

**STATUS, DISTRIBUTION AND THREATS  
TO CONSERVATION OF HORNBILLS  
IN MANIPUR**

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## DECLARATION

This is to certify that the thesis entitled, “STATUS, DISTRIBUTION AND THREATS TO CONSERVATION OF HORNBILL IN MANIPUR” submitted to Forest Research Institute (Deemed) University, Dehradun for the fulfillment of award of the degree of M.Sc. (Forestry) was carried out at Department of Landscape Level Planning and Management, Wildlife Institute of India, Dehradun. No part of this work has been submitted for the award of any degree or equivalent.

Date: 19-06-2017

Place: Dehradun



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## CERTIFICATE

This is to certify that the thesis entitled "STATUS, DISTRIBUTION AND THREATS TO CONSERVATION OF HORNBILLS IN MANIPUR" submitted in partial fulfillment of M.Sc. Forestry to the Forest Research Institute (Deemed) University, Dehradun is a record of bonafide research work carried out by **Mr. Thangsuanlian Naulak, F/15/37** under our supervision and guidance. No part of this thesis has been submitted to any other degree or diploma.

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## SUMMARY

Manipur is a part of a global biodiversity hotspot and two endemic bird areas. In this study at Kailam Wildlife Sanctuary (187.50 sq. km), a survey was carried out for five Hornbill species that occur here: Oriental Pied Hornbill *Anthracoceros albirostris*, Austen's Brown Hornbill *Anorrhinus austeni*, Wreathed Hornbill *Rhyticeros undulates*, Rufous-necked Hornbill *Aceros nipalensis* and Great Hornbill *Buceros bicornis*.

Only three hornbill species were sighted during the study period: Oriental Pied Hornbill (n=10), Brown Hornbill (n=15-21) and Wreathed Hornbill (n=2). However, the questionnaire survey conducted suggests that all five Hornbill species are present in the area. Oriental Pied Hornbill is widely distributed in the area while Brown Hornbill is found in dense forest patches. Wreathed Hornbill is rare as they are seasonal visitors. Rufous-necked Hornbill and Great Hornbill are rarely seen. A checklist of birds was also prepared where a total of 145 bird species from 34 families were recorded.

During the three month survey of status and distribution of Hornbills, Wreathed Hornbill was sighted only once, Brown hornbill was sighted four times and Oriental Pied Hornbill seven times. Most sightings were in primary forests and riverine forests except one sighting in secondary forest. Types of disturbances recorded for the area of sighting are hunting, logging, vehicular road, trapping and forest fire. Hunting is the most common disturbance found at every site, followed by trapping, logging, vehicular road, and forest fire. All hornbill species were observed within the altitudinal range of 450-1500 m. Oriental Pied Hornbills were observed between 450-750 m, Brown Hornbills between 750-1000 m and Wreathed Hornbill between 1400-1500 m.

In this study, peoples' awareness about the protected area, perception and attitude towards conservation were examined through questionnaire survey. A total of 129 respondents from six villages were sampled. The mean family size of respondents (82.95% Male, 17.05% Female) is 6 where 90% of the respondents were literate of which 81% had studied at least till the primary level. There is no significant difference between gender and education ( $\chi^2(3) = 3.855, p > 0.05$ ). The primary occupation of the respondents is shifting cultivation and their average annual income

is around 40,900 INR where 10.01% comes from livestock and another 10.74% from resources collected from the forest, the majority of which is from fish and timber. Gender, family and landholding does not have any significant relationship with annual income ( $p > 0.05$ ) however educational qualification shows significant effect on annual income;  $\chi^2(6) = 12.692, p < 0.05$ . Firewood/Fuelwood is the most common source of energy and is used by every household.

Of the 129 respondents 82.95% (n=107) were aware that the area is a proposed Wildlife Sanctuary while the rest 17.05 (n=22) were not aware about it. Males and females differed in their awareness about the proposed wildlife sanctuary ( $p < 0.005$ ). More males (86%) were aware about the creation of a protected area compared to females (55%). A significant difference was also found in the number of Hornbill species seen by male and female respondents ( $p < 0.001$ ). Only 1% of male respondents have never seen any hornbill species compared to 18% for females (residual value = 3.4).

The majority of respondents think that the creation of KWLS would deprive them of their livelihood (n=107) and would not create opportunities (n=77). 60% (n=77) of the respondent thinks that wildlife needs to be protected. Meanwhile 87% (n=112) are interested in tourism and 59% (n=76) of the total respondent thinks they will benefit from tourism. To improve relations between forest department and local people, a majority of the respondents feel that they should involve local people in decision making and management plans (42%), followed by employment (18%) - employment as official (9%) and secondary employment (9%) – awareness campaigns (13%), others (15%) such as alternative livelihood, schemes, etc. and the rest (12%) do not know. The result from the survey suggests that hunting (41%), habitat loss (22%) and no awareness (19%) among the local people are the major factors that undermine conservation and the rest 10% of the respondents think that low income and poor livelihood opportunities also undermine conservation efforts.

Hunting by local communities is a direct threat to the survival of Hornbills while logging in primary forest is a major threat to their habitat and construction of road in logged areas provides easy accessibility for hunting. Therefore, the need of the hour is to promote research based and community based approach towards conservation. This study is an attempt at creating awareness through research-based approach.

## 1. INTRODUCTION

Northeast India falls under the Indo-Burma biodiversity hotspot accounting for 7000 endemic plants and 528 endemic vertebrates which is 2.3% and 1.9% of the world's total endemic plants and endemic vertebrates respectively (Myers et al., 2000). The region is also home to approximately 135 tribes in India, out of 450 in the country, the culture and customs of which have an important role in figuring out the key issues meant for biodiversity conservation (Chatterjee et al., 2006).

The Indo-Burma biodiversity hotspot contains a total of 1,170 bird species, out of which 140 species are endemic (Myers et al., 2000). Baseline information of avifauna in an area is a prerequisite to assessing the status of birds and the habitat quality with special reference to the indicator species including the rare and endemic species of the region (Kumar & Sivaperuman, 2005). Due to their varied life styles, conspicuousness, and interesting plumage and calls, birds are also regarded as good subjects for exploring a number of questions of ecological and conservation significance (Urfi et al., 2003). They are also ideal bio-indicators and useful models for studying a variety of environmental problems, monitoring and ecological studies (Newton, 1995).

Manipur is a part of the Indo-Burma biodiversity hotspot (Myers et al., 2000, Mittermeier et al., 2004) and two Endemic Bird Areas i.e. Eastern Himalayas and Assam plains (Stattersfield et al., 1998). It covers an area of 22,327 km<sup>2</sup> and is divided into 15 districts. The forest cover of Manipur is very high at 83.51% of the total geographical area (ISFR, 2015). The increase in forest cover from 77.09% (ISFR, 2013) was reported to be due to plantation and conservation activities (ISFR, 2015). Manipur has a protected area network (existing and proposed) of seven in-situ conservation sites, of which two are National Parks and five are Wildlife Sanctuary, and two ex-situ conservation centres, Manipur Zoological Garden and Orchid Preservation Centre.

The state has a rich avifauna with a total record of 607 species, including 3 each of Critically Endangered and Endangered species, and 17 each of Vulnerable and Near Threatened species (Choudhary, 2009). An updated checklist maintains the number at 719 of which 4 are listed as

Critically Endangered, 8 Endangered, 15 Vulnerable and 28 Near Threatened species (Jugeshor, 2014).

The present study focuses on understanding the present distribution, status and threats to conservation of Hornbill species at Kailam Wildlife Sanctuary (KWLS). India is home to nine Hornbill species, two of which are endemic. A total of five Hornbill species are found in Northeast India. Apart from the Great Hornbill *Buceros bicornis*, and Oriental Pied Hornbill *Anthracoceros albirostris*, which also occur in other parts of India, three species occur only in Northeastern part of India; Wreathed *Aceros undulatus*, Rufous-necked *A. nipalensis*, and Austen's Brown *Anorrhinus austeni*.

Habitat loss is a wide-ranging problem with extensive underlying political and economic influences. Habitat of bird species are continuously affected by habitat degradation from logging, firewood collection, shifting cultivation and clearance for agriculture. Due to the remoteness, inaccessibility and political turmoil prevailing in the region no significant research has been undertaken. In view of this, assessment of the status, distribution and conservation threats to these Hornbill species was carried out to develop scientific based protocol.

## **1.1 Background**

Conservation work in Northeast India has always been at a snail's pace especially for the politically conflict state of Manipur. Exceptional cases like the Brow Antlered Deer, One-horned Rhinoceros and a few others have a degree of conservation with support from International Non-Governmental Organisations (NGOs) and the Government of India (GoI). A recent development in the last decade which is worth mentioning is the Nest Adoption Programme by Nature Conservation Foundation (NCF) in Arunachal Pradesh, a scheme specially designed for the conservation of Hornbill species. This programme is a community based conservation program in forests outside PAs where the local communities participate in conservation activities; NCF acts as facilitator. Parallels can be drawn to the proposed KWLS where the Government's conservation programme is stalled due to political tension meanwhile wildlife conservation takes a backseat.

Fortress conservation or the gun and guard approach towards conservation is not an effective process and not a viable solution anymore because of the ever increasing population growth as well as the rise in dependency on natural resources. Man, as part of the natural ecosystem, has a

role in maintaining it and cannot be ruled out. Local communities should be made a part of conservation activity if their resource use is to be denied; meanwhile making them to understand what is at stake. Most problems relating to conservation are site specific and have to be tackled accordingly. Therefore, it is imperative to carry out research work in lesser known but ecologically diverse areas by involving the local people and in the process eking information on how to carry out conservation activities in the best possible way by accumulating information on Traditional Ecological Knowledge and scientific understanding of hornbill ecology.

## **1.2 Objectives**

The main objective of this project is to gather information relating to Hornbills and provide a baseline data for further studies, which may also help in the conservation and management of Hornbill species. The study aims to fulfil the following objectives:-

1. To assess the status and distribution of Hornbill species at KWLS
2. To identify threats to conservation of Hornbill species at KWLS
3. Study the degree of awareness of people on the need for conservation of Hornbills

## **1.3 Research Questions**

The above objectives will be address through the following questions:

### Objective 1

1. How many species of Hornbill are present in the study area?
2. Where are these species found?

### Objective 2

1. What are the threats to conservation of Hornbills?

### Objective 3

1. Do the local people know about the importance of Hornbills?
2. What is their understanding of Hornbills and protected areas?

#### **1.4 Scope and Limitation of the Study**

Baseline information from this study can be used for more intensive research and future surveys. This study would also help to prioritize conservation effort and may also help in future management plans. This study could not cover the whole of KWLS due to limited resources, inaccessibility and short duration/period of the study. Future research work could focus on finding the home range, estimate population density and abundance, what affects their distribution and habitat use of sympatric Hornbill species. The study of Hornbills should be for at least a year to get a proper understanding of their seasonal movement, identification of their feeding habits and the plant species during the flowering season.

The present study could not focus on habitat use due to short duration of the present study period. Therefore, focus is given on recording co-ordinates so that it can be plotted on a map. Sightings are rare because hornbills are hunted in the area and therefore extremely wary (Datta and Rawat, 2003). The present study was carried out in KWLS at Mualnuam, Kaihlam, Umtal, Mualkui, Sinzang, Pamzaal and Sainoujang villages based on accessibility, keeping in mind the short duration of the study period.



## 2. LITERATURE REVIEW

### 2.1 General

Hornbills are adored and admired everywhere, be it for their conspicuous nature, loud calls, casque or their sheer beauty. Hornbills differ from other birds in having a number of common characteristics, which are believed to be evidence of their relatedness and common ancestry (Ahmad, 2013). The most prominent of these characteristics is the development of a casque on the upper mandible of the bill, which is not found in other species (Poonswad, 1991). Hornbills derived their name from this prominent and unique structure of decurved bill and casque (Kemp, 1995). Due to their predominantly frugivorous diet, hornbills have always been considered important agents of seed dispersal in the tropical forest (Datta et al., 2008; Datta, 2009a; Mudappa and Raman, 2008) and thus the focus of much conservation attention.

Hornbills are useful indicators of forest condition and human disturbance because they require large tracts of un-fragmented forest with large fruiting trees for feeding and nesting (Gale & Thongaree, 2006), considered as seed disperser because of their role in the reproductive life histories of many plants (Whitney & Smith, 1998); they are far-ranging in their search for food and drop the seeds of the fruits they eat as they go, dispersing them over a wide area. They also require diverse old-growth forests for feeding and nesting (Raman & Mudappa, 2003). As such, they can be regarded as indicators of high moist forests, ensuring the continuance of forest health and species richness.

