

**Table 3. Recommendations for advancing equitable approaches to nature-based coastal adaptation and shoreline management in California.**

RECOMMENDATION	HOW
<p><b>1. Prioritize appropriate coastal adaptation in frontline and tribal communities, and invest in approaches that elevate community values and needs while maximizing social and environmental outcomes.</b></p>	<ul style="list-style-type: none"> <li>1.1. Embed social equity across all state coastal adaptation and shoreline resilience planning, policies, processes, and grant programs.</li> <li>1.2. Allocate at least 50% of funding or create dedicated grant programs for projects that directly and meaningfully benefit frontline communities and tribes.</li> <li>1.3. Prioritize providing technical assistance in frontline communities and tribes, and increase access to training and communication resources on nature-based coastal adaptation approaches.</li> <li>1.4. Support and expand collaborative networks and regional partnership around nature-based coastal adaptation planning and implementation.</li> </ul>
<p><b>2. Plan for meaningful engagement with frontline communities and tribes and incorporate their values and needs before, during, and after project implementation.</b></p>	<ul style="list-style-type: none"> <li>2.1. Support establishment and long-term capacity building at community-based and tribal-led organizations to increase their ability to engage in shoreline planning processes.</li> <li>2.2. Encourage projects to include community benefits agreements and require community engagement or needs assessments to help ensure projects reflect community values and needs.</li> <li>2.3. Broaden grant eligibility to include funding for community engagement, needs assessment, and outreach activities.</li> <li>2.4. Create a shared database of community plans and needs assessments related to climate adaptation and shoreline management to reduce the burden on communities.</li> </ul>
<p><b>3. Work to address broader structural inequities in California that impact frontline coastal communities and effective ocean and coastal policy and management.</b></p>	<ul style="list-style-type: none"> <li>3.1. Increase interagency, cross-jurisdictional coordination to address high priority environmental justice issues and other community-identified needs in parallel with advancing nature-based climate adaptation.</li> <li>3.2. Expand active and diverse representation and inclusion across coastal science and management.</li> <li>3.3. Include environmental justice practitioners and community representatives on agency advisory committees and boards, grant proposal review panels, and other decision-making bodies.</li> </ul>
<p><b>4. Define context-specific social equity goals early in the process and establish clear equity metrics to evaluate project outcomes.</b></p>	<ul style="list-style-type: none"> <li>4.1. Develop social equity metrics to inform design, monitoring, and evaluation of coastal adaptation projects.</li> <li>4.2. Invest in projects that include community-based participatory research and multidisciplinary project teams that bring together natural and social sciences, and the voices and perspectives of tribes and frontline communities.</li> <li>4.3. Continue to improve environmental justice community screening tools.</li> </ul>

**Table 3. Recommendations for advancing equitable approaches to nature-based coastal adaptation and shoreline management in California. (Continued).**

