**2016 LTER annual meeting: poster abstracts**

**Towards a sustainable management of environmental flows in the Rio Fajardo:  the 2014-15 drought experience**  
Yadiel Bello and Jorge R. Ortiz Zayas  
Department of Environmental Sciences, University of Puerto Rico-Rio Piedras  
  
In 2006, the Puerto Rico Aqueduct and Sewer Authority started the operation of the Northeast Aqueduct designed to improve the water supply system of the region.  The design included novel environmental considerations such as an offstream reservoir and a low head dam that facilitates migration of river fauna and guarantee a minimum instream flow of 2.8 mgd (4.3 cfs).   This flow is equaled or exceeded 99% of the time (Q99).  Regulatory agencies also required that water withdrawal ceased daily for about 3 hours from 9pm to 12m to reduced entrainment of drifting shrimp larvae.  By 2011, however, the franchise requirement was eliminated.   This project evaluated the efficacy of the water intake structure in maintaining an environmental flows during the severe 2014-15 drought.  We applied the Indicators of Hydrologic Alterations software developed by the Nature Conservancy to mean daily streamflow time series collected by the US Geological Survey below the water intake.  The analysis revealed that during the dry season, mean monthly flows before and after 2006 have decreased during February, have increased in March and have not changed in April.  In 2015, mean daily flows below the intake decreased below the minimum instream flow requirement on 93 days or 25% of the time.  Since it started to operate, this represent the first time that the environmental flow requirement was not meet.   Because climate change predictions for Puerto Rico call for more prolonged and extreme droughts, an instream habitat characterization of the Rio Fajardo below the intake is recommended to assess the impacts of the reduced flows on the physicochemical river environment.

**A COUPLED SOCIO-ECOLOGICAL APPROACH TO ASSESSING RIVERINE FRAGMENTATION BY DAMS**  
Jessica C. Chappell1, S. Kyle McKay2, Catherine M. Pringle1  
1Odum School of Ecology, University of Georgia, Athens, GA  
2Environmental Laboratory, U.S. Army Engineer Research and Development Center,   
Athens, GA

Given dramatic declines in riverine connectivity resulting from dams, Puerto Rico’s water managers have recognized the need to balance tradeoffs between ecosystem integrity and socioeconomic needs for freshwater. Watershed connectivity is crucial to the life history of many aquatic migratory organisms, and the island’s stream fauna have been dramatically altered by the presence and operation of dams and water intakes. A variety of connectivity indices have emerged to quantify the effects of dams and other infrastructure on migratory organisms with different life histories. Although rivers are temporally dynamic, connectivity is typically calculated as static through time. We examine the role of intra- and inter-annual variations in connectivity for a variety of amphidromous species within watersheds of the El Yunque National Forest to inform water managers as they weigh trade-off goals of providing municipal water supply and maintaining aquatic ecosystems. In addition to the scientific complexities of connectivity modeling, water management is often influenced by the social challenges of multiple stakeholders and water management agencies. We then analyze the governmental and private institutions and agents governing water management in Puerto Rico. This analysis reveals differing levels of authority and overlapping roles and responsibilities in the day-to-day governance of the island’s water resources. By taking this coupled socio-ecological approach, we hope to not only better understand the ecological complexities of water management, but also translate those challenges into practical and effective management practices.

**Effects of urbanization on leaf-litter decomposition and aquatic macroinvertebrate assemblages in stream ecosystems**   
Leticia Classen, Alonso Ramirez.

Puerto Rico is an island that experiences an increase in urban growth each year. Studies estimate that approximately 40% of the island is under urban sprawl, especially the metropolitan area. This urban increase alters the processes and functions that occur in stream ecosystems. The objective of this study was to determine the leaf-litter decomposition and aquatic macroinvertebrate assemblages along an urban gradient. Our study watershed was the Rio Piedras, draining the San Juan Metropolitan Area. Six streams were selected varying in their level of urbanization. Six leaf-litter bags were placed in three pools in each stream. We measured the change in weight of the leaf-litter, the rate of decomposition and the macroinvertebrates colonizing the leaves. Results show that the most urbanized streams have lower decomposition rates, in which an approximately 0.04% of the leaf-litter is decomposed per day; while the less urbanized streams decompose approximately 1% of the leaf-litter per day. Macroinvertebrate abundance and richness also responded to the urban gradient, with higher diversity in less urbanized streams. We found that the decomposition rate and macroinvertebrate assemblages are affected by the amount of urbanization on the watershed. Urbanization alters sediment deposition, channel morphology and water chemical composition affecting the processes that occur in an ecosystem, such as leaf-litter decomposition, the macroinvertebrate assemblage and their food webs.

