

Stanford Law School

Coastal Policy Lab Practicum

Local Barriers to Nature-Based Strategies for Coastal Hazard Mitigation in California

Simone Barley-Greenfield, M.S. Candidate, Earth Systems
Ju-Ching Huang, LL.M. Candidate, Stanford Law School
Joe Pullano, J.D. Candidate, Stanford Law School
Rose Stanley, J.D. Candidate, Stanford Law School

Meg Caldwell
Senior Lecturer, Stanford Law School

Janet Martinez
Senior Lecturer, Stanford Law School

Anne Siders
Ph.D. Candidate, Environment and Resources

Clients: Juliette Hayes, FEMA, Region IX
Sarah Newkirk, The Nature Conservancy

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Executive Summary

Climate change, coastal erosion, sea-level rise, and coastal storms and flooding threaten public and private infrastructure along the California coast. While political will to relocate away from vulnerable areas remains low, federal, state, and local government officials seek financially practical options to update and improve coastal flood defenses. Nature-based strategies that enhance the natural flood mitigation benefits of coastal ecosystems could be an effective approach, particularly if supported with federal funding through the FEMA Hazard Mitigation Programs. However, local jurisdictions have yet to leverage FEMA funding, and few California jurisdictions have pursued nature-based strategies.

To identify barriers to and opportunities for nature-based strategies, we interviewed city and county-level coastal planners and emergency officials in five coastal California counties. Selected counties were vulnerable to coastal flooding, have received FEMA hazard mitigation funding, and are currently engaged with the Coastal Resilience Network of The Nature Conservancy (TNC).

Barriers identified by respondents include:

- Lack of technical standards to guide implementation and evaluation;
- Low levels of cross-jurisdiction coordination among local, state, and federal entities;
- Insufficient funding for localized data collection, strategic planning, and regional coordination; and
- Lack of public familiarity with nature-based strategies, leading to a lack of political support.

In response to these challenges, we propose several low-cost, no-regret solutions that could be undertaken by FEMA, TNC, or other interested government or non-government organizations to assist in promoting nature-based strategies for coastal flood mitigation in California. A full list of recommendations can be found at the end of this white paper, but some notable examples include:

- Establishing clear technical implementation and monitoring and evaluation standards for nature-based strategies that satisfy FEMA's feasibility requirements for hazard mitigation funding;
- Investing in cross-agency and -jurisdictional communication and coordination, to include funding collaborative projects or providing greater opportunities for in-person networking and coordination;
- Providing clearer guidance on whether and how nature-based strategies can meet the goals and priorities of hazard mitigation funding programs;
- Educating local officials and the public about the benefits and performance of nature-based strategies. This could include creating an online "toolkit" of nature-based flood mitigation strategies that provides information on technical standards, implementation, monitoring, and cost.

Implementing these suggestions or otherwise addressing the barriers identified to nature-based solutions may help protect California's coast and coastal infrastructure for the future.

Background

Nature-Based Strategies Provide Flood Mitigation and Minimize Social and Ecological Harms

Coastal areas are fraught with potential hazards such as flooding, storm surge, sea level rise, and high tides. Traditionally, humanity has fought back with concrete and steel: constructing seawalls, groins, dikes, bulkheads, and levies, all designed to hold the sea back. Unfortunately, these hard structures erode coastal habitat around them, ultimately shifting damage rather than absorbing it. In addition to degrading the natural coastal area and harming ecosystems present there, structural coastal defenses erode the physical beach area, often limiting and impeding public access (Dugan & Hubbard, p. 191). In many states, including California, such consequences may not align with the interests of the public.

In light of the evolving hazards posed by sea level rise, California coastal communities in the coming decades will have to make difficult choices about how to protect shorelines and existing development. One strategy with significant potential is a focus on nature-based strategies (NBS).

NBS are a relatively new concept in development planning, but they have the potential to benefit many coastal communities while simultaneously supporting vibrant ecosystems and softening the divide between built and natural environments. One area where these benefits can clearly be seen is coastal defense and coastal hazard mitigation (Newkirk & Beck, in Craig et. al, p. 20).

