

RESPONSES TO SEA LEVEL RISE ALONG THE COAST OF CALIFORNIA: CASE
STUDIES OF ADAPTIVE PRACTICES

By

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ABSTRACT

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Sea levels are rising due to anthropogenic causes. As the oceans rise coastal areas and inhabitants become progressively more vulnerable. Research done within and about communities grappling with sea-level rise that incorporates vulnerability and resilience theories remains largely lacking. Central to the exploration of this topic are the questions: What are local government responses to sea level rise along the coast of California? What circumstances lend themselves to either one of the three “adaptive practices” (managed retreat, coastal defense, or adaptive restoration scenarios) that local governments employ to respond to global sea-level rise? The three case studies, along the coast of California, that inform this study are: Goleta Beach Park in Santa Barbara (managed retreat), Balboa Island in Orange County (coastal defense), and tidal Napa Plant Site Restoration in Napa County (adaptive restoration). Both social vulnerability and resilience theory have guided my field research and thesis. Qualitative research methods have largely informed my thesis, via 28 semi-structured in-depth interviews, content analysis, site observation, and pictorial representation. Secondary sources and data will have also been utilized to inform this thesis mainly for content analysis. The overall purpose and goal of this examination is to critically analyze how local governments are attempting to address the impacts of sea-level rise, what “adaptive practice” scenarios are local governments

employing, and community responses to government action (or non-action) to sea-level rise the along the coast of California.

Keywords: Climate Change, Sea Level Rise, Adaptive Practices, Resilience Theory, Vulnerability Theory, California

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PREFACE: PERSONAL STATEMENT

The motivating factors behind this research, for me, are a result of a compilation of numerous influences. I grew up in a family that has lived in California for many generations and their values for the non-built environment¹ have permeated throughout my entire life. The majority of my family, and I as a child and an adult, have lived in or near coastal environments. Something about the salty air, the sound of the roaring tides, and the sand between my toes draws me back to my childhood and recharges my soul.

When I was a child, my parents had a small farm in Petaluma, California where we raised chickens, rabbits, cows and pigs – the farm was my playground for exploration as well as my classroom for my preliminary understanding of the interplay between nature and humans. I grew to love and appreciate the value of caring for animals and the plot of land my parents owned. Gardening, land maintenance, tending to the animals and learning to appreciate the outdoors were all blessings that my parents bestowed upon me as a child and I am forever grateful.

My Uncle Scott's parents had a house in Bodega Bay, California. Every summer growing up my cousins and I would spend time soaking up the sun and playing in the sand. What I failed to realize as a child was that, those memories of family time, laughter, and bonding were sewn together by the salty air and sandy beaches. The locality and ties to a place brought my family together. This specific place along the coast of California

¹ The term non-built environment is used here instead of the term “nature”. The term “nature” is such a loaded, meaning that it implies a divide between “nature” and human environments. In reality nature is all around us in and amongst human environments and to separate the two is inherently flawed.

for my family, reunited past generation's memories with new memories as our family continued to grow. As I reminisce now as an adult on time spent at Pebble Beach in Bodega Bay I am grateful for all of the windburns, sand fights, and sunburns that I experienced because without those moments my ties to the non-built environment might not be what it is today. No matter where I am, whether I am at a beach or other coastal areas, these childhood memories come rushing back.

As I grew older, I began to learn the complex interactions between humans and the non-built environment and the multifaceted environmental problems that plague the world we live in. These interactions and environmental problems enhanced my concern for the well-being of the planet, animals, and the future of the world's ecosystems. While obtaining my BA in Global Studies with a concentration in Global Environmental Policy from Sonoma State University I was researching in hopes to find a topic for my senior thesis. I was deciding between ecotourism and environmental sustainability in the context of localized sustainability until I stumbled upon an article about Climate Refugees. I became consumed in this topic and the overwhelming feeling of sadness. My sadness was derived from the harsh reality that these individuals from low-lying island nations will completely lose their entire nations to rising tides. Their sense of place and location where their families have thrived for generations will be lost under water and reclaimed by the ocean. This stuck a cord with me and from that moment on I knew that I wanted to dedicate my life and work to climate change and sea level rise studies.

After completing my undergraduate degree, I wanted to further my studies and research on climate change. I chose to do just that at Humboldt State University in the

Environment and Community M.A. program. After considering all of my interests, concerns for communities that are grappling with climate change, and wanting to incorporate all of the tools that the E&C program offered to teach me; I choose to focus on sea level rise along the coast of California.²

Throughout this research and interactions with participants, I have tried to disclose my bias surrounding all topics. While my own beliefs are omnipresent, this research has become a vehicle for a deeper and richer understanding of climate change, sea level rise, and the interplays³ between the human and non-human environments. Interactions with the non-human environment shape our daily lives whether we are aware or not. From changing weather, shifts in seasons, varying temperatures, or changing environmental landscapes – the non-human environment is a part of our everyday lives. Understanding ways in which to better interact with the non-human environment and new approaches to managing land, water, waste and the environment are all in the future for governments, planners, and concerned individuals across the globe.

² Further evolution of the reasoning's behind choosing this topic can be found in the subsequent chapters.

³ Interplays meaning the associations, interactions, feelings, histories, cultures and so forth that a specific locality of environment ensues for individuals.

COASTAL CALIFORNIA: A LITERATURE REVIEW OF SEA LEVEL RISE AND ADAPTATION STRATEGIES

Introduction

Sea levels are rising due to anthropocentric causes (Church & White 2006; IPCC 2007; National Research Council 2012). Sea level rise can pose many risks to coastal communities including shoreline erosion, increased frequency and severity of storm surges, coastal flooding, shifting ecological conditions, changing marine and animal species that frequent a particular coastal area, threatened infrastructure and changing recreational opportunities (Beatly 2009; Hanak 2013; McGuire 2013). Coastal communities that face the threats of sea level rise will be increasingly vulnerable to changes in seasonal, decadal, and centennial environmental conditions. Sea level rise will not be experienced uniformly across the globe; some areas will face greater levels and frequency of coastal inundation. Therefore, a locality specific planning approach is necessary because a blanket approach to planning is not a viable response option. Responding effectively will require the development of adaptive planning strategies (Barron 2012; Beatly 2009; Hanak 2013; McGuire 2013). Currently, it is imperative for local governments to have sea level rise mitigation and adaptation plans incorporated within their city and county planning strategies.

