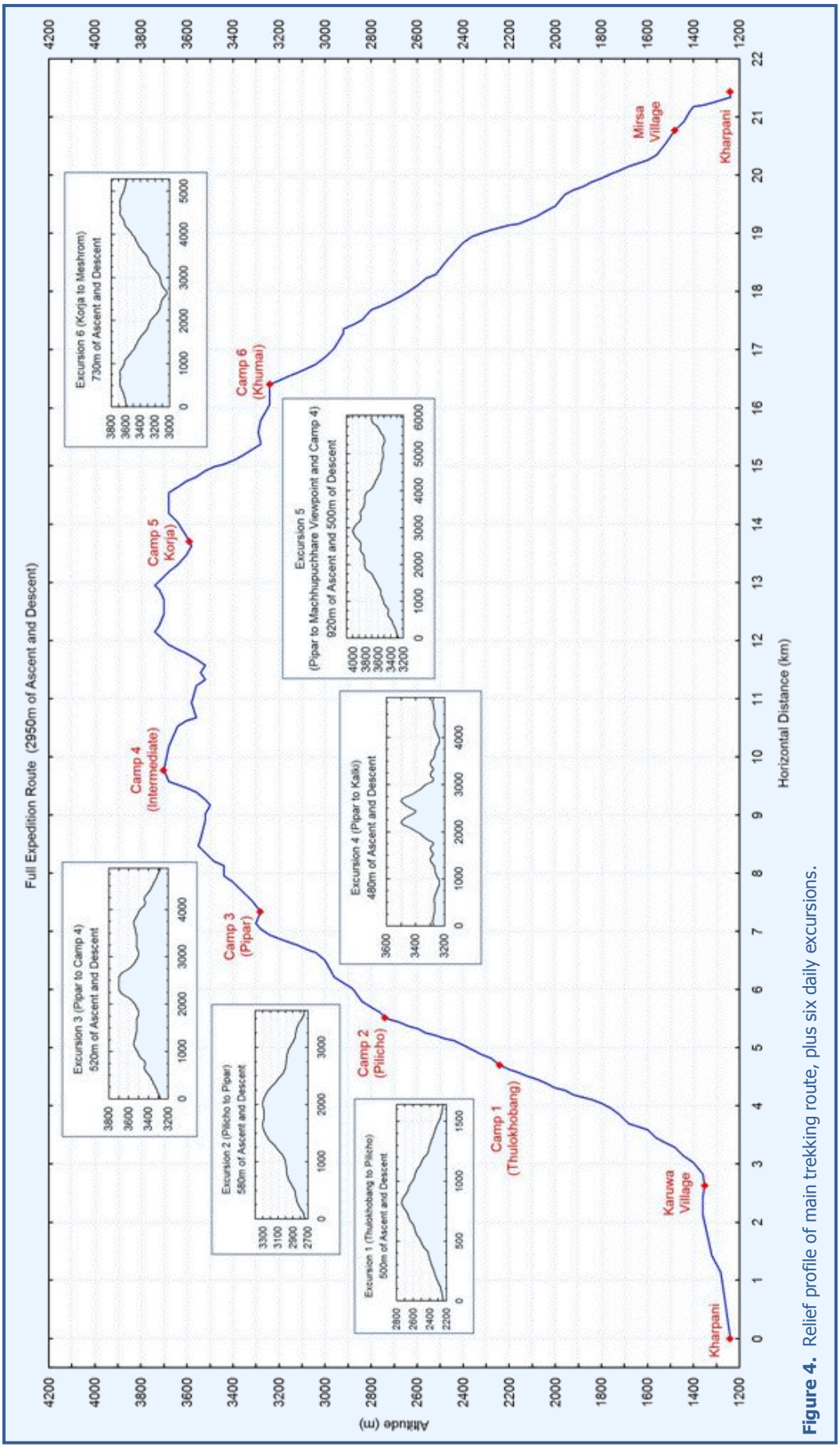


Figure 4. Relief profile of main trekking route, plus six daily excursions.

Methods

New Site Selection

In the past monitoring was concentrated in Pipar bowl (Lelliott and Yonzon, 1980, Howman and Garson, 1993) which was then used to represent the whole area of Pipar Sanctuary. Later, in 1998 (Kaul and Sakya, 2001, Poudyal *et al*, 2009), another site at Thulokhobang was added to act as the lower altitudinal limit of galliforme habitat. Subsequently, it was considered that the large altitudinal gap of around 1100m between these two sites (Thulokhobang at 2200m and Pipar bowl at 3300m) could have resulted in missing data. It was also recognised during the 5th Galliformes Symposium in Thailand in 2010 that these two sites were not able to represent the full range of galliforme habitat in Pipar Sanctuary. Accordingly, a plan was prepared for monitoring during 2011 to add more sites so that they provided a better sampling intensity and could be used for future monitoring of galliformes in Pipar. The new site at Pilicho was at an intermediate altitude (2700-2800m) and the campsite was based around the newly constructed supporter's shelter (Figure 5). A second new site on the Korja ridge extended to altitudinal range to 3700m. The campsite at this location was fairly exposed and in dryer seasons may have problems with water supply.

A systematic or random sampling technique was not feasible in terrain like Pipar, where it was impossible to reach all parts of the forest due to the steepness of slope, limited trails and dense forest. In addition, limited manpower, time and budget all restricted the amount of survey that could be accomplished. Instead we designed the sampling technique based on certain variables to improve the representativeness of each site. These variables included altitude, accessibility, vegetation composition, aspect, ridgeline, distance between sites, *etc*. Furthermore, new site selection also depended on the expert opinions and local knowledge of village guides who were much more familiar with the galliforme habitat and had accompanied different researchers in past monitoring visits. It was never easy to find an ideal site while working in rough terrain with slope up to 65 degrees. Accessibility was a major consideration, as we were establishing the sites for monitoring purposes, rather than single survey, so that easy relocation and revisit would be possible. At no time did we jeopardise safely in order to collect data.

Location of New Listening Stations

For Thulokhobang, Pipar bowl and Khumai, which were previously monitored sites, only established listening stations were used. In this survey, it was decided that stations at these sites adequately covered the galliforme habitat within the site, so focus was given to establishing new sites rather than adding more listening stations to the previously established sites. Furthermore, as listening stations are permanent units, providing "repeated-measures" data, little additional power is added to the historical data by increasing the number of listening stations on existing sites. Four new listening stations at Pilicho and four at Korja were established, so the existing 12 stations (six in Pipar, three in Thulokhobang and three in Khumai) were augmented with eight new stations to give 20 in total.

Galliforme Call Counts

Field Methods

Dawn call counts were conducted using methods developed by Gaston (1980). These have been used in many studies on Himalayan pheasant species (*e.g.* Gaston and Singh 1980, Yonzon 1987,

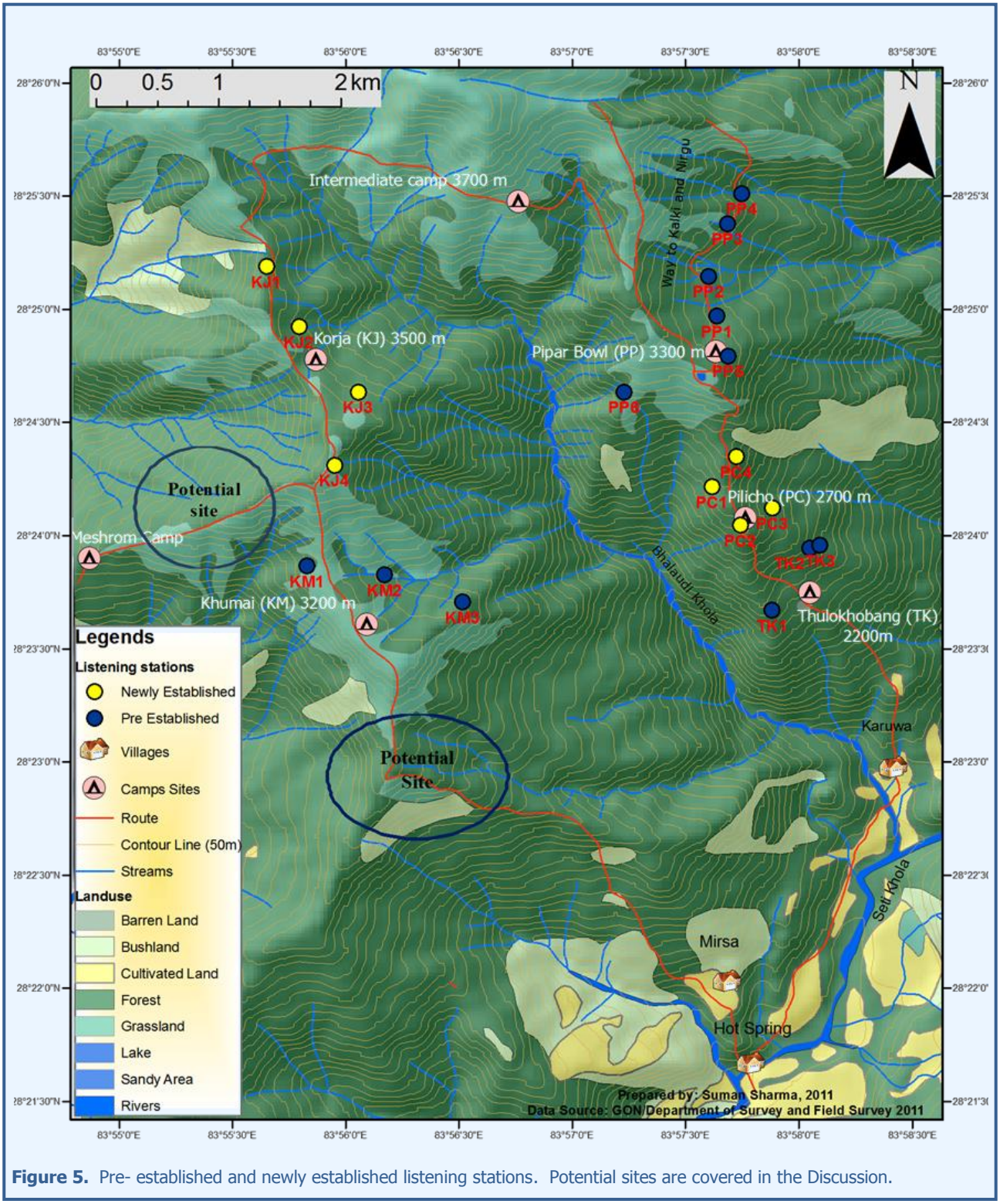


Figure 5. Pre- established and newly established listening stations. Potential sites are covered in the Discussion.

Garson 1983, Picozzi 1984, Duke 1990, Howman and Garson 1993, Khaling *et al*. 1998, Baral et al 2001, Mahato *et al* 2006). The assumption is that every male produces characteristic loud calls at dawn during their breeding season, as a display mechanism to defend their territory or to attract females for mating (Ramesh 2003). Calls of the Galliforme species present in the study area are distinctive, so recognising individual species was straightforward.

Within sites, all stations were visited at approximately the same time by at least two observers (one investigator and one field assistant). With only a few exceptions, the listening stations were

reached at 0445 and observers stayed there for 30 minutes after the first galliforme call, or 60 minutes after arrival if no calls were heard. From each listening station, first calls from a particular bearing were recorded to the nearest five degrees, along with the time to the nearest minute. The distance to the calling point was estimated and assigned to one of five categories (<50m, 50 – 100m, 100 – 200m, 200m – 300m and >300m). Subsequent calls judged to have come from exactly the same location were not recorded. These data were plotted graphically on the recording sheet (see Appendix I). The intention was to undertake three counts at each station, on subsequent mornings, but adverse weather conditions and the time taken to establish new stations meant that this was not always possible.

Data Analysis Techniques

After the field season, these data were stored in a custom designed Microsoft Access database via a data-entry form. This application also provided a number of summarisation functions. Firstly, only calls from within 300m were included in the summary tallies. Secondly, potentially duplicate counts from adjacent stations were identified by triangulation, using the bearing and the time of the call. A time discrepancy of one minute was allowed for time recording errors. If both the estimated distances from these duplicate pairs were less than 300m, then the record from the furthest station was discarded. Finally, these data were tallied to give the number of calls per species from each station on each visit.

