

CES Symposium 2015
Talk and Poster Abstracts

DAY 1 - 6th Feb, 2015

Title: Does it smell like the host? Host detection by the ovipositor of parasites in the fig-fig wasp system

Speaker: Pratibha Yadav

Abstract

In the fig-fig wasp system, volatiles emitted by the host plant can serve as cues in both long range and short range host location. Given that the hosts for non-pollinating fig wasps are hidden inside the fig syconium and they locate their specific targets mainly with the help of the probing ovipositor, the ovipositor becomes the major sensory organ involved in host location. Sensory nature of the ovipositor in the non-pollinating fig wasps of *Ficus racemosa* is investigated and presence of olfactory sensilla on the ovipositor is indicated. Scanning electron microscopy showed presence of different kinds of sensilla. Silver nitrate staining was carried out to check for presence of pores in the sensilla and analysed using light microscope and X-ray tomography. Electrophysiological recordings from the wasp ovipositor were done using GC-EAG setup. This is first study to show olfactory nature of the sensilla present in an ovipositor.

Title: Understanding fig-wasp dispersal across fig-wasp microcosms

Speaker: Vignesh V

Abstract

The fig-fig wasp system usually consists of a pollinator wasp (mutualist) and a guild of non-pollinator wasps (exploiters), all obligatorily dependent on a single host *Ficus* species. All wasp species disperse aurally, locate and colonize host syconia (a closed urn shaped inflorescence) where they lay their eggs and where their offspring develop to maturity. Because of the tight association and the insular nature of this interaction, a syconium that harbours fig wasps is considered a classic microcosm. Emerged winged female fig wasps mate with con-specific wingless males within their natal syconia and disperse in search of other suitable trees that bear receptive syconia to oviposit in. Given that most *Ficus* species exhibit within-tree reproductive-synchrony, and population level reproductive-asynchrony, female fig wasps disperse from their natal trees to locate spatially patchy, temporally ephemeral and often far away oviposition sites. For instance, pollinating fig wasps (size~2mm), have been known to travel phenomenal distances (over 100 km) and locate their species specific hosts. That

differential dispersal abilities could influence species co-existence in the fig-fig wasp system has been a subject of great interest and fascination over the last two decades. There has been a great advancement in understanding theoretically, the influence of dispersal abilities in maintaining community co-existence. However there is scant empirical work that has been undertaken to study differential dispersal propensities of the entire wasp assemblage in any fig-fig wasp system. We investigate the comparative dispersal propensities of seven fig wasp species in the wasp community of *Ficus racemosa*, consisting of a pollinating fig wasp (*Ceratosolen fusciceps*) and six non pollinating fig wasps (*Apocryptophagus stratheni*, *Apocryptophagus testacea*, *Apocryptophagus fusca*, *Apocryptophagus. agraenis*, *Apocrypta westwoodii* and *Apocrypta* species1). We record and analyse novel physiological parameters like flight performances of tethered wasps and mitochondrial densities in their flight muscles to infer their comparative dispersal propensities. We also compare life history traits and anatomical characteristics like wing loading, fecundity, and the ratio of lipids apportioned separately to the eggs and flight/dispersal in this assemblage of fig wasps. Our preliminary results indicate that there could be a trade-off between fecundity and dispersal ability. Our results also indicate correlations between the physiological, anatomical and life-history parameters investigated and also suggest that certain wasps are indeed better dispersers than other wasps in this community, and that these inferences can only be made with a detailed understanding of the system.

Title: **Edaphic heterogeneity in a dry tropical forest; The role of topography, vegetation and fire**
Speaker: **Sandeep Pulla**

Abstract

Edaphic heterogeneity at local scales is hypothesized to promote plant coexistence and help maintain spatially-structured, within-species genetic variation. We examined the roles of topography, vegetation and fire in generating edaphic heterogeneity in a southern Indian seasonally dry tropical forest (SDTF). Of the factors we considered, soils in this forest plot appear to be largely shaped by topography, possibly via water-table effects and water and debris flux, and woody vegetation, via mechanisms that need further investigation.