For this research I am going to be examining three case studies in California with each case study relying on one of the adaptive strategies discussed below. I am going to examine the political, social, economic, and ecological and biological resources in the

context of the planning process in order to garner lessons for future adaptive planning in the state and beyond.

Planning literature and case studies have identified three central “adaptive practices” related to community responses to sea level rise: managed retreat, coastal defense, or adaptive restoration. Managed retreat is the withdrawal, relocation or abandonment of private or public infrastructure and assets from the coastline due to coastal flooding during storm events, land subsidence, or the onset of high-high tide events – typically occurring over several years (Gorddard et al 2011; Vandenbeld and MacDonald 2013). Coastal defense consists of protecting or armoring the coastline with hard structures such as seawalls, rock revetments, ripraps or levees to protect coastal communities, valuable infrastructure, and areas of ecological importance (Heberger 2011; Pilkey 1988; Pittock 2009; Watson 2011). Adaptive restoration is the revitalization of tidal wetlands, salt marshes, estuaries, and other coastal ecosystems and habitats back to their basic vital ecological functions that have been diminished and destroyed throughout time due to development, infrastructure, and human activities within coastal regions (Feagin and Martinez 2010; Ouchani and Niazi 2008). Local governments and communities in California are currently deploying or planning to deploy each of these practices in various parts of the state. However, the cases within the bounds of this study are some of the first attempts to adapt to a changing coastline and mitigate the adverse effects of sea level rise.

Managed retreat over the years has become increasingly common as an approach to adapt to sea level rise. The earliest managed retreat from anthropogenic sea level rise

occurred in 1991 on Northey Island in Essex in the United Kingdom (Townend et al, 2002). Managed retreat on Northey Island entailed transitioning land used for agricultural purposes to marshland and removing infrastructure. The determining variables that lead Northey Island to choose a managed retreat strategy were derived from political pressure and scientific research on long-term sustainable coastal management and defense (Pethick, 2002).

Managed retreat is a strategy that allows the shoreline to migrate inland or inward unimpeded (NOAA, 2013). Coastal development, recreational amenities, and critical infrastructure along the shoreline are either removed or demolished. Managed retreat is a planning process that occurs over many years. Within California two locations, Pacifica State Beach and Surfers Point in Ventura County, have already adapted a managed retreat response to sea level rise, coastal erosion, and threats to coastal infrastructure. One of the substantial benefits of a managed retreat strategy is that it is a more permanent alternative to coastal defense strategies (NOAA, 2013). Another advantage of managed retreat is that it preserves coastline and shoreline activity as well as enables intertidal habitats to adapt to the changing environment in the process. There are a few drawbacks or barriers to a managed retreat strategy. Some examples include the implementation of managed retreat is often met with opposition, depreciated shoreline property values, divergent interests and/or needs of stakeholders, disenfranchisement of some stakeholders and managed retreat is very expensive (NOAA, 2013).

Coastal defense protects coastal infrastructure and the built environment by insulation and construction of armoring structures along the coastline (Heberger 2011;

Pilkey 1988; Pittock 2009; Watson 2011). Advantages of coastal defense include protecting coastal infrastructure, beaches, harbors, and roadways. Sea level rise poses new challenges for coastal planners, communities, and individuals to defend against the rising tides. The disadvantages of coastal defense can range from impairing migration of ecological processes with protective structures to visually unappealing hard structures that obstruct visual aesthetics of private and public areas. Additionally, coastal defense poses some unfavorable ecological consequences such as sediment backup, disrupted patterns of sand migration, and disturbance to vegetation and habitats (Martin et al., 2005, Moschella et al. 2005, Bulleri et al. 2010).

Adaptive restoration, the third strategy for adapting to sea level rise, in tidal wetlands, salt marshes, estuaries, and other coastal ecosystems includes rehabilitating ecological functions to help maintain the benefits of wetlands as well as their surrounding ecosystems (Feagin and Martinez, 2010; Ouchani and Niazi, 2008). In the last 15 years restoring wetland areas has focused on reestablishing basic ecosystem functions in order to provide and facilitate current and anticipated needs (Philip Williams & Associates, Ltd. and P. M. Faber, 2004). Wetland and tidal marshland restoration is a recent strategy that enables communities to combat some of the adverse effects of sea level rise. In bay/estuary regions the goal is to enhance these areas to serve as a buffer against storm surges and excess water during high rainfall periods (Fischman, 1991; White, 2011; Mitsch, 2013). Restoration efforts and projects often combine a variety of stakeholders and considerations. Some restoration efforts include the removal of non-native plants and

planting native ones, creation of habitat for a variety of wildlife, and removing hard structures that prevent natural water flows.

Overview of Sea Level Rise in California

The earth is experiencing the Anthropocene, which is the current geologic time period. The Anthropocene is the time period during which human activities are the most important drivers of environmental and ecological change (Ehlers, 2006). Anthropogenic forces have resulted in global climate change.⁴ Global sea level is rising primarily due to the fact that global temperatures are rising. With the increase in global temperatures glaciers, ice caps and ice sheets are melting as oceans are warming and expanding called thermal expansion of water molecules (National Research Council, 2012). One of the consequences of climate change is global sea level rise. Other consequences include extreme weather events, warming temperatures, melting glaciers and ice sheets (Janin, 2013). Sea level rise projections are based on sequential time intervals. These estimated time intervals, with the calculated increase of sea levels, are 8-23 cm by 2030, 18-48 cm by 2050, and 50-140 cm by 2100 (National Research Council, 2012). There are variations within each calculated interval because these projections are based on the uncertainty of future greenhouse emissions.

