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# The Stakes are Rising: Lessons on Engaging Coastal Communities on Climate Adaptation in Southern California

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# The Stakes are Rising: Lessons on Engaging Coastal Communities on Climate Adaptation in Southern California

Preparing for climate change is rising as a priority for many public policy agendas, driving a demand for information that allows communities to identify both current and projected vulnerabilities to climate change at local and regional levels. In response, a developing climate change adaptation service sector is bringing science and technical training to policy-makers. Approaching adaptation planning through a regional lens is critical, due to the large number of stakeholders and the intensely interconnected nature of geographies, communities, and economies. Decisions made in one jurisdiction will undoubtedly affect its neighbors.

In this emerging field, boundary organizations play a unique role in building capacity across jurisdictions and bridging the gaps among various community, science and government stakeholders. The University of Southern California (USC) Sea Grant Program, located in Los Angeles, has developed a robust stakeholder engagement process to help communities plan for the impacts of climate change along the urbanized coastline. In 2016, USC Sea Grant analyzed its climate change adaptation outreach program to gain insights about its effectiveness. Drawing from this analysis, this paper explores: 1) stakeholder processes; 2) communications methods, particularly the challenges of communicating scientific information; 3) barriers to planning and implementation; 4) how to identify community needs; and, 5) what kinds of investments have been made to meet those needs.

Four primary lessons are identified: 1) place-based boundary organizations can be an effective broker in establishing trust among stakeholders; 2) the ever-evolving and complex nature of climate science can overwhelm stakeholders and stall progress, so it is important to emphasize key messages provided by the scientific information, rather than dive deep into technical details and methods; 3) adaptive management is a promising approach to help communities move forward; and, 4) lack of significant and sustained funding for adaptation will continue to limit progress, however, even modest investments made at the right time can be impactful. Finally, the paper discusses the challenges USC Sea Grant faced in the first six years of its climate adaptation outreach program, and provides thoughts on how to help communities continue to advance their adaptation planning goals in the years to come.

## **Keywords**

Sea Level Rise, Climate Change, Stakeholder Engagement, Adaptation, Coastal Communities, Planning, California

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continued support and recognition of the importance of outreach and education in preparing coastal communities for the impacts of climate change has been critical to our success.

## INTRODUCTION

Public concern about the potential impacts of climate change on our communities has increased over the last few decades. According to a 2013 public survey, an overwhelming majority (82 percent) of Americans want to prepare in order to minimize the damage likely to be caused by global warming-induced sea-level rise and storms (Stanford University 2013). Preparing for climate change is rising as a priority for many public policy agendas, driving a demand for information that allows communities to identify both current and projected vulnerabilities to climate change at the local and regional level. The need for robust science to inform these efforts is likewise increasing (Dilling and Lemos 2011) and a climate change adaptation service sector has developed in response to bring science and technical training to policy-makers.

In this emerging field of climate change adaptation, boundary organizations can serve as a critical component for the adaptation services sector. Boundary organizations work across the traditional boundaries of government, science, and communities to bridge the gaps among various stakeholders and provide the link between scientific understanding and public policy and management (Parker and Crona 2012). These organizations serve as a potential solution for addressing the challenge of building capacity and collaboration across jurisdictions and “crossing the functional and cultural boundaries” of environmental policy and science (Guston et al. 2000). In California (and nationally), boundary organizations are increasingly engaged in providing services in the adaptation field including: translating complex climate science for non-technical practitioners; identifying the best available local scientific information and its applicability to decision-making; providing climate vulnerability assessments and adaptation training; identifying effective adaptation strategies; and engaging a wide range of stakeholders who are or should be involved in the planning process.

The University of Southern California Sea Grant (USC Sea Grant) program, located in Los Angeles at the University of Southern California (USC), is a federal, state, and university partnership that serves as a key non-partisan science and education resource to the communities of California. For more than 40 years, USC Sea Grant has worked across science, policy, and cultural boundaries to build capacity and ensure policy makers and communities have the benefit of sound science when making decisions. USC Sea Grant initiated work on climate adaptation in 2010 by conducting a survey of coastal professionals in California to better understand their needs and barriers in moving forward in adaptation planning. Since that study, USC Sea Grant has developed a robust stakeholder engagement process and education program to help communities plan for the impacts of climate change along the urbanized coastline. In 2016, USC Sea Grant initiated a self-analysis and stakeholder interview process to gain insights about the effectiveness of this program, to learn where improvements could be made, and to garner input for the future directions of the program. Drawing from these experiences, this paper explores:

- 1) stakeholder processes;
- 2) communications methods, particularly the challenges attendant upon communicating scientific information;
- 3) barriers to planning and implementation;
- 4) how to identify community needs; and,
- 5) what kinds of investments have been made to meet those needs.

From this analysis, four primary lessons are identified:

- 1) place-based boundary organizations can be an effective broker in establishing trust among stakeholders;
- 2) the ever-evolving and complex nature of climate science can overwhelm stakeholders and stall progress, so it is important to emphasize key messages provided by the scientific information, rather than dive deep into technical details and methods;
- 3) adaptive management is a promising approach to help communities move forward, however few examples exist for communities to emulate; and,
- 4) lack of significant and sustained funding for adaptation continues to limit progress, however, even modest investments made at the right time can be impactful.

Finally, the paper reflects on the challenges USC Sea Grant has faced in the first six years of its climate adaptation outreach program, and provides thoughts on how to help communities continue to advance their adaptation planning goals in the years to come.

## **ROLE OF BOUNDARY ORGANIZATIONS IN CLIMATE ADAPTATION**

Boundary organizations often provide the link between scientific understanding and public policy and management (Parker and Crona 2012). In 1998, David Guston and colleagues explored the concept of boundary organizations as a potential solution for addressing the challenge of “crossing the functional and cultural boundaries” of environmental policy and science (Guston et al. 2000). Boundary organizations can be found in a number of sectors such as health, agriculture, technology, and environmental protection. According to Guston, to cross the functional divide between science and policy, boundary organizations must meet three criteria. First, they must provide opportunities and incentives for creating and using what he calls “boundary objects or standardized packages.” These are objects or practices that reach across two social worlds, such as science and policy, and can be used by each to facilitate goals. These could be research results, model agreements, and/or standardized classification systems (Guston 2001; Parker and Crona 2012). Second, efforts must involve participation from actors on both sides of the boundary (i.e. scientists and practitioners) as well as mediators. Third, these entities exist at the frontier of the disparate communities but are accountable to both (Guston 2001). Because boundary organizations must serve the needs of and provide resources to both the scientific and practitioner communities, success is determined by the principals on each side, while also remaining stable to external forces and potential internal instability (Guston 2001).

