

Moving from Planning to Implementation

**Bridging Coastal Climate Science, Law, Policy,
and Spatial Modeling**

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Adaptation Planning in California

What have we heard from coastal managers?



Common Themes from Engagement Meetings

Where are we most exposed to climate hazards?

Where are people? Habitats? Infrastructure?

What options are available along our coastline?

How do I determine what is feasible, appropriate, or suitable?

What policy or legal factors limit or enable my options?

Adaptation Planning in California

Filtering options through spatially-dependent features

Spatially Relevant



Geomorphologic Features

Land Use / Zoning

Coastal Exposure

Habitat Presence

Protective Role of Habitat

Population Density

Non-Spatially Relevant

Cultural Attachment

“Not in my back yard”

Avoiding “Takings” Claims

Cost

Political Will

Community Vision & Values

*Jesse Reiblich; Lisa M. Wedding, Eric H. Hartge, *Enabling and Limiting Conditions of Coastal Adaptation: Local Governments, Land Uses, and Legal Challenges*, 22 Ocean and Coastal L.J. 156 (2017).*

Spatially Filtering

What spatial features enable my strategy of interest?

Geomorphologic Features

Land Use or Zoning Category

Habitat Presence

Protective Role of Habitat

Population Density

Exposure/Hazard Mapping



Potential Location for Dune Restoration Project

Connecting Strategies to Spatial Filters

How can we “code” these connections?

Initial Statement

Dune restoration strategies are effective where dunes are present; zoning types are residential, agricultural, parks/open space/public, or uncategorized; and geomorphology includes lowlands.

Coded Selections

Habitats			Zoning					Geomorphology			
Dunes	Wetlands	Eelgrass	Residential	Agricultural	Comm/Ind	Park/Open	Uncat	Blufftop	Beachfront	Estuary	Hard Coast
1	0	0	1	1	0	1	1	0	1	1	
MUST			CAN	CAN		CAN	CAN		CAN	CAN	

Structure Query Language (SQL) Statement

Selection = (dune=1) AND (resident = 1 OR ag = 1 OR park_open = 1 OR uncat = 1) AND (beachfront= 1 OR Estuary = 1)

Visualizing in Online Viewer

HABITATS

- Zoom map to each county
- Obtain summary of science and policy considerations
- Visualize at-risk locations and comparisons to other coastal CA counties

ZONING

- Map land cover and zoning by county
- View aerial photos from the Coastal Records Project

EXPOSURE

- Map scenarios of coastal exposure with InVEST
- Show exposure drivers within user-defined AOI

STRATEGIES

- Map suitable locations for each of four categories
- Click dot symbols to access legal guidance and links to additional online resources

Adaptation Strategies

What options are possible in coastal California?

Legal or Regulatory

Overlay Zones
Downzoning
Development Moratoria
Prohibit Seawalls
No Build Areas
Setback Requirements
Flood Hazard Regulations
Rolling Easements
Zoning Regulations
Redevelopment Restrictions
Density Limits
Time Horizons
Triggering Event Language

Engineered

Beach Nourishment, Restoration
Cliff Stabilization
Seawalls
Breakwaters
Jetties, Groins
Tide Gates
Revetments and Riprap
Elevating Structures
Dune Restoration
Wetland Restoration
Managed Retreat and Relocation
Living Shorelines
Inaction (decision not to act)

Financial

Catastrophe Bonds
Transfer of Development Rights
Buyouts/Buybacks/Leasebacks
Special Assessment for Vuln. Properties
Conservation Easements
Land banking
Geologic Hazard Abatement Districts
Amendments to the National Flood
Insurance Program

****NON-EXHAUSTIVE LIST****

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Spatially Distilled Selection of Feasible Options

Policy Brief List of Strategies

Engineered

- Beach Nourishment / Restoration
- Dune Restoration
- Elevation of Structures
- Living Shorelines
- Riprap
- Seawalls
- Wetland Restoration

Financial

- Buyout Programs
- Conservation Easements
- Geologic Hazard Abatement Districts
- Transfer of Development Rights

Legal & Regulatory

- Development Moratoria
- Overlay Zones
- Redevelopment Restrictions
- “Trigger” Language

Additional Topics

- Public Trust Doctrine
- Coastal Adaptation and Takings Law

Distilled Policy Analysis

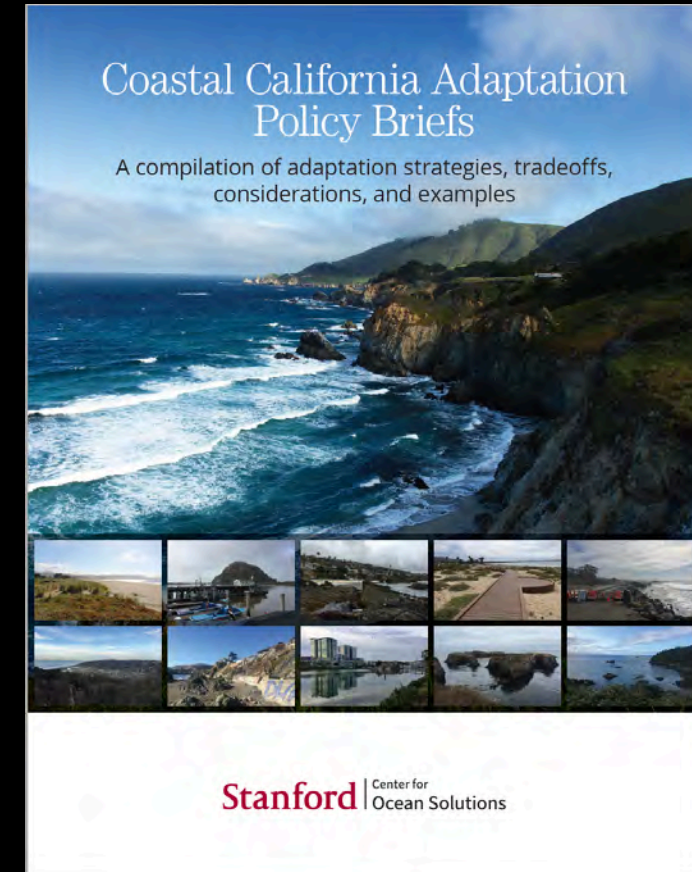
What information will help inform my decision?

Strategy Description

Tradeoffs

Legal Considerations

Examples in California or Beyond



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oceansolutions.stanford.edu/project-coastal-adaptation

natural
capital
PROJECT

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