

Project Update: February 2022

The preliminary survey of this project ended in February 2020, where we identified potential habitat types for placing Audiomoths, gathered permits and local support for this project, identified a local to aid as a citizen scientist, presented a poster on bats in the vicinity of the study area and ways of conserving the roosting and foraging habitat of bats, did an active acoustic monitoring to identify the presence of species in the targeted cave, and mapped out the cave dimensions. This project was, however, affected by the emergence of COVID 19, and was delayed beyond the specified time activity schedule. After a delay of almost 2 years, we have now restarted the project with similar time schedule as in 2020. Simply, the data that was supposed to be collected in winter 2020 will now be collected in winter 2022.

Objectives for First phase

1. Identify additional caves in the vicinity of Kailash cave, conduct cave measurements and study the bats inside identified caves.
2. Quantify the microclimatic condition inside each cave.
3. Use audiomoths to study the cave exiting activity outside each cave.
4. Work with a citizen scientist to help him get familiar with data collection methods.

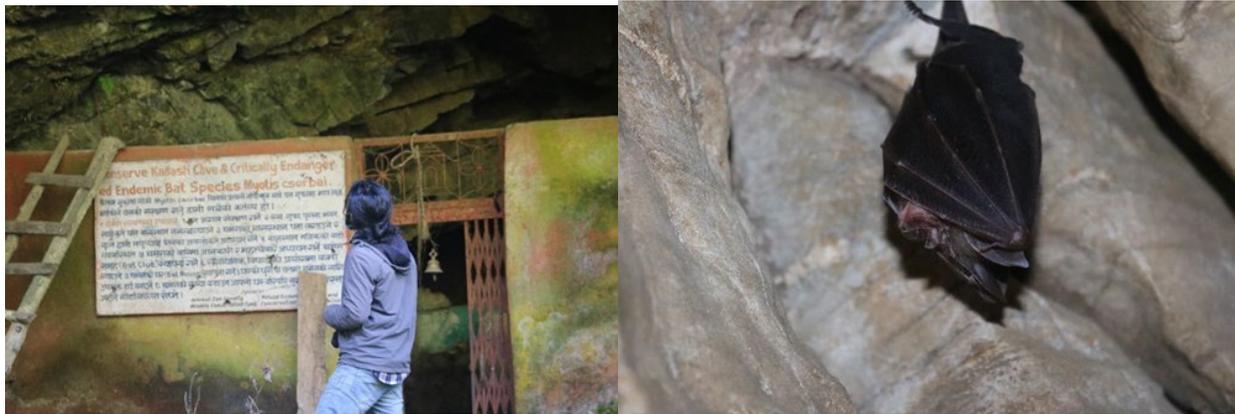
Activities/ field work for each objective

Objective 1

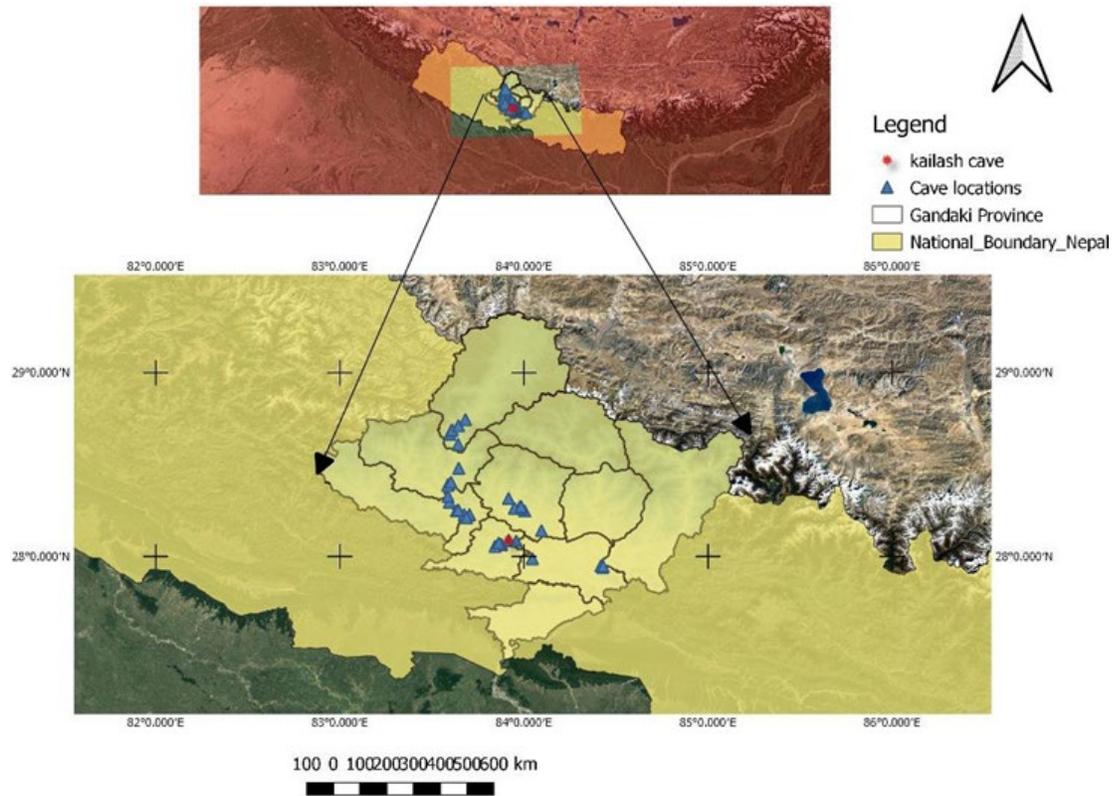
In order to identify additional caves that were used by *Myotis csorbai*, we conducted an extensive cave study. In order to gather more information on the presence/ absence of caves in the study area and nearby districts, we conducted a recce in which the survey team was divided into two groups. Each group visited sites where caves were present, took GPS coordinates, measured surrounding habitat characteristics, measured the cave dimension, surveyed for the presence/ absence of bats, counted the number of bats roosting/ hibernating, deployed Audiomoths at the entrance of the cave for at least 3 nights, and interacted with the locals to collect further information on caves in the vicinity.

