

# Sea Level Rise & Coastal Impacts: Hazard Mitigation Planning & Climate Adaptation

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# Plan for today...

- Who is USC Sea Grant and how can we help?
- Quick overview of SLR
- Hazard mitigation and climate adaptation – How do they fit together?
- Lessons learned from around the country
- A bit on SLR & Storm modeling...more to come at next workshop
- Breakout exercise on mitigation/adaptation strategies

# USC Sea Grant – The Urban Ocean Program

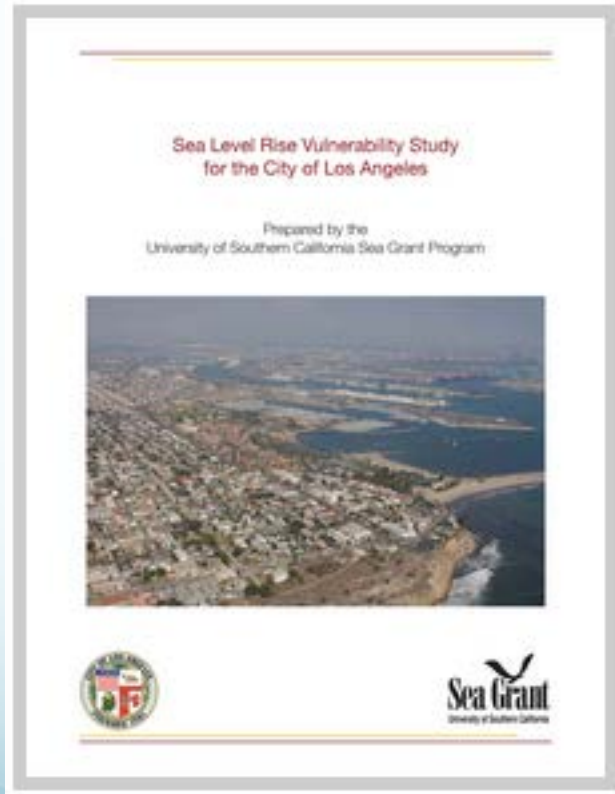


- Funds research
- Community outreach & education
- Technical assistance to local/regional government

## 10 Million by the Sea...

- Climate Change Science & Planning
- Coastal Ecosystem Science
- Coastal Management
- Maritime Affairs

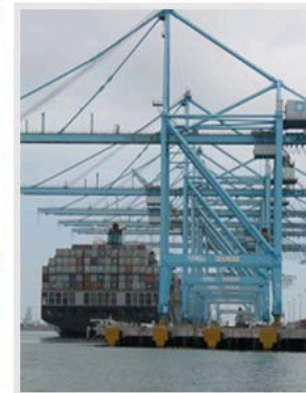
# USC Sea Grant – Climate Change & SLR Program



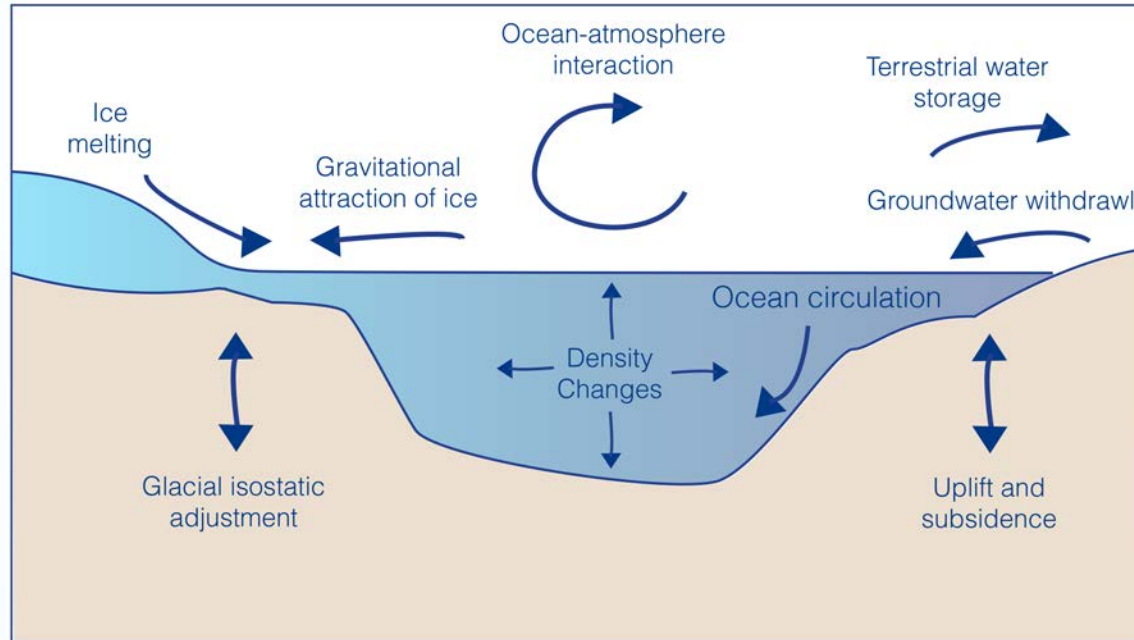
## Regional AdaptLA: Coastal Impacts Planning in the Los Angeles Region

