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PD/PI Name:	William H McDowell, Principal Investigator Grizelle Gonzalez, Co-Principal Investigator Alain F Plante, Co-Principal Investigator Whendee Silver, Co-Principal Investigator
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Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	William H McDowell

Accomplishments

* What are the major goals of the project?

The overarching question guiding LCZO2 is: ***How do hot spots and hot moments in weathering, biogeochemical cycling, hydrologic processes, and atmospheric inputs drive landscape evolution and CZ function in a humid tropical forest?***

Our research is organized into four inter-related focal areas. Focal Area 1 explores the importance of knickpoints and different landscape positions as hot spots for weathering, soil development, and biogeochemical cycling. Focal Area 2 addresses the role of hot spots and hot moments in redox cycling that contributes to the dynamics of weathering, and to the retention and loss of C and nutrients in soils over a range of spatial and temporal scales. Focal Area 3 determines the role of hot moments in the transport of sediment, C, and nutrients in stream flow, and hot spots that determine the distribution of material across the landscape. Focal Area 4 scales up hot spots and hot moments in time and space using climate and hydrologic modeling, and identifies the role of key atmospheric inputs in clouds and rain. Taken together, the research proposed in LCZO2 will provide a well-integrated assessment of critical zone properties and processes that scale from microsites to catenas, watersheds, landscapes, and the region, and from

minutes to hours, days, months, and years. The data collected and synthesized as part of LCZO2 will contribute to our understanding of the controls on weathering, soil development, C and nutrient storage and loss, soil and sediment transport, and ultimately landscape evolution and effects of climate change. Through collaborations with local and federal agencies and educational institutions, we will conduct workshops and outreach activities to inform policy makers and other stakeholders of our research findings and the significance of the Critical Zone in the Luquillo Mountains of Puerto Rico.

Our goal is to address each of the specific hypotheses listed below. Participants responsible for each focal area and hypothesis are also included.

Focal Area 1: Hot spots and hot moments in the deep critical zone (*Brantley Focal Area Lead*)

- H1.1: The higher chemical weathering flux and depletion of rock-derived elements from soils in quartz diorite (QD) above the knickpoint results from the penetration of high-O₂ waters into fractures that promote rapid weathering. Below the knickpoint, relatively low-O₂ waters effectively lower reaction rates. In contrast, in the volcanoclastic (VC) rocks, O₂ is consumed relatively high in the profile throughout the watersheds and deep dissolution of silicates outpaces deep Fe oxidation. As a result, VC-derived soils above and below the knickpoint show less variation than their QD-derived counterparts (*Brantley, Comas, Buss*)
- H1.2: Hot spots of rock-derived nutrient availability are best predicted from denudation rates and lithology. The transition from reaction limitation (below the knickpoint) to supply limitation (above the knickpoint) will result in much higher phosphorus and cation availability lower in the landscape (*Porder*)

Focal Area 2: Hot Spots and Hot Moments in Redox Dynamics and Associated Fe-C interactions (*Silver Focal Area Lead*)

- H2.1: Patterns in rainfall, drainage, and biological activity drive the distribution of redox environments in the critical zone (*Silver*)
- H2.2a: Rapid, high magnitude redox fluctuations create hot spots and hot moments of decomposition by stimulating Fe reduction and associated C decomposition (*Silver, Thompson, Plante*)
- H2.2b The storage and stabilization of soil organic matter in LCZO soils is controlled by hot spots of Fe-C interactions rather than the bulk mineral matrix. (*Plante, Thompson, Silver*)

Focal Area 3: Watershed scale hot spots and hot moments (*Jerolmack Focal Area Lead*)

- H3.1: Particulate carbon, fine sediment and bed material each have different characteristic transit times within a watershed. Particles with short residence times are generated at hot spots in the landscape, and particles with long residence times are eroded and transported from relatively stable parts of the landscape during hot moments. Because of differences in landscape stability, these characteristic time scales will differ with position above or below knickpoints (*Willenbring, Jerolmack, Shanley, González*)
- H3.2: Floods are hot moments that may be treated as 'impulses' that drive sediment transport. The availability of sediment is strongly variable in space due to hot spots associated with physical landscape discontinuities, mainly knickpoints. Sediment transport hysteresis curves allow estimation of time- and space-varying sediment availability. Feedbacks between transport and topography maintain hot spots. (*Jerolmack, Willenbring*)
- H3.3: Hot spots in stream chemistry are associated with recent landslides; hot moments are associated with high flow events that can dilute or enrich various solutes. Watershed lithology controls spatial and temporal variability of solute chemistry through its influence on landslides and subsurface flow paths (*McDowell, Shanley*)

Focal Area 4: Hydrologic and Atmospheric Hot Spots and Hot Moments (*McDowell Focal Area Lead*)

- H4.1: The distribution of hydrologic hot spots like sediment sources and landslides will vary with watershed soils, vegetation, and channel knickpoints; the occurrence of hot spots will vary as a function of storm intensity and frequency (hot moments) (*Bras, Wang, González*)
- H4.2: Orographic precipitation in the LM has decreased during historic times as a consequence of climatic warming. Orographic rains make a disproportionately large contribution to base flow (critical to municipal water supplies), and more so in VC than QD. Cloud level has likewise changed, resulting in smaller cloud inputs of moisture and nutrients to the Luquillo Mountains with important biotic consequences (*Scholl, González, Gould, Shanley*)
- H4.3: Intercontinental transport of African dust alters incoming radiation and cloud formation, and provides nutrient inputs that are significant relative to those from rain events during periods without dust in the atmosphere (H4.2) (*Mayol-Bracero, Scholl, González*).

The major milestones anticipated during the course of LCZO2 are outlined in a supporting file (Accomplishments Supporting File 2).

The core research teams that comprise the LCZO2 and the tasks to meet the goals for each focal area are outlined in a supporting file (Accomplishments Supporting File 2).

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

The LCZO team has made great progress toward achieving our major goals. We have produced over 148 scientific publications and given over 513 presentations at scientific and public meetings over the course of the project. Over the past year, the team published 45 papers, and made 228 presentations at national and international meetings. The LCZO is actively training students and young professionals in the field. Twenty-five of the 45 papers published were authored or co-authored by at least one post-doctoral researcher or graduate student. Twenty-three of 33 additional papers that have been accepted, submitted, are under review, or are awaiting publication also were authored or co-authored by at least one post-doctoral researcher or graduate student. Of the total 161 presentations given during this reporting year, post-docs and graduate students participated in 65 presentations. Graduate students have produced 16 dissertations thus far.

Integration of research among the 4 different focal areas and the coordination of efforts among all our partners and participants occurs through our executive committee and by hosting regular LCZO meetings. The executive committee consists of the PI and co-PIs, and has met regularly since it was formed in December 2013. The executive committee often meets prior to or after the LCZO webinars and communicates regularly via email. Each LCZO co-PI has had special responsibilities in the following areas, with reporting of progress and opportunities to the full Executive Committee:

- Site Management, local operations – González
- Data management, information transfer, engagement - Plante
- Cross-site CZO activities and new research initiatives - Silver

LCZO personnel attended general LCZO meetings via web-broadcast using GoToMeeting approximately every 8 weeks. These meetings were approximately 1.5 hours in length and were structured to present results from the 4 major focal areas and encourage integration across focal areas. The annual all-hands LCZO meeting in Puerto Rico was held from June 7-9, 2018. On the first day, presentations were given on stream response to Hurricane Maria (Bill McDowell), landscape evolution (Gilles Brocard), linking surface and deep (Heather Buss), greenhouse gas fluxes from soils (Whendee Silver) and sources and dynamics of stream solutes and sediment (James Shanley). Fourteen “lightning” presentations on LCZO research were given by each project participant in attendance (including graduate students, post-docs, PIs and senior personnel) and a poster session was held after lunch. Six students accompanied by three teachers participated in the LCZO poster session by presenting their data jam project and interacting with LCZO scientists. In the afternoon of the first day, breakout groups were organized to address the following cross cutting questions: 1) How deep do roots go? 2) How can we quantify hydrologic connections from surface to deep? 3) What is the role of external inputs (rain, dust) versus internal inputs (weathering, perhaps N fixation)? 4) What is the source of carbon, nitrogen, and inorganic sediment transported downstream? and 5) Does landscape history drive current CZ function and at what scales? To what extent are terrestrial and aquatic systems linked? Extensive discussion of these questions continued during the second day with additional focus on developing improved and new conceptual models. One group also discussed the post-hurricane data collection needs. Presentations on LCZO data management (Miguel Leon), outreach and education (Steven McGee) and NGE-Tropics (Robinson Negrón) were given during the morning of the second day. The poster session continued after lunch on the second day. Advisory committee members Matthew Larsen and Ariel Lugo were present throughout the meeting. They presented their assessment of the LCZO and made valuable suggestions for ways in which the project might be improved. On the third day of the meeting, a group of project participants visited the Rio Icacos watershed to observe and discuss the hurricane disturbance. Several project participants conducted LCZO field work before and after the LCZO meeting. The agendas for the LCZO annual all-hands meeting and the LCZO All-Scientist webinars and are attached in the Products Supporting File 1 PDF.

Numerous papers are in preparation that describe the impacts of Hurricanes Irma and Maria on soil carbon stocks, soil microbes, soil solution, and stream chemistry.

The accomplishments of the LCZO from September 2017 through September 2018 are further described within the framework of our milestones by hypothesis and our education

and outreach milestones as outlined in the LCZO management plan. These major activities are contained within the Accomplishments Supporting File 2 PDF.

Efforts to promote cross-CZO science are described in the Additional Reporting Requirements contained within the Accomplishments Supporting File 1 PDF.

Specific Objectives:

Focal Area 1

H1.1 Collect data for paper, "Particle fluxes in groundwater remove primary minerals from subsurface rock in granitoid rocks", to be submitted to Earth and Planetary Science Letters", with authors H. Kim, X. Gu, S. Hynek, S.L. Brantley.

H1.1.1 Investigate incipient weathering mechanisms and rates in volcanoclastic bedrock

H1.1.2 Analyze results from using rare earth elements (REEs) to trace mineral nutrient cycling under variable redox conditions

H1.1.3 Image fracture distribution and its relation to knickpoint dynamics in the Rio Icos watershed using geophysical methods

H1.1.4 Investigate variation in erosion rates and water storage in the Luquillo Mountains using geophysical methods

H1.2 Revise the paper "Differential controls on dinitrogen and nitrous oxide from a wet tropical forest".

Focal Area 2

H2.1

Test the following hypotheses:

Rainfall gradient project

1. Anoxic conditions under high rainfall regimes drive the accumulation of organic P associated with increased soil C
2. Loss of amorphous Fe and Al minerals via leaching will increase with mean annual rainfall, decreasing the importance of sorbed and occluded inorganic P fractions in wetter sites

Redox experiments

3. In soils with extremely high P sorption capacity, anoxic conditions drive the release of Fe-bound P, increase biological P availability to the soil microbiota, and ease microbial P limitation.

Array research

4. Hot moments account for a disproportionate proportion of the greenhouse gas fluxes from humid tropical forest soils
5. Hot spots are dominantly located in lower topographic zones where redox fluctuations are the largest

Throughfall exclusion experiment

6. Drought-induced changes in soil redox initially increase soil respiration and methane uptake due to enhanced aeration, while decreasing nitrous oxide emissions due to low substrate supply

Following a prolonged drought, increasing soil water stress due to low moisture availability combined with a limited substrate supply (i.e., soluble C, N and P) drive an overall reduction in greenhouse gas emissions (CO₂, CH₄, and N₂O)

Additional objectives were to:

1. Identify hot spots and hot moments in redox dynamics and soil biogeochemistry in the field
2. Determine if variation in iron cycling parameters occurs over daily or weekly timescales and if it correlates with rainfall and carbon dynamics.

H2.2a

In the Fe(II) oxidation experiment, our goals were to 1) examine the relationship between the extent of Fe(II) oxidation and soil C loss via CO₂ production and DOC production; and 2) compare the effects of Fe(II) oxidation with soil acidification.

Additional objectives were to:

1. Examine how oxygen concentration during ferrous iron oxidation influences Fe reduction rates, Fe mineral composition and CO₂ production during subsequent anoxic periods.
2. Determine the role of fluctuating redox conditions on Fe-P interactions across a range of native redox conditions.
3. Determine the role of microbes versus minerals in P dynamics in soils from different topographic positions.

H2.2b

Following on the liquid-phase chemical characterization of extracts from selective dissolution experiments, objectives were to:

1. Extend the set of dissolution experiments to include hot-water and alkaline (NaOH) extractions
2. Characterize the solid-phase residues

Focal Area 3

H3.1

Our objective was to combine computational physics models of amorphous and disordered granular materials with field observations of soil production obtained from *in situ*-produced cosmogenic ¹⁰Be in saprolite sampled under soils of different ages. New research describes a compilation of previously published soil production rates compared to calculations of soil flux from granular shear and creep, and the resulting vertical mixing and diffusivity. The computational model uses grains of different size and size distributions to accommodate size variability that is often related to the environment and geology.

H3.2

- Publish the paper “Universal characteristics of particle shape evolution by bed-load chipping”

H3.3

- Continue to collect stream samples in watersheds with contrasting lithology, the Icacos (intrusive quartz diorite), Mameyes (volcaniclastic terrain) and Sonadora (hornfels) watersheds.
- Maintain water quality sensors in the Icacos and Sonadora watersheds
- Following Hurricanes Irma and Maria, increase the sampling frequency to every three months at 35 stream sites that vary in watershed characteristics. These sites have been sampled on an annual basis since 2000 (supported by other funding sources) and are in addition to the LTER stream sites that are sampled weekly.
- Deploy an autosampler on the Sonadora following Hurricanes Irma and Maria to assess TSS and solute delivery to the stream following the hurricanes.

Focal Area 4

H4.1

- Develop a spatially-explicit model of soil organic carbon dynamics coupled with an existing hydro-geomorphic model to assess the redistribution of soil organic carbon at the Luquillo CZO (Completed).
- Develop a spatially-explicit model of carbon and nutrient cycling within the tRIBS hydrological model to study the influence of hydrological fluxes on nutrient dynamics at landscape scale (Completed).
- Building on an existing physically based ecohydrological model (tRIBS-VEGGIE), develop a coupled model of carbon-nitrogen cycle and ecohydrological model using the concept of carbon cost economics (Completed).
- Study the carbon consequence of forest disturbance (e.g., from Hurricane and Landslide) using an integrated plant-soil model (In process).
- Set up terrestrial biosphere model (The Generic Decomposition and Yield (G'DAY) and the Ecosystem Demographic Biosphere (ED2) models) to study carbon consequence of forest disturbance and recovery (In progress).

H4.2

1. Examine the land-atmosphere interaction where the changes on the land surface affect the planetary boundary layer and thus the clouds and cloud moisture.
- Specifically track the abiotic factors that are disturbed and recover with large events such as hurricanes and see how the planetary boundary layer changes concurrently.
 - Quantify the frequency, duration and water content of cloud precipitation simultaneously with temperature and relative humidity at 5 sites ranging from 600-1000 m along the windward slope of the mountains.
 - Collect several data sets to evaluate the influence of cloud water deposition on headwater streamflow and to determine whether, when and how cloud water infiltrated below the root zone in the forest system.

H4.3

Hurricane Maria caused considerable damage to the Atmospheric Chemistry and Aerosols Research Laboratory (ACAR) of the University of Puerto Rico's (UPR) Rio Piedras Campus. This Laboratory, operated by Dr. Olga Mayol, studies the temporal and spatial variability of atmospheric aerosols, in particular African dust, which impacts both cloud physics and the transport of nutrients such as phosphorus to the Luquillo Mountains. The Pico del Este (PE) Cloud Station in the Luquillo Experimental Forest was completely destroyed by Hurricane Maria. The Cape San Juan (CSJ, also known as Cabezas de San Juan and CPR) Atmospheric Observatory in Fajardo was 75% destroyed by hurricane Maria. Because of this our objectives for this past year were to:

- Apply for supplemental funding to replace and upgrade infrastructure and instruments destroyed by Hurricane Maria at PE, the main ACAR site
- Purchase a steel shipping container for use as a field laboratory space at PE
- Order replacement instruments for PE

Education and Outreach

- Develop resources associated with InTeGrate at Carleton College and the Introduction to Critical Zone Science course co-lead by UNH faculty and LCZO collaborator, Dr. Adam Wymore.
- Contribute to the development of the Data Jam model by supporting teachers and students in exploring, analyzing and summarizing long-term LCZO data about the environment and then creatively communicating their discoveries to non-scientific audiences.

Significant Results:

Focal Area 1

H1.1

In the paper in preparation (Particle fluxes in groundwater remove primary minerals from subsurface rock in granitoid rocks, to be submitted to Earth and Planetary Science Letters, with authors H. Kim, X. Gu, S. Hynek, S.L. Brantley) we show that particulates move in the shallow subsurface rindletted zone in the quartz diorite, and that these particles contain primary minerals including feldspar, hornblende, and biotite. This paper is a companion paper to a similar paper published showing subsurface particle movement at Shale Hills (Kim, H., Gu, X., and Brantley, S.L. 2018. Particle fluxes in groundwater change subsurface shale rock chemistry over geologic time. Earth and Planetary Science Letters, 500:180-191). At Shale Hills, subsurface particle movement is not surprising given that the parent rock is shale with micron-sized particles. In Luquillo, our observations are surprising because the particles that are moving in the subsurface are mm-sized. Aaron Thompson, another LCZO team member, measured magnetic susceptibility on the particles and these data will be incorporated into the paper.

Focal Area 2

H2.1

Our results support hypothesis 1; soil C and organic P concentrations accumulated significantly at wetter sites. Contrary to the second hypothesis, soil amorphous Fe and Al minerals also increased with increasing rainfall, suggesting a tight coupling of C, organic P, and amorphous minerals under high rainfall. This coupling was found along two parallel transects of mixed forests and monodominant palm forests, indicating that vegetation cover did not impose a strong control on these biogeochemical patterns along the gradients.

Our results show that in contrast to our third hypothesis, anoxic conditions decrease microbial P uptake and microbial carbon use efficiency (CUE). Addition of P-enriched substrate under anoxic conditions drive microbial CUE and suggests soil microbes are P limited under anoxic conditions, in contrast to what has been previously proposed.

Our array data supported hypothesis 4, but only partially supported hypothesis 5. Approximately 2.3% of the CO₂ fluxes raised the mean soil CO₂ flux by 36%, with the greatest impact on slopes. Only 3.9% of the fluxes raised the mean soil CH₄ flux by 49%, with the greatest impact on valleys (hot spot). Approximately 2.5% of the fluxes raised the mean soil N₂O flux by 20%, with the greatest impact on ridges.

Our throughfall exclusion experiment provides the ideal setting to study the effects of projected reductions in tropical forest rainfall on soil redox dynamics, which regulate soil nutrient availability and soil greenhouse gas fluxes. Our preliminary results from this experiment (hypotheses 6 and 7) reveal significant reductions in soil redox fluctuations during prolonged drought periods, potentially affecting C and nutrient cycling throughout the soil profile.

H2.2

H2.2a

We varied the duration of anoxic incubation and achieved a wide range of Fe(II) oxidation rates that were strongly correlated with soil CO₂ production rate. Soil DOC concentration did not respond to Fe(II) oxidation; however, it was sensitive to soil acidification. Amendment of Fe(II) significantly decreased DOC concentration likely via formation of organo-Fe complexes.

H2.2b

Consistent with liquid-phase analyses of the extracts, chemical composition of solid phase samples after extraction differed substantially, indicating that specific soil minerals act as a fractionation sieve that may control which substrate are available for microbial decomposition versus those retained for long-term stabilization.

Focal Area 3

H3.1

We obtained a physics-based relationship for variation of soil flux with depth in different environments and our findings could have important implications for understanding feedbacks between chemical and physical erosion, and roles of these processes in driving landscape evolution, nutrient transport and the global carbon cycle. This work highlights a need for more measurements of soil residence times and how grains change size within soils over time.

A major result was the linkage of vegetation, climate and tectonic history to understand feedbacks between life, landscape and weathering and erosion. We found that the caliper of gravel bedload is one of the main tools whereby bedrock mountain streams achieve incision. We propose that, due to their shallow slopes and vegetation cover, low-relief uplands in the LCZO erode slowly, delivering reduced fluxes of gravel to streams, hence slowing the upstream migration of incision waves. Slow erosion rates on upland hillslopes due to vegetation cover lead to longer exposure of bedrock and rock fragments to weathering and further associated reduction in size of the bedload fraction.

