

Preliminary Survey Report

PROJECT- “Acoustic survey and monitoring to lay the foundation for conservation of the endemic Csorba’s mouse eared bat (*Myotis csorbai*) in Nepal.”

Objectives of Preliminary Survey

- Cave measurement and bat presence survey
- Identification of potential sites for deploying Audiomoths (within and beyond 2 km radius of the cave).
- Meeting with the cave management committee.
- Identification of a potential citizen scientist.
- Getting permits from the District Forest office.
- Gathering of equipment.

A) Identified habitat patches within and beyond 2km radius of the cave (Small scale)

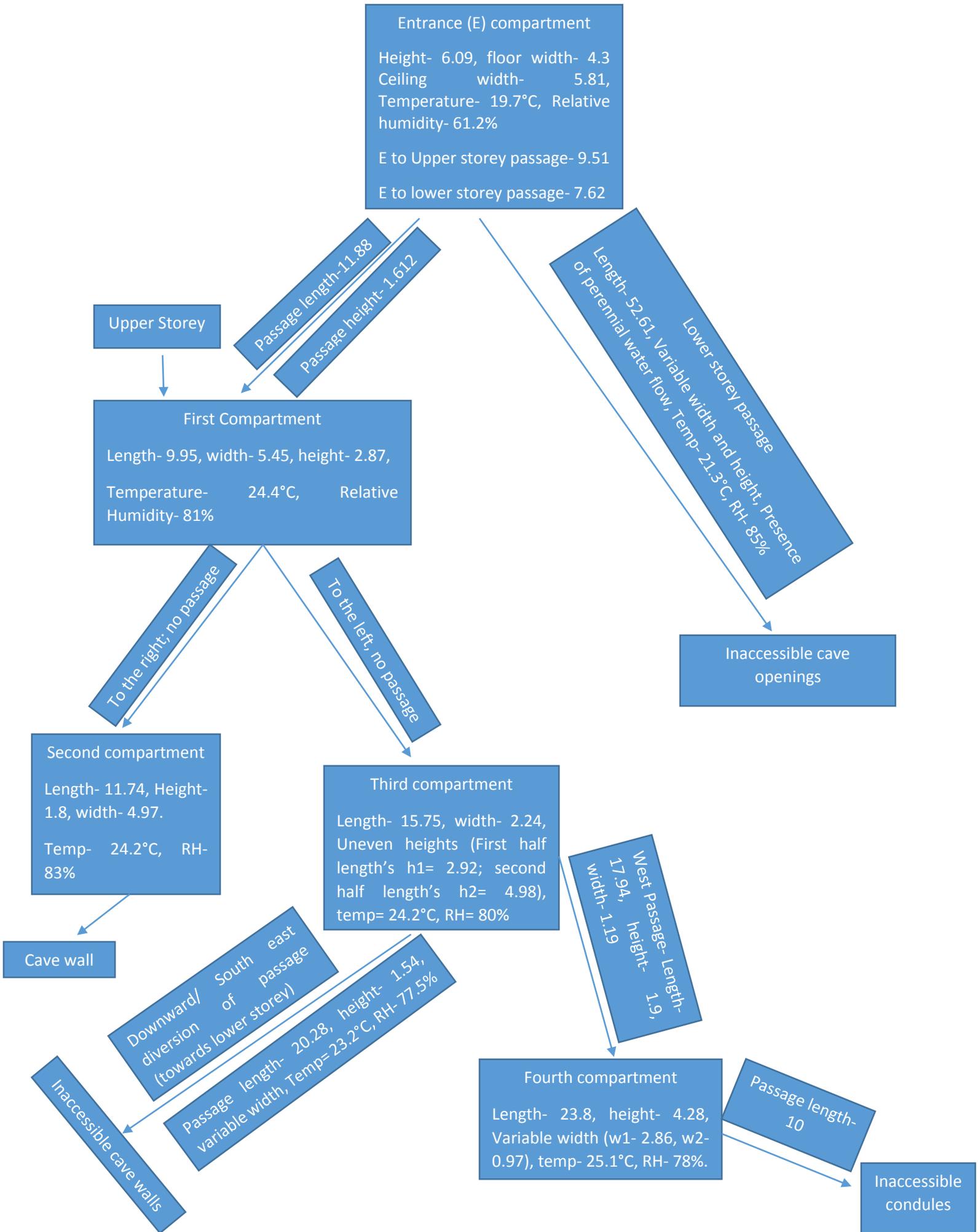
Habitat patches were identified through field visit and recorded using a GPS. Major feature of each patch included its vegetation type and land use. Each candidate site were selected at a distance of at least 250meters to account for possible overlap in echolocation calls when deploying Audiomoths. The audiomoths will be deployed in a way that it is directed towards the proposed habitat patch. The identified habitat types are-