[Focus Areas](#) > [Climate Change](#) > [AdaptLA](#)

Los Angeles is known for its wide sandy beaches, coastal boardwalks, and beach commerce and tourism. However the impacts of climate change not only threaten our treasured beaches but also critical infrastructure, including power plants; sewage treatment plants; and two of the busiest ports in the U.S., along the coast. Planning for the impacts of climate change (adaptation planning) is therefore a priority for the region. To fully understand the impacts of climate change and how they can inform regional planning polices require a link between the best available scientific tools and local governments. *Regional AdaptA: Coastal Impacts Planning in the Los Angeles Region* is a multi-year project that strives to provide this link to local coastal jurisdictions and to develop a community of practice for the L.A. region.



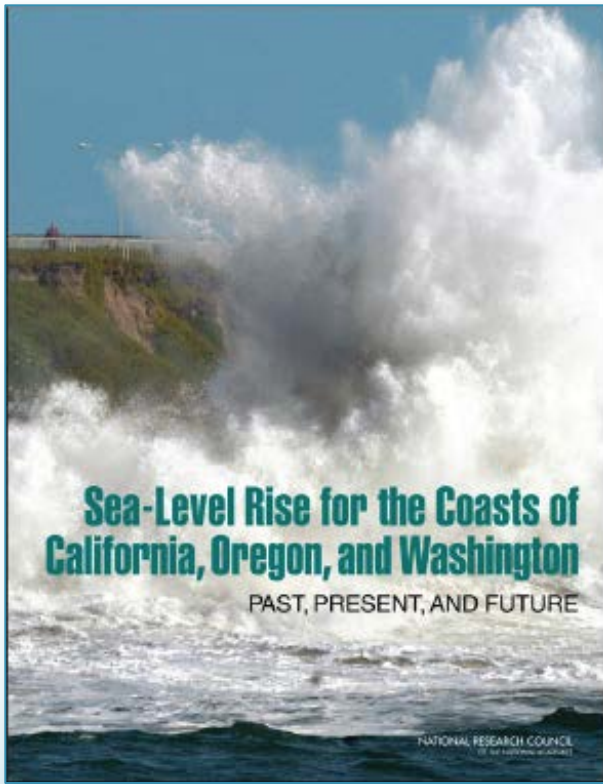
# Sea Level Rise 101



- Thermal expansion
- Melting of Glaciers & Ice Sheets
- Terrestrial Water Storage
- Tectonic Activity

[http://www.nap.edu/catalog.php?record\\_id=13389](http://www.nap.edu/catalog.php?record_id=13389)

# National Research Council: West Coast SLR Projections



Time Period	North of Cape Mendocino	South of Cape Mendocino
2000 - 2030	- 2 – 9 in.	2 – 12 in.
2000 - 2050	- 1 – 19 in.	5 – 24 in.
2000 - 2100	4 – 56 in.	17 – 66 in.

[http://www.nap.edu/catalog.php?record\\_id=13389](http://www.nap.edu/catalog.php?record_id=13389)

