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Experiential Student Learning and Collaborative Research: Understanding Tropical Ecosystem Response to Climate Change from Leaves to Landscapes



The monkeys at Curu were extremely tame and curious

During January 2012, I traveled to Costa Rica to visit potential field sites for a future UNH J-term course in Tropical Ecology and to collect preliminary data for a new research project linked to the course. Both of these initiatives are in collaboration with Dr. Michael Palace, a research scientist at UNH's Earth Systems Research Center. Together, we visited three sites in Costa Rica, each having very different climates and vegetation: Curu Wildlife Refuge, a tropical dry deciduous forest receiving only about 1,500 mm rain annually; La Selva Biological Station, a lowland tropical rainforest that receives over 4,000 mm of rain annually, and Monteverde Reserve, a tropical montane cloud forest that is immersed in fog for much of the year.

These three sites offer students the opportunity to experience three sharply contrasting tropical ecosystems, each with their unique assemblages of wildlife and plant species, as well as conservation issues and priorities. For example, the tropical dry forests at Curu are experiencing tremendous pressure from surrounding human settlements for hunting and timber extraction. Local park managers are working with limited resources and infrastructure to protect wildlife populations, allow the forests to regenerate successfully in previously deforested areas, and encourage scientific research. Curu is particularly well known for its high population of monkeys, including white-faced, spider, and capuchin monkeys. In contrast, La Selva is a world-renowned research facility that is superbly equipped with state-of-the-art laboratories to support scientific activities by researchers from around the globe, and is one of the most intensively studied tropical ecosystems in the world. In particular, research on species diversity

has documented many new animal and plant species and has demonstrated important relationships between biodiversity and microclimate in rainforest environments. Monteverde is one of the best examples of tropical montane cloud forest in the world, and is particularly well known for research on endemic species and climate change. For example, scientists have shown how deforestation in the lowlands has resulted in a rise in the cloud base and declining fog occurrence, which is threatening the plant and animal species that are adapted to the unique microclimate conditions of the cloud forest environment. One of the best examples is the golden toad, which was once a common species in the cloud forest, but went extinct in 1989.

The objective of my visit to these sites in Costa Rica was two-fold. First, I sought to establish the necessary local contacts and logistical arrangements to support the future travel of J-term students from UNH to these sites, and to assess the availability of different learning opportunities that could be incorporated into the course. Interestingly, although the three sites that we visited offered very different types of accommodations, infrastructure, and educational activities, they each provided excellent opportunities for hands-on learning and active participation in research. Primary contact people were identified at each site, all of whom were extremely supportive and helpful, and will be key to enabling us to successfully create and implement a J-term course in 2013. Also critical was gaining an understanding of the public transportation system, living arrangements, and cultural environment, so that we can better prepare students for the experience. Fortunately, Costa Rica is an extremely safe country with fairly well-developed infrastructure, health services, and communication networks, and has a long history of facilitating study abroad programs (several exist already in various departments at UNH), and should provide an ideal location for organizing a tropical ecology course.



Collecting leaf samples from the elfin cloud forest at Monteverde

My second objective was to collect preliminary data that will provide the foundation for developing a long-term research project which is being integrated in the semester-long course in Tropical Ecology I am currently co-teaching with Dr. Palace this spring semester 2012. This research seeks to understand how patterns in individual tree species' leaf traits (e.g., nitrogen content, stable isotope signatures) are related to landscape patterns in spectral imagery detected by remote sensing techniques, and in turn, how these patterns relate to changing climatic conditions. In order to answer this question, we collected leaf samples from the dominant tree species at each of the three sites, and (for Monteverde) at four different elevations. For each leaf sample, we made leaf area measurements while in the field, and then dried the samples in an oven in preparation for export. These samples will be sent to UNH



Cutting leaf samples and analysing leaf areas on a portable scanner

within the next couple of weeks, where they will be analyzed for nitrogen content and stable isotope signatures. As part of our Tropical Ecology course, several students will conduct their semester projects related to different aspects of this research. Students will gain hands-on experience working in the lab, analyzing and interpreting data, and writing a research paper for publication. Ultimately, this work will also lead to several research proposals that we anticipate will generate additional funding to continue this research in the future.

I greatly appreciate the support provided by UNH's Center for International Education to help make this exploratory trip to Costa Rica possible. Funding was also provided by a grant from UNH's NSF-ADVANCE program. I am also grateful to the three field assistants who participated in the research aspects of the visit: Christina Czarnecki, Julia Shimbo, and Jonas Mota e Silva. I am looking forward to building upon this initial visit to Costa Rica by expanding educational and research opportunities for students at UNH in the future.



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