In practice, boundary organizations often have more than two sets of constituents who may have different goals and expectations. Sullivan and Sketcher (2002) utilize the term “reticultist” to describe the role many boundary organizations endeavor to fill to facilitate collaboration among disparate stakeholders. Reticulists are leaders in collaborations that motivate participating stakeholders to collective action. They are adept at convening stakeholders, navigating across boundaries of competing interests, and forging linkages between stakeholders. A reticultist may serve different roles such as a convener, capacity builder, or catalyst, but the key to the role is to “understand and be able to work network relationships,” particularly when personality factors or conflicting interests hamper collaboration (Sullivan and Sketcher 2002).

Sea Grant programs across the country have a strong history of taking on roles to facilitate difficult negotiation processes among stakeholders with conflicting motivations and strong personalities, in fields such as fisheries, ports and maritime affairs, and marine resource management. For example, from 2009 to 2011, USC Sea Grant played a critical role in the establishment of marine protected areas (MPAs) in Southern California, a contentious process wrought with differing interests and stakeholders not accustomed to working together. USC Sea Grant worked with a wide range of constituencies to negotiate differences over preferences in the spatial selection and level of protection of MPAs. USC Sea Grant provided leadership and leveraged resources to ensure the advice and assistance of scientists, resource managers, experts, stakeholders, and members of the public were considered throughout the process. As a result of a robust stakeholder engagement process, a network of 50 science-based MPAs went into effect in Southern California on January 1, 2012.

As early as 2000, Sea Grant was discussed as a potential for leadership as a boundary organization in the context of climate change (Guston et al. 2000). While Sea Grant programs may not have been designed to fill this need, many programs were finding themselves increasingly playing that role. The major barriers for most coastal communities at that time were the lack of continual and assured funding at the national level, and the lack of localized sea level rise information (Guston et al. 2000). While Sea Grant programs have been actively investing in research pertaining to climate science, adaptation became a central focus for many programs starting in 2009. Because this was a need in their local stakeholder communities, climate change adaptation increasingly became a central focus for many Sea Grant programs nationally. The National Sea Grant Program<sup>1</sup> accordingly established a dedicated climate adaptation funding stream to provide consistent funding to the regional programs. Established in 2009, the Sea Grant Climate Network, a network of approximately 90 Sea Grant outreach professionals, was created to increase the effectiveness of climate programming and outreach nationwide by coordinating climate-related activities, sharing talent and resources, and working with climate agencies and organizations within the National Oceanic and Atmospheric Administration (NOAA), in other federal and state agencies, and in local communities. As foreseen by Guston in 2000, this program helped to underpin Sea Grant's now prominent role in the adaptation service industry.

## **SEA LEVEL RISE ADAPTATION PLANNING IN CALIFORNIA**

In California, there has been growing interest from local communities in the emerging issues brought about by a changing climate and the prospect of shoreline change. Sea levels are expected to rise in Southern California, resulting in flooding, beach erosion, and cliff retreat, and damaging coastal infrastructure such as roads, water treatment plants, and power plants (Vitousek 2017, Griggs 2017). Many vulnerable coastal populations will also be impacted. Consequently, coastal communities recognize the necessity of integrating climate change considerations into planning. In 2009, the California State National Resources Agency (CNRA) released the first California Climate Adaptation Strategy to ensure a coordinated effort to adapt to the unavoidable impacts of climate change (CNRA 2009). CNRA and other partners released an Adaptation

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<sup>1</sup> The National Sea Grant College Program is a federal program consisting of 33 university-based programs in all coastal and Great Lakes states. See the National Sea Grant website for more information on background and history of the program - <http://seagrant.noaa.gov/howeare/seagranthistory.aspx>.

Planning Guide in 2012 to provide guidance to regional and local communities addressing climate change impacts. It provides a step-by-step process for vulnerability assessment and adaptation strategy development (CNRA 2012). While there was no official mandate at the time directing local governments to address climate change adaptation, many communities began to evaluate climate risk and discuss adaptation. Some communities had already begun initiating greenhouse gas (GHG) mitigation plans known as Climate Action Plans to meet GHG reduction goals under Assembly Bill 32: The California Global Warming Solutions Act of 2006. Understanding how to address the unavoidable impacts of climate change was a natural next step.

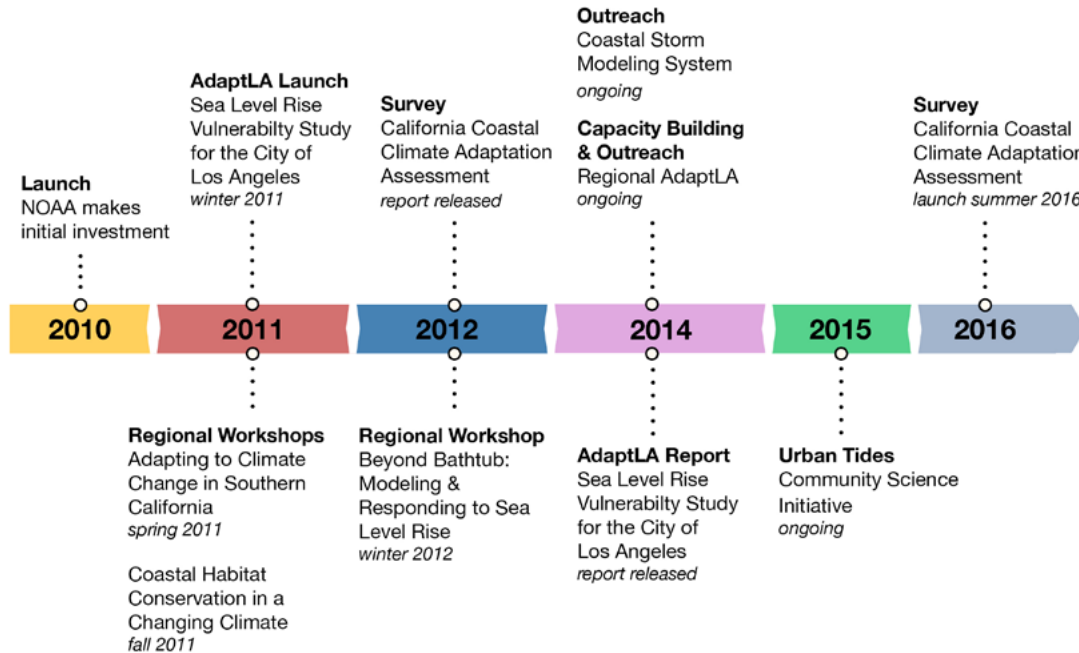


Figure 1: Summary timeline of major projects under USC Sea Grants Coastal Climate Change Adaptation Program from 2010-2016.

