Building Long-Term Coastal Resilience: A Framework for Managing Shoreline Retreat in California

Identification

Proposers

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Project Proposal

Objectives

The California Coastal Commission and the UCSB Ocean and Coastal Policy Center seek to achieve the following objectives.

1. Identify the factors that must be considered when evaluating managed retreat strategies.
2. Design an interdisciplinary framework for determining priority areas for managed retreat that can be replicated by local coastal planners, informed by case study analyses.
3. Evaluate the conditions under which implementation of managed retreat through a buyout-lease back financing program may be viable, with a focus on cost-effectiveness, social equity, and non-market value.
4. Provide recommendations on remaining information needs and next steps.

Implications

Adapting to sea level rise (SLR) with holistic, equitable, and long-term coastal management strategies has become a top priority for California and one of the State's most pressing challenges posed by climate change (OPC, 2024). By 2100, sea levels along California's coast are projected to rise between 0.3 and 2.0 meters, influenced by cumulative greenhouse gas emissions and the accelerated loss of the Greenland and Antarctic ice sheets (Bamber, 2022; Sweet, 2022). Rising seas, coupled with more frequent and intense storms, are already reshaping California's coastline and will increasingly threaten the unique ecosystems, critical infrastructure, and livelihoods of coastal regions under plausible future emission pathways.

To address these vulnerabilities, local SLR adaptation plans commonly include a combination of hard protective structures like seawalls or revetments and softer interventions like sand replenishment and living shoreline approaches (Lester et al., 2023). While these protective measures are often the most politically acceptable options because they help to safeguard property and the regional tax base, some come with significant ecological and social trade-offs (CCC, 2018; Lester et al., 2023; Schooler, 2017). Hard structures, in particular, contribute to coastal squeeze by preventing the natural inland recession of the shoreline, leading to loss of habitat, recreational space, and protective functions of the ecosystem (IPCC, 2019). In contrast, managed shoreline retreat — an approach that involves the planned relocation of infrastructure and development away from vulnerable coastal areas — offers long-term ecological and recreational benefits by allowing natural coastal processes to persist, like cliff erosion, beach replenishment, and inland migration of shoreline features. Despite these advantages, this strategy is rarely included in local adaptation plans, due to public resistance, substantial upfront costs, and lack of clear, actionable guidance for local planners on where and how to implement it effectively (Lester et al., 2022; Lester et al., 2023). Public acceptance of managed retreat, however, is likely to be higher for properties that will inevitably become unviable due to repeated flood or erosion damage, as ongoing repair costs eventually reduce property values to zero. Identifying such high-risk locations is critical for ensuring cost-effective investments in retreat and building community support for its implementation.

In an effort to address upfront costs of managed shoreline retreat in California, Senate Bill 83 and Senate Bill 1079 proposed revolving loan programs designed to facilitate the buying and leasing back of vulnerable coastal properties by local jurisdictions. This financing program aims to provide local jurisdictions with a financial mechanism to acquire at-risk coastal properties, allowing continued occupancy or use until retreat is necessary, while offsetting costs through lease revenues and preserving local tax bases.These bills were quickly passed by the state legislature but ultimately vetoed due to concerns about the lack of a clear implementation plan (Office of the Governor 2021; Office of the Governor 2022). Resistance to these bills highlights the need for a comprehensive strategy that would provide local governments with the guidance and resources to effectively manage such programs in an economically viable, ecologically sensitive, and socially equitable manner that ensures their long-term success.

This project aims to address these needs by identifying the criteria under which managed retreat may be viable and by creating a structured planning framework for the approach tailored to California's unique coastal typologies. Central to this analysis will be a focus on competing values, such as balancing the preservation of popular recreational and ecologically important beaches against the economic and social costs to property owners. By integrating lessons from key case studies, this project will offer actionable insights to inform local and state-level decision-making and has the potential to serve as a model for other coastal states facing similar pressures posed by SLR.

