2021

Progress Report

RESEARCH PROJECT “EFFECT OF EXTREME HEAT EVENT ON INDIAN FLYING FOXES IN PAKISTAN

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Project Name	Effect of Extreme Heat Event on Pteropus medius (Indian flying foxes) in Pakistan		
Project Start Date	24 May 2021	**Project End Date**	15 August 2021
Project Status	In Progress	**Work Completed**	Almost 50%
Data Rretrieval from Data Loggers		½ Study Period Data retrieved	

Introduction

The objective of this research is to determine how extreme heat is impacting Indian flying foxes in Pakistan and more broadly in its entire geographic niche which include Indian subcontinent, Mynammar, and southern parts of China.

Project Goals:

- Determine temperature thresholds that precipitate heat stress in *Pteropus medius* at roost level
- Explore how different landscape variables influences heat stress.
- How weather patterns impact the thermoregulatory behaviors.
- Generate habitate suitability models for other *Pteropus medius* roosting sites by using these studied variables.
- Generate online Heat Stress forecastor for *Pteropus medius*
- Conduct interviews of the local population to identify historic die offs and dietary ecology of Pteropus medius in Pakistan.

During this project we are actively recording thermoregulatoy behaviours of Indian flying fox using vedio scan sampling. We are also monitoring temperature and humidity at roost level using calibrated highly sensitive TGP-4500 Tiny Tags data loggers.

There are eight data loggers installed at eight different roosting sites, which are located in seven districts of Punjab, Khyber Pakthunkhwa (KPK) provinces and capital territory of Pakistan. We selected roosting sites in both urban and semi-urban setting, having different landscape topographical factors (Figure 1)(Table 1).

Table 1. Location and topographical background of study roosting sites

Location of roosting site	**Region**	**Surrounding Landscape Features**
Bagh-e-Jinnah, Lahore	Punjab	Urban Park, in city center
Changa Manga, Kasur	Punjab	Semi-Urban, in planted forest area
Sailanwali, Sargodha	Punjab	Semi-urban on cannal bank
Mailse, Vehari	Punjab	Semi-urban on cannal bank
Sector G-10, Islamabad	Capital territory	Urban on road side
Khanpur Dam, Haripur	KPK	Semi-urban, near water dam
Hattar, Haripur	KPK	Urban, near road side
Gari Habibullah, Manshera	KPK	Urban, near river and road side