**Predator-Prey Distributions of Shrimp in Tropical Streams, Luquillo Mountains, Puerto Rico**Alan Covich1, Todd Crowl2, Omar Perez-Reyes3   
1Odum School of Ecology, University of Georgia, 2Southeast Environmental Research Center and Department of Biological Sciences, Florida International University, and 3Biology Department, University of Puerto Rico

How do freshwater shrimp respond to disturbances such as drought in steep, headwater streams? The effects of dry periods on freshwater species in wet tropical rainforests are unclear because these events are relatively rare. Based on long-term observations (27 years) of the spatial distributions of migratory fishes and freshwater shrimp species in the Luquillo Mountains of Puerto Rico, we concluded that the locations of steep waterfalls determine where predator and prey species of shrimp can minimize their risk of predation because predatory fishes cannot climb high waterfalls. Migratory post-larval shrimp are able to climb waterfalls greater than 10 to 20 m in height. However, the smaller shrimp species (*Atya lanipes* and *Xiphocaris elongata*) remain vulnerable to predation by larger shrimp (*Macrobrachium crenulatum, M. carcinus*). The prolonged lack of flow over waterfalls limits upstream migrations of post larvae and could result in long-term changes in population densities. Along the upper reaches of headwater streams the predator-prey interactions among resident shrimp species are affected by drought-mediated low pool depths. At upper elevations, the relatively small, shallow pools concentrate densities of *Macrobrachium* during prolonged drought.These high densities can lead to changes in movements, especially of sub-dominant *Macrobrachium* predators, to search for less crowded pools. In 1994, one of the two driest years in that last 50 years, adult *Macrobachium* moved farther upstream to extremely shallow pools in Quebrada Prieta than previously observed. Following the 1994 drought the densities of these predators and their shrimp prey retuned to previous levels. In 2015, the second driest year on record, no upstream movements of *Macrobrachium* occurred. These observations are important for better understanding the need to sustain upstream spatial refugia for freshwater prey species from different types of predators above 400 m elevation. At various life stages, these typically abundant freshwater shrimp are active consumers of leaf-litter and associated aquatic insects. Their roles in sustaining water quality and ecosystem functions are important but they are vulnerable to drying out of river and stream channels. Access to the uppermost headwater pools may be limited by future prolonged droughts that interrupt essential migratory pathways for shrimp (as well as many species of fishes and gastropods that dominate these food webs). More frequent and longer droughts will likely decrease connectivity of river networks and disrupt life histories of these diverse amphidromous species and their predator-prey interactions. Changes in long-term population dynamics could affect their importance in ecosystem functions such as grazing and processing detritus.

**Spatial heterogeneity of soil nutrients and their relationship to plant species composition and cover in the Guayama pasture land**  
Wei Huang 1, Xiaoming Zou 1 and Grizelle González 2  
1Environmental Sciences Department, College of Natural Sciences, University of Puerto Rico, P.O.Box 70377, San Juan, PR 00936-8377, USA   
2 International Institute of Tropical Forestry, USDA Forest Service, Jardín Botánico Sur, 1201 Calle Ceiba, Río Piedras, PR 00926-1119, USA

Spatial heterogeneity of soil nutrient is an important driver influencing plant species composition, population dynamics, community structure, plant diversity, and plant productivity. We have demonstrated by charcoal dating that fire has been a frequent disturbance in the Guayama Experimental Forest. Thus, understanding how fire may influence plant species composition, community structure, and productivity through altering the spatial heterogeneity of soil nutrients is critical for the management of subtropical moist forest. This study aimed to investigate the spatial variation of soil nutrients, and their relation to plant species composition and cover in the Guayama pasture land. Data generated from this study can be used as reference for studying the influence of prescribed burn on soil nutrients and plant communities in the subtropical moist forest.

