CRC 4nd Annual Meeting: March 27-28, 2019
Chapel Hill, NC

Education for Improving Resilience of Coastal Infrastructure

Ismael Pagán-Trinidad (PI) [1], Ricardo R. López (Co-PI) [2], Carla López del Puerto[3]

Civil Infrastructure Research Center (CIRC)
Department of Civil Engineering and Surveying
University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico
(MSI-HSI)

1- Department Director; 2- CIRC Director/Dept. Associate Director; 3- Senior Personnel
University of Puerto Rico. Mayagüez

Outline

- **Engagement with Users**
- **Activities and Outcomes**
- **Anticipated Impact**
- **Plans to Institutionalize and Sustain**

HSE Educational Gap

Resiliency of Coastal Infrastructure (RCI)

Goal
Help educate the community by **transferring state of education and practice** knowledge and experiences to stakeholders

Motivation
Engage stakeholders in advancing state of knowledge in coastal resilient infrastructure

Target Stake Holders
Students, faculty, professionals, first responders, work force **(FEMA, municipalities, government)**

Formal Education
New Courses, internships, projects (MS theses, undergraduate research, special professional projects)

Informal Education
Conferences, workshops, seminars, lectures, short courses,
"Conversatories"

Help develop Education Culture in Resilient Coastal Infrastructure (RCI)

Provide Education → **Engage Stakeholders** → **Attract Labor Force**

END USERS ENGAGEMENT

Students: Trainees (Theses, Projects, Internships, Presentations, Articles, Posters, Essays)

Faculty: Trainers/Trainee/Mentors:/Researchers; Courses, Invited speakers, Independent Research, Interviews, Field inspections, Field studies, External funding proposals, Institutional services

Sponsors: Funding, Advise, Support, Opportunities, Partnerships

Professionals: Lecturers, Trainees, Certificates

University Administrators: Trainees, Certificates, Supporters

PR-FEMA – Partners, Planning, Trainers, Trainees, Certificates

Community organizations/individuals: Participants: Audience, Trainees, Certificates, Leadership, Feedback

END USERS ENGAGEMENT –cont.

Government: Speakers, Certificates Federal, Local and Municipal Agencies Officials, Trainees, Trainers, Certificates

ERDC- Coastal and Hydraulic Lab: Sponsors and Mentors, 2 Internships, 4 Projects, 2 Theses; **Environmental Lab**

PR Dept. of Natural and Environ. Res.-Coastal Management Program and PR Climate Change Council-PRCCC (Ernesto Díaz): Instructor-Conference Collaborator, Coauthor

PR College of Engineers and Surveyors Faculty participation on special commissions to review construction codes and regulations (L. Aponte, J. Martínez, R. López); Continuing Education

NOAA Tsunami Center: Training and Drills; **Seismic Network/PRSMP**: Earthquakes, Tsunamis

Transportation Technology Transfer Center: FHWA, PRDTPW, PRHTA (B. Colucci) – Co-sponsor, Lecturer, Mentor

PR Sea Grant and CARICOOS (NOAA) Programs: Collaborators, Co-sponsors

Education Work and Accomplishments
Activities and Outcomes to Date

- **SUMREX**
- **Students' Research**
- **Sponsored Conferences and Presentations**
- **ReTALK**
- **Courses**
- **Expected Activities**

Education Work and Accomplishments

2018 SUMREX INTERNSHIP

2 students @ OSU

Bryan Acevedo, BSCE

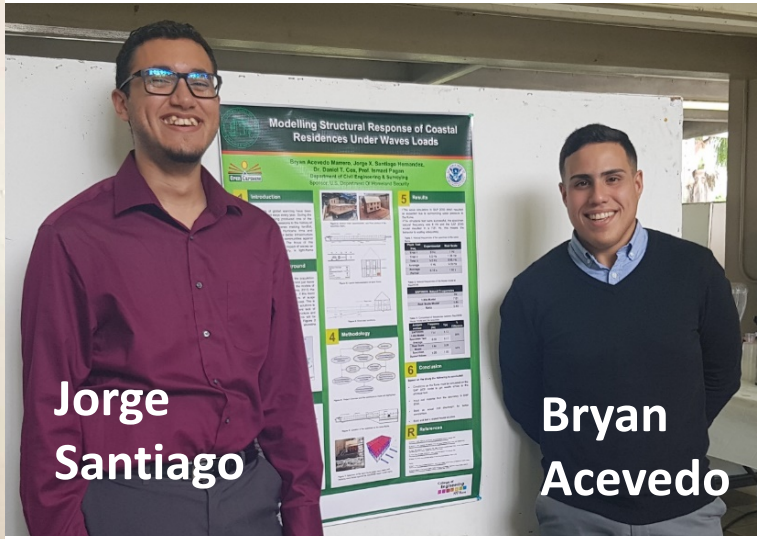
Jorge Santiago, BSCE

Advisor: Dr. Dan Cox , Oregon State University, Corvallis OR

Title: Modelling Structural Response of Coastal Residences Under Wave Loads

Outcome: PPT Oral Presentation,

Proposal, Paper, Poster, Essay, 3 crds.)



Second Prize Winners
Creative Open Capstone
UPRM, Dec. 2018

Education Work and Accomplishments

2018 SUMREX INTERNSHIP

Follow-up on SUMREX Students

Bryan Acevedo, still working on BSCE, participates as undergraduate assistant on NSF project RISE-UP, A Collaborative Undergraduate STEM Program in Resilient and Sustainable Infrastructure. **He also participates in the Earthquake Engineering Institute Seismic Design Competition.**

Jorge Santiago, completed his BSCE at UPRM and is currently working on his PhD in Civil Engineering with specialty on structural and coastal engineering at University of Florida – Gainesville. He holds an NSF IGERT grant led by Dr. Forest Masters with the participation of Dr. Luis Aponte from CE Department at UPRM.

Education Work and Accomplishments

2016 SUMREX INTERNSHIP

Follow up on SUMREX Students

Diego Delgado, SUMREX 2016 and 2017, completed his BSCE at UPRM and is currently working on his PhD in Civil Engineering in Spain.

Kevin Cueto, SUMREX 2016 and ERDC 2017, completed his BSCE at UPRM and is currently working on his MSCE in Civil Engineering in UPRM, working on Computational Fluid Dynamics modelling of effects of storm surge and tsunami loads on structures.

Félix Santiago, SUMREX 2016, completed his BSCE and MSCE at UPRM and is currently working on his PhD in Civil Engineering at LSU, working under the guidance of Dr. Scott Hagen.

Education Work and Accomplishments

2017 SUMREX INTERNSHIP

Follow up on SUMREX Students

Peter Rivera, SUMREX 2017, completed his BSCE at UPRM and is currently working on his Master in Mechanical Engineering at UPRM.

Hector Colón, SUMREX 2017, is close to finishing his BSCE at UPRM. He plans to continue graduate studies.

Education Work and Accomplishments - cont.

CHL-ERDC Internships/Projects

Ismael Pagán -Trinidad (Academic Mentor/PI) – Proposal/Paper/Poster/Presentation/Essay

- **Nelson Cordero (Graduate Student)**: **June 2018 to May 2019**

  Assessment of Hurricane Vortex Models and Boundary Layer Models for the Development of Wind and Pressure Profiles and Fields – Coastal Hydraulic Laboratory

  Advisor: Dr. Norberto Nadal, CHL-ERDC

  Nelson has been working on CHL projects since 2017.

Education Work and Accomplishments - cont.

NSF – PIRE Summer Intern Proposals (Partnership with JSU/TAMG)

Ismael Pagán -Trinidad (Academic Mentor/PI)

Acknowledgement to Dr. Robert Whalin and Dr. Tom Richardson

- **5 Proposals by UPRM students were submitted**
- **Project is sponsored by NSF and managed by Texas A&M-Galveston and Jackson University**
- **One student, Sofia N. Rivera-Soto was selected to attend the internship and travel to Netherlands in Summer of 2019. Will spend 2 weeks in the Netherlands in May and 10 weeks at UPRM completing her research project during Summer.**
- **Assessing changes in pH, temperature and salinity in the Eastern Scheldt estuary :**

  The topic was based on trying to answer two proposed research questions: How have pH, temperature, and salinity levels in the Eastern Scheldt estuary changed since the creation of the barrier in 1986? Additionally, how have these variables impacted the estuary's water and the surrounding land's soil through processes of saltwater intrusion and CO2 absorption?

Education Work and Accomplishments - cont.