- 1) Agro forestry system (Cardamom Plantation)
- 2) Stream bank with trees
- 3) Schima-castonopsis forest (Open canopy)
- 4) Schima castonopsis forest (Closed canopy)
- 5) Bamboo aggregations near settlements
- 6) Agricultural land/ fallow land (Absence of any vegetation)
- 7) Secondary Cave structure
- 8) Settlement area (Orange plantation)
- 9) Open Grassland

B) Cave Characteristics of Kailash Cave

Cave length, height and breadth were measured using a 20meter measuring tape. The cave characteristics of the study cave are shown in a flow diagram below-

- Length, height and breadth are measured in meters.
- Temperature in degree Celsius and Relative Humidity in Percentage.



Entrance (E) compartment
 Height- 6.09, floor width- 4.3
 Ceiling width- 5.81,
 Temperature- 19.7°C, Relative
 humidity- 61.2%
 E to Upper storey passage- 9.51
 E to lower storey passage- 7.62

Upper Storey

Passage length-11.88
 Passage height- 1.612

Length- 52.61, Variable width and height, Presence
 of perennial water flow, Temp- 21.3°C, RH- 85%

First Compartment
 Length- 9.95, width- 5.45, height- 2.87,
 Temperature- 24.4°C, Relative
 Humidity- 81%

Inaccessible cave
 openings

To the right, no passage

To the left, no passage

Second compartment
 Length- 11.74, Height- 1.8, width- 4.97.
 Temp- 24.2°C, RH- 83%

Cave wall

Third compartment
 Length- 15.75, width- 2.24,
 Uneven heights (First half
 length's h1= 2.92; second
 half length's h2= 4.98),
 temp= 24.2°C, RH= 80%

West passage- Length-
 1.9,
 width- 1.19, height- 1.79

Inaccessible cave walls

Downward/
 diversion
 of passage
 (towards lower storey)

Passage length- 20.28, height- 1.54,
 variable width, Temp= 23.2°C, RH- 77.5%

Fourth compartment
 Length- 23.8, height- 4.28,
 Variable width (w1- 2.86, w2-
 0.97), temp- 25.1°C, RH- 78%.

Passage length-
 10

Inaccessible
 condules

Identified habitat types



Human settlements



Agricultural fields



Closed canopy Schima-wallichii



Intermittent water source



Open canopy Schima wallichii



Bamboo aggregations

C) Interaction with Cave management committee

A small meeting and informal interaction was held with the cave management committee as a prior information extension of the current project. The committee head, Mr. Min Bahadur Shahi, hosted the meeting. Discussions were more based on bat movements and prospects of tourism. We came to know about a different cave just a 200 meters north-west of the study cave. Moreover, it was also found that Kailash cave was occupied by bats only during the spring. No hunting or killing of bats existed in the village.

D) Poster Presentation on “Bats of Nepal” and current project in Nepal Owl Festival organized by Friends of Nature (FON) in one of the study areas (Rangbhang).

During the 9th Nepal Owl Festival held in Rangbhang (one of the study site), Syangja, Nepal; a poster was presented on bats of Nepal and the ongoing project. Finance minister of Gandaki Province, Head of Division Forest office, Syangja, Head of Village development committee, school teachers and students, wildlife researchers and locals were the notable people with whom the project details were disseminated.

As much as establishing links with people for further project aid, this presentation also provided us with information regarding the other caves in the area. We gained information on four different caves at a distance of 2 km and surveyed one of them for bat presence. Other three caves will be visited during the first phase of this research.



Picture 1-Poster presentation on Bats of Nepal and the ongoing project in 9th Nepal Owl Festival organized by Friends of Nature (FON)



Picture 2- Local students getting to know the species of bats in their region and in Nepal.



