College of Design, Construction and Planning

UF DCP Research Agenda-Setting White Paper

Building Coastal Futures

DCP Resilient Communities and Infrastructure Working Group

Executive Summary:

The Building Coastal Futures (BCF) initiative is a collective effort spearheaded by the College of Design, Construction, and Planning (DCP) at the University of Florida (UF), with input from our many schools, departments, and research centers including the Florida Institute for Built Environment Resilience (FIBER). Many ongoing initiatives have the potential to synergize faculty efforts that could position DCP as the global leader in coastal resilience research, design, training, and service within the next ten years.

To achieve this ambitious goal, BCF employs a transdisciplinary approach that integrates expertise from diverse fields across our college and integrates contributions from a larger UF-wide network of experts. This approach is particularly crucial given the complex and multifaceted challenges confronting coastal regions, demanding innovative solutions that extend beyond traditional disciplinary boundaries.

WG Members:

	Name	Title	Affiliation
Lead PI	Jeff Carney	Director, FIBER	Architecture, UF
Members	Abhinav Alakshendra	Associate Professor	Urban & Regional Planning, UF
	Jules Bruck	Professor	Landscape Architecture, UF
	Andrea Galinski	Assistant Professor	Landscape Architecture, UF
	Kate Norris	Associate Professor	Geoplan, UF
	Hal Knowles	Instructor Assistant Professor	Sustainability & the Built Environment
	Cleary Larkin	Assistant Professor	Historic Preservation, Urban & Regional Planning
	Jiayang Li	Assistant Professor	Landscape Architecture, UF
	Jason Von Meding	Associate Professor	Construction Management, FIBER
	Bill O'Dell	Director	Shimberg Center for Housing Studies, UF
	Lisa Platt	Assistant Professor	Interior Design, FIBER, UF
	Karla Saldana Ochoa	Assistant Professor	Architecture, UF
	Ryan Sharston	Assistant Professor	Architecture, Construction Management, FIBER, UF
	Mike Volk	Research Associate Professor	Landscape Architecture, UF
	Yan Wang	Assistant Professor	Urban & Regional Planning, FIBER, UF

This white paper highlights and further articulates the pivotal role of DCP in coastal resilience initiatives at UF, highlighting its diverse range of disciplines and expertise that are essential for developing comprehensive and sustainable solutions to coastal challenges. DCP's involvement is integral to UF's success in addressing these challenges.

Florida Context + Challenges

Florida's 8,436-mile coastline1 is increasingly threatened by the impacts of climate change and coastal hazards. The state is grappling with a convergence of challenges that jeopardize economic well-being, public health, and environmental integrity in coastal regions with repercussions felt state-wide. Primary impacts include:

- **Flooding**, driven by rising sea levels and extreme weather events, poses a costly challenge for coastal communities. Chronic tidal flooding and episodic storms damages homes and businesses, cripples infrastructure, and disrupts daily life. Saltwater intrusion also impacts ecosystems, agriculture, and infrastructure. The economic toll is substantial, as businesses struggle to operate and residents face potential displacement.

- **Coastal erosion** threatens Florida's iconic beaches and undermines the coastal economy. The loss of the coastal edge not only diminishes tourism, but also weakens the natural defenses that protect coastal communities from storm surge and flooding.

- **Degraded water quality** due to pollution from stormwater runoff, agricultural activities, and wastewater leaching, contaminates the state's water resources and disrupts marine ecosystems and poses a threat to human health and recreational value of coastal areas.

- **Legacy building construction** is a significant vulnerability for Florida's population. While advances in the building code, materials, and design have made newer structures safer- hundreds of thousands of legacy buildings remain, leaving millions of Floridians at an increased risk. Further, a significant portion of the state's affordable housing is found throughout Florida's coastal counties, which is often more vulnerable and difficult to replace after disaster impacts. For example, 7 of the 8 largest counties by population in Florida are coastal, which contain 482,000 low-income, cost-burdened renter households.

- **Aging infrastructure** like roads, bridges, and stormwater systems pose significant risks to public safety and the economy, as the state grapples with the mounting costs of repair and replacement.

- **Rapid population growth** adds to the complexity of these challenges. An influx of approximately 1,000 new residents each day places an additional strain on coastal resources, amplifying existing challenges and increasing the number of people exposed to coastal hazards while inflating the costs of housing. Of the single-family home sales in 2023, 8 of the top 10 were in coastal counties.

The urgency of addressing these and many more interconnected challenges underscores the need for innovative solutions that transcend disciplinary boundaries and integrate expertise from across DCP. This *BCF* initiative focuses on developing and implementing design solutions, fostering technological innovation, and nurturing a skilled workforce equipped to tackle the issues confronting Florida's coastal regions.

Areas of Expertise + Research Priorities Across DCP

The proposed RCN will synthesize diverse perspectives to create holistic solutions for DCP faculty play a key leadership role in providing a unique breadth of expertise critical for tackling multifaceted coastal resilience challenges.