We also found that the landscapes differ above and below knickpoints. Above knickpoints, slopes are less steep and soils are thick and highly weathered with nutrients provided by dust. Below knickpoints, slopes are steep and nutrients are replenished by primary minerals exposed from below via erosion of the surface. The vegetation mimics these differences in the landscape, with canopy height almost doubling below the knickpoint.

H3.2

All particles that move by “bed load” - rolling, sliding and hopping along the Earth’s surface, exhibit a universal rounding as corners and edges are chipped off, regardless of whether particles are moved by rivers, wind or waves. This result means that particle shape alone can be used to determine the source and transport distance of sediment, and the production rate of fine particulates. The first field demonstration of theoretically-predicted universal rounding was in LCZO (Miller et al., JGR-Earth Surface 2014), which was then applied by us to Mars (Szabo et al., Nature Comm. 2015) and has now been generalized across environments with our new theoretical and experimental work (Novák-Szabó et al. 2018).

H3.3

We have assessed the first 9 months of 15-minute in situ sensor data following Hurricanes Irma and Maria (September 2017) in the Quebrada Sonadora. As expected from past hurricanes, nitrate concentrations increased a few months after the storm. Contrary to expectations, the behavior of many solutes in response to discharge was radically changed after the hurricanes. Specific conductance flipped from a consistent dilution response during high flow to an enrichment response both during and after Maria, likely due to deposition of marine aerosols during the hurricane and subsequent flushing from the soil profile for several months after the storm. Nitrate also flipped its behavior for at least eight months after Maria, with large concentration increases (up to 1.8 mg N/L) observed at high stream discharge during even small rainstorms. Incorporation of this newly recognized sensitivity to discharge into watershed flux estimates results in 2 to 3-fold higher values than with weekly samples. The nitrate response to storms peaked 4 months after the hurricane but was still evident 9 months later, likely mirroring the time course of major biotic processes (litter decomposition and vegetation regrowth) that control nitrate fluxes. The newly recognized sensitivity of nitrate to stream discharge has important implications for future climate change scenarios. With increased frequency and intensity of hurricanes, much greater export to nitrogen-limited coastal waters can be expected than previously estimated. See McDowell presentation at the LCZO annual meeting in Products Supporting File 2.

At our 35 stream sites that drain watersheds with varying characteristics, initial results show that stream nitrate and potassium are elevated at many sites following the hurricanes, but the severity of the response varies among watersheds.

See Accomplishments Supporting file 3 for significant results for Focal Area 4 and Education and Outreach and also for additional FA1 and FA2 results.

Key outcomes or Other achievements:

Focal Area 1

We have discovered that spheroidal weathering of the quartz diorite is an ongoing process in the Icacos watershed and is most prevalent above the major knickpoint on the river. Geophysical measurements show that this type weathering is also most pronounced in deep fractures zones that crisscross the watershed. Geophysical calculations indicate that these fractures may slightly open above the knickpoint, and we infer that such opening allows oxygenated waters to infiltrate to depths and then cause spheroidal weathering perhaps by driving oxidation of biotite. This process in turn produces the particles that we have observed moving in the subsurface. Finally, magnetic susceptibility measurements in the laboratory on the particles has been related to terrain conductivity measured in the field, showing convergence of disciplines (mineralogy, geochemistry, geophysics).

Brantley was awarded the American Chemical Society Geochemistry medal in spring 2017 and the European Association of Geochemistry Urey Medal in summer 2018 for her work on weathering. She also gave numerous invited talks which were partially informed by LCZO research.

Post-doctoral researcher M. Chapela Lara documented the lightest Li isotope value on Earth (-38‰) in the volcanoclastic regolith. The porewater is also isotopically lighter than any other value in the literature.

Focal Area 2

Our research identifies organic matter accumulation as the main mechanism through which rainfall influences soil P speciation. Our study shows that in contrast to what has been previously proposed, low redox conditions decrease microbial P assimilation and lower microbial CUE. Under oxic conditions, microbial P availability is sufficient to support microbial CUE.

Our work investigating hot spots and hot moments in greenhouse gas fluxes shows that hot spots and hot moments have disproportionate impacts on landscape-level patterns of greenhouse gas fluxes for all three key greenhouse gases, even more so than commonly estimated based on closed-chamber studies. Further, we find that hot spots occur across topography and not only in zones traditionally associated with high flux rates – e.g., CO₂ hot spots on slopes, N₂O hot spots occurring outside valleys.

Synthesis of our field and laboratory experiments reveals that short-range-ordered iron minerals are emergent representations of the resident environmental conditions in the soil. Although they are key sorbents for nutrients and organic matter, shifts in soil moisture and oxygen status can reverse their role and they can facilitate carbon loss. The timescales of these changes are on the order of days to weeks and thus these phases respond to hot moments in climate and weather patterns. The reactivity of these phases are determined by how rapidly oxygen is introduced into the soil and anaerobic processes, such as methane generation and anaerobic CO₂ production are highly sensitive to the length of time soils have been exposed to oxygen. This suggests long droughts or conversely, frequent storm returns will have different cumulative impact on anaerobic processes than predicted by soil moisture content alone.

Focal Area 3

Our research highlights how and when climate does and does not impact streams and erosion in the CZO. The results from this research are wide-ranging. Climate has a previously unrecognized effect on landscape evolution through long-timescale grain-size change via weathering, which impacts rates of soil production and incision of streams and the response of streams to base level change. However, over short timescales, our research shows that individual large storms have a limited effect on gravel mobility in streams.

Focal Area 4

Nightly orographic precipitation (cloud water and wind-carried rain) is a consistent and significant contribution to the forest hydrological system especially during periodic droughts when the usual wet-season weather systems are diminished or absent.

The atmospheric moisture balance (cloud immersion patterns, vapor pressure deficit and temperature) from 700-1000 m in the mountains changed significantly after the damage from Hurricane Maria in September 2017. Measurements will continue to quantify these changes through the timeline of unaffected - damaged - recovered status of the forest at higher elevations in the study area.

Education and Outreach

Critical Zone science provides a rich context for middle and high school students in Puerto Rico to investigate their own questions about hot moments like droughts and hurricanes. Ten middle and high school student classes completed a Data Jam project in spite of the major setbacks after Hurricane María. All of the students were successful in developing graphs of their analyses and presenting their results in a scientific poster as well as develop a creative way to communicate their results through poems, dance, models, and song.

*** What opportunities for training and professional development has the project provided?**

Focal Area 1

- Post-doctoral researcher Scott Hynek advanced to a fulltime job at the USGS.
- Post-doctoral researcher Hyojin Kim advanced to a fulltime job in Denmark.
- Brantley hired a new post-doctoral researcher, Xin Gu, who had been completing magnetic susceptibility measurements on the particles for the "Particle fluxes in groundwater remove primary minerals from subsurface rock in granitoid rocks" paper. Xin Gu will complete all measurements and work with Brantley and Kim to publish the paper.
- Oliver Moore completed his PhD at the University of Bristol (funded by NERC) in 2017
- Buss taught her undergraduate 2nd year unit in Soils and the Critical Zone at the University of Bristol for the 3rd time. This unit incorporates cross-CZO concepts and data and explicitly uses specific CZO projects as case studies.
- One Master's student (Chase Cornett) funded under this project was trained in the use of geophysical methods in CZ studies
- One new PhD student (Mackezie Vecchio) started working in this project
- One PhD student (Matthew Sirianni) supported the field campaign efforts in Luquillo during the summer 2018

Focal Area 2

- FA2 has trained four postdocs and three graduate students
- Hot water and alkaline extractions of soil samples were performed by an undergraduate student from the University of Minnesota working as a research assistant at Penn (Benitez) and a high school student from New Jersey (Wu) working as a volunteer research intern. An additional undergraduate student will leverage the subsequent thermal analysis of the residues for their senior thesis research project.
- In the Thompson Lab, the LCZO provided training in 2017/2018 for the dissertation research of Diego Barcellos (Graduated August 2018) and the training of postdoc, Dr. Chunmei Chen on Fe dynamics including use of mineral characterization equipment (XRD, Mössbauer spectroscopy, electron microscopy), trace gas analysis, and operation of field sensor equipment. One additional high school student and one additional undergraduate student was trained in soil characterization methods associated with this focal area.

Focal Area 3

- PhD students Emma Harrison and Travis Clow at UC San Diego are mentored by investigator Willenbring
- REU student Omar Rosales-Cortez was mentored by investigator Willenbring
- Six undergraduate and six graduate students were trained in water quality analysis at the UNH Water Quality Analysis Laboratory
- PI McDowell provided one-to-one and group mentoring of six graduate students and one post-doctoral researcher, Dr. Maria Chapela-Lara.

Focal Area 4

- One-to-one and group mentoring of a graduate students Zhang Jiaying and Maoya Bassiouni
- One-to-one and group mentoring of post-doctoral researcher Ashley Van Beusekom

- Yannis Dialynas (Ph.D. Student) interacted with Luquillo CZO scientists and presented his doctorate research work on the modeling of soil organic carbon dynamics. He received numerous comments and feedback from scientists of different fields, which significantly helped improve the quality of his effort.

Education and Outreach

- Early career faculty Dr. Adam Wymore participated in the development of a manuscript entitled: "Implementing and assessing InTeGrate Critical Zone Science materials in an undergraduate geoscience program."
- Sixteen teachers and 10 classrooms have participated in professional development utilizing LCZO long-term data to conduct investigations. Twenty of the students had the opportunity to present their results to LTER scientists.

* How have the results been disseminated to communities of interest?

Please refer to the Education and Outreach sections of this report and the Accomplishments Supporting File 2 for a more detailed description of how LCZO data and results have been disseminated to communities of interest through development of the InTeGrate curriculum (E&O 1), conducting Data Jam teacher workshops (E&O 2) and data jams at the CZO-LTER Schoolyard Program Symposium (E&O 3). The Introduction to Critical Zone Science course, and its associated lessons learned, was further disseminated to the larger geoscience educational community via a webinar hosted through SERC at Carleton College, and through the development of a book chapter entitled "Implementing and assessing InTeGrate Critical Zone Science materials in an undergraduate geoscience program" to be published in *"Interdisciplinary Teaching about Earth and the Environment for a Sustainable Future"* (Eds: D. Gosselin, A Egger, and J. Taber). Published by the Association of Environmental Science and Studies (AESS) Book Series, Springer, New York.

In addition to the presentations and publications described in the major activities and the products sections of this report, the following dissemination activities occurred over the last year:

- The LCZO maintains a twitter feed with 347 followers and 256 tweets and retweets since early 2014. The twitter feed helps the CZO communicate information about upcoming presentations, posters and recent journal publications. The feed also helps us communicate with our members and the general public about news stories relevant to the CZO such as storms and other events impacting the region. Our feed can be found at <https://twitter.com/lugczo>.
- Lead PI McDowell has contributed to 4 different press releases reaching a broad range of audiences.
- The USFS contributed to 25 press releases on hurricane disturbance from Hurricanes Irma and Maria.
- LCZO technician Carla López-Lloreda coordinated with researchers from the San Juan Bay Estuary to assist in collecting water chemistry data as part of National Water Quality Monitoring Day on April 14, 2018.
- Steven McGee and Noelia Baez Rodriguez of the Learning Partnership hosted a webinar on March 28, 2018 about the Luquillo Data Jam as part of the Concord Consortium's Data Science Meetups. They gave an overview of the Data Jam model and conducted a mini data jam with the participants.
- The Luquillo LTER/CZO Data Jam virtual symposium occurred on May 25, 2018 from 10:30 - 12:30 eastern time via Go To Meeting. The students in Puerto Rico connected with students from the Sevilleta LTER in New Mexico to share their projects in Spanish.

Focal Area 1

- Published: Brantley, S.L., McDowell, W.H., W.E., D., White, T.S., Kumar, P., Anderson, S.P., Chorover, J., Lohse, K.A., Bales, R.C., Richter, D.D., Grant, G. and Gaillardet, J., 2017. Designing a network of critical zone observatories to explore the living skin of the terrestrial Earth. *Earth Surface Dynamics*, 5: 841-860, doi:10.5194/esurf-5-841-2017.
- Published: Chapela Lara M., Buss H.L., Pogge von Strandmann P.A.E., Schuessler J.A. and Moore O.W. 2017. The influence of critical zone processes on the Mg isotope budget in a tropical, highly weathered andesitic catchment. *Geochim. Cosmochim. Acta*. 202, 77-100.
- Published: Chapela Lara M., Buss H.L. and J. C. Pett-Ridge. 2018. The effects of lithology on trace element and REE behavior during tropical weathering, *Chemical Geology*. 500, 88-102.

Focal Area 2

- Results from the Silver lab were presented in the AGU 2017, AGU 2018 and ESA 2018 meetings. Two papers are published, two papers are currently under review, and four additional papers are in preparation.
 - Results from the rainfall gradient were presented in ESA 2018 meeting.
 - Results from the throughfall exclusion experiment have been presented at the ESA 2018 meeting.
 - Results from the hot spots and hot moments work were presented at the ESA 2017 meeting, the Luquillo CZO 2018 meeting, and the at Institute of Soil Research (IBF) of the University of Natural Resources and Life Sciences, Vienna.

- Results from continuous sensor data and field greenhouse gas results were presented in two invited seminars: at Macalester College, MN, USA and San Houston State University, TX, USA.
- The Thompson lab has published 8 papers that acknowledge LCZO support this year. Four of those papers address core LCZO objectives within focal area 2 (Chen and Thompson, 2018, Barcellos et al 2018, Chen et al 2018, and Coward et al 2018); two papers report on key methodological advances related to LCZO activities (Sun et al 2018, Hodges et al 2018); one paper leveraged spectroscopy resources to collaborate with German colleagues on a similar topical area (redox fluctuations, Winkler et al 2018); and one paper is a position piece involving many authors across the CZO network (Richter et al 2018). In addition, we gave several presentations, invited and volunteered, as well as presented CZO related educational outreach to 4-H communities.

Focal Area 3

- PhD student Bianca Rodríguez-Cardona participated in 3 Skype a Scientist sessions: one with a 6th grade class in Oakridge Middle School in Naples, FL, and two with 8th grade classrooms in New Castelar College in Altorreal, Spain. The classrooms were about 15-20 students, roughly. January 2018.
- J. Gaillardet, W.H. McDowell, J.L. Druhan. Convened the B43E Concentration-Discharge Relations in the Critical Zone I Poster Session. 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Chorover, J., J. Gaillardet, W.H. McDowell, J.L. Druhan. 2017. Convened the B54A Concentration-Discharge Relations in the Critical Zone II Poster Session. 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Goodale, C. N. Ohte and WH McDowell. 2017. Convened the Biogeochemistry of nitrogen session at the 9th International Symposium on Ecosystem Behavior. BIOGEOMON August 20-24, 2017. Litomyšl Chateau, Czech Republic.
- McDowell, William H. 2017. Scientific committee, Join Conference, International Long-Term Ecological Research Network, French LTER network, and French CZO network. 2-4 October, 2017, Nantes, France
- McDowell, W.H. 2018. Graduate short course on watershed biogeochemistry, Beijing Normal University, 11-14 April 2018
- McDowell, W.H. and C. López Lloreda. 2018. Luquillo Critical Zone Observatory. Exploring a University of Puerto Rico-Río Piedras (UPRPR)/United States Geological Survey (USGS) Partnership to Foster Water Research. San Juan, PR. August 21, 2018.

Focal Area 4

The 25-year record of rain event amount, duration and intensity at Rio Icacos station provided by the USGS CZO collaborators was used in the 2017 Data Jam exercise for students in Puerto Rico.

* What do you plan to do during the next reporting period to accomplish the goals?

Focal Area 1

- Submit the paper "Particle fluxes in groundwater remove primary minerals from subsurface rock in granitoid rocks" with authors H. Kim, X. Gu, S. Hynek, S.L. Brantley to Earth and Planetary Science Letters.
- Resubmit the paper "Stream solutes map lithology, regolith structure, and watershed function: Luquillo Mountains, Puerto Rico" that was submitted to the Geological Society of American Bulletin with authors S. Hynek, M. Bhatt, H. Kim, W. McDowell, S. L. Brantley.
- Submit a paper from Chapela Lara and Buss combining Mg and Li isotopes to trace biogeochemical CZ processes.
- Submit a paper from Moore and Buss on initial weathering mechanisms in the deep CZ.
- One paper is currently accepted with revisions (Comas et al. Earth Surface Processes and Landforms) and another paper is currently in the works to expand the work on geophysical surveys at the landscape scale in Luquillo CZO.

Focal Area 2

- Silver lab will continue to complete the experiments listed above, analyze data, and submit papers for peer-review.
- In the coming months, the solid-phase residues from the selective extraction experiment reported in Coward et al. (2017) and the new hot-water and alkali extractions will be subjected to thermal analysis by ramped combustion, and high resolution mass spectrometry to characterize the remain organic matter.
- These experiments will be reported in a presentation at the Fall Annual Meeting of AGU in Washington, DC, and will be published in a peer-reviewed journal article.
- Research conducted by PhD graduate Barcellos and former postdoc C. Chen will be submitted for publication in the coming year. This includes two papers on Fe-C redox dynamics in laboratory incubations and two papers on the field measurements evaluating hot spots and hot moments.

Focal Area 3

- The UC San Diego team is completing the publication of two manuscripts in review.

- Three more manuscripts are in preparation as E. Harrison (PhD student) completes her dissertation.
- Several manuscripts on the response of stream chemistry to hurricanes Irma and Maria are in preparation

Focal Area 4

- Understand the role of hurricane and landslide on disturbance and recovery of forest and subsequently the consequence of disturbance and recovery on carbon balance.
- Analyze the data from the hurricane recovery abiotic sensors along with the concurrent response of the planetary boundary layer and the cloud layer.
- Estimate the magnitude of the contribution of cloud water to the water budget, using the ceilometer data, the cloud camera data, and satellite data.
- We may be able to address the relative roles of marine and land sources of moisture in cloud and precipitation dynamics, using the pre-and post-hurricane data and isotopic tracers.
- Several publications and data releases are in progress.
- The shipping container will be installed at the PE site before the end of 2018. Replacement instruments will also be installed, and we hope to resume PE measurements in early 2019.

Education and Outreach

Lead by UNH faculty Wymore, we will continue to seek new funding sources to further develop and disseminate curriculum associated with the Introduction to Critical Zone Science course.

Through an analysis of the Data Jam projects, it was determined that the students could benefit from introductory exercises to help them apply what they are learning about graphing in their math classes. Students are able to create accurate graphs of the data, but they are not necessarily selecting the most appropriate graph to answer the question they are investigating. These introductory exercises will be pilot tested during the 2018-19 Data Jam.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Accomplishments File 1 Additional Requirements.pdf	Additional reporting requirements	William Mcdowell	11/27/2018
Accomplishments File 2 LCZO Research Teams Milestones and Major Activities 2017-2018.pdf	LCZO research teams, milestones and major activities	William Mcdowell	11/27/2018
Accomplishments File 3 Significant Results and Figures.pdf	Addendum for significant results	William Mcdowell	11/27/2018

Products

Books

Book Chapters

Dere, A., Engenlmann C., White, T., Wymore A., Hoffman A., Washburne J., and Conklin M. (2018). Implementing and assessing InTeGrate Critical Zone Science materials in an undergraduate geoscience program. In: Gosselin, D., Egger A. and Taber J. (eds.) Springer, New York. *Interdisciplinary Teaching about Earth and the Environment for a Sustainable Future*. Association of Environmental Sciences and Studies. . Status = AWAITING_PUBLICATION; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

Dylan Rhea-Fournier and Grizelle González (2017). Methodological Considerations in the Study of Earthworms in Forest Ecosystems. *Forest Ecology and Conservation* Chapter 3. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5772/67769.

Dylan Rhea-Fournier; Grizelle Gonzalez (2017). Methodological Considerations In The Study Of Earthworms In Forest Ecosystems.. *Forest Ecology and Conservation. InTech: Rijeka*. . Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5772/63322.