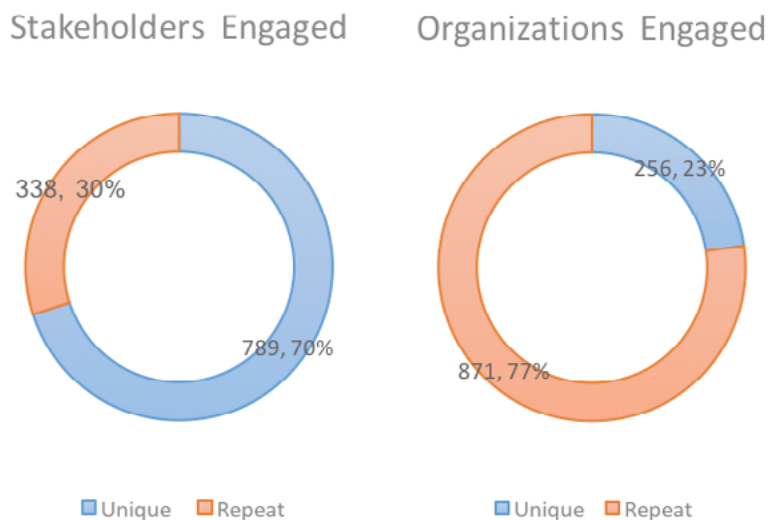


Figure 2: Results from analysis of attendee lists from 30 USC Sea Grant-supported events from 2010-2016 focused of climate change science and adaptation planning.

USC Sea Grant began focusing on climate adaptation extension and outreach in 2010. Its work since then has included local- and regional-scale workshops aimed at sharing the latest scientific information and capacity-building among stakeholders, sea level rise and climate science translation and outreach, targeted technical assistance, a professional development webinar series, and a statewide needs assessment. This work includes six primary projects: 1) California Coastal Climate Adaptation Needs Assessment Survey; 2) Workshops, Training, and Technical Assistance; 3) City of Los Angeles Vulnerability Assessment; 4) Regional AdaptLA Program; 5) Outreach on Coastal Storm Modeling; 6) Urban Tides Community Science Initiative (Figure 1 and Table 1). Through this work, USC Sea Grant has reached more than 5,600 stakeholders through various events, workshops, and sponsored conferences. Through an analysis of approximately 30 outreach workshops and more than 1,100 stakeholders, it was found that more than 250 different organizations involved in climate science and adaptation were engaged in the Southern California region through USC Sea Grant’s efforts and projects. Figure 2 illustrates that while organizations participating in USC Sea Grant events have remained consistent, there have been frequent alterations in staff who have attended. There has therefore been a need for accommodating new participants who might not have had the benefit of prior training or information.

Table 1: Major USC Sea Grant Projects and Outcomes

<b>Project:</b>	<b>California Coastal Climate Adaptation Needs Assessment Survey: 2011, 2016</b>
Audience:	Coastal professionals
Purpose:	The 2011 survey focused on identifying what information and technical assistance coastal communities needed, as well the barriers they faced in climate adaptation planning. The 2016 survey gauged how communities have progressed in their adaptation planning, what current barriers they face, and how boundary organizations, governmental, and non-governmental organizations (NGOs) can better meet their needs.
Outcomes:	In 2011, 90% of surveyed communities indicated that they were in the early stages of planning for climate-induced coastal impacts; and many had begun planning without state- or federal-level mandates that required them to do so. Financial resources, staff resources, and a lack of capacity were identified as top challenges to planning efforts; and that outreach and training in innovative adaptation approaches would be beneficial. 2016 survey results are forthcoming in 2017.
<b>Project:</b>	<b>Workshops, Training, and Technical Assistance: 2011-2017</b>
Audience:	Coastal Professionals, scientists, and public and private sector leaders
Purpose:	To facilitate a suite of regional workshops that brought climate adaptation science, information, and strategies to a broader audience.
Outcomes:	These events introduced the practice of climate adaptation and shared the best science available at the local, national, and global level.



(Table 1, continued)

<b>Project:</b>	<b>City of Los Angeles Sea Level Rise Vulnerability Study (initial AdaptLA program): 2011</b>
Audience:	Representatives from key City departments: Planning, Recreation and Parks, Emergency Management, Harbor, Water and Power, and Public Works; and a broader Regional Stakeholder Working Group of neighboring jurisdictions, Los Angeles County, state and federal partners, and local NGOs.
Purpose:	Assess the vulnerability of assets, resources, and communities situated in the City's coastal reaches. Critical components: 1) highlight the importance of utilizing the best available science in planning; 2) develop an adaptive management approach in planning for sea level rise and coastal impacts to incorporate new information as it becomes available; and, 3) develop a robust stakeholder engagement process.
Outcomes:	The study provided an assessment of the potential physical, social, and economic impacts of sea level rise on the City's resources and population, as well as the possible impacts to coastal and shoreline assets. The project spurred significant partnership development across city government and throughout the region.
<b>Project:</b>	<b>Regional AdaptLA: Coastal Impacts Planning for Los Angeles County: 2014-2017</b>
Audience:	Coastal professionals, scientists, and public and private sector leaders from 12 coastal Los Angeles communities, and the County of Los Angeles
Purpose:	Develop sophisticated sea level rise and shoreline change science for the region; build capacity within the local municipalities to help them utilize technical information for their adaptation planning.
Outcomes:	Provided targeted technical assistance, workshops, and webinars (Figure 3) to 1,368 stakeholders to support local land use, hazard mitigation, and adaptation planning efforts; which directly resulted in increased collaboration among coalition partners, increased use of science in planning efforts, and the advancement of coastal impacts planning efforts in 11 coastal Los Angeles communities and the County.
<b>Project:</b>	<b>Southern California Coastal Impacts Planning Project / Coastal Storm Modeling System Outreach: 2014-2017</b>
Audience:	Coastal professionals, scientists, and public and private sector leaders from coastal communities in the five Southern California counties (Santa Barbara, Ventura, Los Angeles, Orange and San Diego).

