

# UNIVERSITY OF MIAMI



## **Projects on Climate Resilience at the University of Miami**

**Updated May 2, 2022**

This living document provides a working summary of projects related to Climate Resilience, conducted by faculty at the University of Miami (UM). The purpose of this document is to provide information to partners outside UM, who can identify and prioritize collaborative projects with the highest potential to deliver solutions that are required by stakeholders. The Climate Resilience Academy is organized around three intersecting thematic platforms aimed at providing solutions to climate change and related stressors. The platforms, color coded below in the table, are:

Built and Natural Environment

Human and Societal Health

Economic Development

Combination of 2-3 of the above.

| Project Title   | Project Summary  | Sponsors / Stakeholders   | UM Project Leaders  | Status                | In the News  |
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| <b>Resilient305 Collaborative</b>   | <b>Purpose:</b> To accelerate positive outcomes through resilience learning in Greater Miami and the Beaches. <b>Research strategy:</b> Quantify the benefits and investments resulting from the ongoing implementation of the Resilient305 Strategy. Lessons learned from this project will be leveraged to report on and enhance resilience outcomes and cross-sectoral benefits of Resilient305 Strategy. It will also develop new information to improve the translation of the Resilient305 Strategy to help meet the resilience priorities of the community, and replicate the research strategy in other areas. | Sponsor: NOAA<br><br>Stakeholders/partners: UM, FIU, Miami-Dade Community College, MDC, City of Miami, Miami Beach, CLEO, Catalyst Miami, Miami Waterkeeper                         | Amy Clement   | Ongoing               | <a href="https://news.climate.columbia.edu/2021/05/26/community-partnerships-environmental-concerns/">https://news.climate.columbia.edu/2021/05/26/community-partnerships-environmental-concerns/</a><br><br><a href="https://resilient305.com/yearoneupdate/">https://resilient305.com/yearoneupdate/</a> |
| <b>Southeast Florida Regional Citizen Science Climate Action Network (CSCAN)</b>              | Working on a hyper-local scale, the citizens and students involved in the project can inform climate adaptation policy that addresses multiple challenges across the region.   | Stakeholders: UM, FIU, many others.   | Amy Clement, Katharine Mach                                     | Ongoing               | <a href="https://www.climatechallengecup.com/finalist-citizen-scientists-inform-climate-policy-in-south-florida">https://www.climatechallengecup.com/finalist-citizen-scientists-inform-climate-policy-in-south-florida</a>  |
| <b>Coastlines and People</b>  | (Various proposals have been submitted to the National Science Foundation)   | Sponsor: NSF (proposals pending)  | Amy Clement, Ben Kirtman  | Pending               |  |
| <b>On the Move: Climate Migration and Retreat in South Florida, the Caribbean, and Beyond</b> | Lay the groundwork for the pragmatic policies needed to support the migration and retreat of communities in South Florida, the Caribbean, and beyond that are affected by rising seas. Ensure that future policies equitably manage the exposure of people and assets in a changing climate.   | Sponsor: U-LINK<br>Stakeholders: (local to federal) government; community-based organizations; adaptation consultancies; private sector; think tanks; underwater HOA; Resilient 305 | Katharine Mach, Xavier Cortada, Ian Wright, Nicholas Mignanelli | Ongoing (2018-5/2022) | <a href="https://www.nytimes.com/2020/09/22/climate/climate-change-future.html">https://www.nytimes.com/2020/09/22/climate/climate-change-future.html</a>  |

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| <p><b>Training in Heat-Related Equity And Disparities (THREAD) Research Collaborative</b></p>  | <p>The design of effective interventions to adapt to increasing intensity and frequency of extreme heat events requires an understanding of who is most vulnerable, as well as what problems frontline communities are facing where heat plays a role. In this project, we will build upon the work of two previous U-LINK groups, and include new expertise in Public Health Sciences, to address this question. We will create a first-of-its-kind learning community of faculty from many schools and programs at UM, as well as faculty at FIU, numerous community organizations, and local government, who will together support a core cohort of graduate students working on heat impacts and community-oriented solutions in Miami-Dade County.</p>   | <p>Sponsor: U-LINK</p> | <p>Amy Clement, Kilan Ashad-Bishop, Zinzi Bailey, Scotney Evans, Katherine Mach</p>                                   | <p>Ongoing (2022-)</p> |  |
| <p><b>Developing resiliency tools and metrics and co-designing and expert and stakeholder coalition to sustain predictions on the health of South Florida Biome through a human, urban, and environment transect</b></p> | <p>Coastal development intensifies the need for monitoring and predicting climate change impacts on coastal communities. We propose a transformative, trans-disciplinary approach that integrates the ocean’s influence on coastal resilience and on the well-being of coastal communities, toward resilience measures that protect human, urban, and ocean health. Study innovation: we will codesign metrics and contemplate solutions with public and private sector stakeholders, leveraging established relationships, building a local, national &amp; international coalition to address current conditions and future predictions of coastal Biome health, economic and community well-being. Our solutions will advise future policies to ensure climate equity and justice. We will develop integrated tools and metrics to assess environmental, economic, urban, and human aspects of coastal resilience.</p> | <p>Sponsor: U-LINK</p> | <p>Vassiliki Kourafalou, Sonia Chao, David Kelly, Yui Matsuda, Renato Molina, Josefina Olascoaga, Shivangi Prasad</p> | <p>Ongoing (2022-)</p> |  |