Wymore, AS and WH McDowell. (). Variable response of DOC and DON to discharge across critical zone gradients. Abstract submitted to: Biogeochemistry of the Critical Zone. Eds: Wymore AS, Yang W, Silver W, Chorover J, McDowell WH. To be published by Springer-Nature.. *Biogeochemistry of the Critical Zone* Wymore AS, Yang W, Silver W, Chorover J, McDowell WH. Springer-Nature.. . Status = SUBMITTED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes

Inventions

Journals or Juried Conference Papers

Ashley E. Van Beusekom, Nora L. Álvarez-Berríos, William Gould, Maya Quiñones, and Grizelle González (2018). Hurricane Maria in the U.S. Caribbean: Disturbance Forces, Variation of Effects, and Implications for Future Storms. *MDPI remote sensing*. . Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Barcellos, Diego, K. Taylor Cyle, Aaron Thompson (2018). Faster redox fluctuations can lead to higher iron reduction rates in humid forest soils. *Biogeochemistry*. 367. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1007/s10533-018-0427-0

Bassiouni, M., Scholl, M.A., Torres-Sanchez, A.J., Murphy, S.F., (2017). A method for quantifying cloud immersion in a tropical mountain forest using time-lapse photography. *Agricultural and Forest Meteorology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1016/j.agrformet.2017.04.010

Bernhardt, E. S., J. B. Heffernan, N. B. Grimm, E. H. Stanley, J. W. Harvey, M. Arroita, A. P. Appling, M. J. Cohen, W. H. McDowell, R. O. Hall, J. S. Read, B. J. Roberts, E. G. Stets and C. B. Yackulic (2018). The metabolic regimes of flowing waters.. *Limnology and Oceanography*. . Status = PUBLISHED; Acknowledgment of Federal Support = No ; Peer Reviewed = Yes ; DOI: 10.1002/lno.10726

Bhattacharyya A, Campbell AN, Tfaily MM, Lin Y, Silver WS, Nico PS, Pett-Ridge J (2018). Redox fluctuations control the coupled cycling of iron and carbon in tropical forest soils. *Environmental Science & Technology*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Bhattacharyya, A., A. Campbell, Y. Lin, P. Weber, P. Nico, J. Pett-Ridge. (2017). Redox manipulations control the coupled cycling of iron and carbon in tropical forest soils. *fully drafted, will be submitted soon to ES&T*. . Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Brantley, S. L., McDowell, W. H., Dietrich, W. E., White, T. S., Kumar, P., Anderson, S. P., Chorover, J., Lohse, K. A., Bales, R. C., Richter, D. D., Grant, G., and Gaillardet, J. (2017). Designing a network of critical zone observatories to explore the living skin of the terrestrial Earth. *Earth Surface Dynamics*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5194/esurf-5-841-2017

Brantley, Susan L., David M. Eissenstat, Jill A. Marshall, Sarah E. Godsey, Zsuzsanna Balogh-Brunstad, Diana L. Karwan, Shirley A. Papuga, Joshua Roering, Todd E. Dawson, Jaivime Evaristo, Oliver Chadwick, Jeffrey J. McDonnell, Kathleen C. Weathers (2017). Reviews and syntheses: On the roles trees play in building and plumbing the Critical Zone. *Biogeosciences Discussions*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5194/bg-2017-61

Brantley, Susan L., David M. Eissenstat, Jill A. Marshall, Sarah E. Godsey, Zsuzsanna Balogh-Brunstad, Diana L. Karwan, Shirley A. Papuga, Joshua Roering, Todd E. Dawson, Jaivime Evaristo, Oliver Chadwick, Jeffrey J. McDonnell, Kathleen C. Weathers (2017). Reviews and syntheses: On the roles trees play in building and plumbing the Critical Zone. *Biogeosciences*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5194/bg-2017-61

Brantley, Susan L., William H. McDowell, William E. Dietrich, Timothy S. White, Praveen Kumar, Suzanne Anderson, Jon Chorover, Kathleen Lohse, Roger C. Bales, Daniel Richter, Gordon Grant, J. Gaillardet (2017). Designing a network of critical zone observatories to explore the living skin of the terrestrial Earth. *Earth Surface Dynamics*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

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Brocard, G. Willenbring, J.K., Wolf, J., Uriarte, M., Scatena, F.N. (2017). Contribution of vegetation to the shaping of mesoscale topography in a tropical montane rainforest. *Nature Geoscience*. . Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Campbell AN, Bhattacharyya A, Lin Y, Tfaily M, Pasa-Tolic L, Chu R, Silver W, Nico P, and Pett-Ridge J. (2017). The impacts of redox periodicity on microbial community structure and the fate of carbon in wet, tropical forest soils.. *partially drafted manuscript*. . Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Chapela Lara M., Buss H. L., Pett-Ridge J.C. (2018). The effects of lithology on trace element and REE behavior during tropical weathering. *Chemical Geology*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Chapela Lara, M., Buss, H.L., and Pett-Ridge, J.C. (2018). The effects of lithology on trace element and REE behavior during tropical weathering. *Chemical Geology*. . Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Chen, C., & Thompson A. (2018). Ferrous Iron Oxidation under Varying pO₂ Levels: The Effect of Fe (III)/Al (III) Oxide Minerals and Organic Matter. *Environmental Science & Technology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1021/acs.est.7b05102

Chen, C., Meile, C., Wilmoth, J. L., Barcellos, D., & Thompson, A. (2018). Influence of pO₂ on Iron Redox Cycling and Anaerobic Organic Carbon Mineralization in a Humid Tropical Forest Soil.. *Environmental Science & Technology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1021/acs.est.7b05102

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Coward E.K.; Thompson A.; Markewitz D.; Richter D.; Plante A.F. (2017). Land use history effects on extractable iron phases and Fe-organic matter interactions at the Calhoun Critical Zone Observatory. *Soil Science Society of America Journal*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

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Feder, Toni (2018). Earth's skin is an interdisciplinary laboratory. In probing the life-supporting critical zone, researchers hope to protect it for future generations. *Physics Today*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1063/PT.3.3813

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- O'Connell,C.S., Ruan, L., Silver W.S., (2018). Drought drives rapid shifts in soil biogeochemistry and greenhouse gas emissions in a wet tropical forest. *Nature Communications*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1038/s41467-018-03352-3
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- Sun, J., Mailloux, B. J., Chillrud, S. N., van Geen, A., Thompson A., & Bostick, B. C (2018). Simultaneously quantifying ferrihydrite and goethite in natural sediments using the method of standard additions with X-ray absorption spectroscopy. *Chemical Geology*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1016/j.chemgeo.2017.11.021
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- Van Beusekom, A., Gonzalez, G., and Scholl, M.A. (2017). Analyzing cloud base at local and regional scales to understand tropical montane cloud forest vulnerability to climate change. *Atmospheric Chemistry and Physics*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.5194/acp-17-7245-2017
- Van Beusekom, A.E., González, G. and Rivera, M.M. (2017). Response to "Clarifying citation of Torres-Valcárcel et al. 2015 in Van Beusekom et al.. *Earth Interactions*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1175/EI-D-16-0031.1
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Wymore, AS, PL Sullivan, RL Brereton, and WH McDowell. (2017). Expanding the biosphere: merging ecosystem ecology and critical zone science.. *Frontiers in Ecology and the Environment*. . Status = OTHER; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Xavier Comas, William J Wright, Scott A Hynek, Raymond C Fletcher, Susan Brantley (2018). Understanding the architecture of the deep critical zone and its relation to knickpoint evolution in the Rio Icacos watershed (Luquillo Critical Zone Observatory, Puerto Rico) using landscape-scale hydrogeophysics and stress modeling. *Earth Surface Processes and Landforms*.. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Xianbin Liu, Xiucheng Zeng, Xiaoming Zou, Grizelle González, Chao Wang, Si Yang (2018). Litterfall Production Prior to and during Hurricanes Irma and Maria in Four Puerto Rican Forests. *Forests*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.3390/f9060367

Yannis G. Dialynas, Rafael L. Bras (2017). Evolution of Contrasting Tropical Landscapes and Critical Zone Response to Changing Climate.. *Earth Surface Processes and Landforms*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Yannis G. Dialynas, Rafael L. Bras (2017). Evolution of Contrasting Tropical Landscapes and Critical Zone Response to Changing Climate.. *Earth Surface Processes and Landforms*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Licenses

Other Conference Presentations / Papers

Campbell AN (2016). *"Here today, gone tomorrow" – how microbes survive the fluctuating conditions in wet tropical soils*.. LLNL First Annual Research Slam. Livermore, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Coward L.; Thompson A.; Plante A. (2017). *"Soil organic matter stabilization by Fe-C interactions in temperate and tropical soils: A cross-CZO comparison"*. CZO All Hands meeting 2017;. Arlington VA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Ashley Van Beusekom, Grizelle González, Sarah Stankavich, Jess Zimmerman, and Alonso Ramírez (2017). *"Understanding Tropical Forest Abiotic Responses to Canopy Loss and Biomass Deposition from an Experimental Hurricane Manipulation"*. AGU 2017. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, A., A. Helton, R. Barnes, J. Brookshire, S. Kaushal, E. Bernhardt, W.K. Dodds, P. Johnes, S. Johnson, P. Kortelainen, W.H. McDowell, R. Spencer, B. Rodriguez-Cardona, A. Argerich, A. Coble, C. Lopez-Lloreda, P. Sullivan, S. Haq, M. Shattuck. (2018). *(De)-coupling of dissolved organic carbon and dissolved organic nitrogen across stream ecosystems*.. Society for Freshwater Science, Detroit, MI May 2018.. Detroit, MI. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2017). . *Impacts of Catastrophic Hurricanes on Stream Chemistry in Tropical Montane Forests are Long-Lasting, Context Dependent, and Vary by Critical Zone Architecture*. AGU Chapman 2017. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Erickson, H.E.; González, G. (2017). *A 27-Years Chronology of Litter Production in a Puerto Rican Moist Tropical Forest*. Ecological Society of America Annual Meeting 2017.. Portland Oregon. Status = OTHER; Acknowledgement of Federal Support = Yes

Dialynas, Y. G., E. Foufoula-Georgiou, W. E. Dietrich, and R. L. Bras, A (2017). *A Dynamic Hydrology-Critical Zone Framework for Rainfall-triggered Landslide Hazard Prediction*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Brantley,Susan, (2015). *A Few Geological Uses of Neutron Scattering: How Does Porosity Change as Water Enters Rocks?*. Gaithersburg, MD invited talk at the Center for High Resolution Neutron Scattering (CHRNS) NSF Site visit review at the National Institute of Standards and Technology (NIST). Gaithersburg, MD. Status = OTHER; Acknowledgement of Federal Support = Yes

Shanley,Jamie, (2016). *A TROPICAL PARADOX - MERCURY IS HIGH IN DEPOSITION, LOW IN THE FOOD WEB IN PUERTO RICO*. PR LTER Annual Meeting June 2016. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = No

Olga L. Mayol-Bracero (2017). *Activities in Atmospheric Chemistry in Central America and the Caribbean*. iCACGP SSC Annual Meeting. Cape Town, South Africa. Status = OTHER; Acknowledgement of Federal Support = Yes

Coward E, Plante AF, Ohno T, and AT Thompson (2018). *Adsorption and molecular fractionation of dissolved organic matter on iron-bearing mineral matrices of varying crystallinity*. ACS National Meeting. Washington, D.C.. Status = OTHER;

Acknowledgement of Federal Support = Yes

Mayol O. (2014). *African Dust and Clouds at Pico del Este*. LCZO Cyber Seminar February 28, 2014. GoToMeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Van Beusekom, A.E., González, G., Scholl, M.A. (2017). *Analyzing cloud base at local and regional scales to understand tropical montane cloud forest vulnerability to climate change..* LTER Annual Meeting 2017. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Avner Gross, Jennifer Pett-Ridge, Peter K Weber, Steven Blazewicz, Whendee L Silver. (2017). *Anoxic conditions drive phosphorus limitation in humid tropical forest soil microorganisms*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Sebastian Martinuzzi, Lawrence A Corp, Douglas C Morton, Eileen Helmer, Michael Keller (2017). *Assessing biomass accumulation in second growth forests of Puerto Rico using airborne lidar*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = No

Robinson Juarez (2018). *Assessment of hurricane-induced tree mortality: The impact of hurricane Maria to Puerto Rico Forests*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Shanley J.B. (2017). *Biogeochemical response to extreme events at the five USGS WEBB watersheds*. AGU Chapman 2017. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Lee, D. (2015). *Bringing a Smart Rock to Luquillo*. LCZO Meeting 2015. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Anthony Castronova, Liza Brazil, Miguel Leon, Jeff Horsburgh, David Tarboton (2018). *CUAHSI Tools and Services for Managing Research Data*. CUAHSI Biennial colloquium.. Shepherdstown, WV. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon (2017). *CZO common measurement network data products and a cross-czo data repository proof of concept*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Perdrial N, Clark K, Shanley JB, Plante AF and WH McDowell (2017). *Can the mineralogical signature of suspended sediments inform on the dynamics and resilience of river systems impacted by extreme climate events at Luquillo?*. AGU Chapman. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Thompson A.; (2016). *Can we predict iron reduction rates across terrestrial ecosystems?*. Telluride Summer Science Series. Telluride CO. Status = OTHER; Acknowledgement of Federal Support = Yes

Shanley, J.B. (2018). *Capturing sources and dynamics of stream sediments and solutes*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Rodríguez-Cardona, B. (2018). *Carbon and nitrogen dynamics in streams across biomes..* Seminar at the Centre d'Estudis Avançats de Blanes (CEAB), in Blanes, Spain. March 22, 2018.. Blanes, Spain. Status = OTHER; Acknowledgement of Federal Support = Yes

Adam Wymore Sujay Kaushal William H McDowell Pirkko Kortelainen Emily Bernhardt Penny Johnes Walter Dodds Sherri Johnson Jack Brookshire Rob Spencer Bianca Rodriguez-Cardona Ashley Helton Rebecca Barnes Alba Algerich Shahan Haq Pamela Sullivan Carla Lopez-Lloreda Ashley Coble Michelle Daley (2017). *Carbon and nitrogen stoichiometry across stream ecosystems*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

G. Brocard, JK Willenbring, FN Scatena, A Johnson, K Clark, A Plante, S Porder, J Shanly, W McDowell, W Silver (2016). *Carbon storage in forested slopes of Puerto Rico: fluxes to the surrounding ocean*. Deep carbon observatory meeting, University of Sydney. Sydney, Australia. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, AS, S Bernal, E Martí, B Rodríguez-Cardona, and WH McDowell (2017). *Changing perspectives on the biogeochemistry and ecology of dissolved organic nitrogen*. Association for the Sciences of Limnology and Oceanography. Honolulu, Hawaii. 1 March 2017. Honolulu, Hawaii. Status = OTHER; Acknowledgement of Federal Support = Yes

Heather Buss (2016). *Chemical weathering fluxes: the role of deep critical zone hotspots*. Invited talk: Univ of Durham, UK, Physical Geography Seminar, Oct 2016. Durham, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Heather Buss (2017). *Chemical weathering fluxes: the role of deep critical zone hotspots*. Invited talk: Univ of Exeter, UK, Dept of Geography Seminar, Jan 2017. Exeter, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon (2018). *Collaborative RAPID: using Hydroshare to present integrated datasets from Hurricanes Maria and Irma*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell W.H.; Silver W.L.; (2016). *Conceptual models of the CZ*. LCZO Webinar series. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Heather Buss (2017). *Creating the critical zone: dissolving, fracturing, and eating rocks*. Invited talk: West of England Geologists Association, Nov 2017. UK. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. and S.L. Brantley (2017). *Critical Zone Observatories: Platforms for Collaborative Science Town Hall*. AGU 2017. New Orleans, LA,. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Christopher Wilson, Miguel Leon (2018). *Critical Zone Observatory Data Management*. CUAHSI Biennial colloquium.. Shepherdstown, WV. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, A. (2016). *Critical Zone Science: A Transformative World View..* CZO all hands meeting.. Arlington, VA. Status = OTHER; Acknowledgement of Federal Support = Yes

White, T, Wymore, A, Dere AL, Richardson J (2018). *Critical Zone Science: A transdisciplinary approach to environmental science*. Science Education Resource Center: Carleton College. webinar. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, A. (2016). *Critical Zone Science: Building the Capacity of International Critical Zone Science: An Early Career Perspective*. CZO All Hands meeting. Arlington, VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Adam Wymore (2017). *Critical zone structure controls concentration-discharge relationships and solute generation in forested tropical montane watersheds..* CZO All Hands meeting 2017; Arlington VA. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, A., D. Ibarra, R. Brereton, K. Maher, and W.H. McDowell (2017). *Critical zone structure controls concentration-discharge relationships and solute generation in forested tropical montane watersheds. "Critical Zone Science: Current Advances and Future Opportunities"*. National CZO meeting. Arlington, VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon, David Lubinski (2018). *Data Resources and Accessibility*. Using observation networks to advance Earth system understanding. NEON Charette #3. Webinar.. webinar. Status = OTHER; Acknowledgement of Federal Support = Yes

Chapela Lara, M., J.A. Schuessler, H. Buss, W.H. McDowell. (2018). *Decoupling of Shallow and Deep Sources of Nutrients at the Late Stages of Weathering: Insights from Traditional and Non-Traditional Tracers at the Luquillo CZO..* Goldschmidt. Boston, MA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Chapela Lara, Maria; Schuessler, J.A.; Buss, H.L.; McDowell, W. (2018). *Decoupling of shallow and deep sources of inorganic nutrients at the late stages of weathering: insights from traditional and non-traditional tracers at the LCZO*. Goldschmidt Conference, Boston, MA. Boston, MA. Status = OTHER; Acknowledgement of Federal Support = Yes

"Maria Chapela Lara, Jan A. Schuessler, Heather L Buss, William H McDowell, " (2017). *Decoupling of stream and vegetation solutes during the late stages of weathering: insights from elemental and Mg isotope trends at the Luquillo Critical Zone Observatory, Puerto Rico*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Alain F Plante, Elizabeth Coward, Tsutomu Ohno, Aaron Thompson (2017). *Differential chemical fractionation of dissolved organic matter during sorption by Fe mineral phases in a tropical soil from the Luquillo Critical Zone Observatory..* AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Almaraz,Maya, and Groffman,P, and Silver,Whendee, L and Hall,Steven, J and Ruan,Leilei, and Porder,Stephen, (2016). *Differential controls on dinitrogen and nitrous oxide from a wet tropical forest*. LCZO 2016. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Campbell AN, Bhattacharyya A, Lin Y, Silver W, Nico P, & Pett-Ridge J (2016). *Digging up microbial community structure and mineral-organic matter relationships under varying periodicity of redox fluxes in a tropical forest soil*. ISME16. Montreal, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

Carla López-Lloreda, William H McDowell, Jody Potter. (2017). *Dissolved Greenhouse Gas Concentration Patterns and Relationships with Stream Chemistry in Tropical Headwater Streams*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2016). *Dissolved Organic Carbon (DOC) over the Decades*. Departmental Seminar. Technical University of Dresden, Germany. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Drilling to Explore the Transformation of Bedrock into Soil in the Deep Critical Zone*. 2015 Willie Woltz Visiting Scientist Lecture Series, North Carolina State University, Raleigh, NC. Raleigh, NC. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H., C. Lopez-Lloreda, and J.D. Potter (2017). *Drivers of N₂O flux from streams and rivers: searching for a better predictive model of N₂O concentrations in inland waters*. International Workshop on N₂O Emissions in Various Ecosystems: Site-Based Research and Global Synthesis, November 29, 2017, Taichung, Taiwan.. Taichung, Taiwan. Status = OTHER; Acknowledgement of Federal Support = Yes

Silver, Whendee, L (2016). *Drought in the Rainforest: Biogeochemical Responses and Feedbacks to Climate Change*. ESA 2016. Fort Lauderdale, FL. Status = PUBLISHED; Acknowledgement of Federal Support = No

Steven McGee (2018). *Education and Outreach*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Vaughan, E., D.F. Cusack, W.H. McDowell, E. Marin-Spiotta (2017). *Effects of nitrogen enrichment on soil organic matter in tropical forests with different ambient nutrient status*. 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Vaughan, E., D.F. Cusack, W.H. McDowell, E. Marin-Spiotta (2017). *Effects of nitrogen enrichment on soil organic matter in tropical forests with different ambient nutrient status*. 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = No

