



Caribbean Climate Adaptation Network

————— A NOAA CAP/RISA Team —————

**Building equitable adaptive capacities of the US Virgin Islands and
Puerto Rico.**

Annual Report

June 1, 2022, to May 31, 2023

Caribbean Climate Adaptation Network

The Caribbean Climate Adaptation Network (CCAN) seeks to address climate change issues by bringing together a multidisciplinary team of universities, agencies, and non-governmental organizations based out of the Caribbean region and the US. We will enhance and expand partnerships through the development and convening of stakeholders in Puerto Rico and USVI. We are currently working at three scales ranging from the community micro level to territorial meso-level and macro level of regional networks. We use a human-centered design approach, bringing together impacted community and government stakeholders and multidisciplinary scientists to develop and co-produce community climate adaptation capacities, strategies, and actions that build on collectively produced insights and realistic locally grounded scenarios. Equity and justice are built into the aims and objectives of this NOAA CAP/RISA network. We are leading from the point of view of prioritizing opportunities to build empathy and listen, to identify and serve as advocates for under-represented talent. This includes racial and ethnic minorities, socioeconomically disadvantaged people, environmental justice communities, and non-citizen immigrant groups. This Network places all these elements front and center through its diverse personnel, students, and early career researchers, through its “co-production” approach to building network capacity across environmental and social justice organizations, local and regional government agencies, and through its focus on learning with and from underserved and socioeconomically disadvantaged communities.

The Caribbean Climate Adaptation Network serves the United States territories in the Caribbean basin, Puerto Rico, and the United States Virgin Islands (St. Thomas, St. Croix, and St. John).

Table 1. Role and affiliation of collaborators

Role	Name	Affiliation Organization	Organization Type
CCAN Core Team Members			
PI	Pablo A. Méndez-Lázaro	Professor, Department of Environmental Health, University of Puerto Rico Medical Sciences Campus, Graduate School of Public Health	Academia and Research
Co-PI	Frank Muller-Karger	Professor in the College of Marine Science, University of South Florida, Co-lead of the US and international Marine Biodiversity Observation Network and the NOAA Climate Program Office/Sanctuaries Climate Indicator Task Force	Academia and Research
Co-PI	Masoud Ghandehari	Professor Urban Systems Engineering, New York University	Academia and Research
Co-PI	Patricia Chardón	Deputy and Technical Director, University of Puerto Rico-Mayaguez-Caribbean Ocean Observing System (CARICOOS)	Academia and Research
Co-PI	Jorge González-Cruz	Professor, SUNY Empire Innovation Program, University of Albany of Atmospheric and Environmental Sciences, Lead Scientist of the Coastal-Urban Environmental Research Group (CUERG)	Academia and Research
Co-PI	Gregory Guannel	Director of the Caribbean Green Technology, University of the Virgin Islands	Academia and Research
Co-PI	Eric Harmsen	Professor, Department of Agricultural and Biosystems Engineering, University of Puerto Rico Mayaguez Campus	Academia and Research
Co-PI	Stephen Hughes	Professor in the Department of Geology, University of Puerto Rico Mayaguez Campus	Academia and Research
Co-PI	Reza Khanbilvardi	NOAA Chair Professor of Civil Engineer, The City College of New York/CUNY Executive Director, CUNY Remote Sensing Earth System Institute (CUNY-CREST Institute)	Academia and Research