NBS offer an innovative way of thinking about coastal defenses. Rather than battle directly against tidal forces and sea level rise, NBS enhance the way natural systems absorb and minimize flooding and inundation. This approach – replicating and encouraging natural conditions that lessen the severity of flooding events – avoids many pitfalls of hard structuring, with the added benefit of maintaining natural ecosystems and their services.

NBS such as “living shorelines” are often less costly and require less long term maintenance. Unlike seawalls, which lock local planners into years of battling both erosion and structural integrity, living coastlines provide triple benefits by “controlling erosion, maintaining natural coastal processes, and sustaining biodiversity” (Swann, p. 1). These outcomes serve long-term interests of both the public and the natural environment.

Nature-based strategies (NBS) are development strategies that harness the functions and resources contained in healthy ecosystems to solve existing challenges, while maintaining the integrity of the natural environment. These strategies rely on the ingenuity of the natural world, reducing the amount of time, money, and effort human society must exert to keep other natural processes at bay. By pursuing nature-based strategies to coastal hazards, humans avoid degrading the environment and exacerbating environmental issues.

Hazard Mitigation Is the Best Opportunity to Change Our Approach to Coastal Defense

FEMA, through its Hazard Mitigation Assistance (HMA) grant programs, provides funding to states and local communities to invest in resilience.¹ Most grants are awarded and used in the aftermath of a disaster, when the community is most aware of its vulnerability and most willing to act. The post-

¹ See Stanford Coastal Policy Lab Memo, *FEMA Policy Analysis*, 2015 for a related analysis of how NBS fulfill the legal requirements necessary to qualify for FEMA hazard mitigation funding.

disaster planning process gives communities the chance to remedy past land-use mistakes and to address areas where development is unprotected to create more effective solutions and a more resilient public. Structural approaches to coastal hazard mitigation have long been the norm, and remain the default approach in many coastal areas, but this does not mean they are the best option moving forward, especially in light of declining coastal wetland ecosystems, on-going beach erosion, and accelerating sea-level rise.

Though relatively new in the modern hazard mitigation toolkit, compared to existing hard structuring strategies, nature-based and non-structural hazard mitigation strategies address coastal threats in a cost-effective manner, without causing additional damage to the coastal zone, and without producing the false sense of security that has, in the past, enabled development in risk-prone areas (American Planning Association, p. 60). It is crucial to seize these opportunities for a new vision during the recovery and rebuilding phase following a disaster, when the public is not satisfied to simply replace what has already failed before.

Living Shorelines: An Example of a Nature-Based Strategy

Living shorelines may at first appear soft, permeable, and already flooded with water, but the marshy wetlands and sandy beaches that line the coastline of so many states are very effective at protecting coastal areas. If allowed to function naturally, these shorelines resist erosion, keeping some distance between the sea and human property and infrastructure. If the wetlands and beaches are healthy and well maintained, they can absorb wave power and remain intact, thereby reducing the risk of waves reaching and damaging coastal property.

Many states along the Gulf of Mexico have maintained, restored, or developed “living shorelines” as a management strategy to protect coastal property. This approach includes “a suite of bank stabilization and habitat restoration techniques to reinforce the shoreline, minimize coastal erosion, and maintain coastal processes while protecting, restoring, enhancing, and creating natural habitat” (Swann, p. 2).

Local Barriers to Adaptation of Nature-Based Strategies in California Coastal Communities

Despite the opportunity for local California governments to integrate non-structural coastal hazard mitigation strategies into existing plans (or to apply for HMGP or PDM funding for nonstructural projects), very little progress has been made to reduce the reliance of planners on seawalls and other hard armoring systems. Simply having the option of non-structural strategies (and data to support their merit) does not mean these options are easily pursued. Non-structural solutions, especially nature-based strategies, are a relatively unusual approach to coastal hazard mitigation, and many barriers exist in local government agencies when it comes to adapting plans and implementing change.

Research done by Julia Ekstrom and Susanne Moser on the subject of urban climate adaption in the San Francisco Bay Area found that ***institutional and governance constraints impeded effective climate adaptation far more than a general lack of information*** regarding climate adaptation strategies. According to their findings, officials tend to know their adaptation options, but larger political, legal, and socioeconomic conditions prevent them from acting in an optimal fashion (2010, p7). One goal of our research was to determine whether similar institutional and governance constraints are preventing local communities from implementing nature-based strategies.