RECOMMENDATION	HOW
<p><b>5. Prioritize projects that improve access and stewardship by historically excluded frontline communities and tribes in California.</b></p>	<p>5.1. Prioritize projects that improve public access for all Californian’s in policy, funding and permitting.</p> <p>5.2. Assess barriers to tribal use and access of coastal spaces for ceremony, gathering, and subsistence, among both federally recognized and unrecognized tribes.</p> <p>5.3. Support opportunities to expand coastal resource co-management and land return to restore Indigenous knowledge, stewardship, and practices.</p>
<p><b>6. Incorporate traditional knowledge systems in coastal restoration policies and climate initiatives.</b></p>	<p>6.1. Increase funding for tribal-led coastal restoration and adaptation efforts.</p> <p>6.2. Convene collaborative discussions and establish co-management guidelines, partnership and/or policy agreements with tribes and tribal-led organizations around restoration baselines, Indigenous management practices, and opportunities to elevate TK systems within coastal restoration policies and climate initiatives.</p> <p>6.3. Support efforts to further understanding of when and where nature-based coastal adaptation approaches may reduce risk of sea level rise and other threats to cultural resources, ceremonial spaces, and archeological heritage sites within the marine landscape.</p>
<p><b>7. Evaluate potential gentrification outcomes of projects and incorporate displacement avoidance strategies where appropriate.</b></p>	<p>7.1. Analyze potential gentrification risk and outcomes from coastal adaptation planning projects and incentivize inclusion of displacement avoidance strategies.</p> <p>7.2. Explore opportunities to pair nature-based coastal adaptation funding with broader climate and equity initiatives that support local communities and businesses.</p> <p>7.3. Promote avenues for frontline community ownership and management of living shoreline project sites and initiatives.</p>
<p><b>8. Incorporate inclusive education and workforce development opportunities into project implementation.</b></p>	<p>8.1. Leverage increasing federal and state investments in coastal resilience and nature-based solutions to support new green job pathways in coastal restoration and living shorelines.</p> <p>8.2. Ensure socioeconomic benefits of living shoreline projects remain in nearby frontline and tribal communities.</p> <p>8.3. Support programs for youth that increase opportunities for all levels of education and promote community stewardship around living shorelines.</p> <p>8.4. Create pipeline training programs that lead to meaningful, living wage employment opportunities for participants.</p>
<p><b>9. Scale up investment in a strategic suite of living shoreline pilot projects and explore opportunities to reduce programmatic barriers to increasing living shorelines as a coastal adaptation tool.</b></p>	<p>9.1. Identify and invest in a priority set of coastal restoration pilot projects across diverse habitat types and performance measures.</p> <p>9.2. Develop and require monitoring and evaluation of human dimensions and social equity outcomes of coastal adaptation projects.</p> <p>9.3. Explore opportunities to reduce wait times and improve efficiency within California’s coastal adaptation and restoration granting and permitting agencies.</p>

**Table 4. Equity and nature-based coastal adaptation research needs and suggested methods for California.**

RESEARCH QUESTIONS	SUGGESTED METHODS
<p><b>1. What are the social equity outcomes associated with the spectrum of coastal adaptation responses?</b></p>	<ol style="list-style-type: none"> <li>1.1. Evaluate potential gentrification outcomes across the suite of coastal adaptation and shoreline management approaches using both community-centered and data-centered methods.</li> <li>1.2. Synthesize and develop human dimensions and social equity monitoring metrics for coastal adaptation and restoration projects.</li> <li>1.3. Develop a conceptual framework to assess tradeoffs in social equity and ecological outcomes across the suite of coastal adaptation responses. Apply the tool using place-based examples to understand trade-offs within the local context.</li> <li>1.4. Analyze social equity outcomes and trade-offs across the range of adaptation strategies and/or phased adaptation pathways in California to inform equitable responses to sea level rise in different contexts for frontline communities.</li> <li>1.5. Case study analysis of living shoreline’s impact over time to better understand community sense of place across various shorelines, including how coastal spaces are used and changed, including qualitative analysis (see LA River Digital Humanities Project)</li> <li>1.6. Expand human use and recreational data collection and modeling to better understand potential access and use of living shoreline habitats and how those may change over time</li> </ol>
<p><b>2. What are the frontline communities along or near California’s shoreline and the nature of shoreline management challenges in them? What would increase the capacity of frontline communities to pursue and implement nature-based strategies?</b></p>	<ol style="list-style-type: none"> <li>2.1. Improve existing tools for identifying frontline communities, including (a) exploring appropriate measures for representing interests or ancestral lands to identify risk to tribal communities, (b) context-specific vulnerability assessments, and (c) integration of existing mapping tools to better identify intersecting issues, for example pollution exposure and climate risk.</li> <li>2.2. Apply qualitative social science research and evaluation of existing projects to ground-truth learning from community screening tools and other community vulnerability assessments.</li> <li>2.3. Qualitative (e.g., community circles, conversations, storytelling, visioning) and/or quantitative public surveys of frontline communities along or near California’s shoreline to assess the nature of the shoreline management challenges, perceptions, and barriers to advancing nature based adaptation strategies; this process and information can be used as an entry point for adaptation planners to engage communities (see Mayatt-Bell et al., 2002).</li> </ol>
<p><b>3. What are the conditions under which living shoreline projects are ecologically and physically feasible as shoreline management approaches to plan for sea level rise and other climate impacts in California? Where do viable site locations intersect with frontline communities and vulnerable tribal heritage sites?</b></p>	<ol style="list-style-type: none"> <li>3.1. Develop an inventory of current living shoreline project types (including geographic coverage) to track progress and document learning across habitat types. This could leverage the EcoAtlas Wetlands, Beaches and Watersheds inventory.</li> <li>3.2. Analyze geographic placement and efficacy of existing and potential living shorelines relative to frontline communities to better understand distribution of benefits.</li> <li>3.3. Identify and design priority pilot projects for California related to living shoreline performance and benefits.</li> <li>3.4. Integrate frontline community vulnerability assessments and environmental justice screening tools with living shoreline habitat mapping and suitability models to inform citing of living shoreline projects and direct community outreach efforts.</li> <li>3.5. Pair spatial analyses with pilot projects to ground truth ecological and physical performance.</li> <li>3.6. Integrate learning from existing living shoreline projects and future pilot projects to develop consistent engineering methodologies and performance standards or practices for the range of living shoreline types in California.</li> <li>3.7. Evaluate state and local laws and regulations serving as barriers to implementing community based projects.</li> </ol>