Title: **Phylogenetic position and origin of the Capped-Golden langur lineage**
Speaker: **Kunal Arekar**

Abstract

The phylogenetic position of Capped and Golden langurs has been much debated in recent times. Currently they are placed in *Trachypithecus*, a genus distributed predominantly in

Southeast Asia. However recent molecular studies have generated conflicting results. For example, in the mitochondrial Cytochrome b tree they branch with Indian langurs, genus *Semnopithecus*. However in another study the same gene supported their relationship with *Trachypithecus*. A few nuclear markers also suggest this relationship. Two possible reasons have been proposed to explain this discordance are, past Hybridization between *Semnopithecus* and *Trachypithecus* and incomplete lineage sorting of the ancestral haplotypes. Another study proposed a climatic model to explain current distribution of species based on paleoclimatic changes and morphological convergence. To resolve the phylogenetic and taxonomic position of the capped and golden langurs we reconstructed the evolutionary history of langurs using molecular phylogenetic tools. We sequenced nine nuclear markers and the whole mitochondrial genome to build a phylogeny. The data from nuclear markers shows that the capped-Golden langur lineage is sister to the langurs from SE Asia and this group is sister to the langurs from India. A preliminary analysis with the mitochondrial dataset revealed polyphyletic distribution of the Capped and Golden langurs. Wherein some sequences of CG lineage branches with *Semnopithecus* and some other branches with *Trachypithecus*. Further analysis of the mitochondrial data will give more robust results. These results can help us in better understanding their evolutionary origin and also to assess their conservation status in a phylogenetic framework.

Title: **Tracing the biogeography of the Indian blindsnake radiation**

Speaker: **Chinta Sidharthan**

Abstract

Blindsnakes (infraorder *Scolecophidia*) are known to have a Gondwanan origin. However, they are the most poorly known in terms of species diversity, phylogeny and biogeography. They feed on small social insects such as ants and termites and are fossorial. In the Australian continent, the blindsnakes, like several other Australian squamate lineages, have successfully adapted to the expansion of aridity that occurred since the mid-Miocene. This study aims at observing whether similar diversification of the Indian blindsnakes occurred during the aridification of the Indian subcontinent.

Title: **Understanding biogeographic patterns in the Indian subcontinent using freshwater snails as model system**

Speaker: **Maitreya Sil**

Abstract

The Indian subcontinent, due to its geological history and geographical and climatic diversity has been a natural laboratory for evolution to run its experiments and a rendezvous of fauna and flora of different biogeographic origins. We can see complex patterns in both the mode of colonization of the subcontinent from outside, dispersal of biota from India to outside and also in the various ways of geographic and ecological speciation due to interaction with the subcontinent's climate, geography and biotic components. Different freshwater snail families have various biogeographic origins which makes them an ideal system to test various hypotheses of colonisation of Indian subcontinent. I shall try to show how global distribution of different families fit different biogeographic hypothesis and also try to draw analogies from previous studies.

Title: **Species complex and concepts: Vignettes from Indian systems**

Speaker: **Dr. Praveen Karanth**

Abstract

Species are one of the fundamental units in biology and to this date largely identified based on morphological characters. However, with the advent of molecular tools it has become apparent that many widely distributed species harbour cryptic diversity. Such species are termed species complex and harbour multiple cryptic species. Perhaps the next important frontier in biodiversity research is the identification and characterization of this cryptic diversity. However, delimiting the members of such complexes is a challenge given these species exhibit very little or no morphological variation. In this regard, approaches that use multiple lines of evidence for species delimitation has gained ascendancy. This approach also referred to as integrative taxonomy is consistent with the general concept of species that attempts to unify all species concepts. Here I review a few recent studies from India where application of integrative approach has provided us with new insights into the systematics and evolution of these groups. Further I discuss the implication of this approach on taxonomy in particular and ecological and evolutionary research in general.

Title: **Dewlaps in the wind: are lizards also benefitting from clean energy?**

Speaker: **Dr. Maria Thaker**

Abstract

Renewable sources of energy are globally promoted as safe alternatives to fossil fuels for mitigating the effects of climate change. As one of the highest wind energy producers in the world, India is rapidly marching forward on the path towards greater clean energy. But is wind energy ecologically benign? While some adverse ecological effects of wind turbines are well

documented (e.g. collision mortality in birds and bats), I will talk about some of the less obvious effects. Based on our work in the northern Western Ghats, we're discovering that lizards are dramatically affected by wind turbines. Using a multi-disciplined approach, we've documented a complex behavioural and physiological trophic cascade, one that seems to be altering survival strategies.