Methods

Our research team selected five California coastal counties that have previously received FEMA hazard mitigation funding and are currently engaged with the Coastal Resilience Network of TNC. Due to their engagement with both FEMA and TNC, these communities could be expected to benefit from FEMA funding for NBS. Understanding why such communities have not pursued FEMA funding for NBS could shed light on the barriers to NBS implementation in coastal California.

We interviewed county and city level planning and emergency response officials within each county. All respondents are involved in planning or implementing hazard mitigation strategies but play different roles in building coastal resilience. We identified initial respondents through personal connections, online searches, and publicly available FEMA grant information. Respondents were asked to recommend other interview subjects, according to a standard snowball sampling technique. Each interview lasted 30-60 minutes, and included questions about the respondents' duties, experience of the city or county with flooding hazards, current mitigation strategies, familiarity with and perceptions of nature-based flood mitigation strategies, and experience (if any) with the FEMA hazard mitigation funding process. Recurring themes in the interviews were identified and categorized, drawing on the Moser and Ekstrom framework for adaptation barriers. Individual respondents are not identified by name in this report, and their locations, job titles, or other identifying information is altered where necessary to protect their anonymity.

Findings – Barriers to Implementation of Nature-Based Strategies

Respondents identified many particular barriers, which we have grouped into four categories. Each category is discussed below and suggestions are made on how to address the challenge.

- (1) **Technical and Information Barriers**
- (2) **Coordination Barriers**
- (3) **Funding Barriers**
- (4) **Political Will Barriers**

Technical and Information Barriers

Implementing NBS for flood mitigation requires planners to be aware of NBS, understand their limitations and benefits, and know how and where to best deploy NBS. Information barriers arose in several contexts: lack of familiarity with NBS among planners; lack of relevant or localized data that would help planners decide where to deploy NBS; absence of technical standards for the proper implementation of NBS; and uncertainty surrounding monitoring and evaluation practices.

Familiarity with Nature-Based Flood Mitigation Strategies

In general, a majority of respondents were aware of NBS as an approach to coastal flood mitigation. This was particularly true among younger planners, who had been exposed to NBS during their education, and planners who were located near to an on-going NBS project. However, respondents noted that although their offices may be *aware* of NBS, they are most *familiar* with “grey” strategies and therefore have a tendency to “*do what they know.*” This lack of familiarity makes planners nervous to undertake what they see as an unproven course of action (see sections below on lack of technical

standards and evaluation). Planners were concerned about the lack of precedent with NBS, not only in general but specifically in areas similar to their own (with similar development or geographical profiles).

Planners did seem open to the potential to learn more about NBS. One specifically cited the need for a toolkit that would explain how NBS work and how much they cost. Providing such information could help ensure that uncertainty does not become an excuse for inaction (Moser, p. 64).

Relevant and Localized Data

Many planners cited a lack of data-supported, scientific standards for how to create NBS flood mitigation projects that fit the specific needs of their communities. Concerns about data were closely tied with concerns about funding. Lack of funding is a prominent and clear theme that runs through many of the concerns voiced by local officials. This is hardly unique to NBS, but it is important to emphasize how often interview subjects brought up the concern that existing funding schemes fail to help them acquire the data they feel they need to improve their coastal flood mitigation planning.

This may occur due to:

- 1) a local funding shortage,
- 2) funding mechanisms that proscribe the type of data that can be collected, or
- 3) funding mechanisms that do not support the pre-project planning efforts that may be necessary to shift flood mitigation towards the less familiar NBS.

Proscribed Data

Respondents often noted that existing funding mechanisms support the “*wrong*” type of data collection. Planners speculated that funding agencies, such as FEMA and the Coastal Commission, may only fund “*less useful*” but tried and true data due to funding constraints. Planners report feeling that only “*less expensive*” or less politically sensitive data is collected and, as a result, planners voice some skepticism as to the validity of existing risk assessments. One planner went so far as to question whether FEMA’s flood maps were “*scientifically valid*”. This perception of inaccuracy presents major challenges for decision-making and coordination efforts.

As the benefits of NBS often become most apparent when sea level rise is considered, failure to collect and consider data on sea level rise rates can affect planners’ decisions. For instance, one official voiced doubt in the utility of FEMA’s flood maps due to their omission of future sea level rise projections:

“FEMA’s updated flood maps do not take into account sea-level rise and are very conservative. From a municipal standpoint, the city is very happy to have less aggressive predictions for the future [because it does not require them to re-zone future flood areas].”

