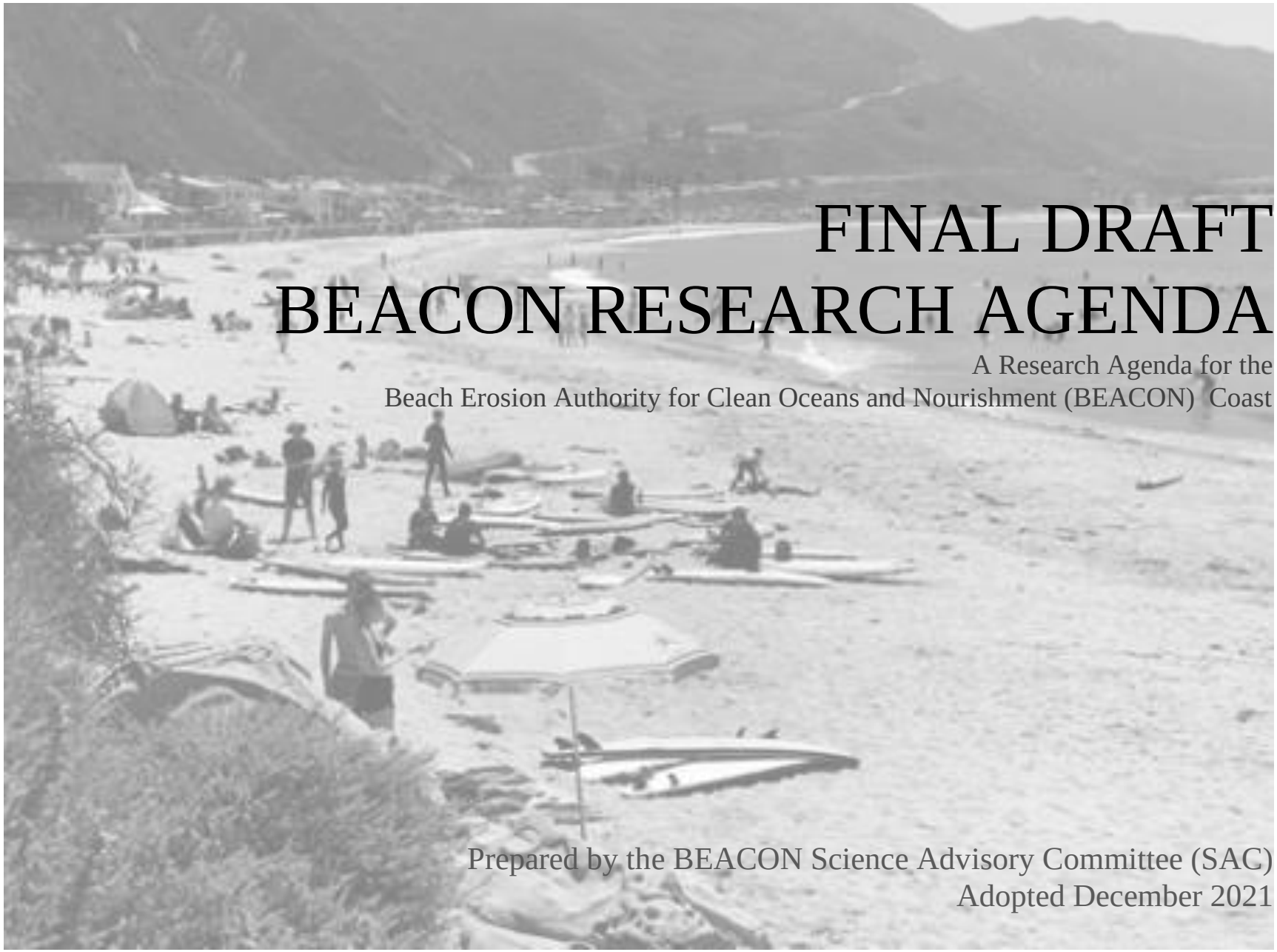

FINAL DRAFT
BEACON RESEARCH AGENDA

A Research Agenda for the
Beach Erosion Authority for Clean Oceans and Nourishment (BEACON) Coast

Prepared by the BEACON Science Advisory Committee (SAC)
Adopted December 2021

A Research Agenda for the BEACON Coast and the Santa Barbara Littoral Cell
2021-2026
BEACON Science Advisory Committee
Adopted December 2021

Table of Contents

BEACON Background

BEACON's policies, projects, and programs seek to accomplish important complimentary goals and objectives. BEACON's Coastal Regional Sediment Management Plan (BEACON, 2009) is intended to outline the ways and means to conserve and restore the valuable sediment resources along the Santa Barbara and Ventura Counties coastline.

BEACON's programs and projects seek to reduce shoreline erosion and coastal storm damages, protect sensitive environmental resources, increase natural sediment supply to the coast, preserve and enhance beaches, improve waterquality along the shoreline, and optimize the beneficial use of material dredged from ports, harbors, and other opportunistic sediment sources.

BEACON's primary objectives[1] are to:
A. Identify solutions to coastal erosion and environmental problems;
B. Coordinate the use of local, state, federal and private resources;
C. Facilitate design, financing, construction and maintenance of beach restoration, shoreline protection, and environmental protection and enhancement projects;
D. Collect and analyze data needed to facilitate the design projects and to monitor their performance;
E. Coordinate local government involvement and keep elected officials and citizens informed;
F. Support the preparation of contingency plans by Member Agencies to be ready in emergencies to direct public and private efforts to combat erosion and to take steps necessary to coordinate the protection of public and private property;
G. Spearhead local government lobbying efforts at the State and Federal levels;
H. Collect and analyze data addressing regional-level climate and sea-level rise impacts to coastal beaches, coastal beach access, and coastal structures;
I. Identify regional-level solutions to impacts resulting from changes in climate, weather, and sea-level rise that may affect BEACON member agencies beaches through coordinated regional planning; and
J. Coordinate regional-level responses among BEACON member agencies to climate, weather, and sea-level rise changes impacting beaches, coastal beach access, and coastal structures.

[1] BEACON Bylaws Article II Section 1

BEACON Mission, Vision, and Operating Principles

BEACON Mission

Provide venue for regional coordination of beach nourishment, coastal resources restoration, and protection of coastal water quality within Ventura and Santa Barbara counties to ensure that beaches are sustainably maintained and preserved, coastal shoreline resources are enhanced, coastal water quality protected, and coastal beach access provided.

BEACON Vision

The BEACON coast, its beaches, and its natural coastal resources are preserved, enhanced and sustainably managed in perpetuity through close coordination and collaboration among its member agencies, the public, and its community and private partners.