Potter, J.D., Wymore, A.S., Rodríguez-Cardona, B., Coble, A.A., López Lloreda, C., Pérez Rivera, K., De Jesús Román, A., Bernal, S., Martí, E., Krám, P., Hruška, J., Prokushkin, A. and McDowell, W.H. (2017). *Examining the role of dissolved organic nitrogen in stream ecosystems across biomes and Critical Zone gradients*. Lamprey River Science Symposium. Durham, NH. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan Brantley (2016). *Exploring the Critical Zone: Where Rock Meets Life*. Wollaston medalist acceptance speech, London Geological Society, London UK. London UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan L. Brantley (2017). *Exploring the Effects on Regolith of Fractures, Water Flow, and Biogeochemical Reactions Inside Hills*. 2017 Goldschmidt Conference. Paris, France. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley S. (2014). *Exploring the Transformation of Bedrock into Soil in the Deep Critical Zone*. Invited talk, UC-Riverside, Apr 8, 2014. UC-Riverside. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Exploring the Transformation of Bedrock into Soil in the Deep Critical Zone*. Departmental Seminar (invited), Dartmouth College, Hanover, NH, April 3, 2015.. Hanover, NH. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Exploring the Transformation of Bedrock into Soil in the Deep Critical Zone*. Departmental Seminar (invited), University of New Hampshire, Durham, NH, January 29, 2015.. Durham, NH. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan L. Brantley (2017). *Exploring the subsurface chemical landscapes where water and biota turn rock into soil (Invited Medal Lecture)*. American Chemical Society Meeting. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Chen, C., Meile, C., Barcellos, D., & Thompson, A. (2017). *Fe and C cycling is modulated by O₂ levels in redox-fluctuating environments*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Liz Coward; Hyojin Kim (2017). *Fe dynamics across the LCZO: nanometer to kilometers scale*. gotomeeting; LCZO Webinar Series. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Steven Hall (2017). *Finding the "missing" cations: biogeochemical mechanisms that liberate occluded nutrients from highly weathered soils*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Comas X (2017). *Focal Area 1: Hot spots and hot moments in the deep critical zone*. gotomeeting; LCZO webinar series.. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Maria Uriarte, Naomi Schwartz, Adnrew Budsock. (2017). *Fragmentation, topography, and forest age modulate impacts of drought on a tropical forested landscape in eastern Puerto Rico*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Pett-Ridge, J. (2016). *From Cradle to Grave: Using Isotopes and Imaging to Track Microbe-Mineral Interactions*. EMSI2016. Montreal, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, AS. (2018). *Global patterns in stream energy and nutrient cycling*. LTER Webinar. March 2018. (<https://www.youtube.com/watch?v=suEFjtlbEE>). webinar. Status = OTHER; Acknowledgement of Federal Support = Yes

Whendee Silver (2018). *Greenhouse gas fluxes from soil*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

O'Connell, Christine S., (2016). *Guest lecture on deforestation and climate impacts in tropical forests*. UC Santa Cruz. Santa Cruz, CA. Status = OTHER; Acknowledgement of Federal Support = No

Sheila F Murphy (2017). *High-Intensity Rain Storm Connects Hillslopes to Channels in a Steep Semi-Arid Catchment*. AGU Chapman 2017. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Silver W.L. (2017). *Hot Spots and Hot Moments in Redox Dynamics and Associated FeC interactions*. gotomeeting; LCZO webinar series. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Diego Barcellos, Whendee Silver, Daniel Markewitz, Nadia Noor, Caitlin Hodges, Chunmei Chen, Christine O'Connell, Daniel Richter, and Aaron Thompson (2017). *Hot spots and hot moments for redox, Iron and Carbon cycling in soils across Luquillo and Calhoun CZOs*. CZO All Hands meeting 2017; Arlington VA. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan Brantley (2016). *How Rocks, Water, and Living Organisms Turn Rock into Soil*. 2016 Global Institute for Water Security's Annual Distinguished Lecture Series. University of Saskatchewan, Saskatoon, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

Brocard, Gilles, and Willenbring, Jane, (2015). *How Saharan Dust Slows River Knickpoints : Coupling Vegetation Canopy, Soils and the Foundation of the Critical Zone*. AGU 2015. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Pett-Ridge, Jennifer, Aaron Thompson, Gilles Pinay, Klaus-Holger Knorr, and Marco Keiluweit (2017). *How Spatial and Temporal Redox Dynamics Shape Biogeochemistry in Soils and Sediments Across Scales*. Goldschmidt 2017. Paris, France. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Gutierrez del Arroyo, Omar, and Silver, Whendee, L (2016). *How deep does disturbance go?*. LTER Annual Mtg. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = No

Thompson, A. (2018). *How ferrous iron oxidation serves to structure iron reduction and other anaerobic processes in redox fluctuating environments*. Fe Biogeochemistry Workshop, Lech, Austria. Lech, Austria. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *How porosity increases during incipient weathering of crystalline silicate rocks*. Pore-Scale Geochemical Processes Short Course, Prague, CZ. Prague, CZ. Status = OTHER; Acknowledgement of Federal Support = Yes

Campbell AN, Bhattacharyya A, Lin Y, Tfaily M, Pasa-Tolic L, Chu R, Silver W, Nico P, & Pett-Ridge J (2016). *How redox fluctuation shapes microbial community structure and mineral-organic matter relationships in humid tropical forest soil*. AGU 2016. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Campbell AN, Bhattacharyya A, Lin Y, Tfaily M, Pasa-Tolic L, Chu R, Silver W, Nico P, & Pett-Ridge J. (2017). *How redox fluctuation shapes microbial community structure and mineral-organic matter relationships in humid tropical forest soil*. JGI User Meeting. Walnut Creek, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Campbell AN, Bhattacharyya A, Lin Y, Tfaily M, Pasa-Tolic L, Chu R, Silver W, Nico P, & Pett-Ridge J. (2017). *How redox fluctuation shapes microbial community structure and mineral-organic matter relationships in humid tropical forest soil*. DOE Genomic Sciences Annual Contractors Meeting. Arlington, VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Shreeram P Inamdar (2017). *How will large storms alter particulate organic matter exports and composition and impact water quality of receiving aquatic ecosystems?*. AGU Chapman 2017. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Ashley Van Beusekom (2018). *Hurricane Maria Damage: Cause, Effect, and Variations for the Future*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Ashley E. Van Beusekom, Nora L. Álvarez-Berríos, William Gould, Maya Quiñones, and Grizelle González (2018). *Hurricane Maria in the U.S. Caribbean: Disturbance Forces, Variation of Effects, and Implications for Future Storms*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Scholl, M.A., Torres-Sanchez, A.J., Van Beusekom, A.E., Shanley, J.B., Bassiouni, M., Gonzalez, G., 2018. (2018). *Hurricane defoliation effects on water cycle processes in the Luquillo Experimental Forest, Puerto Rico*. AGU 2018. Washington, D.C.. Status = OTHER; Acknowledgement of Federal Support = Yes

Gutiérrez-Fonseca, P.E., A. Ramirez, C. Pringle, P.J. Torres, A. Covich, W.H. McDowell T. Crowl, O.Perez. (2018). *Hurricane impacts to a tropical stream ecosystem in the mountains of Puerto Rico*. Society for Freshwater Science, Detroit, MI May 2018.. Detroit, MI. Status = OTHER; Acknowledgement of Federal Support = No

Carla López Lloreda (2018). *Hurricanes Irma and Maria drove a pulse of salts through soils and streams of a tropical watershed*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Hydrologic and Atmospheric Hot Spots and Hot Moments*. gotomeeting; LCZO Webinar Series. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell W.H. (2017). *Impacts of Catastrophic Hurricanes on Stream Chemistry in Tropical Montane Forests are Long-Lasting, Context Dependent, and Vary by Critical Zone Architecture*. AGU CHapman 2017. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Clark, K. E., Shanley, J. B., Stallard, R. F., Scholl, M. A., Plante, A. F., Perdrial, J. N., Murphy, S. F., Perdrial, N., Gonzalez, G., McDowell, W. H. (2017). *Impacts of extreme climate events - drought and hurricane - on carbon and nitrogen in streams draining the Luquillo Mountains in Puerto Rico*. AGU Chapman conference on Extreme Climate Events Impacts on Aquatic Biogeochemical Cycles and Fluxes. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Ashlee Dere, Timothy White, Adam Wymore, Adam Hoffman, James Washburne, Martha Conklin, and Robert Shuster (2017). *Implementing InTeGrate Critical Zone Science materials in an undergraduate geoscience curriculum*. Earth Educator's Rendezvous. Albuquerque, New Mexico. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2018). *In the eye of the storm: Long-term nitrogen dynamics in hurricane-dominated tropical montane ecosystems*. Peking University, Beijing, 17 April 2018. Beijing, China. Status = OTHER; Acknowledgement of Federal Support = Yes

Torres-Delgado, E., C. J. Valle-Díaz, D. Baumgardner, O. L. Mayol-Bracero (2016). *Indirect effect of African dust particles on cloud microphysical and chemical properties in a tropical montane cloud forest in the Caribbean*. 32nd Meeting of the American Meteorological Society – Hurricanes and Tropical Meteorology. San Juan, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Dialynas Y.G.; Bras R.L.; (2016). *Influence of Climate Change on the Evolution of Contrasting Tropical Landscapes in the Luquillo Critical Zone*. AGU 2016. San Francisco, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Comas X.; Wright W.J.; Hynek S.A.; Ntarlagiannis D.; Terry N.; Whiting F.; Job M.J.; Brantley S.L.; Fletcher R.C.; (2016). *Integrated geophysical study to understand the architecture of the deep critical zone in the Luquillo Critical Zone Observatory (Puerto Rico)*. AGU 2016. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Xavier Comas (2018). *Integrating near-surface geophysical methods into critical zone research at the Luquillo CZO*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Song, C., E. Garcia, A. Argerich, M. Whiles, W.K. Dodds, K. Gido, W.H. McDowell, J.S. Kominoski, D. McMaster, M.B. Flinn, M.T. Trentman, J. Rüegg, S.P. Parker, T. Harms, A D. Rosemond, W.B. Bowden, K. Sheehan, L. Koenig, W. Wollheim, K. Farrell, C. Baker, J. Jones, M. Douglas, F. Ballantyne, A. Helton, S. Jia. (2017). *Interaction between physiology and environmental heterogeneity determines discrepancy in stream metabolism across spatial scales*. Society for Freshwater Science meeting, Raleigh, NC. June 4-9, 2017.. Raleigh, NC. Status = OTHER; Acknowledgement of Federal Support = Yes

Brocard, Gilles, (2015). *Interplay of forest and topography during the growth a tropical mountain. Insights from the Luquillo CZO observatory, Puerto Rico*. Department seminar, Tulane University. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Gilles Brocard, Jane K Willenbring, Fred Scatena (2016). *Interplay of forest and topography during the growth of a tropical mountain*. University of Wollongong, Australia. Wollongong, Australia. Status = OTHER; Acknowledgement of Federal Support = Yes

Brocard, Gilles, and Willenbring, Jane, (2016). *Interplay of forest and topography in the Luquillo Critical Zone Observatory: the case of the Rio Blanco knickpoints*. Department seminar, university of Grenoble, France. university of Grenoble, France. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2017). *Interpretive talk on Bisley Experimental Watersheds*. AGU Chapman. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

Pett-Ridge, J. (2016). *Into the Deep: Variability in Soil Microbial Communities and Carbon Turnover Along a Tropical Forest Soil Depth Profile*. Invited Presentation. UC Berkeley. Status = OTHER; Acknowledgement of Federal Support = Yes

Jennifer Pett-Ridge, Karis J. McFarlane; Elizabeth Green; Katherine A. Heckman; Sasha Reed; Tana E. Wood (2016). *Into the Deep: Variability in Soil Microbial Communities and Carbon Turnover Along a Tropical Forest Soil Depth Profile*. Luquillo CZO Annual Meeting. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Jennifer Pett-Ridge (2018). *Into the Deep: Variability in Soil Microbial Communities and Carbon Turnover Along a Tropical Forest Soil Depth Profile*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2017). *Invited Talk: Ecological research in tropical ecosystems and impacts of extreme climate events on stream chemistry and ecology*. AGU Chapman. San Juan, Puerto Rico. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2018). *Invited participant and presenter at Parallel session 1C, "Optimizing the use and outcomes of national Research Infrastructures through international participation"*. International Conference on Research Infrastructures, ICRI, September 12-14, 2018. Vienna, Austria.. Vienna, Austria.. Status = OTHER; Acknowledgement of Federal Support = Yes

Christof D Meile Chunmei Chen Diego Barcellos Jared Wilmoth Aaron Thompson (2017). *Iron cycling under oscillatory redox conditions: from observations to processes*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Coward E, Plante AF and AT Thompson (2017). *Iron speciation at the critical zone: Controls on organomineral complexation and soil C*. Goldschmidt 2017. Paris, France. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Bhattacharyya, A., Campbell, A.N., Nico, P.S., Weber, P. and Pett-Ridge, J. (2017). *Iron-organic matter transformations in wet tropical soils*. ACS Spring Meeting. San Francisco, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Thompson A, Meile, Wilmoth, Barcellos, Chen C, Ginn B, Tang Y, Hodges C (2017). *Key features of redox fluctuating soils that influence iron cycling*. ACS-spring 2017. San Francisco, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Thompson, A., Meile, C, Wilmoth, J., Barcellos, D., Chen, C., Ginn, B., . . . Hodges, C. (2017). *Key features of redox fluctuating soils that influence iron cycling*. American Chemical Society Annual Meeting (Fall). Washington, D.C.. Status = OTHER; Acknowledgement of Federal Support = Yes

Chapela Lara, Maria (2018). *La zona crítica como moduladora de los flujos de elementos en la superficie terrestre: evidencia de isótopos de Mg en estados de intemperismo avanzado*. Invited presentation; Universidad Nacional Autonoma de Mexico. Mexico City. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring J.K.; (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K., (2016). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; Montana State University. Montana State University. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; University of California Los Angeles. University of California Los Angeles. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; Massachusetts Institute of Technology. Massachusetts Institute of Technology. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; University of Oregon. University of Oregon. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; Rice University. Rice University. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (2017). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; University of Southern California. University of Southern California. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, J.K. (). *Life in the slow lane - Tectonic controls on soils, nutrients, and tree canopies*. Invited talk; University of Lausanne, Switzerland. University of Lausanne, Switzerland. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, William H. (2016). *Linking ILTER and Critical Zone Science: Opportunities to build a global understanding of land-water linkages*. International LTER First Open Science Meeting. Kruger National Park, South Africa. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2017). *Linking life, landscapes, and the legacy of transience*. Gilbert Club. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2018). *Linking life, landscapes, and the legacy of transience*. Invited seminar. University of Texas, Austin. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2018). *Linking life, landscapes, and the legacy of transience*. Invited seminar. Stanford University. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Lithology and chemical weathering reaction fronts, and runoff paths through hillslopes*. Departmental Seminar (invited), Purdue University, West Lafayette, IN, Nov 19, 2015.. West Lafayette, IN. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan Brantley (2016). *Lithology, chemical weathering reaction fronts, and runoff paths through hills*. Distinguished Lecture Series, Dept of Geology and Geophysics, University of Wyoming, Laramie, WY. University of Wyoming, Laramie, WY. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Lithology, chemical weathering reaction fronts, and runoff paths through hillslopes*. Gilbert Club Talk (invited), University of California at Berkeley, Berkeley, CA. California at Berkeley, Berkeley, CA. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2016). *Lithology, chemical weathering reaction fronts, and runoff paths through hillslopes*. University of Wyoming, Laramie WY, April 2016.. Laramie WY. Status = OTHER; Acknowledgement of Federal Support = Yes

Heather Buss (2017). *Location, Location, Location! Chemical weathering mechanisms with depth in the Critical Zone and implications for weathering exports*. Invited talk: The Greenhouse Earth System workshop, Bristol, UK, May 2017. Bristol, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, William H. (2017). *Luquillo Critical Zone Observatory: linking spatial and temporal patterns in stream chemistry to underlying critical zone architecture*. Institute of the Physics of the Globe of Paris. Paris, France. Status = OTHER; Acknowledgement of Federal Support = Yes

Gilles Brocard (2018). *Luquillo Mountains evolution over 10⁴-10⁶ yrs timescales: impact on forest soils and plants, and geological archives of past forest changes*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Martha Scholl (2018). *Luquillo Mountains hydrology: The precipitation-atmosphere-forest system*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Shanley J.B. (2017). *Luquillo loco! Insights on hot moments from in-stream optical sensors in the Puerto Rico wet forest*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

James B Shanley (2018). *Luquillo loco! Insights on hot moments from in-stream optical sensors in the Puerto Rico wet forest*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

María Chapela (2017). *Magnesium isotopes reveal a decoupling of Mg sources to the vegetation and the stream at the Luquillo CZO*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Finstad KM, Campbell AN, Plante AF, Veldkamp E, Zhang N, McFarlane K and J Pett-Ridge (2017). *Measurements and modeling of carbon turnover rates in tropical forest soils..* 2017 Joint NACP and Ameriflux Principal Investigators Meeting. North Bethesda, MD. Status = OTHER; Acknowledgement of Federal Support = Yes

Finstad KM, Campbell AN, Koven C, Miller G, Pett-Ridge J, Plante AF, Veldkamp E, Zhang N, and K McFarlane (2017). *Measurements and modeling of carbon turnover rates in tropical forest soils*. DOE Terrestrial Ecosystem Science Program Investigators Meeting. Potomac, MD. Status = OTHER; Acknowledgement of Federal Support = Yes

Lin, Y.; Gross, A.; Silver, W. L. (2017). *Microbial C:P stoichiometry is shaped by redox conditions along an elevation gradient in humid tropical rainforests*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Napiersalski SA, Roden EE, Buss HL (2017). *Microbiological and genomic analysis of a terrestrial subsurface Fe(II)-silicate based lithotrophic microbial community*. AbSciCon. Mesa AZ. Status = OTHER; Acknowledgement of Federal Support = No

Miguel Leon, Louis Derry, Jerad Bales, David Lubinski, Collin Bode, Christian Camacho Colon (2018). *Migrating CZO data to Hydroshare*. CUAHSI Biennial colloquium. Shepherdstown, WV. Status = OTHER; Acknowledgement of Federal Support = Yes

Coward E, Plante AF, Ohno T, and AT Thompson (2017). *Mineral control of dissolved organic matter sorption in a tropical soil*. Goldschmidt 2017. Paris, France. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Stephanie A Pena, Karin A Block, Al Katz, Paul Gottlieb, Aster Volta. (2017). *Mineralogical controls on microbial biomass accumulation on two tropical soils*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Alain Plante (2018). *Molecular fractionation of dissolved organic matter during sorption on iron-bearing mineral matrices in LCZO soils*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Xavier Comas, William J Wright, Scott A Hynek, Dimitrios Ntarlagiannis, Neil Terry, Mario J Job, Raymond C Fletcher, Susan Brantley (2017). *Multi-scale geophysical study to model the distribution and development of fractures in relation to the knickpoint in the Luquillo Critical Zone Observatory (Puerto Rico)*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Jeffrey Q. Chambers, Robinson I. Negrón Juárez (2018). *NGEE-Tropics*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Xavier Comas, Gilles Brocard, Emma Harrison, Matt Sirianni, Chase Cornett, Mackenzie Vecchio, William Wright, Susan L. Brantley, William H. McDowell (2018). *Near-surface geophysical methods at multiple scales of measurement to understand variation in erosion rates and water storage in the Luquillo CZO, Puerto Rico*. AGU 2018. Washington, D.C.. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2018). *Nevertheless, they persisted: understanding the resiliency of evolving landscapes*. Invited seminar. Rice University. Status = OTHER; Acknowledgement of Federal Support = Yes