More generally, planners believe that data collection efforts do not provide the kind of information they feel is needed to pursue NBS. As a result, planners said NBS techniques are not seriously considered. Planners consistently state a need for more localized data, including local tide gauges or groundwater monitoring systems that would ensure flood mitigation strategies are deployed in the most effective manner, rather than being deployed based on the most recent disaster or along political lines.

Planners rely heavily on data about their community’s risk profile, so it is unrealistic to believe that officials will entrust their coastlines and infrastructure to newer, innovative solutions without a full picture of how this impacts both the natural and built environments. Simply put, nature-based solutions

are never going to be on the table for planners without useful, and relevant, data to back them up. There is a general sense that nature-based solutions must undergo the same type of intensive study that precedes current mitigation strategies.

Lack of Support for Pre-Project Planning

As NBS are a relatively unfamiliar concept for hazard mitigation officers and city planners, planners may need greater support from funding sources for planning and data collection efforts. As one planner noted, if funding mechanisms only support “*shovel-ready*” projects, then they will get projects that require a shovel, which will most often mean doing more of the same: more traditional structural approaches. Local planners also frequently feel pressure to be efficient rather than creative, leading to repetitive management practices. Without the time to plan and fully consider NBS, planners default to their traditional approaches:

“We’ve invested lots of resources, and we want to protect on the coast, so without a real comprehensive vision of what something else would look like, [switching to nature-based strategies] is politically unattainable.”

Funding that supported greater planning efforts would provide planners with the space to promote NBS.

Technical Standards

In addition to needing data on where to most effectively deploy NBS, planners require technical standards on *how* to implement NBS. FEMA requires hazard mitigation projects to be technically feasible, which usually requires the project to conform to existing engineering standards, but there are few existing standards for NBS. Lacking technical standards, planners view NBS as “*risky*” and untested alternatives to seawalls and levees.

“[How can we] gauge the effectiveness of nature-based strategies when there are no technical standards”?

“We’re asking public works people to make these decisions, and they like to build things that work, so they know how to design a seawall and the life expectancy. They don’t know how to do managed retreat and beach nourishment and know [those approaches] will have the same level of certainty that needs to happen to make the mayor and everyone else happy.... We don’t have the expertise for these [nature-based] strategies.”

In part, this uncertainty is due to the lack of research and data on engineering standards for NBS in California, especially in developed coastal areas. Studies of nature-based coastal flood mitigation in the United States have generally been limited to the Gulf States (Barbier et al., 2013; Cobell et al., 2013; Peyronnin et al., 2013; Reguero et al., 2014). Outside of the Gulf, existing research includes:

- The U.S. Army Corps of Engineers provides a list of potential performance metrics to measure the success of a nature-based project in various coastal ecosystems, but there are few examples where these metrics have been quantified (US Army Corps of Engineers, 2013);
- One California study, “Quantifying the Engineering Function of Coastal Habitats in Flood Risk Reduction,” is ongoing, but results have not yet been published in full (Narayan et al., 2015);
- A study of costs and benefits of using tidal wetlands for flood protection in the San Francisco Bay Area describes the flood protection benefits of tidal wetlands but no technical guides for implementation are provided (Lowe, 2013).

Meta-analyses exist to support the argument that NBS can be successful if implemented properly (Gedan et al., 2010; Pace, 2011), and case studies from Europe provide tips on what makes a nature-based project work. While useful in illustrating that success is possible, these studies only highlight the need for more site-specific and quantitative analysis and more specific procedures in California if NBS is to be implemented broadly. FEMA, TNC, and other federal and state agencies could make significant strides towards promoting nature-based flood mitigation strategies by developing technical engineering standards for the implementation of NBS.