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| <b>Center for Aerosol Science Technology (CAST)</b>  | CAST will address challenges in spread of infectious diseases, climate change, improving environmental quality, advanced materials, public health, atmospheric sciences, and others.   | Sponsor:   | Pratim Biswas        | Pending             | <a href="https://www.coe.miami.edu/research/shared-facilities/aerosol-science-and-technology-instrumentation/index.html">https://www.coe.miami.edu/research/shared-facilities/aerosol-science-and-technology-instrumentation/index.html</a><br><br><a href="https://news.miami.edu/stories/2021/09/researchers-developing-air-quality-sensors-to-detect-covid-19.html">https://news.miami.edu/stories/2021/09/researchers-developing-air-quality-sensors-to-detect-covid-19.html</a><br><br><a href="https://www.nytimes.com/interactive/2020/04/14/science/coronavirus-transmission-cough-6-feet-around.html">https://www.nytimes.com/interactive/2020/04/14/science/coronavirus-transmission-cough-6-feet-around.html</a> |
| <b>HuRRI (Hurricane Resilience Research Institute)</b>   | HuRRI's vision is to be a national center of excellence in resilience advancing our nation's ability to mitigate, assess, predict, protect, educate and recover from hurricanes for creating/sustaining resilient communities. | Sponsor: The six founding Gulf Coast institutions of higher education (Louisiana State University, Texas Tech, University of Florida, University of Miami, University of Houston, and the University of Texas at Tyler)<br>Stakeholders: Project communities | Derin Ural           | Ongoing             | <a href="https://hurri.uh.edu/home">https://hurri.uh.edu/home</a>   |
| <b>Bio-Inspired Genetically Engineered Self-Healing for Sustainable Cementitious Materials</b> | The research objective of this CAREER proposal is to acquire a fundamental understanding of a genetic engineering approach to self-healing cementitious materials.   | Sponsor: National Science Foundation   | Ali Ghahremaninezhad | Ongoing (2019-2025) | <a href="https://news.miami.edu/stories/2021/08/miracle-matter-engineer-creates-concrete-that-heals-itself.html">https://news.miami.edu/stories/2021/08/miracle-matter-engineer-creates-concrete-that-heals-itself.html</a>   |

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| <b>SEAHIVE (Sustainable Estuarine and Marine Revetment)</b>  | SEAHIVE™ is an ecofriendly and efficient marine and estuarine protection system. The project involves three pilot installations in collaboration with local communities and other stakeholders.  | Sponsor: National Cooperative Highway Research Program (NCHRP) Innovations Deserving Exploratory Analysis (IDEA). Stakeholders: North Bay Village, City of Miami Beach, and City of Pompano Beach/Broward County | Landolf Rhode-Barbarigos, Brian Haus, Antonio Nanni  | Completed (2019-2021) | <a href="https://news.miami.edu/stories/2019/10/community-collaboration-on-sustainable-solutions.html">https://news.miami.edu/stories/2019/10/community-collaboration-on-sustainable-solutions.html</a><br><br><a href="https://www.nbcmiami.com/weather/hurricane-season/university-of-miami-scientists-lead-research-to-mitigate-storm-surges/2464159/">https://www.nbcmiami.com/weather/hurricane-season/university-of-miami-scientists-lead-research-to-mitigate-storm-surges/2464159/</a> |
| <b>Wahoo Bay SEAHIVE: A real-world experiment of green engineering shoreline protection</b>  | This proposal explores an ongoing SEAHIVE™ pilot installation as a paradigm of a green engineering protection. SEAHIVE™ is an engineered marine and estuarine protection system under development at the University of Miami. The working hypothesis is that by reviewing the design of the system proposed, assessing its as-built engineering and ecological performance through in-situ measurements, and working closely together with stakeholders in the analysis of the related legal and governance frameworks, key parameters, challenges and ways around them for the development, deployment and acceptance of novel green engineering solutions, such as SEAHIVE™, will be identified. | Sponsor U-LINK   | Landolf Rhode-Barbarigos, Brian Haus, Antonio Nanni, Rafael Araujo, Prannoy Suraneni, Arthur Gleason, Esber Andiroglu, Renee Evans | Ongoing (2022-)       | <a href="https://www.miamiherald.com/news/local/environment/article260172910.html">https://www.miamiherald.com/news/local/environment/article260172910.html</a>  |
| <b>Center for the Integration of Composites into Infrastructure (CICI)</b>   | This Industry/University Cooperative Research Center undertakes activities aimed at stimulating applications and cost-effective rehabilitation schemes using composite and recycled materials in civil and military structures. Develops industry standards and specifications.  | Sponsor: National Science Foundation (NSF) Member companies, West Virginia Univ., North Carolina State Univ., Texas A&M  | Antonio Nanni, Landolf Rhode-Barbarigos, Prannoy Suraneni, Luis Ruiz Pestana, Francisco De Caso                                    | Ongoing (2019-2024)   | <a href="https://iucrc.nsf.gov/centers/center-for-the-integration-of-composites-into-infrastructure">https://iucrc.nsf.gov/centers/center-for-the-integration-of-composites-into-infrastructure</a>  |
| <b>Acquisition of a High Resolution X-Ray Micro-Computed Tomography System for Multidisciplinary and Integrated Research and Education</b> | This proposal is aimed at the acquisition of a versatile high resolution x-ray micro-computed tomography (micro-CT) system for 3D imaging of materials and their internal structure for a wide range of applications in engineering, natural, marine, and geological sciences, and medicine.   | Sponsor: National Science Foundation   | Ali Ghahremaninezhad, James Giancaspro, Pestle, Eberli   | Ongoing (2019-2024)   |  |