Picture 3- Presenting about bats of Nepal and ongoing project.

E) Cave and Bat Presence Survey.

Many sub-tropical bats hibernate during winter and therefore, we employed only roost counts ensuring minimal disturbance to the bats that are present in the caves. Three different caves were surveyed for bat presence (One known and two unknown) using active acoustics and visual roost counts. Handling of bats was not done because most bats are in deep torpor in winter and could cause deaths due to stress and energy deficiency. Presence and absence of bat species in each cave roost are given below-

i) Kailash Cave-

Back in August, 2019; Kailash cave consisted of more than 7000 individuals of bats majority of which were *Miniopterus fuliginosus*. Other bat species included *Myotis csorbai*, *Miniopterus pusillus*, *Rhinolophus affinis*, *Rhinolophus pearsonii* and *Hipposideros armiger*. However, during winter period all the bats have migrated out of the cave to hibernate in some other caves in the region. Thus, during the roost survey we found only a single individual of family *Rhinolophidae* in deep torpor. We didn't capture the bat to identify to species level due to ethical reasons.



Picture 4- Deep torpor- Species of Family *Rhinolophidae* in Kailash cave.

ii) Cave about 250 meters North-West of Kailash cave-

According to the locals, this cave was formed at the same time of formation of Kailash cave and that decades ago, it used to be a part of it. During Earthquake, rock barriers formed in the passage of Kailash cave and thus, separating them. In this cave too, there was presence of a single individual of family *Rhinolophidae*.



Picture 5- Deep torpor.



Picture 6- A species of Huntsman spider.

iii) Mysterious cave, Rangbhang.

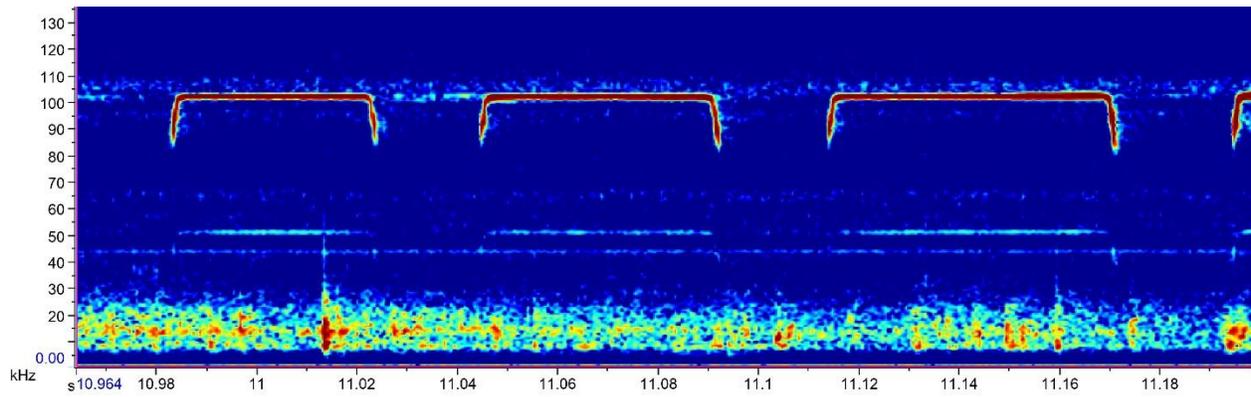
This cave is located about 4.1 km south west of Kailash cave and is one of the sites where Audiomoths will be deployed. It is a vertical cave with about 12ft depth, has horizontal flanks at the bottom and is situated in the agricultural field. The opening of the cave is surrounded by barbed wires so that local childrens wouldn't fall down. Due to inability to conduct roost surveys, dusk-emergence count surveys were conducted. The species were identified by processing the echolocation calls recorded in wildlife acoustics Echometer touch 2 pro. To analyze the calls, Raven pro software was used whose license was funded by Cornell's lab of Ornithology.

Three different species of *Rhinolophids* were recorded while conducting emergence count surveys supplemented with active acoustic monitoring for two hours after sunset. We counted 24 individuals of *R. pusillus*, 12 individuals of *R. affinis* and a single individual of *R. pearsonii*. *R.pusillus* were the first ones to emerge out (5:42pm) followed by *R. affinis* (6:01pm) and then by, *R. pearsonii* (6:10pm).