(Table 1, continued)

Purpose:	Build capacity and lead outreach for the U.S. Geological Survey’s update of its Coastal Storm Modeling System (CoSMoS) for Southern California. CoSMoS is a physics-based modeling approach that projects coastal flooding and shoreline change (sandy beach change and cliff retreat) due to both sea level rise and coastal storms driven by climate change.
Outcomes:	Reached 611 stakeholders and practitioners in Southern California communities, connecting them with the best available scientific modeling projections to support coastal hazard planning.
<b>Project:</b>	<b>Urban Tides Community Science Initiative: 2015 - ongoing</b>
Audience:	Citizen scientists, researchers, community and government leaders
Purpose:	Engage citizen scientists to collect data by photo-documenting current high tides, coastal flooding, and erosion along Southern California’s coastline.
Outcomes:	846 image records are providing critical water level data to help ground truth and calibrate scientific models, including CoSMoS, used to identify vulnerable locations along the coast.

**Outreach Events for Regional AdaptLA: 2014 - 2016**

Key: ■ Workshop ■ Open House ■ Webinar



Figure 3: Summary of outreach events under the Regional AdaptLA – Coastal Impacts for the L.A. Region project from 2014-present.

## **ANALYZING USC SEA GRANT'S COASTAL CLIMATE CHANGE PROGRAM**

To identify lessons learned and assess progress in USC Sea Grant's adaptation and capacity building program, evaluation data from workshops, trainings, technical assistance efforts and other adaptation projects from 2010 – 2016 were analyzed. Using attendee lists, agendas, evaluations, surveys, presentations, and summary reports available from approximately 50 climate adaptation-related events, USC Sea Grant examined perceptions of stakeholders, gauged their continued participation over several years, and assessed how the content and focus of the program has shifted or stayed the same over time.

USC Sea Grant also conducted a series of stakeholder and partner interviews via phone to gain insights about what elements of the program have been effective and useful, where improvements to the outreach program can be made, and to solicit input for future directions in its climate program. USC Sea Grant included a variety of perspectives in the phone interviews, including federal, state and local government representatives, non-governmental organizations (NGOs), and other boundary organizations with missions similar to Sea Grant. Some interviewees are partners on the projects and some are stakeholders and end-users of USC Sea Grant's services. Finally, USC Sea Grant asked its own USC Sea Grant specialists working in the climate adaptation program to answer a set of questions independently, and then convened a series of brainstorming sessions with the full USC Sea Grant climate team to reflect on the program over the years and to identify lessons learned.

### **Lesson Learned #1: Value of Place-based Organizations in Engaging Stakeholders**

A key theme emerging from stakeholder and partner interviews is the notion that being a “place-based” organization - one that has established relationships and cultural knowledge within a geographic area - is a critical element to successfully pull in the appropriate partners for the climate adaptation program and to establish trust among stakeholders. USC Sea Grant has served as a resource for the Los Angeles region since 1972, working with local communities on a range of coastal and ocean challenges. As such, USC Sea Grant has developed an extensive network of stakeholders and partners, which we drew upon for guidance, support and engagement. In the study interviews, many pointed out that their relationship with USC Sea Grant predated the start of the climate adaptation program. One partner who worked with USC Sea Grant to develop the City of Los Angeles AdaptLA project emphasized in her interview the “strength of having USC Sea Grant on the ground in Southern California [because we] brought our stakeholders with us and carried them along the way while we were learning how to do this work.” Another partner described USC Sea Grant as “linked into the local network” and was able to draw upon those relationships to identify and reach out to the people most in need of the information. Another local stakeholder pointed out that there are often higher costs incurred – in both dollars and time – when local communities bring in external consultants or specialists, as the latter often need to spend budgeted time becoming familiar with local geography and socio-political culture.

Adaptation requires long-term planning that will span multiple political cycles. As non-partisan and neutral brokers of science, boundary organizations, like USC Sea Grant, serve an important role in helping engage stakeholders over time and ensure continuity as political

leadership changes. For instance, when the Los Angeles Mayor's office engaged USC Sea Grant in 2011 to help develop a sea level rise vulnerability assessment and adaptation process, the City had recently eliminated its environmental affairs department due to budget constraints, leaving a leadership void. One stakeholder emphasized that the City needed someone to bring the disparate City agencies that had previously worked on adaptation back together. USC Sea Grant was able to reconvene those city officials and agency managers working on coastal issues and infrastructure in order to help develop a process for assessing sea level rise vulnerability. Toward the end of the AdaptLA project, there was a mayoral administration change, bringing in new leadership across City agencies. This slowed the process and the release of the final results; however, USC Sea Grant took the time to engage the new leadership to ensure they embraced the process and study results. The same stakeholder pointed out that it was critical that USC Sea Grant was "resilient to political changes" as this ensured some continuity in the City's adaptation planning efforts.

As USC Sea Grant moved to develop the Regional AdaptLA project in 2014, a region of more than 10 million residents, the number of stakeholder participants increased. The City of Los Angeles project began with a stakeholder group consisting of approximately 50 members; the current Regional AdaptLA stakeholder list consists of nearly 250 active and engaged members. Holding meaningful workshops where participants can actively participate in discussions became much more challenging. In one of the partner interviews, it was discussed at length whether it is more effective to choose partners based on the agency or organization needed at the table, or by the individuals that will bring a given strength to the process. While it is important to have participation from the different agencies that play a critical role in adaptation planning because of their mission or mandate, individuals that help advance the process are equally invaluable. One partner described the need to have "depth and talent of local stakeholders" who are "nurtured" along the way and have "freedom to do what they do well."