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| <b>Coastal Infrastructure Resilience Research (CIRR)</b>  | The intellectual focus of the proposed program centers on coastal infrastructure resilience research. While there have been coastal infrastructure resilience related efforts in recent years, most efforts have been unidirectional and primarily focused on a single specific discipline. The proposed program will take a convergent approach to develop comprehensive and robust solutions by integrating an interdisciplinary sphere of interest that includes engineering, chemistry, biochemistry, biology, and natural and marine sciences. | Sponsor: National Science Foundation   | Ali Ghahremaninezhad, James Giancaspro  | Ongoing (2022-2026)                  |  |
| <b>Naval Coastal Infrastructure Resilience</b>  | Mission readiness is critical to American interests at home and abroad, thus, it is imperative that the Navy enhance coastal infrastructure resilience to ensure sustained global Naval operations. The proposed program will focus on key Naval relevant topics related to coastal infrastructure resilience including coastal land-air-sea interactions, advanced materials, oceanography, and structural integrity monitoring.   | Sponsor: Office of Naval Research  | Ali Ghahremaninezhad, Brian Haus, James Giancaspro, Esber Andiroglu             | Pending (2022-2026)                  |  |
| <b>Integrated Active Demand Flexibility Control of HVAC Systems Utilizing Thermal Mass in Building Structures</b>   | Validation of the proposed technology using buildings in the community and streamlining the technology implementation to broader set of users, ultimately reducing the energy demand in communities. Resilient 305 / Building Efficiency 305 initiative Applied projects.   | Stakeholders: Miami-Dade County Office of Resilience, FP&L, Trane Technologies, Siemens Controls                                 | Gang Wang<br>Esber Andiroglu<br>Li Song- U. Oklahoma<br>Wangda Zuo- U. Colorado | Pending / Under review by US DoE     |  |
| <b>Deployment of A Packaged Electro-Chemical Nutrient Recovery System for Septic Tanks Located in Flood Prone Communities Without Public Sewer Networks</b> | Pilot project design and installation at a private residence in Palmetto Bay. Miami-Dade County Office of Resilience Mitigation and Adaptation initiative in the Miami's Little River Community   | Sponsor: Electric Power Research Institute<br><br>Stakeholder: Miami-Dade County Department of Environmental Resource Management | James Englehardt<br>Esber Andiroglu   | Ongoing (pending additional funding) |  |
| <b>Energy Optimization of Wastewater Pump Stations</b>  | Pilot project for use of Virtual Flow Meters in Improving operational efficiency and fault detection of wastewater pump stations. Experimental investigation currently active at Pump Station #26 – Doral, FL.  | Sponsor and Stakeholder: Miami-Dade Water and Sewer Department   | Gang Wang<br>Esber Andiroglu<br>Jason Grant                                     | Ongoing                              |  |

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| <b>Developing Integrated Solutions for Sustainably Feeding the World, Improving Coastal Water Quality, and Building Resiliency in Coastal Communities</b>                 | <p>Addresses challenges that the aquaculture industry faces as it strives to fill the demand for seafood at a time when overfishing, climate change, and environmental degradation threaten the world’s marine resources.</p>   | <p>Sponsor: U-LINK</p>   | <p>John Stieglitz, Daniel Benetti, Daniel Suman, Brian Haus, Michael Touchton, Daniel Rothen, Angela Clark-Hughes</p>                   | <p>Completed (2020-2020)</p> |   |
| <b>Next generation of coastal structures: Feasibility, quantification, and optimization</b>   | <p>Coastal structures such as bridges, breakwaters, seawalls, and causeways will be critical in mitigating the effect of climate change. A systemic and comprehensive approach to coastal structure design should capture both the overall community-specific dynamics, as well as functional criteria of cost, ecology, and livability. Deliverable: the development of multi-functional, optimized, next generation coastal structures with demonstrated performance significantly better than existing coastal structures.</p> | <p>Sponsor: U-LINK<br/>Stakeholders: North Bay Village; Village of Key Biscayne; City of Miami Beach; Department of Environmental Resources Management; Miami-Dade County; Residents, developers, and financiers</p> | <p>Esber Andiroglu, David Kelly, Joel Lamere, Billie Lynn, Renato Molina, James Sobczak, Kathleen Sullivan Sealey, Prannoy Suraneni</p> | <p>Completed (2018-2021)</p> | <p><a href="https://news.miami.edu/stories/2020/02/college-of-engineering-design-builds-hope-for-a-lasting-seawall.html">https://news.miami.edu/stories/2020/02/college-of-engineering-design-builds-hope-for-a-lasting-seawall.html</a></p> <p><a href="https://meridian.allenpress.com/jcr/article-abstract/37/3/656/450978/Multifunctional-Performance-of-Coastal-Structures?redirectedFrom=fulltext">https://meridian.allenpress.com/jcr/article-abstract/37/3/656/450978/Multifunctional-Performance-of-Coastal-Structures?redirectedFrom=fulltext</a></p> |
| <b>Identifying, prioritizing, and validating green infrastructure approaches to enhance coastal resilience – Implementation of a data-driven test case in Miami Beach</b> | <p>Exploration of ways to restore living shorelines to protect coastal communities from waves and storm surge. Designing and testing the feasibility of installing a hybrid “green/grey” defense system—one that employs both natural and cement-based elements—off the coast of Miami Beach.</p>   | <p>Sponsor: U-LINK<br/>Stakeholders: Miami Beach</p>   | <p>Diego Lirman, Andrew Baker, Brian Haus, Landolf Rhode-Barbarigos, Sonia Chao, Jyotika Ramaprasad</p>                                 | <p>Completed (2018-2021)</p> | <p><a href="https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html">https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html</a></p>  |
| <b>Engineering Coastal Resilience Through Reef Restoration: Reduction of Wave Energy by Reef Structures and Impacts on Storm Surge and Infrastructure</b>                 | <p>Exploring ways to restore green infrastructure—mangroves, seagrasses, and coral reefs—to protect coastal communities from ocean waves, increased flooding, storm surge, and sea-level rise, all exacerbated by climate change.</p>   | <p>Sponsor: U-LINK<br/>Stakeholders: City of Miami Beach; Miami-Dade County; The Nature Conservancy; EConcrete</p>   | <p>Diego Lirman, Andrew Baker, Brian Haus, Landolf Rhode-Barbarigos, Angela Clark-Hughes</p>  | <p>Completed (2018-2021)</p> | <p><a href="https://news.miami.edu/stories/2021/03/team-works-to-enhance-south-floridas-coastal-resilience.html">https://news.miami.edu/stories/2021/03/team-works-to-enhance-south-floridas-coastal-resilience.html</a></p>  |