Co-PI	Tischa Muñoz-Erickson	Co-Principal Investigator of San Juan ULTRA and the SETS Convergence Network, and Research Scientist with the USDA Forest Service, International Institute of Tropical Forestry	Academia and Research
Co-PI	Carlos Ramos-Scharron	Associate Professor, The University of Texas at Austin	Academia and Research
Co-PI	José Seguinot	Director of the Environmental Health Department, University of Puerto Rico Medical Sciences Campus, Graduate School of Public Health	Academia and Research
Co-PI	Mimi Sheller	Inaugural Dean of The Global School at Worcester Polytechnic Institute	Academia and Research
Co-PI	Seth Tuler	Associate Professor, Interdisciplinary and Global Studies Division, Worcester Polytechnic Institute	Academia and Research
Co-PI	Kim Waddel	Project Lead for the USVI Hazard Mitigation and Resilience Plan, Principal Investigator and Director for the VI Established Program for Stimulating Competitive Research (VI-EPSCoR) Update	Academia and Research
Climate Adaptation Program Specialist I	Wanda Crespo	NOAA- Climate Adaptation Partnerships in Puerto Rico	Federal Government Agency
Recruitment Coordinator	Manuel Heredia Morales	University of Puerto Rico Medical Sciences Campus, Graduate School of Public Health	Academia and Research
Team Members			
Climate Adaptation Program Specialist II	Joe Dwyer	NOAA- Climate Adaptation Partnerships in Puerto Rico	Federal Government Agency
Member	John-Michael Davis	Assistant Professor, Worcester Polytechnic Institute, Co-Director, WPI Puerto Rico Center	Academia and Research
Community Outreach USVI	Jeannine Francis-Brown	University of the Virgin Islands	Academia and Research
Member	Scott Jiusto	Professor Emeritus, Worcester Polytechnic Institute, Co-Director, WPI Puerto Rico Center	Academia and Research

Member	Sara Strauss	Professor of Anthropology, The Global School, Worcester Polytechnic Institute	Academia and Research
Member	Michelle Mulkern	Associate Director, Pre-Award Services, Worcester Polytechnic Institute	Academia and Research
Member	Michael Piasecki	Associate Professor, Civil Engineering, City University of New York	Academia and Research
CCAN Research Assistant and Graduate Students			
Research Assistant	Laura T. Cabrera-Rivera	Department of Environmental Health, University of Puerto Rico Medical Sciences Campus	Academia and Research
Teaching/Research Assistant	Francis Russell	The University of Texas at Austin	Academia and Research
Research Assistant	Ryan Brenner	New York University	Academia and Research
Research Assistant	Jhon Ibsen-Chaguendo	City College of New York	Academia and Research
Research Assistant	Keneshia Hibbert	City University of New York	Academia and Research
Research Assistant	Said Mejia-Manrique	City University of New York	Academia and Research
Research Assistant	Solange Uwera	Worcester Polytechnic Institute	Academia and Research
Collaborators and Partners			
Collaborator	Ernesto Rodríguez	National Weather Service-San Juan, Office	Monitoring and Forecasting
Collaborator	Ernesto Morales	National Weather Service-San Juan, Office	Monitoring and Forecasting
Collaborator	Odalys Martinez	National Weather Service-San Juan, Office	Monitoring and Forecasting
Collaborator	Iris Santos	Sub-Secretary, Economic Development and Trade Department of Puerto Rico	State Government Agency
Collaborator	Aranzazu Lascurain	Southeast and Caribbean Regional Lead, NOAA Office of Coastal Management	Federal Government Agency
Collaborator	Jennifer de Jesus	Program Manager, Taller Salud	NGO

Collaborator	Ana P. Ortiz	Associate Director of Cancer Control and Population Sciences Program, Comprehensive Cancer Center UPR	Research
Collaborator	Mary Ann Gabino	Senior Vice-President, Fundación Comunitaria de Puerto Rico	NGO
Collaborator	Maria Rondon	President Coordinator, Fundación Comunitaria de Puerto Rico	NGO
Partner	Kate Brown	Co-Chair, Local2030 Islands Network	Coalition
Collaborator	Francisco Valentín	COSSAO	CBO
Collaborator	Ada Monzón	Founder and President, EcoExploratorio Science Museum	NGO
Collaborator	Rene Esteves	Marine Extension Director/Research Coordinator, Sea Grant Puerto Rico University of Puerto Rico-Mayaguez	Academia and Research
Collaborator	Ruperto Chaparro	Director, Sea Grant Puerto Rico University of Puerto Rico-Mayaguez	Academia and Research
Collaborator	Lourdes Perez	Community Planning Lead, Whole Community Resilience Planning Program, Foundation for Puerto Rico	NGO
Collaborator	Ricardo Arzuaga	Executive Director, United Nations Association of USA-Puerto Rico Chapter	NGO
Collaborator	Zuleika González	Directora de Mitigación, Negociado de Manejo de Emergencias y Administración de Desastres	State Government Agency
Collaborator	Yasmin Detres	University of Puerto Rico-Mayaguez-Caribbean Ocean Observing System (CARICOOS)	Academia and Research
Collaborator	Lillian Ramirez	Sea Grant Puerto Rico University of Puerto Rico-Mayaguez	Academia and Research
Collaborator	Jackeline Andujar Oyola	Municipality of Jayuya, Puerto Rico	Municipal Government
Collaborator	Tamara González Rivera	Municipality of San Juan, Puerto Rico	Municipal Government
Collaborator	Richard Nicklas	MEP New York-FEMA Integration Team (FIT) Preparedness FEMA Region 2 New York State Division of Homeland Security & Emergency Services	Federal Government Agency