When USC Sea Grant initiated its climate adaptation work, its personnel were not "experts" in climate change adaptation. They were learning how to do this alongside local stakeholders and others throughout California and the nation. USC Sea Grant sought out other boundary organizations, both in other California regions and in other states, to glean best practices and lessons, particularly as they launched the adaptation planning process for the initial City of Los Angeles AdaptLA project. As an example, USC Sea Grant partnered closely with its sister NOAA organization, the Tijuana River National Estuary Research Reserve (TRNERR), for much of its work in the San Diego region; most of the initial regional workshops in 2011 and 2012 were developed in parallel with TRNERR (Figure 1). TRNERR is another boundary organization that serves in much the same capacity as Sea Grant programs, but with a more directed focus on the national estuary for which they are stewards. USC Sea Grant has found that its most successful collaborations outside of its specific focus area of Los Angeles have been with other place-based boundary organizations, which have well-developed, engaged and trusting stakeholder communities. Through its analyses, USC Sea Grant realized that partnering with and learning from these other organizations has been critical to its success both in Los Angeles and throughout Southern California.

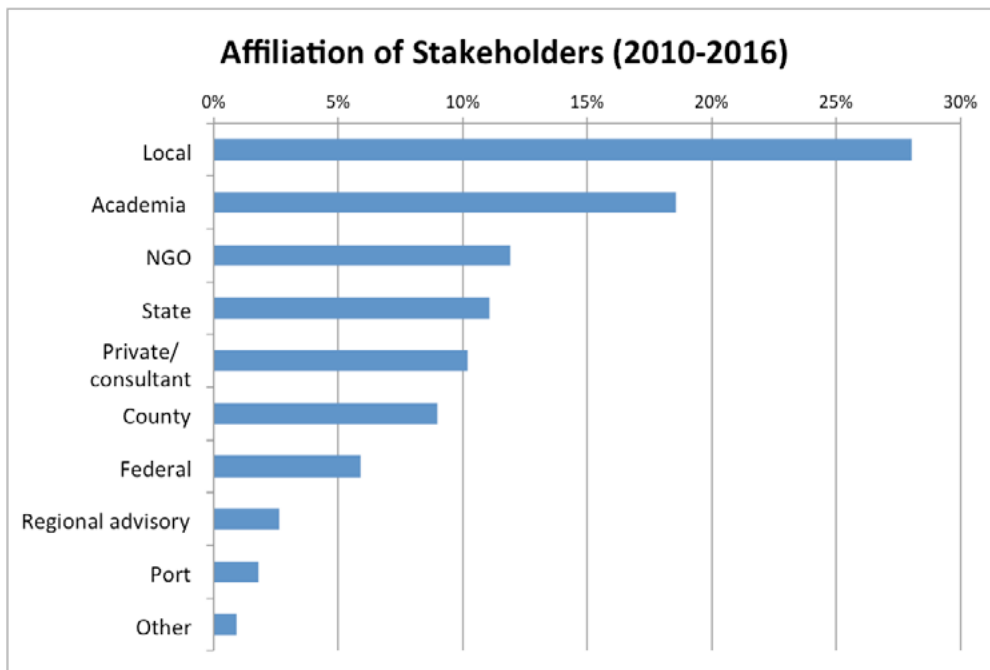


Figure 4: Breakdown of stakeholder by affiliation; analysis of 1,127 stakeholders at nearly 30 USC-supported events from 2010-2016

**Survey Question: Whether or not your organization has already taken action to prepare for the possible impacts of climate change, how much of a hurdle has each of the following issues been in your efforts to date?**

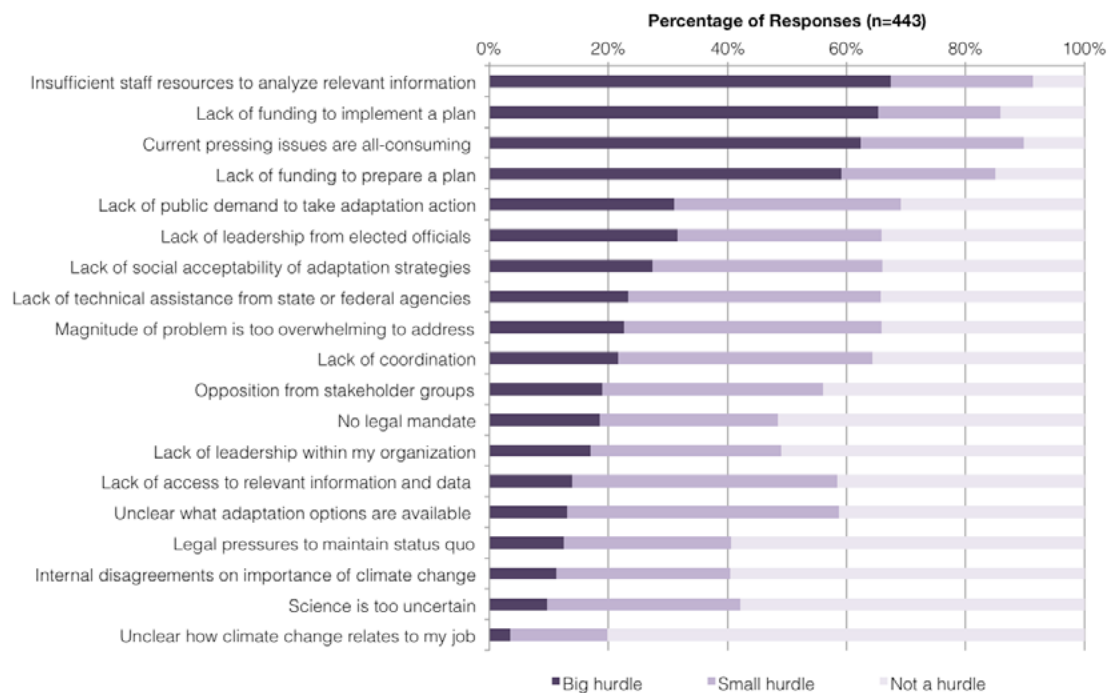


Figure 5: Results from a question included in the 2011 California Coastal Adaptation Needs Assessment survey. The question focused on barriers facing coastal professional in taking action on climate adaptation in their communities.

USC Sea Grant's stakeholder base is dominated by local government participants (Figure 4). It has been a struggle to engage meaningful representation from the private sector. While there is significant representation from consulting firms that participate in public planning efforts, there is not enough participation from other industries (for example, the construction and insurance sectors) that could potentially unlock significant resources to tackle this issue and may be actively considering climate change challenges independently. Moving forward, USC Sea Grant hopes to learn from other boundary organizations who have had success engaging private industry.