Given the effort of almost a month through field visits and secondary data collection, a total of 43 caves have been visited, measured, and mapped. In each cave, the species and number of bats roosting was recorded using visual surveys aided with acoustic recorder (in case the bat was seen flying inside the cave). We didn't employ capture studies to prevent bats from stress during this resource limited phase (winter). Species that were observed during cave visitations in this phase were *Hipposideros armiger*, *Rhinolophus affinis*, *Rhinolophus luctus*, *Rhinolophus macrotis*, *Rhinolophus lepidus*, *Rhinolophus sinicus*, *Rhinolophus pearsonii*, *Rousettus leschenaulti*, and *Cynopterus sphinx*. Through acoustics, we reckon that one of the species could be *Rhinolophus rouxii*, given its echolocation call parameters. This conjecture, however,

needs sufficient evidence in order to confirm the species. We failed to record bats that were present in August 2019 in Kailash cave i.e., *Miniopterus fuliginosus*, *Miniopterus pusillus*, and *Myotis csorbai*. This could mean that this Kailash cave is being used in a different season and could possibly be a maternity site for most bats. During winter, however, no compartment of Kailash cave was occupied except for the lower storey (occupied by two individuals of *Rhinolophus affinis*), which could possibly mean that the cave isn't used for hibernation.

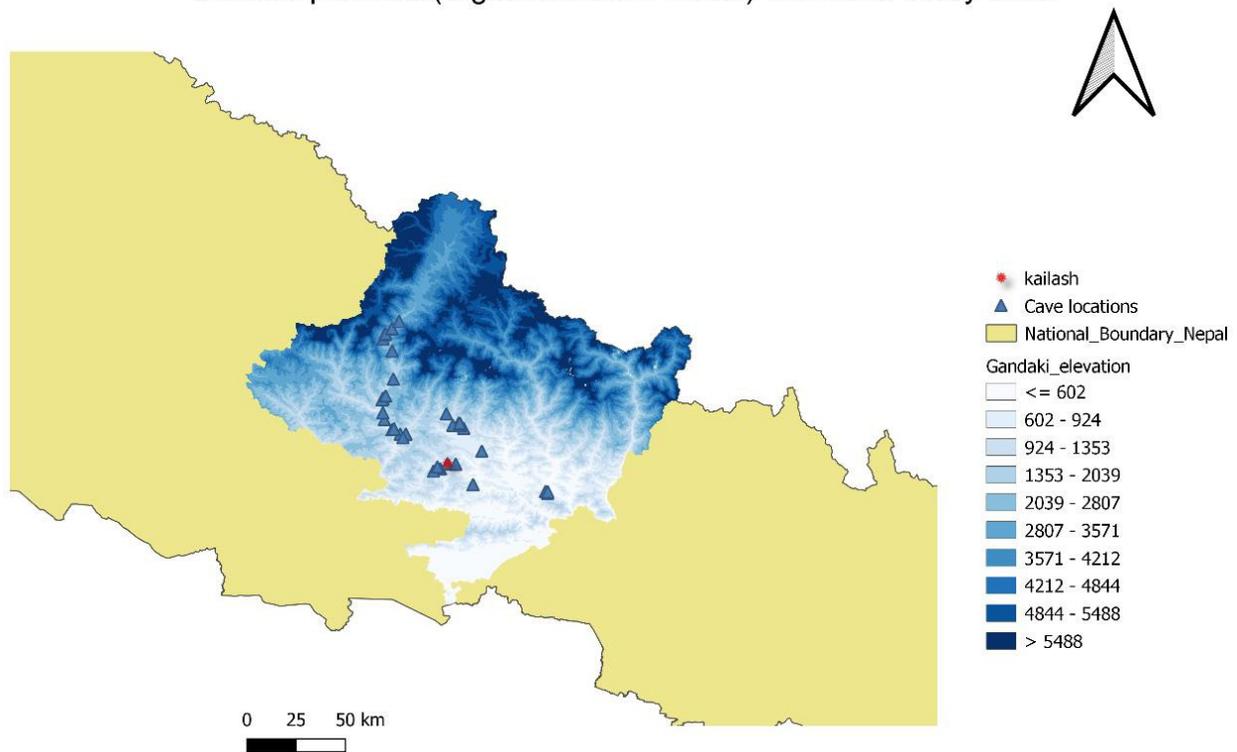


Left: Field assistant at the entrance of Kailash cave. Right: *Rhinolophus affinis* in Kailash cave.



Picture 1- Map of Gandaki province showing Kailash cave and other visited caves. In total 43 cave sites were visited.

Gandaki province (Digital elevation model) with cave/ study sites.



Picture 2 - Identified caves lie in different elevation. This would further help in building information on roosting ecology of cave-dwelling bats in the Himalayas.

Objective 2

In each cave that was identified, we used iButton thermochrons to quantify the variation in temperature inside compartments where bats were present and where bats weren't. These thermochrons were placed near the roosting location of bats whenever possible. When the ceiling height was much higher than accessible, we climbed up the cave wall to the nearest possible location from the cave ceiling. In each cave one to five thermochrons were placed based on the length and number of compartments. Similarly, to quantify the relative humidity inside each compartment, we placed