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| <b>Durability Testing and Chemical Characterization of an Algae-Based Binder Concrete</b>   | To study a low-carbon and novel algae-based binder for sustainable coastal infrastructure   | Sponsor: Oceans Technology Group   | Ali Ghahremaninezhad   | Ongoing (2019-2023) |  |
| <b>Enhancing the Resilience and Climate Readiness of South Florida's Most Vulnerable and Valuable Shoreline Through Coral Reef Restoration: From Coral Colonies to Coastlines</b> | Restore coral colonies to build coastal resilience, incorporate state-of-the-science approaches to build climate resilience, create essential habitats for marine life, and enhance recreation opportunities.   | Sponsors: National Fish and Wildlife Foundation; National Oceanic and Atmospheric Administration (NOAA)<br>Stakeholders: Miami-Dade County, Broward County | Diego Lirman, Andrew Baker, Brian Haus, Landolf Rhode-Barbarigos | Ongoing (2020-2022) | <a href="https://news.miami.edu/rsmas/stories/2019/11/um-scientists-partners-awarded-6-million-to-restore-southeast-florida-coral-reefs.html">https://news.miami.edu/rsmas/stories/2019/11/um-scientists-partners-awarded-6-million-to-restore-southeast-florida-coral-reefs.html</a>  |
| <b>The importance of acclimatory and adaptive response to climate change</b>  | To enhance our ability to predict responses to climate change, we need to understand the relative importance of acclimatory responses and the potential for adaptive divergence.  | Sponsor: National Science Foundation (NSF)   | Marjorie Oleksiak, Douglas Crawford                              | Ongoing (2019-2022) |  |
| <b>More resilient coastal cities and better hurricane forecasts through multi-scale modeling of extreme winds in the urban canopy</b>   | Use state-of-the-art computer models to learn more about and to improve our ability to predict how buildings disrupt and modify the wind beneath landfalling hurricanes. Results will foster better ways to design and locate buildings and other infrastructure near coasts, better ways to forecast hurricane-force winds, and better ways to protect lives and property in the face of impending landfall. | Sponsor: National Science Foundation (NSF)   | David Nolan  | Ongoing (2017-2022) | <a href="https://news.miami.edu/stories/2020/06/scientists-examine-why-hurricane-wind-speeds-vary-within-urban-settings.html">https://news.miami.edu/stories/2020/06/scientists-examine-why-hurricane-wind-speeds-vary-within-urban-settings.html</a><br><br><a href="https://journals.ametsoc.org/view/journals/mwre/149/3/MWR-D-20-0199.1.xml">https://journals.ametsoc.org/view/journals/mwre/149/3/MWR-D-20-0199.1.xml</a> |
| <b>Assessing the changing symbiotic milieu on Caribbean coral reefs under climate change: magnitude, tradeoffs, interventions, and implications</b>                               | Climate change represents an existential threat to coral reef ecosystems worldwide. Given the severity and urgency of this threat it is critical to investigate mechanisms by which some corals might survive warming, assess the degree to which this is happening on reefs, and apply these discoveries to inform conservation interventions that might improve survival trajectories wherever possible.    | Sponsor: National Science Foundation (NSF)   | Andrew Baker   | Ongoing (2019-2022) | <a href="https://news.miami.edu/stories/2020/08/researchers-share-novel-ways-to-restore-south-floridas-coral-reefs.html">https://news.miami.edu/stories/2020/08/researchers-share-novel-ways-to-restore-south-floridas-coral-reefs.html</a>  |



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| <p><b>Exploiting local variation in thermal tolerance to trial small-scale relocation of coral species to build climate resilience in SE Florida</b></p> | <p>Identify and prioritize thermal-tolerant coral colonies to propagate and outplant to ensure reef longevity.</p>   | <p>Sponsor: Southeast Coastal Ocean Observing Regional Association (SECOORA)</p>  | <p>Andrew Baker</p>  |                            | <p><a href="https://secoora.org/announcing-the-vembu-subramanian-ocean-scholarship-winner-kelsey-johnson-sapp/">https://secoora.org/announcing-the-vembu-subramanian-ocean-scholarship-winner-kelsey-johnson-sapp/</a></p> |
| <p><b>Enabling historic property owners to adapt effectively</b></p>   | <p>Pro-bono initiative resulting in two distinct pamphlets which identify adaptation and mitigation resources and options for historic property owners, at the scale of single family and multi-family residences (“Resilience + Preservation”)</p>  | <p>Collaborators: City of Miami and City of Miami Beach Preservation and Resilience Offices</p>   | <p>Faculty in the UM School of Architecture and College of Engineering</p> | <p>Ongoing</p>             | <p><a href="https://www.arc.miami.edu/academics/research/historic-preservation-and-adaptive-use/index.html">https://www.arc.miami.edu/academics/research/historic-preservation-and-adaptive-use/index.html</a></p>         |
| <p><b>Investigating the genomic basis of key performance traits to quantify the evolutionary potential of coral populations under climate change</b></p> | <p>The long-term persistence of Caribbean reefs will ultimately be determined by whether there is sufficient genetic diversity and phenotypic resilience in remaining natural and restored coral populations to survive and reproduce in a rapidly changing climate. This project aims to quantify variation in performance among colonies, determine potential trade-offs between thermal tolerance and other traits, and identify coral genotypes that are most likely to survive under climate change and contribute to adaptive potential.</p> | <p>Sponsor: National Science Foundation (NSF)</p> <p>Partners: Biological Oceanography Program, Integrative Ecological Physiology Program</p> | <p>Andrew Baker</p>  | <p>Ongoing (2021-2023)</p> |  |

