

## Mobility: Strategy for a New Coastline

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Coastal regions are increasingly affected by coastal flooding events associated with land loss as a consequence of sea level rise, erosion, land subsidence, storm surge, and other coastal processes. These flooding events have resulted in damage and loss of vital natural habitats and man-made infrastructure. In many coastal communities, infrastructure losses are affecting the wellbeing and safety of residents and increasing the physical and social vulnerability in these geographical areas. Because the population is still increasing in coastal areas, there is potential for an increase in exposure and flood risk to both episodic events, such as hurricanes, and long-term sea level rise.

To promote the wellness and conservation of natural resources and the ecosystem services they provide, it is important to delineate planning interventions that will align land management with the dynamics of the coastal environment. The sustainability of coastal habitats over longer time scales (decades to centuries) is influenced by the combination of: (1) the ability of the habitats to maintain elevation relative to the mean tidal height, and (2) the ability of habitats to migrate landward as mean water levels increase with rising sea level. Coastal ecosystem migration is a natural process that occurs in response to inundation. However, in today's developed coastline the amount of open "accommodation space" available for the upland migration is limited (Schuerch et al. 2018, Nature). The loss of coastal vegetative habitats and their protective capacity as a buffer from storm surges will expose human settlements to more severe impacts of coastal hazards. Therefore, communities will need to address this emerging challenge through selection of an appropriate mobility strategy, namely, protection, accommodation and relocation.

We propose a **RESEARCH OPPORTUNITY** that will support the interdisciplinary research



needed to better understand the coastal relocation/retreat options as a planning strategy to protect natural and human resources in coastal areas. The overarching research question defining this research cluster is: "How will we as a nation support development of mobility strategies for people and natural habitats to adjust to increasingly flood-prone coastal areas?"

### **Research Recommendations:**

1) As a part of this study it is important to rethink the "managed retreat" terminology and identify more empowering positive phrases such as planning relocation, strategic advancement,

moving up, and advancing to higher ground. This could be achieved by focus groups or similar stakeholder engagement events to remove the stigma of “retreat”, increase public acceptance of a mobility option, and to create broad-scale buy-in and adoption by various stakeholder constituents moving forward. Currently, there is no consensus on the use of terminology and it is not fully clear how it may be perceived by different stakeholder groups.

2) Design creative solutions to synchronize the co-migration of natural environments and the human-built coastal dimensions. For example, generate land-use plans to allow for upland migration of natural habitats into accommodation space created by the relocation of homes and businesses away from the most vulnerable coastal areas. This will require interdisciplinary and transdisciplinary research to: a) forecast areas of inundation and understand the propagation of risk and vulnerabilities in response to coastal flooding; b) develop and promote solutions and proactive approaches for adjusting the footprint of development to accommodate changes in both the natural and built environments; and c) monitor and evaluate the impact of this approach on the surrounding human and natural environment to assess sustainability, effectiveness, and social integrity. This approach may be aligned with planning through a conceptual framework to promote natural resource conservation, economic development, and social justice.

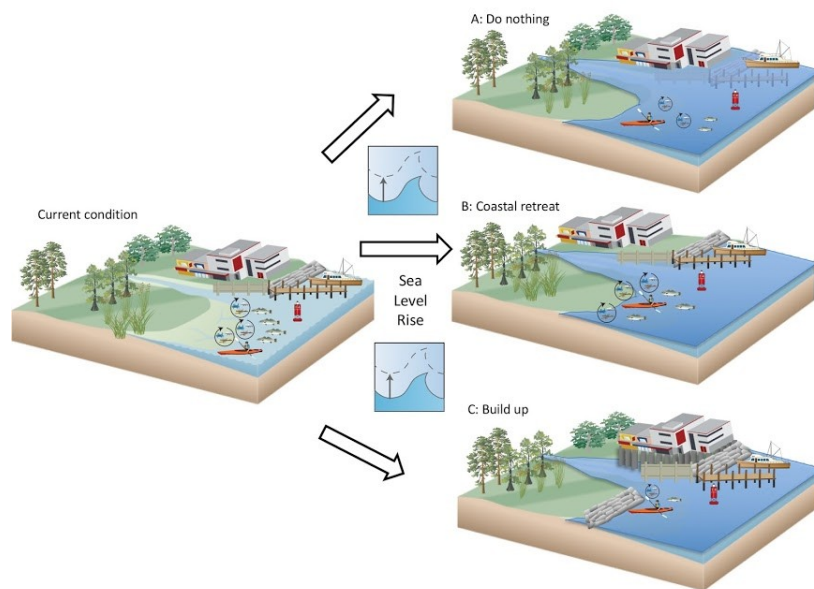
3) Develop scenarios that illustrate the trade-offs with various options for adapting to coastal change. As an example, a 2017 special issue of AGU Earth’s Future contains examples of science-based scenarios of how sea-level rise will likely affect a number of Gulf of Mexico coastlines. Similar projects are now required to address specific local community level impacts around the nation tailored to a range of different mobility outcomes that may include protection, accommodation, and/or relocation.