Research Theses and Projects at UPRM

- **Angel Alicea (PhD): "Dynamic Identification and Nonlinear Modeling for the Structural Health Assessment of Aged Coastal Infrastructure in Puerto Rico", PhD dissertation completed in December 2018, also worked in educational activities for the project, has been co-sponsored by FHWA Eisenhower Fellowships.**
- **Kevin Cueto (MSCE):"Modeling considering Computational Fluid Dynamics of hydraulic pressure exerted on coastal structures", MS thesis in progress, also works in educational activities for the project.**
- **Alexander Molano (MSCE): "Education and Awareness in Resilience of Coastal Transportation Infrastructure", MS thesis in progress, also works in educational activities for the project, prepared several presentations and participated in Special Topics courses, FHWA Eisenhower Fellow.**
- **Jorge Romeu (MECE): "Structural Analysis of Common Coastal Structures Found on the West Coast of PR using FEMA P-646", ME project in progress, also works in educational activities for the project, serves as instructor for Capstone course.**


Dr. Angel Alicea (PhD-Dec 2018)
Advisor: Dr. Ricardo López

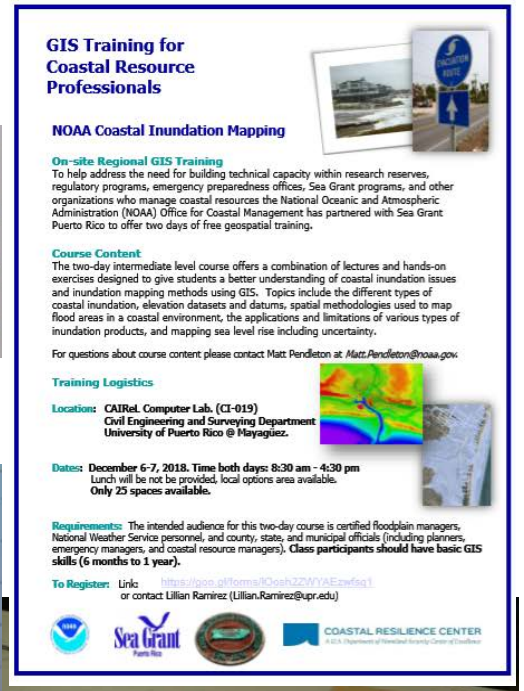
Education Work and Accomplishments - cont.

Research Theses and Projects at UPRM

- **Juan Rodríguez (PhD): 1. "Variation of the nonlinear dynamic response of three-dimensional buildings of reinforced concrete considering the directionality of seismic accelerations", PhD dissertation in progress. 2. Also works in educational activities for the project preparing presentations, certificates and collecting information.**
- **Johnny Rosario (PhD): "Resistance to Tsunami Loads of Critical Structures in Puerto Rico", PhD dissertation in progress.**
- **Nelson Cordero (MSCE): " Configuration and Validation of the Weather Research and Forecasting Model (WRF) for Tropical and Extratropical Cyclones with Applications in Hydrodynamic Modeling" , MS thesis in progress.**
- **Efraín Ramos (MSCE): "Stochastic Simulation of Tropical Cyclones for Quantification of Uncertainty associated with Strong Recurrence and Intensity", MS thesis in progress. Currently working on his thesis at CHL-ERDC.**

Sponsored Conferences and Seminars

- **Re-Imagine Puerto Rico** a discussion panel on solutions to rebuild PR, co-sponsored with Resilient Puerto Rico Advisory Commission, 11 speakers including **Prof. Ismael Pagán**, ample audience participation, UPRM, August 14, 2018
- **Coastal Resiliency Building, Mainstreaming Adaptation**, Ernesto Díaz, Director, Coastal Management Program of Dept. Natural Environment Resources and of PR, offered at Capstone course, UPRM, October 4, 2018
- **Digital Coast Tools Applications-1 day Seminar**, Sponsor: PR Sea Grant, NOAA, CRC; Two NOAA instructors, UPRM, December 5, 2018
- **NOAA Coastal Inundation Mapping Workshop**, Sponsors Sea Grant, NOAA, CRC; two NOAA instructors, UPRM, December 6-7, 2018


GIS Training for Coastal Resource Professionals

NOAA Coastal Inundation Mapping

On-site Regional GIS Training

To help address the need for building technical capacity within research reserves, regulatory programs, emergency preparedness offices, Sea Grant programs, and other organizations who manage coastal resources the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management has partnered with Sea Grant Puerto Rico to offer two days of free geospatial training.

Course Content

The two-day intermediate level course offers a combination of lectures and hands-on exercises designed to give students a better understanding of coastal inundation issues and inundation mapping methods using GIS. Topics include the different types of coastal inundation, elevation datasets and datums, spatial methodologies used to map flood areas in a coastal environment, the applications and limitations of various types of inundation products, and mapping sea level rise including uncertainty.

For questions about course content please contact Matt Pendleton at *Matt.Pendleton@noaa.gov*.

Training Logistics

Location: CAIReL Computer Lab. (CI-019)
Civil Engineering and Surveying Department
University of Puerto Rico @ Mayagüez.

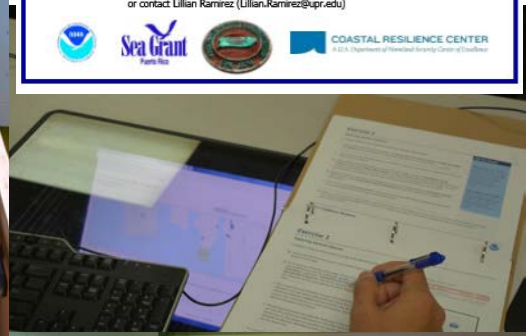
Dates: December 6-7, 2018. Time both days: 8:30 am - 4:30 pm
Lunch will be not be provided, local options area available.
Only 25 spaces available.

Requirements: The intended audience for this two-day course is certified floodplain managers, National Weather Service personnel, and county, state, and municipal officials (including planners, emergency managers, and coastal resource managers). **Class participants should have basic GIS skills (6 months to 1 year).**

To Register: Link:
or contact Lillian Ramirez (Lillian.Ramirez@upr.edu)

Sea Grant Puerto Rico

COASTAL RESILIENCE CENTER



Sponsored Conferences and Seminars, cont.

Research in Coastal Engineering, Sponsors with CARCI NSF planning grant with Dr. Dan Cox, Six speakers including three from Oregon State University, one from Rice University and two from UPR Mayagüez, UPRM, December 6, 2018

NOAA – Introduction to Green Infrastructure for Coastal Resiliency: Co-sponsored with NOAA, PR Sea Grant Program, UPRM-CRC, December 12, 2018

Coastal Resiliency Building and Promoting Adaptation: Ernesto Díaz of Dept Natural Resources and Environment of PR, offered at Capstone course UPRM, January 31, 2019

Low Impact Development and Green Alternatives for Urban Projects: Sponsors FEMA, CRC; Speaker Ismael Pagán Trinidad, Aguadilla FEMA Headquarters, February 8, 2019

Seminar on the Integral Management of Hydrographic Watershed: Sponsors with FEMA, UPRM, March 5, 2019

FEMA: Low Impact Development and Green Alternativesfor Urban Projects, FEMA, Aguadilla