# Beyond SLR...

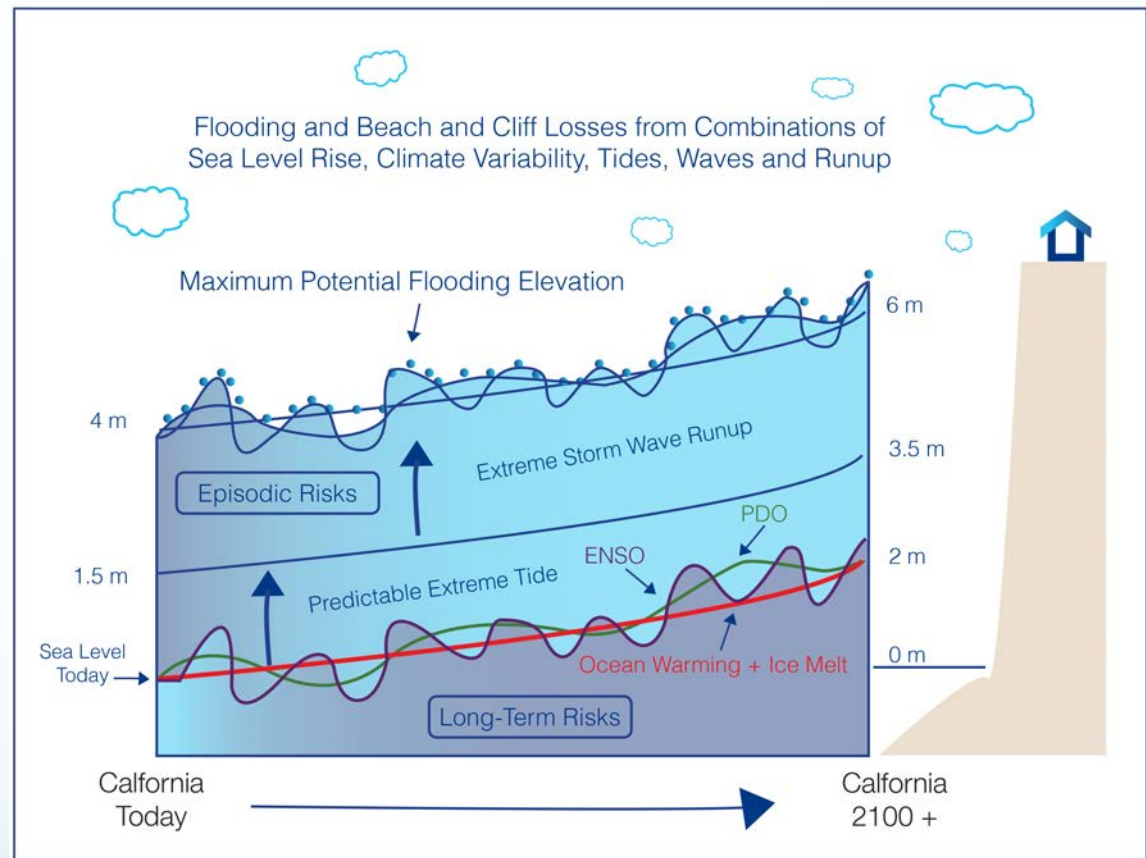


Hurricane Marie  
September 2014

# Coastal Storms

“Today’s storm is tomorrow’s high tide...”

Climate change is a potential amplifier of existing hazards





# Expected Impacts from SLR and Storms

- Accelerated beach erosion rates
- Greater incidence of cliff failures
- Landward translation of coastal flooding & inundation
- Dangerous navigation conditions
- Beach/shore safety compromised
- Saltwater intrusion into coastal aquifers

# Hazard Mitigation & Climate Adaptation

- Multi-Hazard Mitigation Planning: Identify policies and actions that can be implemented over the long-term to reduce risk and future losses.
- Climate Adaptation Planning: Adjustment or preparation of natural and human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

Sources: FEMA Local Mitigation  
Planning Handbook, 2013;  
Safeguarding California, CNRA, 2014