BEACON Operating Principles

Collaborative: Partnering with Others
Inclusive: Informing and Including all interested Stakeholders
Science-based: Utilizing the Best Available Science to Support
DecisionsTransparent: Open Communication of Intentions and
Plans Accountable: Documenting and Measuring Outcomes
Equitable: Ensuring Access and Resilience for all BEACON Communities and all Residents

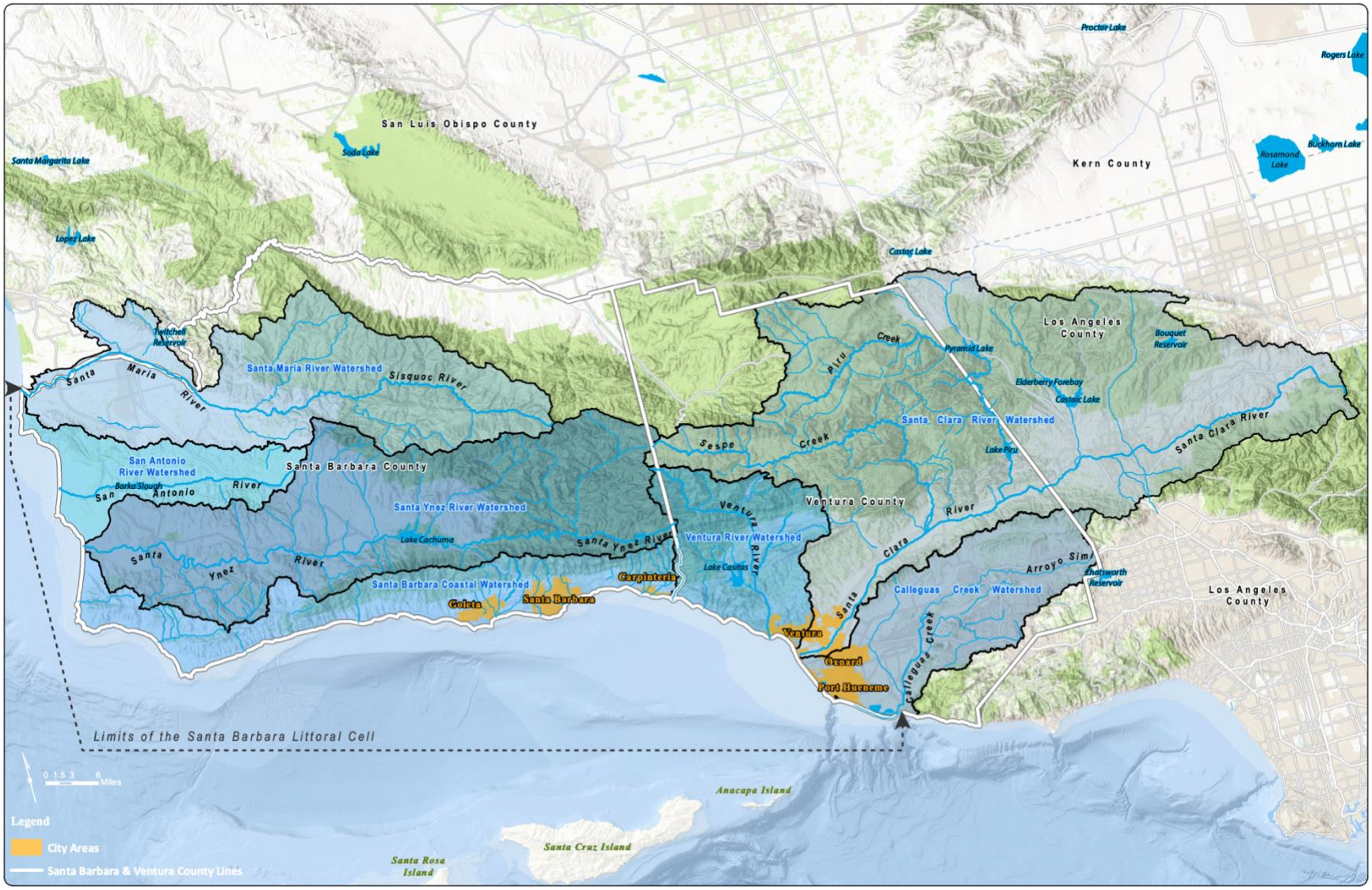

Figure 1. BEACON “Coast” and the Santa Barbara Littoral Cell

Summary: Linking Science Research and Regional Sediment Management and Climate Adaptation

This document outlines an initial Research Agenda for the Beach Erosion Authority for Clean Oceans and Nourishment (BEACON). This document is meant to be adaptable and updated over time as new opportunities, issues, and relevant coastal management needs arise. The information provided within was developed by the BEACON Science Advisory Committee (SAC) for the purposes of identifying key research and scientific actions that would advance BEACON's primary objectives of coordinated regional coastal resource management, including those specifically designated in the updated BEACON Strategic Plan (BEACON 2021c).

For the past year and one-half, BEACON executive staff and Board have been developing and implementing policies and plans for expanded science support for BEACON's programs and projects. In November 2020, the BEACON Board approved Bylaws for a BEACON SAC and confirmed the initial leadership and membership of the SAC (BEACON, 2020a, 2020b, 2021a). Starting in January 2021, the BEACON SAC has been meeting and reviewing how science research and data collection can be enhanced and expanded to better inform decision-making, and address the related topics of regional sediment management (RSM), coastal resource and ecosystem management, and regional climate change and sea level rise (SLR) adaptation planning.[2] The BEACON SAC's over-arching goal is to provide recommendations and guidance to the BEACON Board and executive staff for understanding the existing coastal conditions and anticipated future shifts to coastal resources based on climate and adaptation scenarios.

The BEACON "Coast" (Figure 1), the coast of Santa Barbara and Ventura counties, includes the Santa Barbara Littoral Cell, the largest littoral cell along the California Coast, stretching more than 140 miles from the Santa Maria River in the north to the Mugu Submarine Canyon to the east. The BEACON Coast drains several large coastal watersheds providing sediment and sand to the coast. This important coastal region faces many threats and many challenges, including many management and governance demands, requiring BEACON to seek out the best available science and support any new initiatives, or activities, that would assist with improved decision-making and improved outcomes. Outside the Santa Barbara Littoral Cell, BEACON can provide support and coordinate on sediment projects within the portion of the Zuma and Santa Monica Littoral Cells that reside off the coast of Ventura County.

BEACON's Coastal Regional Sediment Management Plan (CRSMP) (BEACON, 2009) outlines key understandings and management strategies. Particularly, beach nourishment (including beneficial reuse of sediment) has been a long-term strategy used in conjunction with coastal engineering and shoreline stabilization techniques. Going forward there is critical need to better understand policy, regulatory, and funding aspects of coastal regional sediment management (BEACON 2021d, Ulibarri et al., 2020). Additionally, there are gaps of understanding from the physical and engineering perspective of sediment grain size, placement technique, source, and stockpiling where additional research can help inform specific management actions (Ludka et al. 2018, Ludka et al., 2016, Pendleton et al., 2012).

[2] SAC Agenda and Meeting Minutes, January 19, 2021 and SAC Agenda and Meeting Minutes, January 29, 2021.

This document outlines an initial Research Agenda supporting management and decision-making for regional sediment management, coastal resource management and regional climate change and sea-level rise adaptation planning. BEACON is in a unique position to better connect science and policy as it acts in many important ways as a boundary organization[3] translating science and technical information for decision-makers and the public.

The key objective going forward is to bridge identified gaps between science and decision-making, better integrating science into BEACON's program and project initiatives. BEACON can serve as a facilitator, connecting regional to local coastal resilience, science, and decision-making. While the pace of science research in the BEACON coast is accelerating, there is an opportunity to solidify pathways between these science efforts and BEACON's programs and policies. The charge of the BEACON SAC members is to use their expertise and robust experience to inform the BEACON Board and staff on critical science activities to support the region as a whole.

Figure 2 highlights the overlap and illustrates the coordination and integration of science and perspectives from the SAC into BEACON activities. The development of this Research Agenda is an iterative process that requires regular evaluation and feedback from both the SAC and relevant managers and stakeholders. There are several discrete steps that have been followed by BEACON in the process of developing the Research Agenda, including:

- Prepared a Science Strategy, identifying the need for the SAC and the need for a Science Action Plan;
- Identified the elements of a Science Action Plan; Established the SAC;
- Prepared a set of Science Goals and Objectives; Completed an initial Science and Data Gap Analysis;
- Developed priorities for an initial BEACON Research Agenda; Convened a Managers-Scientists Workshop;
- Prepared the BEACON Research Agenda, and developed a short-term Research Agenda Implementation Plan.