Monitoring and Evaluation

Once NBS are implemented, it is still necessary to monitor and evaluate their performance. Such monitoring should include various approaches: “including: physical, biological and ecological monitoring; monitoring of sedimentation and erosion/accretion; monitoring impacts to selected habitats; and monitoring of sea defenses” (Doswald & Osti, p. 23). Benefits of monitoring include:

- To convince local stakeholders, including decision-makers, property owners, and the community, that a nature-based strategy will work in their particular case;
- To assure decision-makers that these strategies have a beneficial effect on the ecosystem and strengthen its defenses;
- To provide a success story with numerical evidence as “a powerful tool for advocating the use of ecosystem-based approaches” (Doswald & Osti, p. 34).

To create a solid strategy and work plan for nature-based solutions in California, local decision makers need more than just stories of success in other parts of the world: they need access to data they can apply to their own jurisdictions. Once localized data is acquired, local decision-makers need either access to experts who can interpret the data or access to a standardized protocol that can aid decision-makers in interpreting the data themselves so they have confidence in the needs of their coastline. In addition, more examples of how to properly implement these strategies in California from an engineering standpoint are needed, as are examples of how to consciously engage community stakeholders in a way that leads to the most effective collaboration.

Potential Solutions to Technical and Information Barriers

- Develop technical engineering standards to guide the implementation of NBS; and standard monitoring, evaluation, and assessment processes to document the performance of NBS.
- Create an online “toolkit” of nature-based flood mitigation strategies. Include information on technical standards, implementation, monitoring, costs, and when and where particular NBS are most appropriate. Identify success stories in California to serve as examples.
- Clarify funding guidelines to expressly and explicitly state whether NBS are eligible; develop a “Frequently Asked Questions” set focused on NBS. In particular, FEMA needs to clarify how NBS information can be used in the cost-benefit analysis tools. Make information from successful hazard mitigation funding applications publically available so other jurisdictions can see how those grants compiled their application materials.
- Provide funding for data collection that addresses the unique needs of NBS; this may require funding for localized data collection or additional planning efforts.
- Hold workshops on the role of NBS in flood mitigation. This would be most effective if held by or in collaboration with FEMA or other hazard mitigation offices and if held in person.

Coordination and Collaboration Barriers

Flood mitigation strategies, whether traditional structural approaches or NBS, affect the flow of water and sediment across more than the just the project site. As a result, these efforts are most effective when performed in coordination with neighboring jurisdictions. However, respondents in our study note that both cross-jurisdictional and cross-agency coordination are extremely rare. Officials recognize this as a barrier to change and in particular a barrier to the use of NBS.

Academic studies note the importance of collaboration in environmental governance generally and NBS specifically. Doswald and Osti, in their meta-analysis of European flood mitigation studies, concluded that “large cooperative projects, involving different partners, are good opportunities to exchange learning and a conduit for innovative ideas” (2011). They highlight a multinational project called WAVE (Water Adaptation is Valuable to Everyone) that brought “regional partners in the Netherlands, UK, France, Belgium, and Germany together to... reduce flooding and manage water resources more sustainably and make the environment more resilient to climate change” using “ecosystem-based adaptation measures” including “wetland preservation, tree planting, river restoration, rainwater collection, sustainable agriculture and renewable energy utilization” (Doswald & Osti, p.19). These findings concur with more general studies on flood mitigation and public management that have found collaboration and stakeholder engagement to be necessary components (e.g., Brody et al., 2010; McGuire, 2006; Innes & Booher, 2003).

Coordination issues in California are both horizontal in nature (e.g., among cities) and vertical (e.g., between cities and counties, or between cities and state or federal agencies). Open communication channels are vital for sharing best practices and gaining wider acceptance of NBS.

However, coordination along the California coast to date tends to be project-specific. This approach limits planners’ ability to seriously consider nature-based mitigation strategies because the coordination is already focused on a pre-determined project, usually a traditional structural project. If NBS are to gain wider acceptance among California planners, there needs to be a forum for officials to communicate ideas, issues, and best practices outside of the context of any specific project. Such coordination would benefit not only NBS, but all types of coastal planning efforts.

One local official spoke of in-person seminars held by FEMA around five years ago where she met, networked, and collaborated with people from many other jurisdictions. Today these FEMA seminars have been replaced by webinars, which are useful for disseminating information efficiently but cut out the interactive personal component that is so vital to spurring collaboration. Planners want to remain informed as to what others in their field are doing, but they note that this is difficult to do given resource limitations and the project-based funding approach.