Four separate analyses have been carried out on different subsets of data. The first three of these included all three species, but due to the large numbers of zeros recorded for Koklass pheasant, this species was excluded from the final analysis:

- All data collected in the current survey (2011) from all five sites have been analysed together to explore the spatial variation between sites, and to a lesser extent, between stations.
- The data obtained from Pipar during this survey has been added to the historic dataset stretching back to 1979. Only Stations 1 to 4 have been included, as we have no data from Stations 5 & 6 before 2005. Furthermore, only koklass and tragopan were included as hill partridge data were not recorded before 2005. This gives a "long and thin" dataset of nine years (the single visits to two stations in 1981 were excluded) to allow the investigation of change over time from a limited spatial sample.
- A balanced dataset of all six stations in Pipar from four years (2005, 2008, 2009 & 2011) allowed an analysis of changes over a limited period of time, but from the whole of the Pipar area. This analysis was also a more robust approach because it avoided the missing data which had to be accommodated in the other analyses.
- Finally, the data from two additional sites (Thulokhobang and Khumai) that had been visited in two or three years (2005, 2008 and 2011) were analysed for corroborating changes over time.

In general, for each dataset, repeated-measures Analysis-of-Variance (ANOVA) models were built using the Station, Site (if appropriate), Year, Visit and Species as predictor variables. The response variable in each model was a power transformation applied to the raw counts, to normalise the over-dispersed data. A full explanation of these analytical techniques is given in Poulton (2011).

Bird Species Lists

Existing trails were walked daily to record encounters with galliformes and also all other bird species. The study methods involved recoding of the observed birds during the trail walks on the identified routes and in camp sites. The route was started from Keruwa 1300m followed by Thulokhobang 2200m, Pilicho 2700m, Pipar 3300m, Pipar up hills 3933m, Namrung 3660m, Korja 3600m, Korja top 3698m, Khumai 3250m and ended at Mirsa. Efforts were also made to walk through the forests wherever possible. Also encounters of birds whilst walking between campsite

and survey stations as well as during call counts were recorded. Binoculars (Nikon Action 8x40, Leica 8x20, Pentax 8x40), and Birds of Nepal (Grimmett et al 2000, Fleming et al 1984) were used to identify the species.

Miscellaneous Data Recording

Apart from the call counts and birds survey, other biological data were also collected during the trip. These included the direct observation of other Galliformes such as, Himalayan monal, blood pheasant, Himalayan snowcock *etc*. We also made direct observations of mammals and recorded their indirect evidence such as prints, scats and droppings. Directly observed mammals were verified with the help of Baral and Shah (2008). Geographic locations were also recorded on trail walks while shifting campsite, going to listening stations or whilst looking for potential listening stations. No systematic method was used to collect these data but they did provide useful supplementary information.

Similarly, *ad hoc* botanical data was collected throughout the survey. In addition, the first 100m of horizontal transect (T1) laid by Picozzi (1984) and later followed by Poudyal (2005) was relocated. Geographic locations were recorded by hand held GPS. The flowering vegetation was identified with the help of Polunin and Stainton (1984), and Stainton (1988). Apart from this, human disturbance and evidence such as poaching and illegal hunting activity, collection of bamboo shoots, collection of Yarsha Gumba caterpillar, cattle and sheep grazing was recorded.

Results

Galliforme Call counts

Analysis of 2011 Data

Call counts from the three main Galliforme species recorded in 2011 are summarised in Table 4. This table also shows the pattern of missing data. Overall, the intention was to make three visits to the 20 stations, giving 60 visits in total. However, ten of these were not made, either due to adverse weather conditions or new stations not being established on the first day. In most cases this simply resulted in two rather than three visits to a station, but in Pilicho Stations 3 & 4, only one visit was made. Consequently, two field assistants returned to these stations on 23 May to obtain additional call count records.

Table 4. Call count data for three species from all five sites covered in the 2011 survey. Dashes represent visits that were not undertaken due to adverse weather or new stations not having been established. Figures given in parentheses were recorded during a subsequent visit on 23 May to provide at least two counts from the stations where these were not obtained during the main survey period.

Site/(Date)	*Station:*	*Satyr Tragopan*			*Koklass Pheasant*			*Hill Partridge*		
	Day:	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Thulokhobang	1	1	0	0	0	0	0	2	3	2
(4–6 May)	2	0	0	0	0	0	0	0	0	1
	3	0	1	1	0	0	0	0	1	1
Pilicho	1	4	–	2	0	–	0	2	–	2
(7– 9 May	2	1	2	2	0	0	0	1	1	1
& 23 May)	3	–	–	9 (0)	–	–	0 (0)	–	–	4 (3)
	4	–	–	3 (1)	–	–	0 (0)	–	–	3 (2)
Pipar	1	2	6	3	0	0	0	1	3	0
(11–13 May)	2	2	3	3	0	0	0	1	2	2
	3	5	4	3	0	0	0	1	0	0
	4	5	5	7	0	0	0	1	3	0
	5	4	2	3	0	0	0	0	0	1
	6	4	3	3	0	0	0	1	1	0
Korja	1	–	2	2	–	1	0	–	0	1
(15–17 May)	2	1	1	4	0	0	1	0	0	3
	3	1	4	0	1	2	1	0	0	0
	4	–	0	1	–	0	0	–	0	0
Khumai	1	2	2	–	0	0	–	0	1	–
(18–20 May)	2	1	0	–	1	1	–	0	0	–
	3	3	1	–	0	0	–	1	0	–

These missing data created an unbalanced ANOVA model, which prevented the analysis of certain factors of interest. In particular, Khumai had no third visits, which meant that it was not possible to test for the difference in visits between sites. To overcome this problem, a preliminary analysis utilising just the first and second visit data allowed a full-rank model to be constructed. This analysis showed no difference between the visits, so the effect was ignored and all visits included in subsequent analyses.

The full analysis showed, firstly, that there was a very highly significant difference between the overall call counts recorded from the three different species ($p \approx 0$). Using back-transformed means from the ANOVA model, there was a very significantly higher call rate from tragopans (1.3 calls/visit) than hill partridges (0.7) and both were significantly higher than koklass pheasants (0.1) (Figure 6). There was also a highly significant difference in overall call rates between the five sites ($p \approx 0.002$). There were significantly fewer calls per visit from Thulokhobang(0.3) than Pilicho (1.0) or Pipar (0.9), although Korja and Khumai showed no differences from the other three sites.

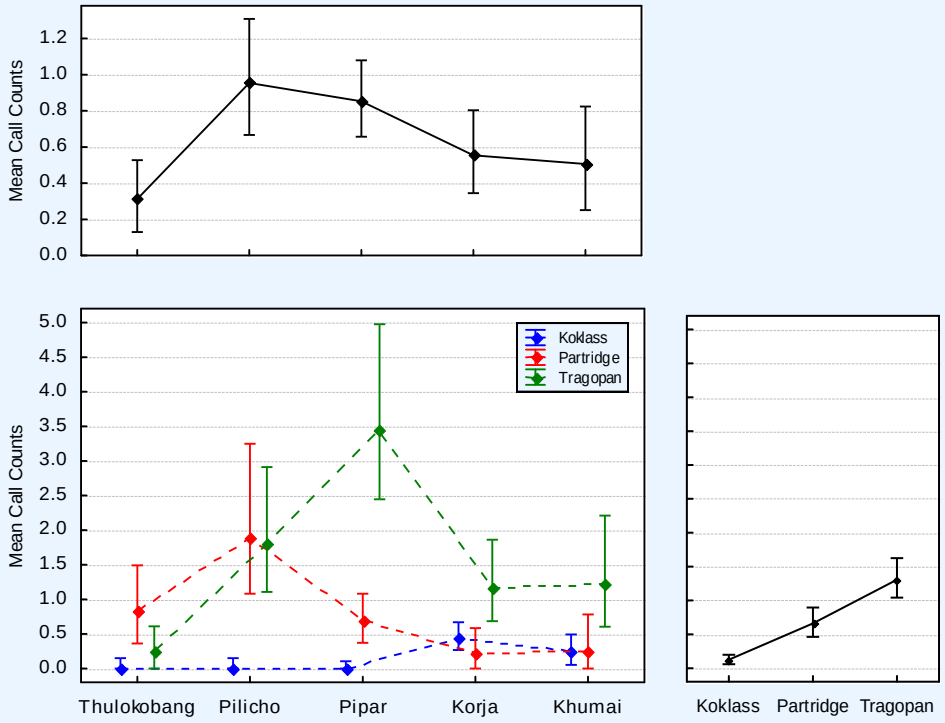


Figure 6. Mean call counts for three galliforme species from all sites surveyed in 2011. All graphs show back-transformed means and 95% confidence intervals. The main graph shows the interaction between Species and Site, while the upper and right-hand graphs show the main effects for these two factors.

Finally the interaction between site and species was very highly significant ($p \approx 0$). This interaction is quite complex and can be interpreted as either the difference between species on the sites, or the difference between the sites for each species. Taking the first approach, it is clear that each of the five sites had significant differences between the species and that the patterns were different in each site. The most extreme of these was Pipar, where koklass were significantly less frequent than partridge which, in turn, was less frequent than tragopan. The site with the least apparent differences was Korja, where tragopan were not significantly different from koklass, but were marginally more frequent callers than partridge. Taking each species in turn, the most obvious effect was the very low call rate for koklass, which was totally absent from three sites. However, note that the ANOVA model still generated error bars for these zero counts, which indicated that the low call rate in Khumai was probably not significantly different from these three sites, while the higher mean call rate at Korja probably was a true effect. Hill partridge had higher call rates in Pilicho than Korja or Khumai, although not the other two sites. Finally, tragopan had higher call rates in Pipar than all other sites except Pilicho, and Thulokhobang had lower call rates than all other sites except Khumai.

Analysis of Long-term Pipar Data

This dataset comprised nine years with between two and four visits per year, giving a total of 30 visits. It only included Stations 1 to 4 as Stations 5 & 6 were only established in 2005, and two species because hill partridge was also only recorded from 2005 onwards. This gave a total of 240 cases in the balanced design, although a number of cases were missing from the dataset. In particular, Station 3 was not visited at all in 1998 (Kaul & Shakya; 2001), which left a potential problem with analysing the Year x Visit interaction. To overcome this problem, an iterative method

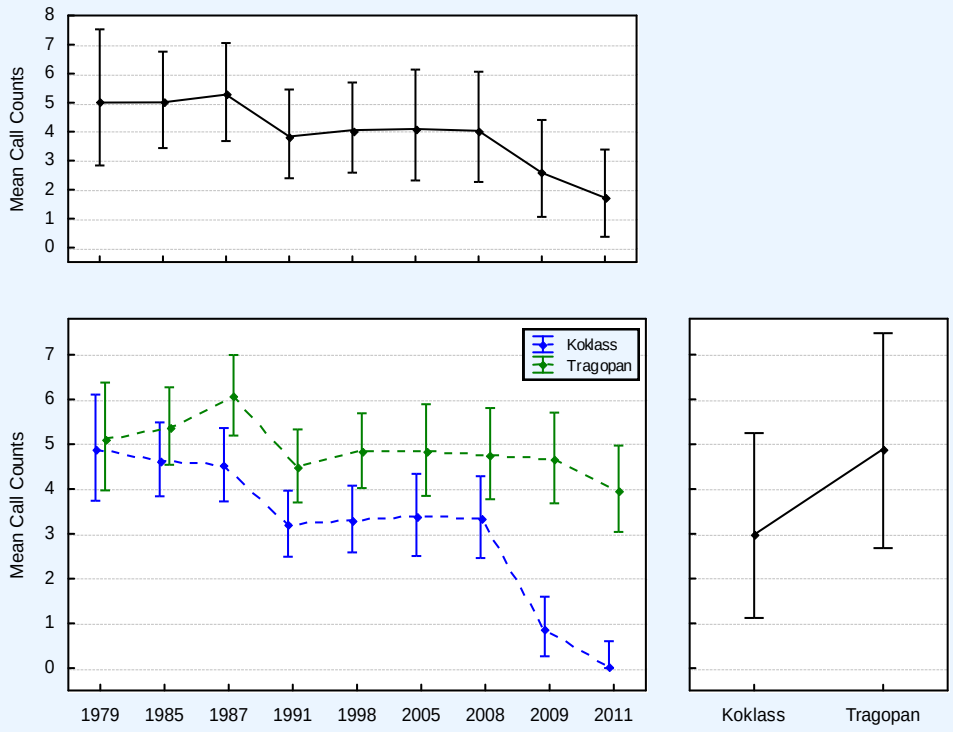


Figure 7. Mean call counts for two galliforme species from Stations 1 – 4 in Pipar from 1979 to 2011. All graphs show back-transformed means and 95% confidence intervals. The main graph shows the interaction between Species and Year, while the upper and right-hand graphs show the main effects for these two factors.

was used to generate dummy values for the missing values to create a fully balanced ANOVA design.