Eight 10×20 m plots consisting of 2 ×2 m grid cells were established in the Guayama pasture land in May 2015. Soil samples before fire were taken from 0-6cm soil layer, percent cover of vegetation was assessed in June 2015. Water extractable soil Al, Ca, Fe, Mg, Na, Mn, K, S and P contents were determined by ICP-MS. Soil total C and N contents were analyzed by C/N/S-Analyzer. Semivariogram analysis was used to examine spatial heterogeneity for soil nutrients and percent cover of vegetation. Cross-semivariogram analysis was used to determine the spatial correlation between soil nutrients and percent cover of vegetation. Data sets that did not visually approximate a normal distribution were ln-transformed to fit a visually approximate normal distribution prior to analysis.

Soil total C, N and water extractable soil Al, Ca, Fe, Mg, Na, Mn, K, S, P exhibited a very strong spatial structure in Guayama pasture land before prescribed fire. Values for these soil nutrients derived from this property had spatial autocorrelation ranges of 4.11 – 15.90 m. The percentage of total variance for these soil nutrients explained by spatial dependence from the sampling grid ranged from 50.1% to 99.9%. Two exotic grasses (*Megathyrsus maximus* and *Dichanthium annulatum*) are the dominant species in grassland of Guayama Experimental Forest before prescribed fire. Geostatistical analyses showed that percent cover of *M. maximus* has a positive spatial correlation with soil water extractable Al, Fe, and Mn, and a negative spatial correlation with soil water extractable Ca, Mg, K, and Na. In contract, *D. annulatum* exhibited a negative spatial correlation with soil water extractable Al, Fe, and Mn, and a positive spatial correlation with soil water extractable Ca, Mg, K, and Na. The spatial dependences were between 86.2 - 99.9%. There were no significant spatial correlation between percent covers of the two grass species and the spatial variation of soil C, N, P, S.

Our data suggest that there exists spatial correlation between soil elements and plant species composition and cover, and fire can influence plant community through altering spatial distribution of soil elements.

**Diversity of Sulfate Reducing Bacteria in Response to a simulated hurricane at El Yunque Rain Forest**Puerto Rico Institute for Microbial Ecology Research, School of Natural Sciences and Technology, Universidad del Turabo, Gurabo, Puerto Rico  
Jonathan López-Carrasquillo, and José R. Pérez-Jiménez

Sulfate-reducing bacteria (SRB), that play a key role in the sulfur biogeochemical cycle, have been found in different anoxic environments, including mangrove sediments and elfin forest soils (El Yunque Rain Forest, Puerto Rico). Five life zones in El Yunque (tabonuco, palm, elfin, dry, and colorado forests) are developed in an elevation gradient subjected to natural disturbance and contrasting physicochemical conditions. A Canopy Trimming Experiment (CTE), that simulated the pass of a hurricane, has been already done in the Tabonuco forest. Samples have being collected at various times to monitor changes in microbiota. Our goal is to determine temporal heterogeneity of sulfate-reducing bacteria within the experimental plots, as detritus deposition of simulated hurricane effect. Soil samples are being collected from plots, every two weeks. Two treatments are considered: with and without detritus deposition trimmed from the local canopy. Total genomic DNA was extracted for amplification of the dissimilatory sulfite reductase gene (*dsrAB*) and terminal restriction fragment length polymorphisms (TRFLP) analysis of their MboI digests. According to the Dice similarity index, under no detritus deposition, the similarity decreased as time progress, 44% at time 0 to 17% at week 10. In contrast, diversity increased over time where detritus was added. Sulfidogenic abundance was lower in the absence of detritus (33 versus 94 phylotypes). The overall sulfidogenic community was dominated by major phylotypes decreasing over time. Only two phylotypes (184-, and 474-bp) persisted for both treatments and the five time periods examined. Our results suggest that a simple sulfidogenic community prevails in the Tabonuco forest soils that diversify as anoxic conditions are exacerbated by the addition of plant residues and their sulfate-containing residues are released to the soil. In the future, characterization of specific taxa presented will be elucidated.