Past sea levels, present conditions and future scenarios can be determined by monitoring and measuring of global mean sea level rise via proxy measurements, tide

⁴ For further exploration on the topic of the Anthropocene please refer to the following literatures; Anthropocene Journal, Encyclopedia of Earth, Department of Oceanography at Texas A&M webpage, Science Daily webpage, PJ Crutzen 2006, W Steffen et al 2007, J Zalasiewicz, and many more.

gauges, satellite altimetry, in addition to Gravity Recovery and Climate Experiment (GRACE) (National Research Council, 2012). The National Research Council states “most of the tide gauges south of Cape Mendocino show that relative sea level has been rising” (National Research Council, 2012). There are tide gauges from 22 stations along the coast of California that measure sea level rise. Tide gauges record the height of the sea surface in relation to the height of the land formations over time.

Future calculated projections of sea level rise along the coast of California pose serious threats to coastal communities. Sea levels have risen approximately eight inches along the coast of California over the past century (Heberger et al., 2012). Based on estimates with a 1.0 meter (m) sea level rise roughly 420,000 people will be at risk and with a 1.4 meter sea level rise approximately 480,000 people will be at risk based on the 100 year flood event (Cooley et al, 2012). Large amounts of the estimated populations affected by future sea level rise are low-income people and significant amounts are communities of color, which enhances these individuals’ vulnerability to sea level rise (Herberger et al., 2012). Future sea level rise will affect infrastructure along the coast of California. Vital infrastructure, such as power plants, water treatment plants, emergency facilities, hospitals, schools, roads, highways and numerous other strategic facilities are at risk to inundation from a 100-year flood event. Continued development in these vulnerable areas puts inhabitants and critical infrastructure at increased risk and weakens the capacity for ecosystem and human resilience.

Vulnerability and Sea Level Rise in California

Literature on vulnerability, in recent years, primarily discusses disaster and risk management, famine, poverty, food insecurity, and climate related studies (Blakie et al., 1994; Adger and Kelly, 1999). The two dominant paradigms of vulnerability studies are biophysical vulnerability and social vulnerability (Brooks, 2003; Clare and Weninger, 2010). The most widely accepted insight from modern vulnerability studies is that the impact of a catastrophic event derives from the interaction between the event itself and preexisting human-caused vulnerabilities. Furthermore, the complex interactions between the physical and social systems in relation to the natural event experienced may - or may not - lead to the disturbance of the entire ecosystem. Biophysical vulnerability is defined as the exposure of human systems to natural extreme event and, as a consequence, to a hazard.⁵ Biophysical vulnerability is the actual physical or environmental disruption experienced from a natural event. In contrast to biophysical vulnerability, social vulnerability in modern literature is used to emphasize the human dimensions of vulnerability to a hazardous event. Social vulnerability is not a direct function of a hazardous event. However, it is associated with the rate of occurrence and severity of the damage associated with the hazard (Brooks, 2003). However, social vulnerability is, to some extent, linked with the particular areas of vulnerability that a system may exhibit (Brooks, 2003). Social vulnerability can only be understood through a holistic

⁵ A hazard is defined as a disruption in equilibrium of a natural event that increases the severity, frequency, durations, speed, geographical extent, spatial dispersion, and temporal spacing (Burton et al., 1993).

understanding of the community in terms of social capital, socio-economic circumstances, and geomorphology of the given area.

Sutherland developed a framework with five categories of sea level rise vulnerability (Sutherland, 2004). The first category is legal vulnerability, which includes threats to legal rights of use (BLM land, farmland etc.), threats to rights of access (recreation, fishing, and hunting), threats to usufructuary rights, threats to property ownership due to sea level rise and or the legal right of the county or state to provide protection of certain asset along the coast. For example, Native American tribes or a fishing village losing territory due to coastal inundation or coastal erosion that they once controlled is a legal vulnerability. Additionally, another example of legal vulnerability would be the county or state (or other responsible party) not being able to provide protection for valuable resources along the coast because of lack of funding.

The second category is economic vulnerability. Economic vulnerabilities include loss of income, incurred costs of relocation, damage to personal property or infrastructure, and state/government economic losses of vital infrastructure (roadways, harbors, hospitals) in coastal areas. Examples of economic vulnerabilities include loss or damage of fishing and hunting areas, loss or damage of land for agricultural purposes, loss or damage to production facilities (e.g. power plants, wastewater treatment areas, etc.), associated with sea level rise. Economic vulnerabilities are place specific, and, along the coast of California these vulnerabilities will not be distributed uniformly. For example renters without renters insurance are not covered by environmental damage to their belongings or personal property while homeowners are covered through

homeowners insurance, flood insurance, and earthquake insurance.⁶ The main difference between legal and economic vulnerability is that the former relates to legal obligation and the latter relates to economic costs because of the environmental disturbance. Economic risks from sea level rise will affect both public facilities and private property along the coast of California (King, 2011).

The third category is socio-cultural vulnerability, which deals with aspects of a population or region's vulnerability to sea level rise. Characterization of these socio-cultural variables include age, race, income, location, mobility, home ownership, property owner, renter, business owner, farmer, cultural or historical capital, and other factors dealing with social and cultural vulnerabilities to sea level rise (Cooley et al, 2012). These social and cultural characterizations affect populations differently. For example, the loss of low income beach access due to coastal inundation or coastal erosion could prohibit low-income families accessing and recreating in coastal areas. As previously discussed on page 6, 420,000 people will be at risk with a 1.0 meter rise in sea level based on a 100-year flood event and roughly 18 percent of the people at risk live in areas of high social vulnerability.⁷ Social vulnerability analysis is also important because it is closely linked to larger issues of climate justice, which is the idea that “no group of

⁶ This discussion on insurance and environmental damage goes far beyond the scope of this thesis as well as a critique of the actual validity and accuracy that these insurances provide for customers. Hurricane Katrina is an example of populations that are vulnerable in different ways (age, race, income, mobility) and how insurance, aid, and assistance is dispersed differently.

⁷ For further information about social vulnerability within this study please refer to Cooley, H., E. Moore, M. Heberger, and L. Allen (Pacific Institute). 2012. *Social Vulnerability to Climate Change in California*. California Energy Commission. Publication Number:CEC-500-2012-013.

people should disproportionately bear the burden of climate impacts or the cost of mitigation and adaptation” (Cooley et al., 2012).