Overall this was a highly significant model, accounting for 50% of the variation in call counts. However, none of the main factors of interest (Year or Species) were significant (Figure 7). Although there appeared to be a decline in overall call counts across the nine individual years, from a mean of over 5 per visit to around 2 per visit, this was not significant ($p \approx 0.132$), due to the very large confidence intervals. Similarly, the large confidence intervals for each species mitigated against a significant difference between them ($p \approx 0.184$).

However, the interaction between these two factors was very highly significant ($p < 0.001$). There was no evidence of a decline in tragopan, despite the apparent dip in 1991. In contrast, there was a significant difference across years for koklass, with an apparent decline in 1991, followed by a period of stability until 2008. Then in 2009 there was a sudden decline, followed in 2011 by a complete absence of calls from this species in Pipar. The other way to interpret this interaction is to note that there were no significant differences between the species in all the years up to and including 2008, but in 2009 and 2011, the discrepancy between them became highly significant. A further, more detailed explanation of these results is given in Poulton (2011).

Analysis of Three Species in Pipar over Four Years

The third dataset comprised 3 Species x 6 Stations x 4 Years x 3 Visits resulting in 216 cases. Because this model was a fully balanced design, all terms could be investigated, with no recourse to interpolated values. In this model, Species, Year and Visit were treated as repeated-measures, leaving just the six listening stations as the true sample size.

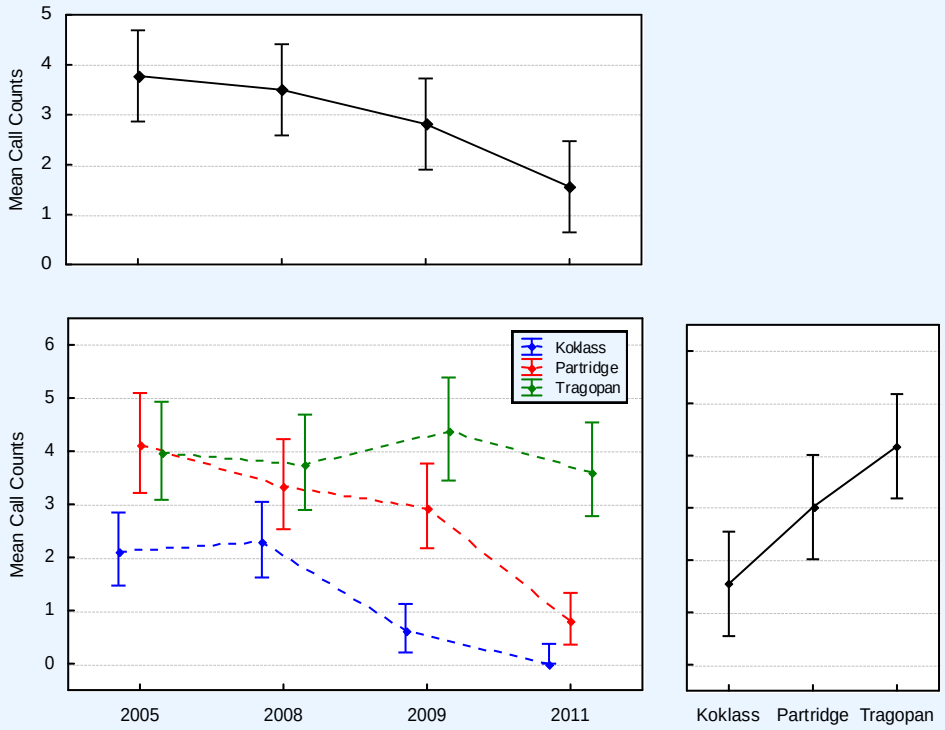


Figure 8. Mean call counts for three galliforme species from all sites in Pipar surveyed between 2005 and 2011. All graphs show back-transformed means and 95% confidence intervals. The main graph shows the interaction between Species and Year, while the upper and right-hand graphs show the main effects for these two factors.

Neither the Visit effect nor any of the interactions of Visit with the other factors was significant – a result which corroborates, more powerfully, the findings from the previous two analyses. The two remaining factors (Year and Species) were both significant ($p \approx 0.003$ and 0.002 respectively). Furthermore, the interaction of Species x Year was highly significant ($p \approx 0.0002$; Figure 8), and shows yet another pattern of variation between species over time. Firstly, there is no change over time for tragopan with all mean call counts around 4 per visit. In contrast, hill partridge showed a significantly lower call rate in 2011 than the other three years. And finally, koklass showed a significantly lower call rate in both 2009 and 2011 compared to 2005 and 2008.

Analysis of Changes in Khumai and Thulokhobang

Although the original aim was to include these two sites in a single analysis, the model was so unbalanced that it was difficult to test all the effects of interest. Consequently, separate analyses were carried out, with Species, Year and Visit as repeated-measures, leaving only three Stations in each analysis as the true sample size. As with the previous three analyses, the response variables were the box-Cox transformed call counts.

None of the factors in Khumai were significant, although there did appear to be a difference between Species. However, when tested against the Station effect with only 2 degrees-of-freedom, it proved not to be so ($p \approx 0.11$).

The model derived from Thulokhobang data, based on three years and only two species, did show some significant effects though (Figure 9). Firstly, there was a marginally significant difference between call rates from the two species ($p \approx 0.015$). Mean rates for hill partridge were 1.95, whilst for tragopan they were only 0.38. However, there was a significant difference between years

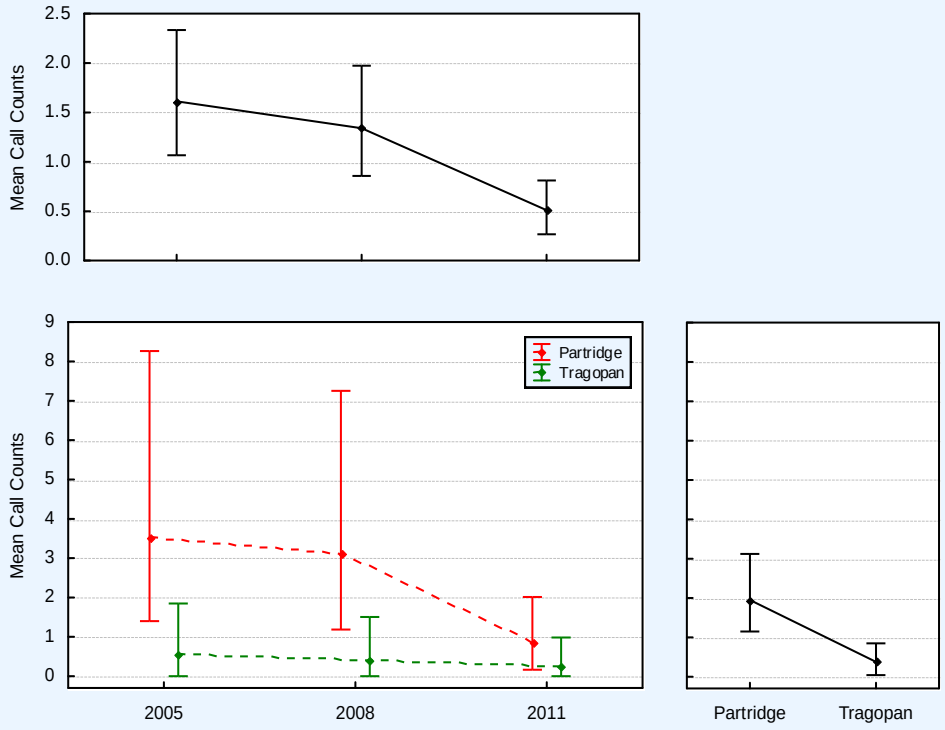


Figure 9. Mean call counts for two galliforme species from Thulokobang surveyed between 2005 and 2011. All graphs show back-transformed means and 95% confidence intervals. The main graph shows the interaction between Species and Year, while the upper and right-hand graphs show the main effects for these two factors.

($p \approx 0.005$), with overall call rates in 2011 being lower than the other two years. Finally, the interaction of these two factors was not significant ($p \approx 0.269$), with tragopan showing consistently low call rates, whilst the significantly higher rates for partridge in 2005 and 2008 were accompanied with extremely large confidence intervals. (Note however, that in the analyses presented in the technical report (Poulton, 2011), which used a different error term, this interaction was highly significant.)

Additional Galliforme Records

Himalayan Monal

Altogether 21 Himalayan monals (10 males and 11 females) were seen during the field trip. Three Himalayan monals (1m and 2f) were flushed at Pipar Kharka on 9th May when we were walking towards Pipar during the camp shifting move to Pipar from Pilicho. In the same place two females were seen on 11th May. Two males and two females were seen at Thulobukeni Karka (3660m) when we were there on the afternoon of 11th May. Four males and three females were seen in Machhapuchhre view point (3935m) which was approximately three hours walk on the Pipar uphill side. The area was a ridge adjoining forest in the north-east and open with cliffs to the south-west. Three Himalayan monals (2m, 1f) were flushed at Korja Kharka during the trail walk to Meshram from Korja on 16th May. The area

Table 5. Calls of Himalayan Monal recorded from listening stations.

Date	*Site*	*Station code*	*Calls*
9th May	Pilicho	PC4	5
11th May	Pipar	PP3	2
12th May	Pipar	PP3	1
16th May	Korja	KJ1	2
17th May	Korja	KJ4	1
17th May	Korja	KJ1	1
18th May	Khumai	KM2	1
19th May	Khumai	KM1	3

was open with cliffs. Two Himalayan monals (1f, 1m) were seen at Khumai at 3250m on 19th May. A total of 16 Himalayan monals were heard from different listening stations during the dawn call count (Table 5).

Blood Pheasant

A group of blood pheasants were seen at Pipar uphill side (3556m) when we were going to Thulobukeni Karka on 11th May. The birds crossed the trail towards west from east and, although our field assistants weren't able to count the birds precisely, they estimated four or five birds. In the same place, a group of three birds were seen on 13th May during the camp shift to Thulobukeni Karka from Pipar.

A group of five blood pheasants were seen in the Rhododendron forest closed to Thulobukeni Karka camp. A bird was seen at Pan Khola (3618m) when we were shifting camp to Korja. A group of four birds was seen closed to Korja top in the rhododendron forest patch at 3650m during the trail walk to Meshram on 16th May. A group of four birds was seen when SS was going back to campsite after dawn count at listening station 2 on 15th May. A blood pheasant was seen at Khumai area on 19th May.

Tibetan Snowcock

Tibetan snowcocks were encountered twice. The first sighting was at Namrung at 3660m on 11th May and next sighting was a bit higher, towards Machhapuchhre view point at 3800m, when LP, SS and SP were climbing up to the top of this ridge.

Kalij Pheasant

One male Kalij Pheasant (Figure 11a) was heard near Keruwa on 3rd May.

Rufous–throated Partridge

One Rufous-throated Partridge was heard near the Thulokhobang Camp site on 5th May.

Black Francolin

Three Black Francolins were heard closed to Keruwa village while the team were moving from Tatopani to Keruwa on 2nd May.