**The reconstruction of late-Holocene fire activity in a subtropical moist forest of Puerto Rico**Xianbin Liu

Fire has already been demonstrated as an important phenomenon in forest ecosystems to influence forest development and dynamics, and is a special perspective to investigate forest composition, structure, and function. Compared to more advanced research in the continent of Canada and America, it will benefit the research field extensively to determine if fire is a frequent disturbance in forest ecosystems of a small insular island in the Caribbean, where fire has been neglected as a frequent disturbance for many decades. This study demonstrates that fire was a frequent disturbance in a Puerto Rican subtropical moist forest. Many natural fire events occurred in the mid-Holocene, and calibrated data of charcoal weight and decay rate reflect historical fire events more precisely. The method used to recover historical fire activity by charcoal weight and decay rate in this manuscript is more precise and reliable than previous studies which rebuilt historical fire activity using radiocarbon data.

**The impacts of biofuel feedstock expansion on soil fertility.**Evald Maceno

The global demand for energy is enormous and is increasing rapidly. Fossil fuels currently provide the main source of energy, but they are finite and have adverse consequences on the environment. Crops are a viable alternative energy source, and represent one of the most important renewable energy options. Therefore, large-scale bioenergy crops have been developed as feedstock, which could help meet consumer needs and decrease the consequences of burning fossil fuels. However, the expansion of cultivated areas often intensifies single crop practices that might adversely impact soil productivity. This study aims to determine if cultivation of bioenergy crops modifies soil physicochemical properties. A field experiment will be conducted in agricultural land located in eastern Puerto Rico at Gurabo Agricultural Experimental Station farm with three bioenergy crops: soybean, corn, and sweet sorghum, to study their impacts on the soil. The effects of these feedstocks will be assessed via analysis of total C and N, soil pH, soil bulk density, water holding capacity, Carbone dioxide (CO2), and potassium and phosphorus available in the soil.

**Community Variation in Collembola (Hexapoda: Entognatha) from the Luquillo Montains, Puerto Rico**C. Marcela Ospina Sánchez 1,2 , Grizelle González2 ,Felipe Soto-Adames31University of Puerto Rico– Intercampus Doctoral Program. cmospinasanchez@fs.fed.us 2International Institute of Tropical Forestry USFS, Rio Piedras, P.R. ggonzalez@fs.fed.us 3Natural History Survey INHS, University of Illinois, Urbana-Champaign fsoto@illinois.edu

It is well understood that complex abiotic and biotic factors influence soil dynamics. To better understand these interactions the ability to discuss focal taxa at a species level could be incredibly informative, albeit difficult to accomplish due to limited knowledge of existing taxa diversity. The utilization of microhabitats by different species may be important in explaining community compositions among forest types. Collembolans represent a unique focus group to help understand soil dynamics because they respond strongly to physico-chemical and/or biological changes that occur within environments even over a small geographic range. This study was conducted along an altitudinal gradient in the Luquillo Mountains of Puerto Rico. We sampled in tabonuco (*Dacryodes excelsa*, 300-520 masl) palo colorado (*Cyrilla racemiflora,* 750-820 masl) and elfin (*Tabebuia rigida,* 950-1050masl) forest types. Sampling occurred in nine plots every four months from August 2014 to August 2015, with three plots in each forest type. In each plot, we selected five trees of the dominant species and sampled soil, leaf litter and epiphytes from the adjacent area of each tree. Berlese funnels were used to extract all arthropods and collembolans were identified to species. In total, 8335 collembolans were collected and found to represent 74 species that belong to 14 families. Community composition varied among forests, in species richness and abundance. According to an analysis of Non Metric Multidimensional Scaling (NMDS) there was a clear separation of Collembola communities in the elfin forest compared to those of tabonuco and palo colorado forests. These results show the importance of several microhabitats for collembolans, especially epiphytes in the elfin forest, which were found to contain high levels of diversity. For soil samples we found two endemic species, while in epiphytes 10 species were found exclusively for this microhabitat. Moreover, the elfin forest showed a species richness of 52 and was the forest type with the highest number of endemic species (10). In previous studies 44 Collembola species were reported for the Luquillo Mountains. So far, in this study we discovered 22 new reports for species in Puerto Rico. The species identification remains in process: So far within Entomobryomorpha we identified 40 species, including two new species. Poduromorpha and Symphypleona groups will result in more reports and new species because those groups are relatively unknown in the Island. This study highlights the dearth of taxanomic information for collembolans in tropical forests and the importance of certain microhabitats that showed high levels of endemicism.