Title: **Non-Human Primate malaria status in India using non-invasive technique**

Speaker: **Dr. Jyotsana Dixit**

Abstract

We share over 90% of our DNA with our Non Human Primate (NHP) cousins, however we still lack much information related to the prevailing pathogens in their wild populations. To this respect malaria is one of the oldest diseases of mankind and despite more than 100 years of research our hopes of complete control over the disease are still distant. Humans are affected by five different *Plasmodium* species causing malaria (*Plasmodium vivax*, *P. falciparum*, *P. ovale*, *P. malariae*, and *P. knowlesi*), on the other hand NHP harbors more than ten species of *Plasmodium* species. With molecular Phylogenetics and dating studies it has been proposed that the two most widespread *Plasmodium* species (*P. vivax* and *P. falciparum*) has got into humans through Host Switch Mechanisms from African Apes. Moreover, recent reports of *P. knowlesi* infections of humans in South East Asia, are a result of zoonotics from macaques to humans. In light of the fact that India reports ~ 2 million cases and 1000 deaths annually to malaria and we lack information on *Plasmodium* species prevalent in wild macaque populations, to gather information on NHP malaria species is the need of the hour. To this respect we have conducted a wide spread screening of fecal samples collected from wild populations of NHP of India for the presence of *Plasmodium* species. Around 200 samples from *Macaca radiata*, *Macaca mulatta*, *Macaca fascicularis*, *Semnopithecus hypoleucos* were collected noninvasively from Southern and Northern parts of India and analyzed using nested PCR for the presence of malaria parasite. One of the human *Plasmodium* species was found in seven of the fecal samples from *Macaca radiata* and one sample from *Macaca mulatta*. The study results in detail would be discussed further.

Title: **Malaria in birds**

Speaker: **Dr. Farah Ishtiaq**

Abstract

The phylogeny of avian haematozoan parasites, *Plasmodium* and *Haemoproteus* and *Leucocytozoons* was studied in a number of migrant and resident Western Himalayan birds in

breeding grounds and wintering grounds (Bangalore) sampled between January-December 2014. Using polymerase chain reaction for parasite detection and sequencing part of their mitochondrial cytochrome b gene, 5 *Plasmodium* and 17 *Haemoproteus* and two *Leucocytozoon* lineages were isolated from multiple host species from six sites across an altitudinal gradient ranging between 600-3200m in western Himalayas and two sites in Bangalore. I discuss reasons behind the observed pattern of variation and identify 3 possible causes: (1) variation in the geographic distribution of the vector species, (2) the degree of parasite sharing in resident and migratory birds, (3) timing of transmission. The study highlights parasites as a cost of migration which could have considerable impact on the evolution of migration and the likelihood of parasite transmission in immunologically naïve resident birds.

Poster title: **Behavioural syndromes over a lifetime: a role for sexual selection?**

Presenter: **Shreekant Deodhar**

Abstract

A behavioral syndrome can be maintained because high gains from one of the traits in one or more contexts offsets the costs of sub-optimal performance of other traits in other contexts. So, understanding the adaptiveness of a syndrome requires that multiple traits be studied in multiple contexts spanning an individual's lifetime. Such studies of syndromes over the lifetime of known individuals in wild populations are rare.

We examined syndromes in breeding males of Indian Rock Lizard, *Psammophilus dorsalis*, and studied the role of sexual selection in maintaining them. We hypothesized that alternative mating tactics (AMTs) may maintain syndromes via the interplay between limited plasticity and behavioral carryover. We expected dominant-territorial males to spend more time in mate-attraction and be more aggressive, exploratory & bolder in both mating and non-mating contexts. We followed tagged males in the wild over their adult lifespans, assaying boldness, measuring display-rates and mating tactics. We used model-presentation experiments and examined correlations in multiple traits (exploratory tendency, boldness and aggressiveness) in two contexts: territory-defense and predation. We report evidence for AMTs and limited plasticity and present patterns in correlations between multiple traits, across mating and non-mating contexts.

Poster title: **Not all that grows is wood! Trees expand and shrink with water: A novel method to correct bias in forest tree growth estimates**

Presenter: **Rutuja Chitra-Tarak**

Abstract

Accuracy in tree woody growth estimates is important to global carbon budget estimation and climate change science. Tree growth in permanent sampling plots (PSPs) is commonly estimated by measuring stem diameter changes, but this method is susceptible to bias resulting from water-induced reversible stem shrinkage. In the absence of bias correction, temporal variability in growth is likely to be overestimated and incorrectly attributed to fluctuations in resource availability, especially in forests with high seasonal and inter-annual variability in water. We propose and test a novel approach for estimating and correcting this bias at the community level. In a 50-ha PSP from a seasonally dry tropical forest in southern India, where tape measurements have been taken every four years from 1988 to 2012, for nine trees we estimated bias due to reversible stem shrinkage as the difference between woody growth measured using tree rings and that estimated from tape. We tested if the bias estimated from these trees could be used as a proxy to correct bias in tapebased growth estimates at the PSP scale.