# Hazard Mitigation Planning Tasks

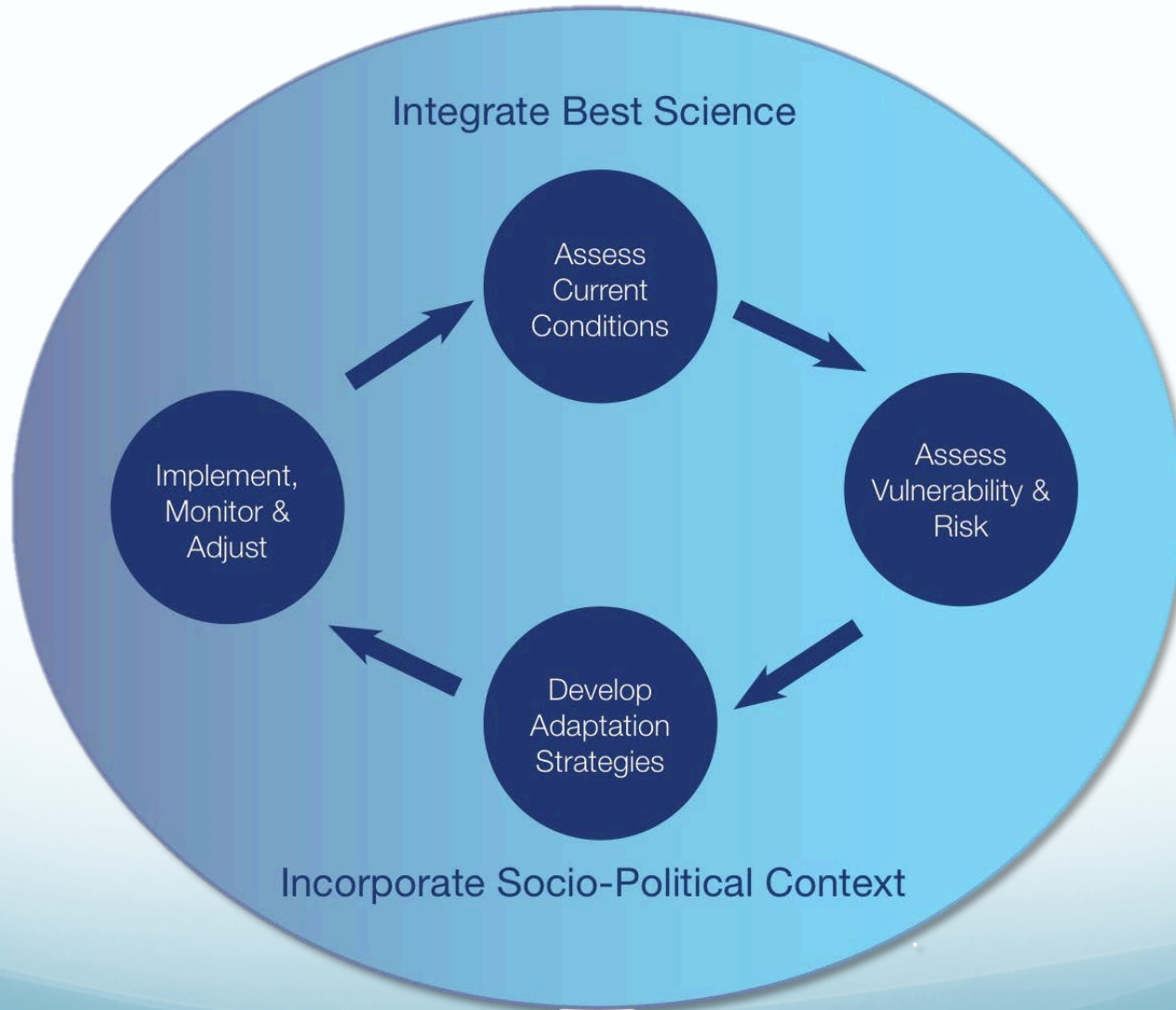


**Figure I-1: Local Mitigation Planning Handbook Tasks.**

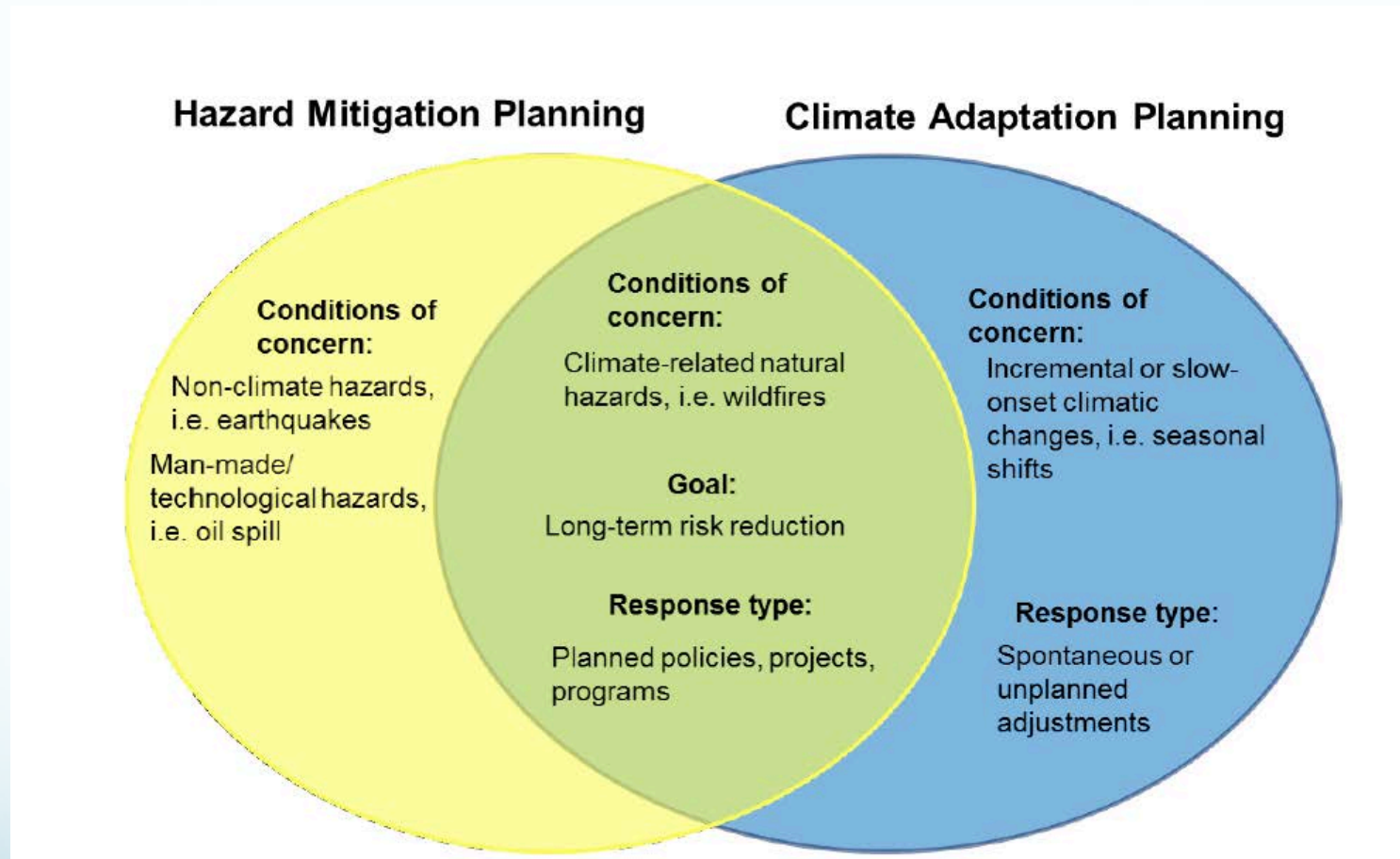
Source: FEMA Local Mitigation Planning Handbook, 2013

- Build planning team
- Create outreach strategy
- Review community capabilities
- Conduct a risk assessment
- Develop mitigation strategies