**Does resource availability affect food preference and biomass of a collector-gatherer mayfly?**  
Ashley Mariani, Keysa Rosas.

Streams can be thought of as the continuing combination of populations that are constantly influenced by physical and biological factors. Many species depend on the input of materials that provide the necessary energy for the optimal functioning of food webs. As the stream widens, the canopy of the riparian forest opens changing the relative inputs of allocthonous and authochthonous resources. These changes in resources along the stream may be reflected in the diet of species that inhibit it. The objective of this study was to evaluate the biomass, abundance and resource consumption of Leptophlebiid mayflies along a stream continuum. Although there was a change in algal and detrital resources across the longitudinal gradient and among habitats, those differences were not reflected in the gut content analysis. The mayflies did however express a preference for habitats, found mostly on pools. Our results suggest that Leptophlebiid mayfly habitat preference may be driven by other factors (such as shelter) and not by food resource availability.

**International Critical Zone Science:  Opportunities to build a global understanding of land-water linkages**  
William H. McDowell

Critical Zone science examines the structure and properties of the thin veneer that links surface properties to deep geology, at time scales of seconds to millennia. One of the fundamental premises of the US Critical Zone Observatories program is that CZOs should include some measurements made in common at all sites, as these common measurements will enable us to make stronger inferences about how the structure and function of the critical zone interact to drive key processes such as soil formation, stream flow generation, and nutrient export. Recent advances in real-time sensors provide new opportunities to address some fundamental questions about how hillslope soils and streams are linked.  Data from the Luquillo Critical Zone Observatory in Puerto Rico, for example, document a previously undescribed transition, or flipping, of stream and soil biogeochemistry in a tropical rain forest. Under typical conditions, soil moisture is high and soil oxygen content is often low, especially at depth.  Streams, in contrast, are typically near oxygen saturation.  Under severe drought, however, oxygen increases dramatically in soil air and declines to values that are well below saturation in streams.  This flipping in redox conditions suggests that despite the strong hydrologic connection between hillslope and stream, gas dynamics and potentially solute dynamics are decoupled along the flow path.  The international CZO community has the opportunity to develop a suite of sensor arrays to document soil air, groundwater chemistry, and stream water chemistry.  Progress towards realizing the potential of these international networks to develop coherent sensor programs will be addressed based on the current status of sensor deployments in CZO networks in the US, China, and Europe.

**Dissemination of historical publications from PRNC/CEER: a foundation of the research of the Luquillo LTER Program of Puerto Rico**

Eda C. Meléndez-Colom(1), Jorge Ortiz-Zayas(1) , Jorge Ramos-Feliciano(1)(2) , Nelson Pagán-Butler(3) , John Monge-Astacio(1), Carlos E. Valverde(1)(4)

(1) Department of Environmental Science, Natural Science Faculty, University of Puerto Rico (UPR), (2) Oficina de Protección Ambiental y Seguridad Ocupacional (OPASO), UPR, (3) History Department, Humanities Faculty, UPR, (4) Music Department, Humanities Faculty, UPR

Rescuing, listing, classifying and scanning the historical documents published by the Puerto Rico Nuclear Center (PRNC), called the Center for Energy and Environmental Research (CEER) in the 1970s, became an important need when CEER ceased operations in the 1980s. The documents generated by PRNC/CEER where moved to the Río Piedras Campus in 2001. A first general list was generated but not disseminated at that time.  The main goal of this project is to make these historical documents available in a website hosted by the Natural Science Faculty Department of Environmental Science (DES) of the University of Puerto Rico. In a joined effort with the DES faculty, the Luquillo LTER Information Management Section and the University of Puerto Rico OPASO (“Oficina de Protección Ambiental y Seguridad Ocupacional”), a list has already been published online.  Presently, we are scanning and publishing all of these documents. This preserves the research that started in 1957 with studies related to radiation and energy that generated a series of terrestrial ecology studies and their related data and publications. This legacy was an important foundation of today’s research performed by the Luquillo LTER Program of Puerto Rico.