## **Lesson Learned #2: The Importance of Communications in Translating Science**

As coastal communities begin their adaptation planning, they need to be able to understand, digest, and then ultimately act on complex and ever-evolving scientific information. In the 2011 Coastal Climate Adaptation Needs Assessment described above (Table 1), the biggest barrier identified by communities in adaptation planning was not the need for more scientific information, but rather the “insufficient staff resources to analyze relevant information” (Figure 5, Finzi Hart et. al 2012). As boundary organizations working at the frontier of coastal marine science and coastal management, Sea Grant is a natural fit to help coastal communities understand and subsequently utilize complex scientific information on sea level rise and coastal climate-related impacts (Guston et al. 2000). USC Sea Grant's adaptation outreach and extension efforts endeavored to fill this need and to provide stakeholders with the best available science as well as to provide them information on how to use this information in adaptation planning. The biggest challenges USC Sea Grant faced in its outreach included:

- 1) identifying who are the most appropriate and effective messengers to deliver scientific information;
- 2) determining the appropriate level of scientific detail to provide for various audiences;
- 3) helping show stakeholders how to take the scientific information and make it actionable at the local planning level.

An analysis of the content in workshops, outreach, and extension efforts demonstrates that while USC Sea Grant provided information on climate science and sea level rise modeling tools, the majority of the information provided focused on climate planning processes (Figure 6). This included content on conducting vulnerability assessments, discussion on adaptation process and strategies, legal policy and sea level rise guidance documents, social vulnerability and climate planning case studies (Figure 7).

Those delivering the scientific and process-based information varied quite substantially over the years. In 2011-2012 and 2015-2016 most of the information was delivered by academics, federal agencies, and NGOs (Figure 8). Most of the initial federal presentations were provided by NOAA through the Office of Coastal Management (OCM, then called the Coastal Services Center) through a suite of adaptation and GIS training programs for coastal communities. USC Sea Grant relied heavily on OCM to help develop content and to train stakeholders on how to begin planning for climate change. Federal representation shifted to the U.S. Geological Survey (USGS) in the later years as their Southern California Coastal

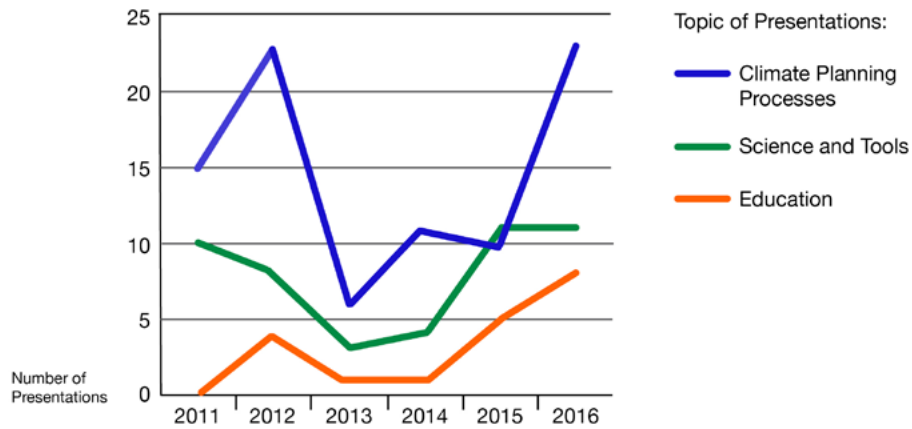


Figure 6: Content analysis of presentations from approximately 50 climate adaptation-related workshops from 2010-2016.

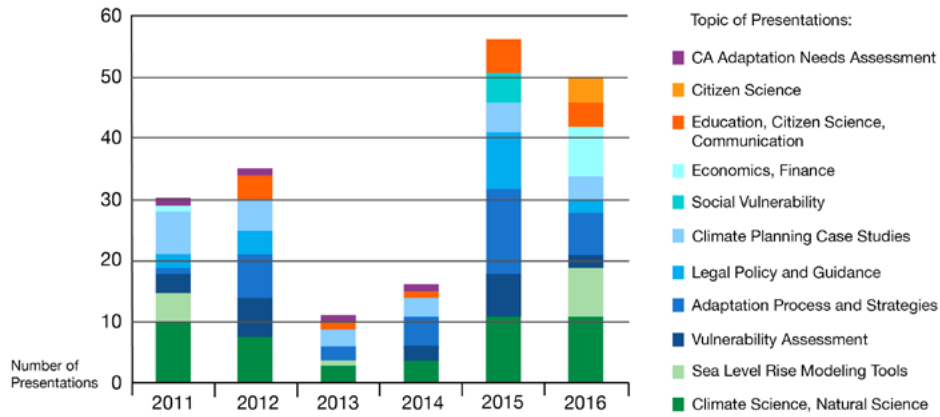


Figure 7: Content analysis by presentation topic from approximately 50 climate adaptation-related workshops from 2010-2016.

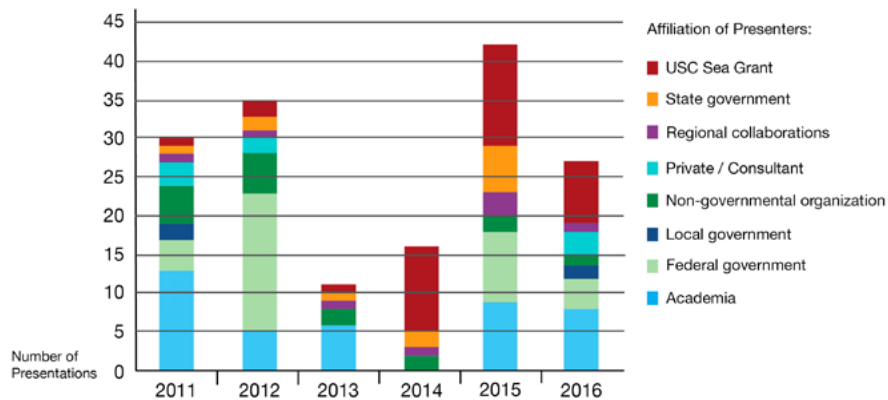


Figure 8: Summary of presenters at climate adaptation events from 2010-2016.

Storm Modeling System (CoSMoS) modeling effort got underway and as initial results were released. USC Sea Grant's outreach focused on communicating those initial results and helping communities integrate model results into existing planning efforts.

