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‘Gone With the Waves’ Project Documents Puerto Rico’s Coastline and Cultural Heritage

Just ahead of Hurricanes Irma and Maria, a research team from the University of California San Diego was able to map and document various underwater and coastal features along Puerto Rico’s coast last month, providing baseline measurements of a number of important archaeological sites that are vulnerable to coastal erosion, particularly due to climate change.

Anthropology students Mariela Declet and Angel Vega, together with citizen scientist Hector Rivera, stand on a coastal outcropping in Puerto Rico earlier this month in an effort to map and document underwater and coastal features with environmental archaeologist Isabel Rivera-Collazo. Photos by Isabel River-Collazo.

Their research effort, dubbed “Gone With the Waves,” is now culminating in a series of geo-referenced 3D maps and models that will make it possible to both view Puerto Rico’s coastal cultural heritage in virtual reality and observe its coast as it changes over time.

Using drones, laser scanners, specialized cameras known as CAVEcams and an imaging technique known as structure-from-motion photogrammetry, Qualcomm Institute (QI) Staff Engineer Eric Lo and Computer Science and Engineering undergraduate student Kaiser Pister joined a team of students from the Scripps Institution of Oceanography (SIO), as well as citizen scientist Hector Rivera, to document archaeological sites being exposed to coastal erosion. The team was led by SIO environmental archaeologist Isabel Rivera-Collazo, who specializes in geoarchaeology, maritime culture, climate change and related disciplines. A native of Puerto Rico, she recently joined the faculty at UC San Diego’s Scripps Institution of Oceanography and the Department of Anthropology, and is a collaborator with QI’s Cultural Heritage Engineering Initiative (CHEI) as well as the newly-launched Scripps Center for Marine Archaeology.

“By using drones for 3D mapping, we were able to document a larger portion of the coastal landscape than would be possible on foot. This gives us a record of the site as it is now, as it’s only going to degrade from here,” said Lo, who has participated in a wide variety of cultural heritage research throughout the world under the auspices of CHEI.

“As usual with fieldwork, we’re always pressed for time,” Lo continued, “but this time we had the unique constraint of flying in the one-hour window between sunrise and when an airport near El Abanico Fort started operations for the day. Despite that, we were able to get the imagery we wanted to compliment our ground-based data, so it was a success. We also had the opportunity to do some imaging at El Abanico Fort, which is associated with Castillo San Cristobal, capturing the exterior as well as some interior graffiti. We are currently working on setting up a website to present and share this content with the public.”

In addition to their work in the Caribbean, Lo and other CHEI researchers at QI are using multi-modal imaging techniques in the Gulf of Mexico region, including the Yucatan of Mexico, to better document and characterize coastal geomorphology and contemporary ecosystems in conjunction with marine archaeological studies.

“This project is a great example of QI’s CHEI serving as a catalyst for the formation of a highly interdisciplinary team working with Isabel on assessing and advancing the resiliency of near-shore archaeological sites,” adds CHEI Director Falko Kuester. “As engineers, we are particularly excited to work with Isabel on the creation of actionable data, and empowering local stakeholders with the tools and techniques to help this project create a persistent stream of data, constructing a record of the seasonal (temporal) changes.”

Kuester notes that Pister, a Frontiers of Innovation Scholars Program (FISP) undergraduate student fellowship recipient with research interests in computer graphics, has been working with CHEI over the past year on turning field-data into actionable data that can be explored and analyzed in Virtual Reality.

“I believe that it is a truly transformative experience for our students to take their research into the wild, braving field conditions that are far apart from the somewhat more sterile classroom and laboratory environments they generally call their home,” notes Rivera-Collazo. “Concurrently, our students are exposed to communicating across a broad technical spectrum while interacting with domain specialists, stakeholders and the public, ultimately turning them into the driving force.”

The “Gone with the Waves” project is supported, in part, by the UC San Diego Frontiers of Innovation Scholars Program, which provides funding to undergraduates pursuing research in one of four areas:

- Understanding and Protecting the Planet
- Enriching Human Life and Society

- Exploring the Basis of Human Knowledge, Learning and Creativity
- Understanding Cultures and Addressing Disparities in Society

QI's FISP matching grants, says Kuester, enable the development of multi-disciplinary collaborations through the use of QI infrastructure and access to CHEI's toolbox and team members.

As for when Lo and his teammates will return to the Caribbean, that remains uncertain, especially given the difficulties of travel in the area following Hurricane Irma. "We learned a lot about the challenges in the field and types of data needed in this first trip, and are excited to develop and execute on this in our next trip," says Lo. "I'm definitely looking forward to returning. It's a beautiful field site, and we have great collaborators. What more can you ask for?"

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