Jeffrey Q. Chambers (2018). *Next Generation Ecosystem Experiments- Tropics*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Michelle Shattuck (2018). *Nutrient chemistry across a range of watersheds in a tropical forest ecosystem: The impacts of hurricanes Irma and Maria*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon (2017). *ODM2 Admin A Data Management Application for Observations of the Critical Zone*. Advancing Hydrologic and Environmental Science through Cyberinfrastructure: Lessons Learned and Paths Forward. CUAHSI, Boston MA,. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon (2017). *ODM2 Admin A Data Management Application for Observations of the Critical Zone*. 2017 CUAHSI Conference on Hydroinformatics. Tuscaloosa, AL. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon, William H McDowell, Emilio Mayorga, Landung Setiawan, Richard P Hooper. (2017). *ODM2 Admin Pilot Project – A Data Management Application for Observations of the Critical Zone*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Leon, Miguel, Carlos (2016). *ODM2 Admin: New Administrative Interface for ODM2 data model for CZO Data Managers*. gotomeeting. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Leon, Miguel, Carlos (2016). *ODM2 Admin: New Administrative Interface for ODM2 data model for the BigCZToolbox*. BiGCZ. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Leon, Miguel, Carlos (2016). *ODM2 Admin: New Administrative Interface for ODM2 data model for the CZO Community*. gotomeeting. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Miguel Leon (2016). *ODM2-Admin Data Management*. 2nd Annual Cross-CZO EarthCube Microbial Ecology Workshop and NEON Microbial Ecology Working Group Meeting. Montreal, Quebec, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

"Coward E.; Thompson A.T.; Plante A.F. " (2016). *Organomineral Complexation at the Nanoscale: Iron Speciation and Soil Carbon Stabilization*. AGU 2016. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Mayol-Bracero, O. L (2015). *Overview of Aerosol and Cloud Measurements in the neighbor-island of Puerto Rico, with focus on African Dust*. 50th Anniversary of Climate Research in Barbados. Barbados. Status = OTHER; Acknowledgement of Federal Support = Yes

Buss HL, Moore OW (2017). *Oxidation-controlled weathering fronts: reaction-driven fracturing vs. oxidative dissolution*. Goldschmidt conference 2017. Paris, France. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Satish Bastola, Rafael L. Bras. (2017). *Parameterization of Nitrogen Limitation for a Dynamic Ecohydrological Model: a Case Study from the Luquillo Critical Zone Observatory*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Satish Bastola (2017). *Parameterization of nitrogen limitation for a dynamic ecohydrological model: a case study from the Luquillo Critical Zone Observatory*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Daniel Ibarra Seulgi Moon Matthew Winnick Adam Wymore Jeremy Caves C Page Chamberlain William H McDowell Kate Maher (2017). *Partitioning Concentration-Discharge Patterns of Weathering Products from Monolithologic Catchments to Global Rivers*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Stone M and AF Plante (2017). *Patterns of substrates, microbes and enzymes with soil depth in the Luquillo Critical Zone Observatory*. CEREGE,. Aix-en-Provence, France. Status = OTHER; Acknowledgement of Federal Support = Yes

Perdrial, Julia N., and Rizzo, J, and Harpold, A, (2016). *Perdrial et al. 2016. Investigating controls on stream water carbon dynamics in varied climates: Luquillo as endmember of a CZO climosequence ?*. LCZO allhands meeting. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = No

Susan L. Brantley (2017). *Perspectives on CZ Science (Invited Plenary Address)*. National Critical Zone Science Workshop. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, William H. (2016). *Plenary talk, International LTER First Open Science Meeting*. Brothers in earth systems research: Convergence of Critical Zone and ecosystem science as used in LTER. Kruger National Park, South Africa. Status = OTHER; Acknowledgement of Federal Support = Yes

Gonzalez, Grizelle, and Scholl, Martha A, and Shanley, Jamie, (2016). *Progress report on Hypothesis 4*. CZO Annual Meeting. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Scholl, Martha A, and Bassiouni, M, and Gonzalez, Grizelle, (2015). *Quantifying amount and variability of cloud water inputs using active-strand collector, ceilometer, dewpoint, and photographic measurements*. AGU 2015, A33H-0278. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Scholl, Martha A, and Bassiouni, M, and Gonzalez, Grizelle, (2016). *Quantifying amount and variability of cloud water inputs using active-strand collector, ceilometer, dewpoint, and photographic measurements*. LCZO Annual Mtg, presented by Torres-Sanchez A. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Lin Y, Gross A, Silver WS (2018). *Redox regulates soil phosphorus status across a rainfall gradient in wet tropical forests*. ESA 18. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Lin Y, Campbell AN, Bhattacharyya A, Nico PS, Silver WS, and Pett-Ridge J (2016). *Redox-induced variations in phosphorus fractions in a humid tropical forest soil*. INTERFACE phosphorus workshop. Townsend, Tennessee, USA. Status = OTHER; Acknowledgement of Federal Support = Yes

Leon, M.C., Appling A.P., W.H. McDowell, Clark K. (2015). *Reducing bias and quantifying uncertainty in watershed flux estimates: The R package loadflex*. CZO C-Q workshop. University of New Hampshire. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

McDowell, W.H. (2016). *Research Opportunities at the Critical Zone Observatories*. Research Priorities to Incorporate Terrestrial-aquatic interfaces in Earth System Models. Rockville MD. Status = OTHER; Acknowledgement of Federal Support = Yes

Clark, Kathryn, (2016). *Research strategy and contribution*. University of Newcastle, UK. Newcastle, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. Invited talk University of Exeter, UK. University of Exeter, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. Invited talk, University of Birmingham, UK. University of Birmingham, UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. Invited talk, University of Winnipeg, Canada. University of Winnipeg, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. Invited talk, University of Victoria Wellington, New Zealand. University of Victoria Wellington, New Zealand. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. Invited talk, University of Canterbury, New Zealand. University of Canterbury, New Zealand. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2018). *Research strategy and contribution*. Lectureship interview in biogeochemical cycles in physical geography. Liverpool UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2018). *Research strategy and contribution*. Academic fellowship interview. Manchester UK. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2017). *Research strategy and contribution*. lectureship interview in biogeochemical cycles. St. Andrew's University, Department of Earth Scien. Status = OTHER; Acknowledgement of Federal Support = Yes

Kathryn Clark (2018). *Research strategy and contribution*. NERC Chair II (research position) natural hazards. Simon Fraser University, Department of earth and e. Status = OTHER; Acknowledgement of Federal Support = Yes

"Emma Jayne Harrison, Gilles Y Brocard, Jane K. Willenbring " (2017). *Resisting Self Arrest: the Soil Production Function in Relict Landscapes*. AGU 2017. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2018). *Resisting Self-Arrest: the Soil Production Function in Relict Landscapes*. Invited seminar. Caltech University. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K Willenbring (2017). *Resisting Self-Arrest: the Soil Production Function in Relict Landscapes*. American Geophysical Union Annual Meeting. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Jennifer Pett-Ridge (2018). *Results from the Great Redox Experiment: How Redox Fluctuations Control Coupled Iron-Carbon Cycling and Microbial Communities in LEF soils*. LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Clark, K. E., Stallard, R. F., Shanley, J. B., Scholl, M. A., Plante, A. F., Perdrial, J. N., Murphy, S. F., Perdrial, N., Gonzalez, G., McDowell, W. H. (2017). *River particulate load transport, drivers and yields in the Luquillo Mountains in Puerto Rico*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Clark, Kathryn, and Stallard, Robert, and Plante, Alain, (2016). *River particulate organic carbon, and nitrogen yields in the Luquillo Critical Zone Observatory*. All-CZO Annual Meeting. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Chapela Lara M., Buss HL, Pogge von Strandmann PAE, Moore OW, Schuessler JA (2016). *Riverine Mg Isotope Ratios Reflect Deep Critical Zone Weathering in a Tropical Andesitic Catchment*. Goldschmidt conference 2016. Yokohama 2016. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

McDowell, W.H., J.D. Potter and C. Lopez-Lloreda (2018). *Sensors reveal flipping of biogeochemical behavior in a small tropical river after major hurricanes*. International Association of Limnology meeting. Nanjing, China. Status = OTHER; Acknowledgement of Federal Support = Yes

William H McDowell, Jody Potter, Carla Lopez-Lloreda. (2017). *Short-term impacts of Hurricanes Irma and Maria on tropical stream chemistry as measured by in-situ sensors*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

William H McDowell, Jody Potter, Carla Lopez-Lloreda. (2017). *Short-term impacts of Hurricanes Irma and Maria on tropical stream chemistry as measured by in-situ sensors*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Support = Yes

McDowell, W.H., J. Potter, and C. Lopez-Lloreda. (2018). *Short-term impacts of Hurricanes Irma and Maria on tropical stream chemistry as measured by in-situ sensors.* Society for Freshwater Science. Detroit, M. Status = OTHER; Acknowledgement of Federal Support = Yes

McDowell, W.H., J. Potter, and C. Lopez-Lloreda. (2018). *Short-term impacts of Hurricanes Irma and Maria on tropical stream chemistry as measured by in-situ sensors.* Society for Freshwater Science, Detroit, MI May 2018.. Detroit, MI. Status = OTHER; Acknowledgement of Federal Support = Yes

Christine S. O'Connell, Omar Gutiérrez del Arroyo, Whendee L. Silver (2018). *Short-term response and long-term trajectory of hurricane disturbance: Impacts of Hurricane Maria on forest biogeochemistry in Puerto Rico.* LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Christine S. O'Connell, Omar Gutiérrez del Arroyo, Whendee L. Silver (2018). *Short-term response and long-term trajectory of hurricane disturbance: Impacts of Hurricane Maria on forest biogeochemistry in Puerto Rico.* ESA 2018. New Orleans, LA. Status = OTHER; Acknowledgement of Federal Support = Yes

Coward L.; Thompson A.; Plante A. (2016). *Soil Organic Matter Stabilization By Fe-C Interactions in Temperate and Tropical Soils: A Cross-CZO Comparison.* SSSA Meeting 2016. Madison, WI. Status = OTHER; Acknowledgement of Federal Support = Yes

Jane K. Willenbring Behrooz Ferdowski Emma J. Harrison (2018). *Soil Production from Above and Below: A Unification Theory from a Granular Physics Perspective.* GSA 2018. Indianapolis, Indiana. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Coward E.K.; Thompson A.T.; Plante A.F. (2017). *Soil organic matter stabilization by Fe-C interactions in temperate and tropical soils: A cross-CZO comparison.* CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Chapela Lara, Maria (2018). *Sources of mineral nutrients to soils and streams at the late stages of weathering: insights from Mg isotopes at the LCZO.* Invited presentation. German Research Centre for Geosciences (GFZ),. Potsdam, Germany. Status = OTHER; Acknowledgement of Federal Support = Yes

Heather Buss (2018). *Spheroidal and non-spheroidal weathering of the volcanoclastic rocks in the Bisley watersheds.* LCZO Annual Meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Tim White, Adam Wymore, Aslee Dere, James Washburne, Adam Hoffman, Martha Conklin (2017). *Teaching climate science within the transdisciplinary framework of Critical Zone science (Invited).* AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Christine S. O'Connell (2018). *Terrestrial landscapes in a changing world: Global change impacts on ecosystem ecology.* Invited seminar. Macalester College, St. Paul MN. Status = OTHER; Acknowledgement of Federal Support = Yes

Christine S. O'Connell (2018). *Terrestrial landscapes in a changing world: Global change impacts on ecosystem ecology.* Invited seminar. Sam Houston State University, Huntsville, TX. Status = OTHER; Acknowledgement of Federal Support = Yes

James B Shanley, Sheila F Murphy, Martha A Scholl, Kimberly Wickland, Brent T Aulenbach, Randall Hunt, David W Clow. (2017). *The Value of Long-Term Research at the Five USGS WEBB Catchments.* AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Susan Brantley (2016). *The effect of fractures on weathering of igneous and volcanoclastic sedimentary rocks in Puerto Rican tropical rain forest.* Water-Rock International (WRI-15) Symposium,. Evora, Portugal. Status = OTHER; Acknowledgement of Federal Support = Yes

Willenbring, Jane, and Jerolmack, Doug, (2016). *The null hypothesis: steady rates of erosion, weathering and sediment accumulation during Late Cenozoic mountain uplift and glaciation.* AGU 2015. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Martha Scholl, Kathryn E. Clark, Ashley Van Beusekom, James B Shanley, Angel Torres-Sanchez, Sheila F. Murphy, Grizelle Gonzalez. (2017). *The role of mountain precipitation as a drought buffer in Puerto Rico: Assessing natural systems resilience to change.* AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Thompson A (2016). *The role of redox variability in structuring iron cycling in soils.* Georgia Tech Seminar Series. Atlanta, GA. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan L. Brantley (2017). *Toward a Conceptual Model Relating Reaction Fronts to Water Flow Paths in Hillslopes (Invited)*. 2017 Catchment Science: Interactions of Hydrology, Biology & Geochemistry Gordon Research Conference. Lewiston, ME. Status = OTHER; Acknowledgement of Federal Support = Yes

Susan Brantley (2016). *Toward a conceptual model relating chemical reaction fronts to water flow paths in hills*. Binghamton Symposium: Connectivity in Geomorphology. Colorado State University, Fort Collins, CO. Status = OTHER; Acknowledgement of Federal Support = Yes

Kari M Finstad, Ashley Campbell, Jennifer Pett-Ridge, Ni Zhang, Karis J McFarlane. (2017). *Tropical forest response to a drier future: Measurement and modeling of soil organic matter stocks and turnover*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Clark, Kathryn, and Shanley, Jamie, and Perdrial, Julia N., and Scholl, Martha A, (2016). *Tropical river suspended sediment and solute dynamics in storms during an extreme drought*. All-CZO Annual Meeting. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Ashley Van Beusekom, Grizelle González, Sarah Stankavitch, Jess K Zimmerman. (2017). *Understanding Tropical Forest Abiotic Responses to Canopy Loss and Biomass Deposition from an Experimental Hurricane Manipulation*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Comas X (2017). *Understanding the architecture of the deep critical zone and its relation to knickpoint evolution in the Luquillo CZO (Puerto Rico) using hydrogeophysical methods*. CZO All Hands meeting 2017;. Arlington VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Comas, Xavier, and Wright, W, and Hynek, Scott, (2015). *Understanding the architecture of the deep critical zone in the Rio Icacos watershed (Luquillo Critical Zone Observatory, Puerto Rico) using a combination of hydrogeophysical methods*. AGU 2015. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Miguel Leon (2018). *Updates on CZO & LCZO Data Management*. LCZO Annual meeting 2018. Luquillo, PR. Status = OTHER; Acknowledgement of Federal Support = Yes

Pett-Ridge, J. (2016). *Using isotopes and imaging to track microbe-mineral interactions in soil*. ISME Meeting. Montreal, Canada. Status = OTHER; Acknowledgement of Federal Support = Yes

Wymore, AS. (2018). *Using long-term observational data to better understand carbon: nitrogen ratios in stream ecosystems*. Departmental seminar. University of New Hampshire. April 2018. Durham, NH. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, S. L. (2017). *Using the Critical Zone Observatory Network to Put Geology into Environmental Science (Invited panel discussion)*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Susan Brantley (2017). *Using the Critical Zone Observatory Network to Put Geology into Environmental Science (Invited)*. AGU 2017. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Song, C., W. Dodds, J. Ruegg, A. Argerich, C. Baker, W.B. Bowden, M. Douglas, K. Farrell, M.B. Flinn, E. Garcia, A. Helton, T. Harms, J. Shufang, J. Jones, L. Koenig, J.S. Kominoski, W.H. McDowell, D. McMaster, S.P. Damien; Parker, A.D. Rosemond, C. Ruffing, K. Sheehan, M.T. Trentman, M. Whiles, W. Wollheim, F. Ballantyne. (2018). *Warming induces asymmetric convergence of stream metabolic balance*. Society for Freshwater Science, Detroit, MI May 2018. Detroit, MI. Status = OTHER; Acknowledgement of Federal Support = No

Shanley J.B. (2017). *Watershed scale hot spots and hot moments*. gotomeeting; LCZO Webinar Series. gotomeeting. Status = OTHER; Acknowledgement of Federal Support = Yes

Brantley, Susan, (2015). *Weathering and Surface Processes: Major Advances in the Past 25 Years*. National Science Foundation (invited), Arlington, VA, Dec 1, 2015. Arlington, VA. Status = OTHER; Acknowledgement of Federal Support = Yes

Silver, Whendee, L and O'Connell, Christine S., and Gutierrez del Arroyo, Omar, (2016). *What drives the distribution of phosphorus across the landscape?*. INTERFACE phosphorus workshop. INTERFACE phosphorus workshop. Status = OTHER; Acknowledgement of Federal Support = Yes

Gutiérrez-Fonseca, P.E., A. Ramirez, C. Pringle, P. Torres, A. Covich, T. Cowl, W.H. McDowell, O. Perez-Reyes (2017). *When the rainforest dries up: Impacts of severe drought in a tropical stream*. Society for Freshwater Science meeting, Raleigh, NC. June 4-9, 2017. Raleigh, NC. Status = OTHER; Acknowledgement of Federal Support = Yes

Other Products

Other Publications

Greg Allen and Marisa Penaloza Interview Grizelle González (2017). *'We Don't Feel Safe Here': Building A Post-Hurricane Life In Puerto Rico*. NPR Interview with Grizelle González. Status = PUBLISHED; Acknowledgement of Federal Support = No

Rebecca Holland Interview with Grizelle González (2018). *8 Things to Know About Visiting Puerto Rico After Hurricane Maria*. <https://www.islands.com/8-things-to-know-about-visiting-puerto-rico-after-hurricane-maria>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Dennis M. Rivera Pichardo for The New York Times Interview with Grizelle Gonzalez (2017). *Another Victim of Hurricane Maria: Puerto Rico's Treasured Rainforest*. New York Times Interview with Grizelle Gonzalez <https://www.nytimes.com/2017/10/11/us/another-victim-of-hurricane-maria-puerto-ricos-treasured-rainforest.html>. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Melissa Block interview with Grizelle Gonzalez (2017). *Assessing The Damage To Puerto Rico's Rain Forest*. Radio, NPR, Weekend Edition Saturday Interview with Grizelle Gonzalez https://www.npr.org/2017/10/28/560554603/assessing-the-damage-to-puerto-ricos-rain-forest?utm_campaign=storyshare&utm_source=twitter.com&utm_medium=social. Status = PUBLISHED; Acknowledgement of Federal Support = No

Douglas J Jerolmack (2018). *By river, ocean, or wind, rocks round the same way*. Penn Today citing. Status = OTHER; Acknowledgement of Federal Support = Yes

features: Kathryn Clark, written by Justin Richardson (2017). *CZO News - June 2017: Research highlight: Studying river biogeochemistry at Luquillo CZO and beyond*. Research Highlight. Status = OTHER; Acknowledgement of Federal Support = Yes

MOISES VELASQUEZ-MANOFF (2018). *Can Dirt Save the Earth?*. The New York Times Magazine citing Whendee Silver. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Jason Crotty Interview with Grizelle González (2018). *Caribbean Hurricanes and Birds: Interview with Dr. Joseph Wunderle (Provided 3 pictures for the article)*. Interview with Grizelle González <http://blog.aba.org/2018/04/caribbean-hurricanes-and-birds-interview-with-dr-joseph-wunderle.html>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Kevin Krajick Interview with Grizelle González (2018). *Climate Change and the Re-Greening of Puerto Rico*. State of the Planet. Earth Institute, Columbia University <https://blogs.ei.columbia.edu/2018/03/22/the-re-greening-of-puerto-rico/>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Quiñones, Maya; Parés-Ramos, Isabel K.; Gould, William A.; González, Grizelle; McGinley, Kathleen; Ríos, Pedro. (2018). *El Yunque National Forest Atlas. Gen. Tech. Rep. IITF-GTR-47. San Juan, PR: U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry. 63 p.*. USDA General technical Report https://data.fs.usda.gov/research/pubs/iitf/iitf_gtr_47_eng_highres.pdf. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Zac Gooch Interview with Grizelle González (2017). *El Yunque National Forest after Hurricane Maria*. <https://www.fs.usda.gov/detailfull/iitf/home/?cid=fseprd566277&width=full>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Interview with Grizelle Gonzalez (2017). *El Yunque luego de los huracanes Irma y María*. wapa.tv inter with Grizelle Gonzalez https://www.wapa.tv/programas/vivalatarde/el-yunque-luego-de-los-huracanes-irma-y-maria_20131122417316.html. Status = PUBLISHED; Acknowledgement of Federal Support = No