The fourth category is the physical vulnerabilities to an area due to sea level rise. The physical category is defined as changes to the landscape and infrastructure based on the rate of sea level rise for that specific area. Examples of physical vulnerabilities include shoreline retreat, cliff retreat, impaired roadways, loss of vital infrastructure and physical changes to the coastline. Along the west coast of the United States the geomorphology varies significantly and different areas will experience high rates of physical vulnerability based on the landscape and infrastructure in the area. Some of the physical adverse effects of sea level rise include coastal inundation of flat and wide beaches, sand dunes, bays, estuaries, lagoons, and wetlands. These areas equate to about 28 percent of the California coastline (National Research Council, 2012). The remaining 72 percent of the California coastline is distinguished by, “steep, actively eroding sea cliffs” which includes, both lower sea cliffs and bluffs as well as higher cliffs and coastal mountainous land formations (National Research Council, 2012).

The final category is the ecological vulnerability to an area due to sea level rise. Some of the characterizations of ecological vulnerability include coastal flooding, damage to vital ecosystems, eroded beaches, pressure on sensitive coastal ecosystems, water pollution and many others (Dolan, 2004; Beatley, 2009; Franco et al., 2011; Barron et al., 2012; National Research Council, 2012). An example of an ecological vulnerability is destruction of habitats or locality specific ecosystems from coastal inundation and/or

storm surges. Sea level rise magnifies storm surges and coastal flooding creating intensified storms, stronger and bigger waves, and higher rates of coastal flooding.

Communities along the coast of California (and coastal communities across the globe) will experience a variety of vulnerabilities that stem from one or more of the five categories above. Planning for vulnerabilities based on the five categories for California coastal communities might include specific attention to minority populations, low income persons, areas of high cultural or historical significance, preservation of low-income access to coastal recreation, protection of areas of high ecological significance and many other factors. Specific vulnerabilities to sea level rise depend on the specific locality, defining physical features, local populations and habitats, and the economic and legal nuances of the area.

Resilience and Sea Level Rise in California

One definition of resilience is the “capacity of a system to absorb disturbances and still retain its basic function and structures” (Walker and Salt, 2006). Similarly, Keim defines resilience theory as the “ability or capacity to cope with and to recover from disaster consequences” (Keim, 2008). In ecology, resilience is the capacity of a system to respond to a disturbance and the ability of that system to recover and rebound after the disturbance (Peterson et al., 1998; Folke et al, 2002). If the disturbance is significant in magnitude or scale, a system may be forced outside of its threshold and would be unable to rebound to its basic and original functions. When a system is forced outside of its

threshold a regime shift takes place and different processes and structures become predominant (Folke et al, 2004).

Localized resilience of a community or area depends on the social capital, the geomorphology, the political sphere and the built environment. Additionally, local resilience depends on the economic means to support planning and implementation of safeguard measures. For example, strong social networks enable communities to cohesively rebound and rebuild after an environmental disturbance. These networks help minimize the migrations of people and valuable resources out of the area (Aldrich, 2012). Another example would be the resilience of the physical landscape or the ecosystem networks of a given area and understanding the past and present geomorphology. The physical resilience for a highly erosive beach that has experienced loss of beach width in the past, might include mobile amenities that can retreat and expand given the current physical landscape.

Resilience is place specific and resilience can be categorized⁸ differently based upon the vulnerability of that specific area. Increasing coastal resilience can reduce vulnerability. First and foremost, long range planning for sea level rise can assist the most vulnerable populations (communities of color, children and elderly populations and low income persons), provide safeguards for sensitive ecosystems, and relocate critical infrastructure out of high vulnerability zones (Aldrich, 2012; Barron, 2012, Beately, 2009; Dolan, 2004; Pelling, 2011). It is important to reiterate the fact that a resilient

⁸ I draw upon the categories from vulnerability and sea level rise to characterize resilience (e.g. legal, economic, socio-cultural, and physical).

coastal community is still vulnerable. However, the vulnerabilities are not severe enough to prohibit the community to recover from, rebound and rebuild to its original basic functions after the perturbation.

Coastal communities vulnerable to sea level rise will need to develop new approaches to managing land, water, waste and ecosystems to enhance their local resilience. Resilience will be unique for each community will be different and incorporate a multitude of differing aspects.

Policy and Planning Process for Sea Level Rise in California

Policy on climate change in California emerges for the legislative branch, (State Assembly, State Senate, and other departments) the executive branch (the Governor's office and many other departments statewide) and the three governing bodies of coastal and marine areas along the coast of California. The three governing bodies are the California Coastal Commission, California Coastal Conservancy and the San Francisco Bay Conservation and Development Commission. California's regulatory agencies govern, regulate, protect and promote climate change planning and environmental management throughout the entire state. California coastal regulatory agencies are currently developing planning scenarios to reduce the vulnerability of communities and valuable infrastructure along the coast of California (BCDC, California Coastal Commission, Coastal Conservancy).

In 2006, the Legislature in California passed AB 32, the Global Warming Solutions Act which sets goals for greenhouse reductions by 2020. In 2008 the governor

issued Executive Order S-13-08 which directed the California Department of Natural Resources in coordination with local, regional, state, federal public and private entities, to develop a state climate adaptation strategy. In response to the governor's executive order the California Department of Natural Resources released its comprehensive statewide adaptation strategy in 2009. The combination of all these actions initiated state efforts to increase climate change planning and mitigation. In response to Governor Brown issuing a "call to action" on climate change, the California Coastal Commission released a draft of their sea level rise planning document, on October 14th, 2013 (California Coastal Commission, 2013). Classified as a guidance document, this document provides an overview of the best available science on sea level rise for California, and includes recommended steps for addressing sea level rise for coastal communities. Managed retreat, coastal defense, and adaptive restoration are the three strategies that have resulted from the policy and planning processes within the state of California. California coastal communities are mandated to incorporate sea level rise planning into their general plans.