Importantly, the initial Science Goals and Objectives and recommended action items have been included in BEACON's first Strategic Planning Goals and Objectives document, adopted in March 2021. (BEACON, 2021c). This document serves as a framework for BEACON to continue supporting research and projects that help implement BEACON's Strategic Plan (BEACON 2021c).

[3] Boundary organizations often perform important translation functions in making complex scientific and technical information 'understandable' to more generalist decision-makers, stakeholders and members of the public.

Gaps in Science, Data, Knowledge, and Policy

Currently, several different data collection and research efforts focused on coastal sediment processes, coastal and ocean physical systems, and a range of climate adaptation needs are being undertaken by partner organizations which could help inform BEACON's regional sediment management actions going forward (BEACON, 2009). Appendix A outlines several relevant science initiatives that can be leveraged to better inform BEACON member agencies.

Figure 2. Diagram of activities and overlap amongst BEACON Board and staff, Science Advisory Committee, and relevant coastal natural resource managers.

BEACON staff and board members, as well as BEACON's member agency managers, need to better understand current data collection and research efforts, gaps in the collection of data, and identify future data collection and research needs. Additionally, BEACON can support increased integration of these science initiatives to support decision-making, and establish pathways for science to inform decision-making, including in the areas of climate adaptation and coastal resilience. Figure 2 illustrates that an interdisciplinary approach is essential to the coordination and integration of science. Information from the local resource managers as well as the SAC can assist the BEACON Board and staff in providing resources and support that is helpful at the regional level.

This proposed research agenda addresses gaps in science and data to support policy, programs, and projects addressing regional management, including related gaps covering a range of topics: Management and Decision Science, Physical Conditions and Shoreline Changes, Social and Economic Conditions and Trends, Coastal Ecology and Ecosystem Services, and restoration science and practice (see Figure 3). These items address goals and objectives (Appendix B) identified in the BEACON Strategic Plan (BEACON, 2021c). It is important to note the emphasis of interdisciplinary efforts throughout many of the identified focus areas,

implementation actions, and nested. Additionally, it is important to note that any future research and science endeavors also need to nest within planning and implementation efforts taken by individual municipalities and jurisdictions in the region. Appendix C catalogues the local agency coastal vulnerability and adaptation planning resources. BEACON intends to keep the activities listed in Appendices A and C up to date going forward. The Research Agenda Early Implementation Actions reflect the prioritization made by the BEACON SAC to key areas where specific investment would benefit the coastal resources in the BEACON region. These Research Agenda Actions take into consideration ongoing science activities (Appendix A) and existing planning investments (Appendix C) all through the lens of BEACON's programmatic goals and objectives (Appendix B).

SAC Focus Area		Research Agenda Early Implementation Actions	Nested Tasks	BEACON Strategic Plan Goals and Objectives					
Management and Decision Science		-	-	**Goal 2**			Obj. 2.1		
		Expand coordination role and activities analyzing and implementing best options to increase coordination and connections, including acting as hub, serving as connector, and/or functioning as a repository	Build BEACON stakeholder network	Obj. 8.1					
		Continue and expand upon focused efforts to link scientists through the BEACON SAC, and develop expanded partnerships with local and regional managers such as ongoing Managers Workshops and targeted integration of science (including social science) efforts to better understand how science activities can contribute to achieving management goals. Consider appointing a Manager Liaison to the SAC to facilitate direct communication between groups.	Science-Policy Pathways (regulatory agency workshops)	**Goal 8**		Obj. 8.2		Obj. 8.3	
			Model Regional Permit	Obj. 1.1	Obj. 1.2	Obj. 1.2.1	Obj. 1.2.2	Obj. 1.3	
Integrating Climate Science into BEACON Policies, Programs and Projects		-	-	**Goal 1**					
		Develop work plans to integrate climate and SLR impacts into regional sediment management plans focused on downscaled regional shoreline models and watershed coastal flooding models.	-	Obj. 2.2					
		Develop an update to the BEACON Coastal Regional Sediment Management Plan (CRSMP) that includes current climate and sea level rise information, in additional to adaptation strategies that can be taken at a regional level.	SLR Update-CRSMP	Obj. 2.2.1			Obj. 3.1		
		Continue to identify and keep up to datea a catalogue of local jurisdiction assessment and planning documents that incorporate sea level rise and climate science into coastal resource management.	-	Obj. 2.2					
Regional Monitoring Programs	-	Further work towards coordination of regional monitoring (of all types) including data standardization, shared data repository for local projects to feed into, and some initial analysis and metrics to help local managers easily use and implement monitoring information, including bluff-backed beaches, and align the various monitoring programs to better leverage one another.	Regional Monitoring Program Review	Obj. 2.3					
	Physical Shoreline Data Collection and Monitoring	Extend shoreline physical profiling to all regional beaches and align the various monitoring programs to better leverage one another.	Aligning Regional Monitoring	Obj. 3.2					
			Extend Shoreline Profiling	Obj. 3.2					
	Coastal Ecology and Ecological Regional Monitoring	Develop a Sandy Beach Habitat and Species Framework Analysis and expand baseline data collection of habitat and species conditions within the region. Areas of less disturbance, and restored sites could be prioritized for reference sites.	-	**Goal 2**					
		Develop draft scope of work for an Ecosystem Goals Program	-	**Goal 2**					
	Human Use and Economics Data Collection and Monitoring	Update human beach use and beach user information, including socio-economics, and investigate development of a data portal housed at BEACON or a local university. Areas of less disturbance, and restored sites could be prioritized for reference sites.	Updating User Data	**Goal 7**			Obj. 7.3		
			Socio-Economic Data Portal						
			Develop Regional Recreational Goals						
Interdisciplinary Research Approach		Extend the CEVA framework analysis from Santa Barbara County to the littoral cells encompassing encompassing Ventura County.	-	Obj. 2.4					
Modeling		-	-	**Goal 3**					
		Seek funding to support further modeling efforts focused on watershed to littoral cell processes and regional downscaling of climate linked impacts (e.g. sea level rise, temperature, fire, precipitation, and flooding) including extreme events.	Regional SLR-Climate Downscaling	Obj. 2.2					
			Regional Beaches Vulnerabilty Modeling	Obj. 3.3					
			Watershed Extreme Event Flood Modeling	**Goal 2**					
		Continue to support data collection and modeling of sediment source, transport, and fate to help inform coastal adaptation activities (e.g. beach nourishment/beneficial use, prototyping shoreline stabilization projects, dredge material placement, identifying priority monitoring areas, etc.) This includes sediments of many grain sizes, from mud to sand and larger sizes such as cobble.	Sediment Fines-Transport&Fate Modeling	Obj. 1.1.1			Obj. 1.1.2		
Prototyping and Demonstration Projects		Develop one or more new research project(s) focused on innovative sediment retention structures that are environmentally sound and provide resilient features.	-	Obj. 4.1	Obj. 4.2	**Goal 5**	Obj. 5.1	Obj. 5.1.1	Obj. 5.1.2
			Beach-Dune LS	Obj. 4.3			Obj. 7.1		
			Green Groins	**Goal 4**					
			Reefs-Oil Piers Demo Pjt	Obj. 4.4					

Figure 3. Crosswalk table of SAC Focus Areas, Research Agenda Early Implementation Actions, Nested Tasks, and BEACON Strategic Plan Goals and Objectives (see Appendix B) (BEACON, 2021c).