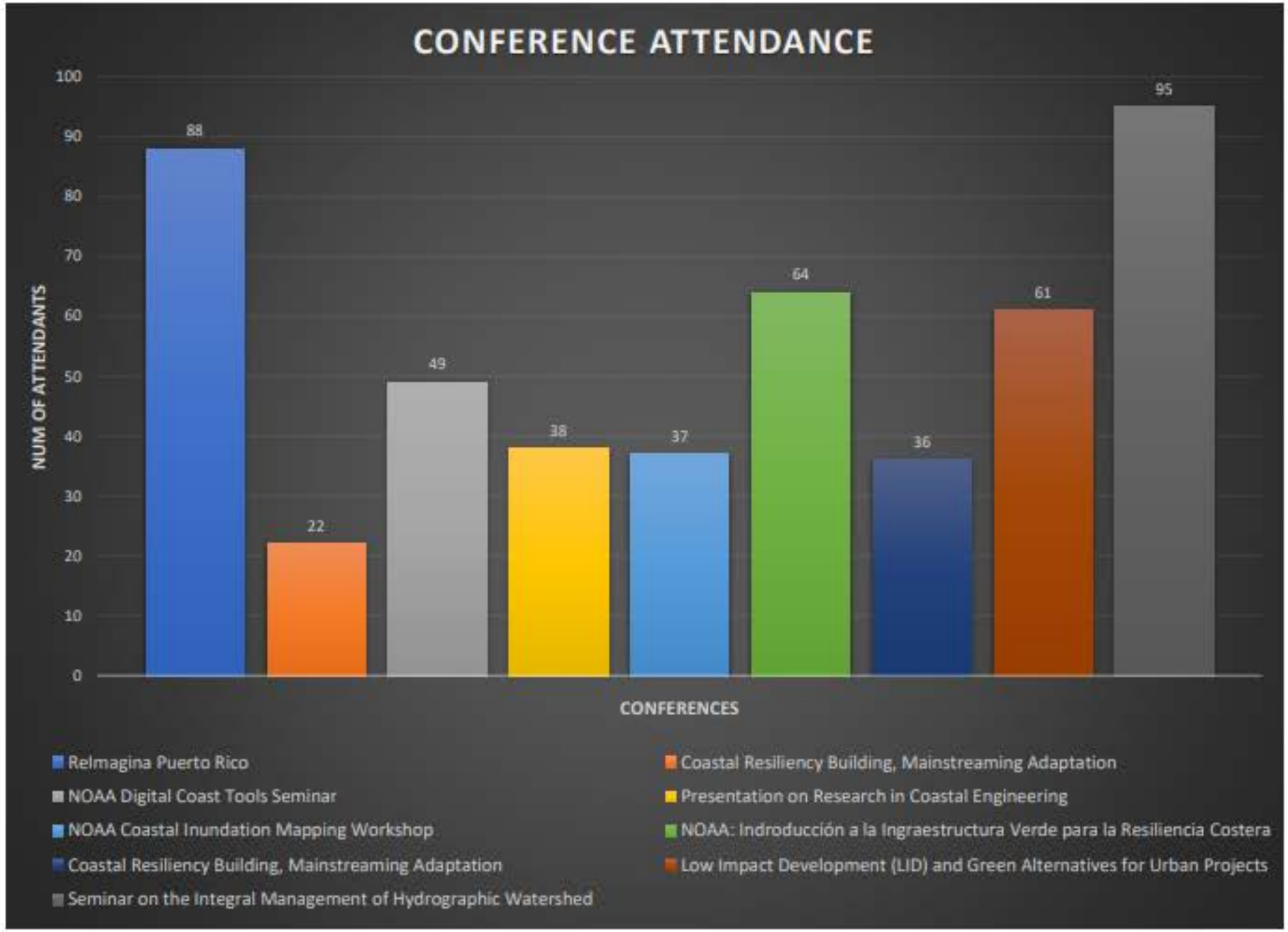
NOAA: Introd. to Green Infrastructure for Coastal Resiliency, Rincon

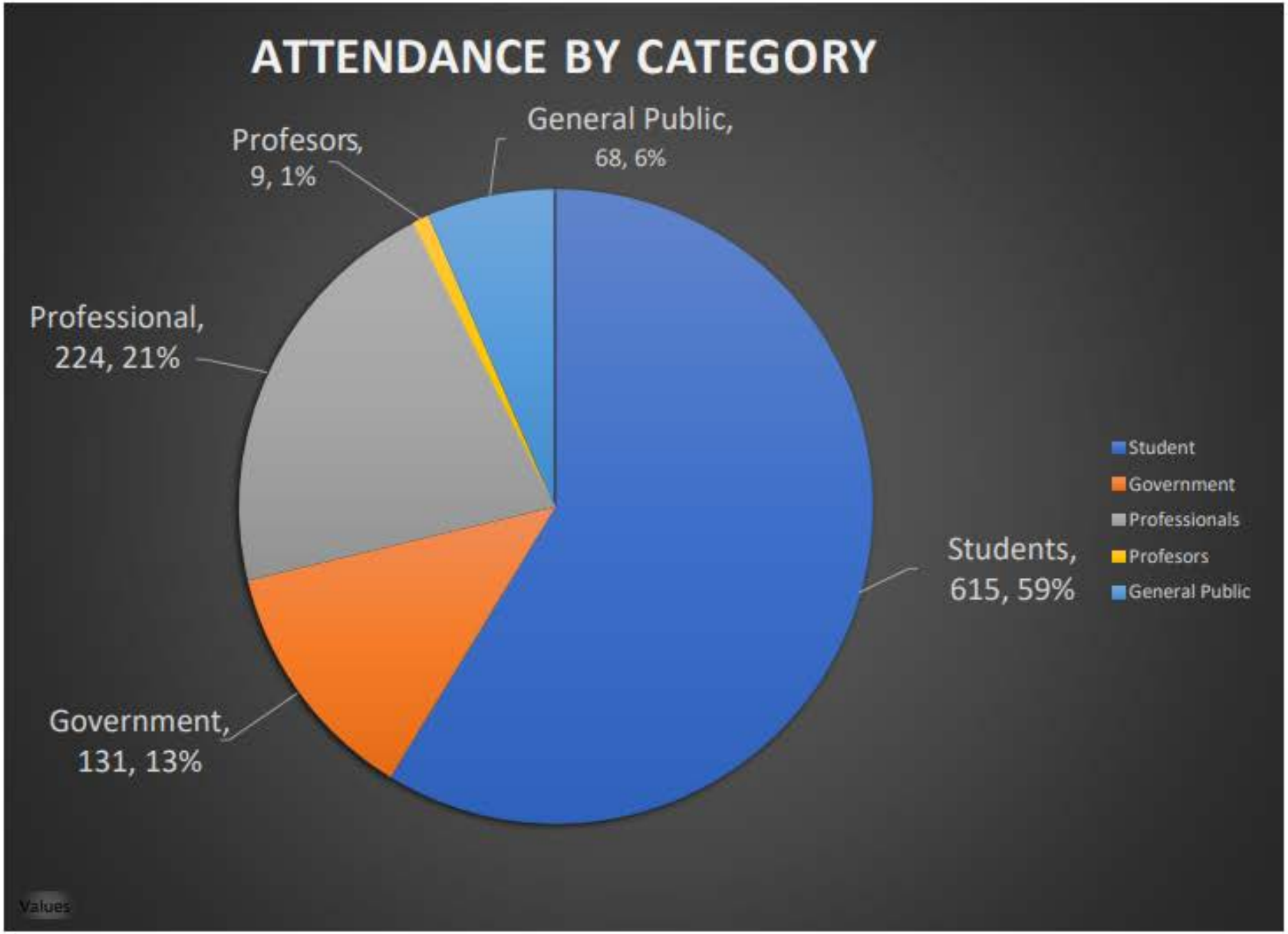
Panels on Energy

- **Small Modular Reactors: A Feasible Option for Puerto Rico?**, a panel discussion, co-sponsored with Nuclear Alternative Project, UPRM, October 30, 2018
- **Public Forum: Energy Policy in Puerto Rico, What is Ongoing**, Co-sponsored with INESI, UPRM, November 29, 2018
- **Note:** A **proposal for the DoE** is under development to study the feasibility of nuclear plants in Puerto Rico with the participation of UPRM faculty

Seminar on the Integral Management of Hydrographic Watershed

Sponsors: FEMA, UPRM-CRC, March 5, 2019 (audience=95)


CONFERENCE ATTENDANCE
NUM OF ATTENDANTS
100
90
80
70
60
50
40
30
20
10
0
88
22
49
38
37
64
36
61
95
CONFERENCES
Relmagina Puerto Rico
NOAA Digital Coast Tools Seminar
NOAA Coastal Inundation Mapping Workshop
Coastal Resiliency Building, Mainstreaming Adaptation
Seminar on the Integral Management of Hydrographic Watershed
Coastal Resiliency Building, Mainstreaming Adaptation
Presentation on Research in Coastal Engineering
NOAA: Indroducción a la Ingraestructura Verde para la Resiliencia Costera
Low Impact Development (LID) and Green Alternatives for Urban Projects


ATTENDANCE BY CATEGORY
General Public, 68, 6%
Profesors, 9, 1%
Professional, 224, 21%
Government, 131, 13%
Students, 615, 59%
Student
Government
Professionals
Profesors
General Public
Values