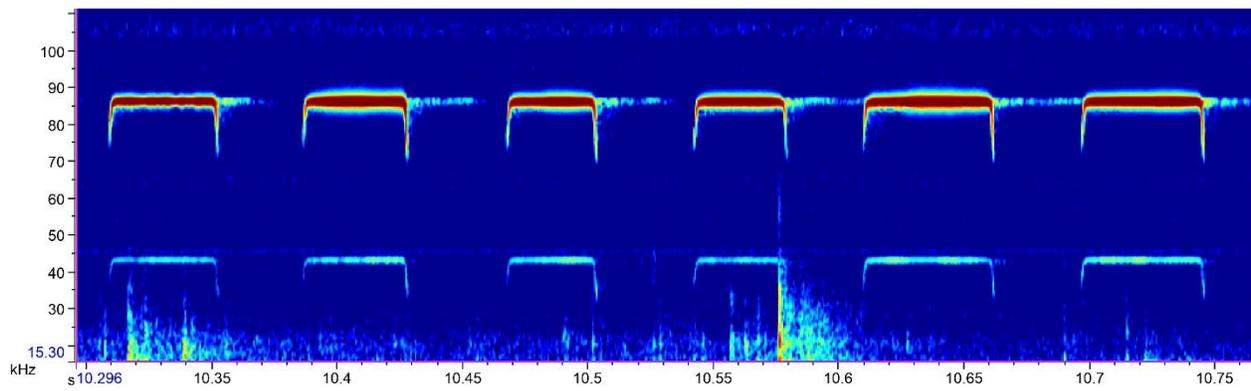


Picture 7- Mysterious cave. The entrance is rounded with barbed wire to protect the children from falling inside.

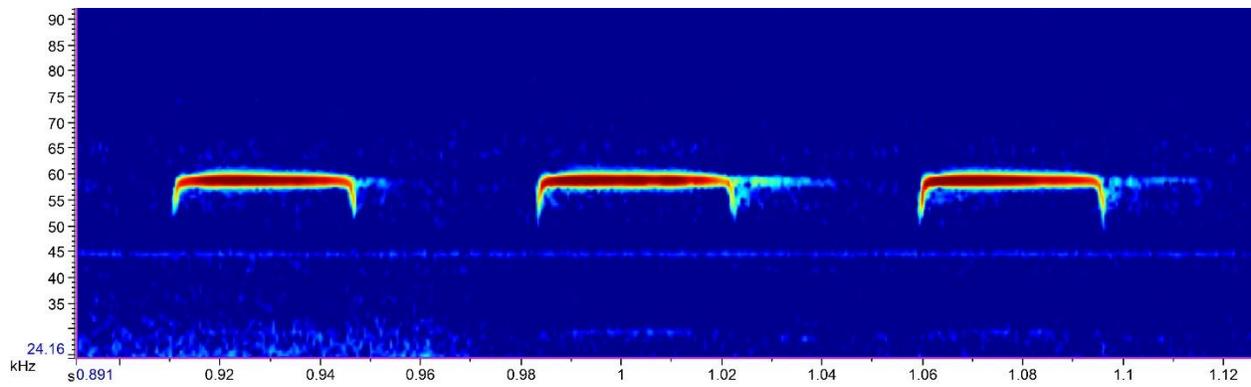
The echolocation calls that were not attenuated and that had almost all the characteristics were selected in Raven Pro, 512 Hanning window for deriving call information. The parameters selected for measurements are- Begin time, End time, Low Frequency, High Frequency, Average Entropy, Frequency Contour Interval, Peak Frequency, Delta Time and Delta Frequency.



Picture 8- Spectrogram view of echolocation call of *R. pusillus*.



Picture 9- Spectrogram view of echolocation call of *R. affinis*.



Picture 10- Spectrogram view of echolocation call pulses of *R. pearsonii*.

Echolocation call characteristics of these three species are presented in the table below-

Table 1- Echolocation characteristics of the emerging bats.