Research Agenda Focus Topics and Suggested Implementation Actions

The Draft BEACON Science Action Plan (2020a) identified several areas of research focus which the SAC reviewed at its sessions in January 2021. SAC members added and further elaborated on these topics, identifying early implementation priorities, continuing data needs, and frameworks and mechanisms for organizing research priorities and activities at its meeting in April 2021.

Below are the research focus areas identified by the BEACON SAC and further described below:

- *Management and Decision Science*
- *Integrating Climate Science into BEACON Policies, Programs and Projects*
- *Regional Monitoring Programs*
    - *Physical Shoreline Data Collection and Monitoring*
    - *Coastal Ecology and Ecological Regional Monitoring*
    - *Human Use and Economics Data Collection and Monitoring*
- *Interdisciplinary Research Approach*
- *Modeling*
- *Prototyping and Demonstration Projects*

Management and Decision Science

BEACON should expand its focus on governance and management science in order to broaden and improve its effectiveness as a regional leader through multi-agency and interdisciplinary coordination, capacity building, and program implementation (Goodrich et al., 2020). Examining the connections between science and policy in an effort to improve them, will require BEACON to bring to bear an analysis and evaluation of governance structure, coastal management process, and science techniques and methods. Identifying and assessing adaptation pathways will also require a focus on governance and management typologies and evaluation methods (Norgaard et al., 2021). This includes the use of a range of analytical tools and activities including focused surveys and workshops of member agencies and relevant researchers, a range of different normative and formative evaluation techniques, and various planning tools, such as scenario planning.

Additionally, of key importance, is BEACON's role as a convener within the region helping share lessons learned from demonstration projects and best practices within the region. The distilling and translating of research, monitoring, and modeling information can support advancements in local efforts to help achieve regional goals (Goodrich and Warrick, 2015).

Regional goals are necessary to drive the form, function, and evaluation of activities pursued by BEACON. Along with climate change impacts, management and governance touches every other aspect of this Science Research Agenda. Through any number of governance and adaptive planning and iterative frameworks, BEACON can champion advancements in regional coastal management through science supported decision making.

These holistic approaches require establishment of regional goals that drive a monitoring and inventory of coastal resources, assessment of changes to those resources, an understanding of feasible actions to implement, and ongoing monitoring to ensure actions meet the designated goals of managing those coastal resources. Figure D-1 (Appendix D) illustrates a framework of an iterative process that can integrate management and governance science with the other major themes identified by the SAC: interdisciplinary, climate science, modeling and prototyping, and monitoring, focused on regional goals.

Early Implementation Actions:

- Expand coordination role and activities analyzing and implementing best options to increase coordination and connections, including acting as hub, serving as connector, and/or functioning as a repository.
- Continue and expand upon focused efforts to link scientists through the BEACON SAC, and develop expanded partnerships with local and regional managers such as ongoing Managers Workshops and targeted integration of science (including social science) efforts to better understand how science activities can contribute to achieving management goals. Consider appointing a Manager Liaison to the SAC to facilitate direct communication between groups.

Integrating Climate Science into BEACON Policies, Programs and Projects

Climate change and sea level rise represent the most serious threat to successful sediment management and coastal adaptation within the BEACON coast. BEACON must integrate up-to-date climate science into its policies, programs, and projects (BEACON, 2016, King et al., 2015). Recent science and technical reports and studies detail projected changes from climate and SLR, including extreme events and impacts on regional shorelines. For example, Vitousek et al. (2017) found that 31-67% of beaches in Southern California could be lost due to shoreline change under SLR projections of 0.93-2.0m in the absence of any adaptation interventions. Study of the 2015-16 El Niño winter demonstrated the need for higher spatial and temporal resolution of shoreline monitoring through LiDAR or satellite imagery to better understand how the shifts of mean wave direction and energy correspond with shoreline changes (Smith and Barnard, 2020, Barnard et al., 2017).

These resources and other assessments should be expanded and further downscaled to the BEACON coast and these new science and research efforts should guide BEACON's incorporation of climate change and SLR considerations into a comprehensive climate and SLR update to the CRSMP (BEACON 2009) which includes considering potential opportunities for regional adaptation strategies. This builds off local efforts towards understanding SLR vulnerabilities and adaptation possibilities that BEACON member agencies have done. BEACON intends to continue coordinating and tracking local activities and initiatives (Appendix C) which will be used to inform how BEACON can promote regional activities to support local agencies.

Early Implementation Actions*:*

- Develop work plans to integrate climate and SLR impacts into regional sediment management plans focused on downscaled regional shoreline models and watershed coastal flooding models.
- Continue to identify and keep up to date a catalogue of local jurisdiction assessment and planning documents that incorporate sea level rise and climate science into coastal resource management.
- Develop an update to the BEACON Coastal Regional Sediment Management Plan (CRSMP) that includes current climate and sea level rise information, in additional to adaptation strategies that can be taken at a regional level

Regional Monitoring Programs

Implementing BEACON's programs and projects need to be supported by continuing regional monitoring, including US Geological Survey's (USGS) shoreline profiling, and expanded regional monitoring program incorporating ecological baseline data and information, and human use and user information. This effort requires a formalized review of all active monitoring programs in the BEACON region.

Early Implementation Actions*:*

- Further work towards coordination of regional monitoring (of all types) including data standardization, shared data repository for local projects to feed into, and some initial analysis and metrics to help local managers easily use and implement monitoring information, including bluff-backed beaches, and align the various monitoring programs to better leverage one another.

Physical Shoreline Data Collection and Monitoring:

Monitoring physical changes to the coastline has been a long priority of BEACON, its member agencies, and partners. Fortunately, there exists a robust surveying program through the USGS for much of the Santa Barbara and Ventura coastline. Additionally, there are other various physical monitoring efforts including those that utilize student groups at CSU Channel Islands led by SAC co-chair Dr. Kiki Patsch, and the Community Alliance for Surveying the Topography of Sandy Beaches (CoAST SB) program sponsored by California Sea Grant. Additionally, various ad hoc monitoring occurs to a limited extent around coastal development projects. While these activities provide ample information about the physical status of the beaches, BEACON should take a leadership role to better align the monitoring programs to fill spatial and temporal gaps, as well as to focus efforts around management needs.

Early Implementation Actions*:*

- Extend shoreline physical profiling to all regional beaches and align the various monitoring programs to better leverage one another.

Coastal Ecology and Ecological Regional Monitoring:

Less ecological research has been conducted in the past twenty years within the BEACON coast than physical science. However, BEACON's sediment management efforts have relied on available physical and ecological science initiatives addressing the regional sediment management program and individual project impacts. While assessments of individual projects on coastal ecology have been helpful, they are often performed to achieve specific permitting requirements with narrow spatial and temporal scopes. Thus, they have been unable to provide a holistic view on the status and trends of regional coastal ecology, nor how management actions coupled with background climatic and seasonal changes alter these systems. Going forward, BEACON's sediment management and climate change adaptation programs and activities should expand support for up-to-date ecological research focused on coastal and marine ecosystems, habitats, and species, particularly shoreline and marine environments including sensitive beach and intertidal areas (Barnard et al., 2021, Myers, et al. 2019).