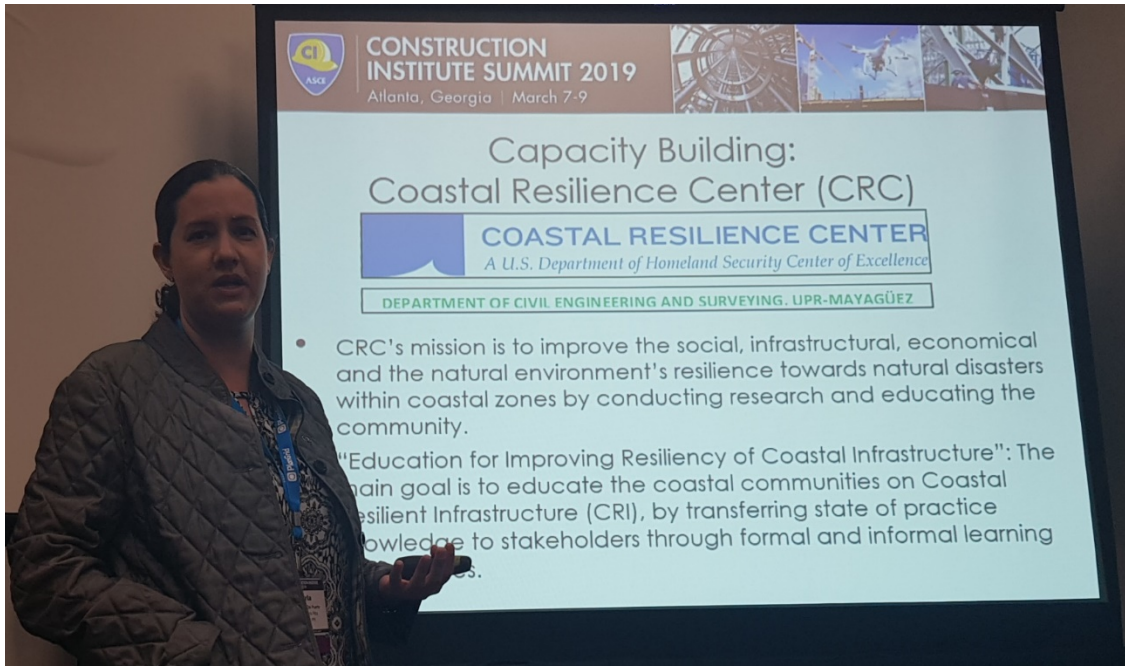
Presentations/Meetings by Researchers

- **Ismael Pagán Trinidad and Ricardo López** at Re-Imagine PR, Mayaguez, August 2018
- **Ismael Pagán Trinidad and Ricardo López** at Rincón, December 12, 2018
- **Ismael Pagán Trinidad, Ricardo López and Raúl Zapata**, at Aguadilla, February 8, 2019
- **Carla López del Puerto, Ismael Pagán Trinidad and Ricardo López** at ASCE Construction Summit in Atlanta, March 7 to 9, 2019
- **Ismael Pagán Trinidad and Ricardo López**, at Gavin Smith's Seminar at UNC, February 27, 2019, remote.
- **Ismael Pagán Trinidad and Ricardo López**, at Gavin Smith's Seminar at NCSU, February 27, 2019, remote.
- **Ismael Pagán Trinidad and Ricardo López** were invited and participated in Coastal Engineering Workshop, sponsored by NSF, held in Arlington, Virginia, November 13 and 14, 2018.

Presentations by Researchers

Carla López del Puerto, Ismael Pagán Trinidad and Ricardo López

ASCE Construction Summit in Atlanta, March 7 to 9, 2019



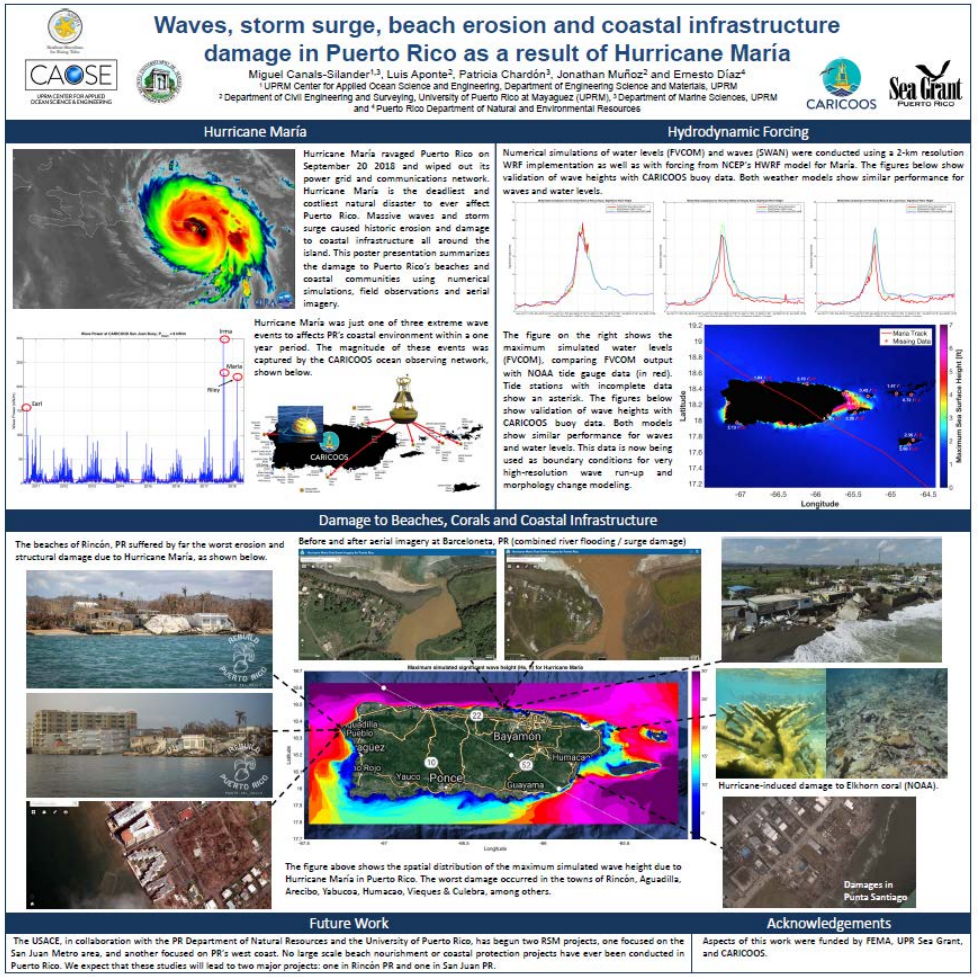
Poster presented at: American Shore & Beach Preservation Association; Resilient Shorelines for rising Tides; Galveston October 30 – November 2, 2019

Puerto Rico Beach Recovery Post-Maria 2017: Erosion Assessment, Control and Management

Dr. Luis D. Aponte-Bermúdez, Professor; Dr. Miguel Canals, Professor UPRM; Dr. Jonathan Muñoz Associate Professor, UPRM, Dra. Patricia Chardon, UPRM Researcher & Mr. Ernesto Diaz, Director of DRNA Coastal Management Program Office

Purpose:

Provide support to decision making for the Department of Interior Puerto Rico Hurricane Maria recovery efforts. Specifically, addressing the need for science support to assess shoreline changes and identify beach erosion amelioration strategies, including recommendation to protect, adapt or retreat. The findings presented on this poster were funded by the US Dept. of Interior Fish and Wildlife Service Award No. F18AC00144



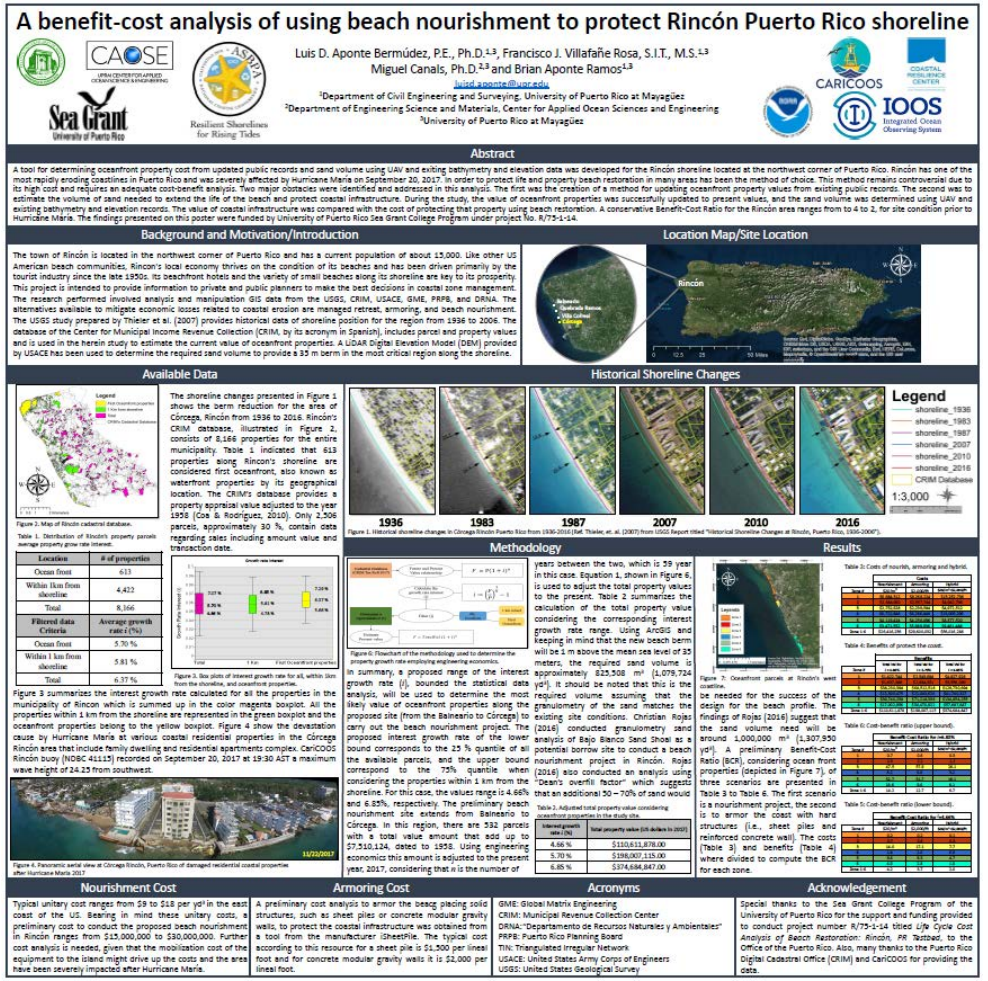
Poster presented at: American Shore & Beach Preservation Association; Resilient Shorelines for rising Tides; Galveston October 30 – November 2, 2019

