Salty Urbanism: Towards an Adaptive Coastal Urban Design Framework to Address Sea Level Rise

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Coastal areas face a gamut of environmental threats that span across spatial and temporal scales and involve collaboration among many disciplines. Participants range from practicing architects and planners negotiating site, infrastructure and architectural issues, to researchers involved in modeling climate, sea level rise and urban development patterns along coastal corridors. The complexity of environmental issues, as well as the diversity of disciplines and methodologies involved, present substantial barriers to establishing integrated solutions that might be possible within a more collaborative and comprehensive framework. Parallel to this, coupling ecosystem services with urban development is at obvious odds with current planning and zoning regulations. The situation summons creative approaches on how to retrofit architecture and planning to address paradigm-shifting threats of storm surge, sea level rise, and fluctuating rainfall and runoff patterns. Defending against water encroachment from all directions is a particularly unique challenge of South Florida (Fig. 1), making it a good candidate for development of an adaptation framework that can be appropriated by coastal communities.

Salty Urbanism develops an integrated research and pedagogical approach that envisions and quantifies the experiential and ecological outcomes of alternative development pathways in response to flooding events that are a result of rising sea levels (projected six feet by 2100)[1]. These outcome scenarios consider an inevitable future of saturated landscapes and integrate research models that accommodate a variety of best management practices, green infrastructure tools (Fig. 2), and alternative urban design and architectural concepts to be implemented over time. An interscalar approach that fosters urban solutions at the scales of individual lots, public rights-of-way, and neighborhood proved an appropriate point of departure to manage the potentially awkward intersections of knowledge and to more effectively cross-reference the multiple interdependencies and challenges of urban and natural systems. The integration of design practice, speculative studio environments and interdisciplinary research was leveraged to develop a framework for designing adaptive coastal communities in the wake of rising sea levels, while at the same time preparing emerging professionals for the inevitable future challenges facing their disciplines.

Figure 1. “King Tide” tidal flooding in low-lying area of Las Olas Boulevard, Fort Lauderdale. Jeffrey Huber.

PROJECT

Figure 2. Soft Shoreline Infrastructure Menu. FAU.