Stakeholders along the coast of California include local (municipal and county) governments, regional institutions, state and federal agencies, the private sector, Non-governmental organizations, home and property owners, renters, tribal governments and communities, business owners, and community members. These identified stakeholders are closely linked to discussions about climate change adaption because these stakeholders are motivated by either one or more of the concerns (political, economic, social, and/or ecological) surrounding sea level rise. For example, local, regional, state, and federal government agencies all play a major role in enacting climate change policy,

mitigation plans, and ensuring the safety of all people. In addition, enhancing economic growth and the preservation of private property and recreational opportunities along the coast of California are among the few motivating factors that drive agencies to plan for the adverse effects of sea level rise. Another example of a stakeholder is home and/or property owners along the coast of California who are and will experience some of the impacts of sea level rise that I have discussed in the above pages (e.g. coastal erosion, coastal inundations, and/or extreme weather events).

Exploring how the overarching policies from regulatory agencies affect the planning process that coastal communities undergo is central to this study. Additionally, identifying characteristics that lend themselves to the adoption of particular planning responses and adaptation strategies (managed retreat, coastal defense, and adaptive restoration) is a goal of the current research.

Table 1, on page 16, shows hypotheses related to the different variables associated with each adaptive strategy. For each strategy, I have identified the variables that are closely linked to the defining characteristics for each approach. For example, a coastal defense strategy might include a small physical area, whose average monetary value is extensive and that also has high cultural and historical value. An adaptive restoration strategy might include a very large physical area, with medium economic value, and low social capital. A large physical area, with a high social capital and the availability to plan to relocate the area overtime could be variables associated with a managed retreat strategy. Table 1 was developed prior to conducting my field research and it has informed my study through the development of interview questions. Identifying which response

characteristics enhance resilience or not, is essential to crafting an adaptive strategy (or a combination of adaptive strategies) that effectively decrease the local vulnerabilities associates with sea level rise. Additionally, Table 1 has provided a way to frame my research within the existing literature on vulnerability and resilience theories as well as literature on sea level rise and climate change. Table 1 provides one way of thinking about the conditions under which one or another of the strategies may be chosen as a preferred option. However, in some localities the selection of one or more of the options is mandatory based on the advice from the California Coastal Commission’s permitting requirements associated with that planning option.

Table 1: Preliminary Hypotheses

Variable	Coastal Defense	Adaptive Restoration	Managed Retreat
Physical extent	Small	Large	Large
Value	Average High	Average Medium	Varies
Economic	High	Medium	Depends High value private area vs. Public access
Cultural	High	Medium	Depends
Historical	High	Medium-High	Depends
Initial Capital Requirement			
Monetary	Medium-High	Medium	Low-High
Social	High	Low	High
Dependence of Public Funds	High	Low	High
Public Input in Planning	High	Varies	Depends
Public Safety	High	Low	High
Time Scale	Urgent “Now”	“Now” but outcome is overtime	Overtime Planned

Table 1: In the table above, as stated in the above paragraphs, this table was developed prior to entering the field and was the bases for my preliminary hypotheses. On the right hand side of the table from top to bottom are the variable developed associated with each adaptive strategy. The three adaptive strategies are across the top of the table. The rest of the table is filled in with a high, medium, or low response or outcome associate with the variable and given adaptive strategy.

Overarching Research Questions

The overarching research questions below guided the exploration of this research.

The overall purpose and goal of this examination is to critically analyze how local governments are attempting to address the impacts of sea-level rise, what "adaptive practice" scenarios local governments are employing, and community responses to government action (or non-action) to sea-level rise the along the coast of California.

1. What are local government responses to sea level rise along the coast of California?
2. What circumstances lend themselves to either one of the three "adaptive practices" (coastal defense, managed retreat, or adaptive restoration scenarios) that local governments employ to respond to global sea-level rise? How did the context influence the decision to use a particular adaptive process?
3. For each adaptive strategy, what circumstances enhance resilience and decrease overall vulnerability to sea level rise with in each site-specific case study?
4. What can we learn from the strengths and weaknesses or challenges and success of these three cases to guide future thinking about future sea level rise adaptation?

Analysis

The approach to analysis for this research stems from a four-fold examination of the political, social, economic, and ecological and biological resources exemplified throughout each case study.

(1) The political analysis examines the regulatory context surrounding these different case studies with particular attention to the relationship between the state's coastal governing bodies (Coastal Commission, BCDC) and the local entities involved in the cases. In addition, the political analysis section showcases the evolution of the decision-making process and how the coastal governing bodies made decisions, approvals, and denials for each case study.

(2) The social analysis section emphasizes the level and quality of public and local participation in the project as well as issues within each case study that emerge in the social realm.

(3) Economic analysis for each case study focuses on the total cost of the project from start to finish and who has or is paying for the project over time.

(4) The ecological and biological resources include identifying the areas of ecological and biological vulnerability and ways in which these resources are enhanced. Each case study differs in scope and scale, however important lessons and ideas emerge within each category of analysis for each case study.

Conclusion

The literature surrounding my research topic is vast and well developed in regards to sea level rise science and overall climate change research. Despite the intrinsic value of the current literature, a gap still remains. Site-specific research that uncovers coastal community's vulnerabilities to future sea level rise and ways to enhance localized resilience is necessary. The necessity lies within planning for an inevitable future that is uncertain and case studies can provide a framework or starting point for other coastal communities to plan for changing conditions along their coast. Additionally, it is my intent to outline the three prominent strategies for adapting to sea level rise and the sequence of events that lead each locality to adopt this plan of action. The following section of this thesis outlines the methodological approaches and governing frameworks that I utilized in my research. Additionally, the following chapter outlines how the frameworks and approaches were used to gather empirical data in the field and throughout the exploration of secondary literature.

METHODS CHAPTER

This research is a case study analysis of sea level rise along the coast of California. In this chapter I discuss the epistemology and methodology that guided this study. I also describe the process of selecting participants, data collection, analysis and modes in which results were disseminated.

Ethical Concerns

Ethical concerns that I have for my research include an ethical responsibility to the interactions between the participants and myself, understanding my own bias, and honesty to the information gathered from my participants. The first and foremost concern is the ethical responsibility on my part as the researcher because I have a social responsibility to use my participant's information (my research) towards positive ends while minimizing harm in the process. It is above all most important that I do not do anything that would cause emotional and physical harm to my participants. It is also important for me as a researcher to make sure that my thesis and the research ultimately benefits the communities within which I am researching. I plan to achieve this by disseminating my research to all participants.