tempnote dataloggers. Since we only had 10 units of tempnote loggers, the loggers were translocated after 24 hours measurements in each cave microsite. The data, thus collected, is stored in the laptop using an iWire adapter. For analysis of the data, we'll first look at the variation in temperature within and across caves. Exploratory as well as detailed statistical analysis are yet to be carried out. These analyses will be conducted after gathering data for all three phases.



Picture 3- A tempnote is placed near the roosting location of *Rhinolophus luctus*. The difference in cave wall temperature and that of bat is taken using a TG-165 thermal camera.

Objective 3

Outside each cave, an Audiomoth was placed to quantify the cave-exiting activity of bats. The recorders were placed for at least 3 nights. Because we had a limited number of Audiomoths ($n = 7$), we prioritised caves based on the number of bats present inside. After 3 nights, the Audiomoths were translocated to a different cave. These recorders were configured in such a way that they recorded echolocation pulses above 15KHz for 5 seconds with 10 seconds resting period, and recording was done from 6 p.m. to 6 a.m. The calls thus recorded will be analysed in terms of bat passes (a 5 second sequence file with at least two identifiable echolocation pulses) and will be used as a proxy for bat activity. Bat calls will be filtered using Kaleidoscope, and analysed using Raven Pro.



Picture 4- Audiomoth with a notice asking local people to not handle or take the recorders away.

Objective 4

One of the local people, Bal Kumar Gurung, was selected as a field guide/ citizen scientist to help identify caves in the region. With him, a team of two field researchers went on to explore caves and helped him gain field experience on cave and bat studies. He participated in cave measurements, bat identification, and acoustic data collection in field. During preliminary field visit in 2019, we had selected one other local to become a field guide/ citizen scientist but because of his unavailability, we had to select another local person from the same area.



Picture 5: Local citizen scientist and researcher inside Kailash cave.

Conclusion

After a much-delayed start of the project, we're finally gaining some pace on conducting field studies. Data has already been collected for the first phase research. We still have to conduct analyses of the available data, which will be done after the completion of the third phase.