Biología Boricua (2017). *El impacto de huracanes Irma y María en la investigación*. Podcast, Biología Boricua, episode 25 11/13/2017 <https://biologiaboricua.com/episodio25/>. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Henry Fountain (2018). *Forests Protect the Climate. A Future with more storms would mean trouble.*. The New York Times citing Maria Uriarte. Status = OTHER; Acknowledgement of Federal Support = Yes

Hopewell, John. Based on article by Maddie Stone and pictures shared by LCZO. (2017). *Hurricane Maria decimated the nation's only tropical rain forest outside Hawaii*. September 29, 2017. The Washington Post. https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/09/29/hurricane-maria-decimated-the-nations-only-tropical-rain-forest/?utm_term=.d226aa91d336. Status = OTHER; Acknowledgement of Federal Support = Yes

Ann M. Simmons Interview with Grizelle González (2018). *Hurricane Maria stripped Puerto Rico's forests bare. Now conservationists and scientists are working to replenish them*. Los Angeles Times <http://www.latimes.com/nation/la-na-puerto-rico-reporting.research.gov/rppr-web/rppr?execution=e1s82>

environment-20180226-story.html. Status = PUBLISHED; Acknowledgement of Federal Support = No

Cheryl Dybas (2018). *Hurricanes lead to resilience: Good news follows bad for Puerto Rico's tropical forests*. Press release citing Whendee Silver. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Interview with Grizelle González and Maria Uriarte (2018). *NASA Surveys Hurricane Damage to Puerto Rico's Forests*. NASA's Earth and Goddard <https://www.nasa.gov/feature/goddard/2018/nasa-studies-storm-damage-to-puerto-rico-forests>. Status = PUBLISHED; Acknowledgement of Federal Support = No

WIPR 940, Sistema TV, Máxima Actualidad (2017). *News. Variety Radio and TV*. WIPR 940, Sistema TV, Máxima Actualidad Interview with Grizelle González. Status = PUBLISHED; Acknowledgement of Federal Support = No

Katherine Unger Baillie (2017). *Penn Doctoral Student Probes the Secrets of Ancient Carbon in Tropical Soils*. Penn News (<https://news.upenn.edu/news/penn-doctoral-student-probes-secrets-ancient-carbon-tropical-soils>). Status = OTHER; Acknowledgement of Federal Support = No

Interview with Grizelle González (2017). *Post-Maria, A Key Ecosystem In Puerto Rico Faces Slow Recovery*. Radio, NPR, Morning Edition, Blog <https://www.npr.org/2017/12/17/568849541/post-mar-a-a-key-ecosystem-in-puerto-rico-faces-slow-recovery>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Katherine Unger Baillie (2017). *Puerto Rico 'Data Jam' lets students put their spin on scientific data*. Penn News (<https://penncurrent.upenn.edu/news/puerto-rico-data-jam-lets-students-put-their-spin-on-scientific-data>). Status = OTHER; Acknowledgement of Federal Support = No

EcoAméricas Interview with Grizelle Gonzalez (2017). *Ravaged El Yunque viewed as storm-recovery lab (Published online, Printed)*. EcoAméricas Interview with Grizelle Gonzalez. Status = PUBLISHED; Acknowledgement of Federal Support = No

NBC News Interview with Grizelle González (2018). *Scientists say Hurricanes have lasting effects on Mangroves*. NBC news <https://www.nbcnews.com/nightly-news/video/hurricanes-inflict-long-lasting-damage-on-mangroves-scientists-say-1272246851934?v=railb&>. Status = PUBLISHED; Acknowledgement of Federal Support = No

KATIE L. BURKE (2018). *Scientists in the Wake of the Hurricanes*. American Scientist citing Olga Mayol-Bracero. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Interview with Grizelle Gonzalez (2017). *Serios destrozos en El Yunque*. TV, TeleMundo channel 2, TeleNoticias "9/14/2017 https://www.telemundopr.com/noticias/destacados/Serios-destrozos-en-El-Yunque_TLMD---Puerto-Rico-444573713.html". Status = PUBLISHED; Acknowledgement of Federal Support = No

Stone, Maddie; based on an interview with W.H. McDowell (2017). *The Only Tropical Rainforest in the National Forest System Was Devastated by Hurricane Maria*. Earther <https://earther.com/americas-only-tropical-rainforest-was-devastated-by-hur-1818827517>. Status = OTHER; Acknowledgement of Federal Support = No

Maddie Stone of Earther interviews Grizelle González and Ariel Lugo (2017). *Two Months After Maria, Puerto Rico's Rainforest Is Bouncing Back*. Interview with Grizelle González <https://earther.gizmodo.com/puerto-ricos-rainforest-is-recovering-but-theres-a-lon-1820483535>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Denise Oliver Velez Interview with Grizelle González (2018). *Water is life: Puerto Rico, potable water, and El Yunque*. Daily KOS <https://www.dailykos.com/stories/2018/1/14/1730774/-Water-is-life-Puerto-Rico-potable-water-and-El-Yunque>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Interview with Grizelle González (2017). *We Dig Plants EPISODE 212 Zone Envy – Zone 1*. Radio, We Dig Plants, Heritage Radio Network <http://heritageradionetwork.org/podcast/zone-envy-zone-1/>. Status = PUBLISHED; Acknowledgement of Federal Support = No

SciGirls interview Grizelle González (2018). *¡Puerto Rico aún necesita de mucha ayuda! Our 6th episode – Asombrosos Árboles – took place in Puerto Rico but unfortunately last year the island and our #SciGirls endured #HurricaneMaria Let's see how they are doing and how you can help! #PuertoRico #LatinasinSTEM #GirlsInSTEM*. <https://twitter.com/SciGirls/status/977213487242981376>. Status = PUBLISHED; Acknowledgement of Federal Support = No

Patents

Technologies or Techniques

Thesis/Dissertations

Oliver W Moore. *Chemical weathering of volcanic rocks in the tropics: Using small scale studies to determine the mechanisms, rates and impacts of perturbations.* (2017). University of Bristol, UK. Acknowledgement of Federal Support = Yes

Chapela Lara M.. *Controls on Mg and water fluxes in a highly weathered tropical catchment over different spatial and temporal scales.* (2017). University of Bristol. Acknowledgement of Federal Support = Yes

Yannis G. Dialynas. *Influence of Linked Hydrologic and Geomorphic Processes on the Terrestrial Carbon Cycle.* (2017). Georgia Institute of Technology. Acknowledgement of Federal Support = Yes

Elizabeth Coward. *Iron-Carbon Complexation at the Critical Zone: Impacts of Metal Speciation and Ligand Structure.* (2017). University of Pennsylvania. Acknowledgement of Federal Support = Yes

Almaraz, Maya. *Nitrogen Availability and Loss from Managed and Unmanaged Ecosystems.* (2016). Brown University. Acknowledgement of Federal Support = Yes

King, E.K.. *Understanding Molybdenum Isotope Dynamics in Terrestrial Environments.* (2017). Oregon State University. Acknowledgement of Federal Support = Yes

Websites

Hurricane Maria in Puerto Rico 2017

<https://arcg.is/00f1ij>

An arcgis story map with maps and data related to Hurricane Maria in Puerto Rico in 2017. Created by LCZO data manager Miguel Leon.

ODM2 Admin documentation website

<http://odm2.github.io/ODM2-Admin/>

During the reporting period a new documentation website was developed for ODM2 Admin through github.io. This site provides extensive documentation about how to use ODM2 Admin and some explanation about why it was developed. This site acknowledges federal support.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Products File 1 LCZO advisory committee report-annual meeting-webinar agendas.pdf	Luquillo CZO advisory committee report following the 2018 annual meeting; LCZO Annual Meeting and Webinar Agendas for 2017-2018	William McDowell	11/26/2018
Products File 2 LCZO Annual Meeting Presentations 2018 Day 1.pdf	LCZO annual meeting presentations Day 1 (McDowell, Silver, Shanley, Brocard and Buss)	William McDowell	11/27/2018
Products File 3 LCZO Annual Meeting Lightning Slides.pdf	LCZO annual meeting lightening talks from all participants	William McDowell	11/27/2018
Products File 4 LCZO Annual Meeting Presentations 2018 Day 2.pdf	LCZO annual meeting presentations Day 2 (Leon, McGee and R. Negron (NGEE-Tropics))	William McDowell	11/27/2018

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
McDowell, William	PD/PI	1

Name	Most Senior Project Role	Nearest Person Month Worked
Gonzalez, Grizelle	Co PD/PI	1
Plante, Alain	Co PD/PI	2
Silver, Whendee	Co PD/PI	1
Bastola, Satish	Co-Investigator	6
Brantley, Susan	Co-Investigator	1
Bras, Rafael	Co-Investigator	1
Buss, Heather	Co-Investigator	2
Comas, Xavier	Co-Investigator	1
Crowl, Todd	Co-Investigator	0
Jerolmack, Doug	Co-Investigator	0
Mayol, Olga	Co-Investigator	2
Porder, Stephen	Co-Investigator	0
Thompson, Aaron	Co-Investigator	2
Willenbring, Jane	Co-Investigator	1
Fernandez, Denny	Faculty	1
Hall, Steven	Faculty	2
Job, Mario	Faculty	0
Marin-Spiotta, Erika	Faculty	0
McGee, Steven	Faculty	1
Ntarlaginannis, Dimitrios	Faculty	1
Perdrial, Julia	Faculty	1
Perdrial, Nicolas	Faculty	1
Pett-Ridge, Julie	Faculty	1
Wang, Jingfeng	Faculty	1
Yang, Wendy	Faculty	0
Arnone, Elisa	Postdoctoral (scholar, fellow or other postdoctoral position)	0

Name	Most Senior Project Role	Nearest Person Month Worked
Brocard, Gilles	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Chen, Chunmei	Postdoctoral (scholar, fellow or other postdoctoral position)	4
Clark, Kathryn	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Gross, Avner	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Gu, Xin	Postdoctoral (scholar, fellow or other postdoctoral position)	3
Guillon, Herve	Postdoctoral (scholar, fellow or other postdoctoral position)	2
Hynek, Scott	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Hyojin, Kim	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Lin, Yang	Postdoctoral (scholar, fellow or other postdoctoral position)	2
O'Connell, Christine	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Ruan, Leilei	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Seiphoori, Ali	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Szabo, Timea	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Van Bueusekom, Ashley	Postdoctoral (scholar, fellow or other postdoctoral position)	12
Wymore, Adam	Postdoctoral (scholar, fellow or other postdoctoral position)	3
Zhou, Qingtao	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Baez Rodriguez, Noelia	Other Professional	1
Brown, Josh	Other Professional	0
Jimenez, Rafael	Other Professional	0
Leon, Miguel	Other Professional	9
Potter, Jody	Other Professional	1
Shattuck, Michelle	Other Professional	3
Bosiak, Matt	Technician	0
Diazgranados, Jorge	Technician	0
Gomez, Nicolas	Technician	5
Gonzalez, Gisela	Technician	8

Name	Most Senior Project Role	Nearest Person Month Worked
Lopez, Carla	Technician	6
Salazar Ortiz, Monica	Technician	0
Sallady, Ryan	Technician	12
Schwaner, Geoff	Technician	0
Snyder, Lisle	Technician	1
Swan, Katherine	Technician	1
Torres, Angel	Technician	8
Yudkin, Brian	Technician	6
Gould, William	Staff Scientist (doctoral level)	0
Martinuzzi, Sebastian	Staff Scientist (doctoral level)	0
Murphy, Sheila	Staff Scientist (doctoral level)	1
Scholl, Martha	Staff Scientist (doctoral level)	3
Shanley, Jamie	Staff Scientist (doctoral level)	1
Stallard, Robert	Staff Scientist (doctoral level)	1
Wood, Tana	Staff Scientist (doctoral level)	1
Almaraz, Maya	Graduate Student (research assistant)	0
Barcellos, Diego	Graduate Student (research assistant)	6
Brereton, Rich	Graduate Student (research assistant)	0
Chapela Lara, Maria	Graduate Student (research assistant)	7
Cornett, Chase	Graduate Student (research assistant)	9
Coward, Elizabeth	Graduate Student (research assistant)	0
Cyle, Taylor	Graduate Student (research assistant)	0
Dialynas, Yannis	Graduate Student (research assistant)	0
Dunne, Kieran	Graduate Student (research assistant)	1
Earll, Marisa	Graduate Student (research assistant)	12
Gutiérrez del Arroyo, Omar	Graduate Student (research assistant)	12

Name	Most Senior Project Role	Nearest Person Month Worked
Harrison, Emma	Graduate Student (research assistant)	12
Hodges, Caitlin	Graduate Student (research assistant)	0
Hoyt, Virginia	Graduate Student (research assistant)	4
Jiaying, Zhang	Graduate Student (research assistant)	6
King, Elizabeth	Graduate Student (research assistant)	3
Koenig, Lauren	Graduate Student (research assistant)	1
Lee, Dylan	Graduate Student (research assistant)	0
Litwin-Miller, Kim	Graduate Student (research assistant)	0
McClintock, Matthew	Graduate Student (research assistant)	0
Moore, Oliver	Graduate Student (research assistant)	9
Noor, Nadia	Graduate Student (research assistant)	1
Orlando, Joe	Graduate Student (research assistant)	0
Perez, Katherine	Graduate Student (research assistant)	1
Phillips, Colin	Graduate Student (research assistant)	0
Rodriguez, Josely	Graduate Student (research assistant)	0
Saccardi, Brian	Graduate Student (research assistant)	0
Santos, Gilmarie	Graduate Student (research assistant)	1
Shaw, Meaghan	Graduate Student (research assistant)	1
Sirianni, Matt	Graduate Student (research assistant)	1
Stone, Maddie	Graduate Student (research assistant)	0
Torres, Elvis	Graduate Student (research assistant)	8
Veccio, Mackenzie	Graduate Student (research assistant)	1
Whiting, Finn	Graduate Student (research assistant)	0
Wilmoth, Jared	Graduate Student (research assistant)	0
Wright, William	Graduate Student (research assistant)	1
Ardington, Emma	Undergraduate Student	1

Name	Most Senior Project Role	Nearest Person Month Worked
Aviles, Gabriela	Undergraduate Student	2
Bell-Rosof, Madison	Undergraduate Student	3
Benitez, Gabriel	Undergraduate Student	3
Bodek, Sophie	Undergraduate Student	0
Casey, James	Undergraduate Student	1
Chancey, Danielle	Undergraduate Student	1
Chang, Bowen	Undergraduate Student	0
Ciaburri, John	Undergraduate Student	1
Crespo, Ashley	Undergraduate Student	0
Earwood, Racheal	Undergraduate Student	1
Gauthier, Brook	Undergraduate Student	1
Gondak, Geneva	Undergraduate Student	0
Kovalovitch, Aria	Undergraduate Student	0
McGrath, Casey	Undergraduate Student	0
Mcharo, Light	Undergraduate Student	1
Mroz, Christina	Undergraduate Student	0
Nunez, Mayra	Undergraduate Student	0
Osota, Elizabeth	Undergraduate Student	3
Phillips, Margaret	Undergraduate Student	0
Rivera, Felipe	Undergraduate Student	2
Rogers, David	Undergraduate Student	0
Rosales, Omar	Undergraduate Student	3
Sanders, Hannah	Undergraduate Student	1
Seawards, Kyle	Undergraduate Student	1
Sherman, Justin	Undergraduate Student	0
Silver, Heather	Undergraduate Student	0

Name	Most Senior Project Role	Nearest Person Month Worked
Stien, Rebekah	Undergraduate Student	0
Sullivan, Conor	Undergraduate Student	0
Tamayo, Cooper	Undergraduate Student	0
Terry, Neil	Undergraduate Student	0
Tilyou, Mary	Undergraduate Student	0
Traxler, Emily	Undergraduate Student	0
Waldron, Liam	Undergraduate Student	1
Yamamoto, Kana	Undergraduate Student	0
Villanueva, Roberto	High School Student	1
Wu, Yiyu	High School Student	2
Morales, Flavia	Consultant	0
De Jesus Roman, Albertyadir	Research Experience for Undergraduates (REU) Participant	0
Perez Rivera, Katherine	Research Experience for Undergraduates (REU) Participant	1

Full details of individuals who have worked on the project:

William H McDowell

Email: bill.mcdowell@unh.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Executive Committee Member, responsible for intellectual project integration and stream sensor network

Funding Support: UNH

International Collaboration: No

International Travel: No

Grizelle Gonzalez

Email: ggonzalez@fs.fed.us

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 1

Contribution to the Project: Monitoring of climate and hydrological data, ceilometer data interpretation

Funding Support: USDA FS

International Collaboration: No

International Travel: No

Alain F Plante**Email:** aplante@sas.upenn.edu**Most Senior Project Role:** Co PD/PI**Nearest Person Month Worked:** 2

Contribution to the Project: Oversees research in soil carbon quality and dynamics. Supervises 1 PhD student, 2 undergraduate students, and co-supervises 1 post-doc. Has established cross-CZO working group in organic matter research.

Funding Support: UPenn LCZO

International Collaboration: No

International Travel: No

Whendee Silver**Email:** wsilver@berkeley.edu**Most Senior Project Role:** Co PD/PI**Nearest Person Month Worked:** 1

Contribution to the Project: Soil Trace Gases, Iron Redox. Oversees post-docs and graduate students.

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Satish Bastola**Email:** Satish.bastola@ce.gatech.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 6

Contribution to the Project: Hydrologic modeling; landslide modeling.

Funding Support: Georgia Tech

International Collaboration: No

International Travel: No

Susan L Brantley**Email:** brantley@eesi.psu.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1

Contribution to the Project: Investigates chemical and physical processes associated with the circulation of aqueous fluids in shallow hydrogeologic settings. Supervises a Post-Doc and Masters student.

Funding Support: Penn State

International Collaboration: No

International Travel: No

Rafael Bras**Email:** rbras@gatech.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1

Contribution to the Project: Hydrologic modeling; landslide modeling.

Funding Support: Georgia Tech

International Collaboration: No
International Travel: No

Heather Buss

Email: h.buss@bristol.ac.uk

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Consulted on borehole drilling, analysis of borehole samples, measurement and analysis of weathering profiles through deep CZ

Funding Support: University of Bristol, LCZO

International Collaboration: Yes, United Kingdom

International Travel: No

Xavier Comas

Email: xcomas@fau.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Work on GPR, deep critical zone science.

Funding Support: Florida Atlantic University

International Collaboration: No

International Travel: No

Todd Crowl

Email: crowl@fiu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 0

Contribution to the Project: Local coordination and facilities management.

Funding Support: FIU

International Collaboration: No

International Travel: No

Doug Jerolmack

Email: sediment@sas.upenn.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 0

Contribution to the Project: Oversees research related to sediment transport and fluvial processes. Established 3 sediment transport monitoring stations, supervises one PhD student and co-supervises one PhD student.

Funding Support: UPenn

International Collaboration: No

International Travel: No

Olga Mayol

Email: omayol@ites.upr.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. Determination of dust concentrations

Funding Support: UPR

International Collaboration: No

International Travel: No

Stephen Porder

Email: stephen_porder@brown.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 0

Contribution to the Project: Nitrogen and Phosphorus Cycling and limitation

Funding Support: Brown

International Collaboration: No

International Travel: No

Aaron Thompson

Email: AaronT@uga.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Oversees research in soil carbon quality and dynamics. Supervises students and postdocs.

Funding Support: UGA

International Collaboration: No

International Travel: No

Jane Willenbring

Email: erosion@sas.upenn.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Conducting and coordinating all cosmogenic dating studies in the LCZO; Large scale geomorphology.

Funding Support: UCSD

International Collaboration: No

International Travel: No

Denny Fernandez

Email: dsfernandez@gmail.com

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Impacts of African dust on radiation.

