LAS CRUCES LSAMP REU MENTORS 2018

* Patricia Esquete

1. **Habitat preferences of freshwater crabs in tropical streams**

Freshwater crabs constitute an integral part of stream ecosystems: they make up for an important proportion of the macroinvertebrate biomass and play an important role of food webs; they are important detritivores that reduce particle size of food items for other species, prey on small invertebrates, and serve as a food items for larger animals. Furthermore, they present direct developments, with no dispersal larval stage, and consequently to study their population densities can through light on the ecological consequences of reproductive strategies in tropical environments. Nevertheless, their habitat preferences, trophic ecology, or population structures in tropical streams remain largely understudied. For instance, how does the stream's width, current speed, litter composition or riparian vegetation affect the population densities and structures? Do the different life stages have preferences for certain microhabitats? The REU student will use different field capture techniques, animal manipulation methods and environmental variables measurements to respond these and other exciting questions. If more than one student is interested, two projects could be carried out on this subject.

Summary: Freshwater crab's ecology and biology

2. **Variations in the activity of semi-aquatic spiders of the genus Trechalea according to abiotic factors**

Semi-aquatic spiders are fascinating animals that live in crevices in the vicinity of water bodies, preying on insects, frogs, tadpoles, and other organisms including small fish. Two species of the non-web genus Trechalea are abundant in the rainforest's streams of Costa Rica, where they play an important ecological role by controlling other species' populations. However, little is known about their behaviour and the factors affecting their hunting/resting activities. This study aims to investigate their predation strategy and activity rhythms; for instance, the long-held hypothesis that Trechalea spiders are active during the night and during the day rest in places different from the predation sites may be tested. The REU student can expect searching rivers for big spiders during different times of the day, observing activity patterns, and mapping their movements. If more than one student is interested, two projects could be carried out on this subject

Summary: Activity of semi-aquatic spiders

* Cristian Martinez

1. **Tropical restoration and its effect on the insect community**

Students can assess what impact tropical forest restoration have on the insect community across the transitional grasslands, secondary forest, and primary forest at Las Cruces biological station. An additional question such as does selective logging change the leaf-litter habitat compared to the uncut primary forest, can also be addressed.

2. **Impact of tropical woodland restoration on leaf litter decomposition dynamics and insect activity density**
Students can assess how restoration activities at Las Cruses impact the ground leaf-litter habitat, and what members of the detrital insect community are most affected by changes in leaf litter structure. This question can be assessed by documenting the leaf litter characteristics and by using pitfall traps to gauge activity density of major ground active insects such as spiders and beetles.

Justin Montemarano

1. **Investigating the longitudinal distribution of fish communities in Las Cruces**: previous surveys of fish communities at Las Cruces have suggested low richness (four species), but a possible elevational range extension of at least one fish species. I would like to continue monitoring fish community composition, and extend the monitoring along the Rio Java river.

2. **Characterizing the distribution and role of crayfish in decomposition**: crab densities in and around stream systems at Las Cruces are variable, and there is limited data available that explains the variability. Further, it is clear that crabs contribute to decomposition of leaf matter through shredding. I would like to explore factors controlling crab densities (e.g., predation risk and habitat structure), and elucidate leaf processing rates and preferences of crabs.

* Juan Moreira

1. **Bat pollination and seed dispersal across a tropical fragmented landscape**
This project will utilize the existing fragmented landscape configuration surrounding LC (or LS) to address landscape level provisioning of pollination and seed dispersal services by bats to rainforest plants. Using mist nets at night, bats will be caught at various forest sites across the study landscape and samples of pollen and seeds will be collected from their fur and feces. Fruit-eating bat species will be immediately released after collection of samples as will be most nectar-feeding bats—a few nectar-feeding bat individuals will be kept for the second experiment (see below) and will be released later. Bat species whose diets do not include nectar, pollen and/or fruits will be released immediately. During the day, samples of seeds and pollen will be processed and assigned to plant species using the OTS herbarium database and knowledge of local staff experts to build up a database of regional bat-plant interactions with the aim of turning it into a multi-year long term study. In addition, weekly surveys of the forest sites will determine the relative abundance and flowering/fruiting phenology of plant species used by bats in the landscape. Using Geographical Information Systems resources available from the local OTS station, we will relate bat abundance (by species and foraging guild) and estimates of pollen and seed dispersal services (e.g. plant richness in pollen and seed samples, number of pollen grains

carried, number of seeds in fecal samples), to landscape and forest cover variables, and to the relative densities of plants used by bats.