We observed significant shrinkage-related bias in the growth estimates of the nine trees in some censuses. This bias was strongly linearly related to tape-based growth estimates at the level of the PSP, and could be used as a proxy. After bias was corrected, the temporal variance in growth rates of the PSP decreased, while the effect of exceptionally dry or wet periods was retained, indicating that at least a part of the temporal variability arose from reversible shrinkage-related bias. We also suggest that the efficacy of the bias correction could be improved by measuring the proxy on trees that belong to different size classes and census timing, but not necessarily to different species.

Our approach allows for reanalysis – and possible reinterpretation – of temporal trends in tree growth, above ground biomass change, or carbon fluxes in forests, and their relationships with resource availability in the context of climate change.

Poster title: **Performance and Problems of the Bee Keeping Industry in Karnataka**

Presenter: **Milind Kolatkar**

Abstract

In collaboration with Prabhakar Bhat and Prof. Raghavendra Gadagkar I have studied beekeeping practices in Karnataka. We focused on Uttara Kannda district of Karnataka. Information on different aspects of bee keeping industry in the district was collected from six Beekeepers' Societies by using two sets of questionnaires. Data was collected on the number of beekeepers, number of bee colonies, honey produced by the bee keepers, honey marketed through the societies, bee equipment, development programs in bee keeping etc. In depth statistical analysis was performed to investigate the trends and the complex relationships between honey production, beekeepers, boxes used, and most importantly - grants by the Government.

Collection and analysis of the data helped us identify the problems facing the beekeeping, beekeepers and Beekeepers' Cooperative Societies. Statistical analysis revealed how the parameters work in tandem. It helped us understand the way to higher honey production is through training. Our main finding is that the training camps rise number of well trained beekeepers. That in turn raises the honey production in subsequent years.

GUEST TALK

Title: **Islands with islands: Ecology, genetics and bird songs reveal differing effects of deforestation on isolated bird populations on sky islands of Western Ghats**

Speaker: **Dr. Robin Vijayan**

Post-Doctoral Fellow, National Centre for Biological Sciences, Bangalore, India

Abstract

- To be added shortly

DAY 2 - 7th Feb, 2015

Title: **Bats, bushcrickets and signaling in a tropical evergreen forest**

Speaker: **Prof. Rohini Balakrishnan**

Abstract

Bushcricket males produce long-distance acoustic signals which are used by females to find conspecific males. Typically, males remain in one spot and call whereas females move towards them. Bats prey on bushcrickets and can do so in two ways: using echolocation or by homing in on male calls. Both male calls and female movement thus entail risks of predation and we investigated which sex faces the higher predation risk. The lesser false vampire bat *Megaderma spasma* is a major bushcricket predator: both diet analyses and behavioural experiments indicate that female bushcrickets are at higher risk of predation by *M. spasma* than males. We therefore examined the behavioural response strategy of females of a common pseudophylline bushcricket species, *Onomarchus uninotatus*, to the calls of conspecific males to quantify their movement. We found that the immediate and sustained response of females of *O. uninotatus* to male calls was in the form of a series of whole-body tremulations, with each tremulation being exactly out of phase with individual male chirps, constituting a novel acoustic-vibratory duet.

Females only performed phonotaxis after long bouts of tremulation. We further showed that males are capable of using the substrate-borne vibrations of the female tremulation to locate them. Our results suggest that female tremulation in response to male calling may have evolved due to the higher bat predation pressure on females.

Title: **Rising differential entropy - Precursor of regime shifts in dynamical systems**

Speaker: **Nikunj Goel**

Abstract

Complex dynamical systems like ecological, climatic, financial systems etc. are prone to sudden catastrophic shifts, also known as regime shifts, even in a slowly changing environment. Regime shifts are difficult to predict and their degrading effects are difficult to reverse. Therefore, recent research has focused on devising early warning signals of such transitions. In this work, based on analytical and numerical calculations, we propose that differential entropy can be used as a precursor of catastrophic events. A novel aspect of this indicator is that it can capture nonlinearities of the system close to transition. We are currently working on empirical validation of this new early warning signal of regime shifts.