Funding Support: UPR-Humacao

International Collaboration: No

International Travel: No

Steven Hall

Email: stevenjh@iastate.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Iron redox and soil carbon dynamics

Funding Support: Iowa State University

International Collaboration: No

International Travel: No

Mario Job

Email: mjob@fau.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 0

Contribution to the Project: Support with geophysical surveys

Funding Support: FAU

International Collaboration: No

International Travel: No

Erika Marin-Spiotta

Email: marinspiotta@wisc.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 0

Contribution to the Project: Mechanisms of soil organic matter stabilization Hydrologic controls on carbon & nutrient transport

Funding Support: University of Wisconsin

International Collaboration: No

International Travel: No

Steven McGee

Email: mcgee@lponline.net

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Responsible for K-12 curricula development

Funding Support: Northwestern University and The Learning Partnership

International Collaboration: No

International Travel: No

Dimitrios Ntarlaginannis

Email: dimntar@scarletmail.rutgers.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Work on electrical resistivity

Funding Support: FAU + Rutgers

International Collaboration: No

International Travel: No

Julia Perdrial**Email:** julia.perdrial@uvm.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** DOM (sample and data) analysis of storm Erika samples**Funding Support:** University of Vermont**International Collaboration:** No**International Travel:** No

Nicolas Perdrial**Email:** nicolas.perdrial@uvm.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Particulate mineral analysis of storm Erika samples**Funding Support:** UVM**International Collaboration:** No**International Travel:** No

Julie Pett-Ridge**Email:** Julie.Pett-Ridge@oregonstate.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Chemical weathering, soil formation, and biogeochemical cycling**Funding Support:** Oregon State**International Collaboration:** No**International Travel:** No

Jingfeng Wang**Email:** jingfeng.wang@ce.gatech.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Hydrologic modeling; landslide modeling.**Funding Support:** Georgia Tech**International Collaboration:** No**International Travel:** No

Wendy Yang**Email:** wyang@life.illinois.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 0**Contribution to the Project:** Iron Redox**Funding Support:** University of Illinois**International Collaboration:** No**International Travel:** No

Elisa Arnone**Email:** elisa.arnone@gmail.com**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 0**Contribution to the Project:** Hydrologic modeling; landslide modeling.**Funding Support:** Government of Italy**International Collaboration:** Yes, Italy**International Travel:** No

Gilles Brocard**Email:** gbrocard@sas.upenn.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 1**Contribution to the Project:** Conducting cosmogenic dating studies in the LCZO and operating the UPenn cosmogenic lab.**Funding Support:** grant**International Collaboration:** Yes, Australia**International Travel:** No

Chunmei Chen**Email:** cmchen@uga.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 4**Contribution to the Project:** Conducting research on iron redox processes in LCZO soils.**Funding Support:** UGA**International Collaboration:** No**International Travel:** No

Kathryn Clark**Email:** kathryn.clark@ouce.ox.ac.uk**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 1**Contribution to the Project:** Synthesis postdoc working on dynamics and properties of fine sediment transport in LCZO streams.**Funding Support:** UPenn LCZO**International Collaboration:** No**International Travel:** No

Avner Gross**Email:** avner.gross@berkeley.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 12**Contribution to the Project:** redox, Fe, P, C interactions**Funding Support:** Israel, LLNL

International Collaboration: Yes, Israel
International Travel: No

Xin Gu

Email: xug102@psu.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 3

Contribution to the Project: Postdoc working on particle movement in groundwater

Funding Support: LCZO and DOE

International Collaboration: No

International Travel: No

Herve Guillon

Email: herve.guillon@univ-grenoble-alpes.fr

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 2

Contribution to the Project: Determining size distribution of fine sediments to determine their source

Funding Support: France

International Collaboration: Yes, France

International Travel: No

Scott Hynek

Email: scott.hynek@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: geochronology, geochemical tracers, and isotope geochemistry to understand processes and pathways in modern environments.

Funding Support: USGS

International Collaboration: No

International Travel: No

Kim Hyojin

Email: hxx31@psu.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Post-doc working on geochronology, geochemical tracers, and isotope geochemistry to understand processes and pathways in modern environments.

Funding Support: Penn State

International Collaboration: No

International Travel: No

Yang Lin

Email: yanglin@berkeley.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 2

Contribution to the Project: Iron Redox

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Christine Sierra O'Connell

Email: coconn@berkeley.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: Redox and greenhouse gas controls

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Leilei Ruan

Email: ruanleil@msu.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Iron Redox

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Ali Seiphooori

Email: aliseiph@sas.upenn.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Examining composition of suspended sediment sampled from storms

Funding Support: Jerolmack - NIH grant

International Collaboration: No

International Travel: No

Timea Szabo

Email: tszabo.hu@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 0

Contribution to the Project: Field and theoretical investigations of pebble abrasion

Funding Support: Hungarian Gov.

International Collaboration: Yes, Hungary

International Travel: No

Ashley Van Bueusekom

Email: ashley.vanbueusekom@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 12

Contribution to the Project: responsible for work on cloud ceiling and its effects on forest ecosystems.

Funding Support: USDA FS

International Collaboration: Yes, United Kingdom

International Travel: No

Adam Wymore

Email: Adam.Wymore@unh.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 3

Contribution to the Project: Stream Solutes

Funding Support: UNH

International Collaboration: No

International Travel: No

Qingtao Zhou

Email: Qingtao.Zhou@unh.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Soil processes and stream solutes

Funding Support: UNH AES

International Collaboration: No

International Travel: No

Noelia Baez Rodriguez

Email: nbaez@ites.upr.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: Data Jam organizer

Funding Support: Luquillo LTER

International Collaboration: No

International Travel: No

Josh Brown

Email: luquillo.czo@mail.com

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 0

Contribution to the Project: Assists all LCZO personnel in field work and sample processing in Puerto Rico.

Funding Support: None

International Collaboration: No

International Travel: No

Rafael Jimenez**Email:** ajz@sas.upenn.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 0**Contribution to the Project:** Conducting research on decadal-scale changes in cloud base.**Funding Support:** None**International Collaboration:** No**International Travel:** No

Miguel Leon**Email:** leonmi@sas.upenn.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 9**Contribution to the Project:** data manager, responsible for expanding datasets online, working with other CZO managers to ensure comparability of datasets, communications, field work scheduling, and work on data products**Funding Support:** UPenn LCZO**International Collaboration:** No**International Travel:** No

Jody Potter**Email:** jody.potter@unh.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 1**Contribution to the Project:** lab manager, responsible for training UNH graduate students in laboratory analyses, and providing ongoing QA/QC of all analytical work for which UNH has responsibility**Funding Support:** UNH WQAL**International Collaboration:** No**International Travel:** No

Michelle Shattuck**Email:** michelle.shattuck@unh.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 3**Contribution to the Project:** assists with grant and sub-contract management including reporting**Funding Support:** UNH**International Collaboration:** No**International Travel:** No

Matt Bosiak**Email:** mwz28@wildcats.unh.edu**Most Senior Project Role:** Technician**Nearest Person Month Worked:** 0**Contribution to the Project:** Technician in the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed**Funding Support:** UNH WQAL

International Collaboration: No
International Travel: No

Jorge Diazgranados

Email: jorge.diazgranados@upr.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 0

Contribution to the Project: Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. Determination of dust concentrations

Funding Support: UPR-RP

International Collaboration: No
International Travel: No

Nicolas Gomez

Email: nicolas.x.gomez@gmail.com
Most Senior Project Role: Technician
Nearest Person Month Worked: 5

Contribution to the Project: Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. Determination of dust concentrations

Funding Support: UPR-RP

International Collaboration: No
International Travel: No

Gisela Gonzalez

Email: gisela.gonzalez688@gmail.com
Most Senior Project Role: Technician
Nearest Person Month Worked: 8

Contribution to the Project: Field support

Funding Support: UC-Berkeley

International Collaboration: No
International Travel: No

Carla Lopez

Email: carla.lpez09@gmail.com
Most Senior Project Role: Technician
Nearest Person Month Worked: 6

Contribution to the Project: Technician responsible for conducting nutrient addition experiments in streams and assisting with other LCZO field and lab work, recently graduated from UPR

Funding Support: UNH

International Collaboration: No
International Travel: No

Monica Salazar Ortiz

Email: monica.salazar@upr.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 0

Contribution to the Project: Field Technician

Funding Support: LCZO

International Collaboration: No

International Travel: No

Ryan Sallady

Email: rsalladay@berkeley.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 12

Contribution to the Project: Instrument installation

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Geoff Schwaner

Email: gwj4@wildcats.unh.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 0

Contribution to the Project: Responsible for field sampling in Puerto Rico in support of all CZO projects

Funding Support: None

International Collaboration: No

International Travel: No

Lisle Snyder

Email: Lisle.Snyder@unh.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 1

Contribution to the Project: Assists with aquatic sensor deployment and maintenance; assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH, NSF

International Collaboration: No

International Travel: No

Katherine Swan

Email: Katherine.Swan@unh.edu

Most Senior Project Role: Technician

Nearest Person Month Worked: 1

Contribution to the Project: Technician in the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No

International Travel: No

Angel Torres

Email: ajtorres@usgs.gov
Most Senior Project Role: Technician
Nearest Person Month Worked: 8

Contribution to the Project: Field Technician, collects samples.

Funding Support: USGS

International Collaboration: No
International Travel: No

Brian Yudkin
Email: bay2zh@virginia.edu
Most Senior Project Role: Technician
Nearest Person Month Worked: 6

Contribution to the Project: TRACE and LCZO technician

Funding Support: DOE-TRACE

International Collaboration: No
International Travel: No

William Gould
Email: wgould@fs.fed.us
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0

Contribution to the Project: Planning, data collection, analyses, presentation, and publication of results

Funding Support: USDA FS

International Collaboration: No
International Travel: No

Sebastian Martinuzzi
Email: sebamartinuzzi@gmail.com
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 0

Contribution to the Project: LiDAR analyses and interpretation

Funding Support: University of Wisconsin

International Collaboration: No
International Travel: No

Sheila Murphy
Email: sfmurphy@usgs.gov
Most Senior Project Role: Staff Scientist (doctoral level)
Nearest Person Month Worked: 1

Contribution to the Project: USGS Collaborator on rivers.

Funding Support: USGS

International Collaboration: No
International Travel: No

Martha Scholl**Email:** mascholl@usgs.gov**Most Senior Project Role:** Staff Scientist (doctoral level)**Nearest Person Month Worked:** 3**Contribution to the Project:** Isotope Hydrology**Funding Support:** USGS**International Collaboration:** No**International Travel:** No

Jamie Shanley**Email:** jshanley@usgs.gov**Most Senior Project Role:** Staff Scientist (doctoral level)**Nearest Person Month Worked:** 1**Contribution to the Project:** Mercury and Carbon Biogeochemistry**Funding Support:** USGS**International Collaboration:** No**International Travel:** No

Robert Stallard**Email:** stallard@usgs.gov**Most Senior Project Role:** Staff Scientist (doctoral level)**Nearest Person Month Worked:** 1**Contribution to the Project:** River carbon biogeochemistry**Funding Support:** USGS**International Collaboration:** No**International Travel:** No

Tana Wood**Email:** wood.tana@gmail.com**Most Senior Project Role:** Staff Scientist (doctoral level)**Nearest Person Month Worked:** 1**Contribution to the Project:** Warming experiment**Funding Support:** USDA FS**International Collaboration:** No**International Travel:** No

Maya Almaraz**Email:** maya_almaraz@brown.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Nitrogen Cycling**Funding Support:** Brown**International Collaboration:** No**International Travel:** No

Diego Barcellos**Email:** diego.barcellos@yahoo.com.br**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 6**Contribution to the Project:** Conducting research on iron redox processes in LCZO soils.**Funding Support:** UGA**International Collaboration:** No**International Travel:** No

Rich Brereton**Email:** rich.brereton@unh.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** work describing how riparian flow paths affect stream chemistry**Funding Support:** UNH**International Collaboration:** No**International Travel:** No

Maria Chapela Lara**Email:** m.chapelalara@bristol.ac.uk**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 7**Contribution to the Project:** Mg isotope analysis, analysis of decoupling of surface and deep nutrient cycles**Funding Support:** CONACYT (Mexico) PhD Scholarship; LCZO UNH**International Collaboration:** Yes, United Kingdom**International Travel:** No

Chase Cornett**Email:** ccornet1@fau.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 9**Contribution to the Project:** "Support with geophysical surveys (graduate assistant)"**Funding Support:** FAU**International Collaboration:** No**International Travel:** No

Elizabeth Coward**Email:** ecoward@sas.upenn.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Conducting research on iron-organic matter interactions in LCZO soils.**Funding Support:** UPenn Ben Franklin Grad Fellowship

International Collaboration: No
International Travel: No

Taylor Cyle

Email: unkown@notsure.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: dissolved organic carbon measurements. Worked to optimize the methodology for the unique extract matrices.

Funding Support: UC- Berkeley

International Collaboration: No
International Travel: No

Yannis Dialynas

Email: ydialynas@gatech.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Hydrologic modeling; landslide modeling.

Funding Support: Georgia Tech, 2006T95, 2006V31

International Collaboration: No
International Travel: No

Kieran Dunne

Email: kdunne@sas.upenn.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Examining controls of river-bank cohesion on channel geometry

Funding Support: UPenn Ben Franklin Grad Fellowship

International Collaboration: No
International Travel: No

Marisa Earll

Email: mearll@ucsd.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Conducting and coordinating geodetic analyses in the LCZO; Large scale hydrology

Funding Support: UCSD

International Collaboration: No
International Travel: No

Omar Gutiérrez del Arroyo

Email: omar.gutierrezdela@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Soil carbon and nutrient cycling controls (i.e., depth, climate)

Funding Support: UC-Berkeley

International Collaboration: No

International Travel: No

Emma Harrison

Email: haem@sas.upenn.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 12

Contribution to the Project: Conducting cosmogenic dating studies in the LCZO and operating the cosmogenic lab.

Funding Support: UCSD

International Collaboration: No

International Travel: No

Caitlin Hodges

Email: chodges@uga.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: conducting field-level assessments of iron reduction potential.

Funding Support: University of Georgia

International Collaboration: No

International Travel: No

Virginia Hoyt

Email: ah1208@wildcats.unh.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 4

Contribution to the Project: Stream Solutes

Funding Support: LCZO

International Collaboration: No

International Travel: No

Zhang Jiaying

Email: jiaying.zhang@gatech.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 6

Contribution to the Project: Terrestrial biosphere modeling; Forest disturbance and recovery

Funding Support: Georgia Tech

International Collaboration: No

International Travel: No

Elizabeth King

Email: eking@coas.oregonstate.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 3

Contribution to the Project: Chemical weathering, soil formation, and biogeochemical cycling

Funding Support: Oregon State, SAVI

International Collaboration: No

International Travel: No

Lauren Koenig

Email: Lauren.Koenig@unh.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Stream Solutes

Funding Support: NSF Fellowship

International Collaboration: No

International Travel: No

Dylan Lee

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Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Developing smart rocks for bedload transport analysis

Funding Support: UPenn

International Collaboration: No

International Travel: No

Kim Litwin-Miller

Email: klitwin@sas.upenn.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Conducting research on sediment transport in the LCZO.

Funding Support: UPenn

International Collaboration: No

International Travel: No

Matthew McClintock

Email: mmclintock316@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Chemical weathering, soil formation, and biogeochemical cycling

Funding Support: Oregon State

International Collaboration: No

International Travel: No

Oliver Moore

Email: oliver.moore@bristol.ac.uk

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 9

Contribution to the Project: Analysis of deep CZ weathering: reactive transport modelling, traditional and synchrotron spectroscopies

Funding Support: NERC (UK) PhD Fellowship

International Collaboration: Yes, United Kingdom

International Travel: No

Nadia Noor

Email: nadia.noor25@uga.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Conducting research on iron redox processes in LCZO soils.

Funding Support: UGA

International Collaboration: No

International Travel: No

Joe Orlando

Email: jjo167@psu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Research on deep CZO geochronology, tracers.

Funding Support: Penn State

International Collaboration: No

International Travel: No

Katherine Perez

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Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Stream Solutes

Funding Support: LTER

International Collaboration: No

International Travel: No

Colin Phillips

Email: colinp@sas.upenn.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 0

Contribution to the Project: Conducting research on sediment transport and exports of Luquillo streams.

Funding Support: UPenn

International Collaboration: No

International Travel: No

Josely Rodriguez**Email:** josely_rodriguez313@hotmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** African Dust Inputs**Funding Support:** PRLSAMP fellowship**International Collaboration:** No**International Travel:** No

Brian Saccardi**Email:** bek36@wildcats.unh.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Stream Solutes**Funding Support:** UNH**International Collaboration:** No**International Travel:** No

Gilmarie Santos**Email:** gilmarie17@hotmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Sampling and determination of dust concentrations**Funding Support:** UPR**International Collaboration:** No**International Travel:** No

Meaghan Shaw**Email:** mes1109@wildcats.unh.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Stream Solutes**Funding Support:** UNH**International Collaboration:** No**International Travel:** No

Matt Sirianni**Email:** matt.sirianni@icloud.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Support with geophysical surveys**Funding Support:** FAU**International Collaboration:** No**International Travel:** No

Maddie Stone**Email:** mmstone83@gmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Conducting research on microbial ecology and organic matter characterization in LCZO soils.**Funding Support:** NSF-GRF**International Collaboration:** No**International Travel:** No

Elvis Torres**Email:** elvis.torres810@gmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 8**Contribution to the Project:** Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. Determination of dust concentrations**Funding Support:** UPR**International Collaboration:** No**International Travel:** No

Mackenzie Vecchio**Email:** vecchio647@gmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Support with geophysical surveys**Funding Support:** FAU**International Collaboration:** No**International Travel:** No

Finn Whiting**Email:** unknown@dontknow.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Support with geophysical surveys**Funding Support:** FAU**International Collaboration:** No**International Travel:** No

Jared Wilmoth**Email:** jared.wilmoth@gmail.com**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 0**Contribution to the Project:** Conducting research on iron redox processes in LCZO soils. PhD student Jared Wilmoth completed his dissertation and secured a postdoc at Oak Ridge National Lab.**Funding Support:** UGA

International Collaboration: No
International Travel: No

William Wright

Email: wwright19@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Support with geophysical surveys

Funding Support: FAU

International Collaboration: No

International Travel: No

Emma Ardington

Email: eca47061@uga.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Assisted with the analysis of soil samples in the lab

Funding Support: UGA

International Collaboration: No

International Travel: No

Gabriela Aviles

Email: gabrielamarie.aviles@upr.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. Determination of dust concentrations

Funding Support: UPR-RP

International Collaboration: No

International Travel: No

Madison Bell-Rosof

Email: bemad@sas.upenn.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 3

Contribution to the Project: UPenn LCZO

Funding Support: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

International Collaboration: No

International Travel: No

Gabriel Benitez

Email: benit036@umn.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 3

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: UPenn LCZO

International Collaboration: No

International Travel: No

Sophie Bodek

Email: sopbodek@sas.upenn.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Conducting research on sediment transport and exports of Luquillo streams.