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| <b>Storm Surge Building Vulnerability (SSBV) project</b>  | A new model that is being developed to characterize the vulnerability of buildings to storm surge flooding in Miami-Dade County.  | Sponsor: National Science Foundation (NSF) | Sonia Chao, Benjamin Ghansah, Richard Grant                               | Ongoing         | <a href="https://news.miami.edu/as/stories/2021/05/adapting-to-climate-change-with-micro-geographies.html">https://news.miami.edu/as/stories/2021/05/adapting-to-climate-change-with-micro-geographies.html</a> |
| <b>Space-geodetic monitoring of coastal structures</b>  | We propose a multidisciplinary study to investigate the use of satellite geodesy to monitor buildings in Miami-Dade County. The proposed project has three objectives: 1) to conduct a detailed case study at a currently subsiding building to validate the satellite measurement; 2) to understand the causes and consequences of the observed subsidence; 3) to effectively communicate the findings of this investigation to community stakeholders in order to inform and eliminate the unnecessary mental distress which the news about building subsidence may imply.  | Sponsor: U-LINK                            | Falk Amelung, Esber Andrioglu, Antonio Nanni, Amin Sarafraz, Imelda Moise | Ongoing (2022-) |   |
| <b>Multidimensional resilience of Port Miami: Collaborative engagement, interdisciplinary assessment, and an educational “Port Hub”</b> | Our project aims to contribute to recalibrating the port-city synergy by better understanding multidimensional port resilience to disruption, and enhanced understanding of the role of resilience planning and resilience infrastructure at Port Miami. Our emphasis in the proposed project addresses more resilient infrastructure for coastal cities, resonating with the National Academy of Engineering’s Grand Challenge “Restore and Improve Urban Infrastructure” as well as the National Science Foundation’s core strategy of investing in targeted areas of research related to high priority societal needs. | Sponsor: U-LINK                            | Richard Grant, Shouraseni Sen Roy, Landolf Rhode-Barbarigos               | Ongoing (2022-) |   |

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| <b>Engineering corals for climate change resilience</b> | <p>US coral reefs cover ~17,000 km<sup>2</sup>, and reduce wave impacts during storm and flooding events, thereby preventing loss of life, and mitigating property damage.</p> <p>Key threats to coral reefs include pollution, construction, and water quality; however, ocean warming and acidification is arguably the most critical global threat to coral reef sustainability. If we are to ensure coral resilience towards ocean acidification, the influence of the growth environment on the coral microstructure, macrostructure, and health must be elucidated for different coral genotypes.</p> | <p>Sponsor: U-LINK</p>   | <p>Prannoy Suraneni, Landolf Rhode-Barbarigos, Vivek Nagendra Prakesh, Diego Lirman</p> | <p>Ongoing (2022-)</p>     |  |
| <b>Florida Current and Sea Level (FOCUS)</b>            | <p>Discovering how offshore conditions in the Florida Straits – including the dynamics of the Florida Current, marine heatwaves, and sea level change – affect coastal sea level and flooding events in Miami.</p>  | <p>Sponsor: National Science Foundation (NSF)</p>  | <p>Lisa Beal</p>  | <p>Ongoing (2021-2027)</p> | <p><a href="https://news.miami.edu/rsmas/stories/2021/10/miamis-ocean-scientists-have-been-documenting-sea-level-rise-for-decades-now-they-urge-action-to-save-our-city.html">https://news.miami.edu/rsmas/stories/2021/10/miamis-ocean-scientists-have-been-documenting-sea-level-rise-for-decades-now-they-urge-action-to-save-our-city.html</a></p> |
| <b>Energy Assessment Center</b>                         | <p>Through various research, training, and educational activities, the project will focus on energy analytics and efficiency, improving productivity, enhancing cybersecurity, promoting resiliency planning, and providing training to various manufacturing entities.</p>   | <p>Sponsor: Department of Energy (DOE)<br/>Stakeholders: Miami-Dade County Office of Resilience, Florida Power &amp; Light (FPL)</p> | <p>Ramin Moghaddass</p>   | <p>Ongoing</p>             | <p><a href="https://news.miami.edu/coe/stories/2021/08/ramin-moghaddass-receives-five-year-grant-from-doe-for-energy-center.html">https://news.miami.edu/coe/stories/2021/08/ramin-moghaddass-receives-five-year-grant-from-doe-for-energy-center.html</a></p>   |

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| <b>Towards Self-Healing Resilient Microgrids Using Data Driven Methods</b>   | <p>We investigate dynamic data driven methods for the self-healing of microgrid clusters against system anomalies while considering the tradeoff between the accuracy of decisions and computational burden of data processing.</p>   | <p>Sponsor: AFOSR</p>   | <p>Nurcin Celik</p>  | <p>Ongoing</p>             | <p><a href="https://news.miami.edu/stories/2020/02/a-collaborative-network-of-microgrids-could-provide-backup-electricity.html">https://news.miami.edu/stories/2020/02/a-collaborative-network-of-microgrids-could-provide-backup-electricity.html</a></p> <p><a href="https://news.miami.edu/stories/2021/02/frigid-weather-exposes-the-nations-frail-power-grids.html">https://news.miami.edu/stories/2021/02/frigid-weather-exposes-the-nations-frail-power-grids.html</a></p> <p><a href="https://twitter.com/AFOSR/status/1431019476041015298?s=20">https://twitter.com/AFOSR/status/1431019476041015298?s=20</a></p> <p><a href="https://news.miami.edu/stories/2018/01/2017-the-year-in-review.html">https://news.miami.edu/stories/2018/01/2017-the-year-in-review.html</a></p> |
| <b>SRS-RN Planning Grant: Integrated and convergent sea level adaptation for urban and rural systems in the Gulf of Mexico coastal regions</b> | <p>The proposed planning grant will address the challenge of responding to sea level rise (SLR) in linked urban-rural systems located along the Gulf of Mexico Coastal Region (GCR). This group will create convergent research outputs and foster stakeholder relationships to build a collaborative Track 1 Sustainable Regional Systems Research Networks (SRS-RN) proposal. The execution of this effort will follow a trajectory with three phases: (1) an on-line high-performance charrette will be used to coordinate partnering researchers and stakeholders, and assemble the foundations of the network, (2) an in-person charrette will be used to co-produce research priorities and hypotheses for the proposed SRS-RN, (3) a centered expert workshop will integrate these efforts and synthesize the output products.</p> | <p>Sponsor: National Science Foundation (NSF)<br/>Stakeholders:</p> | <p>Murat Erkoç, Katherine Mach, Rusty Feagin, Diani Mitsova-Boneva, Sabarethinam Kameshwar</p> | <p>Ongoing (2022-2022)</p> |   |
| <b>National Summer Transportation Institute</b>  | <p>To provide education and outreach activities related to resilient transportation infrastructure.</p>   | <p>Sponsor: Federal Highway Administration</p>                      | <p>Ali Ghahremaninezhad</p>  | <p>Ongoing (2015-2023)</p> |   |