Collaborator	Ernesto Díaz	Puerto Rico Climate Change Council	NGO
Collaborator	Nora Alvarez	USDA-Caribbean Climate Hub	Federal Government Agency
Advisory Committee			
Member	Soledad Gaztambide	Senior Program Officer, Foundation for Puerto Rico	NGO
Member	Ingrid Vila Biaggi	President of Cambio	NGO
Member	William Gould	Director, Caribbean Climate Hub and Research Ecologist, USDA Forest Service	Federal Government Agency
Member	Nelson Colón	President & CEO, Fundación Comunitaria de Puerto Rico	NGO
Member	Daniel Imani	Executive Director, Imkada Solutions	NGO
Member	Hillary Lohmann	Coastal Resilience Coordinator, Department of Planning and Natural Resources, USVI	State Government Agency

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Accomplishments

UN Local 2030 Islands Network

As an important step in creating a network that promotes the development of public policy that goes toward creating more resilient communities in Puerto Rico and the US Virgin Islands, the CCAN has begun its process to join the Local 2030 Islands Network. In early April 2023, our Principal Investigator, Dr. Pablo A. Mendez-Lazaro, had the opportunity to attend the Pacific Risk Management ‘Ohana (PRiMO) 2023 Conference in Honolulu, Hawaii, to learn about the United Nations Local2030 initiative and explore how the CCAN could be a part of it and help further the Sustainable Development Goals (SDG) in the Caribbean basin.

Since then, the CCAN has been meeting virtually with various partners involved in the initiative, including Pacific RISA, NOAA, or even Local2030 co-chair, Ms. Kate Brown. We also have met with local stakeholders in Puerto Rico, such as Sea Grant Puerto Rico, Fundación Comunitaria de Puerto Rico, United Nations Association of the USA, the Department of Economic Development and Commerce, and other stakeholders from the government, non-profit organizations, and community-based organizations. Our intention was to investigate their current initiatives toward the fulfillment of the SDGs and how the CCAN could strengthen these initiatives and help create new ones. As a result, we are currently working on the development of internship programs, webinars, and other activities aimed at expanding the knowledge and promoting its exchange between partners at all levels: macro (Caribbean basin), meso (regionally between Puerto Rico and USVI), and micro (communities in both Puerto Rico and the USVI).

New Partnerships

1. Promoting SDG2030 in the Caribbean through an Equitable Climate Adaptation Peer to Peer Exchange Program (Summer 2024)

A collaboration between NOAA CAP/RISA Caribbean Climate Adaptation Network (CCAN), NOAA Sea Grant UPR-Mayaguez, and Local2030 Islands Network. Its main goal is to promote Sustainable Development Goals and Equitable Climate Adaptation on island nations and territories in the Caribbean Region that are currently active members on Local2030 Island Network. This will be a two cohorts, 9 days comprehensive program with the following objectives: to empower a regional knowledge-climate action network of community residents, stakeholders, practitioners, and private sector; to exchange socio-ecological and technological knowledge on Equitable Climate Adaptation, facilitate communication, and build cross-regional connections and capacity; and to understand the regional context, barriers, knowledge, shared

risks and vulnerabilities, perceptions and attitudes associated to Climate Change in the Caribbean Region.

2. Collaboration between NOAA CAP/RISA CCRUN and CCAN

Co-PIs at WPI and UVI have been strongly recommended for the award of the NOAA-BIL funding for cooperation between NOAA-CAP/RISA CCRUN (The Urban Northeast) and CCAN, along with community partner Fundación Comunitaria de Puerto Rico and a sub-award to University of the Virgin Islands to hire a Community Engagement Facilitator. We expect the award to be announced in September. This will lead to new cooperation between the oldest CAP/RISA region, the Northeast, and the newest, the US Caribbean. We plan to hold a series of three workshops sharing community engagement methodologies and will then integrate research by the CCAN Postdoc at WPI and a new Doctoral researcher with four community-based groups (2 in PR and 2 in USVI).