According to Gandhi (2000), the most important role of forest birds such as Hornbills is the dispersal of forest tree species. Seed dropping down immediately beneath the canopy of the tree fail to grow successfully on account of predation as large concentration of seeds beneath the parent tree attract predators. Another important reason for the failure of establishment near the parent plant is inadequate sunlight.

Asia harbours 31 species of Hornbills in nine genera and Africa harbours 23 species in five genera. Hornbills (Order Bucerotiformes) are confined to the Afro tropical, Indo-Malayan and Australasian regions. There are a total of 54 recognized species, two ground Hornbills in the Bucorvidae family and 52 'true' Hornbills in the Bucerotidae (Datta, 2001). Most Hornbills occur

in tropical forests; only 13 species occur in more open savannah and woodland habitats, 12 in Africa and 1 in India (Kemp, 1995). There is also growing evidence that Hornbills are of significance in the ecology of those areas of African and Asia graced by their presence. Africa supports a majority of savanna-dwelling species, most of them are carnivorous than frugivorous, while Asian species are almost all forest-living and fruit eating (Kemp, 1995; Kinnaird & O'Brien, 2007).

India is home to nine Hornbill species (Datta, 2001; Mudappa and Raman, 2008) of which five are found in Northeast India; Oriental Pied Hornbill *Anthracoceros albirostris*, Austen's Brown Hornbill *Anorrhinus austeni*, Wreathed Hornbill *Rhyticeros undulates*, Rufous-necked Hornbill *Aceros nipalensis* and Great Hornbill *Buceros bicornis*. Wreathed, Rufous-necked and Austen's Brown Hornbill are restricted to Northeast India showing their biogeographical affinity with South-east Asia (Datta, 2001). The other two, Oriental Pied Hornbill and Great Hornbill have a wider range and are found in different parts of India. The table below (table 1) shows the current status of the Hornbill species found in Northeast India.

**Table 1 Table showing current global Status of Hornbills found in Northeast India (Birdlife International, 2017b)**

Sl. no.	Species	Population size	Population trend	Distribution ( km <sup>2</sup> )	Altitude (m)
1	Oriental Pied Hornbill	Unknown	Stable	10,700,000	0-700
2	Brown Hornbill	Unknown	Decreasing	1,650,000	0-1800
3	Wreathed Hornbill	Unknown	Decreasing	7,020,000	0-2560
4	Great Hornbill	13,000-27,000	Decreasing	10,300,000	0-2000
5	Rufous necked Hornbill	1,500-7,000	Decreasing	1,300,000	150-2200

An important factor that might explain patterns of distribution of Hornbills is the number of sympatric species in a given area. In India, a total of nine species occur, but in any given area, no more than four species occur together. In most areas only two species occur together. Only in Northeast India, where plant diversity is greater (Hajra et al., 1996), there are five species, but

here too, in most areas no more than four species co-exist together probably because of fine-scale differences in habitat preferences among species (Datta, 2001).

Hornbills are secondary cavity nesters, using natural cavities or those excavated by other birds (Kemp, 1995). They use natural cavities in trees, crevices in rock faces or holes in mudbanks and have a peculiar and unique nest hole sealing habit with the female confined in the nest during the breeding season (Datta, 2001) and leaves only a narrow slit through which the male provides food to the female until the nesting period is completed (Santhoshkumar and Balasubramanian, 2010). The female remains there for most of the nesting period and often show high nest fidelity, returning to the same nest cavity year after year (Kemp, 1995).

The breeding and nesting season are generally timed with the peak in fruiting where the availability of fruiting trees and suitable nest sites are considered the prime factors that determines the nest site selection in Hornbills (Kannan, 1994; Kannan and James, 1997; Poonswad et al., 1999). Reports of Hornbill nest characteristics are mainly from the tropical wet forests, which have high plant species richness and less seasonality with respect to reproductive phenology (Shukla et al., 2015).

There is some variation between Hornbill species in the timing of the female's emergence or whether assistance is available to the male from members of a group (Poonswad et al. 2004). Species also differ in size, duration of the nesting cycle and number of eggs laid and chicks raised (Poonswad et al., 1987; Kemp, 1995). Hornbills are generally monogamous as a consequence of the dependence of the female and young on the male for food, and the inability of the male to provision two females simultaneously (Leighton, 1986).

## **2.2 Conservation Issues**

All Hornbills in India, except the Indian Grey Hornbill *Ocyceros birostris* and the Malabar Grey Hornbill *Ocyceros griseus*, are rare and threatened, and have been placed under Schedule I of the Indian Wildlife (Protection) Act, 1972 (Datta, 1998; Mudappa and Raman, 2009). According to Bird life International (2017a), the Rufous-necked Hornbill, Austen's brown Hornbill and Great Hornbill, and the Oriental Pied Hornbill and Wreathed Hornbill are listed as Vulnerable, Near Threatened and Least Concern respectively in the IUCN red list category. The Great Hornbill and Rufous-necked Hornbill are placed under Appendix I of CITIES while Brown Hornbill,

Wreathed Hornbill and Oriental Pied Hornbills are placed under Appendix II which effectively prohibits commercial trading of these species both at the International and National market.

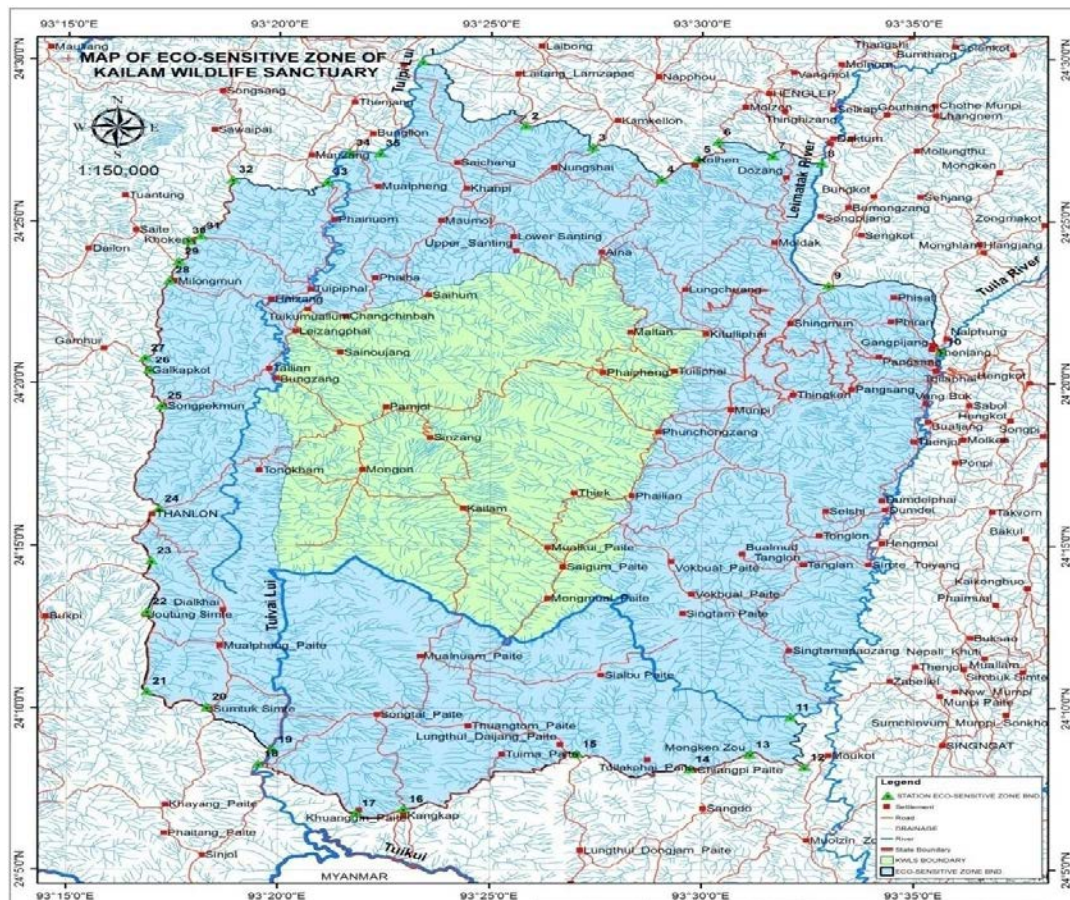
### **2.3 Threats**

Most Hornbill species are highly vulnerable mainly due to their primarily frugivorous diet and the consequent dependence on a resource which may be patchy in time and space, their specialized nesting requirements, and reported nomadic behaviour of some species (Leighton and Leighton, 1983; Poonswad and Tsuji, 1994; Suryadi et al., 1998) and dependence on large tracts of primary forest (Datta, 2001). The population trend of all Hornbill species found in Northeast India is decreasing except for the Oriental Pied Hornbill which is stable. Hunting and habitat loss are the major threats to these Hornbill species (Birdlife International, 2017b). Hunting of all Hornbill species, by most tribal communities is a major threat and a primary cause of Hornbill decline in many areas (Datta, 2009b). Logging activities and construction of road in logged areas has lead to increased accessibility for hunting (Datta, 1998).

### 3. MATERIALS AND METHODS

#### 3.1 Study Area

Kailam Wildlife Sanctuary is located at Kailam-Tipaimukh, Churachandpur district covering an area of 187.50 sq. km (Fig 1). The area falls under the Indo-Burma region of the biodiversity hotspots declared by Conservation International. It is geographically located at 93° 25.00' E longitude and 24°12.00' N latitude with an altitude ranging from 500 - 2,018 m above msl. The greater part of the Sanctuary falls in Biome-9 (Indo-Chinese Tropical Moist Forest) and in the higher reaches Sino-Himalayan Subtropical Forest (Biome-8) is seen (BirdLife International, 2017b).



**Figure 1 Map of Kailam Wildlife Sanctuary and its eco-sensitive zone (Source: Forest Department, Manipur)**

The terrain is mainly hilly, with a large number of streams, and thick forested hillsides covered with Tropical Evergreen and Semi-evergreen Forests and Bamboo brakes. It acts as a catchment area for Tuivai River and provides habitat for many species of flora and fauna.



**Plate 1 Different views of Kailam Wildlife Sanctuary a) View of Tuivai River b) View of Kailam Village c) View of proposed Kailam Wildlife Sanctuary from Kailam village**

KWLS is home to five species of Hornbills; Brown *Anorrhinus tickelli*, Rufous-necked *Aceros nipalensis*, Great Pied *Buceros bicornis*, Wreathed *Aceros undulatus* and Oriental Pied *Anthracoceros albirostris*. Apart from this, Leopard *Panthera pardus*, Golden Cat *Catopuma temmincki*, Serow *Capricornis sumatraensis*, Hoolock Gibbon *Hylobates hoolock*, Stump-tailed Macaque *Macaca arctoides*, Asiatic Black Bear *Ursus thibetanus*, Chinese Pangolin *Mainis pentadactyla*, Eurasian Otter *Lutra lutra* and Chinese Ghoral *Naemorhaedus griseus* are also present.

There are 135 tree species, 119 herb species, 80 shrub species and a combination of 68 grass and bamboo species recorded in the Southern Forest Division (Sharma, 2010). The general soil of the District is alluvial and red sandy. The climate of the district is generally cool and pleasant. The average annual temperature ranges from 5°-35°C. The average annual rainfall is about 1800 mm. The Western part of the district receives less rainfall compared to the Eastern and Northern part. Henglep area receives the highest rainfall which may exceed 2800 mm. Humidity is high ranging from 67 to 100.

### People and Culture

KWLS covers a total of 20 villages and another 59 villages under its' eco-sensitive zone. The land holding system in these villages is that of Chieftainship where the Chief is the owner of the land and has full authority over its use. The area is predominantly inhabited by tribal people called Zomi (The Zo people), a conglomeration of different tribes recognised by the Government of India as Paite, Simte, Zo, Sukte, Vaiphei, Thadou and Hmar. The age-old traditional system of agriculture i.e. shifting cultivation or slash and burn is still practised. The area to be cultivated is specified at the beginning of the year by the Village Chief and his Village Council members and allocation of land for cultivation is done through draw of lots (numbers) where the person who picks the first number gets to choose the area first and so on. In shifting cultivation, there is no permanent tenancy system as the jhum land is cultivated for a year and allowed to lay fallow for regeneration. The fallow period differs depending on the size of the village and number of household, usually 4-5 years but may even go up to 20 years.