**Arthropod Diversity And Nutrient Mineralization In Green Litter Decomposition In A Simulated Hurricane Experiment**

Ivia Moreno, María F. Barberena-Arias, PhD and Sharon A. Cantrell, PhD

Graduate Program Environmental Science, Universidad del Turabo

Ivia\_pr@Hotmail.com

Hurricanes generate disturbances in forests such as canopy opening, fallen trees and leaves which in turn alter physicochemical characteristics of the habitat, as well as, decomposer activity and nutrient fluxes. Our objective is to evaluate the effects of hurricane driven changes to forests on decomposition, decomposer communities and nutrient mineralization. Specifically, we will study the effect of a hurricane in green litter decomposition, decomposer fauna and nutrient mineralization. This study is part of the Canopy Trimming Experiment 2 performed by the Luquillo LTER at El Verde Field Station. For this, three blocks (A, B and C) were selected, each with two plots of 20m x 20m, one plot was used for control and the other Canopy opening (Trim). Each plot was subdivided into 16 sub-plots, from which three sub-plots (5m x 5m) were randomly selected. This experimental design represents 3 blocks x 2 plots/block (1 trim/ 1 control) x 3 subplots x 3 litterbag mesh sizes x 4 collecting times, for a total of 216 litterbags. Each of these litterbags were used as the sampling unit. In each one, decomposer fauna and nutrients were measured. Decomposer fauna were retrieved using Berlese Funnels and mineralized nutrients were quantified using WesternAg PRS probes. Preliminary results suggest significant differences in abundance of decomposer fauna and in available nutrient concentration between trim and control plots, and among litterbags. Also, decomposer arthropod abundance was higher in large mesh litterbags. These results suggest that when all decomposer arthropods are present, available nutrients are higher.

Andrew Quebbeman

The majority of tropical forests now exist as mosaics of old-growth and regenerating fragments as a result of human land-use. Understanding the distribution of soil fungal communities in secondary forests and their interactions with tree communities and nutrient cycling provides important insight into forest recovery and biogeochemical cycles. We tested the hypothesis that fungal communities are correlated with tree community composition and soil conditions. By analyzing soil cores collected in four forest stands of El Yunque National Forest in Puerto Rico, our findings indicate that the relationship between soil fungal communities and soil conditions is weakest in forests with more recent historical land-use. This suggests that the effects of historical land-use may have lasting effects on forest recovery and nutrient cycling.

**Drought effects on macroinvertebrate assemblages in tropical streams, Puerto Rico**Roberto Reyes-Maldonado, Alonso Ramírez.

Natural disturbances, both frequent rain and droughts, are important factors affecting macroinvertebrate assemblages in streams. In tropical rainforest streams, macroinvertebrates are known to be principally affected by floods, but we lack information on their responses to droughts, as they are uncommon phenomena. As global change models predict increases in drought frequency, it becomes critical to understand its effects on macroinvertebrate assemblages. Our aim was to characterize macroinvertebrate assemblages during the 2015 drought in Puerto Rico and contrast them with more frequent periods of high and low flow to understand macroinvertebrate responses to drought. We analyzed macroinvertebrate samples from two streams at El Yunque National Forest collected during the summer 2015 drought. In addition, samples from our long-term monitoring of the same two streams were selected as comparisons of rainy and average conditions. Macroinvertebrate assemblages during drought conditions were clearly different from non-drought periods. During drought, macroinvertebrate abundance was highest. Taxonomic richness also increased in response to drought. However, the two study streams showed different patterns indicating site specific responses to drought. Overall, drought favored macroinvertebrate abundance, but altered their composition.

**Life history of Phylloicus pulchrus (Trichoptera: Calamoceratidae) in Puerto Rico**  
Limarie Reyes, Alonso Ramirez

Phylloicus pulchrus is an important member of tropical streams ecosystems, where it is a shredder of leaf litter. We assessed the life history and phenology of P. pulchrus in the Luquillo Mountains, Puerto Rico. The goal was to understand which environmental factors are controlling P. pulchrus population dynamics. P. pulchrus were never abundant, only 25 adults (68% females, 32% males) were collected from June-December 2015. There was a moderate negative correlation (r=-0.47) between monthly abundance and average rainfall and a moderate positive correlation (r=0.48) between monthly abundance and temperature. The correlation between sex and average rainfall was moderate negative for males (r=-0.44) and females (r=-0.55). Female abundance was positively related to air temperature (r=0.61), males did not respond to air temperature (r=-0.08). P. pulchrus females spawn over water and it is possible that the quantity of females collected was the result of the closeness of the light trap with the stream (1.2m). Precise relationships between environmental variables and life history will help us understand the role of P. pulchrus in tropical streams.