Bird Species Lists

A total of 152 species of birds were recorded in this survey, representing 9 orders and 29 families (Figure 10 and Appendix). The Passeriformes was the best represented order with 106 species followed by galliformes and Ciconiiformes (9 species each), Cuculiformes (8 species), Piciformes (7 species), Strigiformes and Columbiformes (5

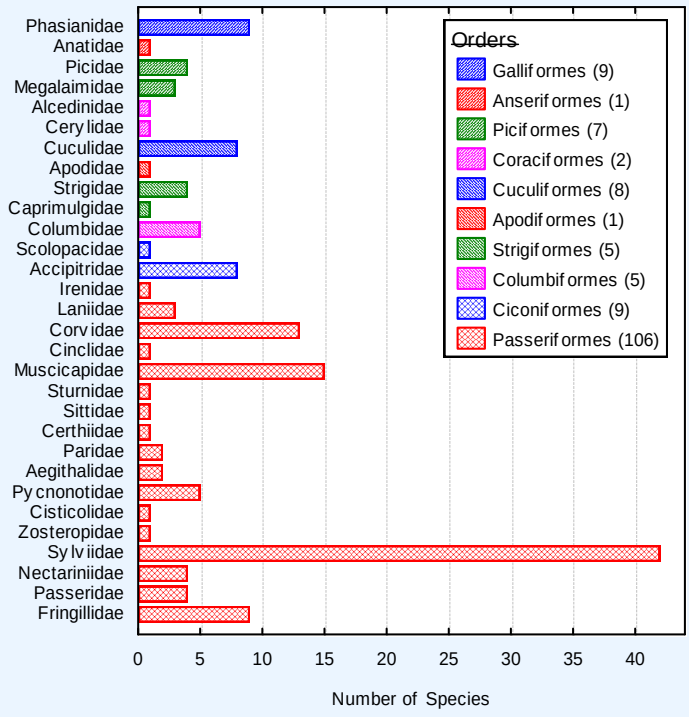


Figure 10. Orders and families of birds recorded during the study with numbers of species belonging to each.

species each), Coraciformes (2 species) and Anseriformes (1 species).

Sylviidae was the best represented of the families with 42 species followed by Muscicapidae (14 species) and Corvidae (13 species). 12 families– Anatidae, Alcedinidae, Cerylidae, Apodidae,

Figure 11. a) Kalij pheasant,.b) globally threatened Egyptian Vulture & c) fire-tailed sunbird. (All photos © J. Thakuri.)

Caprimulgidae, Scolopacidae, Irenidae, Cinclidae, Sturnidae, Sittidae, Certhiidae and Zosteropidae were represented by only one species. Of the 152 species recorded, 130 species were the resident bird and 10 species were summer visitor.

A globally threatened Egyptian Vulture *Neophron* percnopterus (Figure 11b) was also recorded. This bird is also endangered in nationally threatened status. Other nationally threatened birds recorded were Lammergeier *Gypaetus barbatus*, White–browed Piculet *Sasia ochracea*, Slender–billed Scimitar Babbler *Xiphirhynchus superciliaris*, Golden Babbler *Stachyris chrysaea*, Cutia *Cutia nipalensis*, Great Parrotbill *Conostoma oemodium*, Himalayan Griffon *Gyps himalayensis* and Satyr Tragopan.

Three restricted range species Hoary–throated Barwing *Actinodura nipalensis*, white–throated Tit *Aegithalos niveogularis* and Spiny Babbler *Turdoides nipalensis*, which is also an endemic bird of Nepal, were also recorded during this survey.

Botanical Records

We found a wide variety of vegetation types and different species when we ascended to Pipar (3300m) from Keruwa (1300m). We identified 28 species belonging to 18 genera and 9 families (Appendix 6). The family Rosaceae and Ericaceae comprised the largest number of plant species (6 species each) followed by Betulaceae and Caprifoliaceae (3 species each) and Aceraceae and Araceae (2 species each). *Berberis* and *Arundinaria* species were identified to the genus level only. There were several species of *Berberis* probably the *aristata, asiatica* and some others. According to the local field assistants accompanied with us, there were five species of *Arundinaria* which followed a largely altitudinal sequence. Tite Nigalo represented the low altitudinal range (1400–2200m) then Ghore Nigalo (1800–2400m), Malinge Nigalo (2200–2700m) and Chigar (2600–3050m). Jarbutto covered the higher altitudinal range of 2900–3800m.

As we visited and made general observations in the first 100m of the horizontal transect at Pipar Bowl; a *Salix* sp., *Viburnum grandiflorum, Rhododendron campanulatum* and *Berberis* spp. were found there.

Mammal Records

Four different categories of ad hoc mammal records were made (Table 6). Five species were actually sighted, with Himalayan tahr (*Hemitragus jemlahicus*) being seen on a number of occasions (Figure 12a). The largest group (>12) was observed on the ridge above the Pipar campsite, but closer encounters with smaller numbers were made near Thulobukeni and Korja. Himalayan pikas (*Ochotona roylei*) were also seen on a number of occasions, most notably on the Meshrom ridge, when one was observed for over 15 minutes from a distance of a few metres (Figure 12b). One fleeting glimpse of a squirrel was made near the Thulokhobang campsite at around 2,200m. As Prater (1971) reported that *Calloscuirus pygerythrus* only occurs up to 1,525m, it is more likely that this was the orange-bellied Himalayan squirrel (*Dreomys lokriah*). A brief sighting of a vole was also made just below the Khumai campsite at approximately 3,200m. It was dark brown in colour and about 100mm in length. Prater (1971) describes *Alticola roylei* which fits the description as well as the habitat and altitude. However, the distribution appears to be confined to the western Himalayas and Corbet & Hill (1992) describe this as a species restricted to the margins of the Indo-Malayan region and only include Pakistan and Afghanistan. These authors give no distributions for *Microtus* in Nepal, but they do mention two species of *Pitymys*, of which *sikkimensis* is most likely as its habitat is described down to 2700m in Nepal. Vole runs were also recorded in abundance at altitudes of between 3,800 and 4,000m near the ridge above Thulobukeni.

Table 6. Records of mammals made during the 2011 expedition. Scientific names follow Corbet & Hill (1992). A ✓ represents a single record and ✓✓ represents multiple records.

		Sighting	*Call*	*Faeces*	*Sign*
Carnivora					
Fox	*Vulpes vulpes*			✓✓	
Mustelid (small)	*Mustela sp.*			✓	
Mustelid (large)	*Martes sp.*			✓	
Leopard	*Panthera pardus*			✓✓	Prints, scrapes & hair
Himalayan black bear	*Ursus thibetanus*				prints
Artiodactyla					
Himalayan tahr	*Hemitragus jemlahicus*	✓✓		?	prints
Goral	*Nemorhaedus goral*	✓			
Barking deer	*Muntiacus muntjak*		✓✓	✓✓	
Rodentia					
Orange-bellied himalayan squirrel	*Dreomys lokriah*	✓			
Vole	Arvicolinae	✓			runs
Lagomorpha					
Himalayan pika	*Ochotona roylei*	✓✓		?	

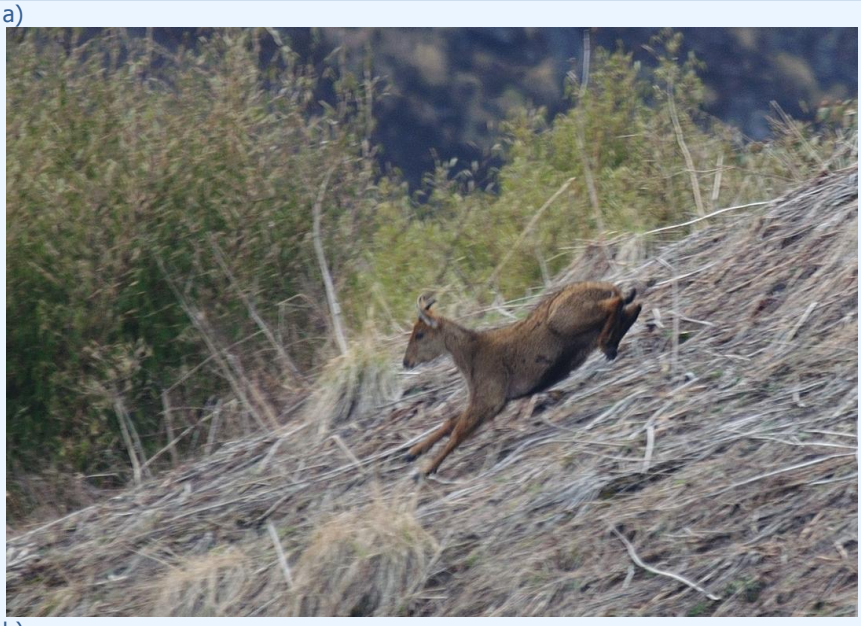
Although these may not have been made by the same species, the size of the runs was consistent with a 100mm long animal.

Calls of barking deer were heard frequently and deer droppings, most likely from this species were commonly found in the more wooded areas. In more open habitat, ruminant droppings were more likely to have been fro Himalayan tahr. Carnivore droppings were frequently encountered, mostly of small canids. Corbet & Hill (1992) report that *Vulpes bengalensis* is limited to 1,400m altitude, whereas they indicate that *V. vulpes*, although it is on the limit of its geographical range is found between 1,000m and 4,000m. Very small mustelid droppings were also recorded, most likely from a species of Mustela. Three species are known from the area, although the most likely based on altitudinal range is *altaica* (Corbet & Hill; 1992). One larger dropping was also collected near Pipar which may have been from a larger mustelid, probably *Martes flavigula*, but possibly *M. foina*.

The most notable mammal records, though, were of two large carnivores. Droppings of leopard (*Panthera pardus*) were found on a number of occasions. In particular, a very large deposit (200mm) was found near the trail below the Khumai campsite (3,100m). Although it was several weeks old, it contained many bone fragments and several small hooves, most likely from a young tahr. Leopard scrapes were recorded on the trail beyond Pipar Listening Station 4, in the direction of Nirghu. The strongest evidence for the presence of leopard was in Pipar, the morning after heavy rain, when fresh prints only hours old were found within 100m of Listening Station 1. These were >100mm across and had been made in soft sand under a boulder that the animal had used for marking. Hair was also collected from this point.

Finally, on the trail about 250m from the Khumai campsite, several prints on Himalayan black bear (*Ursus thibetanus*) were found in soft mud (Figure 12c). Like the leopard prints, these had been made only hours previously after a night of heavy rain. The fore foot measured at least 280mm in length from the metatarsal pad to the claw marks and over 130mm across the toes, with the hind foot prints even broader. Anecdotal evidence came from two bamboo cutters who reported that a bear had scavenged a buffalo carcass the night before.

a)



b)

c)

Figure 12. a) Himalayan takr near thulobukeni, b) Himalayan pika on Meshrom ridge & c) print of black bear near Khumai campsite. (Photos © a; J. Thakuri, b & c; S. Poulton)

Discussion

Galliforme Call counts

The four different analyses presented in the results attempted to explore different aspects of the long-term monitoring data, combined with the data collected in 2011. The statistical models were as complete as possible, incorporating all species, sites and years, where relevant, in multi-way ANOVA models. However, more sophisticated analyses are presented in Poulton (2011), which also explains in some detail why these data should not be treated as direct estimates of numbers of calling birds. In particular, the raw field data represent registrations of calling points, which have numerous errors associated with them, such as duplication from multiple listening stations, erroneous distance estimates, and different birds probably calling on different days. So, for the purposes of this discussion, results of interest will be explained in terms of call counts, with no extrapolation to actual numbers of birds, or population estimates. Furthermore, each species will be reviewed in turn, pulling together the results from the different analyses.

Koklass Pheasant

The most important result from this survey was that koklass pheasants were not recorded at all from the three sites on Pipar Kharka. Low call counts were recorded from Korja and Khumai, and a single call was heard during the walk from Thulobukeni (3660m) to Korja on 14th May, but this area was not included in formal call count surveys. It should be pointed out that in two previous years (2005 and 2008) there were no records of calls from Thulokhobang, so the absence of this species from the lower Pipar Kharka may not be new.

However, the analyses on the four long-term stations at Pipar and all six stations over four years, showed the same pattern. Firstly, although there did appear to be a general decline from 1979, there was no significant difference between the mean call counts in the first seven surveys. This result is in contrast to previous analyses which used linear regression methods. However, in 2009 there was a highly significant reduction in mean call counts, which then declined to a complete absence in 2011. It is encouraging, therefore, that the low counts in Khumai were not significantly different from the mean call counts recorded in 2008.

The fact remains that koklass do appear to have disappeared from the Pipar bowl. There may, however, be other explanations for the lack of calls, even if birds had been present;

- The field visit was relatively late compared to previous years, so calling may have ceased. This effect is explored further in the technical report (Poulton; 2011).
- Other factors such as changes in weather patterns, or even climate change, may have encouraged an earlier breeding season; also resulting in cessation of calls.
- The unusual weather conditions, especially overnight rain, may have discouraged calling birds.
- There was an unusually high degree of disturbance (see Human Influence below), which could have caused the birds to remain silent or even move away temporarily.