There are opportunities to attenuate climate change related impacts to different coastal habitats, including beaches and wetlands. Local governments can manage these ecosystems and the surrounding area so they more effectively sustain ecosystem services and the beneficial services they provide into the future (e.g. stopping beach grooming and restoring wide beaches so dunes can form; allowing both wetlands and beaches to transgress inland; removal of shoreline armoring and effective sediment management), contributing to an ecosystem-based adaptation (Schooler et al., 2019, Myers, et.al., 2019). At the same time, there is a need to better understand the potential for ecological impacts of specific coastal management features and strategies (e.g. groins, revetments, nourishment activities, etc.) as well as a better understanding of the immediate, cumulative, and long term ecological impacts of these (Griggs et al., 2020, Dugan and Hubbard, 2011).

The SAC discussed two models of regional ecosystem goal setting for habitat and resource restoration in CA that may offer some lessons learned, including the San Francisco Bay Habitat Goals program (SCC, 2010-18) and the Southern California Wetlands Recovery Program (SCC, 2018). These examples can help scope a path forward for BEACON to consider regional ecosystem goal setting relevant to coastal resources.

Early Implementation Actions*:*

- Develop a Sandy Beach Habitat and Species Framework Analysis and expand baseline data collection of habitat and species conditions within the region. Areas of less disturbance, and restored sites could be prioritized for reference sites.[4]
- Develop draft scope of work for an Ecosystem Goals Program

Human Use and Economics Data Collection and Monitoring:

Over the past twenty years, BEACON has incorporated available coastal user and economic data into its program and project development, supporting the collection and assessment of baseline human use and economic information. These data remain incomplete, however, and BEACON needs to support expanded social science data collection and analysis to support its sediment management, climate adaptation, and ongoing coastal resilience efforts (King et al. 2018, King and McGregor, 2012).

Currently, many social science topics addressing governance, institutional competencies, and law and policy remain un- and under-studied. Socio-economic data, including beach use data, "is stale or inaccurate" (King, 2021). The BEACON study area needs more human use research with regard to the following: (1) Who visits, why, and where are they from? (2) What mechanisms can improve underserved communities access and use of BEACON's beaches? (3) What is the economic impact of BEACON's beach visitation? (4) How will sea level rise and other anthropogenic changes impact BEACON's beaches and beach visitation? The answers to these questions can lead BEACON towards better understanding current recreational activities and potential regional recreational goals.

Early Implementation Actions*:*

- Update human beach use and beach user information, including socio-economics, and investigate development of a data portal housed at BEACON or a local university. Areas of less disturbance, and restored sites could be prioritized for reference sites.[5]

Interdisciplinary Research Approach

Translating scientific research into useful management actions requires an interdisciplinary approach and lens. Deconstructing silos and bridging gaps between fields is an approach that the BEACON SAC has identified as critical for supporting informed regional sediment management and sea level rise adaptation. Recent science activities (Appendix A) and local agency planning (Appendix C) both contain interdisciplinary research approaches. Going forward, the BEACON SAC

[4] These can include areas with limited access, development, disturbance, as well as sites that have been restored. For example, portions around Vandenberg Air Force Base, Hollister Ranch, and the Jack and Laura Dangermond Preserve, among others.

supports projects with multi-disciplinary teams that help achieve regional sediment management challenges. For example, BEACON's programs and projects must address combined social and ecological systems if they are to be successful. Regional sediment management approaches emphasize the development of multiple benefit projects that address both environmental and social benefits. Increasing efforts within the BEACON coast are being directed to interdisciplinary analysis but gaps and voids remain (Myers et al., 2019). Through the SAC activities and objectives identified in the Science Action Plan, BEACON will have the requisite information to intentionally encourage interdisciplinary science for improved decision-making. The Santa Barbara Area Coastal Ecosystem Vulnerability Assessment (CEVA) analyzed future changes to southern Santa Barbara County climate, beaches, watersheds, wetland habitats and beach ecosystems. This example framework can be implemented in Ventura County providing for a consistent analysis of ecosystem vulnerability for the BEACON region.

Early Implementation Actions:

- Extend the CEVA framework analysis from Santa Barbara County to the littoral cells encompassing Ventura County.

Modeling

BEACON needs to continue to support and expand modeling efforts of partners that can help provide insight to innovative regional sediment management and SLR adaptation solutions. BEACON has supported efforts to model regional climate and SLR impacts on coastal resources and supported modeling efforts aimed at better understanding sediment transport and fate dynamics on a littoral cell basis. BEACON should further this work and include watershed scale approaches that link upper reaches of fluvial systems with coastal environments. This information can directly lead to advancements in the development of and understanding of various prototypes of coastal adaptation strategies and shoreline stabilization techniques.

BEACON should support updating and refining regional down-scaling of climate, and weather models, including extreme events, that address coastal watershed and coastal ocean conditions affecting both sediment management and coastal adaptation.

Early Implementation Actions:

- Seek funding to support further modeling efforts focused on watershed to littoral cell processes and regional downscaling of climate linked impacts (e.g. sea level rise, temperature, fire, precipitation, and flooding) including extreme events.
- Continue to support data collection and modeling of sediment source, transport, and fate to help inform coastal adaptation activities (e.g. beach nourishment/beneficial use, prototyping shoreline stabilization projects, dredge

material placement, identifying priority monitoring areas, etc.) This includes sediments of many grain sizes, from mud to sand and larger sizes such as cobble.

Prototyping and Demonstration Projects

BEACON has been a long-time supporter of proof-of-concept demonstration projects, involving living shoreline treatment projects, and innovative coastal resource restoration projects, including integrated beach and dune restoration and 'managed retreat' projects.

BEACON should continue to support innovative prototyping efforts, including sand stabilization and retention structures, such as 'green' groins that prioritize mimicking natural cobble berm features. These efforts can better establish the type and extent of impacts (positive and negative) coastal resilience strategies have on natural environments (Ventura County, 2019). In particular this includes building experimental design components into projects with alternative features to support designing strategies that produce the best results to achieve local and regional goals (i.e., ecological, recreational, protective, etc.).

Early Implementation Actions:

- Develop one or more new research project(s) focused on innovative sediment retention structures that are environmentally sound and provide resilient features.

Research Agenda Early Implementation Actions Summary

Management and Decision Science

- Expand coordination role and activities analyzing and implementing best options to increase coordination and connections, including acting as hub, serving as connector, and/or functioning as a repository
- Continue and expand upon focused efforts to link scientists through the BEACON SAC, and develop expanded partnerships with local and regional managers such as ongoing Managers Workshops and targeted integration of science (including social science) efforts to better understand how science activities can contribute to achieving management goals. Consider appointing a Manager Liaison to the SAC to facilitate direct communication between groups.

Integrating Climate Science into BEACON Policies, Programs and Projects

- Develop work plans to integrate climate and SLR impacts into regional sediment management plans focused on downscaled regional shoreline models and watershed coastal flooding models
- Continue to identify and keep up to date a catalogue of local jurisdiction assessment and planning documents that incorporate sea level rise and climate science into coastal resource management.
- Develop an updated to the BEACON Coastal Regional Sediment Management Plan (CRSMP) that includes current climate and sea level rise information, in additional to adaptation strategies that can be taken at a regional level.

Regional Monitoring Programs

- Further work towards coordination of regional monitoring (of all types) including data standardization, shared data repository for local projects to feed into, and some initial analysis and metrics to help local managers easily use and implement monitoring information, including bluff-backed beaches, and align the various monitoring programs to better leverage one another.

Physical Shoreline Data Collection and Modeling

- Extend shoreline physical profiling to all regional beaches and align the various monitoring programs to better leverage one another.

Coastal Ecology and Ecological Regional Monitoring

- Develop a Sandy Beach Habitat and Species Framework Analysis and expand baseline data collection of habitat and species conditions within the region. Areas of less disturbance, and restored sites could be prioritized for reference sites.