**Temporal and spatial patterns in mayfly emergence in tropical streams in Puerto Rico**  
Jose Sanchez, Pablo Gutierrez, Alonso Ramirez

Aquatic insect emergence patterns remain an understudied topic in the tropics. Temporal emergence patterns respond to multiple factors, likely to change among streams. In this study, we studied temporal patterns of Ephemeroptera emergence and whether patterns differed between streams, one shrimp dominated and the other fish-dominated. The study was conducted in Quebrada Prieta (shimps present) and Quebrada Bisley (shimps absent), both situated in El Yunque National Forest, Puerto Rico. Emergence traps were placed and emptied every month for 20 months, from December 2001 to July 2003. Mayflies where identified to genus. Results revealed similar monthly fluctuations in emergence for both streams. Almost all taxa belonged to the genus Neohagenulus and Borinquena (98%). When comparing the streams, we found that the absence of shrimp greatly diminishes mayfly abundance. Temporal patterns in emergence were generally similar to those previously reported for one of the streams. Contrasting abundance of mayflies among streams appear to be related to their interaction with shrimps. As scrappers, mayflies are negatively affected when sediment accumulates over substrates. Shrimp-dominated streams are generally low in sediment, favoring mayflies.

**Natural history of Telebasis vulnerata in Puerto Rico**   
Josian Sanchez Ruiz, Alonso Ramirez.

Natural history studies provide useful information on species dynamics, population structure and the role of a species in its environment. Odonata are good models for these studies, but there is limited information for tropical species. Here we present the natural history of Telebasis vulnerata (Coenagrionidae), a dominant species of damselfly in Puerto Rico. We assessed its population structure and describe its behavior (e.g, territoriality, sex ratio, reproduction and microhabitat use). The study took place during summer 2015 at El Yunque National Forest, Puerto Rico. A mark-recapture method was used to study territoriality and population characteristics, along with individual behavioral observations. Males exhibited the expected territorial behavior; defending ovipositional areas, staying within a small area (<20m) and spending most of their time perching and defending territories. Reproductive behavior had the typical characteristics of high population density; females oviposited in tandem, increasing male success and groups of pairs were observed ovipositing in the same area. Gender ratio was biased to males, 3.3 males per female. Telebasis presented the characteristic territorial behavior of most Odonata, with an unexpected bias toward male abundance.

**A tropical paradox – Mercury is high in deposition, low in the food web in Puerto Rico**Jamie Shanley, Oksana Lane, Wayne Arendt, Mark Marvin-DiPasquale , Bill McDowell, and Steven Hall

Wet deposition of mercury (Hg) at an unpolluted site in the Luquillo Mountains of northeastern Puerto Rico averaged 28 µg m-2 yr-1, higher than any site in the USA Mercury Deposition Network. The high input is reflected in extremely high total Hg (THg) flux in nearby Rio Icacos of 54 µg m-2 yr-1. Most of the stream THg flux is associated with particulates, and only about 0.5% is methylmercury (MeHg). Despite these high THg input and export values, Hg uptake in the food web appears to be quite low. This result was surprising given the high Hg inputs and watershed features that would seem to favor Hg(II)-methylation – high soil moisture with anoxic zones, ample organic matter and sulfur, and year-round warm temperatures. However, when we tested both methylation and demethylation potential in three landcape settings, we found that demethylation consistently outpaced methylation. Thus it is likely that MeHg is broken down as quickly as it is formed. We are declaring “Paradox Lost”!