Epistemology

Constructivism is the overarching epistemology that guides my research. Knowledge claims that form the foundation of this research are formulated from subjective understandings, opinions, experiences in addition to scientific data gleaned from interviews, site observation, and secondary literature. Knowledge is produced

through long-term conversations about identities, a phenomenon, or discourses that shape people's perceptions. Knowledge is constructed through a constructivist lens by interactions and discussions between individuals. Knowledge claims derived from interactions and discussions regarding people's perceptions, issue or topic gain meaning towards through social connections. John Creswell states "These meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrow meanings....the goal of the research, then, is to rely...on participants' views of the situation being studied" (Creswell, pg. 8).

Integrating Creswell's definition of constructivist knowledge claims, this thesis employs a mixed methods approach and four-fold analysis approach to analyzing empirical data collected. This four-fold analysis approach entails identifying the social nuances, economic variables, ecological and biophysical characteristics, and policy and planning intricacies throughout each case study. Subsequently, the goal of this research is to understand, interpret, and analyze local government responses to sea level rise in the three case studies bounded by this study. This is important because I am gathering information about sea level rise within a specific location regarding an explicit adaptation/migration response. Creswell goes on to state, "constructivist researchers often address the "process" of interaction among individuals" (Creswell, 2003). Understanding the interactions and planning process local governments and coastal communities undertake regarding sea level rise is vital to which strategies are pursued to adapt to the changing coastline. Constructivism will not only support my research by understanding

how knowledge is created by participants but also how discourses shape these interactions between individuals.

Methodology

A case study approach enables the researcher to gather data on several cases studies to delineate the differences and similarities between them (Yin, 2003). Creswell states case study research is a qualitative approach in which the researcher “explores a bounded system (case) or bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources” (Creswell, pg 73). Qualitative case study research enables researchers to explore a phenomenon using numerous data sources (Berg, 2009). I selected three localities along the coast of California to conduct my field research. Within these localities the local governments are already employing or plan to employ one of the three "adaptive strategy scenarios" to sea level rise. The reason I selected these case studies was because each of these areas is deploying a different adaptive practice, which will allow for comparisons between groups attempting different practices. Identifying the strengths and weaknesses among and between different cases and practices provides valuable insight for future sea level rise plans.

Positionality

Understanding my position regarding sea level rise is important given the scope of this study. Before commencing my field research and data collection I brainstormed the reasons why I am passionate about this topic and where I am positioned within this research. A few of my positions include sea level rise planning should incorporate public

and community involvement, planning for sea level rise is crucial to ensure the safety of coastal communities and ecosystems, and more often than not proactive planning is more effective than reactive planning.

Methods

I employ a mixed methods approach using open-ended, semi-structured interviews, secondary literature and site observation.

Interviews support my research by obtaining a first-hand understanding and insights into key informant and stakeholder views and perspectives. Additionally, it was important to understand how my participants were choosing to position themselves within the discussion of climate change and sea-level rise. Interviews are a vital component to my research. I contacted 28 participants via telephone calls and/or sent e-mails soliciting participation. Participants were interviewed about their public positions, involvement with the specific adaptive strategy, about their specific job responsibilities or their affiliation with the case study. The types of people that I was interested in contacting were agency representatives, county employees and representatives, Non-governmental organizations, local, state, and federal agencies involved with the project, business owners and community representatives. I identified the initial participants through secondary literature and the remaining participants I acquired through snowball sampling. The rationale behind choosing to implement snowball sampling was because not all secondary literature highlights all key actors or persons involved, no matter what the focus of the study is. Snowball sampling is defined for this research as acquiring

additional participants from the initial pool of participants. My participant list grew, just as a snowball grows when rolling down a hill, by asking the initial participants at the end of each interview if they can provide me with any additional stakeholders or organizations contact information. By employing snowball sampling I bolstered my findings with comprehensive data from numerous sources. The below table outlines the number of participants contacted and the number of participants interviews from each case study site.

Table 2 Summary of the Number of Participants Contacted and Interviewed

Case Study:	# Of Participants Contacted	# Interviews Conducted	# Of No Response Participants	# Of Participants Declined
Goleta	16	12	2	2
Balboa	18	4	3	11
Napa	17	8	7	2

Table 2 Participants Contacted and Interviewed. The table above is a summary of the number of participants contacted from each case study and the number of participants interviewed from each case study.

Once all research participants were selected, I went through all processes (e.g. consent form, open dialogue about my research, how, where and when my thesis will be published, etc.) prior to interviewing each participant. During this time, I held an open conversation with the interviewee about my research and answered any questions that the

participant had prior to the interviewee signing the consent form. The interviews typically lasted approximately 30 minutes to 1 hour depending on the participant. However, a handful of interviews lasted well over 1 hour. All interviews were conducted in an area that was most comfortable for the participant. The participant received no compensation for their participation in this study. The information given by the participant will remain completely confidential and all information will be coded and kept in a safe location.

I contacted 51 participants total from all three localities. I interviewed a total of 28 participants, 7 did not respond, and 16 participants declined. The majority of participants who declined to participate in this research were from Balboa Island and Little Balboa Island. Stakeholders ranged from local community organizations to regional and state government agencies (For a full range of stakeholders' please see Appendix page 141). The interview time period started in June of 2013 and went through January 2014. Follow up interviews when needed were conducted via phone and/or email.

Overall, interviewee participation in this study was high and successful. However, certain case studies exhibited higher active willingness to participate. Furthermore, some localities exhibited higher rates of none participation, specifically Balboa Island. A total of 11 participants declined to contribute to this thesis. Some of the interviewees that declined did not state a reason why they were not willing to participate, while others stated openly the reasons for nonparticipation. A few examples of the reasons some of the interviewees mentioned include: not actively involved with the project, it was too controversial, job security reasons, and/or too busy. In my opinion the current lack of participation from the Balboa Island Case study corresponds with the current status of the

project. As the project progresses increased participation from a variety of stakeholders will emerge.

I analyzed secondary literature through policy and content analysis lenses. Secondary literature that I consulted included newspapers, board meeting minutes, environmental impact assessments and secondary literature. The compilation of these literatures aided in my understanding of local responses, perspectives, and views surrounding my research. Moreover, I identified participants to interview from secondary literature in the preliminary stages of my research.