3. NSF Just Transitions in Island Climate Adaptation and Energy Resilience

We are looking at ways to extend of CCAN networking activities to other independent small island states in the Caribbean and the Pacific region, including partners at the University of Hawai'i and the University of Melbourne (Australia). If feasible, this will lead to further research on community-based co-design methods.

Research Highlights

1- First CCAN's Annual Meeting

UPR Medical Sciences Campus, Graduate School of Public Health, organized an in-person meeting on February 1-3, 2023. In this meeting were present the Principal and Co-Principal Investigators, postdoctoral researchers, students, and Federal and Local Agency personnel in San Juan, PR. This served as the first in-person meeting of the team. The team worked on refining a vision for the project, and objectives and had active discussions within working groups to advance project priorities. The entire team participated in a field trip to areas of Puerto Rico that had been rendered uncommunicated after Hurricane Maria and had a first-hand look at how communities recuperated and to explore perceptions of such events and climate change at the local level.

2- Puerto Rico Landslide Forecast Network

<https://sites.google.com/uprm.edu/slidespr/>

Funds from the CCAN were used to support the installation of soil moisture, suction, and groundwater pressure sensors that are part of the Puerto Rico Landslide Forecast Network. The

network includes 15 stations at present, and data products are shared in real-time via derrumbe.net.

3- WPI Puerto Rico Project Center

The WPI Puerto Rico Project Center began cooperation with the CCAN network by having six undergraduate student teams work on related projects during their Interactive Qualifying Project. The IQP involves partnering with local organizations to work together on projects they identify to advance their organizational mission and community well-being. Projects extend over four months (two months of student prep on campus and two months fieldwork in PR) and occur in two cohorts (Jan-Mar, Mar-May). Each student team is advised by a pair of WPI faculty members, including CCAN members Davis and Jiusto. Topics included:

- Developing a Communication and Information-Sharing Plan for the CCAN: by interviewing CCAN and other CAP/RISA team members, this team helped develop a communication plan and Google Drive system presented at our first All Hands meeting in San Juan.
- Assessing Carbon Offsetting Programs for the WPI Puerto Rico Project Center
- Developing Resilience Strategies in Cubuy-Lomas, Puerto Rico
- Facilitating a Network of Rescued Schools in Puerto Rico
- Advancing Community Climate Adaptation: Case Study on Resilience Centers in Puerto Rico
- Participatory Mapping to Empower Communities – La Perla

These projects advanced insight, resources, and tools on the above themes through cross-cultural learning partnerships with new organizations and communities (e.g., Taller Comunidad La Goyco, Corporación La Fondita de Jesus, La Junta Comunitaria de La Perla, Cubuy-Lomas Community Services and Development Center). Project outcomes include student reports available online (<https://wp.wpi.edu/puertorico/projects/>); new community data collection and mapping tools and guides for initial use by the co-creating local partners, with further development and sharing more widely anticipated in the coming year; a co-authored article prepared for publication by students, local sponsor, and project advisor, Dr. John-Michael Davis.

Outreach

Conferences, webinars, workshops

1- “Calentamiento global y salud”

<https://open.spotify.com/episode/311GVw5ZvesVaEKJB98R4B>

On November 17, 2022, Dr. Pablo A. Mendez-Lazaro shared his profound insights into the intertwined dynamics of global population growth, climate change, and human health in a podcast of 37 minutes from the newspaper El Nuevo Dia with Luis A. Ferre Rangel.