Considering the original reasons for the establishment of the Pipar sanctuary, the lack of any koklass calls from this site is regrettable. It is strongly recommended that future surveys be designed to check if this is a real and permanent phenomenon, to explore possible reasons and to determine whether it can be reversed.

Hill Partridge

Overall in 2011, call counts for hill partridge were higher than for koklass, although this was only evident in the three sites on the Pipar Kharka where no koklass calls were recorded. There was an indication that call counts were higher at the two sites below 3000m altitude, although there was no significant difference between means from Thulokhobang and Pipar.

This species was only recorded in Pipar and Thulokhobang from 2005 onwards although the latter site was not included in the 2009 survey. There was a significant decline in call counts from Pipar over these four surveys, although individual differences between years were only significant when comparing 2011 with the previous years. This pattern appeared to have been repeated in Thulokhobang, although the results were not significant. There was no significant difference between 2008 and 2011 in the call counts of this species in Khumai.

Satyr Tragopan

Call counts from this species were significantly higher than those from the other two species in 2011 alone, and significantly higher than koklass pheasant over the period 2005 – 2011. However, this was not a constant effect over space and time. Firstly, the higher call counts in 2011 were really only found in Pipar, where the mean call counts were significantly higher than all other sites and species other than Pilicho. In contrast, in Thulokhobang, this species had significantly lower call counts that hill partridge between 2005 and 2011.

The most important finding for this species though, was that there was no evidence of a decline in the Pipar bowl, either in the long-term stations (1 – 4) or all six stations from 2005 to 2011. There did appear to be a difference (based on confidence intervals) between the mean call count in 1987 (6.1) compared to 2011 (4.0), but overall this was not a significant effect. The important point to note is that there was more variation between stations than there was between years, which largely explains the lack of significant change. These results are supported by the data from Thulokhobang, where mean call counts were consistently around 0.5.

Additional Galliforme Species

Out of 22 species of galliformes considered to be found in Nepal, thirteen species have been recorded so far in the Pipar area. The Tibetan snowcock was the only additional species to be recorded in 2011 by direct sighting. In addition, other two species, Himalayan monal and blood pheasant were also sighted during the field trip. Very few calls of kalij pheasant and rufous-throated partridge were heard below 2000 meter altitude. These birds were not sighted in this survey, but were encountered in previous surveys of 2005 and 2008. The loud calls of black francolin in the lower altitudes showed its existence as in previous studies. There were previous reports of snow partridge, chukor, Tibetan partridge and Himalayan snowcock, but we didn't able locate any of these species in this survey.

Other Biological Data

The biodiversity of Pipar is high. This area (which includes all five sites of this survey) is very rich in bird species and also hosts a range of small to large mammals. Out of 152 species of birds recorded in this survey, 14 species were recorded for the first time. White-browed piculet was a new species, not only for Pipar, but also for the whole ACA. Winter visitor species *e.g.* bar-headed goose and brown shrike were recorded probably due to the late migration of these species.

Previous studies had recorded 17 species of mammals and the most notable feature of records from 2011 was the absence of any primate species. In particular, the common or Hanuman langur

(*Semnopithecus entellus*) had been recorded in 2005 and there were previous records of the Rhesus macaque (*Macaca mulatta*). These species were not even recorded around villages and fields or in the lower forests during the ascent and descent to the study sites. We suspected that poachers may have taken these species as bushmeat, either for personal consumption or for sale in the cities.

A number of other species had been recorded in previous years, such as the Indian porcupine (*Hystrix indica*), jungle cat (*Felis chaus*), yellow-throated marten (*Martes flavigula*) and Asiatic golden jackal (*Canis aureus*). However, as these are relatively scarce and cryptic species, it may not be surprising that they were unrecorded during this expedition. We might have expected to see hoary-bellied Himalayan squirrel (*Calloscuirus pygerythrus*) which had also been recorded previously. The only other notable species which remained unrecorded in 2011 was the musk deer (*Moschus chrysogaster*); the large number of small deer droppings found during this *ad hoc* survey were all assigned to the more common barking deer.

The relatively frequent signs of rodents and the several sightings of pikas indicates that food for small and medium-sized carnivores was fairly abundant. This was supported by the sign and faeces of at least three species, plus the clear presence of two large carnivores. A more systematic survey of the mammals of this area would be valuable, especially the carnivores, as the prey items of mustelids and canids would also include ground-nesting birds such as pheasants and partridges and their eggs and young.

We saw several insects, moths and butterflies either on the trail walks or during the call count period, although these were not identified. There was a list of 26 species of moth 39 species of butterfly and 63 species insect in the past (Shrestha; 1984, Khanal; 1985). Many bird species, including galliformes, feed on these; about 3% of food supply for pheasants is from insects (Bhandary *et al*; 1986).

The forests of Pipar are characterized by a mosaic of habitats from primary and secondary sub tropical forests at lower altitudes to temperate forests, small openings and alpine grasslands at the higher altitude (Poudyal *et al*; 2009). The plants of Pipar Bowl were well described by Picozzi (1984) and Poudyal (2005). But the floral information of other areas is scant. The survey team identified some flowered plants in the study sites. It is very important to assess botanical data in all the study sites.

Relocation of Botanical Transects

There were nine transects (one horizontal transect at 3290m, and eight further transects running downhill on an easterly compass bearing from this horizontal transect) laid in 1983 and followed in 2004. Due to the bad weather of the day allocated for this work, we only able to relocate the first 100 meter distance of the horizontal transect of 750m. The trees and shrubs recorded in 1983 and in 2004 were relocated in 2011 with surprising accuracy, using GPS. This would allow the botanical survey to be repeated for a second time, providing an extremely valuable comparative study of botanical composition over a 30-year time-period.

We made general observations, mostly on flowered plants, in all five study sites and found a wide variety of vegetation types and different species. A comprehensive study on vegetation in the altitudinal gradient from the edge of the village to the alpine grassland, focussing on all five study sites in different seasons, and relating this to local collection and use would be crucial work for future.

Human Influence

Predation of Galliformes

Trapping and shooting of game species in Nepal has been practiced traditionally for meat, medicines and jewellery (Mahato et al. 2006). During the 1970s, there were expeditions of hunters in Pipar consisting of two to nine men lasting from three to twelve days for the purpose of killing game (Lelliott and Yonzon 1980). Hunting is a major cause of declining population of galliformes in Nepal (Baral 2005). Trapping is considered as the great threat to the survival of galliformes in Pipar and its adjoining areas (Subedi 2009). We didn't hear any gunshots in this trip but found evidence of poaching on two occasions in the forests. First was at Kalki forests (3440m) where we found a hut used as a camping place by poachers and as a wild meat roasting place. There were feathers of Himalayan monal and mammal bones, probably the goral, left in the camp. Petrol, water and beer bottles suggested that the poachers might be amateur hunters from cities. And second was at Machhapuchhre view point (3900m), where we found an old stick fences, about 20m in length, used for pheasant trapping. Hunters used spring snooze gates to trap the pheasants. We didn't find any other evidence regarding the predation of galliforme species, but we shouldn't overlook the evidence from past years. In 2009, 27 snares for pheasants were observed and two dead blood pheasants and one dead hill partridge were found in traps (Subedi 2009). Similarly, 33 snares for pheasants, seven snares for mammal species and five camping places used by poachers were found in 2008 (Poudyal 2008). Live-trapping of pheasants was also reported during the study. Anecdotally, it is said that if someone succeeded to trap live male and female Himalayan monal, they would receive about NRs 20,000. Apart from the meat, Himalayan monal and tragopan feathers are used to make crowns by conjurors. Hunting wild animals without permission from government authority is illegal in Nepal.

Buffalo and Sheep grazing

People of Mirsa, Keruwa, Diprang and Ghachok were using Pipar forests for nomadic grazing. Sanokhobang, Thulokhobang, Pipar, Korja and Khumai were the hotspots for summer grazing (Gyawali 2004). We noticed buffaloes in Sanokhobang (1700m) at the beginning of the trek and below Khumai, when we were descending from our last camp. These buffaloes were left unattended for grazing in the forest on the day time and in the evening the buffaloes themselves come into the Goths/huts.

Usually the livestock from these villages were taken to Pipar forests for grazing in early June. These include mainly buffaloes and sheep and a few cattle and goats. Anecdotally, it is said that grazing buffaloes at such a high altitude is unusual and such practices are hardly found in other parts of Nepal. Buffaloes and cattle were grazed for about three months and brought back to villages in September. Sheep were taken for grazing at higher altitudes to the alpine pastures and brought back close to villages in November. The sheep herders built many temporary huts on the route and grazed their sheep for about one week in each area. We found many scrambled temporary huts on the trekking route.

Collection of Yarsha Gumba Caterpillars

People collecting Yarsha Gumba caterpillar were encountered mostly when we were walking up from Pilicho to Pipar bowl and we found few people in the bowl who were collecting the caterpillar. According to the local people, this year the price of the caterpillar has gone down due to lower demand, as the caterpillar found in Pipar bowl are not as good quality as found in Dolpo or the far-western region of Nepal. According to them, last year caterpillars from Pipar could be sold for a minimum of NRs 25 each, but this year they could hardly sell at a price of NRs 10-15 each.

However, the exact reason for the lower price this year is still unknown. Greater attention is required in order to save the galliformes habitat from human disturbance. It was also found that people who collect the caterpillar, not only focus on colleting them, but were involved in other, illegal actives, like hunting galliformes and other birds, mammals and other wildlife. So strict laws and regulations should be imposed and enforced for illegal hunting. Collection of caterpillars must be regulated, for example, by opening up certain areas where caterpillars could be collected, whilst other areas it should be strictly prohibited, for galliforme conservation. Apart from this, an alternative livelihood program must be implemented, focusing on those people/villages that fully depend on caterpillar collection for their livelihood. For example, this year we found that most people were from the villages close to forest (Keruwa, Bhaludi, Kapuche, Rumja).

Collection of bamboo shoots

Apart from Yarsha Gumpa caterpillar collection, we frequently encountered people who were collecting nigalo *Arundinaria falcata*, (a bamboo species), which is commonly used for making baskets, dust bins, winnow sieves and many other useful materials. The very young nigalo shoot is also used as a vegetable, so most of the people from adjacent villages depend on Nigalo for their livelihood. We encountered 2-4 persons per day during our trip in the Pipar forest entering the forest with the purpose of collecting this species. Even though there were numbers of people who were collecting Nigalo from the forest, interestingly the cover of Nigalo was not in a bad condition *i.e*. it did not appear degraded when considering the human pressure. This may be because the nigalo species can be annually harvested, as it becomes mature within one year, and Pipar forests hold a good density of this species. But if the current level of human pressure on the forest continues, it may have direct effects on galliforme habitat. As already noted above, collectors may be involved in illegal activities, like hunting of galliformes, during the harvesting of nigalo, so it is highly recommended that we should regulate the collection of nigalo.

Collection of medicinal plants

According to the people of Keruwa village, medicinal plants have been collected from Pipar forests for a long time. The main collected plant species include nirmasi *Delphium denudatum*, jatamasi *Nardostachys grandiflora*, bamboo shoots *Arundinaria* spp., ban karalla *Mordica indica*, kurilo *Asparagus racemosus*, panchaule *Dactylorhiza hatageria*, kutki *Neopicrorhiza scrophulariiflora*, padamchal *Rheum austral* and satuwa *Paris polyphylla*. People collect these medicinal plants either for their individual home use or for sale. However, we didn't encounter any people who were collecting medicinal plants. These plant collection activities happen mainly in post-monsoon season (Lelliott and Yonzon, 1980). Two people were seen collecting nirmasi during the vegetation survey in November 2004 (Poudyal, 2005). People of Keruwa agreed that they are not aware of guideline for collection techniques of these plants. Some important species like jatamasi, nirmasi and panchaule have declined due to excessive collection of these species in the past (Gyawali, 2004). The haphazard collection of medicinal plants might disturb the wildlife and also lead to over exploitation. Anecdotally, it is said that sometimes these people set traps for pheasants on their way to collection spots either for their consumption or for sale in the cities. The area is remote and far from villages. The implementation of control mechanism, which should be applied by ACAP, in such a remote area is difficult. It seems that there was no presence of ACAP staff in these areas.