4) Identify potential policy mechanisms and incentives that are transparent, equitable, and sustainable by using case study analysis and social science methodology to understand how people make the decision to relocation/retreat to a safer area. For example, qualitative analysis could help identify barriers and opportunities for development of relocation support mechanisms

that would reflect contextual human and community dimensions in different coastal settings (e.g., norms, culture, values, attitudes, and beliefs).

**Impacts and Value:**

The impacts of this proposed research opportunity will more explicitly define future coastline conditions under which coastal habitats may be less extensive and provide fewer ecosystem services than in the past. Coastal habits provide protection from high water and storm surge because they help to reduce wave energy and coastal erosion, providing protection for built infrastructure such as houses and roads. Loss of these natural habitats with sea level rise, erosion and



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subsidence increases the risk of catastrophic structural damage during storm events, and hence, increases the cost of insuring, rebuilding, or relocating property along the coastline. Mapping and modeling products and future scenarios need to be refined and scaled appropriately to communicate these various risks effectively to communities and individuals, thereby empowering them to make more informed decisions.

This research activity must also engage vulnerable and disadvantaged populations (e.g., disadvantaged urban residents and rural population that live off ecosystem services) in co-production of knowledge by accounting for their perspectives and experiences in identification of research questions and methodological design. Community participation will be important to

Different mobility options that can be adopted by communities to adapt to the realities of new coastlines. Protection of both built and

delineate mobility options according to their social and economic circumstances. This strategy may be performed in collaboration with government and academia.

The research generated from this opportunity will promote peer-to-peer learning through networking among vulnerable communities so that they can share concerns, challenges, and potential solutions. Learning examples come from coastal communities that have been forced to adjust to land loss, demographic changes, loss of amenities, and in a few cases the abandonment of entire communities. These examples from both the U.S. (e.g., coastal settlements in Alaska and Louisiana, and small island communities in Chesapeake Bay) and from international locations (e.g., low-lying island nations including Marshall Islands and Seychelles) provide case studies that other communities can learn from. To facilitate learning and communication, a community of practice should be encouraged. This would provide vulnerable communities with an opportunity to engage others in similar circumstances to share experience in development of workable practical solutions.

Fundamental and applied research is required to develop, refine, and provide decision-making tools and robust science-based empirical evidence to support strategic planning in coastal areas. These may include, but are not limited to, spatial hazard identification and communication, risk assessment and socio-economic cost analyses, novel geospatial mapping and modeling tools to better simulate processes driving change in both natural and human-dominated landscapes, and integration of these approaches into user-friendly and actionable products, webtools, mobile device apps, and other appropriate information transfer opportunities. To facilitate these activities, we propose the incorporation of an information exchange so that scientists can provide the essential data and research results that can be used to develop information products so they are readily accessible to coastal managers and decision-makers, practitioners, as well as concerned citizens.

The research products arising from this proposed opportunity will ultimately develop a framework to help design effective and customized mobility pathways tailored to individual coastal communities that will allow them to understand the underlying processes, impacts, and proactive strategies that can be taken to maintain the many values of coastal areas and avoid future catastrophic losses.