Human Use and Economics Data Collection and Monitoring

- Update human beach use and beach user information, including socio-economics, and investigate development of a data portal housed at BEACON or a local university. Areas of less disturbance, and restored sites could be prioritized for reference sites.

Interdisciplinary Research Approach

- Extend the CEVA framework analysis from Santa Barbara County to the littoral cells encompassing Ventura County.

Modeling

- Seek funding to support further modeling efforts focused on watershed to littoral cell processes and regional downscaling of climate linked impacts (e.g. Sea level rise, temperature, fire, precipitation, and flooding) including extreme events.
- Continue to support data collection and modeling of sediment source, transport, and fate to help inform coastal adaptation activities (e.g. beach nourishment/beneficial use, prototyping shoreline stabilization projects, dredge material placement, identifying priority monitoring areas, etc.) This includes sediments of many grain sizes, from mud to sand and larger sizes such as cobble.

Prototyping and Demonstration Projects

- Develop one or more research project(s) focused on innovative sediment retention structures that are environmentally sound and provide resilient features.

Research Agenda Implementation Schedule 2021-2022

The implementation schedule below (Figure 4) highlights key activities to be initiated, or expanded and enlarged, in the next two years in support of ongoing and proposed BEACON activities. Leveraging external sources, BEACON has secured funding for some of the early implementation activities recommended and will be working with project partners to implement portions of the recommended actions and activities, including considering developing coordinated regional monitoring programs, and supporting demonstration projects to evaluate project effectiveness and feasibility and potential applicability to other coastal sites and locations.

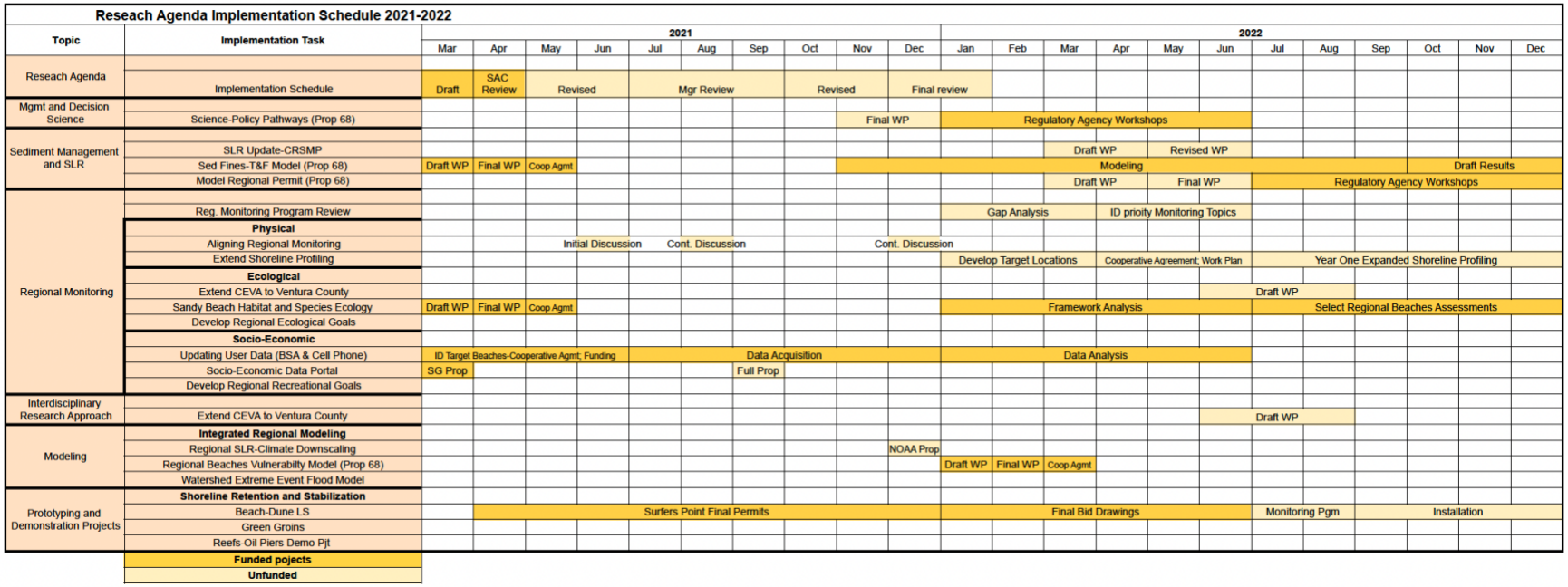

Figure 4. Research Agenda Implementation Schedule 2021-2022

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Appendix A: Relevant Research and Science Initiatives in SBLC

Research Initiative	Sponsor Agency	Research Topic	Geographic Extent	Principal Investigator(s)	Time Period	Research Focus	Source of Funds	Cooperating Agencies	Link to Available Resource
Shoreline Monitoring	USGS	Physical Monitoring	SBLC-Elwood-Pt. Mugu	Dan Hoover	1995-present	Shoreline monitoring	USGS	BEACON	
SBC LTER	NSF	Ecological Monitoring	Santa Barbara Channel (local focus)	Bob Miller	2000-present	Kelp ecosystem monitoring		NSF, UCSB, MSI, LTER network	https://sbclter.msi.ucsb.edu/
SBC Kelp Monitoring	UCSB	Ecological Monitoring	Coal Oil Point Reserve	Jessica Nielsen	2012 to present	Kelp monitoring			https://copr.nrs.ucsb.edu/about/programs/subtidal-monitoring
Multi-Agency Rocky Intertidal Network (MARINe)	BOEM, NPS, OPC, PISCO, US Navy	Ecological Monitoring	Alaska to Baja	Pete Raimondi	1997-present	Rocky intertidal habitats	Various	Several	https://marine.ucsc.edu/index.html
BOEM		OCS Oil and Gas Pgm				Environmental impacts			
CoSMoS	USGS	Flood Modeling, Cliff Failure, Coastal Groundwater Response	California	Patrick Barnard	2013-present	Coastal storms and sea level rise impacts modeling	USGS, OPC	Several	• https://www.usgs.gov/centers/pcmsc/science/coastal-storm-modeling-system-cosmos?qt-science_center_objects=0#qt-science_center_objects • https://ourcoastourfuture.org/ • https://www.usgs.gov/apps/hera/
CoSMoS COAST	USGS	Shoreline Modeling	California	Sean Vitousek	2017-present	Shoreline evolution	USGS	Several	
Santa Barbara Channel MPA Collaborative	OPC, BEACON	Ecological Management	Santa Barbara MPAs	Julie Bursek, Kristen Hislop	2012-present	MPA management and enforcement	OPC, SB Museum of Natural History	OPC, CDFW, CINMS, EDC	https://www.mpacollaborative.org/santabarbara/
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)	UCSB, UCSC, OSU	Ecological Monitoring	Oregon and California	Jennifer Caselle, Carol Blanchette, Libe Washburn	1999-present	Long term ecosystem monitoring	Various	CDFW, OPC, CINMS, ReefCheck	http://www.piscoweb.org/
Beach Sustainability Assessment (BSA)	CSUCI	Interdisciplinary coastal assessment	Santa Barbara and Ventura	Kiki Patsch, Dan Reineman, Phil King, Nina Roberts, Charles Lester	2013-present	Ecology, Geomorphology, Social Utility	CSUCI, CSU COAST, CASG		https://www.bsa-camp.org/
COPE Ecological Monitoring Network	UCSB	Ecological Monitoring	Central Coast	Ali Burgos	2021-present	Subtidal ecological monitoring	NSF COPE		
Dune Science Collaborative	CASG	Dune/Living Shoreline strategies	California	Laura Engeman; Nick Sadrpour	2020-present	Community of practice around dune coastal resilience strategies	Honda Foundation CASG	CASG, USC SG, Bay Foundation, CRC	https://www.resilientcoastlines.com/home
Permit Streamlining: Fine Sediment Transport/Fate, Ecological Impacts,	OPC, BEACON	Interdisciplinary sediment permitting	Santa Barbara	Marc Beyeler, Jon Warrick, Jenny Dugan, Nick Sadrpour,	2021-2023	Permit Streamlining: Fine Sediment Transport/Fate,	OPC, BEACON, SB County	Santa Barbara County Flood Contol District	