In 2015, the increase in the number of presentations provided by state agencies is directly correlated with the development of key state-level documents. Most notably, the California Coastal Commission Sea Level Rise Planning Guidance, while not regulatory, was released in 2015 and provides guidance to coastal communities on how to incorporate sea level rise impacts in coastal development. Ensuring that communities understand this guidance became an important goal for USC Sea Grant's extension program.

In the earlier years, most of the academic presentations were delivered by climate scientists from throughout Southern California. At the time, communities were still in the early stages of grappling with climate science. Much of the content focused on providing primers on climate science, modeling and sea level rise. There was also the need to provide "proof" that climate change was occurring, that humans played a significant role in causing it, and in presenting initial downscaling modeling results. The science presentations had an undercurrent of defensiveness; it felt necessary to have leading climate scientists deliver the information in order to demonstrate credibility. However, a common critique of these early workshops was that the scientific information was too complex and too detailed, and communities felt even more overwhelmed by the scientific presentations. Moreover, communities did not feel like they had the information they needed to take action at the local level.

In later years, presentation content shifted away from "proving" climate change to focusing immediately on sea level rise modeling, coastal impacts science and how to integrate that information into local planning. USC Sea Grant's strength - confirmed by stakeholder interviews - is its role as science translators. As one partner stated, Sea Grant helps "interpret academic findings and helps people digest the information, particularly for those who are not specialized and will benefit [from this information]." In later years, we shifted to having Sea Grant extension specialists (who are also still considered academic) present the scientific information. As another partner indicated, USC Sea Grant found that it was "important to communicate key talking points which was better than giving [stakeholders] everything." When necessary, USC Sea Grant presentations were supplemented with more technical presentations by either consultants or the USGS modelers to help communities delve deeper into the scientific models. But in general, USC Sea Grant purposely embraced the approach that "less is more." To minimize jargon-heavy presentations, USC Sea Grant worked with presenters to help them develop presentations that were content-appropriate for the various audiences. Following workshops, USC Sea Grant often held webinars or smaller meetings where modelers and technical consultants could dive deeper into model assumptions and methodologies. Some professions need that technical detail, but many stakeholders do not need the same level of specificity to move forward in planning. USC Sea Grant found that often providing everyone with the same high level of detail can slow down progress.

Another important strategy was to provide different means for communicating with stakeholders. Recognizing the very real struggle with stakeholder fatigue, we sought to provide



information both in in-person discussions, at larger workshops, and through recorded webinars. The latter often drew a large number of participants, but also provided the opportunity for people to view the webinar (or review it) at a time that was convenient for them. Similarly, varying the meeting times and formats was another essential strategy. A series of open houses were held that were intended to be informal gatherings where people could network among themselves and the scientists. These were held in the evening so as not to interfere with working hours. Similarly, for the open house held in the Harbor Area of Los Angeles, a predominately Latino community, real-time Spanish interpretation of the kick-off presentations were provided as well as Spanish and English versions of the posters and outreach materials.

### **Lesson Learned #3: Adaptive Management Approach**

Even with USC Sea Grant's efforts to provide scientific information at the appropriate scale and to provide training and guidance on vulnerability assessments and adaptation planning, the critique heard during stakeholder interviews, as well as from workshops and webinar evaluations, was that communities were still struggling with feeling that there is too much competing, and potentially conflicting, scientific information. They continue to be stuck in the cycle of waiting for the "perfect" or "right" information before acting.

During the 2012 Beyond Bathtub workshop, USC Sea Grant, in partnership with the California Ocean Protection Council and TRNERR, brought scientists, modelers and practitioners together with the goal of discussing the different modeling methodologies currently available to California coastal communities and the applicability of this information to coastal planning. While the event was very well attended and had the key players at the table, participants left the meeting still questioning which science they should use; the debate on which models and tools to use, and under what circumstances, remained unclear. This prompted a joint state and federal sea level rise modeling workshop entitled "Lifting the Fog," but this also found organizers struggling to clarify pathways to help communities move forward.

In USC Sea Grant's early work on the City of Los Angeles's Sea Level Rise Vulnerability Study, the team struggled with this same question of which information to use. With the City, USC Sea Grant started discussing the concept of "adaptive management." Ecologists Walters and Holling coined the term in 1970s, applying the concept to natural resource management. They characterized adaptive management as a process of 'learning by doing' that utilizes new results to make informed management decisions (Walters and Holling 1990). It is a formal iterative process that acknowledges uncertainty and utilizes structured feedback (Allen 2013). Central to the notion of adaptive management is that science, and particularly climate science, is an area of active research. USC Sea Grant has tried to help communities understand that the scientific process is exactly that – a process. Scientific advances are contingent upon scientists trying to repeat others' experiments, testing old questions with new methodologies, and building upon each other's work to advance our common understanding. However, coastal communities who are trying to figure out where to site their new hotel or other business and residential interest or restore natural dune ecosystems, need actionable information they can utilize today.

In 2015, the California Coastal Commission (CCC) Sea Level Rise Policy Guidance document included language that advocated for an adaptive management approach in sea level rise planning. It states: “if the likelihood of impacts is expected to increase with rising sea level, it may be necessary to design for some amount of sea level rise and include design flexibility that will allow future project changes or modifications to prevent impacts if the amount of sea level rise used in the design is not sufficient.” The guidance encourages communities to develop flexible planning processes that will allow future project changes or modifications, and employ flexible monitoring with various triggers or change points (CCC 2013). The CCC Sea Level Rise Policy Guidance is not a regulatory document, but the recommendations within are considered important guidance for communities as they request permits for coastal development. Thus, the concept of adaptive management has now made its way into the coastal land use planning vernacular.

Over the past few years, communities are also beginning to explore adaptive approaches in planning documents and process. TRNERR’s Climate Understanding and Resilience in the River Valley (CURRV) project utilized scenario planning as a central strategy for their vulnerability assessment process (CURRV 2014). The City of Solana Beach prioritized monitoring of both short and long-term sea level rise in their local coastal program. They also committed to re-evaluate their erosion rate every ten years and more often if physical conditions warrant (City of Solana Beach LCP 2014). King County in Washington State is one of the most aggressive local governments in its adaptive approach that we have seen to date, as the state’s Growth Management Act requires counties and cities to use the best available science in their planning (WA Growth Management Act 2010). King County’s comprehensive plan commits to evaluating a range of projected future climate scenarios based on best available science to help ensure that conservation efforts are able to meet their objectives in a changing climate and allows for amendments to the plan every year if new information necessitates a change (King County Comprehensive Plan 2012). Still, integrating adaptive management into planning is a challenge for many communities, considering many do not have the funds or staff to revisit plans at the speed required to keep up with the evolving science.