Academic Units

- **School of Architecture:** The architecture faculty contribute to a range of essential research components including robust building materials, low and zero energy building research, resilient neighborhood design, and much more. Faculty specializing in AI, play a key role in developing data-driven tools for disaster preparation, response and mitigation. For example: detecting changes in satellite imagery before and after a disaster, embedding carbon sequestration metrics into land-use planning tools, or creating structurally viable 3D forms from text prompts, AI becomes a natural extension of our approach to design. Moreover, ARCH faculty develop interfaces to leverage VR and AR tools to demonstrate and explore options in real-time. The SoA's work through research and robust community engagement to encourage the design of buildings and infrastructure that can withstand the impacts of storms and other coastal hazards.

- **Department of Interior Design:** Interior design faculty, specializing in sustainable and supportive design play a critical role in creating interior spaces that prioritize occupant safety, comfort, and well-being in response to regionally specific climatic conditions and in wake of coastal disasters. Research and instructional faculty expertise in environmentally responsive materials, furnishings, fixtures and equipment, smart home technologies and construction techniques is vital for advancing knowledge in fostering occupant health, promoting ecological sustainability, and minimizing building recovery costs post-disaster. These efforts contribute to the development of resilient and adaptable interior environments that enhance the safety, health, and resilience of buildings, spaces in coastal communities.

- **School of Landscape Architecture:** Landscape architecture faculty lead efforts in coastal planning and design, with a focus on nature-based solutions. Faculty expertise include conservation planning, design of living shorelines, floodplain management, and landscape performance/valuation of ecosystem services. Integrating both environmental and social dimensions, faculty explore how coastal landscapes are perceived and function, and how green infrastructure can be used to reduce climate risks and support healthier communities and ecosystems.

- **Department of Urban and Regional Planning:** Urban and regional planning faculty address housing and infrastructure challenges and contribute to the data and analytical capacity we have to manage large urban systems through GIS, AI, and sophisticated modeling. This expertise will be crucial in developing resilient urban and regional solutions adapted to the specific needs of coastal communities facing sea level rise, storm surge, and flooding.

- **Rinker School of Construction Management:** This expertise is vital for ensuring that infrastructure and buildings are designed and constructed to withstand coastal hazards, but also for interrogating the development process itself, which often creates additional risk. By incorporating resilience considerations into construction, Rinker Faculty contribute to reducing physical vulnerability, but must also engage critically with how design and development practices may reproduce social and spatial inequalities. Their work thus sits at the intersection of technical capacity and the politics and economics of risk distribution in coastal communities.

- **Sustainability in the Built Environment:** SBE defines sustainability as an experience-based, value-derived, decision-making process to maintain desired social-ecological system states within spatial and temporal boundaries. Leveraging green building protocols, systems thinking principles, and resilience theory and practice, faculty and students explore wicked problems and their potential management strategies along the natural-to-urban transect. SBE applies a holistic and generalist approach that requires students to cope with complexity, adapt to uncertainty, and demonstrate an understanding of the interdependencies between the goals of sustainability and the activities of the built environment disciplines, including architecture, building construction, historic preservation, interior design, landscape architecture, and urban and regional planning.

- **Historic Preservation Program:** An interdisciplinary faculty in the Historic Preservation program bridges Urban and Regional Planning, Architecture and Interior Design. Research and teaching are community-based and focused on the state's historically, socially, and culturally significant communities, often on the coasts or adjacent to Florida's many rivers. The Historic Preservation program address critical questions at multiple scales: from materials conservation to buildings to neighborhoods and regions. Recent projects have included a partnership with the College's GeoPlan Center to create a GIS database for vulnerability assessments that include historic resources; surveys and documentation of neighborhoods in Jacksonville that are affected by storms; outreach and support for the community of North Port St. Joe, hit by Category 5 Hurricane Michael in 2018; and annual on-site research in St. Augustine for the State-owned historic properties through our Preservation Institute St. Augustine (PISA) materials conservation lab.

Research Centers + Institutes

There are a number of centers and programs within DCP that contribute their unique expertise to the RCF initiative. These include:

- **The Florida Institute for Built Environment Resilience (FIBER):** FIBER seeks to build knowledge at the intersection of research, application and lived experience around ideas and innovations that foster built environment resilience. Our faculty come from across DCP.

- **Shimberg Center for Housing Studies:** The Shimberg Center works closely with state agencies, local governments, and our peers at University of Florida and other Gulf Coast and national institutions to learn how Florida's vulnerable populations and housing stock can be kept safe from natural disasters. For example, the Center and Florida Sea Grant have launched a research project to characterize the link between water-dependent businesses and affordable housing.

- **Center for Landscape Conservation Planning:** The Center conducts applied research on conservation and land use, nature-based recreation, and green infrastructure design. This includes the role of coastal ecosystems and conservation in increasing resiliency, and upland land uses in maintaining water recharge, storage, and filtration services that support upland and coastal communities.

- **GeoPlan Center:** This center's expertise in spatial data analysis and decision support tools will provide critical data and insights for developing comprehensive coastal resilience plans, incorporating transportation and urban growth.

- **Center for World Heritage Research & Stewardship:** This program's focus on historic preservation of endangered coastal structures, buildings, and communities is helping to reimagine what preservation means in an environment undergoing profound change.