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| <b>Low Carbon and Green Infrastructure Concrete</b>   | The main goal of this proposal is to provide innovative program related to low carbon and green infrastructure concrete materials utilizing waste materials.  | Sponsor: Constellation  | Ali Ghahremaninezhad   | Completed (2020-2021) |   |
| <b>UM STEM Summer Camp</b>  | The proposed program aims to provide high school students with a rich and engaging set of activities related to the smart and green coastal infrastructure materials.   | Sponsor: Miami-Dade County  | Ali Ghahremaninezhad, Esber Andiroglu  | Completed (2021-2022) |   |
| <b>Bio-inspired Bacteria-Induced Biomineralization for Self-Healing of Smart Infrastructure Materials</b> | To explore a bacteria induced approach for self-healing coastal infrastructure.   | Sponsor: Provost Research Award   | Ali Ghahremaninezhad   | Completed (2019-2020) |   |
| <b>The Structural and Durability Performance of Glass Modified Concrete</b>                               | To investigate the use of waste glass in infrastructure materials.  | Sponsor: Florida Department of Transportation   | Ali Ghahremaninezhad   | Completed (2013-2015) |   |
| <b>Environmental determinants of post-Covid recovery</b>  | Analysis of integrated climate risk, which will then be compared to patient-reported outcomes and electronic medical records data to evaluate disparities in COVID-19 recovery and the environmental factors associated with it. Working in collaboration with U-LINK project: 'COVID19: Evaluating Fault Lines in the Health of Our Communities and Developing Community Centered Solutions. Pilot to a larger grant submission to the National Institute of Health (NIH). | Pilot project; UM<br><br>Sponsor: National Institute of Health (NIH)<br><br>Partners: Nova and others                     | Ana Palacio  | Ongoing               | <a href="https://ulink.miami.edu/projects/social-equity-rapid-response/covid-19/index.html">https://ulink.miami.edu/projects/social-equity-rapid-response/covid-19/index.html</a>                                     |
| <b>Climate Equity and Mapping (CAMP)</b>  | Explores the impact of heat-related issues. Continuation of the Housing Resiliency and a Sustainable South Florida project also by JP Morgan Chase Foundation which focused around flooding with data collection and mapping, an adaptation-strategy analysis, and creative strategies and policies to equitably address the resilient future of Miami's affordable housing stock.  | Sponsor: JPMorgan Chase Foundation<br>Partners: Miami-Dade County, Arcadis, South Florida Community Development Coalition | UM Office of Civic and Community Engagement, Robin Bachin, Jennifer Posner, Landolf Rhode-Barbarigos | Ongoing (2021-2023)   | <a href="https://www.govtech.com/analytics/miami-climate-change-affordable-housing-plans-driven-by-data.html">https://www.govtech.com/analytics/miami-climate-change-affordable-housing-plans-driven-by-data.html</a> |

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| <b>Antiracism and climate justice dialogues to build an interdisciplinary course and research inquiry</b> | Organization of presentations and conversations focused on antiracism and climate justice (the idea that adaptation to climate change must be done in fair and equitable ways, so that the consequences for residents of all backgrounds are transparent and responsible).  | Sponsor: U-LINK<br>Stakeholders: the Black community and social justice community groups in Miami | Katharine Mach, Scotney Evans, Armen Henderson, Abigail Fleming  | Completed (2021)      |   |
| <b>The University of Miami Well-Being Institute (UWIN)</b>  | Vision: a multidisciplinary institute that incorporates research and evidence-based practice (and the development of evidence-based approaches) in the dimensions of individual, organizational and community well-being. There is an inventory of well-being related initiatives, and plans for others, focused on the principle of health equity.   | Community Partners: Overtown Children and Youth Coalition, Miami YWCA, Air Ventures.              | UWIN Working Group: Henri Ford, Jose Szapocznik, Marie Dasborough, Joanna Lombard, Isaac Prilleltensky. Adam Carrico, Joan St. Onge, Radu Saveanu, Hieid Allespach, Karen Koffler (Osher Center) | In development        |   |
| <b>(HyLo) Hyperlocalism: Transforming the paradigm for climate adaptation</b>                             | Advancing a new Integrated Climate Risk Assessment protocol with community partners to develop an innovative and replicable model for community member and policy-maker communication. Expected results: new co-produced knowledge to inform climate adaptation strategies; increased coordination across key stakeholders in climate adaptation, and more effective individual, neighborhood and community climate adaptation decision-making. | Sponsor: U-LINK, ATT<br><br>Stakeholders: City of Miami; Miami-Dade County; CLEO; Catalyst Miami  | Amy Clement, Tyler Harrison, Joanna Lombard, Sam Purkis, Gina Maranto, Angela Clark  | Ongoing (-5/2022)     | <a href="https://news.miami.edu/stories/2020/01/u-link-hyper-localism-project-receives-support-from-att.html">https://news.miami.edu/stories/2020/01/u-link-hyper-localism-project-receives-support-from-att.html</a> |
| <b>Aerosolization of algal toxins and pathogens in South Florida and their human health effects</b>       | Investigation of the risks posed to people who inhale toxic aerosols from breaking waves on the beach. Examples include toxins produced by blue-green algae, and elevated bacteria levels in South Florida's coastlines and waterways.  | Sponsor: U-LINK   | Cassandra Gaston, Alberto Caban-Martinez, David Lee, Grace Zhai, Larry Brand, Kimberly Popendorf, Brian Haus, Helena Solo-Gabriele, James Klaus, Angela Clark-Hughes                             | Completed (2018-2019) | <a href="https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html">https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html</a>                   |