USC Sea Grant has provided guidance to local communities in how they can begin to utilize adaptive management and triggers in their planning. This includes guiding them to:

- create productive relationships between scientists and decision-makers;
- conduct iterative assessments of vulnerability and risk to incorporate new science;
- embrace uncertainty by developing a range of possible outcomes;
- plan re-evaluation of policies and robust monitoring; and
- include flexible language in planning documents.

We expect there will be a growth period as communities experiment with this new approach and as land use plans begin to be presented to local regulatory agencies for review and approval.

## Lessons Learned #4: Investments in Climate Adaptation

Funding to support climate adaptation planning is a significant challenge facing local communities. Through our analysis, however, we found that even modest funding, provided at the right time and to the right recipient, can help advance adaptation planning. Between 2010 and 2016, USC Sea Grant received \$280,000 from the National Sea Grant Office’s CCCAI funding. This has been supplemented by an additional \$60,000 in funding from the California State Coastal Conservancy to support outreach of the USGS CoSMoS model and Regional AdaptLA science initiatives. Through its work, USC Sea Grant has reached approximately 5,700 stakeholders, comprised of over 250 organizations. When surveying attendees from its workshops, webinars and other events, USC Sea Grant determined that 19 Southern California municipalities (representing 12 U.S. Congressional Districts) indicated that they have initiated or made significant headway in adaptation planning (Figure 9). As noted above, within just Los Angeles county – all 11 coastal communities (representing 3 U.S. Congressional Districts) and the engaged stakeholder group of approximately 250 have indicated that the training and information provided by USC Sea Grant “increased their understanding of sea level rise” and “they learned something they would apply in their work in the future.” For Los Angeles specifically, it is clear that being a place-based organization with already deep ties to an engaged stakeholder community has allowed USC Sea Grant to have an impact on such a broad audience.

Equally, partnerships with other place-based boundary organizations, such as TRNERR



Figure 9: Impact in Southern California of the initial investment in USC Sea Grant’s Coastal Climate Change Adaptation Program.

in San Diego, allowed USC Sea Grant to expand the reach of its limited funding as well. Those organizations too have only received seed funding from their parent NOAA office for their work, but still have large impacts within their networks. Working with TRNERR as a key partner in San Diego enabled USC Sea Grant to broaden its reach, and take advantage of another place-based organization that in itself has an engaged and trusting stakeholder group. Thus through this partnership, USC Sea Grant was able to leverage two sources of small seed funding, effectively stretching small amounts even further.

In the 2011 California Coastal Climate Adaptation Needs Assessment Survey (Finzi Hart et. al 2012), coastal practitioners consistently identified funding and staff resources (which is also linked to funding) as their primary challenge in moving forward in adaptation (Figure 5). The results of the survey spurred investments from the State of California to encourage local action in climate preparedness, totaling nearly \$13 million. It is quite remarkable to consider that this state money became available due in large part to a survey that cost less than \$30,000 to develop, implement, administer and analyze (with significant in-kind contributions from all of the survey partners). Thus a small amount of money, strategically placed and strategically leveraged, can have quite considerable impacts.

However, with 20 coastal California counties, and hundreds of local municipalities, progress in coastal climate adaptation will be limited without more significant statewide funding sources. Federal agencies are also providing competitive funding opportunities to help fill this need, but these resources are highly competitive and very limited. The grants funded thus far have primarily funded vulnerability assessments and preliminary considerations of adaptation measures. Few municipalities have implemented these measures and invested funding in actual on-the-ground construction projects or policy implementation.

It is critical to note that the timing of this initial funding also plays an important role. In 2010, there were only a handful of organizations working with coastal communities on climate adaptation. Since then, the adaptation services industry has exploded with many different types of organizations involved in helping communities adapt: from boundary organizations such as Sea Grant programs and the NERRs, to federal, state, and regional agencies, to private consultants, to academic institutions. It is not clear if the small investment of \$30,000 would yield the same impact today that it did half a decade ago.

## **CONCLUSION**

When USC Sea Grant began work on climate adaptation, the lack of a mandate at the state or federal level directing local communities to plan and adapt for climate risk and corresponding funding to support action, stymied progress at the community level. Over the last several years, however, several key pieces of California legislation have passed that have begun to mandate state-level action on climate adaptation planning. These include: 1) SB379, requiring communities to incorporate discussion of climate change in the safety element of their general plans; 2) AB1482, mandating that the Strategic Growth Council update the state's adaptation strategy every three years, directing state agencies to consider climate change impacts with state investments, and to promote the use of natural systems and natural infrastructure; 3) AB2800, requiring development of design standards that incorporate climate change for planning, designing, building, operating, and maintaining investments in state infrastructure; and 4) SB246, requiring state agencies to consider and implement strategies to reduce their greenhouse gas emissions.

When the first California Coastal Climate Adaptation Needs Assessment Survey was conducted in 2005, the researchers found that only 10% of respondents were actively planning for climate change (Moser and Tribbia 2006). When the survey was repeated in 2011, these

results were flipped around with approximately 90% indicating that they were in the early stages of adaptation planning. When probed more deeply, it was clear that these communities were still in the early stages of adaptation planning (perhaps “brainstorming”) but had commenced nonetheless (Finzi Hart et al. 2011). The 2016 update to this survey is currently underway and will provide insight on whether communities have moved further along in the planning and if more have moved to implementation. We do know that many communities are calling for more examples and case studies before investing scarce resources in potentially long-term climate adaptation implementation projects. The perception is that the stakes are too high and there is not enough funding to change course if an implementation planning misstep occurs.

USC Sea Grant is hopeful that as adaptation-focused legislation and concepts of adaptive management mature and become embedded in coastal communities’ planning processes, many of the initial barriers identified by coastal communities will be addressed. Most importantly, with the stakes rising as quickly as they are, hopefully communities will recognize that there are boundary organizations in their own jurisdictions and regions, to whom they can turn for non-biased, science-based assistance in their climate adaptation planning work.

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