The California State University
COUNCIL ON OCEAN AFFAIRS, SCIENCE & TECHNOLOGY (COAST)

STATE SCIENCE INFORMATION NEEDS PROGRAM (SSINP)
Request for Proposals (RFP)
ROUND 2: Sea-level Rise

KEY DATES & INFORMATION

Application deadline:	~~Monday, July 27, 2020, Tuesday, August 25, 2020~~ Thursday, September 3, 2020, 5:00 p.m. Pacific time
Amount available:	Up to $800,000
Award funding range:	Most awards will range from $200,000-$400,000; requests up to $500,000 with significant justification may be considered.
Who can apply	Lead PIs must be from the CSU; non-CSU co-PIs are permitted. See Grant Guidelines for additional details.
Start date:	Applicant will specify date between ~~January 15 and March 31~~ February 15 and April 30, 2021
Project duration:	30 months
Webinar:	A two-part webinar was held on Tuesday, June 2, 2020. To view a recording, please go to COAST's SSINP webpage.

PROGRAM DESCRIPTION

With funding from a one-time appropriation of funds in the FY 2019-2020 state budget, the CSU Council on Ocean Affairs, Science & Technology (COAST) has established a new research funding program called the State Science Information Needs Program (SSINP). The overall purpose of SSINP is to fund research to support the state of California's highest priority marine, coastal, and coastal-watershed science information needs.

SSINP Grant Guidelines are available on COAST's website and articulate the basic purpose of the grant program, outline program restrictions such as eligibility requirements and award conditions, describe how funds will be administered, and describe the required components of an application. Please be sure to review the Grant Guidelines carefully when preparing your proposal. The Grant Guidelines are incorporated by reference into this present RFP.

Please refer to the Grant Guidelines for information on anticipated subsequent RFPs.

RESEARCH PRIORITIES

For Round 2 of SSINP funding, COAST will accept proposals that address the topic of **sea-level rise (SLR).**

Global sea levels are rising due principally to the melting of ice sheets and thermal expansion of seawater. Sea levels off California's coast have risen approximately 0.64 ft (7.7 in) over the last 100 years [1]. Sea levels will undoubtedly continue to rise in the next century and a half due to greenhouse gases (GHG) already in our atmosphere, though the rate at which levels will rise is beyond 2050 is highly dependent upon future emission scenarios. Vertical land motion is another factor in determining site-specific SLR. The 2017 SLR report commissioned by the state of California indicates that SLR in La Jolla (near San Diego), as an example, will *likely* rise 0.7-1.2 ft by 2050 and *could* rise 10 ft by 2100 under the worst case scenario of significant melting of ice sheets [2]. It is the combination of long-term sea-level and shorter-term processes (e.g., storms, high tides and El Niño events) that increase the risk of coastal flooding and erosion.

According to the federal United States Geological Survey (USGS), 600,000 people and $150 billion in property in California are at risk of coastal flooding by 2100 [3]. Beaches and other types of shoreline habitat are undergoing a "coastal squeeze" due to the fact that, in many places, the built environment prevents their inland migration. Fifty-five percent of current coastal habitat area (e.g., sandy beaches, rocky shoreline, estuaries, dunes, chaparral) is highly vulnerable to SLR of five feet or more [4]. For example, 31-67% of Southern California beaches may become completely eroded (up to existing coastal infrastructure or sea-cliffs) by the year 2100 under scenarios of SLR of 3.2-6.5 ft [5]. The sustainability of beaches will directly influence the tourism and recreation sector of the California economy, the largest of California's six ocean-dependent sectors [6]. Wetlands, which provide important ecosystem services, are particularly vulnerable to SLR due to their low-lying nature and limited naturally-occuring sediment supply that may otherwise allow wetlands to increase in elevation and withstand SLR.

Throughout California's history, low-income communities, communities of color, and other marginalized and under-resourced communities have faced disproportionate environmental injustices, such as overexposure to pollution and increased barriers to coastal access. Similarly, vulnerable communities facing environmental injustices may be disproportionately impacted by the loss of beaches or shoreline access. Key physiological and psychological benefits result from access to recreational resources such as shoreline access [7]. SLR and adaptation choices in response to SLR may exacerbate these existing inequities to these key resources [8]. An assessment of SLR impacts on shoreline access for these communities will advance informed and equitable decision-making on adaptation strategies.

In light of the scientific understanding about the negative ecological impacts of coastal armoring (e.g., seawalls), coastal managers and decision-makers are increasingly looking to options provided by natural infrastructure [9, 10] (see California Executive Order B-30-15, the Safeguarding California report). California Government Code section 65302 describes natural infrastructure as the 1) preservation and/or restoration of ecological systems and 2) utilization of engineered systems to increase resiliency to climate change.