# “Adaptive” Adaptation Planning



# Hazard Mitigation & Climate Adaptation

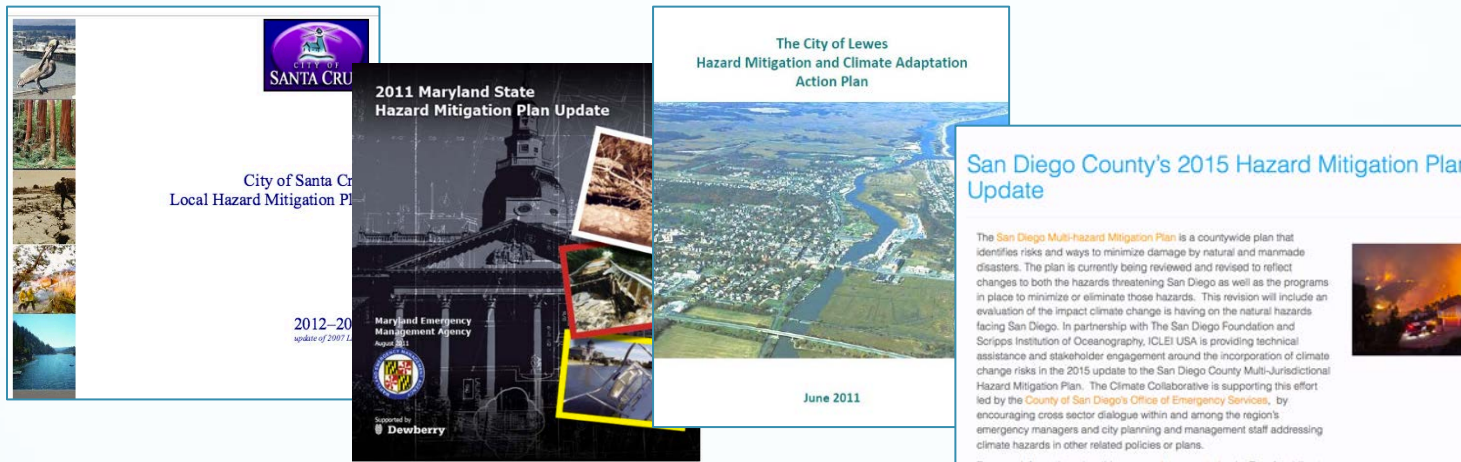


Source: Melissa Higbee et al, ICLEI, 2014

# Integrating HMP & Climate Adaptation

- No current mandate, but strong encouragement from FEMA and the state to incorporate climate change considerations into planning
- Clear opportunities to include climate in HMP process:
  - Ensuring the right stakeholders participate in the process
  - Conducting the Risk Assessment
  - Identifying mitigation strategies and priority activities
- However, challenges do still exist –
  - FEMA has not provided clear guidance
  - Questions about scenarios and planning horizons
- Your work here will help pave the way!

# Lessons Learned Around the Country



- Having a broad stakeholder group at the table and keeping stakeholders engaged
- Opportunity to integrate plans (i.e. LCP and HMP)
- Terminology – ensuring everyone understands the lingo!
- Discuss Climate Change during Risk Assessment Phase

# Getting the right people at the table



- Considering climate change may require broadening our stakeholder group
- Similarities between planning processes and information needed – HMP, LCPs, General Plan, and/or Adaptation Plan
- Who else should be here? What other organizations/agencies should be involved?
- Let's get these communities of practitioners together!