Life Cycle Coast Analysis of Beach Restoration: Rincón, PR Testbed

Dr. Luis D. Aponte-Bermúdez, Professor; Dr. Miguel Canals, Professor
UPRM; Graduate Student: Francisco Villafañe

Abstract:

A tool for determining oceanfront property cost from updated public records and sand volume using UAV and exiting bathymetry and elevation data was developed for the Rincón shoreline located at the northwest corner of Puerto Rico. Rincón has one of the most rapidly eroding coastlines in Puerto Rico and was severely affected by hurricane Maria on September 20, 2017. In order to protect life and property beach restoration in many areas has been the method of choice. This method remains controversial due to its high cost and requires an adequate cost-benefit analysis. Two major obstacles were identified and addressed in this analysis. The first was the creation of a method for updating oceanfront property values from existing public records. The second was to estimate the volume of sand needed to extend the life of the beach and protect coastal infrastructure. During the study, the value of oceanfront properties was successfully updated to present values, and the sand volume was determined using UAV and existing bathymetry and elevation records. The value of coastal infrastructure was compared with the cost of protecting that property using beach restoration. The findings presented on this poster were funded by the University of Puerto Rico Sea Grant College Program under project No. R/75-1-14.



Instructor of FEMA Building Science Courses

Dr. Luis D. Aponte-Bermúdez, Professor UPRM and STARR II Consultant

- **Fundamentals of Building Science (L0312 – 4Day course)**
- **Coastal Construction course (L0386 – 2Day course)**
  - Multi-Hazard Mitigation Design Concepts
  - Audience: FEMA and Government of Puerto Rico personnel
  - Purpose: Building capacity among local government officials and FEMA personnel
  - Dr. Aponte in collaboration with other FEMA consultants customize the training with content, conclusions, and recommendations from the Mitigation Assessment Team Report: Hurricanes Irma and Maria in Puerto Rico (FEMA P-2020).

Publications by Students

- **Hector Colón**, SUMREX 2017, Paper and Presentation, ASCE Coastal Engineering International Conference, **"NUMERICAL MODELLING OF TSUNAMI INUNDATION CONSIDERING THE PRESENCE OF OFFSHORE ISLANDS AND BARRIER REEFS"**, Baltimore, MD, July 2018

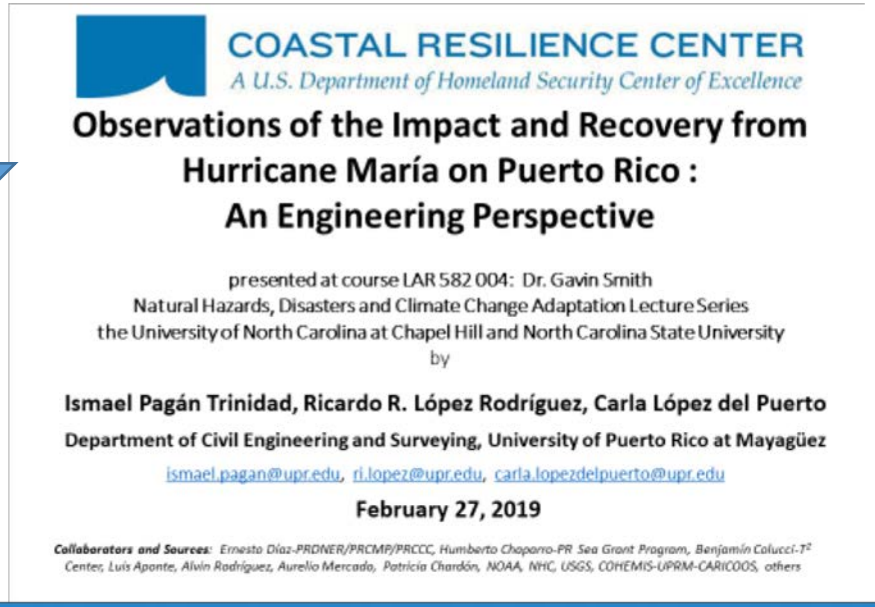
- **Alexander Molano**, Graduate student supported by the CRC project, Paper and Presentation, **"Impacts and Lessons Learned as a Result of the Passage of Hurricane Maria on the Transportation Infrastructure of the Caribbean Island of Puerto Rico", by** Colucci, Figueroa and Molano, UPADI, August 2018.

- **Alexander Molano**, Graduate student supported by the CRC project, Paper and Presentation, **"Lessons Learned for the Puerto Rico Transportation Infrastructure after Hurricane María", by** Colucci, Figueroa and Molano, ITE, October 2018.

ReTALK

- **Research in Coastal Engineering** at UPRM, Dr. Dan Cox, OSU, **6 lectures,** December 6, 2018

- Two lectures by Ismael Pagán and Ricardo López on Gavin Smith's courses in UNC and NCSU, February 27, 2019.


COASTAL RESILIENCE CENTER
A U.S. Department of Homeland Security Center of Excellence

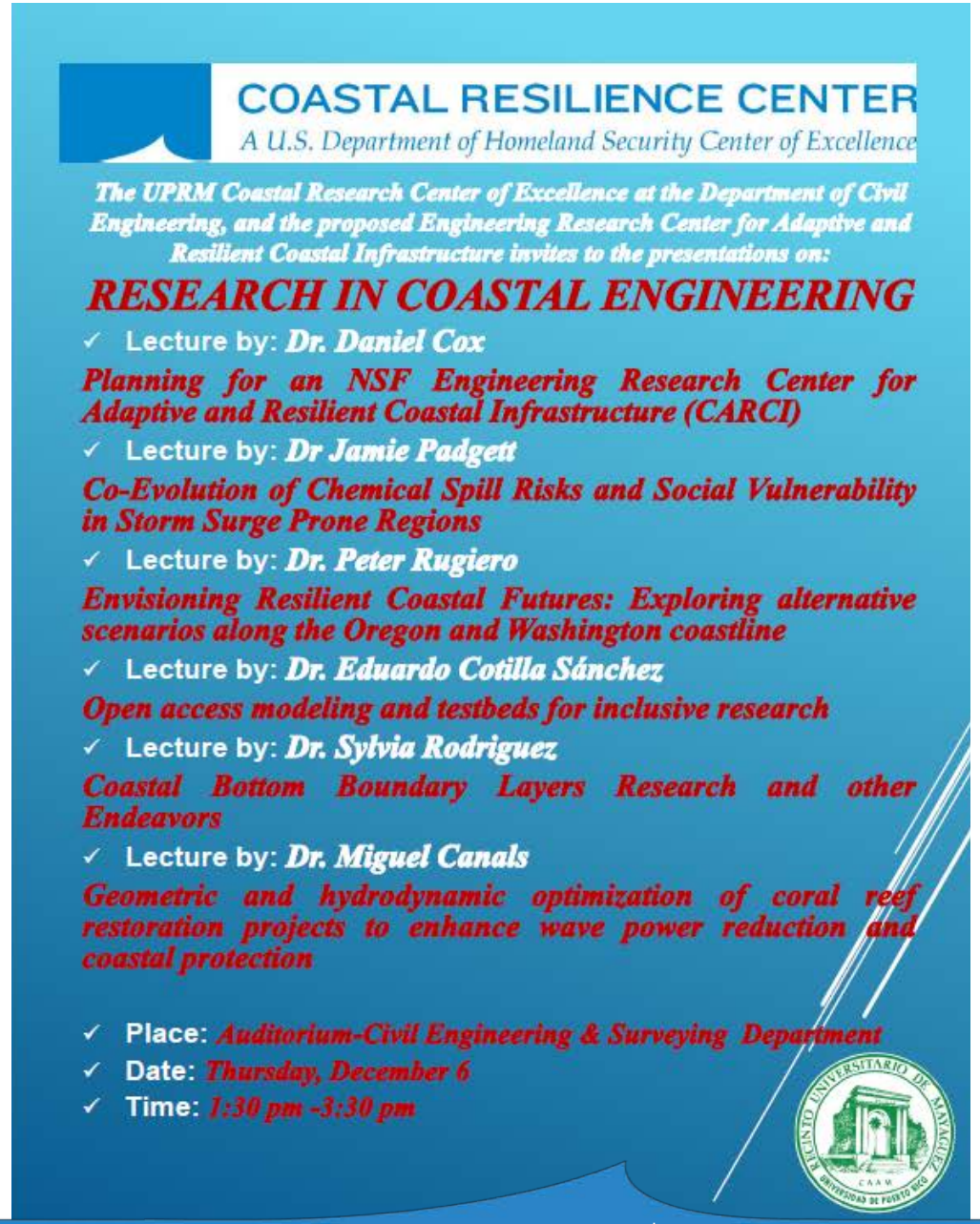
Observations of the Impact and Recovery from Hurricane María on Puerto Rico : An Engineering Perspective

presented at course LAR 582 004: Dr. Gavin Smith
Natural Hazards, Disasters and Climate Change Adaptation Lecture Series
the University of North Carolina at Chapel Hill and North Carolina State University
by