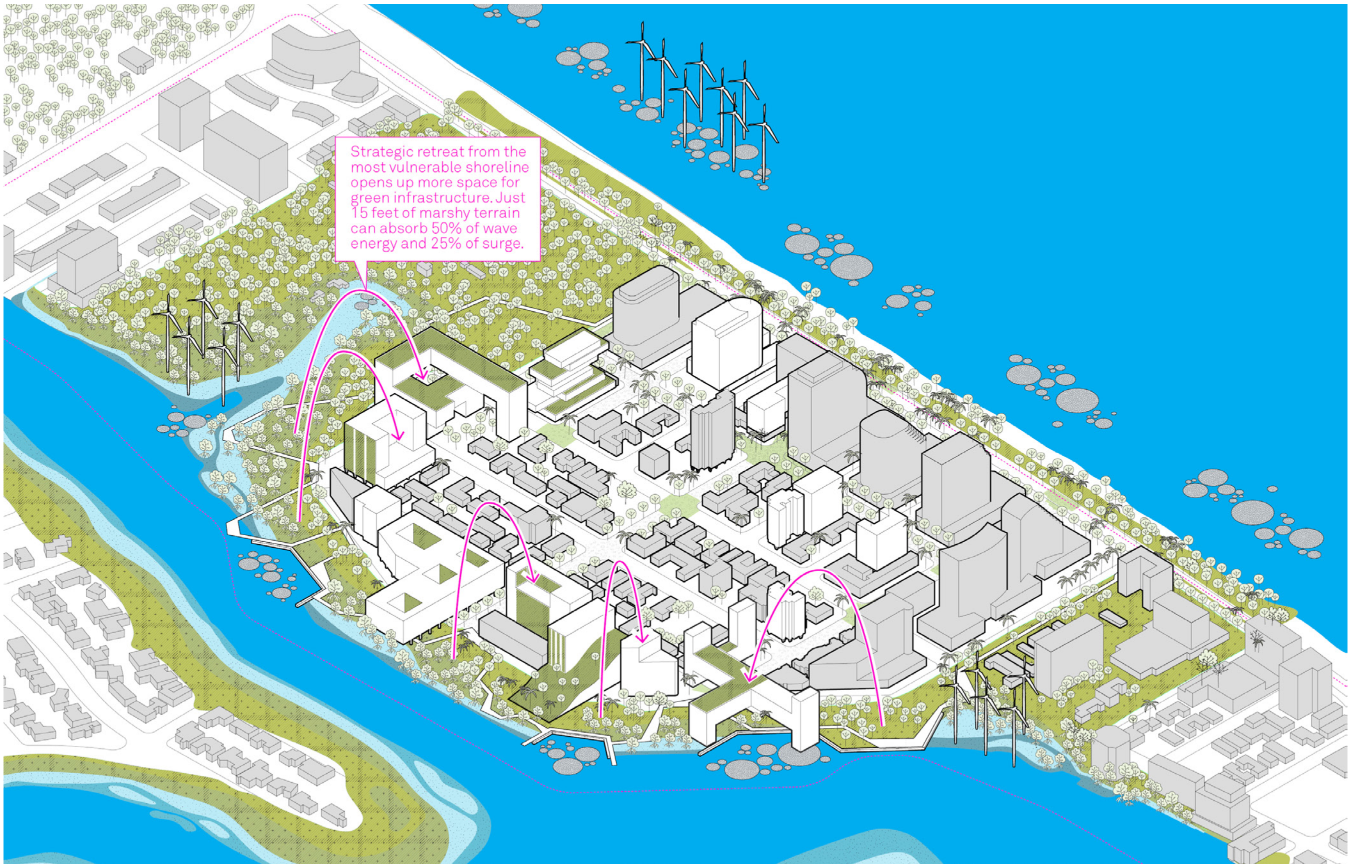

Figure 3. Soft Defense Scenario. FAU.

Four design studios at three schools of architecture across the nation collaborated to envision future adaptation scenarios. Utilizing alternative planning scenarios, with results from asset modeling and a matrix of soft and hard engineering technologies, scenarios were explored through design visioning for North Beach Village, a small barrier-island neighborhood enclave in Fort Lauderdale. A robust set of strategies emerged that link ecological and urban design thinking. The proposals re-think preconceptions about conventional infrastructure, since most students are unaware or have never designed for these complexities. Although some radical proposals were produced, they were plausibly comprehended by stakeholders – an indication of the severity of risk facing coastal areas, a threat increasingly recognized by experts and laypersons alike. The following is a general assessment and description of design outcomes within each scenario thinking.

"Soft Defense Scenario" (Fig. 3) combined strategies of both hard and soft engineering to mitigate impacts of rising seas and non-point source pollution from urban runoff allowing current development to remain largely unaltered. Installation of living shorelines, as well as bioswales and rain gardens in the street rights-of-way created high-tide gardens with salt-tolerant, halophytic landscapes and pervious paving systems. (Fig. 4) These saltwater landscapes become "biopumps" with phreatophytic vegetation—long-rooted trees that transpire significant amounts of water for hydraulic control, thereby reducing the time streets are flooded. Architectural strategies include allowing first floor levels to be designed to flood – a strategy already finding its way into building codes and architectural typologies in coastal areas.

"Strategic Retreat Scenario" (Fig. 6) accepts a lateral shift in urban footprint and develops a gradual removal of urban development through relocation to higher ground on the coastal ridge. Thus, a retreat enables naturalizing low-lying areas (Fig. 5) and intensifying urban development on higher ground through Transfer of Development Rights. This includes soft-engineered solutions that can be implemented over time as "rewilding" in both public and private properties (Fig. 7). Through these scenarios, students participated in policy and regulation discussions as they pertain to the built environment and lifestyles of residents, thereby promoting awareness to the numerous politically sensitive issues that will factor in many adaptation strategies in coming decades. Policy and recommendations included a "Department of Unplanning" that can manage urban decommissioning. Additionally, amphibious and floating structures would be proposed within rewilded areas.