The village economy is more or less a subsistence economy where most of the requirements are met within the family or the village. Normally, the entire household would be involved in cultivation which is mainly paddy with patches of vegetables; some households may also maintain plantations of banana, ginger, chilli, etc. Skilled artisans such as blacksmith, weavers, handicrafts, etc are also present in villages but these vocations are undertaken as an added activity to agriculture (Summinlun, 2016). They also rely heavily on hunting wild animals, fishing, logging of wood and rearing of animals such as Goat, Cow, Pig, Mithun (*Bos frontalis*), etc to supplement their meagre income. Most of these animals are free-ranging. Goods and services evaluation of forest resources used by local people in Churachandpur District is as shown in Table 2. This shows very high dependency on forest resources.

**Table 2 Valuation of goods and services extracted from the forest, Churachandpur District, Manipur (Bisht and Singsit, 2011).**

Sl. No.	Goods & Services	% of Household (HH)	Average quantity used by HH	Total no. of HH	Quantity	Value (INR)
1.	Timber	86.67	1.02 (m <sup>3</sup> )	32929	33587.58 (m <sup>3</sup> )	9,43,81,100
2.	Fuel wood	87	3663 (kg)	32929	120618927 (kg)	36,18,56,781
3.	Charcoal	66.67	50 (kg)	25331	1266550 (kg)	12,66,550
4.	Bamboo Culms	51	273 (nos.)	20891	5703243 (nos.)	11,40,64,860
5.	Bamboo shoots	82.00	55 (kg)	31146	1715278 (kg)	2,57,29,176
6.	Vegetables	85	500(Rupees)	32295		1,61,47,500
7.	Medicinal plants	60		22796		22,79,600
8.	Mushrooms	22	250(Rupees)	8356		20,89,000
9.	Grazing					20,73,08,320

### Issues and Problems

The area was notified and declared to be a Wildlife Sanctuary on 18<sup>th</sup> June, 1997 (Appendix I) by the Governor of Manipur by exercising the powers conferred by sub-section (1) of Section 18 of the Indian Wildlife (Protection) Act, 1972. The Collector is required to publish (Section 21) in the regional language in every town and village or in the neighbourhood of the area regarding the situation and limits of the Sanctuary and determine rights (Section 19) within the limits of the Sanctuary. The notification has not been published in any vernacular language and no settlement of rights has been carried out so far. As such, village chiefs from the affected area has written a petition (Appendix II) challenging the Declaration/Proclamation of KWLS and filed a case for the same at the High Court of Manipur citing failure to carry out Section 19 and 21 of the Indian Wildlife (Protection) Act, 1972 after the area was notified to be a Sanctuary.

A fragmented society with a legacy of exclusionary social practices in the Valley and the state leaders' sharpening their Meitei identity to create a Meitei core of new state resulted in counter mobilization by tribal leaders with clear separatist objective where the chiefs' association and tribal councils are the most active in politics in Hill districts (Hassan, 2008). Therefore, it is not surprising that most of the tribal people consider the proposed KWLS to be an ulterior motive of the Meiteis' to grab tribal land using the Government as a functionary.



## 3.2 Methodology

### Status and Distribution

- ❖ The data was collected from 4 stations - Mualnuam, Kaihlam, Tuivai and Sinzang - using transect line technique to survey species presence in the study area for a duration of 4 months (February to May). A total of 313.5 km was covered in 24 line transects with an average distance of 5.9 km for each line transect. Transects were walked between 6:30 am to 11:00 am in the morning and from 2:00 pm to 6:00 pm in the afternoon. Locations of sightings were noted using GPS (Garmin etrex 20) and the same device is used to measure track distance. Calls and visual sightings (Bushnell H2O binocular 8x42) were used to confirm species presence.
- ❖ Habitat parameters are defined as 1) primary forest - presence of old growth trees and where no cultivation has been carried out in the last century. 2) Secondary forest, areas where trees have regenerated and have been as such for the past 2 to 3 decades. 3) Riverine forest – forest near rivers. 4) Cultivation areas are areas where shifting cultivation is currently practised.
- ❖ Disturbance such as presence of vehicular road nearby, logging activity, hunting and trapping of wild animals, forest fire and farming were noted. Two anthropogenic factors (distance to village and distance from road) which were identified as directly or indirectly affecting patterns of abundance and distribution of Hornbills (Poonswad, 1993; O'Brien et al., 1998; Sitompul et al., 2004; Kinnaird and O'Brien, 2007) were also noted.
- ❖ Toposheet of KWLS and its eco-sensitive zone was obtained from Manipur Forest Department. This was geo-referenced using ERDAS software by entering Ground Control Points manually with the help of Grid reference given in the toposheet.
- ❖ Using feature construction tools in ArcGIS, location of Station and Hornbill species were plotted in the map. Legends, scale text and scale were added using Layout view.

### Checklist of Birds

- ❖ A list of birds found during the study period was prepared. All records were based on opportunistic sightings and calls with inputs from the locals. Identification was done by

comparing the photographs taken with Bird field guide by Grimmett et al. (2011) and Grewal et al. (2016).

- ❖ Some individuals from the local Paite tribe, who have an intimate knowledge of birds in the area, were interviewed. Interviews included showing them field guides and photographs of birds and noting down the species that were known to them from various habitats. Additionally, Paite names for the bird species were recorded.

### Questionnaire Survey

- ❖ Questionnaire based survey was carried out in randomly selected households in select villages based on accessibility, keeping in mind the short duration of the study period. A total of 129 households from six villages - Mualnuam, Umtal, Kaihlam, Mualkui, Pamzaal and Sainoujang – were sampled to assess their dependence on forest resources as well as to understand their perception towards conservation.
- ❖ Data on 30 parameters (Appendix IV) were collected to extract information on livelihood, dependence on forest, land use pattern, awareness and threats to conservation
- ❖ The data obtained was analysed using MS Excel and SPSS.

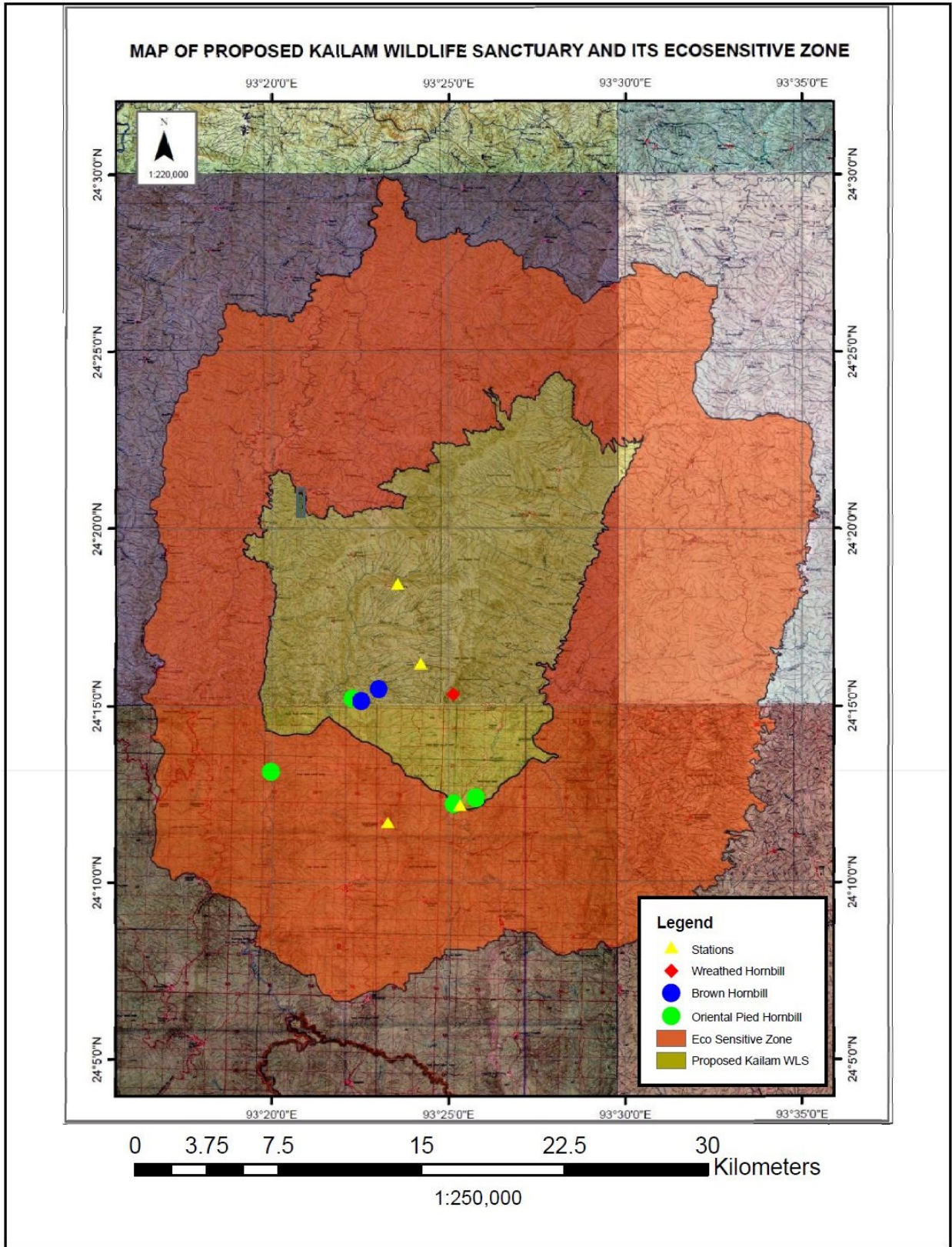
## 4. RESULTS

### 4.1 Status and Distribution

In 313.5 km of total sampling effort Wreathed Hornbill was sighted in 1 location, Brown Hornbill (Plate 2a) in two locations and Oriental Pied Hornbill (Plate 2b) in 4 locations. The table below (Table 3) show details of sighting, providing information on the location, elevation, habitat type and distance to village. A map was prepared showing locations of our Station and the locations of sightings (Figure 2).

**Table 3 Table showing current status of Hornbill species found at Kailam Wildlife Sanctuary.**

Sl. No.	Date	Location	Elevation (m)	Habitat	Distance from village (km)
<b>Wreathed Hornbill (WH)</b>					
1	02-04-2017	N 24°15'19.76"	1447	Secondary forest	2.8
		E 093°25'07.09"			
<b>Brown Hornbill (BH)</b>					
1	23-02-2017	N 24°15'08.20"	780	Primary forest	7.9
		E 093°22'31.18"			
2	24-02-2017	N 24°15'28.67"	966	Primary forest	7.4
		E 093°23'01.32"			
<b>Oriental Pied Hornbill (OPH)</b>					
1	24-03-2017	N 24°15'12.38"	723	Primary forest	8.3
		E 093°22'16.80"			
2	12-04-2017	N 24°12'23'99"	628	Primary forest	3.2
		E 093°25'45.66"			
3	01-05-2017	N 24°13'06.88"	484	Riverine	9.5
		E 093°19'58.24"			
4	04-05-2017	N 24°24'13.68"	546	Riverine/Near Cultivation	7.2
		E 093°25'08.47"			



**Figure 2 Map showing study area and locations of birds and sampling station.**



**Plate 2 (a) Austen's Brown Hornbill (b) Oriental Pied Hornbill**

During the three month survey of status and distribution of Hornbills, Wreathed Hornbill was sighted only once, Brown hornbill was sighted four times and Oriental Pied Hornbill seven times (Table 4). Most sightings were in primary forests and riverine forests except one sighting in secondary forest. A total of 2 Wreathed Hornbills were sighted, 15-21 Brown Hornbills and 10 Oriental Pied Hornbills. The average sighting distance of Hornbill from a village is 6.6 km.