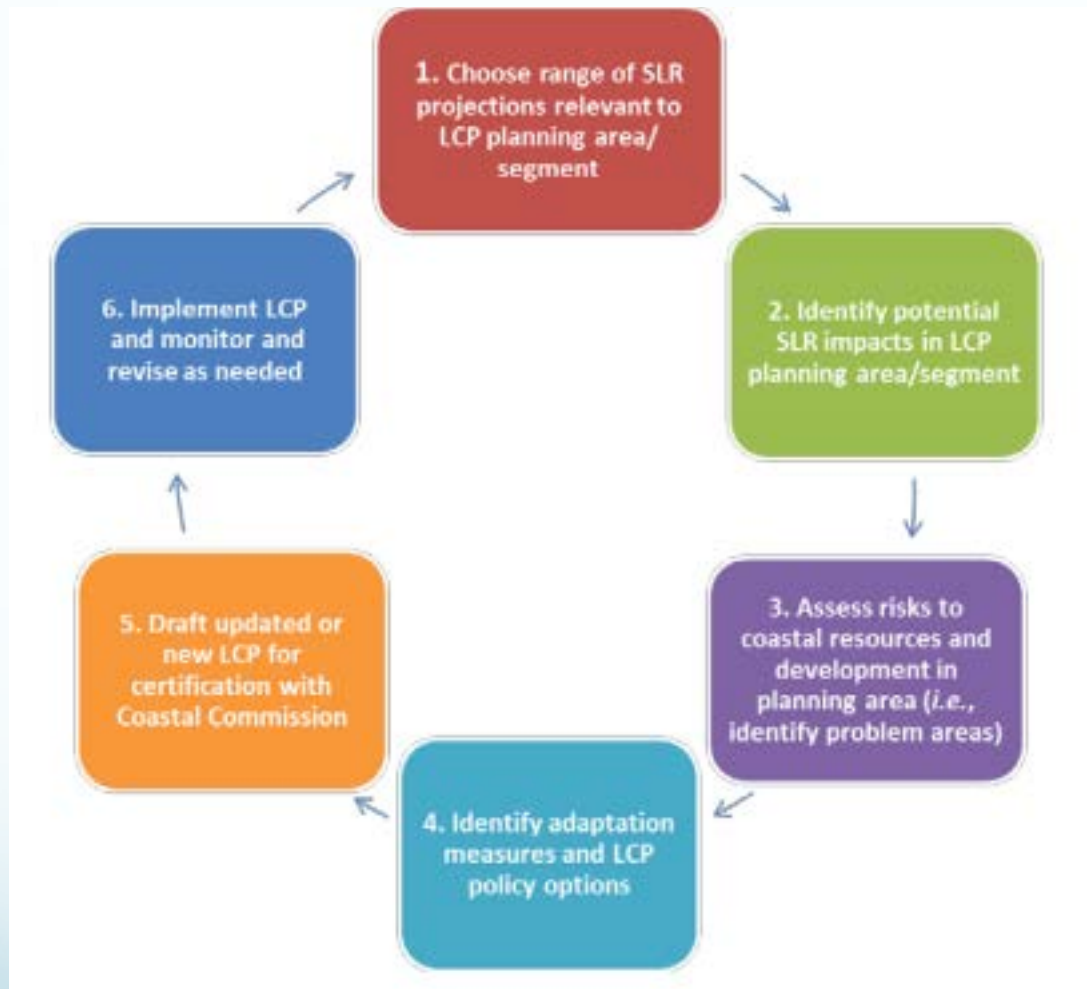


# What is a Local Coastal Program (LCP)?

- LCPs are basic planning tools used by local governments to guide development in the coastal zone
- They contain ground rules for future development and the protection of coastal resources
- Must be consistent with the CA Coastal Act
- An LCP is submitted to the CA Coastal Commission and once approved, coastal permitting authority over most new development is transferred to the local government
- Many LCPs in the state are being updated -- new guidance from CCC on integrating sea level rise considerations into LCP

[CA Coastal Commission Sea Level Rise Policy Guidance](#)

# What is a Local Coastal Program (LCP)?



CA Coastal Commission Sea Level Rise Policy Guidance

# Stakeholder & Public Engagement



Political Leaders  
City Councils  
Sustainability Depts  
Wastewater Treatment  
Emergency Managers  
Private Industry  
Consultants  
Public Utilities  
Public Works  
Harbor Depts  
Planning Depts  
Park Managers

NGOs  
Academia  
Educators  
State Agencies  
Federal Agencies  
MPOs, JPAs, COGs  
Museums, Aquariums  
Community Organizations  
Professional Associations  
Regional Organizations  
Neighborhood Councils  
Social Justice Organizations

# Let's Be Clear on Terminology

- i.e. Mitigation (hazard mitigation vs. climate mitigation)

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Act

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elimin  
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Climate cha  
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Climate chan  
eruptions, an  
Convention o  
indirectly to h  
observed ove  
activities alte

Hazard: The  
life, injury, or  
and environm  
impacts.

Exposure: Th  
or economic,

Vulnerability  
elements incl

Impacts: Effe  
and human s  
livelihoods, h  
hazardous cli  
also referred  
and sea level

Risk: The pot  
diversity of va  
these events  
the term risk

Adaptation:  
or avoid harm  
climate and i

**Carbon Sequestration** This refers to the capture of CO<sub>2</sub> from the atmosphere and its long term storage in oceans (oceanic carbon sequestration), in biomass and soils (terrestrial carbon sequestration) or in underground reservoirs (geologic carbon sequestration).<sup>605</sup>

**Climate** Climate in a narrow sense is usually defined as the "average weather" or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.<sup>606</sup>

**Climate Adaptation** Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.<sup>607</sup>

**Climate Mitigation** A human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.<sup>608</sup>

**Ecosystem Services** Ecosystem services are commonly defined as the benefits people obtain from ecosystems. Ecosystem services include basic services - provisioning services like the delivery of food, fresh water, wood and fiber, and medicine - and services that are less tangible