Figure 4. Botanized street with rainwater gardens. FAU.

Figure 5. Rewilded area with living shoreline. FAU.

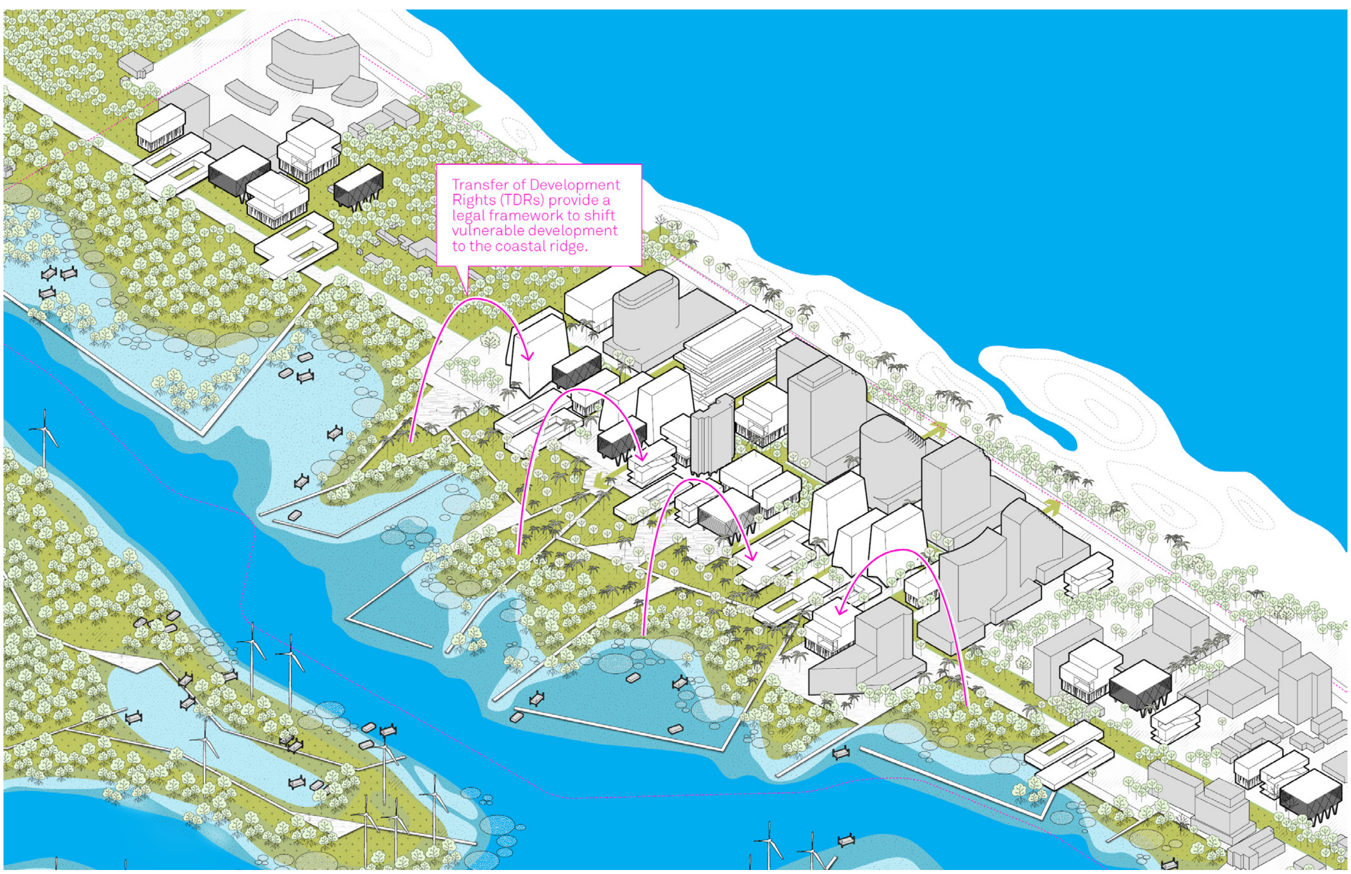

Figure 6. Strategic Retreat Scenario. FAU.