Example of Successful Coordination: Santa Barbara and Humboldt Counties

The County of Santa Barbara is currently undertaking a project to model sea level rise. Both city-level and county-level planners in Santa Barbara are engaging in productive dialogue about the ongoing project and its impacts. Similarly, Humboldt County established a very effective Sea Level Rise Adaptation Planning Group, which brought in stakeholders and officials from throughout the county to discuss the impacts of sea level rise. Even after completion, members of this group still share information and remain connected today.

Finding a way to spur more in-person networking and communication may lead to wider adoption of innovative, nature-based strategies.

Vertical collaboration is needed to align funding sources with local goals and needs. And horizontal collaboration is needed to align regional plans and create a vision of coastal flood mitigation that incorporates nature-based strategies into a flexible, adaptive shoreline rather than a piece-meal collection of structural approaches. Hazard mitigation and coastal planning efforts are divided into two physical offices, and, according to respondents, these offices rarely speak to one another or coordinate their efforts. However, such coordination will be necessary to prepare and protect California coasts for the long-term effects of climate change and natural hazards.

Potential Solutions to Collaboration and Coordination Barriers

- Provide a mechanism for local officials to provide feedback to federal and state agencies on funding processes and funding needs.
- Hold in-person training events on NBS or related topics (flood mitigation, hazard mitigation funding); provide time and space to encourage local planners to network.
- Provide funding to support collaborative planning efforts; or allow portions of larger grants to be used for planning efforts. Provide more lead-time in advance of funding applications to give applicants time to explore their options.
- Create an online forum for exchange of information on flood mitigation and NBS.
- Identify coastal regional groups to promote functional collaboration areas (e.g. Monterey Bay) according to ecological and geological markers rather than political.

Funding Barriers – Use of FEMA Hazard Mitigation Funding for NBS

A perceived lack of funding is a core issue referenced in all interviews. We have already discussed the role of funding in collaboration and data collection, but funding also plays a role in the way that NBS are perceived: as “green” ecological projects or as flood mitigation projects. From our interviews with California planners, we draw two broad conclusions:

(1) Many planners have not made the connection between nature-based strategies and hazard mitigation or with FEMA as a potential funding source.

(2) If planners do make the connection between FEMA and NBS, most planners believe that FEMA regulations would make the use of FEMA funding for NBS impossible.

Many respondents felt that existing hazard mitigation funding is too specific and could not be applied to broad and ambiguous projects such as nature-based strategies. One planner wanted to collect more data relevant to nature-based strategies, but believed she could not get the necessary funding to pursue this research. Other officials expressed the opinion that if FEMA intended to fund NBS, the agency would have made an explicit statement to that effect. Still others believed that NBS would not meet FEMA’s cost-benefit analysis requirements. In a related legal analysis of FEMA’s hazard mitigation funding, our policy lab concluded that there are no legal barriers to the use of FEMA funding for NBS.

Rather, a lack of communication (or miscommunication) between FEMA and local jurisdictions has created the false impression that only structural solutions would qualify for hazard mitigation funding.

Planners already struggle through the process of applying for funding for their current projects, which take significant time and resources and can be frustrating and fruitless. Given their time constraints, few planners have the space to consider new and unorthodox funding opportunities. As a result, planners are often unwilling to invest the time or energy necessary to determine whether NBS would meet FEMA requirements. They would be far more willing to engage FEMA funding if it were clear whether or how NBS could meet the FEMA application requirements.

Potential Solutions to Funding Barriers

Most of these suggestions would require action by FEMA:

- Publish an official statement endorsing the use of nature-based flood mitigation strategies.
- Clarify which hazard mitigation funding programs NBS would be eligible for; Provide guidance on the type of information that would be required.
- Provide clearer guidance (or, to also promote collaboration, hold an in-person workshop) on the benefit-cost-analysis (BCA) (and software) and how NBS can meet the BCA requirements. Develop an FAQ section on the FEMA website dedicated to NBS in hazard mitigation funding and solicit questions from local planners.
- Make the information from successful applications publicly available (or available on request) to potential applicants so that planners can see the type of information that needed to be collected in order to pursue NBS.