Placement Protocols, etc.				Maureen Spencer		Ecological Impacts, Placement Protocols, etc.	Flood Control		
Marshes on the Margin	SCC, NCCOS	Ecological and physical changes of wetlands due to sea level rise	Southern California Bight	Evyan Sloane, John Largier, Karen Thorne, Jeremy Lowe, Jeff Crooks, Melodie Grubbs, Eric Stein	2018-present	wetland transitions and mouth opening/closing changes due to sea level rise	NCCOS EESLR	TRNERR, Santa Barbara Airport	https://trnerr.org/marshes-on-the-margin/
Coastal Resilience-Ventura/Santa Barbara	TNC	Coastal Hazards Modeling	Santa Barbara and Ventura	Bob Battalio	2013-Present	Coastal Hazards Mapping	TNC	ESA, BEACON, several	https://coastalresilience.org/project/santa-barbara-county/ https://coastalresilience.org/project/ventura-county/
Coastal User Assessment	BEACON/ MRCA/C ASG	Coastal use	Santa Barbara-Malibu	Kiki Patsch, Nate Merrill, Sean Anderson, Marc Beyelor, Elena Eger, Nick Sadrpour, Tom Ford	2021-Present	Coastal User identification	BEACON, MRCA,C ASG	BEACON, MRCA, CASG, CSUCI, Bay Foundation, EPA	
Impact of Sea-Level Rise on Groundwater Pollution Vulnerability in Shallow Coastal Aquifers	CSU COAST/ CASG	SLR flooding and groundwater	Oxnard	Ben Hagedorn, Matt Becker, Danielle Bram	2021-Present	Groundwater flooding impacts on toxic sites	CSU COAST/C ASG	CSULB, CSUN	
Community Science:									
Grunion Greeters	Pepperdine	Ecological Monitoring	Southern California Bight	Karen Martin	2010?	Grunion spawning	NMFS-SWR	Several	http://grunion.pepperdine.edu/ggproject.htm
Communicty Alliance for Surveying the Topography of Sandy Beaches (CoAST SB)	CASG	Physical Monitoring	Santa Barbara (various beaches)	Aaron Howard	2018-present	Shoreline monitoring	Various	USGS, BEACON, CASG	https://caseagrant.ucsd.edu/project/coast-sb-community-alliance-for-surveying-the-topography-of-sandy-beaches
Beach Water Quality	SB ChannelKeeper	Water Quality Monitoring	Santa Barbara and Ventura	Ben Pitterle		Water quality	Island Brewing Company		https://www.sbck.org/our-work/field-work/beach-water-quality/
Surfrider BWTF-Ventura	Surfrider	Water Quality Monitoring	Ventura and Santa Barbara	April Bender	2018-present	Water quality	Chuck Vinson Memorial Fund		https://ventura.surfrider.org/programs-and-campaigns/bwtf/
King Tides	California Coastal Commission	Coastal Storms and Flooding	Ventura and Santa Barbara			Coastal flooding		Coastal Commission	https://www.coastal.ca.gov/kingtides/index.html

Appendix B- BEACON Strategic Plan Goals and Objectives (BEACON, 2021c)

Strategic Planning Work Plan Actions	1-2 years	3-5 years	Continuous
Goal 1 Promote Beach Preservation and Beneficial Use of Sediment			
Obj. 1.1 Preservation and Restorationof Natural Sand Supply			X
Obj. 1.1.1 Complete SB Debris Basin Project	*X*		
Obj. 1.1.2 Support Matilija Dam Removal Project	*X*		
Obj. 1.2 Support Harbor Sand By-pass Dredging			X
Obj. 1.2.1 CI Sand Bypassing	*X*		X
Obj. 1.2.2 Port of Hueneme Sand Dredging	*X*		X
Obj. 1.3 Opportunistic Sand-Regional Permit	*A1; A2*	A3; A4	
Goal 2 Expand Science Support to BEACON			
Obj. 2.1 Create Science Advisory Committee	*A1; A2; A3*		
Obj. 2.2 Integrate Climate/SLR Science in BEACON Policies	*X*		
Obj. 2.2.1 Complete SLR Update to CRSMP	*X*		
Obj. 2.3 Continue and Expand Regional Shoreline Monitoring			X
Obj. 2.4 Promote Interdisciplinary Science Research Efforts			X
Goal 3 Expand BEACON's Regional Sea Level Rise Coordination and Planning Activities			
Obj. 3.1 Develop Regional Climate and Sea Level Rise Adaptation Strategy	*X*		
Obj. 3.2 Investigate Establishing Regional Shoreline Monitoring Program	*X*		
Obj. 3.3 Pursue Regional-Level Sea Level Rise Studies, Projects and Funding	*X*		
Goal 4 Develop Innovative Sand Retention Projects			
Obj. 4.1 Seek funds to study innovative approaches	*X*		
Obj. 4.2 Identify and develop innovative demo projects			X
Obj. 4.3 Surfers Point Project-Complete Final Engineering	*X*		
Obj. 4.4 Oil Piers Reef Project-Update Feasibility Analysis		X	
Goal 5 Support Expanded Coastal and Marine Restoration			
Obj. 5.1 Support Natural Infrastructure Demo Projects			X
Obj. 5. 1.1 Expand Goleta Bay Kelp Demo Project	*X*		
Obj. 5.1.2 Dunes Demonstration Model Project		*X*	
Goal 6 Maintain and Enhance Coastal Water Quality	*X*		
Obj. 6.1 Integrate Water Quality Criteria in Projects			X
Goal 7 Support Coastal Access and Recreation			
Obj. 7.1 Support Completion of Surfers Point Project		A2	
Obj. 7.2 Complete Mondo's Cove Beach Access Project	*A1*	A2	
Obj. 7.3 Maximize Coastal Access and Recreation in BEACON projects			*X*
Goal 8 Improve Planning, Governance and Funding	*A1*		
Obj. 8.1 Develop Strategic Planning Goals and Objectives			
Obj. 8.2 Strengthen Governance Partnerships	*X*	A2	X
Obj. 8.3 Develop Expanded Local Funding	*A1*		X

Appendix C- BEACON Local Agency Coastal Vulnerability and Adaptation Planning Resources