**Seasonal Cloud Base Patterns Highlight Small-Mountain Tropical Cloud Forest Vulnerability**  
Ashley E. Van Beusekom, Grizelle González, Martha A. Scholl

Tropical montane cloud forests (TMCFs) are wet ecosystems that are home to an abundance of unique species and provide a significant water resource to humans. Cloud water has been deemed critical for the health of TMCFs, specifically for the abundant epiphytes which require consistent moisture input from the atmosphere. TMCFs on small mountains with peak elevations near the base of typical cloud layers might be assumed to have variable cloud immersion, due to seasonal changes in relative humidity. Cloud base is rarely quantified near mountains, so the degree to which cloud immersion sustains TMCFs during rainless periods (dry seasons or drought) is not well understood. Here we show a healthy small-mountain TMCF in Puerto Rico had lowest cloud bases during the mid-summer dry season, and cloud bases that were lower than the tops of the mountains as often in the winter dry season on a daily basis as in the wet seasons, for a 2.5-year period. Analysis with relation to local and regional weather parameters, and regional cloud bases observed for 16 years, lent robustness to the result of low clouds in the dry seasons at the TMCF. Proximity to the oceanic cloud system where lower clouds are seasonally invariant in altitude and cover; along with orographic lifting and trade-wind control over cloud formation at the mountains, may explain the low clouds in the dry seasons. This study indicates that potential climate change impacts on small-mountain TMCFs are not limited to the dry season; projected changes in regional-scale climate patterns that increase drought periods during the wet seasons may also be a significant threat to ecosystem health.

**Microbial Diversity and Nutrient Mineralization in Green Litter Decomposition in a Simulated Hurricane Experiment**  
Johnathan Velázquez Cruz1, Ivia Moreno1, María F. Barberena-Arías1, Sharon A. Cantrell1   
1Department of Biology, Universidad del Turabo, Gurabo, PR 00778  
velazquezjohn@outlook.com

Hurricanes generate disturbances in forests such as canopy opening, fallen trees and leaves which in turn alter physicochemical characteristics of the habitat, as well as, decomposer activity. Litter decomposition depends primarily on the interaction among climate, litter quality and biota; as a consequence any change in habitats will result in   
changes in these factors. Identifying the changes in the fungal community structure in soil and forest floor litter can help understand the factors that influence ecosystem recovery. This study is part of the Canopy Trimming Experiment 2 performed by the Luquillo LTER at El Verde Field Station. For this, three blocks (A, B and C) were selected, each with two plots of 20m x 20m, one plot was used for control and the other was subject to canopy opening and debris addition (Trim plus debris). In each subplot, litterbags with different mesh sizes were placed. This experimental design represents 3 blocks x 2 plots/block (1 trim+debris/ 1 control) x 3 subplots x 3 litterbag mesh sizes x 4 collecting times, for a total of 216 litterbags. A pool sample for each mesh size from the 3 subplots/per plot/time was obtained for DNA extraction. DNA was extracted using Power Soil DNA Isolation kit   
from MoBio. The TRFLP technique was used to obtain the profiles of the fungal communities of each sample using the fungal ITS region. The diversity between samples was analyzed using NMDS and UPGMA Cluster analysis using the Dice and   
Bray-Curtis similarity index. This analysis also showed homogeneity between the communities of fungus which were grouped by treatment. In conclusion, the results show us that the Ammonium and Phosphorous were significantly higher in trim plots and inside large mesh litterbags. In the future, we analyzed the effect of a hurricane on the structure of green litter microbial communities.

**Poster title: Tree biodiversity inventory and forest structure study in 1-ha Guayama moist forest**Xiu Zeng

Poster summary: We established a 1-ha (100 x 100 m^2) long-term ecological research plot in Guayama experimental moist forest. More than 6000 tree stems, with DBH > 1cm, were tagged and identified to species level. There is 72 tree species were found in total 4060 individuals. We also analyzed descriptive variables for community ecology and forest structure, such as diversity index, tree abundance and basal area, etc.

**LTER SCHOOLYARD POSTERS**

**Stream characterization of the Limón River in Puerto Rico during 2015 drought**

Students: Keisha M. Mestey-Rivera, Kristofer J. Santa-Archilla and Prof. Elliot López-Machado

Juan Ponce de León ll High School - Florida, Puerto Rico

**La relación entre la precipitación diaria en el Verde y los Niveles del Emabalse del  Lago Loíza durante los Periodos de Sequía y Lluvia en los Años 1994 y 2015**

Estudiantes: Jaleisha Vélez Velázquez, Andrea Rivera Rodríguez Maestra: Glenda Almodóvar

Escuela Especializada de Bellas Artes Ernesto Ramos Antonini de Yauco