



## Coastal Adaption Strategies: Integrating Science and Policy

Coastal communities face multiple threats from climate change and have traditionally used vulnerability assessments to identify the areas most exposed to climate-related hazards. However, most of these assessments stop short of identifying the adaptation strategies that are the most feasible or suitable to deploy at site-specific locations. Using California as a model, Stanford researchers assembled an interdisciplinary team to bridge the existing knowledge gap between climate science, law and policy to provide practical comparisons and reveal the tradeoffs and true implications of various coastal adaptation strategies.

Their efforts resulted in a prototype interactive online portal (<http://marineapps.naturalcapitalproject.org/california/index.html>), a tool which allows users to select a geographic location, apply a filter to delineate types of potential adaptation strategies (engineered, financial, legal/regulatory), and view the benefits alongside the tradeoffs for each aided by a series of topic-specific briefs (<https://oceansolutions.stanford.edu/coastal-adaptation-policy-briefs>).

### Points for Policymakers

The team of legal and spatial analysts, ecologists, technologists and community engagement specialists developed a novel science-policy approach to coastal adaptation that can assist planners in aligning potential strategies with place-specific implementation locations along the California coast. Most notably, the team was able to identify enabling and limiting conditions, giving planners the ability to determine optimal scenarios that are the most feasible (physically possible) or suitable (legally or socially appropriate) adaption strategies.

Key results of this research and benefits of the interactive tool include:

- ▶ *Providing municipalities with a better understanding of the most optimal, location-specific strategies which can help planners avoid conflicts before they occur.* Understanding in advance where local governments could implement strategies, such as conservation easements, dune restorations, or redevelopment restrictions, is helpful.



- ▶ *Applying strategies adopted in California communities could transfer to interests at the state, national or international levels.* Having an interactive online tool can help planners more precisely determine how to attain maximum co-benefits through placement of site-specific adaptation solutions now and as scenarios change in the future.
- ▶ *Identifying opportunities to amend current laws and policy to better facilitate coastal adaptation actions.* Programs and regulations at the state and local levels could be changed to clarify certain ambiguities as well as to strengthen the authority of responsible agencies or organizations.
- ▶ *Helping to avoid legal controversies with a place-specific approach, especially where public spaces border private coastal properties.* Local governments generally want to avoid litigation and property rights issues. They often face dual priorities that include the need to protect people and property from the effects of climate change while minimizing legal controversies over land usage and property rights.

## Background

The gap between science and policy in coastal adaptation solutions has long been acknowledged, but a successful methodology for bridging that divide has been elusive. Coastal vulnerability studies, which are the most widely used planning and projection tools, do not directly link the science to specific, preferred place-based policies and often fail to offer up actionable science. To address this missing linkage, a multi-disciplinary approach and team was formed at Stanford to develop a methodological framework that leverages climate and ecosystem sciences to enable or advance coastal adaptation planning. As a way to ensure the project's investigative assumptions were on target, the team directly engaged with individuals in local governments, including cities and counties, as well as state government agencies. These in-depth meetings further helped guide the team's research towards particularly relevant topics.

The team discovered that while state agencies and other higher-level organizations can employ hybrid and more long-term approaches, local coastal planners benefit from practical comparisons between competing adaptation strategies. Having access to relevant policy briefs and the online portal (<http://marineapps.naturalcapitalproject.org/california/index.html>) with a prototype interactive tool like the one developed for this project allows planners to consider the physical tradeoffs and legal considerations to implementing any specific set of strategies while also



providing them with ongoing examples of best practices in variable environments. By spanning the boundary between climate science, adaptation planning and land use policy, the tool helps support state- and county-level agencies tasked with evaluating the feasibility of different adaptation strategies as well as local planners considering a smaller subset of options in specific locations.

This research provides results that can inform climate adaptation planning at local scales in California now, and offers the opportunity to transfer the methodologies and tools to the state, national and international levels in the future. But ultimately, climate adaptation planning will remain an issue that local communities and regions must address directly to meet their individual needs. Having an articulated framework such as the one outlined in this project will help to ensure quality decision-making processes with actionable alternatives, clear values and tradeoffs, and meaningful information are available to planners.

This California-based project analyzed issues under currently existing laws and policies to develop a model that can be translated to other locations. It also revealed that there are significant opportunities for policy changes that could foster coastal adaptation. Specifically, the Coastal Act might be amended to clarify ambiguities or even strengthen the California Coastal Commission's authority to deal with these issues. Similarly, the National Flood Insurance Program (NFIP) could be modified

to no longer incentivize rebuilding in increasingly precarious locations, possibly through the Community Rating System which lowers flood insurance premiums in communities that proactively reduce vulnerability to flood damages. Streamlined permitting processes for nature-based adaptation strategies, such as preserving open space or restoring natural habitat, could also promote implementation where appropriate. Finally, policymakers could enact legislation that features inherent adaptive capacity mechanisms and principles (often referred to as "adaptation pathways") to accommodate uncertainty.

### About the Authors

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