Tourism

There have been significant recent changes in the Pipar area in terms of tourism development. ACAP and Trekking Agents Association Nepal (TAAN), along with local people, have opened up different trekking routes in the area. As well as trail improvement, ACAP and TAAN have built shelters for visitors, who choose not to carry tents, in various camp sites along the Pipar route.

During our trip there was a shelter being constructed in the Pipar bowl with the direct involvement of local people. They were building the camp with the aim of attracting tourists and visitors to Pipar, although we later confirmed that they did not have permission from ACAP. Despite this investment to attract the tourists, the only tourist we encountered during our trip was one French trekker with a local "guide".

Apart from this, there was also a flow of people, especially students from Pokhara, either to spend a day or just for a picnic at the hot springs at Kharpani. Last year, during the picnic season (October – January), there were more than 20 buses a day bringing people to Kharpani. With the development of road and frequent public buses to Kharpani, this number may increase more in the future, so we must now consider the regulation of foreign and domestic tourists before the area deteriorates.

Potential Sites for Future Galliforme Monitoring

Apart from monitoring current sites, we also searched for suitable monitoring sites for future surveys. These potential sites were identified close to the existing sites, which be reached within a few hours trek. One of the potential sites is Meshram camp located south-west of Korja camp, which could be reached in 2-3 hours from Korja camp (Figure 5). This potential site looks towards the western side of the Korja Dada ridgeline, whereas the existing stations at Korja look towards the eastern side of the ridgeline. One morning call count was done looking down the western side of the ridgeline sitting close to Korja camp. A total of nine satyr tragopan calls, three hill partridge calls and one koklass call was heard from the whole western side of the ridgeline. The other potential site was identified in the forested area below Khumai on the way back to Mirsa village (Figure 5). This site is located south-east of Khumai, at an altitude of about 2700m, within a 2 – 3 hour descent from Khumai camp. We recommend that these two potential sites be included in the future monitoring programme.

Recommendations

Future Monitoring

- During the survey there was no evidence of koklass pheasant in Pipar bowl. In-depth research into behaviour, habitat preference and condition, *etc*., should be carried out to explain its absence.
- In future, monitoring should include the potential sites identified during the current survey.

Other Recommendations

- This area has very high potential for the collection of Non-Timber Forest Products (NTFPs) like nigalo and medicinal plants like yarsagumba (caterpillar). However, these practices should be managed and their collection should be regulated.
- Research should be focused on identifying the potential of NTFP and medicinal plants as an alternative livelihood for the local people.
- In order to reduce the illegal hunting and human pressure, a number of wildlife guards should be appointed under the Conservation Area Management Committee (CAMC), focusing on Pipar forest.
- The number of tourists visiting the area is increasing. Before the area becomes degraded, a proper tourism management plan should be developed and local people made aware of the impact of tourism on galliformes and other wildlife.
- Conservation education and extension program should be launched, focusing on the villages that are adjacent to the Pipar forest to make local people aware of the importance of galliformes and other wildlife, and to reduce illegal hunting and poaching. This should include promotion of the work of WPA in the Pipar area.

References

BARAL, H.S. 2005. Status and conservation of Nepal's Galliformes: An update. Pp. 1-4 in: Fuller, R.A. & Browne, S.J. (eds) 2005. Galliformes 2004. Proceedings of the 3rd International Galliformes Symposium. World Pheasant Association, Fordingbridge, UK.

BARAL, H.S. & INSKIPP, C. (2005) Important bird areas in Nepal: key sites for conservation. Bird Conservation Nepal, Kathmandu and Birdlife International, Cambridge, UK.

BARAL, H.S., GURUNG, P.C., KAUL, R. & RAMESH, K. (2001) Santel Galliformes Survey: a possible extension of Pipar Pheasant Reserve, Annapurna Conservation Area, Central Nepal. A report to the World Pheasant Association (UK) and Annapurna Conservation Area Project. Nepal. Unpublished.

BHANDARY, H.R., SCHEMNITZ, S.D. & PICOZZI, N. (1986) Autumn foods of forest pheasants of Pipar, Central Nepal. Journal of the World Pheasant Association 11:29-33

BIRD CONSERVATION NEPAL (2009) Birds of Nepal: an official checklist. Department of National Parks and Wildlife Conservation and Bird Conservation Nepal, Kathmandu.

CORBETT, G. B. & HILL, J. E. (1992) The Mammals of the Indomalayan Region. Oxford University Press, Oxford.

DUKE, G. (1990) Using call counts to compare western tragopan populations in Pakistan's Himalaya. In Pheasants in Asia 1989 (eds D.A. Hill, P.J. Garson, and D. Jenkins), pp. 116-123,. World Pheasant Association, Reading, U.K.

FLEMING, R.L. SR., FLEMING, R.L. JR. & BANGDEL L.S (1984) Birds of Nepal with reference to Kasmir and Sikkim, Avalok Publishers, Kathmandu, Nepal.

FULLER, R.A. & GARSON, P.J. (EDS. 2000) Pheasants Status and Conservation Action Plan 2000-2004.WPA/Birdlife/SSC Pheasant Specialist Group. IUCN, Gland. Switzerland and Cambridge, UK and the World Pheasant Association, Reading, UK.

GARSON, P.J. (1983) The cheer pheasant Catreus wallichii in Himachal Pradesh, western Himalayas: an update. Journal of the World Pheasant Association, 8, 29-39.

GASTON, A.J. & SINGH, J. (1980) The status of Cheer pheasant Catreus wallichii in the Chail Wildlife Sanctuary, Himachal Pradesh. Journal of the World Pheasant Association, 5, 68-73.

GASTON, A.J. (1980) Census techniques for Himalayan pheasants including notes on individual species. Journal of the World Pheasant Association, 5, 40-53.

GRIMMETT, R., INSKIPP, C. & INSKIPP, T. (2000) Birds of Nepal. Prakash Books Depots, New Delhi, India.

GYAWALI, N. (2004) Study on impact of summer grazing and collection of non-timber forest products in Pipar, Annapurna Conservation Area, Nepal. A report to the World Pheasant Association (UK). Unpublished.

HOWMAN, S. & GARSON, P.J. (1993) Pheasant survey at Pipar Nepal (1979-91). Abstract in Pheasants in Asia 1992 (ed D. Jenkins). World Pheasant Association. Reading. UK.

INSKIPP, C. (1989) Nepal's forest birds: their status and conservation. ICBP Monograph No 4. International Council for Bird Preservation, Cambridge, UK.

KAUL, R. & SHAKYA, S. (1998) A Wildlife survey of the Pipar Sanctuary, Central Nepal, 28 April – 5 May 1998. WPA- SARO and BCN. A report to the World Pheasant Association (UK).

KAUL, R. & SHAKYA, S. (2001) Spring call counts of some Galliformes in the Pipar Reserve, Nepal. Forktail, 17, 75-80.

KHALING, S., KAUL, R. & SAHA, G.K. (1998) Survey of the Satyr tragopan Tragopan satyra in the Singhalila National Park, Darjeeling, India using spring call counts. Bird Conservation International, 9, 361-371.

KHANAL, B. (1985) Lepidoptera of Pipar. Journal of Natural History Musium Vol 9(1-4): 7-14

LELLIOTT, A.D. & YONZON, P.B. (1980) Studies of Himalayan pheasants in Nepal. Journal of the World Pheasant Association, 5, 11-30.

LELLIOTT, A.D. (1981) Studies of Himalayan pheasants in Nepal with reference to their conservation. MSc Thesis. Durham University. Unpublished.

MAHATO, N.K., POUDYAL, L.P., SUBEDI, P. & SINGH, P.B. (2006) 2005 spring survey of Galliformes in the Pipar Reserve and of Santel, Annapurna Conservation Area, Central Nepal: a World Pheasant Association Report. World Pheasant Association, Fordingbridge, UK

PICOZZI, N. (1984) An ecological survey of a proposed reserve for Himalayan pheasants at Pipar, Nepal in November 1983. A report to the World Pheasant Association (UK). Unpublished.

PICOZZI, N. (1987) Pipar pheasant trek, April (1987) Unpublished report to WPA, Reading, UK.

POLUNIN, O. & STAINTON, A. (1984) Flowers of the Himalayas. Oxford University Press, Delhi.

POUDYAL, L.P. (2008) Distribution and Habitat Use of Pheasants in the Headwater Forests of Setikhola, Annapurna Conservation Area, Nepal. Masters Thesis to the Tribhuvan University-Institute of Forestry, Nepal

POUDYAL, L.P., MAHATO, N.K., SINGH, P.B. SUBEDI, P., BARAL, H.S. & MCGOWAN P.J.K. (2009) Status of Galliformes in Pipar Pheasant Reserve and Santel, Annapurna, Nepal. International Journal of Galliformes Conservation (1) 49–55.

POUDYAL, L. P. (2005) A study of floral diversity and grazing impacts in Pipar Pheasant Sanctuary, Nepal. BSc Thesis, Tribhuvan University – Institute of Forestry, Pokhara, Nepal. Unpublished.

POULTON, S. M. C. (2011) *Call Counts as a method for Monitoring Galliforme Species in the Pipar Area of Nepal*. Unpubl. Report to World Pheasant Association. pp. 61.

PRATER, S. H. (1990) The book of Indian Animals. Oxford University Press, Bombay.

RAMESH, K. (2003) An Ecological Study on Pheasants of the Great Himalyayan National Park, Western Himalaya. PhD Thesis. Forest Research Institute – Deemed University, Dehra Dun. Unpublished.

SHRESTHA, P.K., (1984) Some Insects of Pipar. Journal of Natural History Musium Vol 8(1-4): 9-22

STAINTON, A. (1984) Flowers of the Himalayas. A supplementary copy. Oxford University Press, Delhi.

SUBEDI, P. (2010) Monitoring of Yarsagumba (Cordyceps sinensis) Harvesting and Assessing Its Effect on Pheasants and the Livelihoods of Local People at Pipar, Nepal. Masters Thesis to the Tribhuvan University-Institute of Forestry, Nepal.

TAMRAKAR, J.K. & LELLIOTT, A.D. (1981) Report to the National Parks and Wildlife Conservation Department, HMG, on the Pipar area, Kaski district. Unpublished report.

UNEP. 1995. Global Biodiversity Assessment. Cambridge University Press, Cambridge, UK.

WPA. (2004) Pipar Conservation Plan. World Pheasant Association (UK), Annapurna Conservation Area Project (Nepal) and Bird Conservation Nepal (Nepal). Unpublished report, World Pheasant Association, Reading, UK.

YONZON, P.B. (1987) Nepal-Himalaya pheasant surveys at Pipar, Machhapuchare. In Pheasants in Asia 1982.(eds C.D.W. SAVAGE & M.W. RIDLEY), PP. 55-57. World Pheasant Association, Reading, UK.