**Table 4 Details of sighting of Hornbills in Kailam Wildlife Sanctuary, Manipur**

Species	No. of Locations	No. of sightings	Total no. of individuals sighted
Wreathed Hornbill	1	1	2
Brown Hornbill	2	4	15-21
Oriental Pied Hornbill	4	7	10

Apendix III shows diet of hornbills, kinds of site specific disturbances found and the elevation of sightings. Four tree species were identified as being used by Hornbills, three of which is a food tree species (*Aphanomixis polystachya*, *Ficus sunndaica* and *Ficus spp.*) and one is a nest tree species (Unknown *spp.*). Types of disturbances found at the site of sighting are hunting, logging, vehicular road, trapping and forest fire. Hunting is the most common disturbances found at all

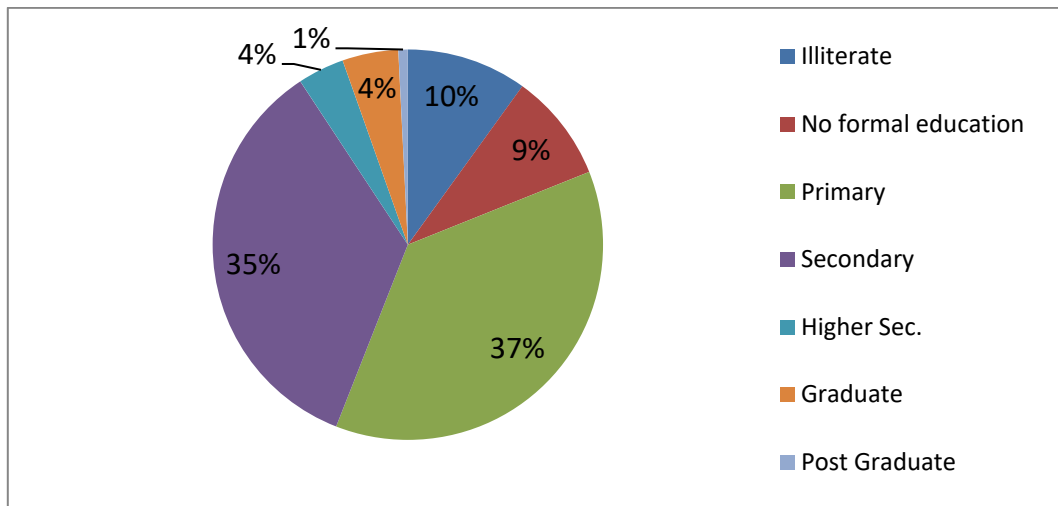
sites, followed by trapping, logging, vehicular road and forest fire. All hornbill species were observed within the altitudinal range of 450-1500 m. Oriental Pied Hornbills were observed between 450-750 m, Brown Hornbills between 750-1000 m and Wreathed Hornbill between 1400-1500 m.

A checklist of birds (Appendix V) found in the study area was also prepared. A total of 145 bird species from 34 families were recorded.

## 4.2 Questionnaire Survey

### Socio-economic profile of the respondents

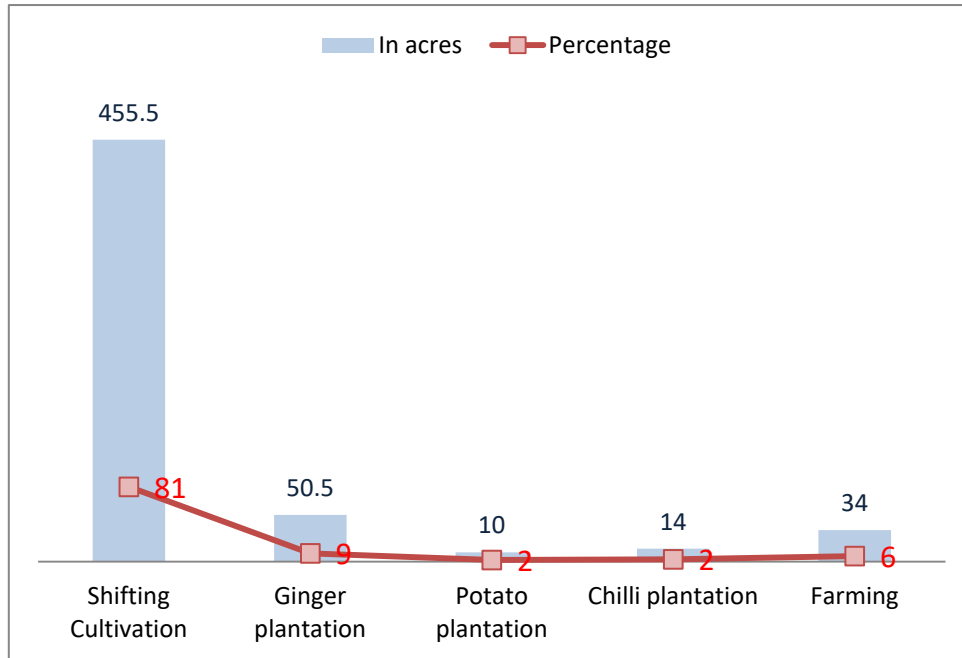
The mean family size of respondents (82.95% Male, 17.05% Female) is 6 where 90% of the respondents were literate of which 81% had studied at least till the primary level (Fig 3). There is no significant difference between gender and education ( $\chi^2(3) = 3.855, p > 0.05$ ). The main occupation of the respondents is shifting cultivation (88.37%), followed by Business (4.65%), Mission worker (3.88%), Government Service (0.78%), House wife (1.55%) and weaving (0.78%). Secondary occupation includes labour (27.91), business (8.53%), vegetable collection (28.68%), plantation (6.20%) and others (15.51%).



**Figure 3 Educational profiles of respondents in Kailam Wildlife Sanctuary, Manipur**

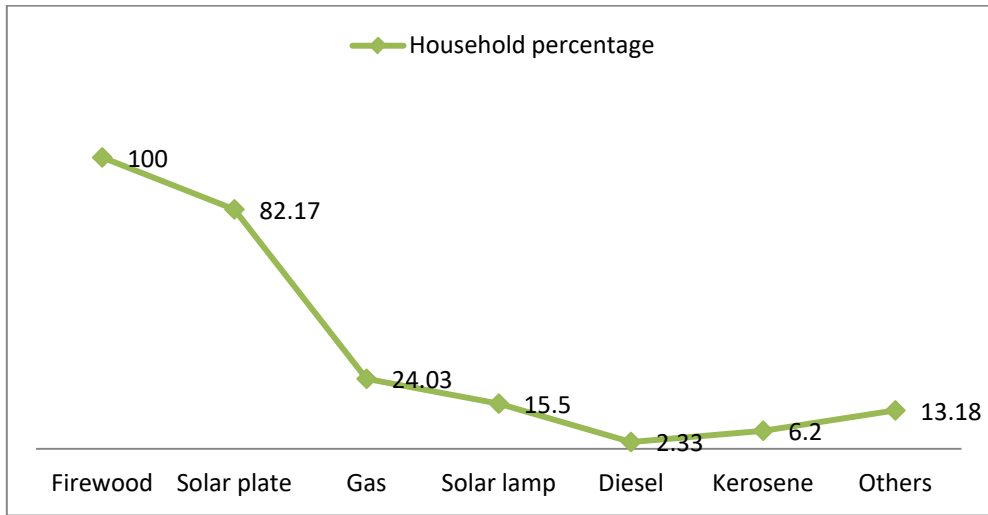
The average annual income is around 40,900 INR where 10.01% comes from livestock and another 10.74% from resources collected from the forest, the majority of which is from fish and timber. Gender, family and landholding does not have any significant relationship with annual

income ( $p > 0.05$ ) however educational qualification shows significant effect on annual income;  $\chi^2(6) = 12.692$ ,  $p < 0.05$ . The average land holding size is 4.37 acres, where 81% constitutes shifting cultivation, followed by ginger plantation (9%), chilli (2%), potato (2%) and farms (6%) as shown in Figure 4. 25.58 % of the respondents have land property or plots in the town area.



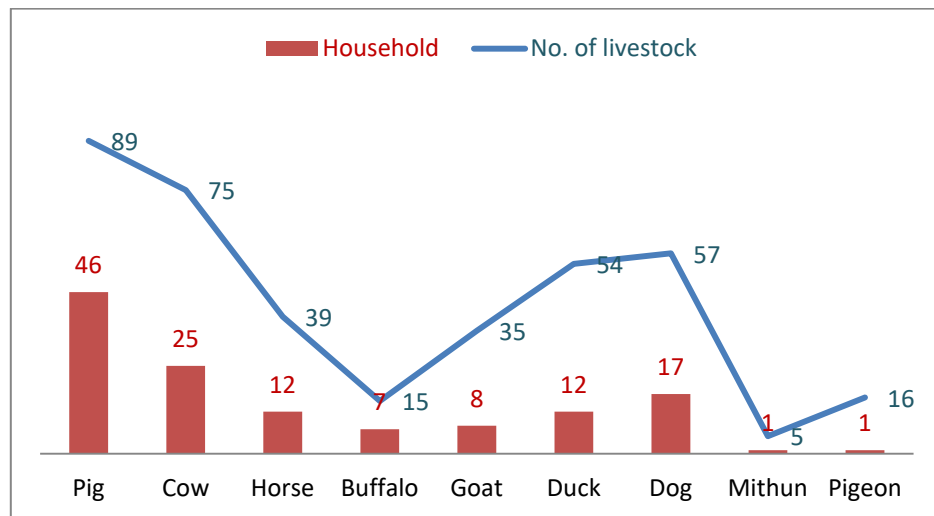
**Figure 4 Land use of respondents at Kailam Wildlife Sanctuary, Manipur**

Firewood/Fuelwood is the most common source of energy. It is used by every household (Fig 5) followed by Solar energy; solar plate (82.17) and solar lamp (15.5), Gas (24.03), Kerosene (6.2), Diesel (2.33) and Others (Petrol, electricity, candles and inverter) (13.18).



**Figure 5 Percentages of type of energy used by household in Kailam Wildlife Sanctuary, Manipur**

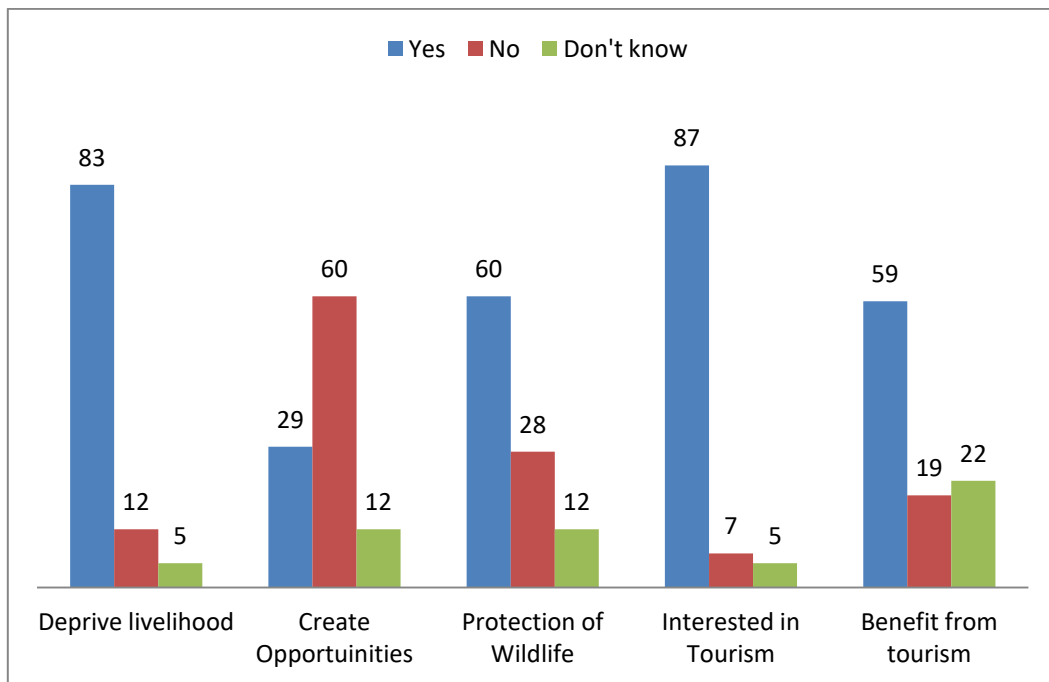
A total of 1238 poultry is reared by 99 households and is the most common livestock owned by the local communities. Livestock other than poultry that are reared, population and number of household owning them are given in Fig 6. Pig rearing is the most common with 46 households (hh) owning 89 pigs, followed by 77 cows owned by 25 households, 27 Dogs (17 hh), 39 Horses (12 hh), 54 Ducks (12 hh), 35 Goats (8 hh), 15 Buffaloes (7 hh), 5 Mithuns (1 hh) and 16 Pigeons (1 hh).



