Project Update: December 2019

This is a look back at the happenings of the field season which began in August 2019 and is now coming swiftly to an end. This is not the official report, that will come later.

The aim of this field season was to ascertain whether or not insectivorous bats contributed in a significant manner toward the control of insect pests which plague rice crops in India. Well aware of the challenges of demonstrating this with any degree of confidence, I designed the methodology such that each analysis built upon the other, and lend itself, in one way or another, to answering the ultimate question. The methodology I decided upon approached the question from three angles, each of which can be summarized with a question of their own.

- Do insectivorous bats follow trends in rice pest abundance over a rice season?
- Do insectivorous bats which hunt over rice fields consume said pests?
- Does the productivity of rice change with the exclusion of the insectivorous bat community?

As with most field experiments, many variables were far outside my control, and others which I believed to be within my control demonstrated their autonomy. Nonetheless, as I plan to leave this season and this site, I leave with the following types of data. They are, as yet, unrefined and messy, and it will be some time before I can make a judgement as to their usefulness.

Regarding the abundance and activity of insectivorous bats over rice fields, I placed 6 Audiomoth recorders at the control plots of my six enclosures (each of which was at least 100 m from one another). From the very beginning of the season, these recorders were in place once every 3 nights, and this increased to every night from October. This data (amounting to some 4 terabytes) will need to be scanned with a sophisticated programme to extract the number of species and the number of passes (which corresponds to activity) in each 10-minute window. From this data one can map activity levels of different species both temporally and spatially. Based on very cursory inspection of the data, it seems that bat activity does change with the progression of the season, and that the species distribution is affected by distance to the nearest treeline, however I will need to have all the numbers before I can make such a claim with certainty.

Regarding the diet of insectivorous bats, as of 3rd December 2019, I have captured 127 bats which have given me usable scat samples for analysis. The minimum number of individuals per species required to establish diet is 30, but due to the cryptic nature of many of the smaller species of insectivores, I have not been able to identify all my captures, thus leaving me unsure of how many captures per species I really have. This was an anticipated problem, and I have recorded the call and collected wing biopsies from these cryptic individuals and will be able to identify them on analysis of the call and/or wing biopsy. I estimate that I will have the required 30 samples from either two or three species. This analysis will take place at Southampton University, and I cannot make a guess as to the answer it will provide.

Regarding the difference in productivity of rice with the inclusion and exclusion of insectivorous bats, while the final numbers have not been collected yet, preliminary

numbers indicate that the variance of the dataset will be too large to demonstrate a difference in yield with statistical significance. This is due to the nature of rice and the range of factors which affect its growth. In essence, this was a field experiment which required laboratory levels of control over complicated factors such as weather and soil quality. While mid-season data might reveal a statistically significant effect on yield by bats, to truly demonstrate the effect of such interactions, future studies will have to change factors such as the scale of the enclosures, the monitoring of the land before the crop is sowed, using locations not prone to floods or elephant raids, and accounting for the plantation history of the land. The other option is to use more experimental methods such as lidar to track mid-air captures, or to use a different crop altogether. Rice is not the easiest one to work with.

The next steps lie in the direction of code and genes. Diet and activity data will guide the narrative around the ultimate question, and either support the findings of the exclusion experiment, demonstrating no difference in yield, or refute it. The few studies which have considered the effects of bats on crop pests have indicated a significant effect, but the magnitude of the effect varies hugely based on the methodology used to calculate it, with exclusion experiments reporting smaller or non-significant effects. Rather than be discouraged, I believe that such results only reinforce the idea that inter species interactions are complex and deserve investigation. They can demonstrate interactions which, if boosted, can have far reaching positive consequences both for conservation and sustainability. The potential value of studies cannot be understated.

A point to note.

A trend being seen in villages across the country is the shift from bamboo/wood houses to concrete ones. Conversations regarding bat activity routinely brought up the fact that bats were more abundant ten years ago, when the majority of the houses in the village were made of bamboo. Now, less than 10% are made this way. The original field site, which was abandoned for logistical reasons did, in fact, have a higher proportion of bamboo houses, and it was there that I planned this project, after villagers described to me the huge numbers of bats which swarm the fields around the time that the rice matures. If roost sites are in fact the limiting factor controlling bat abundances, then a long term study involving the installation of bat boxes is called for, in order to study our ability to increase the numbers of those species which can provide invaluable services to the farming community.