Species	No. of pulses analyzed	Avg low frequency (khz)	Avg High Frequency (khz)	Avg Entropy	Avg Peak Frequency (khz)	Avg Delta time (seconds)	Avg Delta Frequency (khz)
R. pusillus	26	82.006	104.67	1.751	103.15	0.0406	22.67
R. affinis	14	69.62	87.76	1.448	86.250	0.0501	18.14
R. pearsonii	9	50.68	60.01	1.366	58.5	0.0439	9.33

F) Identification of a citizen scientist.

As per the discussion with the cave management committee, we had interaction with a local person named ‘Suman Shahi’ for his involvement in this project as a Citizen scientist. He is well known to the area and had previously guided a team of BBC Earth to the cave. He has completed his high school studies (Grade 12), ages 26 years old and is a potential leader of the cave management committee in near future. Assessing all these qualities and his enthusiasm, a verbal agreement with him was made for citizen scientist position.

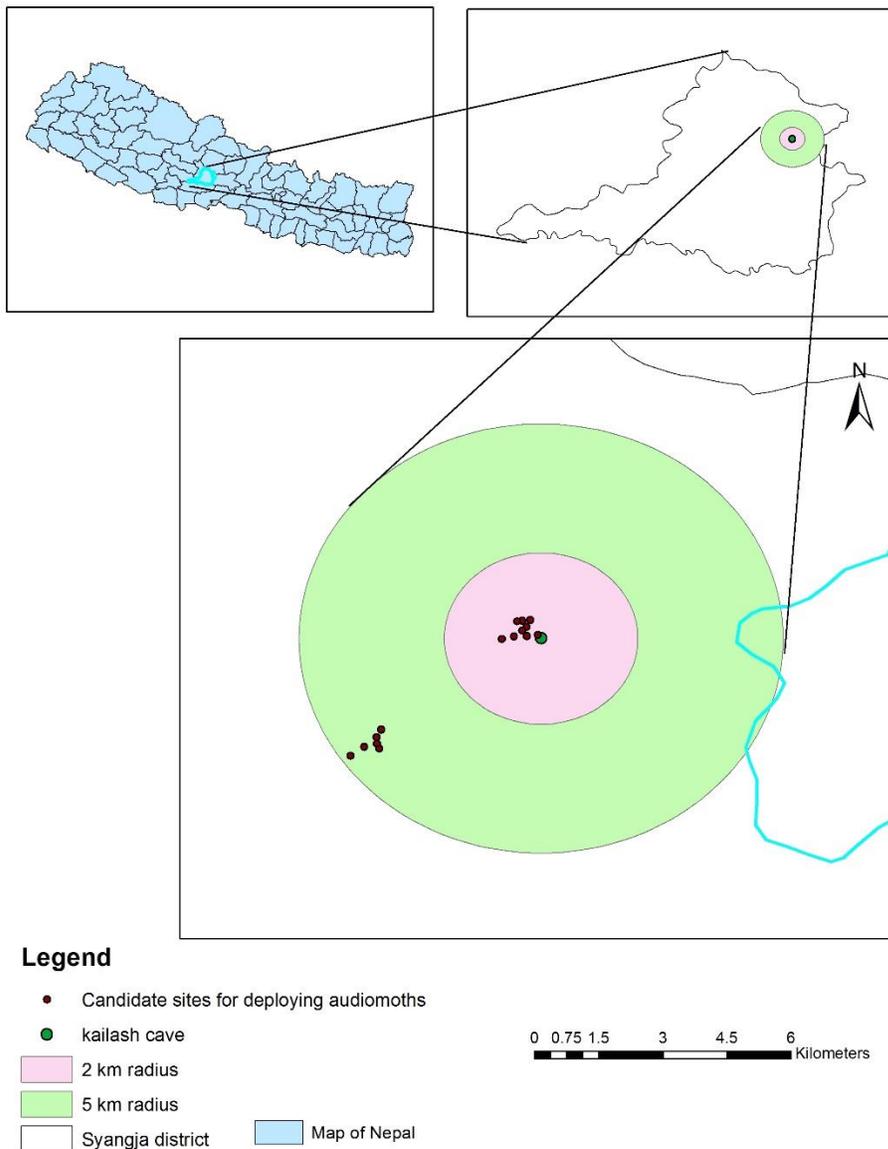


Picture 11- Citizen Scientist of this project- Mr. Suman Shahi.