Political Will Barrier

Political will barriers relate to pushback from influential stakeholders at efforts to adopt nature-based strategies for coastal hazard mitigation. A political will barrier includes issues relating to “politics and the political process (e.g., property rights issues . . . fear of legal repercussions, resistance to collaboration).” This also includes the “inability to message the story in an appealing or politically salient way,” “public or stakeholder opposition to choices,” or “resistance from affected parties” (Moser, p. 64-66).

Local planners believe community members are often supportive of plans to deal with climate change and sea level rise. Pushback occurs when the public does not understand how a certain plan will affect their homes and lives. The public is often familiar with nature-based strategies as a conservation strategy (e.g. wetland restoration to maintain habitat) but not as flood mitigation. As a result, they may be skeptical of the ability of NBS to protect coastal homes. This is tied to the lack of technical standards and monitoring and evaluation data discussed above. Without technical standards or performance data, planners feel unable to convince the public that NBS will work. Furthermore, if NBS do fail to protect citizens, planners also worry about potential legal liability and political repercussions. This uncertainty can make planners and city councils unwilling to invest in NBS, even though they are aware of the long-term benefits.

Addressing the data concerns discussed above would provide planners with more scientific evidence to support the use of NBS and reassure planners and the public that NBS are being properly implemented.

A demonstration project that was monitored and evaluated both during and after implementation would also create greater public familiarity.

Conclusion

City and county officials in California recognize that despite the acknowledged benefits of nature-based flood mitigation strategies for protecting coastal development and ecosystems, there are substantial barriers to shifting away from traditional structural approaches and towards nature-based strategies. These barriers include lack of specific data, technical standards, regional and inter-agency coordination and collaboration, and political will. However, none of the barriers identified by coastal planners are insurmountable. Identifying the barriers is only the first step.

This report identifies specific barriers as reported by city and county officials and suggests some actions that could be taken by FEMA or The Nature Conservancy or other interested organizations to address these barriers and promote the use of NBS. Implementing these suggestions or otherwise addressing the barriers identified to nature-based solutions may help protect California's coast and coastal infrastructure for the future.

Suggested Actions to Promote Nature-Based Flood Mitigation Strategies in CA Coast

Potential Solutions to Technical and Information Barriers

- Develop technical engineering standards to guide the implementation of NBS.
- Develop a standard monitoring, evaluation, and assessment process to document the performance of NBS.
- Create an online “toolkit” of nature-based flood mitigation strategies. Include information on technical standards, implementation, monitoring, and cost. Especially important to provide information on when and where particular NBS are most appropriate. Identify success stories in California to serve as examples.
- Clarify funding guidelines to expressly and explicitly state whether NBS are eligible; develop a “Frequently Asked Questions” set focused on NBS. In particular, FEMA needs to clarify how NBS information can be used in the cost-benefit analysis tools.
- Provide funding for data collection that addresses the unique needs of NBS; this may require funding for localized data collection or additional planning efforts.
- Call for more academic studies to focus on the performance of NBS flood mitigation in California.

Potential Solutions to Collaboration and Coordination Barriers

- Provide a mechanism for local officials to provide feedback to federal and state agencies on funding processes and funding needs.
- Hold in-person training events on NBS or related topics (flood mitigation, hazard mitigation funding); provide time and space to encourage local planners to network.
- Provide funding to support collaborative planning efforts; or allow portions of larger grants to be used for planning efforts. Provide more lead-time in advance of funding applications to give applicants time to explore their options.
- Create an online forum for exchange of information on flood mitigation and NBS.
- Identify coastal regional groups to promote functional collaboration areas (e.g. Monterey Bay) according to ecological and geological markers rather than political.

Potential Solutions to Funding Barriers

- (FEMA) Publish an official statement endorsing the use of nature-based flood mitigation strategies.
- Clarify which hazard mitigation funding programs NBS would be eligible for; Provide guidance on the type of information that would be required. Make the information from successful applications publicly available (or available on request) to potential applicants so that planners can see the type of information that needed to be collected in order to pursue NBS.
- Provide clearer guidance (or, hold in-person workshops) on FEMA’s cost-benefit analysis (and software) and how NBS can meet the BCA requirements. Develop an FAQ section on the FEMA website dedicated to NBS in hazard mitigation funding and solicit questions from local planners.
- Hold workshops on the role of NBS in flood mitigation. This would be most effective if held by or in collaboration with FEMA or other hazard mitigation agencies and if held in person.

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