# Coastal Storms and SLR Modeling

## The best of the best...

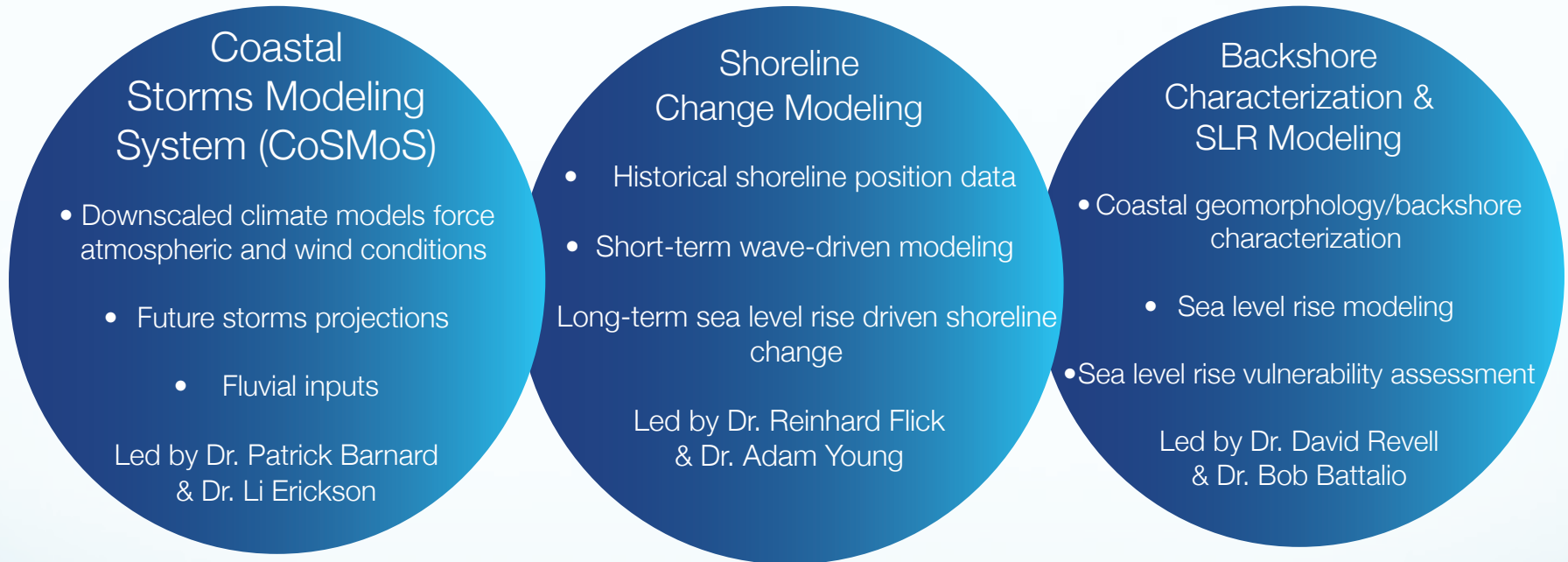
- Coastal Storms Modeling System
  - USGS, led by Dr. Patrick Barnard & Dr. Li Erickson
- Backshore Characterization & SLR Modeling
  - Revell Coastal and ESA, Dr. David Revell & Dr. Bob Battalio
- Shoreline Change Modeling
  - TerraCosta Consulting Group, Dr. Ron Flick & Dr. Adam Young



# Coastal Storms Modeling System (CoSMoS)

- Dynamic - Physics-based numerical modeling system for assessing coastal hazards on West Coast
- Projects coastal hazards for:
  - Full range of SLR scenarios (0 – 2 m & 5 m)
  - Annual, 10 yr, 20 yr and 100 yr storms
- Decision support tools to meet local adaptation planning needs

# How it all fits together...



- Better prediction of coastal storms under numerous SLR scenarios
- Better understanding of how beaches will respond to SLR and storms

# Mitigation/Adaptation Strategies

1. Acquiring Scientific Information
2. Local Planning, Policies and Regulations
3. Structure and Infrastructure Projects
4. Natural Systems Protection
5. Education, Awareness and Community Engagement
6. Engage Stakeholders and Build Capacity for Local Agencies



# Acquiring Scientific Information

Information needed to help inform local plans and decision-making

- Assessment of information needs of local entities
- Vulnerability assessments
- Cost-benefit analyses
- Engineering and geotechnical studies

# Local Planning, Policies and Regulations

Policies, regulations and planning processes aimed at reducing or eliminating risk

- Policies to manage/restrict development
- Improve land use policies and regulations
- Promote or require standards in development
- Prevent new development in high risk zones

# Structure and Infrastructure Projects

Hardening infrastructure and construction projects to reduce or eliminate risk

- Protecting critical infrastructure
- Manage retreat projects
- Flood control maintenance projects
- Floodproofing
- Retrofit

# Natural Systems Protection

Nature-based solutions, that is, solutions that reduce social and economic risks and maximize the benefits that nature provides.

- Preserve High-Hazard Areas as Open Space
- Protect and Restore Natural Buffers
- Maintain Beaches
- Stabilize Erosion Hazard Areas
- Protect and Restore Natural Flood Mitigation Features

# Education, Awareness and Community Engagement

- Engaging the public, enhancing awareness and education programs
- Educating property owners about risk
- Increase public awareness of hazard zones
- Educate and engage communities, especially vulnerable communities
- Engage formal and informal educators and students

# Engage Stakeholders and Build Capacity for Local Agencies

- Provide opportunities for local planners and managers to learn about issues
- Engage a wide spectrum of stakeholders in planning processes
- Build governance structures
- Enhance local government coordination

# Facilitated Breakout Exercise – Mitigation Strategies/Adaptation Strategies

- 30-minute exercise
- Breakout into groups of 4-5 people
- Take 10 minutes to fill out strategies matrix
  - Currently implementing, feasible, medium, not feasible/difficult
- Group discussion:
  - Are there categories or strategies missing?
  - What “mitigation” projects are currently going on in your agencies and departments? Do those fit into a strategy?
  - What strategies did you mark as feasible? Why? Are these priorities for L.A.?

Next Steps!



# Thank You!

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