Ismael Pagán Trinidad, Ricardo R. López Rodríguez, Carla López del Puerto
Department of Civil Engineering and Surveying, University of Puerto Rico at Mayagüez
ismael.pagan@upr.edu, ri.lopez@upr.edu, carla.lopezdelpuerto@upr.edu

February 27, 2019

Collaborators and Sources: Ernesto Díaz-PRDNER/PRCMP/PRCCC, Humberto Chaparro-PR Sea Grant Program, Benjamín Colucci-T² Center, Luis Aponte, Alvin Rodríguez, Aurelio Mercado, Patricia Chardón, NOAA, NHC, USGS, COHEMIS-UPRM-CARICOOS, others


COASTAL RESILIENCE CENTER
A U.S. Department of Homeland Security Center of Excellence

The UPRM Coastal Research Center of Excellence at the Department of Civil Engineering, and the proposed Engineering Research Center for Adaptive and Resilient Coastal Infrastructure invites to the presentations on:

RESEARCH IN COASTAL ENGINEERING

- ✓ Lecture by: ***Dr. Daniel Cox***

Planning for an NSF Engineering Research Center for Adaptive and Resilient Coastal Infrastructure (CARCI)

- ✓ Lecture by: ***Dr Jamie Padgett***

Co-Evolution of Chemical Spill Risks and Social Vulnerability in Storm Surge Prone Regions

- ✓ Lecture by: ***Dr. Peter Rugiero***

Envisioning Resilient Coastal Futures: Exploring alternative scenarios along the Oregon and Washington coastline

- ✓ Lecture by: ***Dr. Eduardo Cotilla Sánchez***

Open access modeling and testbeds for inclusive research

- ✓ Lecture by: ***Dr. Sylvia Rodriguez***

Coastal Bottom Boundary Layers Research and other Endeavors

- ✓ Lecture by: ***Dr. Miguel Canals***

Geometric and hydrodynamic optimization of coral reef restoration projects to enhance wave power reduction and coastal protection

- ✓ Place: ***Auditorium-Civil Engineering & Surveying Department***
- ✓ Date: ***Thursday, December 6***
- ✓ Time: ***1:30 pm -3:30 pm***

Education Work and Accomplishments - cont.

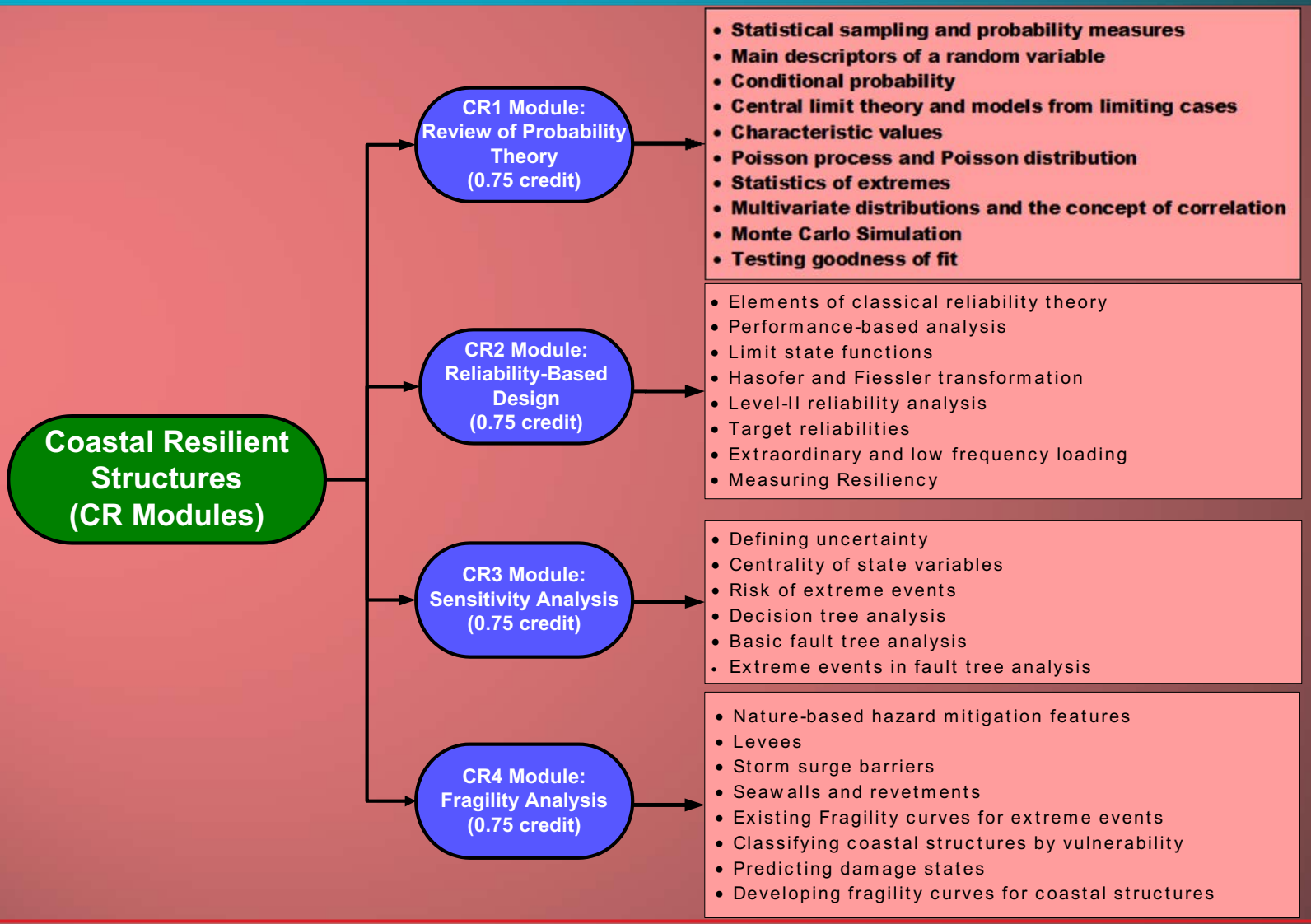
Formal Courses: 5

- Resilience and Reliability : Ali Saffar, on line course to be offered 2019
- Rehabilitation of Coastal Infrastructure: José Guevara, offered 2018
- Solid Waste and Debris Impact on Coastal Environments - West Coast of Puerto Rico : Ismael Pagán Trinidad, ongoing Spring 2019
- Complex Project Management for Coastal Communities Carla López del Puerto, developed Spring 2019, to be offered Fall 2019
- Civil Engineering Capstone Course: 5 Professors, offered every semester with a different project related to coastal engineering