**Table 4. Equity and nature-based coastal adaptation research needs and suggested methods for California. (Continued).**

RESEARCH QUESTIONS	SUGGESTED METHODS
<p><b>4. What is the distribution of current and historic coastal adaptation funding, including living shorelines, relative to frontline communities?</b></p>	<p>4.1. Analyze historic and current distribution of state, federal, local, and private coastal adaptation funding within/ adjacent to frontline communities and tribes in California to inform more equitable resource distribution.</p> <p>4.2. Analyze and understand equitable distribution of local, state and federal funds to underserved communities and tribes.</p> <p>4.3. Evaluate state and local laws and regulations serving as barriers to implementing community-based projects.</p> <p>4.4. Evaluate impact of past policy interventions to improve equity in coastal planning or restoration.</p>
<p><b>5. What are the opportunities to assess and/or incorporate knowledge of historic tribal uses/ habitats and project future restoration potential? How do histories of land usages and historical conditions shape future-oriented coastal adaptation efforts?</b></p>	<p>5.1. Expand research efforts that center traditional ecological knowledge and tribes within living shoreline and coastal adaptation projects.</p> <p>5.2. Community-led research initiatives documenting environmental history and community visioning.</p> <p>5.3. Partner with tribes seeking to develop or expand habitat and tribal resource maps to inform climate adaptation risk assessments and Include traditional uses prior to colonization.</p>
<p><b>6. What are the regulatory barriers and inequities that could be streamlined or amended within California’s permitting process for living shorelines?</b></p>	<p>6.1. Identify regulatory barriers to living shoreline adoption by surveying communities and agencies who interact with the regulatory process, building on recent analyses by Grenier et al, 2021.</p> <p>6.2. Analyze of inequities associated with existing regulatory frameworks and permitting structures.</p>
<p><b>7. What is the potential for workforce development within coastal adaptation and resilience planning efforts in California (including living shorelines)?</b></p>	<p>7.1. Analyze economics/costs associated with expected workforce transition (from climate-vulnerable careers) and job creations needed to achieve California’s climate change goals.</p> <p>7.2. Analyze socio-economic impacts, including job creation, from existing and future nature-based coastal adaptation projects.</p> <p>7.3. Evaluate existing career pipeline and educational training program outcomes within living shorelines and other nature-based coastal adaptation and resilience planning efforts.</p> <p>7.4. Evaluate opportunities to scale and support small and DBEs who are focused on expanding the opportunities for a more diverse and inclusive workforce.</p> <p>7.5. Research on just workforce transition of decommissioned coastal enterprises (e.g., agricultural operations, power plants).</p>