Appendices

Locations of Listening Stations and Calling Points

Site	*Listening Station*	*Elevation (m)*	*Slope (°)*
Korja	1	3680	15
	2	3597	44
	3	3599	9
	4	3636	29
Kumai	1	3226	20
	2	3216	21
	3	3068	33
Pilicho	1	2767	38
	2	2703	32
	3	2677	36
	4	2855	33
Pipar	1	3248	19
	2	3238	15
	3	3245	19
	4	3254	24
	5	3258	23
	6	3127	16
Thulokhobang	1	2279	31
	2	2387	30
	3	2369	35

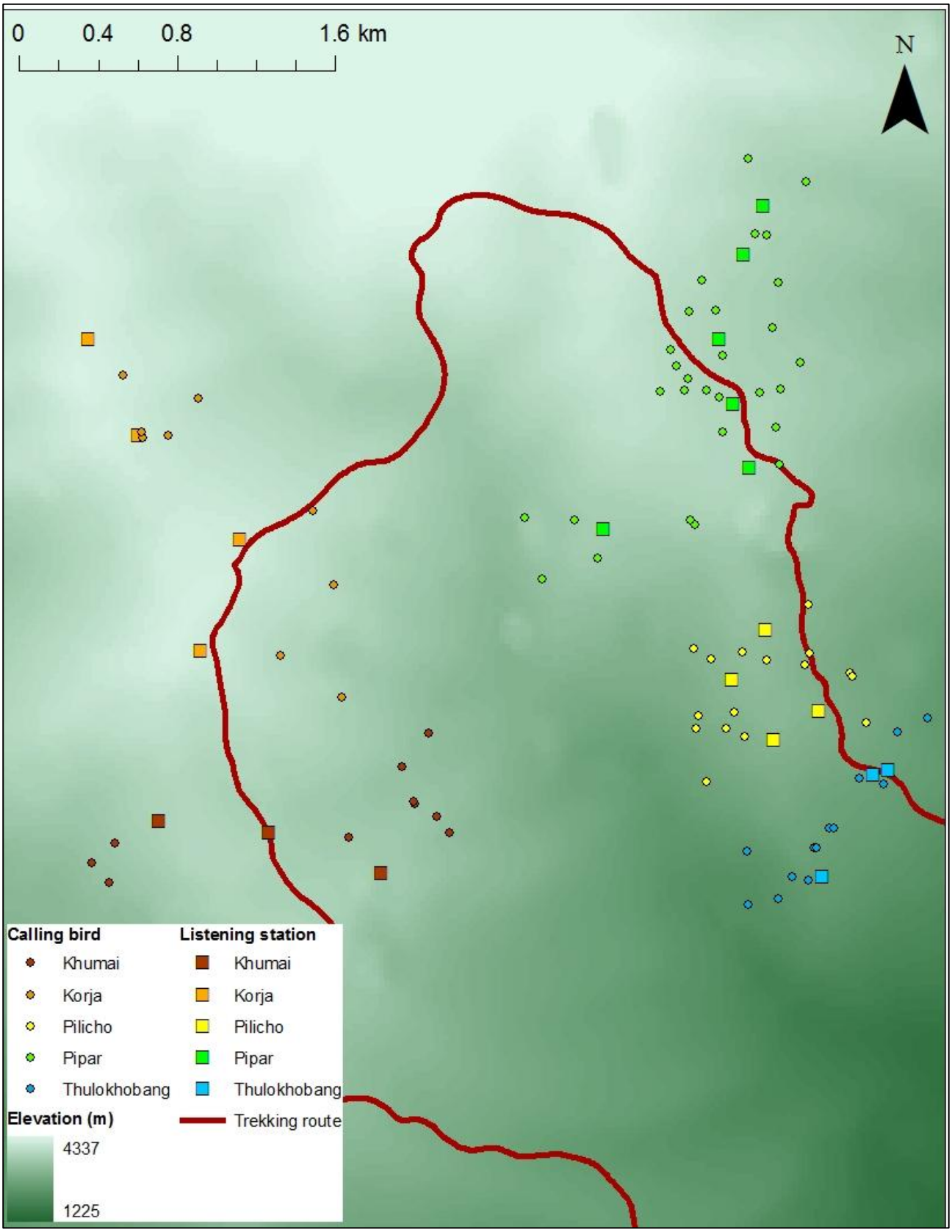


Figure 13. Locations of calling hill partridge heard from the listening stations

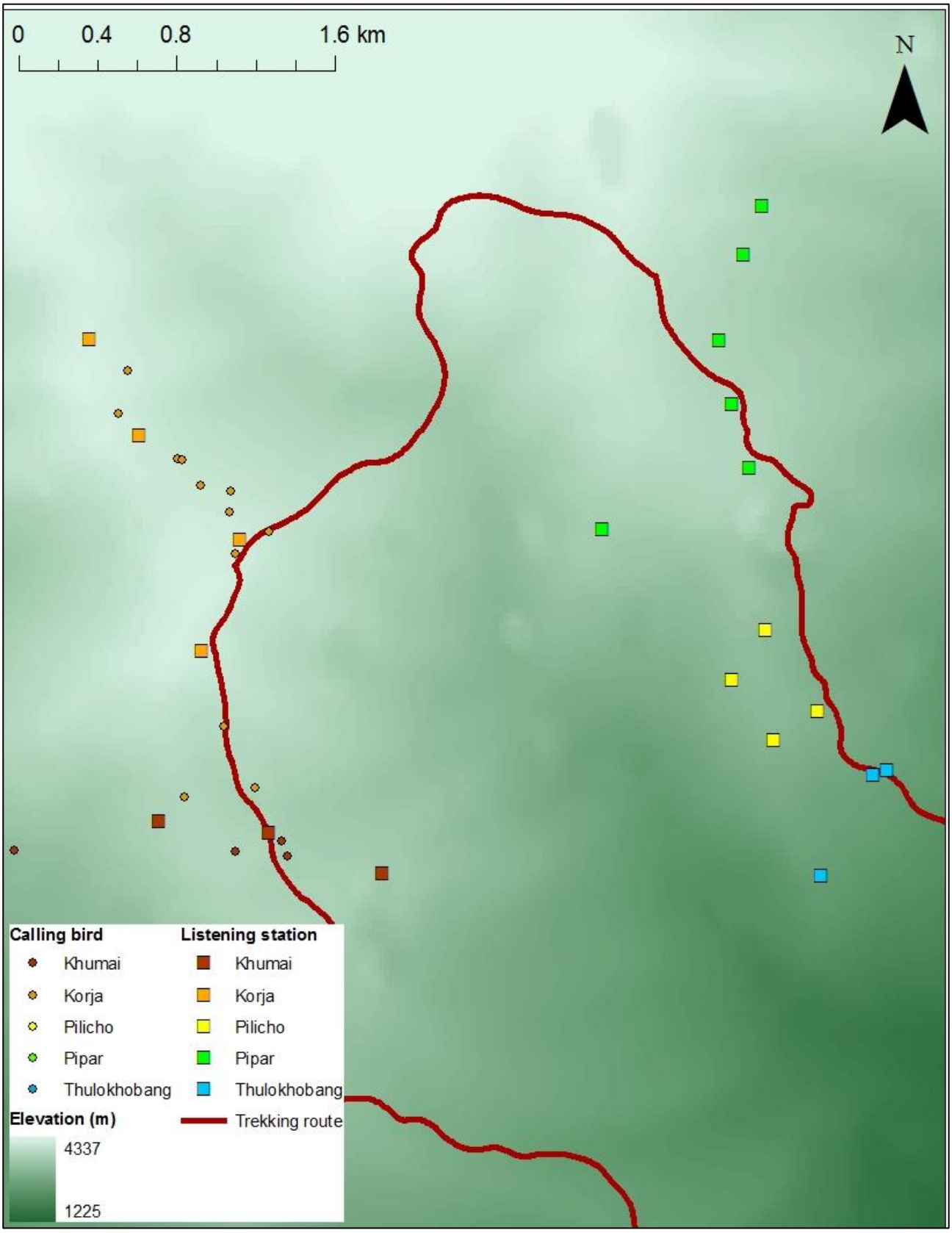


Figure 14. Locations of calling koklass pheasant heard from the listening stations

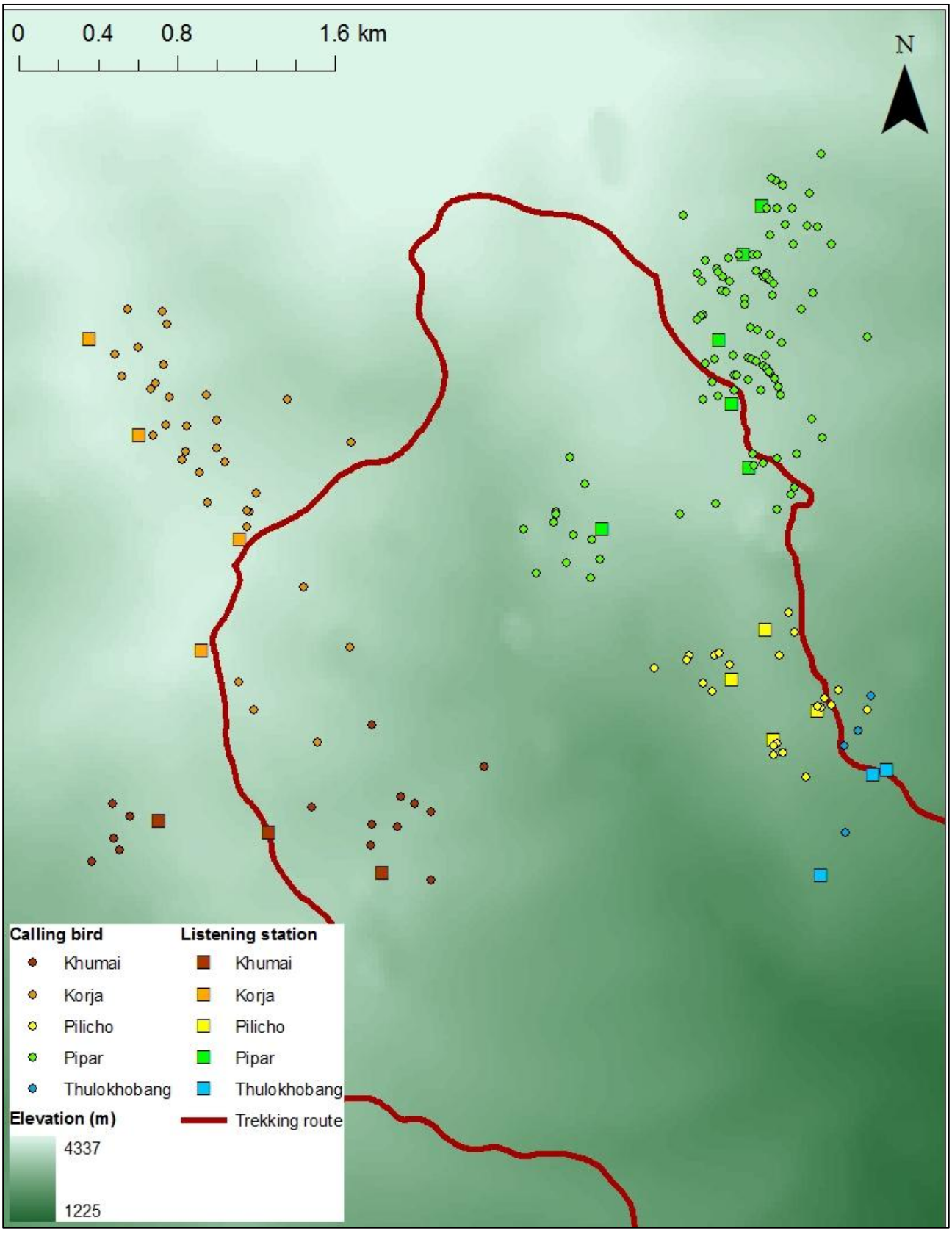


Figure 15. Locations of calling satyr tragopan heard from the listening stations

Bird Species List

SN	Scientific Name	Common Name	Status
Galliformes			
Phasianidae			
1	*Tetraogallus tibetanus*	Tibetian Snowcock	R
2	*Francolinus francolinus*	Black Francolin	R
3	*Arborophila torqueola*	Hill Partridge	R
4	*Arborophila rufogularis*	Rufous–throated Partridge	R
5	*Ithaginis cruentus*	Blood Pheasant	R
6	*Tragopan satyra*	Satyr Tragopan	R
7	*Pucrasia macrolopha*	Koklass Pheasant	R
8	*Lophophorus impejanus*	Himalayan Monal	R
9	*Lophura leucomelanos*	Kalij Pheasant	R
Anseriformes			
Anatidae			
10	*Anser indicus*	Bar–headed Goose	M
Piciformes			
Picidae			
11	*Picumnus innominatus*	Speckled Piculet	R
12	*Sasia ochracea*	White–browed Piculet	R?
13	*Dendrocopos darjellensis*	Darjeeling Woodpecker	R
14	*Blythipicus pyrrhotis*	Bay Woodpecker	R
Megalaimidae			
15	*Megalaima virens*	Great Barbet	R
16	*Megalaima franklinii*	Golden–throated Barbet	R
17	*Megalaima asiatica*	Blue–throated Barbet	R
Coraciformes			
Alcedinidae			
18		Common Kingfisher	R
Cerylidae			
19	*Megaceryle lugubris*	Crested Kingfisher	R
Cuculiformes			
Cuculidae			
20	*Hierococcyx sparverioides*	Large Hawk Cuckoo	S
21	*Hierococcyx varius*	Common Hawk Cuckoo	S
22	*Cuculus micropterus*	Indian Cuckoo	S
23	*Cuculus poliocephalus*	Lesser Cuckoo	S
24	*Cuculus canorus*	Eursian Cuckoo	S
25	*Cuculus saturatus*	Oriental Cuckoo	S
26	*Cacomantis passerinus*	Grey–bellied Cuckoo	S
27	*Eudynamys scolopacea*	Asian Koel	S
Strigiformes			
Strigidae			
28	*Bubo bubo*	Eurasian Eagle Owl	R
29	*Glaucidium brodiei*	Collared Owlet	R
30	*Glaucidium cuculoides*	Asian Barred Owlet	R
31	*Athene brama*	Spotted Owlet	R
Caprimulgidae			
32	*Caprimulgus indicus*	Grey Nightjar	R
Columbiformes			
Columbidae			
33	*Columba livia*	Rock Pigeon	R
34	*Columba pulchricollis*	Ashy Wood Pigeon	R
35	*Streptopelia orientalis*	Oriental Turtle Dove	R
36	*Streptopelia chinensis*	Spotted Dove	R
37	*Treron sphenura*	Wedge–tailed Green Pigeon	R