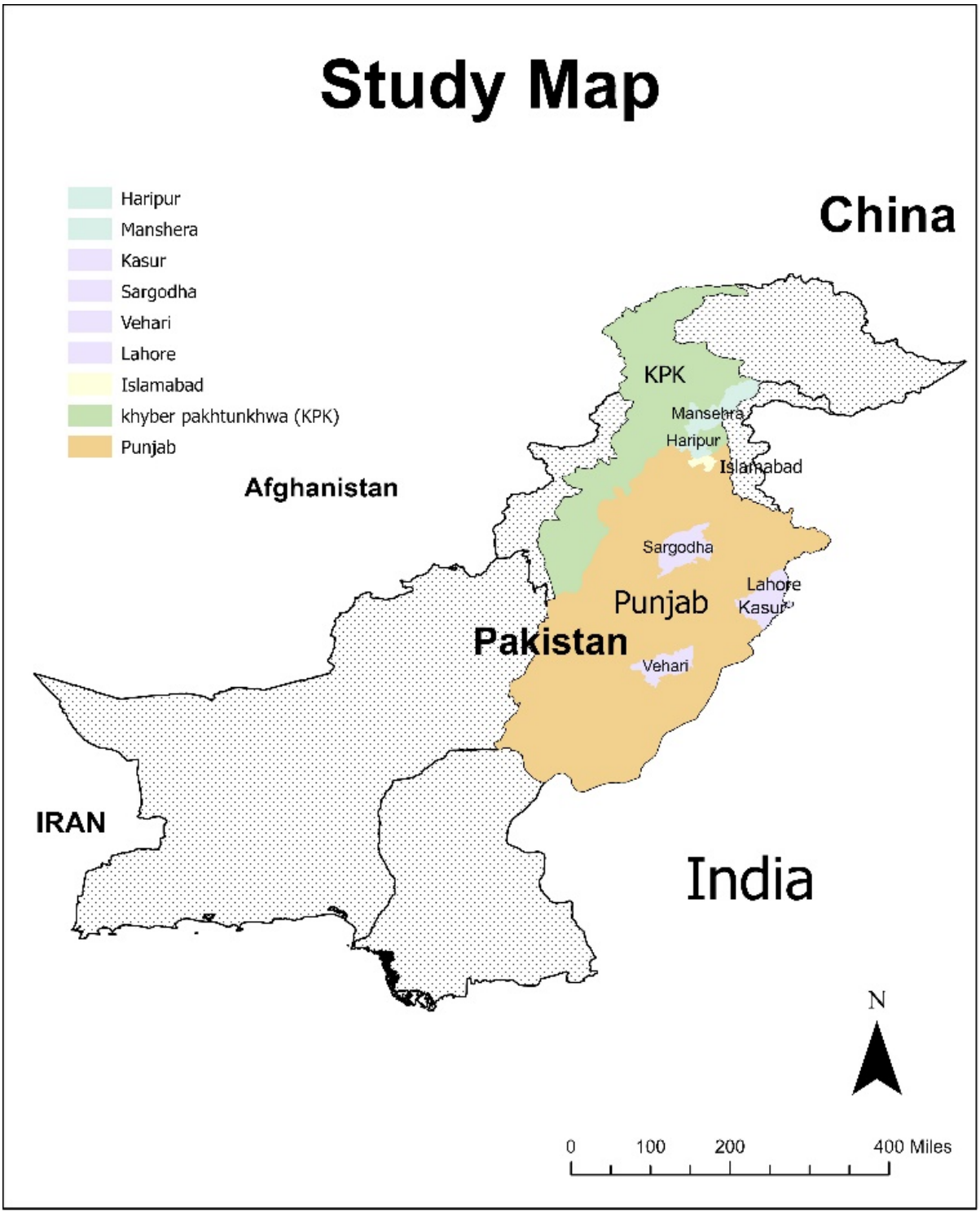

Figure 1. Study Map showing location of roosting sites of Indian Flying Foxes in Punjab and Khyber Pakhtunkhwa (KPK) Province of Pakistan

During this project, we have observed and recorded all the thermoregulatory behaviours, which starts with wind fanning followed by clustering, clumping, panting, wrist licking and eventually death. We also documented other thermoregulatory behaviours such as water bathing if water source is available.

So far, we have recorded more than 20 heat stress related mortalities when temperature exceed 42C. Here is observation of flying foxes death.

Clustering Behaviour at Khanpur, Haripur

Clumping Behaviour at Sector G-10, Islamabad

Belly soaking behavior at Silianwali, Sargodha

Meanwhile, here is temperature and humidity data collected by research assistant at the time of the death of flying fox in the field.

Heat stressed related death of flying fox in Hattar, Haripur

Spread sheet showing temperature and humidity recorded by highly sensitive data loggers at the time of death. It was 43C with 19.8% relative humidity.

2132	Jun 10 2021 1:42:00 PM	43.201 °C	20.1 %RH	15.5 °C	
2133	Jun 10 2021 1:57:00 PM	42.902 °C	20.1 %RH	15.2 °C	
2134	Jun 10 2021 2:12:00 PM	42.806 °C	18.9 %RH	14.2 °C	
2135	Jun 10 2021 2:27:00 PM	43.108 °C	19.4 %RH	14.8 °C	
2136	Jun 10 2021 2:42:00 PM	43.000 °C	19.8 %RH	15.1 °C	
2137	Jun 10 2021 2:57:00 PM	43.097 °C	21.6 %RH	16.5 °C	
2138	Jun 10 2021 3:12:00 PM	43.242 °C	20.3 %RH	15.7 °C	
2139	Jun 10 2021 3:27:00 PM	43.494 °C	19.4 %RH	15.1 °C	
2140	Jun 10 2021 3:42:00 PM	43.217 °C	19.6 %RH	15.1 °C	
2141	Jun 10 2021 3:57:00 PM	43.399 °C	19.1 %RH	14.9 °C	

Dead bat on tree trunk at Changa Manga Forest Area in Kasur

Additional work

- In addition to our proposed work, we are also collecting fecal samples (N=600) from bats to describe population-level fecal cortisol range in the Indian flying foxes, and corelates the fecal cortisol levels with heat stress, landscapes variables and fecal AMR resistance.
- We are processing bat fecal samples to determine the presence of pathogenic E. coli and Salmonella, by the generous lab support provided by National Agriculture Research Center (NARC), Islamabad, Pakistan
- Antimicrobial Sensitivity (AST) of selected E.coli and Salmonella isolates will be performed to determine Antimicrobial resistance (AMR).
- AMR genes in selected fecal E. coli isolates will be identified by using Polymerase Chain Reaction (PCR) method.

- We will determine fecal bacterial load and its association with physiological stress by corelating with cortisol levels and environmental temperature.

In addition, to that, we are aiming to collected dead bats after IACUC approval from Texas Tech University. We will perform histopathological examination for heat stress and starvation lesions as well as extract RNA from vital organs of these dead bats for detection of various viral zoonotic pathogen including Nipah Virus.
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