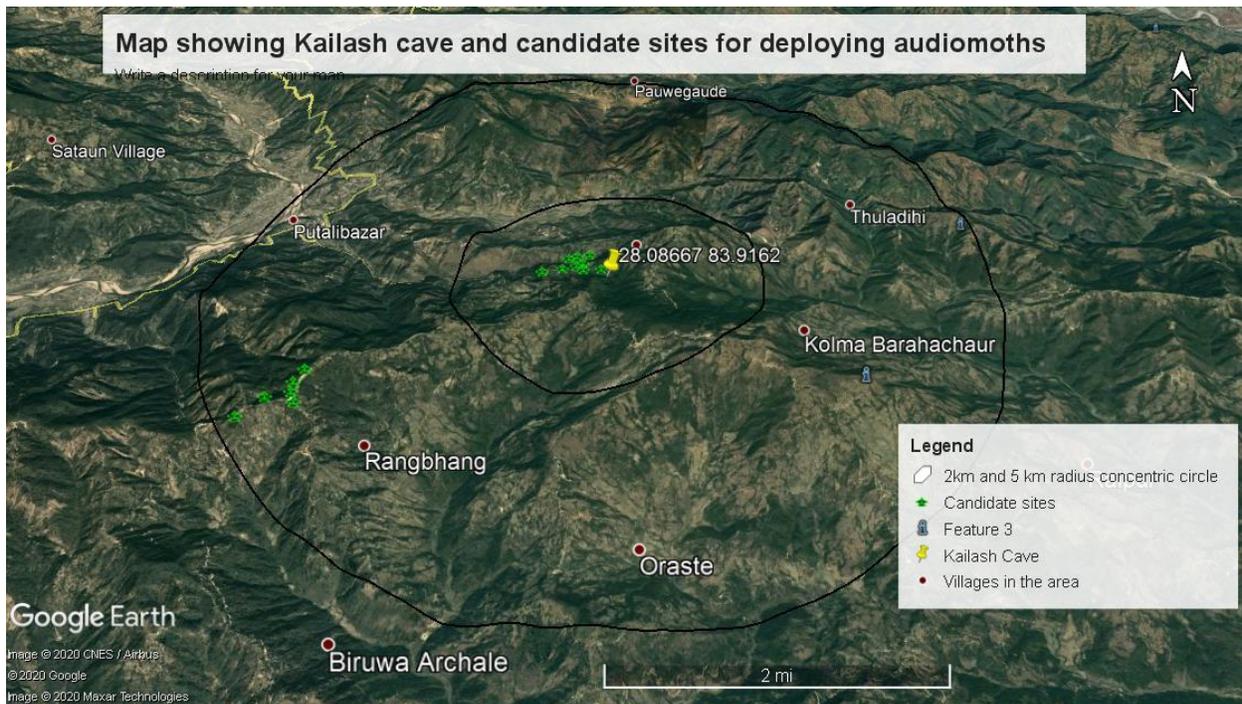
H) Gathering of equipment and permits.

All the permits and equipment have been gathered. We were planning to begin our first phase project by deploying Audiomoths in field by the first week of March, 2020. Its been more than an year since then (delays due to pandemic) and hopefully, we will begin by October 2021 (after being vaccinated).

I) Maps.



Picture 12- Map of the study area as plotted in GIS.



Picture 13- Map of the study site- Google Earth.

J) CONCLUSION

After beginning the project on the first of February, 2020; preliminary surveys have been completed successfully. We have collected Audiomoths, weather meters, projectors and dataloggers to begin the first phase of the study. The major finding during this survey was the absence of bats in Kailash cave. This simply means an intensive survey of the known and unknown caves in the region to identify the possible wintering roosts of the extant bat species. Similarly, a more detailed study on the seasonal use of Kailash cave would ensure ideal time for cave tourism as well as bat conservation. If no overlap in these activities exist, eco-cave tourism could well be encouraged. We have already gained information about four other caves which will be discovered during the first phase of this project.

Like everything else right now, this project has also been hit by COVID-19 and all our timelines has to be re-scheduled. Even if the first phase should be delayed further, we are certain to get valuable information on roosting and foraging ecology of cave dwelling bats in the study region whenever the project starts again.