2- SLIDES-PR

On November 3, 2022, student assistants of the SLIDES-PR program presented information about the endeavor at the Puerto Rico Science, Technology, and Research Trust Forward Research Symposium in San Juan, PR. On December 17, 2022, student assistants of the SLIDES-PR program participated in a community event, “Agua(nte) Tierra”, in a remote community in the municipality of Cidra, PR. The group was about 30 people, and they were shown landslide susceptibility maps, educational guides, and other important information. Between January 8-13, 2023, students of the SLIDES-PR program presented research results at the American Society of Agricultural and Biological Engineers International Symposium “Soil Erosion under a Changing Climate”. The conference was held in Aguadilla, PR, and on campus at UPR Mayaguez. On January 26, 2023, student assistants of the SLIDES-PR program participated in the UPR Mayaguez research fair to showcase the program’s activities and impact on the local community. On February 18, 2023, Dr. Stephen Hughes participated in a Spanish-language forum organized by the EcoExploratorio: “Las Ciencias detras de los desastres naturales”. The other panelists were Puerto Rico Seismic Network representatives and the NOAA International Tsunami Information Center Caribbean Office. Hughes detailed the science of landslides in Puerto Rico and the SLIDES-PR program at UPRM. The forum had over 100 people in attendance in person and over 1,700 online views. On April 1, 2023, Dr. Stephen Hughes offered this 45-minute Spanish-language presentation at the EcoExploratorio Science Museum of Puerto Rico. The in-person audience included about 50 people, and it was recorded live via social media platforms. The online views are more than 1,500. This presentation was offered as part of the EcoExploratorio “Resilience Institute” initiative sponsored by FEMA.

3- UT-Austin

On January 9 and 10, 2023, respectively, the UT-Austin team led by Co-PI Ramos-Scharrón presentations were given on "Landslide-related work in Puerto Rico conducted by the University of Texas at Austin" and "Sediment issues, research & solutions in the Río Loco-Guánica Bay system". On February 8, 2022, the UT-Austin team led by Co-PI Ramos-Scharrón presented a special seminar titled "Human-driven sediment dynamics in the dry and wet tropics – Examples from the Northeastern Caribbean" was delivered. On March 1, 2023, the UT-Austin team led by

Co-PI Ramos-Scharrón participated in the International Geomorphology Week 2023, presenting "The road to increased sediment yields in the Northeastern Caribbean – roads as hydro-geomorphological features". On May 24, 2023, UT-Austin team led by Co-PI Ramos-Scharrón presented "Sediment mobilization by land sliding in steep wet tropical settings – The case of western Puerto Rico" at the Spring 2023 Virtual Workshop 1.

4- Let's talk about Heat Stress in Puerto Rico and US Virgin Islands

<https://www.facebook.com/ecoexploratorio/videos/926505435274892/>

On May 18, 2023, with the collaboration of the National Weather Service in San Juan (NWS SJU), EcoExploratorio Science Museum, NOAA, Albany University, and the Green Caribbean Center (USVI) CCAN's members were part of the webinar "*Let's talk about Heat Stress in Puerto Rico and US Virgin Islands*" as part of the activities of the Heat Awareness week. This webinar was to provide the communities in Puerto Rico and USVI with valuable information about rising temperatures in the Caribbean, the meaning of heat stress, how it impacts our daily lives, and how we can adapt. NWS SJU Science & Operations Officer, Ernesto J. Rodriguez, talked about the Excessive Heat Warning System and what were the criteria for issuing excessive heat warnings and watches. Then, Dr. Pablo A. Mendez-Lazaro, Principal Investigator of the CCAN, talked about the risks involved with excessive heat exposure in the population. Professor Jorge E. González-Cruz, Co-PI of the CCAN, gave some insight into how climate change impacts the rise in excessive heat in the Meso-America and Caribbean region. Finally, Professor Gregory Guanel, Co-PI of the CCAN, gave the context of excessive heat in the US Virgin Islands and the challenges these islands face in heat awareness in their communities. This webinar had an attendance of 84 people through the video conferencing platform Zoom; also, it had 14,989 post reach in the EcoExploratorio Science Museum Facebook page.

5- XII Reunión Cumbre del Consejo de Cambio Climático

On May 19, 2023, Dr. Pablo A. Mendez Lazaro presented at the XII Summit Meeting of the Climate Change Council ("XII Reunión Cumbre del Consejo de Cambio Climático"). The meeting was held at the hotel Embassy Suites, Isla Verde, Carolina, Puerto Rico.