In terms of the first category described above, ecosystems such as marshes, seagrass beds, kelp forests, and reefs have been shown to mitigate risks from SLR [11]. Wetlands, in particular, sequester carbon and help protect shorelines by attenuating waves [12]. However, wetlands themselves are highly vulnerable to SLR. Wetlands may be able to migrate inland if they are adjacent to open space with the right topographic conditions, but inland migration may be prevented by infrastructure. In the latter case, the addition of sediment to the system may be the only option to ensure the persistence of a particular wetland into the future. A knowledge gap currently exists regarding the best way to manage sediment on a subregional basis in San Francisco Bay, the largest estuary on the west coast of the U.S. and where 90% of the state's wetlands can be found.

In terms of the second type of natural infrastructure described above, engineered solutions may be necessary in locations where wetlands, reefs, or other types of ecosystems do not exist. Known as living shorelines, these systems usually consist of a protected, stabilized coastal edge made of natural materials such as plants, sand, or rock. Unlike concrete seawalls or other hard structures, which impede the growth of plants and animals, living shorelines grow over time [13]. In the California context, living shorelines may include, but are not limited to, the use of vegetated sand dunes, cobble berms, native oyster reefs, and eelgrass beds. Living shorelines are relatively new to the west coast of the U.S. and more information is needed on their effectiveness and ecological benefits they provide.

While not generally considered natural infrastructure, beach nourishment has become a prevalent adaptation strategy. In southern California, in particular, local governments spend significant funding annually on beach nourishment [14]. The best management practices of beach nourishment (e.g., grain size, frequency of deposition) have been well studied [15]. There is a current knowledge gap regarding the impacts of beach nourishment practices on beach dynamics and the surrounding areas.

Recent scientific reports have brought to light the issue of rising groundwater. Rising sea-levels increase pressure on shallow coastal aquifers, causing that groundwater to rise and emerge as surface water. Recent modeling of the San Francisco Bay Area predicts that 3 ft of sea-level rise will result in rising groundwater inundating an area equal to that affected by SLR alone [17]. In other words, when rising groundwater is considered in inundation models, the area predicted to be inundated doubles. Rising groundwater can also infiltrate pipes, mobilize contaminants in the soil, flood low lying components of the human-built environment (e.g. basements), and increase the risk of liquefaction in seismic regions [17]. The aforementioned impacts of SLR are likely to be exacerbated by rising groundwater; a more complete understanding will be critical to reducing impacts to human health and safety, the California economy, and coastal and estuarine habitats.

Additional important reports related to SLR:

- State of California Sea-Level Rise Guidance Document
- Safeguarding California Report

- [The Baylands and Climate Change: Baylands Ecosystem Habitat Goals Science Update 2015]
- [Wetlands on the Edge: The Future of Southern California's Wetlands]

RESEARCH OBJECTIVES

The research objectives below reflect iterative discussions with state of California management and regulatory agency representatives. These objectives have emerged as some of the state's highest priority science information needs within the topic of sea-level rise. Please note that the inclusion of these research objectives in the RFP does not constitute a commitment on behalf of COAST to fund projects addressing each of them.

1. **Economics**
   1.1. Quantify the economic impact of losing California's beaches due to sea-level rise. The state is particularly interested in the use of market and non-market valuation techniques to assess the impact.

2. **Environmental justice**
   2.1. Assess how low-income communities, communities of color, and other marginalized and under-resourced communities' access to California's shoreline for recreation will be impacted by sea-level rise.

3. **Adaptation strategies for coastal and estuarine habitats**
   3.1. Analyze living shorelines and related projects for their ability to protect shorelines from erosion. Additionally, assess the degree to which these structures provide ecological benefits. The state is particularly interested in ecological indicators for the development of cost-effective and feasible monitoring protocols for living shoreline projects.
   3.2. Assess options for sediment management on a subregion basis in San Francisco Bay in order to ensure, to the extent practicable, that wetland maintenance and restoration is not impeded by a lack of sediment availability and supply.
   3.3. Evaluate the impacts of beach nourishment practices on beach shape and behavior, wave dynamics, beach ecology and adjacent subtidal habitats. The state is particularly interested in ecological indicators for the development of cost-effective and feasible monitoring protocols for beach nourishment sites as well as adjacent intertidal and subtidal habitats.

4. **Coastal and estuarine geomorphology**
   4.1. Develop new or identify improvements to existing modeling techniques to predict the effect of sea-level rise on (i) bluff retreat rates, (ii) beach and dune or (iii) coastal lagoons systems with both constrained and unconstrained profiles.

5. **Groundwater**
   5.1. Assess how the vulnerability of California's natural habitats and built infrastructure changes when rising groundwater resulting from sea-level rise is included in inundation models.

6. **Other sea-level rise research questions**
   6.1. Proposals addressing state needs for scientific information on sea-level rise outside of the priority research objectives listed above will also be accepted. A successful proposal must concretely demonstrate the relevance of the research project to state needs, including identification of specific state agencies that will benefit in the form of a detailed letter of support from said agency.

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