**Figure 6 No. individual of livestock (except poultry) owned by households in Kailam Wildlife Sanctuary, Manipur**



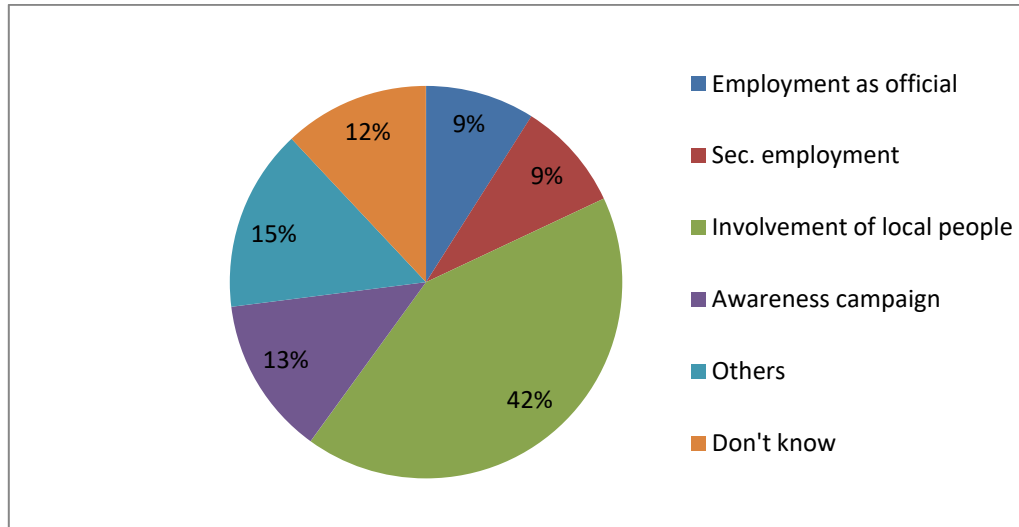
Of the 129 respondents 82.95% (n=107) were aware that the area is a proposed Wildlife Sanctuary while the rest 17.05 (n=22) were not aware about it. Only 29% of the respondent knew the objective of a protected area while the rest 71% have no idea about it. As many as 55% of the respondent knew about the proposed KWLS through social conversation, only 15% of them got to know about it from Forest Department officials and sitting MLAs while the rest got to know about it from different sources ranging from newspapers and magazines to awareness campaigns. Fig 7 provides data on respondents' attitude towards the creation of KWLS and protection of wildlife.



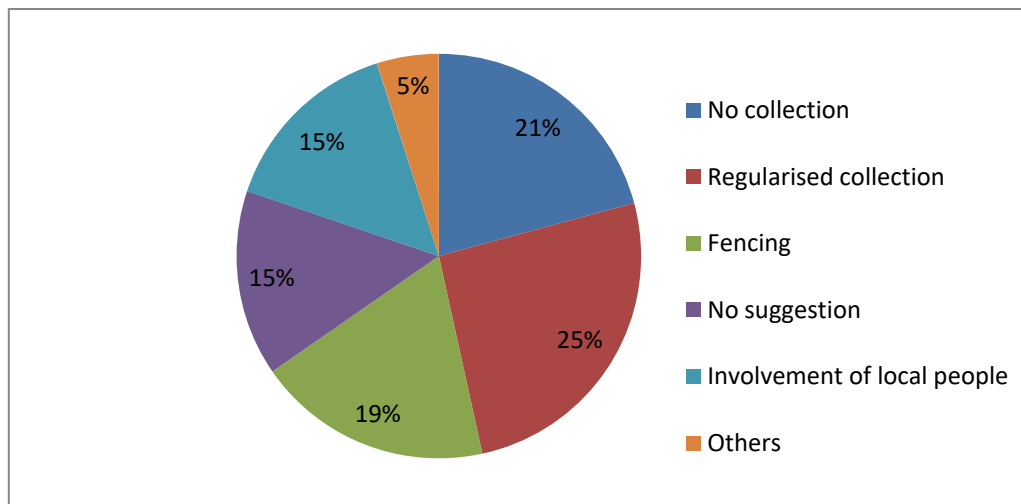
**Figure 7 Percentage of awareness in Kailam Wildlife Sanctuary, Manipur**

The majority of respondents think that the creation of KWLS would deprive them of their livelihood (n=107) and would not create opportunities (n=77). 60% (n=77) of the respondent thinks that wildlife needs to be protected. Meanwhile 87% (n=112) are interested in tourism and 59% (n=76) of the total respondent thinks they will benefit from tourism. To improve relations between forest department and local people, a majority of the respondents feel that they should involve local people in decision making and management plans (42%), followed by employment (18%) - employment as official (9%) and secondary employment (9%) - awareness campaigns (13%), others (15%) such as alternative livelihood, schemes, etc. and the rest (12%) do not know

(Fig 8). Suggestions to wildlife habitat are no collection (21%), regularised collection (25%), fencing 19%), involvement of local people (15%), others (15%) – no hunting, alternative livelihood to hunters, etc. while the rest (5%) have no suggestions (Fig 9).



**Figure 8 Response to opinion on how to improve relations between local people and Forest Department in Kailam Wildlife Sanctuary, Manipur**



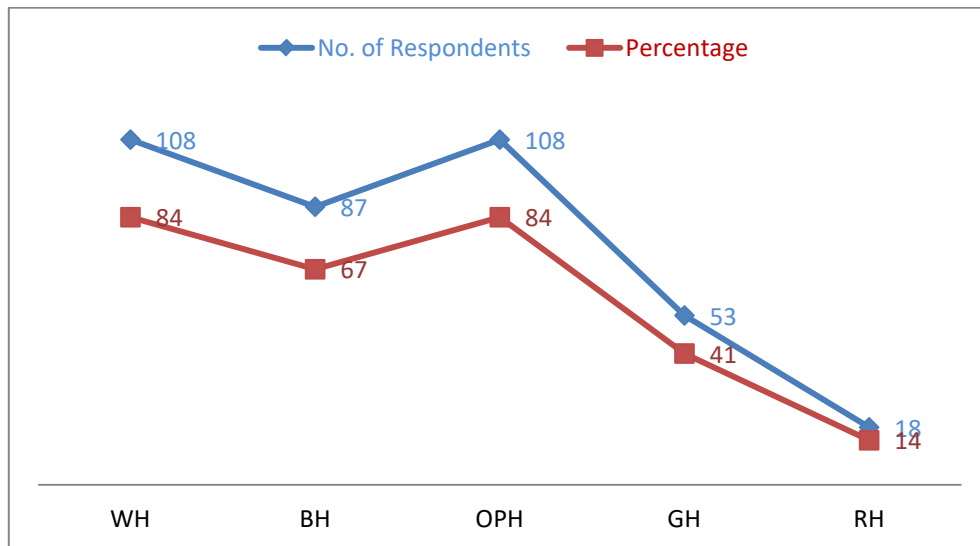
**Figure 9 Suggestions to improve wildlife habitat in Kailam Wildlife Sanctuary, Manipur**  
Socio-economic and attitude relations

Males and females differed in their awareness about the proposed wildlife sanctuary ( $p < 0.005$ ). More males (86%) were aware about the creation of a protected area compared to females (55%). A significant difference was also found in the number of Hornbill species seen by male and

female respondents ( $p < 0.001$ ). Only 1% of male respondents have never seen any hornbill species compared to 18% for females (residual value = 3.4). However, gender difference, education and annual income does not have any significant effect on the attitude towards protection of Hornbills ( $p > 0.05$ ). About 92% and 86% of male and female respondents respectively thinks that there is a need to protect Hornbills.

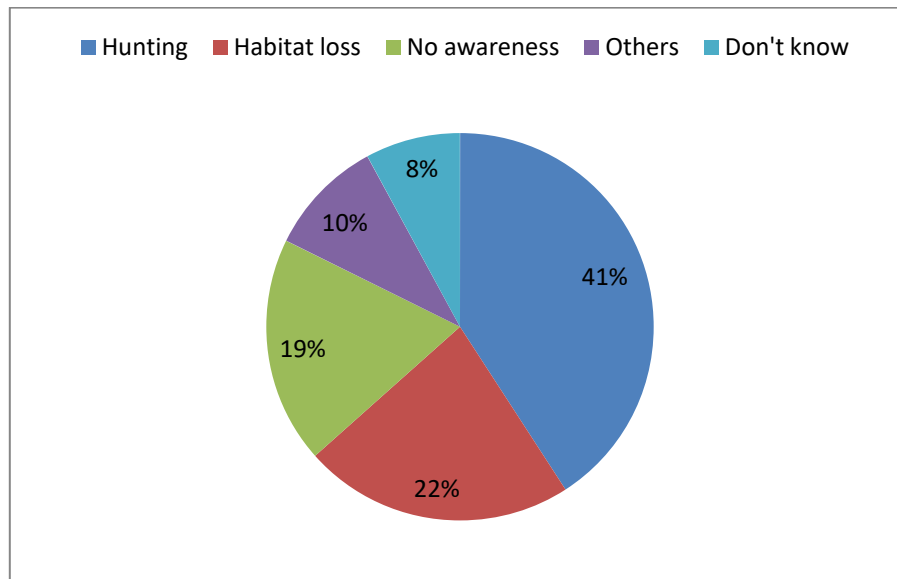
#### Sighting frequency and threats

Wreathed hornbill and Oriental Pied Hornbill was sighted by 84% of the respondents followed by Brown hornbill 67%, Great Hornbill 41% and Rufous-necked Hornbill 14% respectively (Fig. 10).



**Figure 10 Percentage sighting of Hornbill species by respondents in Kailam Wildlife Sanctuary, Manipur (WH-Wreathed Hornbill, BH- Brown Hornbill, OPH-Oriental Pied Hornbill, GH-Great Hornbill, RH-Rufous-necked Hornbill)**

The result from the survey suggests that hunting (41%), habitat loss (22%) and no awareness (19%) among the local people are the major factors that undermine conservation while the rest 10% of the respondents think that low income and poor livelihood opportunities also undermine conservation efforts (Fig 11).



**Figure 11 Factors that undermine conservation in Kailam Wildlife Sanctuary, Manipur**

## 5. DISCUSSION

### 5.1 Status and Distribution

The study area is known to harbour five species of Hornbills (Birdlife International, 2017b), of which only three species were observed during the study period. Observations by tribal communities indicate that Brown hornbill and Oriental Pied hornbill are local residents as they are found within the study area throughout the year. Wreathed Hornbill and Great Hornbill are found seasonally while Rufous-necked Hornbill is seen very rarely.

The status of Hornbills, as per sighting record and questionnaire survey, is that Wreathed Hornbills are very rare during the breeding season but may be seen occasionally during the non-breeding season, whereas Brown Hornbill and Oriental Pied Hornbill have a healthy population but may become rare if their population is left unchecked. The distribution of Hornbills in KWLS is a factor of habitat as can be seen from Table 3. They prefer primary forest and riverine forest. Brown Hornbills are restricted to small localized areas, Oriental Pied Hornbills are more widely distributed across different habitat types in the study areas whereas Wreathed Hornbills move long distances and as such are found seasonally. The one sighting of Wreathed Hornbill in secondary forest was in-flight while other sightings in primary and riverine forest are of feeding or perching. Most of the sightings were very far from the village areas (approx. 6.6 km) suggesting that Hornbills prefer to stay away from human habitation. This may be due to hunting pressure. Occasional sightings, as reported by locals, from villages were of Wreathed Hornbills flying in flocks of 10-20 in numbers.

The global range of Austen's brown Hornbill is Northeast India, Myanmar, Thailand, Laos, Vietnam and Southern China. The distribution is restricted to Eastern Arunachal Pradesh and Assam (Datta, 2009b). Austen's Brown Hornbill was sighted at two locations (780 m and 966 m) which is well within range of below 1000 m as observed by Naniwadekar and Datta (2013) in Arunachal Pradesh. On both the occasions, they were seen feeding on *Aphanomixis polystachya* and *Ficus sundaica*. This is the first record of Austen's Brown Hornbill in Manipur. Earlier report of similar Hornbill (Tickell's Brown Hornbill) was from Ukhrul District (Choudhury, 2009).



**Plate 3 Oriental Pied Hornbill (a) Pair, 25-03-2017 (b) Male, 09-05-2017**

Oriental Pied Hornbill is a widespread resident in northern South Asia, southern China, Indochina and Western Indonesia. In India, it occurs in the Northern and Northeast India. A nest and three other independent sightings were recorded at different locations (Table 3). Their occurrence in disturbed, riverine forests and edges is similar to observations on habitat use in Arunachal Pradesh (Datta, 1998; Datta and Rawat, 2003). Although a nest was found, no attempts were made to study diet composition from droppings as it may hamper successful nesting. Datta (2009b) observed that Hornbills do nest in logged and degraded forest, though these attempts are often unsuccessful, mainly due to anthropogenic disturbance. Plate 3 shows successful nesting.