News and Media Coverage

1- SLIDES-PR media engagement

During the period of September 28, 2022, through May 31, 2023, the SLIDES-PR Spanish-language social media page (<https://www.facebook.com/SlidesPR/>) reached 211,699 people online. The page now has over 4,400 subscribed followers. The page is used to share educational material about landslides, landslide science, landslide news, and other information. Also Dr. Stephen Huges has appeared in several television news programs providing information about the importance of the Puerto Rico Landslide Forecast Network in future extreme weather events

in the islands. (https://wapa.tv/programas/cuartopoder/nueva-tecnolog-a-podr-a-ayudar-a-salvar-vidas-ante-un-deslizamiento-de-terreno/video_a0302838-f548-5887-a50f-b153cd0dd122.html)

2- Indispensable atender el cambio climático para el desarrollo económico

https://www.elvocero.com/economia/otros/indispensable-atender-el-cambio-clim-tico-para-el-desarrollo-econ-mico/article_8d50c84c-e86c-11ed-8243-6f7d71cc97e8.html

On May 15, 2023, in an article for El Vocero, Dr. Pablo A. Mendez Lazaro discussed the impacts of climate change on various sectors of the economy and health.

Challenges

The initiation of the project experienced delays due to the time required to establish administrative agreements between the main grantee (UPR Medical Sciences Campus) and each of the institutions involved in the team. Despite these obstacles, the PI worked hard to resolve administrative obstacles, and all was positively resolved. Subcontracts were successfully issued in January 2023, and the team is now fully engaged.

Additionally, the funding cycle is not paired with academic calendars, and therefore an existing student had to be funded through a teaching assistantship position during the 2022-23 academic year instead of a research assistantship.

Next Steps

- Co-Pi Stephen Hughes is planning to advance the Landslide Ready initiative of the SLIDES-PR program, partnering with at least 2 pilot municipalities in Puerto Rico. They have started conversations with the municipality of Utuado to be one of these initial jurisdictions.
- WPI have hired, Postdoctoral Fellow Sarah Molinari, who will begin work for CCAN on August 1st, 2023. Based in San Juan, she will begin working with FPR and identifying community groups to work directly with as soon as possible. In September they are expecting the announcement that they have been awarded a NOAA-BIL grant to develop and assess participatory methods through cooperation between CCAN and the CCRUN CAP/RISA. They plan to hold their first workshop at Drexel University in November 2023. WPI will also host the New England Council for Latin America Studies Annual Meeting in November, and as part of a Keynote Address Co-PI Mimi Sheller will present an overview on the CCAN project there and help build network connections.

- The University of Texas at Austin team will have new members: *Keivan Tavakoli*, Incoming PhD student in the Department of Geography & the Environment who comes with a strong modeling background and a master's in engineering from Politecnico de Milano will be involved in work related to landslide modeling from both a hazard and a geomorphological perspective. *Francis Russell*, Current PhD student in the Department of Geography & the Environment who recently completed an MA in Geography at UT-A will use a mixed methods approach that includes remote sensing, GIS, and both qualitative and quantitative analyses to study impacts of natural hazards on the coffee farming sector in western PR. Francis will be conducting some initial fieldwork during the Summer of 2023 in the region between the municipalities of Adjuntas and Maricao-Las Marías. The team will also carry out bathymetric surveys of Lagos Guayo, Garzas, Caonillas during the Summer of 2023 thanks to the Lozano Long Institute of Latin American Studies at UT-Austin. This work is meant to improve our understanding of the impacts of land sliding on water storage capacities and is therefore relevant to hazards such as landslides and drought. Work will be facilitated through a series of undergraduate capstone projects for students in Geography and Environmental Sciences.

Impact

Evaluation

The Team received clear programmatic guidance emphasizing the social aspects of co-design as a priority in defining the project activities. The Team met in person in San Juan, Puerto Rico, from February 1-3 to plan the implementation of the project and evaluate possible strategies to address co-design. A preliminary strategy has been laid out to monitor progress. This includes establishing an Advisory Board, the number and type of community organizations engaged in PR, and in the VI who will serve as conduits to the individual vulnerable communities and to government actors. Each working group is considering additional metrics, which will be refined as we cultivate community contacts through a co-design process.

Evidence of social impact

While it is too soon to have evidence of impact, the project team already has had a chance to interact with members of communities affected by Hurricane Maria and heatwaves in the US Territories. Different working groups within our team are diligently considering metrics to measure our impact effectively. We are eagerly looking forward to seeing the positive changes our project can bring about in these communities.