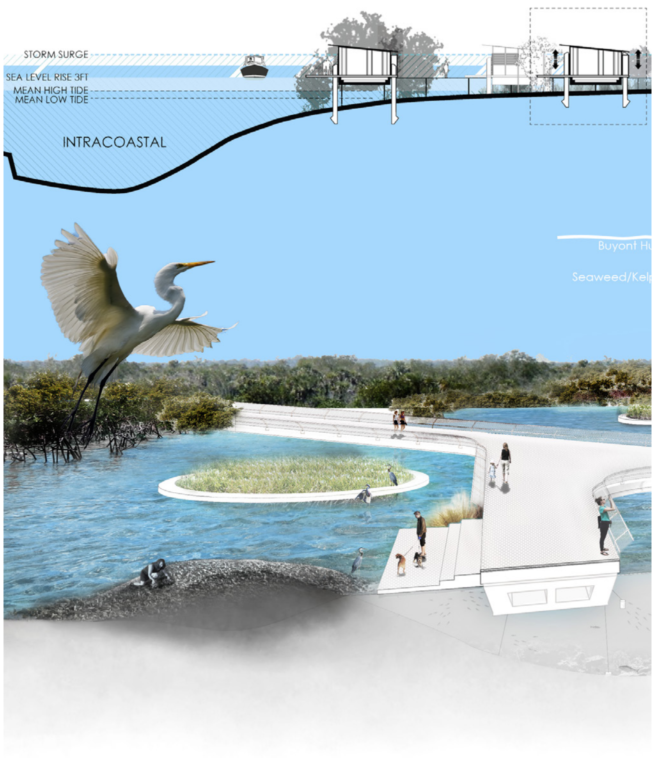

Figure 7. Rewilded area with amphibious structures. FAU.

Figure 8. Land Adjustment Scenario detail. FAU.

"Land Adjustment Scenario" (Fig. 10) reformats buildings, blocks, and streets into an idealized urban and ecological morphology approach. Unconventional building types that showcase raised platforms for habitation, floating structures, and submerged living units with a transition to more water-based transportation systems were explored. (Fig. 8) Micro-grid distributed power-generation plants and neighborhood-scaled utility systems would be implemented in order to create resilient and redundant infrastructure as neighborhoods become more disconnected from mainland services.

The development of integrated place-building models, like *Salty Urbanism*, engage socio-environmental development and collectively yield a new ecology of the city necessary to address the greatest ongoing challenge to planning and design: ecological design within human-dominated ecosystems.[2] By adopting ecological terms, architecture and planning can achieve greater resilience and retool themselves with the ability to adapt to changing conditions. It is at this juncture that *reconciliation ecology*[3] and urban design, provides a framework for innovation. Beyond composition, ecological thinking requires logics of assembly where timing, interactivity, sequencing, componentization, and recombination constitute another aesthetic and utilitarian intelligence. Urban design projects bring problems involving community-scaled systems that work in tandem to ecological and social resiliency.[4] *Salty Urbanism* provokes a policy platform to change prevailing development codes which have diminished both urban and ecosystem services. *Salty Urbanism* forms a path toward permittable structures and infrastructure, albeit in a simplified form. (Fig. 9) Likewise, urban design and the architectural profession might serve as leaders to navigate substantial barriers and establish a more collaborative framework. Integration of research, practice and education—coupled with community partners and public interest design—may be the norm, rather than the exception, as urban areas face increased uncertainty resulting from environmental and social challenges.