SN	Scientific Name	Common Name	Status
Ciconiiformes			
Scolopacidae			
38	*Scolopax rusticola*	Eurasian Woodcock	R
39	*Milvus migrans*	Black Kite	RM
40	*Milvus migrans*	Lammergeier	RM
41	*Neophron percnopterus*	Egyptian Vulture	R
42	*Gyps himalayensis*	Himalayan Griffon	R
43	*Spilornis cheela*	Crested Serpent Eagle	S
44	*Accipiter nisus*	Eurasian Sparrowhawk	RWM
45	*Buteo hemilasius*	Upland Buzzard	RWM
46	*Ictinaetus malayensis*	Black Eagle	R
Passeriformes			
Irenidae			
47	*Chloropsis hardwickii*	Orange–bellied Leafbird	R
Laniidae			
48	*Lanius cristatus*	Brown Shrike	RWM
49	*Lanius schach*	Long–tailed Shrike	R
50	*Lanius tephronotus*	Grey–backed Shrike	R
Corvidae			
51	*Urocissa flavirostris*	Yellow–billed Blue Magpie	R
52	*Urocissa erythrorhyncha*	Red–billed Blue Magpie	R
53	*Dendrocitta formosae*	Grey Treepie	R
54	*Nucifraga caryocatactes*	Spotted Nutcracker	R
55	*Corvus macrorhynchos*	Large–billed Crow	R
56	*Oriolus traillii*	Maroon Oriole	R
57	*Coracina macei*	Large Cuckooshrike	R
58	*Coracina melaschistos*	Black–winged Cuckooshrike	S
59	*Pericrocotus ethologus*	Long–tailed Minivet	R
60	*Rhipidura hypoxantha*	Yellow–bellied Fantail	R
61	*Rhipidura albicollis*	White–throated Fantail	R
62	*Dicrurus macrocercus*	Black Drongo	R
63	*Dicrurus leucophaeus*	Ashy Drongo	R
Cinclidae			
64	*Cinclus pallasii*	Brown Dipper	R
Muscicapidae			
65	*Monticola rufiventris*	Chestnut–bellied Rock Thrush	R
66	*Myophonus caeruleus*	Blue Whistling Thrush	R
67	*Turdus boulboul*	Grey–winged Blackbird	R
68	*Ficedula strophiata*	Rufous–gorgeted Flycatcher	R
69	*Eumyias thalassina*	Verditer Flycatcher	S
70	*Niltava grandis*	Large Niltava	R
71	*Niltava macgrigoriae*	Small Niltava	R
72	*Niltava sundara*	Rufous–bellied Niltava	R
73	*Muscicapella hodgsoni*	Pygmy Blue Flycatcher	R
74	*Culicicapa ceylonensis*	Grey–headed Canary Flycatcher	RS
75	*Tarsiger chrysaeus*	Golden Bush Robin	R
76	*Copsychus saularis*	Oriental Magpie Robin	R
77	*Phoenicurus frontalis*	Blue–fronted Redstart	R
78	*Rhyacornis fuliginosus*	Plumbeous Water Redstart	R
79	*Grandala coelicolor*	Grandala	RW
Sturnidae			
80	*Acridotheres tristis*	Common Myna	R
Sittidae			
81	*Sitta frontalis*	Velvet–fronted Nuthatch	R
Certhiidae			
82	*Certhia nipalensis*	Rusty–flanked Tree–creeper	R
Paridae			
83	*Cephalopyrus flammiceps*	Fire–capped Tit	R
84	*Parus monticolus*	Green–backed Tit	R

SN	Scientific Name	Common Name	Status
Aegithalidae			
85	*Aegithalos concinnus*	Black–throated Tit	R
86	*Aegithalos niveogularis*	White–throated Tit	R
Pycnonotidae			
87	*Pycnonotus striatus*	Striated Bulbul	R
88	*Pycnonotus leucogenys*	Himalayan Bulbul	R
89	*Pycnonotus cafer*	Red–vented Bulbul	R
90	*Hypsipetes mcclellandii*	Mountain Bulbul	R
91	*Hypsipetes leucocephalus*	Black Bulbul	R
Cisticolidae			
92	*Prinia criniger*	Striated Prinia	R
Zosteropidae			
93	*Zosterops palpebrosus*	Oriental White–eye	R
Sylviida			
94	*Tesia castaneocoronata*	Chestnut–headed Tesia	R
95	*Tesia cyaniventer*	Grey–bellied Tesia	R
96	*Orthotomus sutorius*	Common Tailorbird	R
97	*Phylloscopus affinis*	Tickell's Leaf Warbler	R
98	*Phylloscopus pulcher*	Buff–barred Warbler	R
99	*Phylloscopus maculipennis*	Ashy–throated Warbler	R
100	*Phylloscopus chloronotus*	Lemon–rumped Warbler	R
101	*Phylloscopus humei*	Hume's Warbler	R
102	*Phylloscopus trochiloides*	Greenish Warbler	swm
103	*Seicercus burkii*	Golden–spectacled Warbler	R
104	*Seicerus whistleri*	Whistler's Warbler	R
105	*Seicercus xanthoschistos*	Grey–hooded Warbler	R
106	*Seicercus castaniceps*	Chestnut–crowned Warbler	R
107	*Abroscopus schisticeps*	Black–faced Warbler	R
108	*Garrulax albogularis*	White–throated Laughingthrush	R
109	*Garrulax leucolophus*	White–crested Laughingthrush	R
110	*Garrulax striatus*	Striated Laughingthrush	R
111	*Garrulax rufogularis*	Rufous–chinned Laughingthrush	R
112	*Garrulax ocellatus*	Spotted Laughingthrush	R
113	*Garrulax lineatus*	Streaked Laughingthrush	R
114	*Garrulax variegatus*	Variegated Laughingthrush	R
115	*Garrulax erythrocephalus*	Chestnut–crowned Laughingthrush	R
116	*Pomatorhinus ruficollis*	Streak–breasted Scimitar Babbler	R
117	*Xiphirhynchus superciliaris*	Slender–billed Scimitar Babbler	R
118	*Pnoepyga albiventer*	Scaly–breasted Wren Babbler	R
119	*Stachyris pyrrhops*	Black–chinned Babbler	R
120	*Stachyris chrysaea*	Golden Babbler	R
121	*Turdoides nipalensis*	Spiny Babbler	R
122	*Leiothrix lutea*	Red–billed Leiothrix	R
123	*Cutia nipalensis*	Cutia	R
124	*Pteruthius flaviscapis*	White–browed Shrike Babbler	R
125	*Pteruthius xanthochlorus*	Green Shrike Babbler	R
126	*Actinodura nipalensis*	Hoary–throated Barwing	R
127	*Minla cyanouroptera*	Blue–winged Minla	R
128	*Minla strigula*	Chestnut–tailed Minla	R
129	*Minla ignotincta*	Red–tailed Minla	R
130	*Alcippe vinipectus*	White–browed Fulvetta	R
131	*Heterophasia capistrata*	Rufous Sibia	R
132	*Yuhina flavicollis*	Whiskered Yuhina	R
133	*Yuhina gularis*	Stripe–throated Yuhina	R
134	*Yuhina occipitalis*	Rufous–vented Yuhina	R
135	*Conostoma oemodium*	Great Parrotbill	R
Nectariniidae			
136	*Dicaeum ignipectus*	Fire–breasted Flowerpecker	R
137	*Aethopyga nipalensis*	Green–tailed Sunbird	R
138	*Aethopyga saturata*	Black–throated Sunbird	R
139	*Aethopyga ignicauda*	Fire–tailed Sunbird	R

SN	Scientific Name	Common Name	Status
Passeridae			
140	*Passer montanus*	Eurasian Tree Sparrow	R
141	*Motacilla cinerea*	Grey Wagtail	R
142	*Anthus roseatus*	Rosy Pipit	RM
143	*Anthus sylvanus*	Upland Pipit	R
Fringillidae			
144	*Carduelis spinoides*	Yellow–breasted Greenfinch	R
145	*Carpodacus erythrinus*	Common Rosefinch	R
146	*Carpodacus rodochrous*	Pink–browed Rosefinch	R
147	*Carpodacus vinaceus*	Vinaceous Rosefinch	R?
148	*Carpodacus rodopeplus*	Spot–winged Rosefinch	R
149	*Carpodacus thura*	White–browed Rosefinch	R
150	*Carpodacus rubicilla*	Great Rosefinch	R
151	*Pyrrhula erythrocephala*	Red–headed Bullfinch	R
152	*Melophus lathami*	Crested Bunting	R

Botanical Species List

SN	Scientific Name	English Name	Nepali Name	Family	Identified Location
1	*Acer campbelli*	Mapple	Kapaasi	Aceraceae	PP
2	*Acer pectinatum*	Mapple	Thusipaangraa	Aceraceae	PP
3	*Alnus nepalensis*	Alder	Uttis	Betulaceae	Below TK
4	*Arisaema griffithii*	Cobra lily	Dhakaayo	Araceae	PC
5	*Arisaema nepenthoides*	Cobra plant	Baanko	Araceae	PC
6	*Arundinaria species*	Bamboo	Jarbuttaa	Gramineae	PP, PC
7	*Berberis species*	Berberry	Chutro	Berberidaceae	All sites
8	*Betula alnoides*	birch	Saur	Betulaceae	KM
9	*Betula utilis*	birch	Bhojpatra	Betulaceae	KM, KJ
10	*Clematis species*	Clematis	Angurjhaar	Ranunculaceae	Khumai
11	*Cotoneaster frigidus*	Cotoneaster	Jhaar	Rosaceae	PP, KM
12	*Lyonia ovalifolia*	Lyonia	Angeri	Ericaceae	PP
13	*Magnolia Campbellii*	Magnolia	Lekali Chaamp	Magnoliaceae	PP
14	*Pieris formusa*	Pieris		Ericaceae	PP
15	*Piptanthus nepalensis*			Papilionaceae	PP
16	*Prunus cornuta*		Aarupaate	Rosaceae	PP
17	*Prunus rufa*		Jangali Paiyu	Rosaceae	KM
18	*Rhododendron barbatum*	Rhododendron	Chimal	Ericaceae	PP, KJ, KM
19	*Rhododendron campanulatum*	Rhododendron	Nilo Chimal	Ericaceae	PP, KM
20	*Rhododendron arboreum*	Rhododendron	Laaliguraans	Ericaceae	PP,TK, PC, KM
21	*Ribes takare*	Currant	Taafu	Grossulariaceae	KM
22	*Rosa species*	Rose	Jangali Gulaab	Rosaceae	KM, KJ
23	*Rubus hypeargyrus*	Black Raspberry	Aiselu	Rosaceae	PC
24	*Sorbus cospidata*			Rosaceae	PP, KM, KJ
25	*Sorbus microphylla ?*			Rosaceae	PP, KM
26	*Vibernum cordifolium*			Caprifoliaceae	PP
27	*Vibernum erubescens*			Caprifoliaceae	PC
28	*Viburnum grandiflorum*			Caprifoliaceae	PP
29	*Rhododendron lepidotum*		Sunpaate	Ericaceae	KJ, KM
30	*Primula calderana strumosa*			Primulaceae	PP
31	*Girardiana palmata*	Himalayan Nettle	Allo	Urticaceae	TK
32	*Uetica dioica*	Stinging Nettle	Sisnu	Urticaceae	TK, PP, PC