Equity

In California, the central justice and equity dimension addressed by managed shoreline retreat is the equal right to, and loss of, public coastal resources. Sea level rise threatens environments such as beaches, tidal wetlands, and shoreline access that are essential for recreation, and cultural and spiritual practices (OPC, 2024). Prioritizing the protection of private shoreline property through protective or accommodating grey infrastructure will accelerate erosion of these public goods. Some of the most expensive real estate in the state is located along the coast. To the benefit of wealthy property owners, the loss of public access disproportionately impacts less wealthy and resourced inland communities, as well as Indigenous communities who were historically displaced from their coastal territories. Alternatively, managed retreat offers an opportunity to reallocate coastal parcels for the public's benefit. By supporting initiatives like land-back and co-management programs, and promoting long-term beach and wetland resiliency, managed retreat strategies address key coastal equity concerns regarding public access. However, they also raise important equity considerations related to the varying adaptive capacities of local communities, the distribution of adaptation and loan program benefits, and the potential displacement of vulnerable populations. These considerations will be incorporated into the framework developed by this project to equitably protect the public's connection to California's unique and vulnerable coastal environments.

Available Data

This analysis will largely use data from the public databases listed below.

- Redfin sale price data
- Census tract level land values from Davis et al. (2021)
- CalEnviroScreen 4.0
- Coastal California Environmental Justice Mapping Tool

- Coastal Storm Modeling System (CoSMoS)
- NOAA Coastal Flood Exposure Mapper
- California Coastal Records Project
- California Coastal Commission Open Data
- The Nature Conservancy California's Wild Coast Modeler
- California Aquatic Resource Inventory

Data developed by the Ocean and Coastal Policy Center for the California Beach Resiliency Plan (CBRP) may also be used in the analysis, as it becomes available.

Possible Approach

1. Conduct a literature review focusing on past and current examples of shoreline retreat to identify key social, economic, and environmental factors that are potentially affected by managed retreat.
2. Map the identified factors along California's coastline (as feasible) and develop coastal typologies to categorize subregions by geomorphology, asset vulnerabilities, and social and ecological values at risk.
3. Use the mapped factors and typologies to select representative communities for case studies. These case studies will evaluate the factors to develop criteria for determining priority managed retreat areas and assess the feasibility of implementing a revolving loan financing strategy. One important element of public acceptability and the terms of a loan contract is the risk faced by property owners. Our case study analyses will build on the framework developed by Danziger and Plantinga (2024) to estimate reduction in asset values associated with SLR. We will extend the model to include broader social and ecological values and trade-offs that may be supported by the financing program, such as an increase in the social benefits of managed retreat (Young, 2020).
4. Synthesize insights from the case study analysis into a guidance framework for local coastal planners to assess feasibility and guide planning for managed shoreline retreat.

Deliverables

In addition to the required Bren School deliverables (i.e. a final report, executive summary, and final presentation), this project will produce one or more of the following:

- A user-friendly and interactive online mapping tool designed to guide local planners through the managed retreat framework.
- A guidance document tailored to local planners that could include a step-by-step decision-making framework or decision-tree to assist in determining when and where retreat may be the most viable strategy, best practices for integrating social equity and ecological considerations, and recommendations for leveraging the buyout-leaseback financial program.

Internship

The California Coastal Commission is committed to hosting one intern from the project team (likely to be selected by the team itself) during Summer 2025. The internship is well defined and will be funded. The Ocean and Coastal Policy Center will "most likely" offer an internship, but it is not well-defined and funding is unclear at this time. See client letters for more details.

Supporting Materials

Citations

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Budget and Justification

Andrew Plantinga has a UC Lab Fees grant on coastal wetlands restoration that can provide support for site visits to the locations selected for case studies.

Client Letters of Support

Client letters of support are included at the end of this proposal.

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Master of Environmental Science (MESM) Group Project Committee
Bren School of Environmental Science and Management
University of California, Santa Barbara

January 10, 2025

Re: Project Proposal – Building Long-Term Coastal Resilience: A Framework for Managing Shoreline Retreat in California

Dear MESM Project Review Committee,

The Coastal Commission is pleased to express its support for and commitment to the project proposal "Building Long-Term Coastal Resilience: A Framework for Managing Shoreline Retreat in California."