A First Course on Coastal Resilient Structures
Unit 1: Design Overview

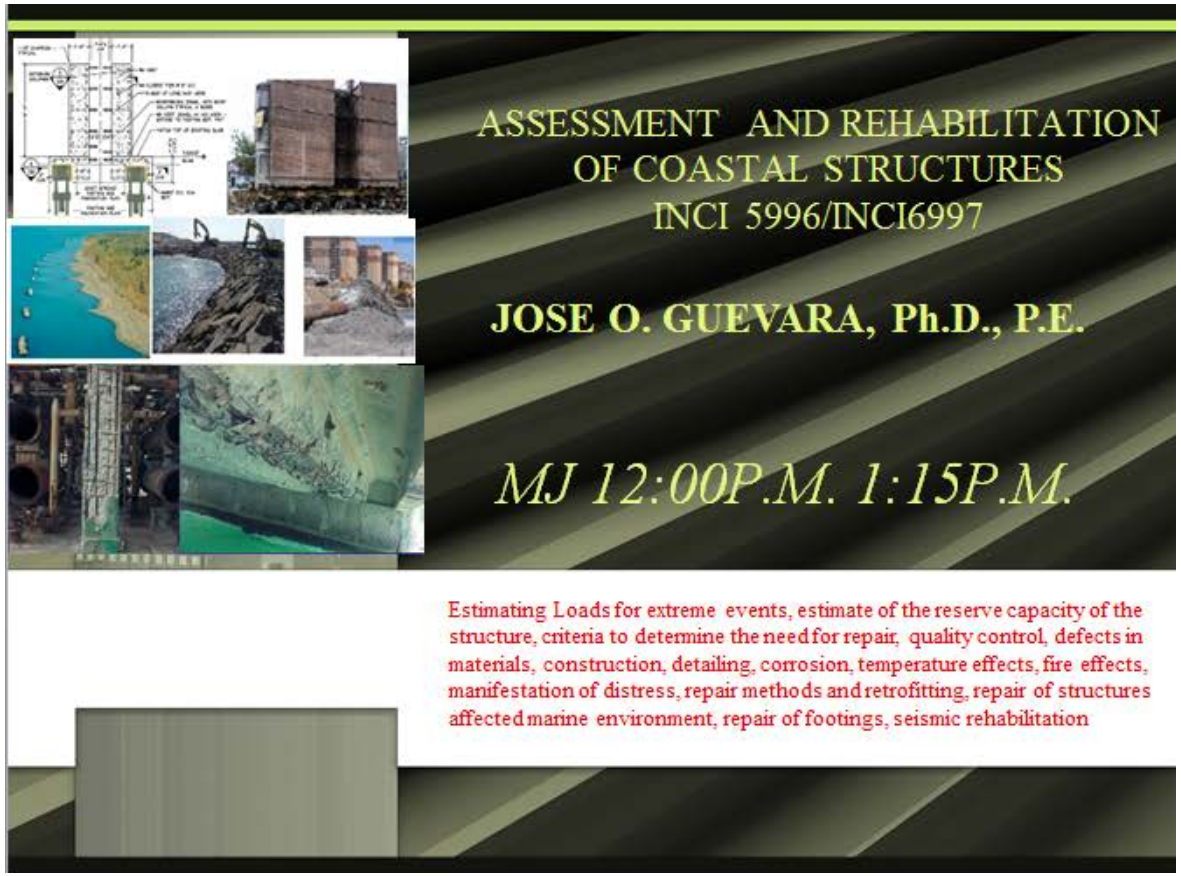
Dr. Ali Saffar

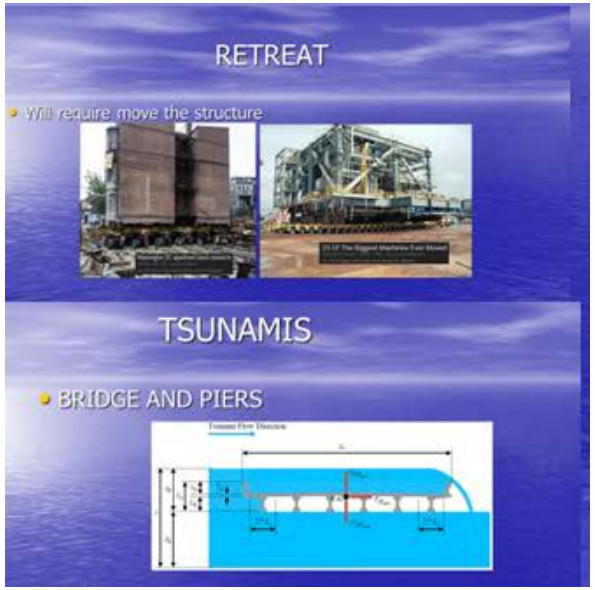
Structure of the Course



Education Work and Accomplishments - cont.

Regular Courses –Rehabilitation





Complex Project Management for Coastal Communities

Dra. Carla López del Puerto, Associate Professor, UPRM

Purpose: To provide participants with the skills necessary to assess the complexity of a project to manage the project effectively

Emphasis: Managing complex project in coastal communities to restore services after natural disasters.

Focus: Actions that can be taken to meet or exceed expectations for project time, cost, quality, stakeholder satisfaction, and financial feasibility. A five dimensional project management model will be used to manage complexity related to cost, technical, schedule, finance and context. Complexity maps will be plotted to quantify a project´s complexity footprint.

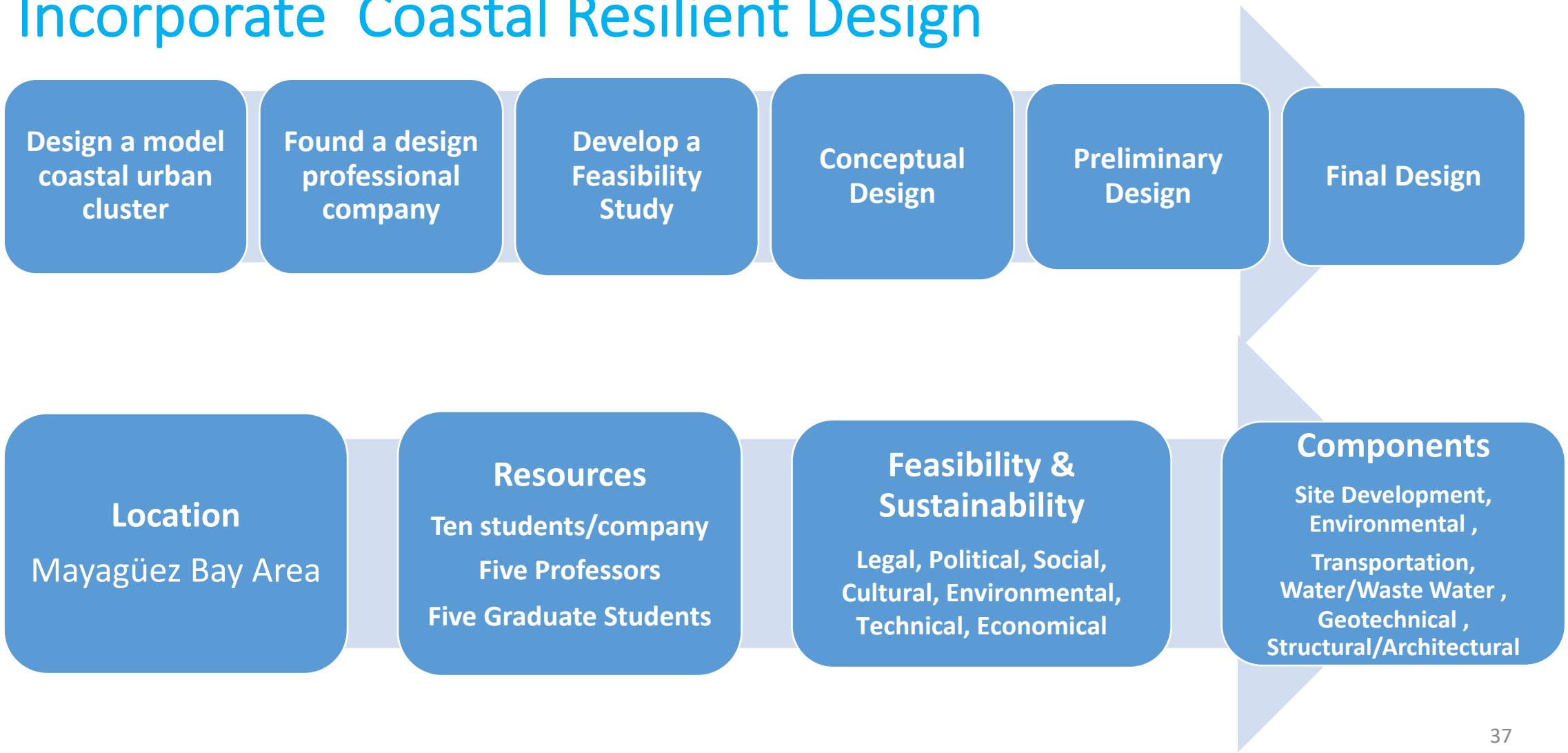
Collaboration: The Department of Civil Engineering and Surveying has several initiatives that share the **goal of capacity building to increase readiness before, during and after natural events such as hurricanes, tsunamis and earthquakes**. In particular, the **collaboration between CRC, RISE-UP and NSF Rapid projects lead to a panel session titled "Hurricane Maria in Puerto Rico: Assessment of the Damages, Reconstruction Efforts and Beyond Recovery",** that was presented at the Construction Industry Summit in Atlanta, Georgia.