Additionally, while in the field I conducted site observations and took photographs to visually document the “adaptive practices” (defend, retreat, adapt), coastal erosion, environmental degradation, or structural erosion due to rising tides. I took roughly 1,000 pictures throughout the duration of my fieldwork. Depicting the adaption strategies and case studies through images is important for to me as a researcher because using images to tell a story is powerful and has a lasting impression. These images can be found in Appendix F.

Analysis

The coding of my interviews was done by hand. I did not fully transcribe each individual interview, however I did pullout themes and important ideas and quotes during the coding process. I choose to not transcribe my interviews because I felt that entire transcriptions were not necessary. I used highlighter color-coding to organize all information that is important to my thesis. I focused on pulling out themes and codes

from all interviews relating to the social, political, ecological, and economic dimensions. With the identification of recurring themes and codes, I provide, in the analysis sections of each case study, site-specific information that sheds light on what local governments are doing to adapt and mitigate against sea level rise. Coding of all interviews was achieved by listening to voice recordings of all interviews numerous times. I took notes and pulled out quotes and themes while listening to all recordings. The themes that were generated from all interviews fell into one or more of the four categories of analysis political, social, economic, and ecological. Initially, I listened to all interviews separately and pulled out themes that were unique to each interview on their own. After individual theses were generated, I compared individual interview themes with other interviewee's themes for each case study. Lastly, I compared all case study themes and extracted recurring themes that were prevalent throughout all three localities and strategies to compare and contrast between the different case studies.

I selected secondary literature from peer-reviewed journals, newspapers, government documents, and transcriptions from public hearings surrounding each case study site. In addition to gathering the above secondary literature, I compiled information from multiple sources on the overarching ideas of global and regional sea level rise and the adaptation strategies currently utilized. I use secondary literature in this thesis throughout the development of my literature review, methods chapter and within each case study. Additionally, I use secondary literature in this thesis to bolster themes and ideas derived from interviews and site observation.

I conducted multiple site assessments and observations for each case study. During each site assessment I walked the publically accessible areas, took pictures of the site, and took notes on the location of hard structures, vegetation, parking spaces, available amenities, and the average number of users present. Observation and assessment of each case study site is important for my thesis because the information and data collected from the site observation provides specific details about what is happening at that specific site. Moreover, details on the specifics of each site are critical because sea level rise adaptation planning is not uniformly applicable to the various geomorphologic areas along the coast of California.

I photographed all case study sites while conducting site assessments. I took pictures of vegetation, infrastructure, signs, available amenities, public access areas (such as trails, boat launching, and bike paths etc.) and hard structures. I utilize these photos to visually represent the current condition of all case studies as well as document the available amenities offered at each specific site. I took over 1,000 pictures throughout the course of my field research. I have added a few pictures throughout my case studies showcasing different aspects of each site. It is impossible to include all of the pictures taken from each site in each case study chapter.

Barriers

Only two barriers emerged throughout the course of this study. The first barrier was the participation in the Napa Plant Site and Balboa Island case studies. I have argue that the low participation levels associated with these two cases studies, is associated with

the current stage the projects are in. For the Napa Plant Site restoration project, as I discuss further in chapter 4, this project is already completed. However, monitoring and maintenance is ongoing but the majority of the agencies and associated personnel have directed their focus to other restoration efforts and projects. In addition, other participants that I identified in the primary stages of this research, had either no longer held the positions associated with the project or their titles and job descriptions changed.

The second barrier or obstacle that I as a researcher had to overcome was managing multiple case studies and associated interviewees at one time. I am a highly organized individual, but the individual attentiveness and number of interviewees from different localities was difficult to manage at the beginning of my field research. I quickly developed my own system and found a way to balance all case studies the further my research progressed.

Strengths

Two strengths emerged from this research. The two strengths include the timeliness on the part of the interviewees who participated in follow up interviews and the overwhelmingly high participation from participants in the Goleta Beach case study.

I contacted four participants to participate in follow up interviews through email. The follow up interviews involved asking if the quote I was using from the interviewee was correct, confirming dates, job titles and responsibilities and/or how the interviewee was actively involved with the project. Participants who participated in follow up interviews were contacted through email and questions were also answered through

email. All interviewees who participated in a follow up interview responded to my email within five days. The timeliness of the interviewee's responses to my follow interviews enabled the progression of important aspects of my thesis.

The second strength is associated with the overwhelming participation in my research from the Goleta Beach case study participants. A total of 12 participants out of 16 who were contacted, participated. I attribute this to the highly active participation in the planning process, current progress of the project, and contested top-down managed retreat directive from the California Coastal Commission. The active participation from interviewees provided the Goleta Beach case study with rich empirical analysis and evidence that showcases responses to the adaptive strategy of managed retreat.

GOLETA BEACH PARK, SANTA BARBARA COUNTY, CA: CASE STUDY OF MANAGED RETREAT



Figure 1: Goleta Beach Park, picture taken by Emily Bridgewater. Image above is of Goleta Beach Park facing south towards the City of Santa Barbara with USCB campus behind the photographer.

Introduction

This research examines local government responses and seeks to understand stakeholders' views, concerns and ideas surrounding a managed retreat approach to adapt

to sea level rise within the county of Santa Barbara. Goleta Beach Park has experienced rapid coastal beach erosion over the past 20-30 years, which has threatened local and regional marine ecosystems, critical infrastructure, and recreational access. This research is not only important because it examines the barriers to a managed retreat option for future planners but it is important because it highlights ways to enhance a community's resiliency when faced with a changing environment. Additionally, this case study provides insights concerning the social, economic, ecological and political dimensions to a managed retreat strategy; this will benefit local governments contemplating this adaptation strategy.