Funding Support: UPenn-PURM Fellowship

International Collaboration: No

International Travel: No

James Casey

Email: jdf74@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No

International Travel: No

Danielle Chancey

Email: ddc1004@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No

International Travel: No

Bowen Chang

Email: bchang@sas.upenn.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Assisting PhD student on nutrients and topography participated in fieldwork with Willenbring

Funding Support: PURM fellowship

International Collaboration: No

International Travel: No

John Ciaburri

Email: jvk29@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No
International Travel: No

Ashley Crespo

Email: acrespo@sas.upenn.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: None

International Collaboration: No
International Travel: No

Racheal Earwood

Email: rachel.earwood25@uga.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Assisted with the analysis of soil samples in the lab

Funding Support: UGA, NSF

International Collaboration: No
International Travel: No

Brook Gauthier

Email: beg1007@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No
International Travel: No

Geneva Gondak

Email: ggondak@sas.upenn.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Undergrad research assistant for geomorph group

Funding Support: UPenn LCZO

International Collaboration: No
International Travel: No

Aria Kovalovitch**Email:** ariakov@sas.penn.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Assisting PhD student usign experiments on wormholes and soils and participated in fieldwork with Willenbring**Funding Support:** PURM fellowship**International Collaboration:** No**International Travel:** No

Casey McGrath**Email:** crm12@wildcats.unh.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed**Funding Support:** UNH WQAL**International Collaboration:** No**International Travel:** No

Light Mcharo**Email:** cal1037@wildcats.unh.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 1**Contribution to the Project:** Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed**Funding Support:** UNH WQAL**International Collaboration:** No**International Travel:** No

Christina Mroz**Email:** notknown@unh.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed**Funding Support:** UNH WQAL**International Collaboration:** No**International Travel:** No

Mayra Nunez**Email:** mnunez@sas.upenn.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: UPenn LCZO

International Collaboration: No

International Travel: No

Elizabeth Osota

Email: elizabeth.osota25@uga.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 3

Contribution to the Project: Field work in Puerto Rico and assistance in the lab analyzing samples

Funding Support: UGA

International Collaboration: No

International Travel: No

Margaret Phillips

Email: mp1060@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No

International Travel: No

Felipe Rivera

Email: felipe.rivera08@hotmail.com

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 2

Contribution to the Project: Impacts of African dust on cloud chemical composition and microphysics at Pico Este. Impacts of African dust on radiation. African dust and radiation

Funding Support: UPR-RP

International Collaboration: No

International Travel: No

David Rogers

Email: davrog@sas.upenn.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Development of R scripts for color and thermal analyses of soils

Funding Support: UPenn LCZO

International Collaboration: No

International Travel: No

Omar Rosales

Email: omarrosalescortez@gmail.com

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 3

Contribution to the Project: Undergrad REU student working with Willenbring

Funding Support: SURF REU

International Collaboration: No
International Travel: No

Hannah Sanders

Email: hansan@sas.upenn.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: UPenn LCZO, Penn CURF

International Collaboration: No
International Travel: No

Kyle Seawards

Email: kgs2010@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No
International Travel: No

Justin Sherman

Email: jsherman7732@gmail.com

Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No
International Travel: No

Heather Silver

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Most Senior Project Role: Undergraduate Student
Nearest Person Month Worked: 0

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: UPenn

International Collaboration: No
International Travel: No

Rebekah Stien**Email:** unknown@notsure.com**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Nitrogen Cycling**Funding Support:** Brown**International Collaboration:** No**International Travel:** No

Conor Sullivan**Email:** unknown2@notsure.com**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Nitrogen and Phosphorus limitation**Funding Support:** Brown**International Collaboration:** No**International Travel:** No

Cooper Tamayo**Email:** unknown3@notsure.com3**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** nutrient cycling**Funding Support:** Brown**International Collaboration:** No**International Travel:** No

Neil Terry**Email:** nterry@usgs.gov**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Work on electrical resistivity**Funding Support:** CZO Savi Summer intern + FAU**International Collaboration:** No**International Travel:** No

Mary Tilyou**Email:** mtilyou@sas.upenn.edu**Most Senior Project Role:** Undergraduate Student**Nearest Person Month Worked:** 0**Contribution to the Project:** Assisting with laboratory experiments on organic matter characterization in LCZO soils.**Funding Support:** UPenn Velay Fellowship

International Collaboration: No
International Travel: No

Emily Traxler

Email: etraxler@purdue.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: None

International Collaboration: No
International Travel: No

Liam Waldron

Email: lk1003@wildcats.unh.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 1

Contribution to the Project: Assists with analyses at the UNH Water Quality Analysis Laboratory where stream and groundwater samples are analyzed

Funding Support: UNH WQAL

International Collaboration: No
International Travel: No

Kana Yamamoto

Email: kyamamoto95@berkeley.edu

Most Senior Project Role: Undergraduate Student

Nearest Person Month Worked: 0

Contribution to the Project: Redox and litter decomposition

Funding Support: UC-Berkeley

International Collaboration: No
International Travel: No

Roberto Villanueva

Email: roberto.villanueva@uga.edu

Most Senior Project Role: High School Student

Nearest Person Month Worked: 1

Contribution to the Project: Assisted with the analysis of soil samples in the lab

Funding Support: UGA

International Collaboration: No
International Travel: No

Yiyu Wu

Email: ywu-19@peddie.org

Most Senior Project Role: High School Student

Nearest Person Month Worked: 2

Contribution to the Project: Assisting with laboratory experiments on organic matter characterization in LCZO soils.

Funding Support: Volunteer

International Collaboration: No

International Travel: No

Flavia Morales

Email: fmorales.upr@gmail.com

Most Senior Project Role: Consultant

Nearest Person Month Worked: 0

Contribution to the Project: Determination of dust concentrations

Funding Support: UNH

International Collaboration: No

International Travel: No

Albertyadir De Jesus Roman

Email: albertyadir@yahoo.com

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 0

Contribution to the Project: REU student from UPR conducting nutrient addition experiments in streams

Funding Support: UNH

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: University of Puerto Rico

Government fiscal year(s) was this REU participant supported: 2016

Katherine Perez Rivera

Email: kathxpr.027@live.com

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 1

Contribution to the Project: REU student from UPR conducting nutrient addition experiments in streams

Funding Support: UNH

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: University of Puerto Rico

Government fiscal year(s) was this REU participant supported: 2016

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Budapest University of Technology and Economics	Academic Institution	Budapest, Hungary
Columbia University	Academic Institution	New York, NY
Università degli Studi di Palermo	Academic Institution	Palermo (PA), Italy

Name	Type of Partner Organization	Location
Hebrew University of Jerusalem, Israel	Academic Institution	Jerusalem, Israel
Oregon State University	Academic Institution	Corvallis, OR
University of Grenoble	Academic Institution	Grenoble, France
University of Maine	Academic Institution	Orono, ME
University of Miami	Academic Institution	Miami, Florida
University of Puerto Rico at Mayagüez	Academic Institution	Mayagüez, Puerto Rico
University of Puerto Rico – Humacao	Academic Institution	Humacao, Puerto Rico
University of Wollongong	Academic Institution	Wollongong, Australia

Full details of organizations that have been involved as partners:

Budapest University of Technology and Economics

Organization Type: Academic Institution

Organization Location: Budapest, Hungary

Partner's Contribution to the Project:

In-Kind Support

Facilities

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Collaborator Domokos serves as mentor and external advisor to LCZO PhD student Litwin, and Domokos' PhD student has performed research at LCZO.

Columbia University

Organization Type: Academic Institution

Organization Location: New York, NY

Partner's Contribution to the Project:

In-Kind Support

Collaborative Research

More Detail on Partner and Contribution: Maria Uriarte from Columbia University has a postdoc who just started (May 2015) and is interested in working with the CZO LiDAR data. Their interests are primarily in quantifying vegetation structure (e.g., biomass, LAI) and examining underlying drivers (e.g., topography, elevation, etc). LiDAR-derived vegetation metrics will be used for models.

Hebrew University of Jerusalem, Israel

Organization Type: Academic Institution

Organization Location: Jerusalem, Israel

Partner's Contribution to the Project:

Facilities

More Detail on Partner and Contribution: Dr. Alon Angert, Hebrew University of Jerusalem, Israel, is an expert on phosphorus in dust and he and his group are collaborating with H4.3 to identify airborne sources of phosphorus using stable isotopes of dust

aerosol samples.

Oregon State University

Organization Type: Academic Institution

Organization Location: Corvallis, OR

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution:

University of Grenoble

Organization Type: Academic Institution

Organization Location: Grenoble, France

Partner's Contribution to the Project:

In-Kind Support

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution: Herve Guillon has planning a field campaign with us to measure grain size distribution of fine sediments, using technology developed by critical zone researchers in France.

University of Maine

Organization Type: Academic Institution

Organization Location: Orono, ME

Partner's Contribution to the Project:

Facilities

Collaborative Research

More Detail on Partner and Contribution: Dr. Stom Ohno, at the University of Maine, is a key collaborator on the characterization of DOM samples by FT-ICR-MS. Through his collaboration, we were able to submit samples to Dr. Pat Hatcher's lab. Dr. Ohno also provided expertise in the analysis and interpretation of the FT-ICR-MS, and will be a co-author on a pending publication.

University of Miami

Organization Type: Academic Institution

Organization Location: Miami, Florida

Partner's Contribution to the Project:

Facilities

Collaborative Research

More Detail on Partner and Contribution: Dr. Prospero's group from the University of Miami is collaborating with H4.3 for the determination of the dust concentrations.

University of Puerto Rico at Mayagüez

Organization Type: Academic Institution

Organization Location: Mayagüez, Puerto Rico

Partner's Contribution to the Project:

Collaborative Research

Other: Led part of the annual meeting field trip to introduce meeting participants to the caves.

More Detail on Partner and Contribution:

University of Puerto Rico – Humacao

Organization Type: Academic Institution

Organization Location: Humacao, Puerto Rico

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Dr. Denny Fernandez, from the University of Puerto Rico – Humacao is collaborating with H4.3 on the impact of African dust on radiation at Pico del Este.

University of Wollongong

Organization Type: Academic Institution

Organization Location: Wollongong, Australia

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution:

Università degli Studi di Palermo

Organization Type: Academic Institution

Organization Location: Palermo (PA), Italy

Partner's Contribution to the Project:

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution:

What other collaborators or contacts have been involved?**Focal Area 1**

- Nicole West will conduct research in the LCZO supported by NSF funding.

Focal Area 2

- Dr. Jennifer Pett-Ridge and Dr. Peter Weber at LLNL.
- Dr. Melanie Mayes at ORNL.
- Solid-phase high resolution mass spectrometry of extraction residues was performed in collaboration with Dr. Sunghwan Kim from the Department of Chemistry at Kyungpook National University in South Korea.

Focal Area 3

- Liz King, PhD student at Oregon State University, analyzed stream samples collected from the LCZO in 2016 for molybdenum isotopic composition. Results were published in King and Pett-Ridge, 2018 (<https://doi.org/10.1130/G45124.1>).
- Amy Marcarelli, Associate Professor, Department of Biological Sciences, Michigan Technological University, will visit PR Fall 2018/Winter 2019 to sample LCZO streams as part of a cross-biome comparison of N-fixation/denitrification rates (CAREER award).
- Lin Ma, Associate Professor, Department of Geological Sciences, University of Texas at El Pasotrace, collaborating on metals and isotope analysis at the LCZO.

Focal Area 4

- Dr. Leonardo V. Noto, Dr. Elisa Arnone from Università degli Studi di Palermo, and Cheng Yao from Hohai University, Nanjing, have collaborated from home Organization with suggestions, reviews and writing papers.
- Thomas Mote and Paul Miller at University of Georgia.
- Amanda Schmidt from Oberlin College has two students working on Pre and Post hurricane Maria landslide mapping in Puerto Rico.
- David Litwin, undergraduate at the University of Illinois.

Education and Outreach

- Dr. Tim White (Penn State University/Shale Hills CZO/National Office)
- Dr. Ashlee Dere (University of Nebraska Omaha/Shale Hills CZO)
- Dr. Justin Richardson (University of Massachusetts, Amherst/National Office)
- Dr. Adam Hoffman (University of Dubuque)
- Dr. James Washburne (University of Arizona/Catalina-Jemez CZO)
- Dr. Martha Conklin (University of California, Merced/Southern Sierra CZO)

Impacts

What is the impact on the development of the principal discipline(s) of the project?

Focal Area 1

Post-doctoral researcher M. Chapela Lara documented the lightest Li isotope value on Earth (-38‰) in the volcanoclastic regolith. The porewater is also isotopically lighter than any other value in the literature.

Focal Area 2

Our studies advance the mechanistic understanding of the redox control on biogeochemical processes in tropical forest ecosystems. In environments that experience dynamic redox conditions, similar redox effects on soil P speciation and microbial P uptake may be expected. We find that estimating and constraining hot spot/hot moment greenhouse gas fluxes is likely important when attempting to understand larger-scale patterns in trace gas fluxes. This improved understanding in turn will help guide investigations into the drivers of greenhouse gas emissions and hot spots/moments of those fluxes, in addition to being relevant to applied global change science questions.

Our throughfall exclusion study provides valuable insights on two major uncertainties in the response of tropical forests to drought: the short and long-term effects on nutrient availability, which largely regulate the response of vegetation to global changes (i.e., [CO₂], warming, drought), and the direction of change of soil greenhouse gas fluxes, the largest natural source of greenhouse gases to the atmosphere.

Focal Area 3

Our work has highlighted new roles of climate on surface processes - particularly in the areas of the landscape and stream response to climate forcing. We have also made connections to groups in the LTER, which allowed us to understand the feedbacks and linkages between life and landscape. The changes in forest structure due to hurricanes Irma and Maria will provide a strong test case of the links between biotic processes and CZ function.

Focal Area 4

H4.1

Characterization of hydrologic feedbacks to hot spots and hot moments in landslide occurrence and sediment transport, cycling of nutrient in soil and plant system, and disturbance and recovery of forest on carbon consequence are the most important aspect of this work. The distributed hydro-geomorphic model and dynamic ecohydrological model as used in this project resolves important physical processes in both space and time, at scales relevant to landslide occurrence and to the balance of carbon in plant and soil system. The model is also the integrator of carbon dynamics and nutrient cycling at watershed scale. The process-based models are advantageous over empirical approaches as they represent underlying physical laws of soil dynamics, nutrient cycling and hydrologic processes in data scarce spatially complex built terrains. The analysis spans a range of scales, capturing the small-scale complexity of sediment transport and nutrient cycling in assessing the watershed integrated response in terms of soil organic carbon fluxes.

With increasing availability of high-resolution topography, geological and biogeochemical datasets, the models developed in this work are able to reproduce spatiotemporal distributions of sediment transport, primary productivity, and of soil organic carbon content at different soil profiles. The coupled spatially-explicit formulations can be used in landslide studies and landslide warning systems. The models are applied to simulate the topsoil erosion and landslide occurrence for the two climatic scenarios (2016-2099). The model is also applied to simulate net primary productivity for the 36 plausible future climate scenarios for the Mameyes watershed. The dynamic eco-hydrological model developed in this project has the potential to assist the installation of biogeochemical observatories at landscape scale.

Regeneration of forest after disturbance is an important ecological process that influences forest and climate-ecosystem interaction. Forest disturbance from hurricanes can result in terrestrial carbon sink by affecting the structure and function of forests. Apart from landslides, the forest ecosystem of Luquillo is significantly disturbed by hurricane events. Understanding of recovery rates and responses of tropical forest to natural disturbance is an important aspect of this ongoing effort, which will improve quantitative and predictive understanding of critical zone processes.

H4.2

Better information on the impact of hurricanes on abiotic forest factors and the effect this has on the clouds will help Earth Systems Modelers correctly model tropical forests. Tropical forests cycle more carbon and water than any other biome and play critical roles in determining Earth's energy balance, however, the Earth Systems Models do not yet accurately model the land-atmospheric interaction at these forests.

Mountains collect and store much of the world's freshwater supply, but major challenges remain in measurement of liquid precipitation with respect to undercatch of small droplets in windy mountain environments. Our studies of cloud-land interactions at Luquillo CZO will continue to lead to better understanding of the importance of orographic clouds to forest water resources.

What is the impact on other disciplines?

Results from our studies provide concrete data for building and parameterizing biogeochemical models at both local and global scales.

What is the impact on the development of human resources?

There were 11 undergraduate students, 20 graduate students and 10 post-doctoral researchers involved in the LCZO in year 5 (please refer to the participants section for more detailed information). Students and post-doctoral researchers receive one-to-one and group mentoring by LCZO PIs and other senior personnel. Because the project includes collaborators at the national and international levels, it provides opportunities for graduate and undergraduate students to interact with collaborators/researchers from different institutions, background training, and field of expertise. These interactions create foundations for better scientific critical analyses and communication that are the basis for research, education, and networking for all people involved.

The Data Jam project contributes to student training by exposing middle and high school students to LCZO long-term datasets. As a result, students increased their familiarity and interest in environmental science as well as increased their confidence in working with long-term data and presenting results in a creative way.

For additional impacts on the development of human resources, see the opportunities for training and professional development in the accomplishments section.

What is the impact on physical resources that form infrastructure?

- Soil sensor networks and stream sensor networks have been established through a collaboration with CZO, DOE, and the Stream PULSE Macrosystems Biology project.
- Collaboration with USGS-Sacramento sensor group has resulted in new guidelines for successful application of in-stream optical sensors in a harsh environment (high flow, high sediment load).
- Jerolmack's laboratory has developed experimental setups for the study of abrasion due to collision or fragmentation during bed load, supported by LCZO.

What is the impact on institutional resources that form infrastructure?

Nothing to report.

What is the impact on information resources that form infrastructure?

- LCZO data manager, Miguel Leon, is helping lead a cross-CZO effort to migrate CZO datasets from CZO institution hosted web servers and criticalzone.org to Hydroshare. This will result in improved accessibility of CZO data through better search and web

services. The migration also provides a single hosting solution for CZO data reducing the CZO programs exposure to data loss that might occur with the shutdown of information systems at CZO host institution or the withdrawal of funding from a CZO.

- LCZO data manager Miguel Leon provided geotechnical data to Philip Bar of the Federal Aviation Administration for a road stabilization project on the East Peak access road following damage from Hurricane Maria.

What is the impact on technology transfer?

We have continued development and support for our data management platform 'ODM2 Admin'. Our partnership with CUAHSI on this platform has continued and has led an additional deployment of ODM2 Admin with the Texas Water Observatory. Previous deployments continue to be supported and include deployments for the critical zone integrative microbial ecology activity (CZIMEA) project, the Catalina-Jemez CZO and additional deployments to the Dry Creek Experimental Watershed managed by Boise State and the Michigan State Hydrogeology lab. ODM2 Admin was presented at AGU in 2017, the BiG CZ workshop in November 2017 and the CUAHSI Biennial Colloquium in 2018. The platform has been enhanced with support for Water One Flow (WOF) web services for machine to machine interaction. The platform has also been upgraded to support newer version of Python and Django extending the viability of the platform.

What is the impact on society beyond science and technology?

- Soil blankets 94% of Earth's ice-free subaerial surface, yet, this dynamic soil layer is often ignored when attempting to understand how landscapes respond to tectonic perturbations. Even worse, we don't understand how soil—a critical natural resource—responds to state change and environmental or tectonic perturbations. We know that soil erosion impacts fluvial sediment loads, but this is generally not considered in models of fluvial incision following a change in erosion rates.
- With increased frequency and intensity of hurricanes, our results suggest that N export to nitrogen-limited coastal waters will increase. This could cause adverse impacts such as eutrophication, algal blooms, loss of aquatic life and a decline in ecotourism.
- Landsliding is the source of extraordinary infrastructure damage, land degradation and loss of lives. Carbon capture and release (e.g., from forest disturbance and recovery, sedimentation) is a key component of the climate equation. The tools developed here can be used for planning, prediction and prevention and to develop management practices to control landslides and increase carbon capture. Furthermore, the ecohydrological model developed in this study can aid in developing comprehensive biogeochemical observational system at landscape scale.
- Estimating hurricane disturbance on forests before hurricanes happen, and possible paths of recovery with water balance changes, will provide guidance for policy makers.

Changes/Problems

Changes in approach and reason for change

The passage of Hurricanes Irma and Maria caused a significant disturbance to the Luquillo Experimental Forest. Hurricane Irma was a category 5 hurricane passing to the north of Puerto Rico on 6 September 2017 resulting in tropical storm force winds on the island. Hurricane Maria was a category 4 hurricane that directly struck Puerto Rico on 20 September 2017.

This major disturbance offered several new research opportunities to study the response of Luquillo Mountain hydrology, biogeochemistry, and critical zone function to these extreme events. We now have the opportunity to study our hypotheses from a hurricane simulation experiment in reality, and to expand the results to include satellite results and results on the land-atmospheric interaction that we weren't able to previously study with the smaller scale hurricane simulation. We also have the opportunity to study the hydrologic and biogeochemical response of streams draining different watersheds with different lithologies.

Actual or Anticipated problems or delays and actions or plans to resolve them

Hurricanes Irma and Maria and their aftermath brought devastation to the entire island of Puerto Rico and its residents. This also affected our work in the Luquillo CZO where some field supplies and equipment were damaged and areas of the Luquillo CZO were inaccessible for weeks after the hurricane. Despite this setback, most research activities have resumed. However, the Atmospheric Chemistry and Aerosols Research Laboratory (ACAR) of the University of Puerto Rico's Rio Piedras Campus received considerable damage. This Laboratory, operated by Dr. Olga Mayol, studies the temporal and spatial variability of atmospheric aerosols, in particular African dust, which impacts both cloud physics and the transport of nutrients such as phosphorus to the Luquillo Mountains. The Pico del Este (PE) Cloud Station in the Luquillo Experimental Forest was completely destroyed by Hurricane Maria. Supplemental funds were requested and received from NSF to replace and upgrade infrastructure and instruments that were destroyed at this station. A steel shipping container that will be used as instrument storage and field laboratory space at PE has been ordered and will be installed before the end of 2018. Replacement instruments are on order and we hope to resume measurements in early 2019.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.