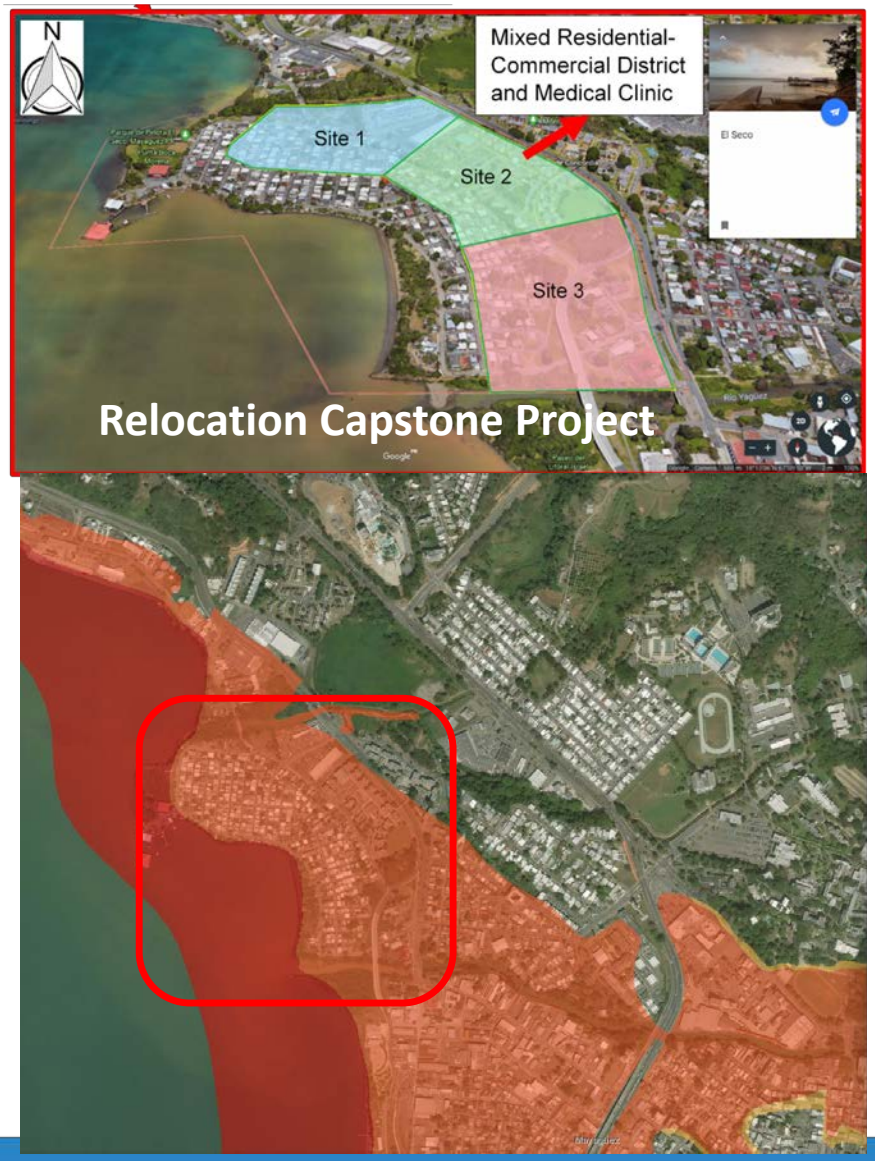
Case Study Projects
PR and New Zealand

Education Work and Accomplishments - cont.

Regular Courses :The Senior CE Capstone Experience

Incorporate Coastal Resilient Design





CAPSTONE DESIGN PROJECT

Site: El Seco Community - Spring Semester
Participants: 31 Students, 5 Faculties, 2 Grad Students
Purpose: Mixed Use Project (Commercial, Offices , Housing)
Hazards: Coastal and riverine floods, wind, earthquake, soil instabilities
Objective: Flood Relocation Project (adjacent to the neighborhood)

3D view of overall alternative 3 project site
Conceptual Plan-El Seco Community

New Site Layout- El Seco

Conceptual Design
Retreated and Elevated Structures

Education Work and Accomplishments - cont.

Regular Courses :The Senior CE Capstone Experience

Incorporate Coastal Resilient Design

Students from the CE Capstone Course won Third Prize in the Open Capstone Competition at UPRM, December 2018

Expected activities

- ReTALK by Dr. Gavin Smith, **" Relocation of Coastal Communities",** April 2019
- **Low Impact Development**, Two days Course/Workshop by ERDC, April 2019
- **NSF ERC proposal** participation
- **Consciousness of Tsunamis** (May 22, 2019); **Tsunami Awareness Training for the Disable** (July 31) with the help of FEMA and National Disaster Preparedness Training Center (NDPTC)-UPRM
- Paper submitted and approved for presentation and publication to ASEE Conference in Tampa, FL, June 2019 (*"**Education and Building Capacity for Improving Resilience of Coastal Infrastructure**")*
- Course offering –Curricular option Certificate on Resiliency of Coastal Environments
- Curricular Sequence on Coastal and Ocean Engineering (College of Engineering)

Anticipated Project Impact

- **Stakeholders:**
  - **Orient/Train/Educate/Support university/government initiatives to help rise up PR**
  - **Provide expert resources from the department to our constituents.**
  - **Focus on collaboration, coordination, and partnerships to deal with mitigation and community preparedness .**
  - **Make our resources available to support Emergency Offices, First Responders, Faculty and Students**
  - **Provoke/Promote leadership**
- **Pursue and Develop New Knowledge:**
  - **Creative/Research/Development Projects: Students projects and theses, faculty as lecturers, and presentations:**
    - Increase faculty and students participation in **"learned by doing experiences"**
    - Attract more faculty and students to pursue educational and research proposal and projects
    - Attract applications and retain undergraduate and graduate students in CE
    - Stimulate the faculty to work together and be available to continue helping "Rise Up PR"

Anticipated Project Impact-cont.

- **SUMREX and Internships: Motivate and maintain students pipeline and interest into RCI enterprise**, help identify **research and thesis topics, attract students into graduate programs and labor force**

- **Curriculum Impacts: Strengthen CE Curriculum and better prepared for professional practice considering resilient civil infrastructure**
- **Reach a larger audience by research, publications and presentations**

SUSTAINABILITY AND INSTITUTIONALIZATION

- **Department:** Proposed curricular option (certificate) on resilient coastal infrastructure – new and existing courses; engaged faculty, attract students
- **Deanship:** Partnering with other departments to create a multi-department curricular option (or minor)
- **Campus Committee of Emergencies (COE):** Active participation in trainings and emergency drills
- **Municipality:** Participation as members of the Community Advisory Board on Mayagüez Territorial Ordering Plan
- **Partnering:** Engage in active collaboration with DHS partners **(FEMA, NIST, RAND Corporation, NOAA, ERDC, NDPTC, PRDNR, ReImagine PR, The Nuclear Alternative, PRDNR, PR Sea Grant Program, NSF RISE-UP, Oregon NSF-ERC others).**

SUSTAINABILITY AND INSTITUTIONALIZATION

- **Research/Education/Services**: Synergistic initiatives on research, curriculum development, and institutional services on the topic of resilient infrastructure
  - **Proposals and Projects**
    - **UPRM-NSF RISE-UP Project** : Multicampus-multidisciplinary educational project (CLDP-PI; RL,IPT- Senior Personnel)
    - **NSF CARCI Planning Grant:** Center for Adaptive and Resilient Coastal Infrastructure (RL- UPRM CoPI, a team of faculties from UPRM)
    - **ERDC BAA Projects and Summer Internships** (IPT, PI)
    - **"Expert Analysis of FEMA Cost Estimate Development process and validation for FEMA-4339-DR-PR and FEMA-4340-DR-VI (Hurricane Maria) Remediation / Reconstruction**": project to assist RAND Co. Consultants to FEMA Center of Excellence (RL-PI, IPT-COPI)
    - **NIST Study of Hurricane Maria's effects on Puerto Rico** – Faculty participation
  - **Engage Faculty and Students:** Continue engaging faculty and researchers in the topic of resilience and sustainable costal infrastructure
  - **Students pipeline:** Motivate and maintain the interest into RCI enterprise, help identify research and thesis topics, attract students into graduate programs and labor

Acknowledgement

The authors want to acknowledge the contributions that deserve all the credit behind the work and efforts reflected in this presentation which are the results of the cooperation, collaboration, supports, creative work, and diligence of all those that are identified, mentioned, are referenced or cited, or helped in anyway for preparing this presentation. To all of them, our deepest and sincere appreciation.

This educational project within de Coastal Resilience Center (CRC) of Excellence is sponsored by the Department of Homeland Security (DHS) through the coordination of an outstanding team of researchers led by the University of North Carolina (UNC) for the research component and Jackson State University (JSU) for the educational component. We thank CRC leaders, administrators and staff for their continuous support. Our deepest appreciation for the continuous support of Dr. Gavin Smith, Rick Luettich, Dr. Robert Whalin, Dr. Tom Richardson, and Anna Schwab, and Josh Kastrinsky, and the CRC staff to the Educational Component for his encouragement and support. Special thanks to Eleanore Hajian for her encouragement, guidance and support.


Thank You!