Since its inception, the Coastal Commission has been committed to protecting and enhancing California's coast and ocean for present and future generations through careful planning and regulation of environmentally-sustainable development, rigorous use of science, strong public participation, education, and effective intergovernmental coordination. Looking to the future, a major challenge to this mission will be the impacts that sea level rise and climate change have on our coastline. The ability to effectively ensure continued access to the shoreline, safe and thriving coastal communities, and protection of coastal habitats will require thoughtful consideration and identification of a range of adaptation strategies to be implemented across the coast over a variety of planning horizons. One such strategy – managed retreat – may be the best, or in some locations only, option for ensuring long-term protection of coastal resources, yet it has become extremely contentious and raises significant, political, legal, economic, and logistical challenges.

Implementing managed retreat in appropriate locations, circumstances, and timelines and in a manner that will be economically viable, ecologically sensitive, and socially equitable will necessitate careful planning. The proposed project aims to advance this type of planning work by identifying key criteria relevant to assessing where managed retreat may be most viable and most likely to provide needed coastal resource protection. It will also include development of a structured planning framework, informed by case studies and tailored to California's unique coastal typologies, to determine priority areas for managed retreat that can be replicated by local coastal planners.

The Coastal Commission will support this project through ongoing mentoring and coordination with project participants throughout the project. Commission staff will work with the chosen project participants to set up preferred coordination and communication options, likely including routine project check-ins, review of project materials, and similar. The Commission is

also committed to hosting an intern from the project team (likely to be selected by the team itself) during Summer 2025. In addition to primarily focusing on the proposed project, the intern would be integrated with the Commission's Statewide Planning Unit Sea Level Rise team, with opportunities to shadow statewide planning and other Coastal Commission staff, participate in recurring team and other relevant meetings, and, depending on interest, capacity, and timing, contribute to relevant ongoing sea level rise planning work at the Commission. The Commission can pay $20.86 - $22.52/hour (depending on the number of graduate credits completed) to support the intern for a period not to exceed 3 months.

We appreciate the committee's consideration of this project and would be excited to work with students from the Bren School, if selected. Please feel free to reach out if additional information is needed.

Sincerely,

Kate Huckelbridge, PhD
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UC SANTA BARBARA
Ocean and Coastal Policy Center

msi
Marine Science Institute

January 10, 2025

Master of Environmental Science (MESM) Group Project Committee
Bren School of Environmental Science & Management
University of California, Santa Barbara

Subject: Project Proposal – Building Long-Term Coastal Resilience: A Framework for Managing Shoreline Retreat in California

Dear MESM Project Review Committee,

The Ocean and Coastal Policy Center (OCPC) is pleased to express its support for and commitment to the project proposal "Building Long-Term Coastal Resilience: A Framework for Managing Shoreline Retreat in California." OCPC is involved with policy research and advising concerning coastal resilience, with a particular emphasis on sea level rise adaptation planning and coastal management in California. As the director of OCPC, I have a special interest in the proposal, including as it relates to and would build upon core research and planning questions that are being developed under beach resiliency planning grant from the California Ocean Protection Council. As a former director of the California Coastal Commission, the proposal would address challenging shoreline management questions that I have been grappling with for some time.

The proposed project aims to evaluate one of the core issues of sea level rise adaptation planning by considering the factors and concerns that may shape a successful strategy of managed retreat for California. This topic has been a matter of critical public policy, political, legal, and social concern for more than a decade in our state. Notwithstanding, there is a strong need for the kind of detailed assessment and development of decision tools that is imagined by the proposed project if California is to successfully adapt to long-term sea level rise.

OCPC will support this project through mentoring the project participants, providing guidance and oversight of project activities, providing data available through the beach resiliency planning work of OCPC, and facilitating communications with the other primary client – the California Coastal Commission – as well as other active participants in California's coastal management arena. An internship will most likely be offered to one of the team members, but it is not well-defined, and funding is unclear at this time.

OCPC appreciates the committee's consideration of this project and would be excited to work with students from the Bren School, if the project is selected. Please let me know if additional information is needed.

Thank you,

Charles Lester
Director