Title: **Endemic radiation of *Ceropegia* within the Western Ghats**

Speaker: **Dr. Siddharthan S.**

Abstract

The Western Ghats mountain ranges are a paradise for evolutionary biologists. Several plants and animals have diversified in the varied soil, altitude and climatic types of Western Ghats hence making it a hotspot to study endemic radiations. The model plant genus used in my study is *Ceropegia* which has about 55 species described from India. Most of them are narrowly endemic to small ranges in the Western Ghats. The northern and southern Western Ghats are proven to have different climatic and geological conditions. Therefore I wanted to test the hypothesis that there might be disjunct clades of species between the northern and southern Western Ghats. And what are the ecological and morphological characters that characterize these two clades. Earlier results from African species showed that another genus *Brachystelma* was polyphyletic with *Ceropegia*. Interestingly, similar results were also found among Indian species of *Brachystelma* and *Ceropegia*. In this talk I will discuss about the phylogenetic relationships between the *Ceropegias* of African, Indian and Asian origin

Title: **Group Structures in Heterogeneous Populations**

Speaker: **Athmanathan**

Abstract

Empirical studies have shown that group living organisms do not always occur in characteristic sizes; rather they exhibit fat-tail tailed distributions such as log-normal or a power-law which means that there may be no typical group size. Theoretical frameworks based either on individual based simulations or that consider merge and split dynamics have been developed to explain such features. However, most of these studies assume that individuals in groups are all homogeneous. Animal groups in nature consist of heterogeneous individuals either because of individual variations within conspecifics, or because groups may consist of individuals from different species. Here, we develop a theoretical framework based on merge-split model that accounts for heterogeneity in individual preferences for grouping and investigate properties such as group size distributions and within group compositions.

Title: **Empirical Studies on mixed-species shoaling dynamics**

Speaker: **Subhankar & Amith Kumar**

Abstract

Shoaling across taxa occurs either in conspecific or heterospecific groups. A large body of research on collective behaviours that investigates patterns of movement and decision making groups, however, is restricted to studies on conspecific shoals. Since the trade-offs associated with grouping in conspecific and heterospecific groups are likely different, we are interested in studying heterospecific shoaling behaviour. We have designed two experiments using species *Tilapia* (*Tilapia mossambicus*) and *Europlus* (*Europlus surantensis*), both of which exhibit shoaling and occur in similar habitats in peninsular India. The goal of the first experiment is to investigate patterns of collective movement in mixed species groups. In the second experiment, we investigate collective decision making in the context of mixed species groups. We will present preliminary results of these experiments.

Title: **Impact of river flow modification on estuarine bivalves**

Speaker: **Boominathan**

Abstract

Bivalves are sedentary organisms which are more susceptible to river flow modification. They play a vital role in ecology as a filter feeder, and in economy as food, lime, ornaments, poultry feed, etc. Hence, the impact of river flow modifications on estuarine bivalve diversity and distribution was evaluated in selected river estuaries of Uttara Kannada district, Karnataka. Also, comparative assessment of estuaries were made between those rivers with hydroelectric

projects and rivers without any major anthropogenic alterations. It reveals that the estuaries with modified river flow had low salinity, consequently lowered bivalve diversity and productivity, which affected the ecosystem goods and services, and livelihood of people.

Title: **Studying human social foraging groups in Berlin**

Speaker: **Dr. Hari Sridhar**

Abstract

In this talk, I will present the results of a short project I carried out in the restaurant of the Wissenschaftskolleg zu Berlin a.k.a Wiko. The Wiko invites people from around the world from different academic disciplines to spend a year in Berlin pursuing a project of their choosing. During this fellowship, the fellows have full freedom to work as they wish, on their own. But one of the, very few, obligations of the fellows is to have lunch with the other fellows in the restaurant every day. The idea behind this is to encourage dialogue between disciplines, which might help the fellows "reconsider their approaches, and may lead to unexpected innovation".

Last year, when I was a Wiko fellow, during a desperate time when my real Wiko project was not going anywhere, I decided to carry out a side project on "social foraging groups" in the Wiko restaurant. I decided to find out how fellows chose their lunch companions in the restaurant. Do they seek the familiarity and comfort of others from their own academic disciplines? Or the opportunity for new knowledge and new ways of thinking from fellows of other disciplines? Do other factors influence the choice - nationality, gender, age? Most importantly, is the Wiko successful in its mission to create "productive friction" between disciplines? I will provide some answers to these questions in my talk.

Title: **Elephant height sensor**

Speaker: **Amithabh Shrivastava**

Abstract

Demographic data of wild populations of animals is important for understanding their ecology and behaviour. Data on wild elephants are collected most of the time opportunistically, when one encounters elephants in the forest. This method however, is expensive, slow, inaccurate and can potentially disturb the animals.