Wreathed Hornbill occurs in the Indo-Malayan realm and is exclusive to the north eastern region in India. Locally, it is reported to visit KWLS seasonally with densities peaking during autumn season and early winter coinciding with the fruiting of *Phoebe hainensiana* (Hualsing) and *Canarium resiniferum* (Begaw). This seasonal movement of Hornbills were also observed in Nadampha Tiger Reserve, Arunachal Pradesh (Naniwadekar and Datta, 2013). An opportunistic sighting of pair in-flight was recorded (Table 3) which is earlier than expected for a sighting of Wreathed Hornbill. This suggests that there could be Wreathed Hornbills residing or breeding in

the area. The most recent report of sighting in Manipur was in Imphal East District near Manipur-Assam Border (Choudhury, 2009).

Hornbills were a common sight in the area 40-50 years ago. According to Khamsuanmung (pers. comm.), one of major factors that lead to a rapid decline in their population is excessive logging of *Tetrameles nudiflora* along Tuivai river. *Tetrameles nudiflora* is the most common nesting tree used by Hornbills in the foothill forest in Western Arunachal (Datta, 2009b).

## 5.2 Threats to Conservation

Hunting by hill tribes, encroachment of primary forest for farming, logging and poor law enforcement are the major threats to conservation resulting in the decline of Hornbill (Pattanavibool et al., 2004; Datta, 2009b, Trisurat et al., 2013). State's law and enforcement presence (the police, court houses, and the like) is negligible throughout much of the Hill Districts (Hassan, 2008) as such there is no mechanism to check activities like hunting and illegal logging (Plate 4, 5).



**Plate 4 Disturbances; cultivation (a,c) logging (b) at Kailam Wildlife Sanctuary, Manipur**

People's perception towards conservation of hornbill is positive with 91% of the respondents felt the need to protect Hornbills and 77% thinks the Government should play active role in the

conservation of Hornbills. However, only 60% of the respondents feel the need to protect wildlife in general. This may be due to the fact that there is no conflict of interest w.r.t. Hornbill but wildlife such as Wild boar *Sus scrofa*, Red jungle fowl *Gallus gallus* etc. which directly affects their livelihood as they destroy crops in cultivation areas. Although the people are aware about the declining population trend of Hornbills over the years, they feel that protection of Hornbill will never be effective as long as there is no active intervention from a higher authority viz. Forest Department, Village Chiefs, Civil society, etc.



**Plate 5 Heads/beaks of Hornbills owned by villagers; Oriental Pied Hornbill (a), Brown Hornbill (b, c) at Kailam Wildlife Sanctuary, Manipur**

Hornbills are considered important mainly for their aesthetic value (59%), cultural value (13%) and the rest (28%) - for their meat, medicinal purposes, feathers and casques. Hunting of Hornbills is taboo in many areas as it is in Arunachal Pradesh (Datta, 2009b) especially during the breeding season but that does not deter them from hunting. Hunting is considered a taboo during the breeding season because killing a Hornbill means killing a family of Hornbills. Hunting of Hornbills is mainly opportunistic as the tribal people do not go into the forest just to hunt for Hornbills. Hunting is a major threat mainly to wild boar *Sus scrofa*, Barking deer *Muntiacus muntjak*, Serow *Capricornis sumatraensis*, Chinese Goral *Naemorhaedus griseus* and Swamp deer *Cervus unicolor*, but hunts Hornbills if they happen to see them or if they find



nothing else during hunting. The wreathed Hornbill is prized for its medicinal value (fats are used as ointment for treating sprain, joint pains, burns, etc), feathers (used in traditional headgear for folk dances) and owning a casque is a pride and honour for the tribal people.

Shifting cultivation landscapes supported an impressive diversity of forest species and also fared better than plantations in retaining habitat structure and in the density of native trees, bamboo and forest birds (Mandal and Raman, 2016). Moreover, it does not pose an imminent threat to the conservation of Hornbills and the distribution of hornbill as they pertain to primary forest. Shifting cultivation areas are usually closer to villages whereas primary forests are further away from the village. The average distance of sighting of Hornbills from the village is 6.6 km (Table 3), where primary forest begins. However, 5-10 year cycles in shifting cultivation are inadequate to conserve forest birds and woody plant communities, as such it essential to demarcate and protect areas of primary and late-successional forests in order to achieve conservation goals (Raman et al., 1998). This is also true for conservation of Hornbills as the primary threat to their survival is logging and hunting in these areas.

## 6. CONCLUSION

Hassan (2008) suggests that a good starting point for societies in the Northeast driven by conflict and instability might be to promote political cultures of rights and citizenship, expand public spaces from within, and see how participatory strategies could help with peace building. More generally, actions around local issues particularly those that are about inclusionary participation mechanisms, such as through public action for provision of public services-health, education, livelihood, justice and the like- will need to be pursued. An institution-building work in India would be best attempted around micro-level solutions directly affecting citizens.

The above still holds true even for an effective conservation management strategy. Implementation of fortress conservation is not the right solution at the present situation. It will only antagonize the local communities who are more or less fully dependent on the forest for their livelihood. Research-based and community-based conservation are the most effective conservation measure with emphasis on intrinsic value of natural resources rather than focussing on the economic benefits and to help transform an economically based community to altruistic community (Poonswad et al., 2013).

Hassan (2008) observed that state's law and enforcement presence (the police, court houses, and the like) and provisions for public services-health, education, livelihood and the like are negligible throughout much of the Hill Districts of Manipur. As long as these basic problems of the local communities remain, they will rely on the only means of survival they know. However, the people are willing to change, given alternatives and due consideration to their needs. Involvement of local community has been successful in removing threat to poaching of Hornbills and also ensures continued co-existence of humans and Hornbills (Poonswad et al., 2005; Poonswad et al., 2013; Naniwadekar et al., 2014).

Hunting is particularly intense in the remote Indo-Myanmar and Eastern Himalaya hotspot complex of north eastern India, compared with Western Ghats, Western Himalayas and Nicobar Islands (Velho et al., 2012). Therefore, a systematic strategy has to be chalked up sooner than later to protect wildlife in general. Hornbills should be used as flagship species for conservation. A research centre for Hornbills needs to be developed where local communities may be allowed to participate so that they may get benefits from it. Local people should be involved in

identification, monitoring and protection of nest, roost sites and food tree species to ensure long term protection of Hornbills and wildlife at specific sites. Lack of awareness is a major factor responsible for reckless hunting as such more awareness campaigns on the ecological implications of hunting should be conducted more often especially among the youth to make them understand the need for conservation.

## 7. REFERENCES

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## APPENDIX

## Appendix I

A Notification by the Government of Manipur declaring Kailam Wildlife Sanctuary on 18<sup>th</sup> June 1997.



Manipur Gazette

EXTRAORDINARY  
PUBLISHED BY AUTHORITY

No. 129 Imphal, Wednesday, July 2, 1997 (Asadha 11, 1919)

GOVERNMENT OF MANIPUR  
SECRETARIAT : FOREST DEPARTMENT

## NOTIFICATION

Imphal, the 18th June, 1997

No. 55/5/97-For.—Whereas the Govt. of Manipur considers that the area as specified in the schedule below is of adequate ecological, faunal, floral, geomorphological, natural and Zoological significance to be a wildlife sanctuary for the purpose of protecting, propagating and developing wildlife or its environment.

Now, therefore, in exercise of the powers conferred by sub-section (1) of Section 18 of the Wildlife (Protection) Act, 1972, the Governor of Manipur, hereby declares the said area as Kailam Wildlife Sanctuary.

Further, as provided under section 19 of wildlife (protection) Act, 1972, the Collector/Deputy Commissioner (Churachandpur) shall enquire into and determine the existence, nature and extent of the right of any person in or over the land comprised within the limit of the sanctuary in accordance with procedure laid down in section 21 to 25 of the Act.

## SCHEDULE OF KAILAM WILDLIFE SANCTUARY

**NORTH:**—From the point where New Churachandpur-Tipaimukh Road crosses Tuipi river, along the Road towards Churachandpur upto the place where it meets Tuili river.

**EAST:**— From the point where New Churachandpur-Tipaimukh Road meets the Tuili river then following the course of Tuili river upto the confluence of Tuili river with Tuivai river.

**WEST:**— From the point where New Churachandpur-Tipaimukh Road crosses Tuipi river, following the upward course of Tuipi river, upto the confluence of Tuipi river with Tuikhat river upto the source of Tuikhat river and after crossing the saddle from the source of the unnamed tributary of Tuivai river along the lok, upto the confluence of the lok with Tuivai river.

**SOUTH:**—From the confluence of unnamed lok the Tuivai river in the West, following the upward course of Tuivai river upto the confluence with Tuili river in the East.

In extent it will cover about 187.50 sq. Kms.

ANNA YOK J. TAYENG,  
Commissioner (Forests & Envi), Govt. of Manipur.

**Appendix II**

Acknowledgement of writ petition challenging the declaration of Kailam Wildlife Sanctuary, Manipur by the Chief Justice, Manipur High Court.

A  
- ORDER -



Heard Mr. S. Serto T. Kom, learned counsel appearing on behalf of the petitioners as well as Mrs. Th. Sobhana, learned Addl. G.A appearing on behalf of the State respondents.

It appears that in this writ application the petitioners have challenged the Proclamation/Declaration of Notification dated 02.12.1997 under Section 21 of Wild Life (Protection) Act, 1972. However, after such Proclamation/Declaration no further steps have been taken by the Government till now. Therefore, no cause of action arises to file the present writ application. I am, therefore, not inclined to entertain the writ application at this stage. However, liberty is granted to the petitioners to approach this Court as and when cause of action arises.

This writ application is disposed of accordingly.

Sd/-L.K. MOHAPATRA  
CHIEF JUSTICE (ACTING)

Signature of copyist:  
*N. Robindro Singh* 4/3/14  
(N. ROBINDRO SINGH)

CERTIFIED TO BE A TRUE COPY  
*S. Chandrasekhar* 04/03/14  
Assistant Registrar  
High Court of Manipur, Imphal  
Authorised Under Section-76, Act. 1  
of 1872

Read by: *Th. Jekulchandra Singh* 4/3/14  
Compared by: *N. D. Bormeha Singh* 4/3/14

*One*  
*4/3/14*

### Appendix III

Details of Transect lines walked during the survey at Kailam Wildlife Sanctuary, Manipur.

Transects: K,S,T,M-Initials of Station; 1,2,3...-Numbering of transects; a-morning, b-afternoon

Date	Track Route	Distance (km)	Sighting	Flock size	Activity	Tree	Disturbance	Elevation (m)
<b>Station 1. Kaihlam N 24°16'08.55'' E 093°24'12.18'' (1360m)</b>								
16-02-17	K1a	5.6						
17-02-17	K2a	1.9						
18-02-17	K3a	7.4						
18-02-17	K3b	7.4						
21-02-17	K4a	8.3						
21-02-17	K4b	8.3	Brown Hornbill	5-8	Feeding	<i>Aphanomixis polystachya</i>	L/H/T	780
22-02-17	K1a	5.6						
23-02-17	K4a	8.3	Brown Hornbill	5-8	Feeding	<i>Ficus sunndaica</i>	L/H/T	780
24-02-17	K3b	7.4	Brown Hornbill	5-8	Feeding	<i>Ficus sunndaica</i>	L/H/T	966
25-02-17	K5a	1.2						
27-02-17	K6a	3.7						



09-05-17	K4b	8.3	Oriental Pied Hornbill	1	Nesting		L/H/T	723
10-05-17	K6a	3.7						
<b>Station 2. Sinjang N 24°18'23.48'' E 093°23'33.21'' (1315m)</b>								
27-02-17	S1b	3.7						
03-03-17	S2a	4.5						
22-03-17	S1a	3.7						
11-05-17	S2a	4.5						
<b>Station 3. Tuivai N 24°12'07.03'' E 093°25'18.75'' (529m)</b>								
15-02-17	T1a	10.1						
03-04-17	T2b	7.1						
10-04-17	T3b	1.1						
11-04-17	T4a	3.9						
11-04-17	T4b	3.9						
12-04-17	T4a	3.9	Oriental Pied Hornbill	1	Feeding	Unknown spp.	F/H	628
12-04-17	T5b	2.5						
13-04-17	T6a	3.6						
13-04-17	T2b	7.1	Oriental Pied Hornbill	1	Perching	Ficus spp.	VR/H	546
03-05-	T4b	3.9						

17								
04-05-17	T1a	10.1						
<b>Station 4. Mualnuam N 24°11'38.80'' E 093°23'13.46'' (1199m)</b>								
15-02-17	M1a	7.1						
06-04-17	M2a	7.2						
06-04-17	M2b	7.2						
07-04-17	M3a	3						
09-04-17	M3b	3						
10-04-17	M1a	7.1						
01-05-17	M5a	9.5						
01-05-17	M5b	9.5	Oriental Pied Hornbill	1	Call	Unknown spp.	H	484
03-05-17	M1a	7.1						

**Disturbance Codes:** - Vehicular Road-**VR**, Logging-**L**, Hunting-**H**, Forest Fire-**FF**, Trapping-**T**, Farming-**F**

**Appendix IV**

Details of Questionnaire Survey conducted at Kailam Wildlife Sanctuary, Manipur.