Member Agency	Climate Planning Documents	Climate Action Plan	Regional Modeling	Vulnerability Assessment	Economic/ Fiscal impact	Governance	Adaptation Policy/ Strategy Planning	Regional Adaptation Policies and Strategies	BEACON Regional Consultation	Notes
City of Santa Barbara	Climate Action Plan (2012); Goleta Slough Area Sea-Level Rise and Management Plan (2015); Sea-Level Rise Vulnerability Assessment (2018); Updated Coastal Land Use Plan (2019); Draft Sea Level Rise Adaptation Plan and Vulnerability Assessment Update Public Review Draft (2020)	CAP: Appendix B. SB Sea Level Rise Study (2012)	P. Barnard-USGS; Santa Barbara County Coastal Hazard Modeling and Vulnerability Assessment (2015)	Sea Level Rise: Griggs & Russell (2012): Vulnerabilty Analysis (2015); Vulnerability Assessment Update (2018)	Cost-Benefit Analysis AECOM (2020)	SLR Adaptation Plan Subcommittee; City Staff Interdepartmental SLR Team	Prioritiization and Selection of Adaptation Strategies (2018); Coastal Land Use Plan interim development review policies (2019); High Priority for Next Five Years (2020)	Shoreline Monitoring: Beach, Bluff, SLR, Groundwater, Flooding Events; Expand Beach Nourishment; Joint Studies; Regional Climate Collaborative: Research on case studies, law and policy on adaptation implementation; BEACON SLR Update to CRSMP; State Adaptation Funding	K. Traiberg; G. Comati-BEACON	ESA and AECOM; CoSMoS (USGS); Adaptation Principles
City of Goleta	City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report (2015)	City of Goleta Climate Action Plan (2014)	Santa Barbara County South Coast Coastal Resiliency ESA Modeling (2015); USGS Coastal Storm Modeling System (CoSMoS)	City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report (2015)	City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report (2015)		City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report (2015)		Anne Wells, Goleta; G. Comati; J. Bailard-BEACON	https://www.cityofgoleta.org/city-hall/planning-and-environmental-review/advance-planning-division
City of Carpinteria	General Plan/Local Coastal Plan Update; Sea Level Rise Vulnerability Assessment and Adaptation Project (2019)		COSMos	D. Revell- Revell	P. King-Revell		D. Revell-Revell	Dune & Shoreline Management Plan: Living Shoreline Project (Phase 1: City Beach)	B. Brennan; J. Bailard	
County of Santa Barbara	Sea Level Rise & Coastal Hazards Vuolnerability Assessment (2017);	Energy and Climate Action Plan (2015)	B. Battalio-ESA (South Coast); Coastal Resilence Santa Barbara (ESA) 2015; D. Revell-Revell (North Coast);	D. Revell-Revell					M. Beyeler-BEACON	
City of Oxnard	Local Coastal Plan Update: Sea Level Rise Vulnerability Assessment (2016); Sea Level Rise Adaptation (2018)			D. Revell-Revell	P. King-SFSU		S. Hecht-UCLA (Not completed)			
City of Ventura	Climate Action and Resilience Plan (2020)									Prop 84 Wildfire Recovery and Resiliencey Planning Grant (June 2020)
County of Ventura	Sea Level Rise Adaptation Strategies Report (2019)	2040 General Plan (Sept, 2020)	TNC/CCC Coastal Resilience Tool, ESA.; B. Battalio-ESA; CoSMoS 3.0,; Barnard-USGS;	County/D. Revell-Revell, 2018	P. King-Revell	Local Coastal Program Amendments led by Planning; CAP implementation Planning and CEO's Office, Climate Emergency Council	Adaptation Plan by County/Revell, 2019. Planning working with other agencies on adaptation projects, preparing Local Coastal Program(LCP) Amendments	Shoreline Management Plans, Beach Nourishment; Ephemeral Cobble Groin Pilot Project, sediment bypassing at Point Mugu, transport inland debris basin sediment to the coast, dune restoration, support Beacon updates to CRSMP, improve access, etc.	J. Bailard; M. Beyeler-BEACON	Planning Divison is Updating LCP with CCC Planning Grant, Harbor Dept. applied to Conservancy for dune restoration grant in Summer of 2020 for Hollywood Beach

Appendix D: Framework for Integration

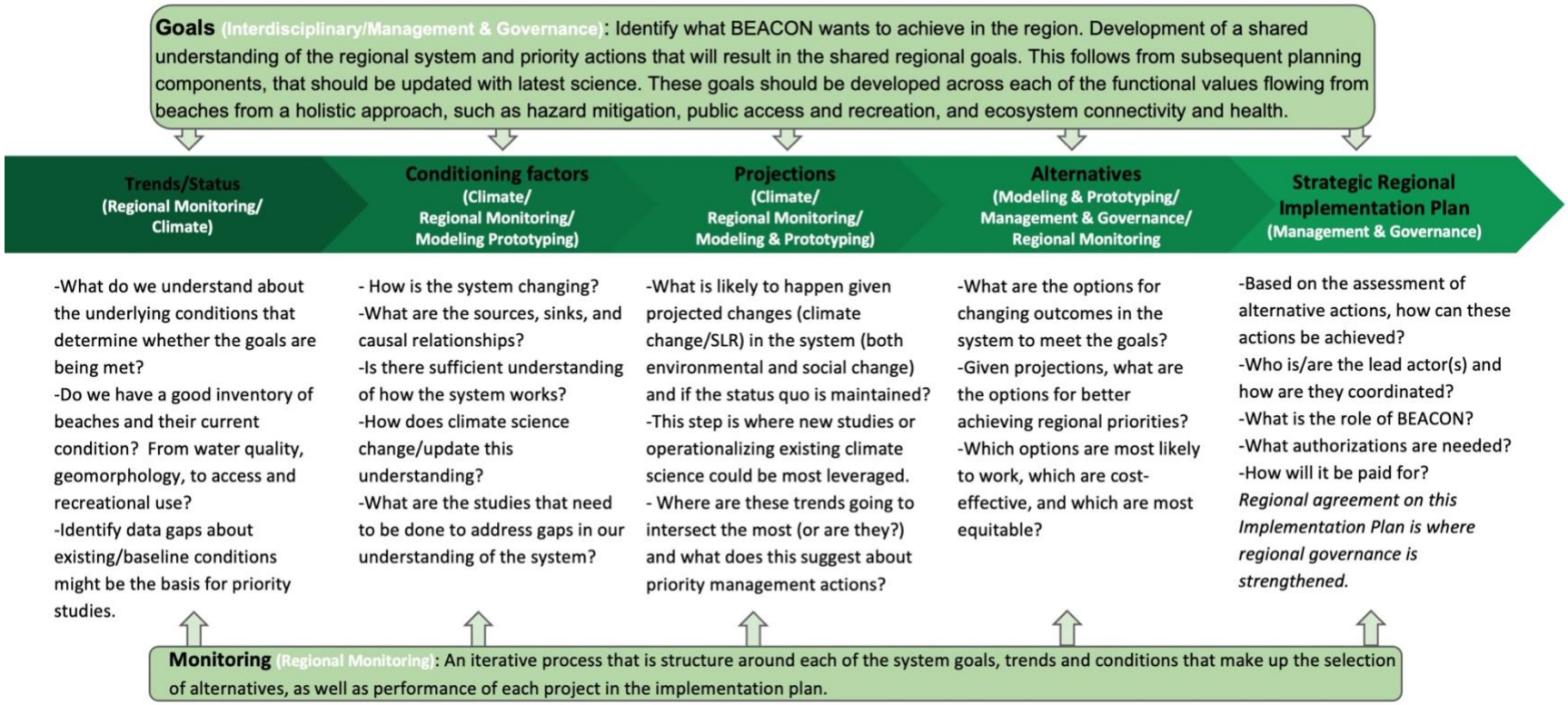

Figure D-1. A framework of an iterative process that can integrate management and governance science with the other major themes identified by the SAC: interdisciplinary research approach, climate science, modeling and prototyping, and monitoring, focused on regional goals.

Report Preparation

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