Here, we present a passive infrared emitter-detector array based solution to measure elephant encounters. Since elephants grow throughout their life, their height can be used as a surrogate

for age. When an elephant passes between the emitter and the detector, it's shadow is detected and stored. The height -amongst other body parameters- can then easily be obtained. The method promises to be relatively more accurate and cost effective while sampling simultaneously across a large region.

Title: **Measuring fitness payoff of oviposition site selection decisions**

Speaker: **Manvi Sharma**

Abstract

Oviposition site selection decisions in mosquitoes can have important fitness consequences for the female because the quality of the site selected can influence the quality (e.g., survival, growth, size at maturation) of her offspring. I measured the fitness payoffs associated with ovipositing in pools varying in two important ecological variables: larval predation and larval competition. From these payoffs I intend to model and predict optimal oviposition strategies in different ecological settings.

Title: **Early warning signals for transitions from savanna to woodlands along a spatial gradient**

Speaker: **Amit Agrawal**

Abstract

Savanna ecosystems may shift from savanna to woodlands as a function of rainfall and other abiotic and biotic drivers such as fire and grazing. Monitoring of grass cover alone may not always be sufficient to forecast such transition because such transitions can also occur abruptly. Recent studies have proposed various early warning signals of ecological transitions. Here, we investigated whether these tools can be applied to anticipate transition from savanna to tropical forest in Serengeti-Mara landscape. Due to unavailability of temporal data of such transitions, we took the approach of 'space-for-time substitution'. First, we found that increasing rainfall is associated with decrease in grass cover, suggesting that rainfall is a key driver of vegetation in this landscape. We found that proposed spatial early warning signals increased substantially before decline in grass cover. Our study provides an empirical evidence of these statistical tools to forecast regime shifts in savanna ecosystem. However, it is required to perform such studies using temporal data.

Title: **Influence of thermal refuge on activity of alpine small mammal**

Speaker: **Dr. Sabuj Bhattacharyya**

Abstract

A central aim in ecological research is to improve understanding of the interactions between species and their environments; these improvements will prove crucial in predicting the ecological consequences of climate change for isolated montane species, such as Royle's pika. Influence of thermal refuge of alpine talus habitat on the activity patterns of Royle's pika has been studied in the period May to August for four year within six permanently marked plots deployed along an altitudinal gradient (2,900 to 3,680 m) within the Kedarnath Wildlife Sanctuary, India. Pika activity was recorded through direct observation during the period from 0600 to 1900 on each observation day and normalised as the percentage of individuals observed in an hourly interval relative to the maximum number of individuals sighted in a particular plot during the observation day. Microclimatic data in pika habitat were recorded across the altitudinal zones using automatic data loggers, a soil thermometer and a hygrometer deployed within the site during each observation interval. Using linear mixed effect models, we simulated pika activity as the number of active versus inactive individuals with logical alternate combinations of habitat microclimatic parameters, altitudinal zone and daily time interval. The pika had a bimodal activity pattern with high activity in the morning and evening hours and low activity during midday hours. The best fit candidate model demonstrated that pika activity increased with ambient humidity and decreased with increasing temperature. The reduction of activity due to an increase in temperature was significantly higher in the subalpine zone (2,900 to 3,200 m) than in the alpine zone (3,400 to 3,680 m). Thus, Royle's pika avoids heat stress by reducing activity during warm midday hours and taking shelter in microclimatically favorable cooler talus habitat. Changes in habitat microclimatic conditions (specifically, increases in temperature) might significantly restrict Royle's pika daytime activity.

GUEST TALK

Title: **Pollination services and coffee production in a forested landscape mosaic**

Speaker: **Dr. Smita Krishnan**

Post-Doctoral Fellow, ETH Zurich (Swiss Federal Institute of Technology, Zurich)

Abstract

Globally, forest conversion to crop lands has resulted in a landscape mosaic of forest fragments interspersed among various types of agricultural lands and human settlements. Forest fragments within agricultural landscapes are recognized to provide a variety of ecosystem services, several of which benefit adjoining agricultural lands. In a landscape mosaic with a high density of remnant forests dispersed within a largely coffee-agroforestry matrix, we explore the role of forest fragments in harbouring pollinators that enhance coffee fruit-set and the landscape attributes that influence the abundance of pollinators. Specifically, the importance of

wild pollinators, remnant forests, extent of coffee and non-coffee (native shade trees) flowering in coffee pollination and fruit-set would be discussed.