Solutions and Methodological Considerations

1. Collaboration and Integration

Transdisciplinary collaboration is a core principle supporting DCP collaboration around resilience. This collaborative spirit is evident in the structure of our many projects and grants, which brings together faculty to break down traditional silos. Through the BCF initiative, DCP will expand upon these efforts through a series of initiatives that can eventually lead to larger and more complex collaborations:

- **Joint Degree Programs:** Starting from the development of a "resilient urban design degree," we will provide students with interdisciplinary training, combining the strengths of DCP to offer expertise in the planning and

design of coastal resilience. These programs will equip students with the necessary skills and knowledge to address the complex challenges of coastal resilience, preparing them for careers in this rapidly growing field.

- **Research Center Collaboration:** Centers from across DCP are collaborating on initiatives including developing Florida's Digital Twin, Florida Resilient Cities (FRC) program, the Florida Wildlife Corridor, historic preservation partnerships, and more. These projects leverage expertise across various disciplines in DCP and across UF, including coastal and environmental engineering, hydrology, urban planning, landscape architecture, architecture, and AI, to create a comprehensive digital model of Florida's coastal systems.

2. Technology Innovation and Transfer

Developing and transferring technologies through patents and commercialization will bolster DCP's commitment to coastal resilience and our effectiveness. The initiative's focus on integrating design, construction, and planning will lead to the development of sustainable and impactful solutions, ensuring the safety and well-being of coastal communities. For example, AI-driven scenario planning software offers significant benefits for enhancing resilience in the built environment, particularly in the face of climate change and natural disasters enabling improved forecasting and risk assessment, enhanced decision-making and resource optimization to support building adaptive design capabilities.

- **BCF Technologies:** Examples of technologies that BCF aims to develop include urban digital twins, storm-resistant structures, energy efficient systems, resilient material assemblies and more. Technologies and novel processes will play a critical role in enhancing the resilience of coastal communities, enabling them to better prepare for, respond to, and recover from coastal hazards.

- **Service to Professions:** Skills, assemblies and techniques developed through BCF will immediately serve our industry through partnerships, student internships, and PhD level research. Centers, Institute, and departmental professional advisory boards should work to leverage this work.

- **Technology Transfer:** Focus on accelerated technology innovation and transfer, ensure that the technologies developed through CP initiatives are effectively disseminated and implemented in real-world settings. This focus on technology transfer will ensure that core discoveries of research translating into practical solutions is recognized.

3. Workforce Development

DCP is committed to workforce development through all levels of higher education across its interrelated fields working on coastal resilience.

- **International, Experiential Learning-Based Workforce Development:** DCP programs are developing joint degrees focused on hands-on training and international exposure that strategically blends DCP's strengths. Programs including the Resilient Urban design degree, SBE, and others test ways to augment and accelerate the role of traditional departments. The focus on experiential learning will provide students with real-world experience and prepare them for careers in coastal resilience.

- **International Scholar Exchanges:** DCP has substantial international scholar exchanges to facilitate the exchange of ideas and foster collaboration with leading coastal resilience programs worldwide including abroad programs for our students and programs like the Fulbright which brings faculty to UF. These exchanges provide students and faculty with opportunities to learn from international experts and gain valuable insights into global best practices in coastal resilience. BCF efforts will help to correlate these efforts.

WG's Strengths, Weaknesses, Opportunities, and Challenges:

Strengths	• Faculty with coastal resilience expertise (architecture, landscape, planning, historic preservation, etc.) • Active research centers (FIBER, GeoPlan, Shimberg, CLCP)	• Existing siloing of colleges and departments across UF • Limited institutional incentives/mechanisms to coordinate and sustain large-	Weakness

	already working on resilience projects • Long history of strong local partnerships, community engagement, and applied research • Innovative use of technologies (AI, GIS, VR/AR, Digital Twins) for resilience planning • UF resources like network of Florida Sea Grant and IFAS agents	scale interdisciplinary efforts in the long-term • Need for more visibility within UF and across national/international research networks • Workforce development and joint degrees still in early phases or proposal stage • Dispersed leadership could dilute momentum without central coordination	
Opportunities	• Become a national model for coastal resilience through BCF initiative • Procure large-scale research funding from federal and state agencies • Launch and expand joint/interdisciplinary degree programs to train the future coastal workforce • Leverage increasing state funding for research/technical analyses, resilience projects, and plan development • Build a brand that will expand national and international partnerships, researchers/scholar exchange	• Extreme weather events and climate change effects are increasing (sea level rise, flooding, heat) • Persistent social and spatial inequities in hazard exposure, mitigation, and disaster recovery across Florida • Coordinating policy and research across diverse stakeholders and jurisdictions • Uncertainty of federal funding	**Challenges**

In conclusion, the College of Design, Construction, and Planning will play a key role in building the future coast of Florida. DCP's expertise across its diverse disciplines, its commitment to collaboration and integration, its focus on technology innovation and transfer, its dedication to workforce development, and its efforts to enhance its visibility will be instrumental in achieving our goal of establishing UF as a global leader in coastal resilience.