2. **Tropical nectar-feeding bats as selection agents for floral evolution**
Nectar-feeding bats pollinate many Neotropical plants but the extent by which they have driven floral evolution has been less explored than in plants pollinated by other agents. We will use bats in staged experiments with flowers in a flight cage to determine the floral traits influencing pollen transfer and therefore under selection for increasing pollination efficiency. Bats will be taught to feed from a hummingbird feeder filled with sugar water (otherwise will be released), and be kept for experiments < 24 h. Using flowers of the most abundant bat-pollinated plants available at LC (or LS), we will create mixed floral arrays in a flight cage where a bat will be allowed to fly for ~30 min without the feeder (1 trial). Each array will have two flowers per plant species (one male phase, one female phase) with their relative position shifted randomly between trials. Measured floral traits will include those involved in the mechanical fit during a bat visit to a flower: corolla length, corolla width, anther length and orientation, style length, and stigma surface area. Pollen transfer will be determined for each plant species using small squares
of double-sided tape on the stigma surfaces of the two female-phase flowers in each trial, and later counting these pollen grains under the microscope. By using realized pollen transfer to measure pollination efficiency, this project will reveal which floral traits help plants to optimize the mechanical fit with bat pollinators and thus likely be under selection to diverge from co-occurring plant competitors.

* Breanna Putman

Does forest fragmentation influence predation risk and do animals adaptively respond to this risk?
Because predation is ubiquitous in the lives of most animals, it is a strong source of selection on prey behavior. Habitat can influence predation risk; for instance, prey might be more vulnerable in open habitats where they are more detectable. The land around Las Cruces provides a unique opportunity to study whether predation risk is affected by forest fragmentation, and whether animals modify behaviors to match this risk. The semi-aquatic anole (Anolis aquaticus) is an ideal organism to test these hypotheses because it is dispersal-limited (restricted to boulders within streams)— lizards must respond to risk or face the consequences. At Las Cruces, these lizards occur in streams that are surrounded by different land use: primary forest, secondary forest, and abandoned pastures. I intend to have one OTS-REU student measure predation risk in different streams by placing out clay lizard models, a common and reliable method used to quantify avian attacks on lizards. This student will test whether streams surrounded by more open habitat have higher predation risk. A second student will test whether lizard boldness associates with these differences in predation risk. Boldness is measured by quantifying the latency to emerge into a novel environment from a refuge. I have successfully used this method previously in semi-aquatic anoles. Students will work together, but have independent hypotheses that each is testing. Their

research will be important from a conservation perspective (i.e., does deforestation increase risk in prey?), and also an evolutionary one (i.e., can prey respond to changes in risk?).

Student Project 1: **Use of clay lizard models to test whether land use affects predation risk**
Student Project 2: **Behavioral assays to test whether lizard boldness associates with predation risk**

* Juan Rivero

1. **Avian malaria in tropical birds**

In this project, the student will investigate avian malaria parasites infecting birds from tropical forest. To accomplish the project the student will use different methods, as is mist-netting to capture the birds, blood drawing to take the samples and optical microscopy to identify the parasites. The goal of this study is to use the avian malaria model to investigate the relationships among host and parasites in tropical forests. By the identification of parasites, the student will be able to estimate the prevalence of infection in local birds and will learn about the ecological and evolutionary factors affecting avian malaria infections.

2. **Bird diversity in tropical forest**

In this project, the student will investigate avian diversity in different forests, varying on their degree of disturbance. The student will apply different methods to estimate bird's diversity from primary, secondary and restored forest. To do that, the student will use direct observation of birds and mist-netting. The goal of this study is to understand the effects of forest disturbance on birds' diversity. After the study, the student will appreciate the importance of forest conservation on birds' biodiversity and ecology.

In both projects, the students will learn to create and analyze data bases and the application of statistical techniques like GLMs and model selection. At the end of the project students will have the necessary skills to perform an independent research project in the tropics.

* Lindsey Swierk

1. **Water anole home range and microhabitat use**. Understanding how individuals distribute themselves in space is a fundamental problem in ecology. In collaboration with Dr. Bree Putman, this project will explore the social structure of water anole populations and their relationship to the microhabitat. Little is known about this unusual lizard's home range and social behavior. The student conducting this research will study water anole home range sizes and shapes to address natural history questions regarding sex- and age-related habitat use, territoriality, and density.

2. **Locally optimized thermal ecology in water anoles**. Cool-adapted tropical species like the water anole tend to be sensitive to temperature extremes, but they will increasingly be subjected to warming temperatures with climate change. The student leading this project will explore the hypothesis that water anoles, though heatsensitive, demonstrate local adaption to average conditions within their habitats. We will examine lizard thermal preferences within primary forest, secondary forest, and abandoned pastures and test whether thermal tolerances are optimized to habitat types.