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| <b>Post Maria Puerto Rican Families Relocated to Florida: A Multisite Study of Alcohol Misuse and Mental Health Problems</b> | <p>Investigation into the disaster- and migration-related experiences of Puerto Rican families relocating to South Florida in the aftermath of one of the costliest natural disasters in United States' history. Such research would provide information vital to the development of evidence-based programs designed to target alcohol misuse and mental health problems among a large and at-risk population of US-citizen migrants.</p>   | <p>National Institute of Mental Health</p>   | <p>Eric Brown, Mildred Maldonado-Molina (Univ Florida)<br/>Christopher Salas Wright (BU), Seth Schwartz</p> | <p>Ongoing - 2019-2024</p>   |  |
| <b>Improving Hurricane Risk Communication for Vulnerable Populations / Dynamic Communication of Weather Risk</b>             | <p>New graphical products to communicate the risks and potential threats of approaching tropical storms and hurricanes, especially to underserved populations who, because of limited resources for adequate preparation and recovery, often bear a disproportionate burden of these natural disasters.</p>  | <p>Sponsor: U-LINK and National Oceanic and Atmospheric Administration (NOAA)<br/>Stakeholders: National Weather Service / National Hurricane Center / TV stations</p> | <p>Barbara Millet, Kenneth Broad, Alberto Cairo, Scotney Evans, Sharan Majumdar</p>                         | <p>Completed (2018-2021)</p> | <p><a href="https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html">https://news.miami.edu/stories/2018/10/new-ulink-awards-focus-on-climate-change-risks.html</a></p> |
| <b>Dynamic Communication of Weather Risk: A User-centered Design Approach</b>  | <p>The project is aimed at effective visual communication of forecast risk and uncertainty, including probabilistic information and hazard threat levels. Complicating factors include multiple hazards during the same event, the dynamic nature of the risk over multiple space and time scales, and disparate abilities of the public to accurately interpret the information and accordingly make decisions. The problem will be addressed via a mixed-methods, integrated approach drawing on diverse disciplines. A primary goal is to establish a translatable process for NOAA to harness public feedback to rethink and redesign weather risk graphics, and to evaluate the new visualizations.</p> | <p>Sponsor: NOAA<br/>Partners: NCAR, NWS, OAR</p>  | <p>Sharan Majumdar, Kenneth Broad, Alberto Cairo, Scotney Evans, Barbara Millet</p>                         | <p>Ongoing (2022-2023)</p>   |  |

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| <p><b>Advancing Interdisciplinary Research on the Microbiome to Optimize Health</b></p>  | <p>Understanding the role that abnormalities in the microbiome—the large, diverse populations of bacteria, viruses, and fungi that occupy almost every surface of the human body—play in the development and progression of chronic diseases, beginning with HIV/AIDS.</p>   | <p>Sponsor: U-LINK</p> | <p>Adam Carrico, Sabita Roy, Maria Alcaide, Hansel Tookes, Savita Pahwa, Xi Chen, Michael Antoni, Vera Spika</p> | <p>Ongoing (2018-)</p> |  |
| <p><b>Climate Gentrification: Designing a comprehensive assessment tool of historical, social, and geographic factors to guide actionable and equitable neighborhood resilience</b></p>          | <p>Miami is “ground zero” for two of the nation’s most pressing issues: housing affordability and climate change. Through this project, we will investigate how climate consequences such as sea level rise, flooding, and extreme heat are the latest in a long line of forces contributing to displacement for residents in historically under-resourced neighborhoods. Our work would aim to outline the specific attributes of climate gentrification to demonstrate how it differs from traditional gentrifying impacts. As opposed to the loose, blanket application of this term, a rigorously researched definition and set of indicators ultimately empowers advocates and policy makers with a more refined understanding of climate gentrification to render potent and actionable solutions.</p> | <p>Sponsor: U-LINK</p> | <p>Robin Bachin, Imelda Moise, Abigail Fleming</p>   | <p>Ongoing (2022-)</p> |  |
| <p><b>Using community-engaged research to launch climate change resilience from an inclusive design beachhead starting with Southeastern Floridians living with spinal cord injury (SCI)</b></p> | <p>Resilience in S.E. Florida increasingly requires diverse preparations and actions to reduce impacts of extreme weather and climate events, as well as daily exposures to heat, high-tide flooding, reduced water quality, and other hazards.<sup>4</sup> There is also growing awareness of the capacity for adaptive measures that protect those most vulnerable to climate impacts to yield wide-ranging, cost-beneficial, and empowering benefits across society. We will simultaneously innovate an educational module for the UM Climate Resilience Academy, support internships with community partners for students interested in SCI and climate resilience, and develop learning resources for design, medical, public health, and resilience practitioners.</p>                                 | <p>Sponsor: U-LINK</p> | <p>David McMillan, Katherine Mach, Trevor Green, Joanna Lombard</p>  | <p>Ongoing (2022-)</p> |  |