**HOUSEHOLD QUESTIONNAIRE SURVEY**

Name:.....Age:.....

Gender: ( M/F)..... Educational Qualification.....

Tribe.....Village.....

**1. Family structure:**

M(>18y)	F(>18y)	Children	Total

**2. Primary occupation:**

Agri.	Govt. service	Labour	Fishing	Veg.coll	Others

**3. Secondary occupation:**

Agri. labour	Fishing	Veg. collection	Business	Others*

\*Weaving, Blacksmith, Handicrafts.

**4. Income:**

Daily	Weekly	Monthly	Annually

**5. House type:**

Pucca house	Semi-pucca	Thatched house

**6. Land holding and use:**

Area	Paddy	Vegetables	Plantation	Others



**7. Livestock:**

	Cow	Mithun	Pig	Poultry	Others
Nos.					
Income from livestock products (if any)					

**8. Source of energy:**

Fuelwood	Kerosene	Solar power	Gas	Others

**9. Source of firewood:**

Purchased	Homestead	Forest	Jhum areas	Others

**10. Assets:**

4-wheeler	2-wheeler	Rice Mill	Television	Others

**RESOURCE EXTRACTION****11. Do you extract a any resource from the forest?**

Yes	No

**12. Resources collected from the forest**

Vegetable	Fuel wood	Fodder	Thatch	Others

\*NWFP

**13. Extraction pattern:**

Product	Domestic/Commercial	Who collects		
		Male(>18)	Female(>18)	Children
<i>Vegetables</i>				
<i>Fuel</i>				
<i>Fodder</i>				
<i>Fish</i>				
<i>Thatch</i>				
<i>Others</i>				

**14. Income from resources extracted (if any):**

Amount sold	Frequency	Whole Sale	Retail	Middle man	Market	Income

**CONSERVATION PERCEPTION**

**1. Have you ever seen these birds?**

(Yes/No)

WH	BH	OH	GH	RH

**2. Are these birds important to you? (Yes/No)**

WH	BH	OH	GH	RH

**3. If yes, then why or how are they important?**

	Aesthetic	Cultural	Edible	Others
Wreathed Hornbill (WH)				
Brown Hornbill (BH)				
Oriental Pied Hornbill (OH)				
Great Hornbill (GH)				
Rufous necked Hornbill (RH)				

**4. Do you think Hornbills should be protected?**

**(Yes/No) If yes, then clarify why.**

**5. Name three factors that undermine the conservation of Hornbills?**

**6. How would you rate the role of the Government in conservation of Hornbill?**

Important	Not Important	Don't know

**7. Do you know the objective of creating a protected area? (Yes/No)**

**If yes, then clarify or elaborate**

**8. Are you aware that the area is proposed to be a Wildlife Sanctuary? (Yes/No)**

**9. If you are aware, how do you get to know about it?**

**10. Do you think that the proposed Wildlife Sanctuary would**

- Deprive you of your livelihood Yes/No
- Create opportunities for youngsters Yes/No

**11. How is KWLS important to you?**

Source of livelihood	Cultural heritage	Gave recognition	Others

--	--	--	--

**12. Do you think wildlife should be protected?**

Yes	No	Don't know	Others
-----	----	------------	--------

**13. Are you interested to have tourists in nearby areas?  
(Yes/No)**

**14. Tourism will bring benefits for you.**

Yes it will bring benefit	No it will not bring benefit	It will harm local people	Don't know	Others

**15. What programs do you expect from the Forest Department to improve the relation of people with the Forest Department?**

Employment as official	Secondary employment	Involvement of local people in management	Others

**16. Suggestions to improve wildlife habitat**

No collection	Regularised collection	Fencing	No suggestions	Others
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## Appendix V

Checklist of birds found at Kailam Wildlife Sanctuary, Manipur during the study period.

	<b>Species</b>	<b>Scientific Name</b>	<b>Vernacular (Paite)</b>
A	<b>Phasianidae</b>		
1	Common Quail	<i>Coturnix coturnix</i>	Vamim
2	Rufous-throated Partridge	<i>Arborophila rufogularis</i>	Vengke
3	Mountain Bamboo Partridge	<i>Bambusicola fytchii</i>	Valah
4	Hill Partridge	<i>Arborophila torqueola</i>	Mengkeng
5	Blyth's Tragopan	<i>Tragopan blythii</i>	Chongthoi
6	Red Junglefowl	<i>Gallus gallus</i>	Akpa
7	Kalij Pheasant	<i>Lophura leucomelanos</i>	Vagik
8	Mrs Hume's Pheasant	<i>Syrnaticus humiae</i>	Vavu
9	Grey Peacock Pheasant	<i>Polyplectron bicalcaratum</i>	Varehaw
B	<b>Ardeidae</b>		
10	Cattle Egret	<i>Bubulcus ibis</i>	Vakang
C	<b>Falconidae</b>		
11	Amur Falcon	<i>Falco amurensis</i>	Khakawi
D	<b>Accipitridae</b>		
12	Jerdon's Baza	<i>Aviceda jerdoni</i>	Muvanlai
13	Oriental Honey Buzzard	<i>Pernis ptilorhynchus</i>	Mu
14	Black Kite	<i>Milvus migrans</i>	Mupi
15	Crested Serpent Eagle	<i>Spilornis cheela</i>	Mu buang
16	Shikra	<i>Accipiter badius</i>	Musi
16	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	Mupal
17	Black Eagle	<i>Ictinaetus malayensis</i>	Khupching kha
E	<b>Columbidae</b>		
18	Ashy Wood Pigeon	<i>Columba pulchricollis</i>	Vakhu ngawng gial
19	Common Pigeon	<i>Columba livia</i>	Vapaal
20	Spotted Dove	<i>Stigmatopelia chinensis</i>	Vakhu
21	Emerald Dove	<i>Chalcophaps indica</i>	Gam vapaal
22	Orange-breasted Green Pigeon	<i>Treron bicinctus</i>	Vahui
23	Ashy-headed Green Pigeon	<i>Treron p phayrei</i>	Vahui
24	Thick billed Green Pigeon	<i>Treron curvirostra</i>	Vahui
25	Pin-tailed Green Pigeon	<i>Treron apicauda</i>	Vahui ngia nei
26	Wedge-tailed Green Pigeon	<i>Treron sphenurus</i>	Vahui
27	Green Imperial Pigeon	<i>Ducula aenea</i>	Gam vahui
28	Mountain Imperial Pigeon	<i>Ducula badia</i>	Huitupi
F	<b>Cuculidae</b>		
29	Large Hawk Cuckoo	<i>Hierococcyx sparveriioides</i>	Kakhut
30	Hodgson's Hawk Cuckoo	<i>Hierococcyx fugus</i>	Pengpelep

31	Indian Cuckoo	<i>Cuculus micropterus</i>	Vakawlkap
32	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	
34	Green-billed Malkoha	<i>Rhopodytes tristis</i>	Va uk
G	<b>Centropodidae</b>		
35	Southern Coucal	<i>Centropus s parroti</i>	Van ak
H	<b>Strigidae</b>		
36	Collored Scops Owl	<i>Otus b lettia</i>	Simbu
37	Eurasian Eagle Owl	<i>Bubo bubo</i>	Simbu kii nei
38	Dusky Eagle Owl	<i>Bubo coromandus</i>	Tuithu
39	Tawny Fish Owl	<i>Ketupa flavipes</i>	Simbu
40	Collored Owlet	<i>Glaucidium brodiei</i>	Bak thak
41	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	Simbu
I	<b>Caprimulgidae</b>		
42	Grey Nightjar	<i>Caprimulgus I jotaka</i>	Vabak
J	<b>Apodidae</b>		
43	Himalayan Swiftlet	<i>Collocalia brevirostris</i>	Phialphiah
44	Brown-backed Needletail	<i>Hirundopus giganteus</i>	Phialphiah
45	Fork-tailed Swift	<i>Apus pacificus</i>	Kawl phialphiah
K	<b>Trogonidae</b>		
46	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	Vapuan san
L	<b>Coraciidae</b>		
47	Indian Roller	<i>Coracias bengalensis</i>	Vatual tawn
48	Dollar Bird	<i>Eurystomus orientalis</i>	
M	<b>Halcyonidae</b>		
49	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	Tuiva eng
50	Black-capped Kingfisher	<i>Halcyon pileata</i>	Tui va
N	<b>Alcedinidae</b>		
51	Blue-eared Kingfisher	<i>Alcedo meninting</i>	Kaikuang gaal
52	Common Kingfisher	<i>Alcedo atthis</i>	Kaikuang gaal
O	<b>Cerylidae</b>		
53	Crested Kingfisher	<i>Megaceryle lugubris</i>	
P	<b>Meropidae</b>		
54	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	Lensiam
Q	<b>Upupidae</b>		
55	Common Hoopoe	<i>Upupa epops</i>	Huihtuun
R	<b>Bucerotidae</b>		
56	Brown Hornbill	<i>Anorrhinus austeni</i>	Vakhawpi
57	Oriental Pied Hornbill	<i>Anthracoseros albirostris</i>	Vahai
58	Great Hornbill	<i>Buceros bicornis</i>	Phualpi
59	Rufous-necked Hornbill	<i>Aceros nipalensis</i>	Phok-ngang
60	Wreathed Hornbill	<i>Rhyticeros undulatus</i>	Vaphual
S	<b>Megalaimidae</b>		

61	Great Barbet	<i>Megalaima virens</i>	Tang-awm
62	Blue-throated Barbet	<i>Megalaima asiatica</i>	Tukrou
T	<b>Picidae</b>		
63	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	Vasingdang-tu
64	Lesser Yellownape	<i>Picus chlorophus</i>	Vasingdang-tu
65	Greater Yellownape	<i>Picus flavinucha</i>	Ngeital
66	Grey-headed Woodpecker	<i>Picus canus</i>	Vasingdang-tu
67	Common Goldenback	<i>Dinopium javanense</i>	Vasingdang-tu
U	<b>Eurylaimidae</b>		
68	Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>	Thezin
V	<b>Pittidae</b>		
69	Hooded Pitta	<i>Pitta sordid</i>	Zova
W	<b>Corvidae</b>		
70	Short-billed Minivet	<i>Pericrocotus brevirostris</i>	Thanghou leh Liandou
71	Scarlet Minivet	<i>Pericrocotus f speciosus</i>	Thanghou leh Liandou
72	Maroon Oriole	<i>Oriolus traillii</i>	
73	Black Drongo	<i>Dicrurus macrocercus</i>	Khankha meika
74	Ashy Drongo	<i>Dicrurus leucophaeus</i>	Khankha
75	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	Khankha nge-nei
76	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	Vakul
77	Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	
78	Common Green Magpie	<i>Cissa chinensis</i>	
79	Eastern Jungle Crow	<i>Corvus m levaillantii</i>	Va-ak
84	<b>Laniidae</b>		
80	Long-tailed Shrike	<i>Lanius schach</i>	
81	Grey-backed Shrike	<i>Lanius tephronotus</i>	
X	<b>Hirundinidae</b>		
82	Plain Martin	<i>Riparia paludicola</i>	
83	Red-rumped Swallow	<i>Cecropis daurica</i>	
84	Straited Swallow	<i>Cecropis striolata</i>	
85	Nepal House Martin	<i>Delichon nipalese</i>	
Y	<b>Alaudidae</b>		
86	Bengal Bush Lark	<i>Mirafra assamica</i>	Sihlu
Z	<b>Cisticolidae</b>		
87	Straited Prinia	<i>Prinia criniger</i>	Gialngiat
88	Rufescent Prinia	<i>Prinia rufesens</i>	
1A	<b>Sylviidae</b>		
89	Mountain Tailorbird	<i>Phyllergates cuculatus</i>	Nah khok
90	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	Chiterek
91	Ashy-throated Warbler	<i>Phylloscopus maculipennis</i>	Langbawm pu