ENDNOTES

1. Bloetscher, Frederick "Tools for Assessing Sea Level Rise Vulnerability," (Journal of Water and Climate Change 6, no. 2 June 2015). 181–190.
2. Rudolf Steven de Groot, "Environmental Functions and Economic Value of Ecosystems," in Investing in Natural Capital: The Ecological Approach to Sustainability, eds. Ann Mari Jansson et al. (Washington DC: Island Press, 1994)
3. Rosenzweig, Michael. Win-win Ecology, How the Earth's species can survive in the midst of human enterprise. (Oxford, UK: Oxford University Press, 2003)
4. Prough, Thomas and Costanza, Robert. Natural Capital and Human Survival (Solomons MD, USA: ISEE Press, 1995).

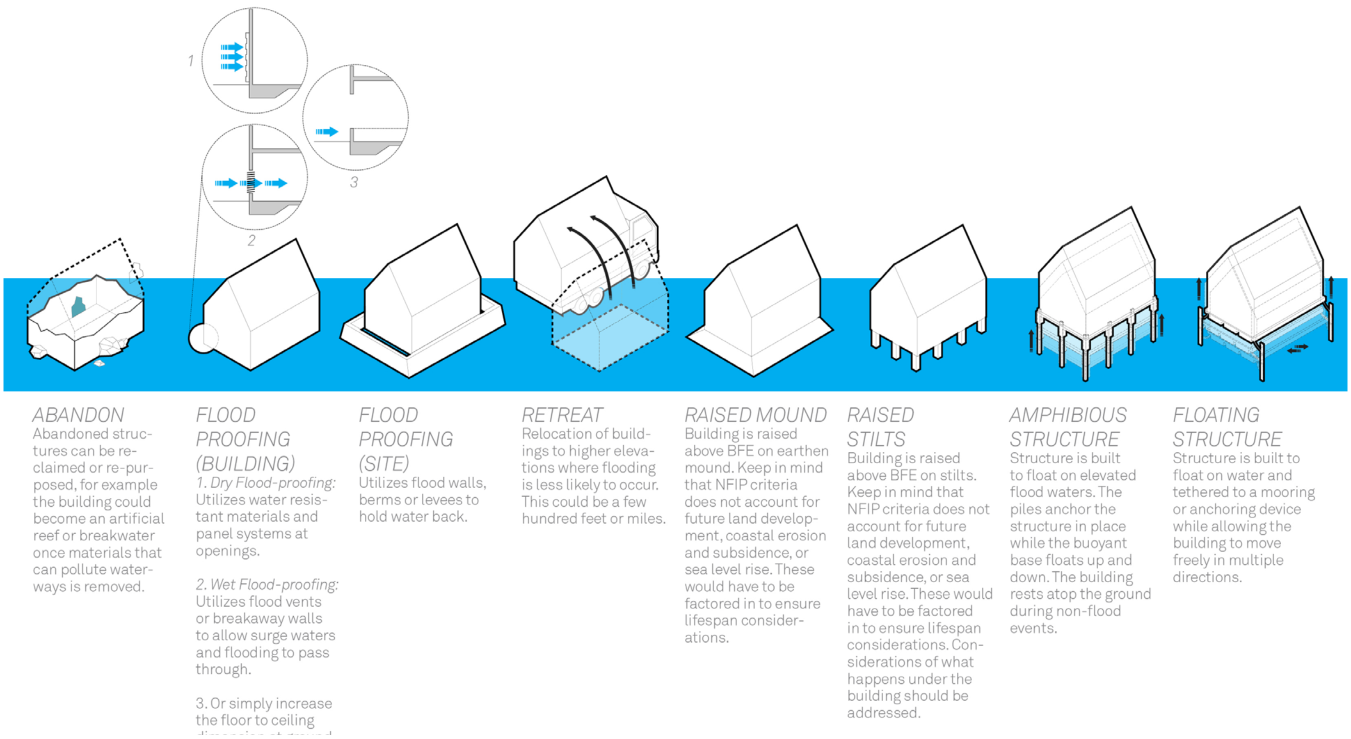

Figure 9. Flood-Adaptative Architecture Menu. FAU.