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| <b>Untold stories at risk: Coastal heritage, site risk assessment, and educational outreach</b>   | Scholars have recently begun estimating and planning for the impacts climate change will have on heritage resources in regions around the world. The Coastal Heritage at Risk Task Force (CHART) team is a partnership of public, private, academic, and government entities. CHART's aim is to create visibility of at-risk coastal heritage sites and their untold stories in Florida for secondary education classrooms and the public, while also assessing site risk for future adaptation strategies.   | Sponsor: U-LINK   | Meryl Shriver-Rice, David Scheidecker, Clay Ewing, Allison Schifani, William Pestle, Sara Ayers-Rigsby, Jeff Moates   | Ongoing (2022-) |   |
| <b>Climate change, natural and man-made disasters: Impacts on the environment and human health</b>  | The application is focused on the effects of natural and man-made disasters (e.g., environmental pollution) on the redistribution of environmental toxicants in the environment that provides the hazard to the health of exposed communities. Specifically, we are focusing on the susceptibility to emerging infectious diseases, which provide one of the biggest threats to human health and the global economy. The long-term goal: To provide solutions that increase public health resilience advancing knowledge through the proposed work on combating the effect of climate change and natural disasters on pollution and the emergence of pathogens. | Sponsor: U-LINK   | Michal Toborek, Sylvia Daunert, Sapna Deo, Natasha Schaefer-Solle, Brian Haus, Marc Knecht, Mitsunori Ogihara, Alberto Caban-Martinez, Dushyanatha Jayaweera, Ali Habashi, Bryan Page | Ongoing (2022-) |   |
| <b>ECO-CBET: Design of Electrocatalytic Net-Zero Water Treatment for Percent Reductions in US Energy Demand</b>                                   | We are developing a new economical, chemical-free, treatment system to directly recycle 100% of municipal wastewater, saving 2.5% of total US energy, producing fertilizer, and saving 45,000 US cancers/year.  | Sponsor: National Science Foundation, Environmental Protection Agency<br><br>Stakeholders: Electric Power Research Institute                            | James Englehardt, Luis Pestana, GeCheng Zha, James Coakley  | Pending         |   |
| <b>Electrohydromodulation Nutrient Recovery for Municipal Water Management: Phase 1 Bench-Scale Design and Demonstration and Phase 2 Scale Up</b> | We demonstrated 90% recovery of nitrogen and phosphorus from settled sewage as fertilizer, while disinfecting and purifying the water, and are now demonstrating at single-home scale to address septic failures.   | Sponsor: Electric Power Research Institute, EnviroTrust LLC, Florida Dept. of Environmental Protection<br><br>Stakeholders: Miami-Dade County taxpayers | James Englehardt  | Ongoing ()      | <a href="https://coemiamiedu.wordpress.com/nutrient-recovery/">https://coemiamiedu.wordpress.com/nutrient-recovery/</a> |

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| <b>Adaptation Infrastructure and Property Values</b> | Analyzing 170+ coastal infrastructure projects designed to alleviate sea level rise, flooding, and/or storm surge and 400K+ property transactions. Finds that property values around projects rise after completion and almost all pass benefit/cost test. Conference presentations and invited seminars including UCLA, City of Miami, North Bay Village, and the Assn of Env. and Resource Economists | Sponsor: U-LINK<br><br>Stakeholders: City of Miami and Miami-Dade County to help evaluate infrastructure decision making. | David Kelly, Renato Molina | Ongoing (2019-) | Working paper: <a href="http://moya.bus.miami.edu/~dkelly/papers/KellyMolina8-29-20.pdf">http://moya.bus.miami.edu/~dkelly/papers/KellyMolina8-29-20.pdf</a>  |
| <b>Coastal Fortifications and Gentrification</b>     | Using data on income and relocations for every MDC resident, the project will determine how coastal protections, which cause rental prices and housing prices to rise, lead to gentrification.  | Stakeholders: City of Miami and Miami-Dade County.  | David Kelly, Renato Molina | Ongoing (2020-) | <a href="https://thehill.com/opinion/energy-environment/520158-climate-gentrification-and-affordable-housing-policies">https://thehill.com/opinion/energy-environment/520158-climate-gentrification-and-affordable-housing-policies</a> |
| <b>The Value of Hurricane Forecasts</b>              | Project will create a high-resolution spatial hurricane forecast error index, which will be linked to resilience expenditures (e.g. sandbags, evacuations), to derive the value of improved hurricane forecasts.  | Sponsor: NOAA<br><br>Stakeholders: coastal cities and counties.   | Renato Molina              | Ongoing (2020-) |   |
| <b>Hurricane adaptation and insurance markets</b>    | Preliminary work shows that FL made regulatory decisions after the 2005 hurricane season that limited property insurance price increases, which in turn reduced a market risk signal. The project will show that households undertook less adaptation and resilience measures and more coastal construction, relative to a counter-factual where insurance prices rose.                                 | Stakeholders: Property insurance industry, FL insurance regulators (FLOIR).   | David Kelly                | Ongoing (2018-) |   |

## APPENDIX

This list of projects has been compiled by Sharan Majumdar, Brian McNoldy, Ijeoma Adele, Amy Clement, Rudy El-Khoury, David Kelly, Antonio Nanni, and Joan St. Onge, with help from many Deans and Faculty (University of Miami).

The projects are at different stages of their evolution. Some projects have been ongoing for 3+ years or have recently been completed, whereas others are just beginning or pending sponsorship. With a few exceptions, each of these projects is typically funded for 2-3 years at a time, before either finishing or receiving additional funding. Funding sources are primarily from the Federal government (especially the National Science Foundation or NSF), and the University of Miami's Laboratory for Integrated Knowledge (U-LINK), with other funding from foundations, businesses, and national and local agencies. U-LINK provides seed funding for projects for 2-3 years, after which the project leaders are required to seek funding outside UM to continue their projects. Further details on the U-LINK projects are available on <https://ulink.miami.edu/projects/index.html>.

The list of projects will continually change. As current projects conclude and new projects begin, future versions of the list will be provided