92	Hume's Leaf Warbler	<i>Phylloscopus humei</i>	Chikchilik
93	Chestnut-crowned Warbler	<i>Seicerus affinis</i>	
94	Large Scimitar Babbler	<i>Pomatorhinus hypoleucos</i>	
95	White-browed Scimitar Babbler	<i>Pomatorhinus schisticeps</i>	Khawkhel
96	Pygmy Wren Babbler	<i>Pnoepyga pusilla</i>	Vatual tawn
97	White-crested Laughingthrush	<i>Garrulux leucolophus</i>	Vavual lukang
98	Lesser Necklaced Laughing thrush	<i>Garrulax monileger</i>	Vavual khi-ok
99	Greater Necklaced Laughing thrush	<i>Garrulax pectoralis</i>	Vavual khi-ok
100	Red-faced Liocichla	<i>Liocichla phoenicea</i>	Phualkhasan
101	Silver-eared Mesia	<i>Mesia argentauris</i>	
102	Black-headed Shrike Babbler	<i>Pteruthius rufiventer</i>	
103	Rufous-backed Sibia	<i>Leioptila annectans</i>	
104	Grey Sibia	<i>Malacias gracilis</i>	Vaseel
105	Whiskered Yuhina	<i>Yuhina flavicollis</i>	
1B	<b>Pycnonotidae</b>		
106	Black-crested Bulbul	<i>Pycnonotus m flaviventris</i>	Tuk-kum blik
107	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Baibek
108	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Baibek tawsan
109	White-thriated Bulbul	<i>Alophoixus flaveolus</i>	
110	Straited Bulbul	<i>Pycnonotus striatus</i>	
111	Ashy Bulbul	<i>Hemixos flavula</i>	
1C	<b>Zosteropidae</b>		
112	Oriental White-eye	<i>Zosterops palpebrosus</i>	Vamit kau
1D	<b>Sturnidae</b>		
113	Asian Glossy Starling	<i>Aplonis panayensis</i>	
114	Jungle Myna	<i>Acridotheres fuscus</i>	Vaiva
1E	<b>Muscicapidae</b>		
115	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	Luiva vom
116	Oriental Magpie Robin	<i>Copsychus saularis</i>	
117	Blue-fronted redstart	<i>Phoenicurus frontalis</i>	
118	Black-backed Forktail	<i>Enicurus immaculatus</i>	Luiva -jem
119	Spotted Forktail	<i>Enicurus maculatus</i>	Luiva-jem
120	Blue Rock Thrush	<i>Monticola solitarius</i>	
121	Chestnut bellied Rock Thrush	<i>Monticola rufiventris</i>	
122	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>	
123	Taiga Flycatcher	<i>Ficedula albicilla</i>	
124	Blue-throated Blue Flycatcher	<i>Cyornis rubeculoides</i>	
125	Vivid Niltava	<i>Niltava vivida</i>	
126	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	
1F	<b>Nectariniidae</b>		
127	Orange-bellied leafbird	<i>Chloropsis hardwickii</i>	
128	Golden-fronted leafbird	<i>Chloropsis aurifrons</i>	



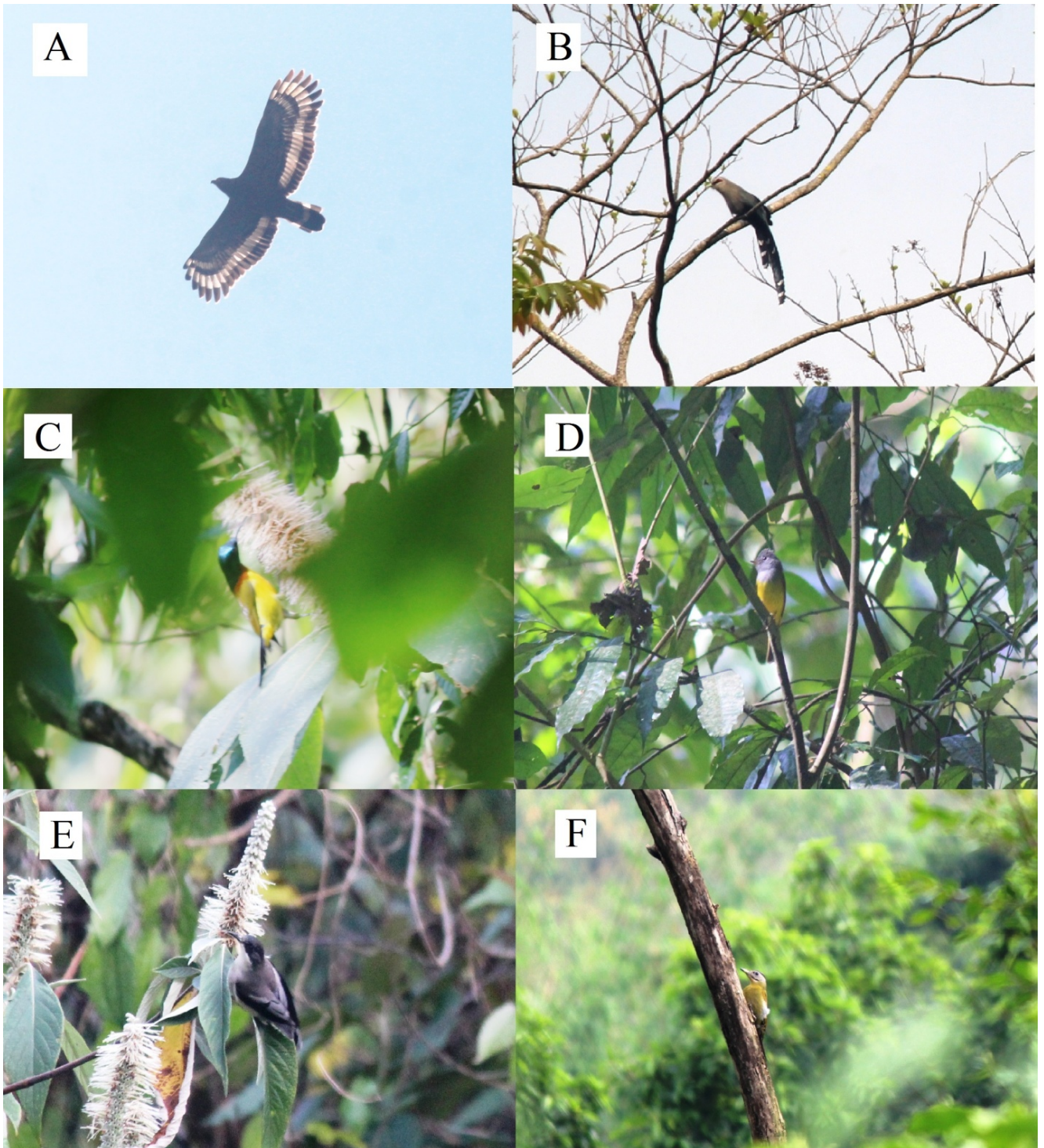
129	Purple Sunbird	<i>Cinnyris asiaticus</i>	
130	Mrs Gould's Sunbird	<i>Aethopyga guoldiae</i>	Zawl-ai
131	Green-tailed Sunbird	<i>Aethopyga nipalensis</i>	
132	Black-throated Sunbird	<i>Aethopyga saturata</i>	Dawn-chiang
134	Little Spiderhunter	<i>Arachnothera longirostra</i>	Nahtangju-tawp
135	Streaked Spiderhunter	<i>Arachnothera magna</i>	Nahtangju-tawp
1G	<b>Passeridae</b>		
136	House Sparrow	<i>Passer domesticus</i>	Kawlgit
137	Russet Sparrow	<i>Passer rutilans</i>	Gita
138	Eurasian Tree Sparrow	<i>Passer montanus</i>	Kawlgit
139	White-rumped Munia	<i>Lonchura striata</i>	
140	Yellow Wagtail	<i>Motacilla flava</i>	Lailen
141	White Wagtail	<i>Motacilla alba</i>	
142	Paddyfield Pipit	<i>Anthus rufulus</i>	
143	Olive-backed Pipit	<i>Anthus hodgsoni</i>	
1H	<b>Fringillidae</b>		
144	Common Rosefinch	<i>Carpodacus erythrinus</i>	Vadul
145	Scarlet Finch	<i>Haematospiza sipahi</i>	Vadul san

**Appendix VI**

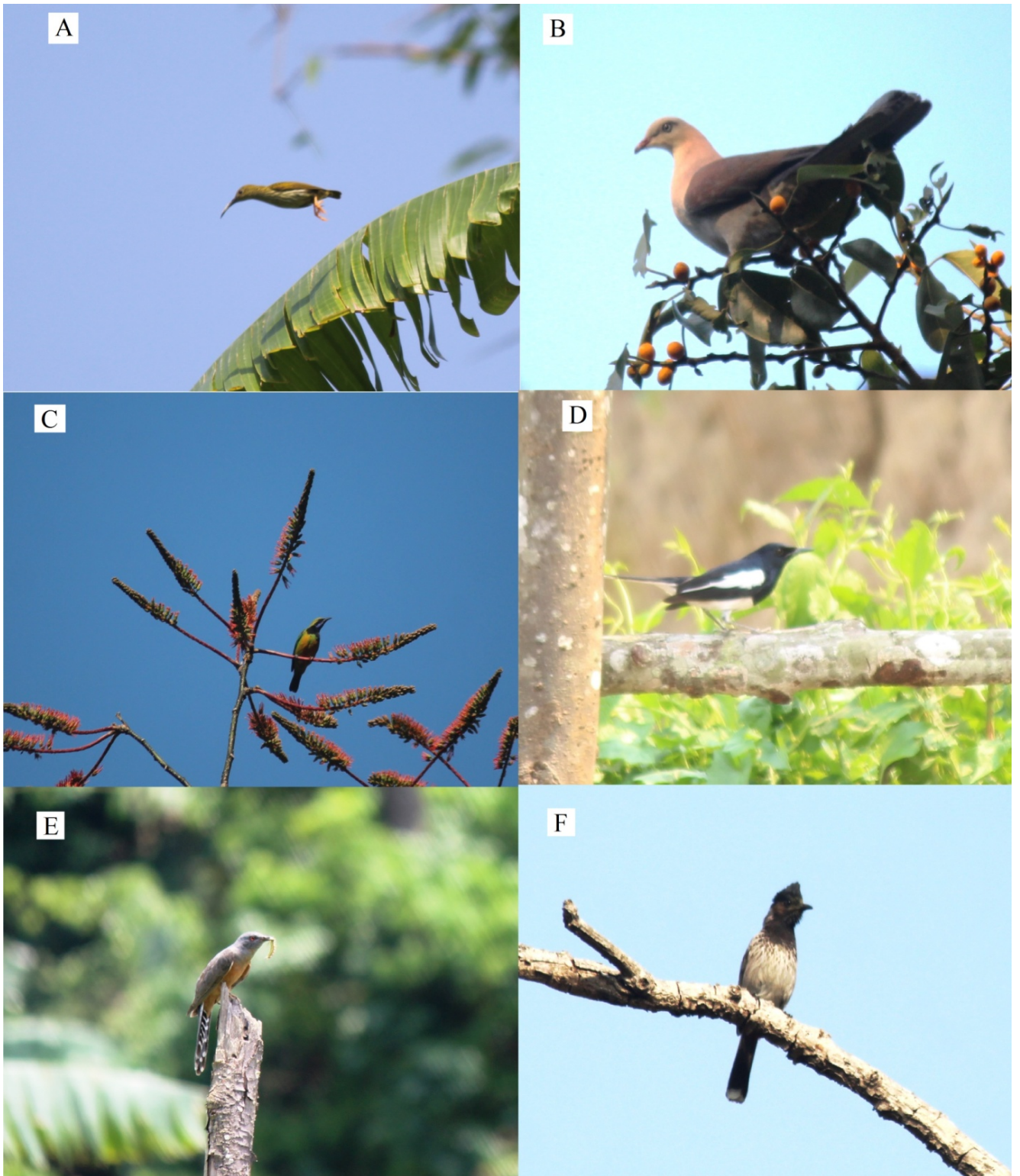
Pictures of some Birds taken during the study period in Kailam Wildlife Sanctuary, Manipur.



**Plate 6 a) Black crested Bulbul b) Blue-throated Barbet c) Chestnut-headed Bee-eater d) Greater Goldenback e) Common Green Magpie f) Common Hoopoe**



**Plate 7 a) Crested Serpent Eagle b) Green-billed Malkoha c) Green-tailed Sunbird  
d) Grey-headed Canary flycatcher e) Grey Sibia f) Grey-headed Woodpecker**



**Plate 8 a) Streaked Spiderhunter b) Mountain Imperial Pigeon c) Orange-bellied Leafbird  
d) Oriental Magpie Robin e) Plaintive Cuckoo f) Red-vented Bulbul**



**Plate 9 a) Rufous-bellied Niltava b) Silver-eared Mesia c) Southern Coucal d) Spotted Dove  
e) Striated Bulbul f) Wedge-tailed Pigeon**