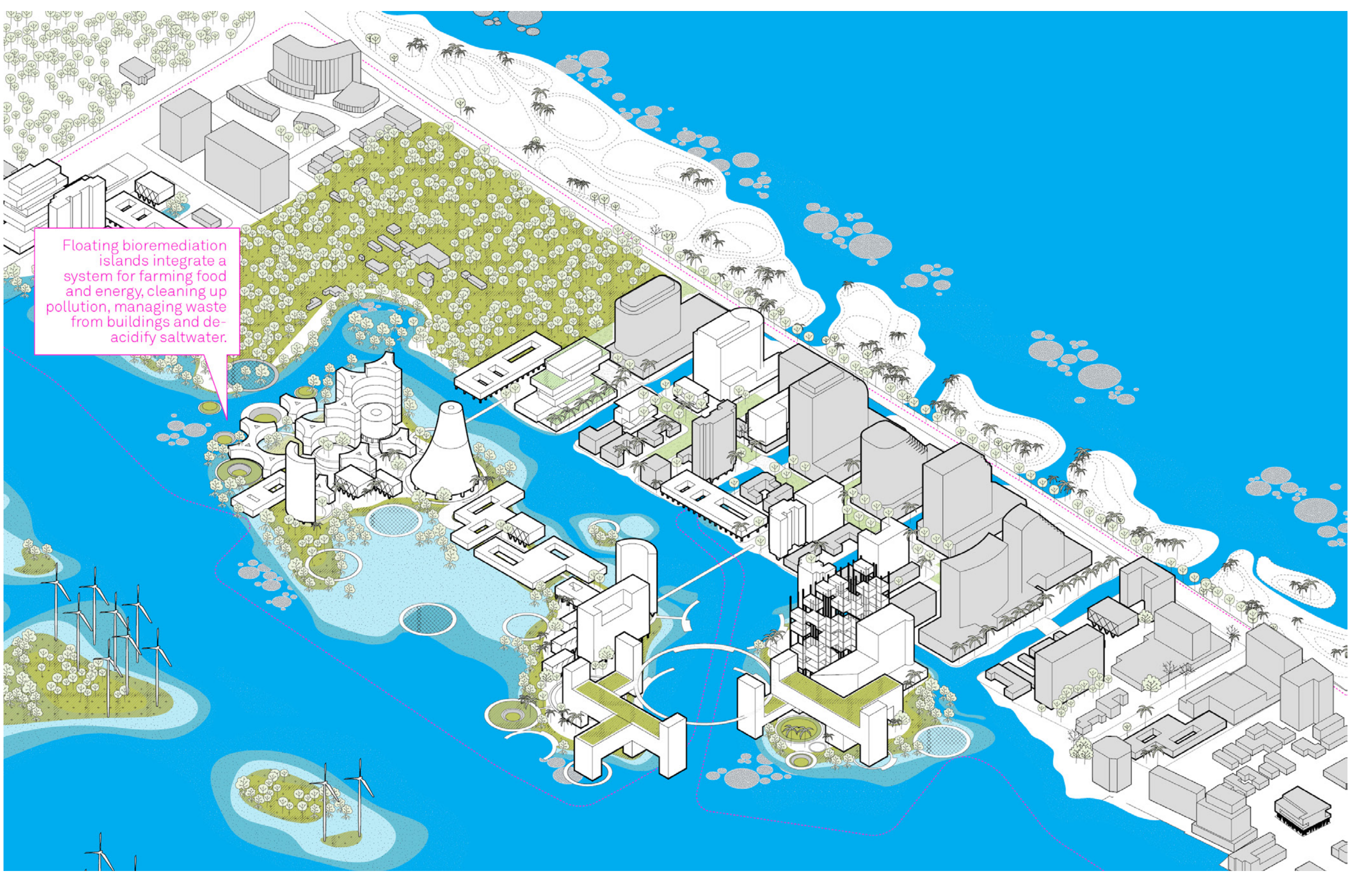

Figure 10. Land Adjustment Scenario. FAU.