Goleta Beach Park Background

Goleta Beach Park is in the unincorporated area of the city of Goleta in the County of Santa Barbara. The Park occupies roughly 29 acres of coastal property and the county park was created in 1940s (City of Goleta, 2013). In the Goleta Valley, Goleta Beach Park provides access "to the longest easily accessible public beach" for recreational uses (County of Santa Barbara and AMEC, 2013). Goleta Beach Park utilities, infrastructure, and recreational amenities have been under attack by coastal processes, coastal erosion, storm events, coastal flooding, and long-term cyclical changes (oscillations) in beach width for many decades (County of Santa Barbara and AMEC, 2013). In the 1980s and 1990s Goleta Beach Park was vulnerable to repeated El Nino events, which lead to a decreased or receded beach width over the years (County of Santa Barbara and AMEC, 2013). In 1975, the Goleta Beach Parks historical peak width was

400 ft. and in 2000 it had diminished to an average width of 75 ft. (County of Santa Barbara and AMEC, 2013). Managed retreat strategy and planning processes for Goleta Beach Park has evolved over the years in response to coastal armoring and beach nourishment efforts failing.

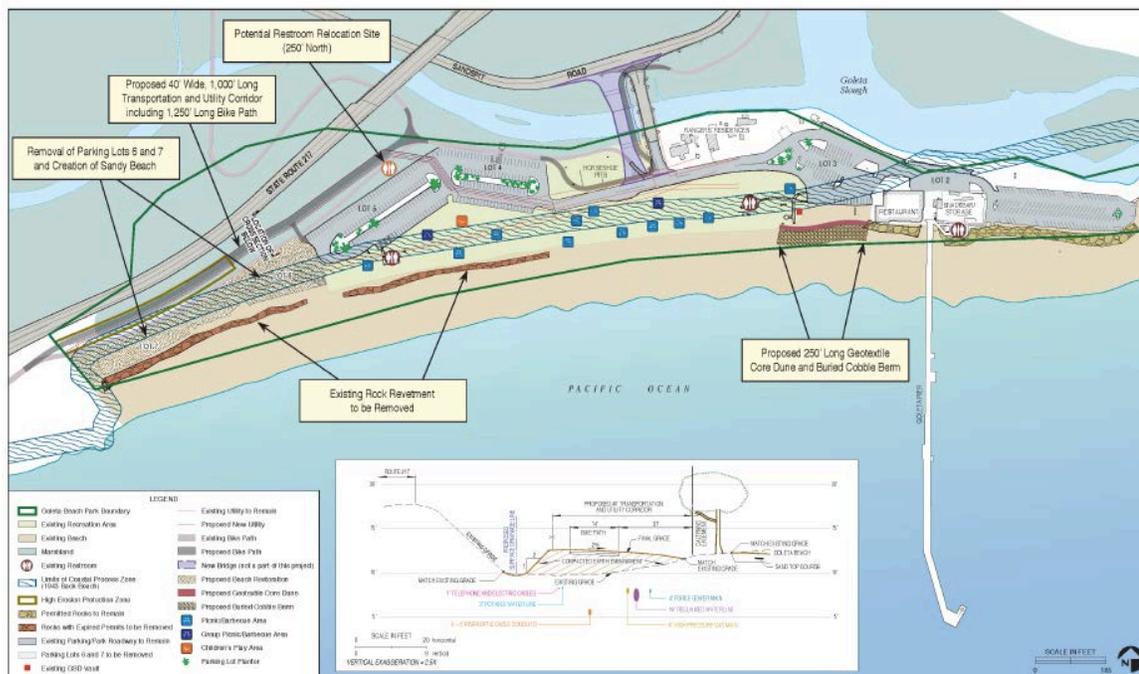


Figure 2: Project Site and Overall Plan. The image shows the proposed Goleta Beach 2.0 project and overall projected changes. The map has arrows indicating the changes in text bubbles and where the project or change is taking place within the park vicinity.

The managed retreat plan is different from what one might expect. Instead of moving infrastructure inland and upland, planners proposed to move it west, away from the parts of the beach experiencing significant erosion. Goleta Beach Park transects Goleta Slough. The main planning goal is to facilitate a westward-managed retreat of developed areas of the Park away from the environmentally sensitive and erosive mouth of Goleta Slough and historic sandpit area. Typical managed retreat plans move the

infrastructure, utilities, and recreational amenities inland. However, in this case Goleta Beach Park cannot move inland due to Goleta Slough, Southern California Gas Companies natural gas plant and highway 217 that connects University of California Santa Barbara with the city of Goleta (County of Santa Barbara and AMEC, 2013). At this time the natural gas plant is not threatened by sea level rise in the projected planning time sequence of 2015-2050.

After the working group formed in 2000, a major El Niño event enhanced storm surges and wave energy, and damaged the park severely in 2002. In response to this damaging storm that affected the beach landscape the California Coastal Commission approved an emergency rock revetment permit for the most corrosive area of Goleta Beach Park. During the early 2000s beach nourishment⁹ was also utilized as a strategy to replenish the beach area, enhancing the overall integrity of the beach. Following this permit the County of Santa Barbara decided to move forward and create the Goleta Beach Park Master Plan. The Goleta Beach Park Master Plan process happened between 2003 and 2005. Following the Goleta Beach Park Master Plan Process, the County of Santa Barbara in 2006 issued a Draft Environmental Impact Report (DEIR) and outlined the propose plan to construct a permeable groin and revetment project. After the DEIR report was finished the County of Santa Barbara submitted the proposed project and plans to the California Coastal Commission for review in 2008. In 2009, the California Coastal

⁹ Beach nourishment is when material (typically sand) is replaced by sources outside of the eroding area. Beach nourishment is necessary because of heavy erosion, storm damage, and unfavorable beach conditions.

Commission denied the permeable pier and revetment project, and directed the County of Santa Barbara to consider managed retreat as a viable option. In 2010, the County of Santa Barbara Board of Supervisors endorsed the Goleta Beach 2.0 Project, westward-managed retreat of the park. Following the endorsement of the managed retreat project the county once again issued a Draft EIR assessment. In June of 2013, the Draft EIR report was finalized and available for public comment. The County of Santa Barbara held a workshop, three public meetings, and invited the public to send in written comment regarding the proposed project by August 30, 2013 when public comment ended for the Draft EIR.

The vulnerable Goleta Beach Park is an important site of social and economic activity for the local community. Over 1.5 million visitors visit Goleta Beach Park each year. Additionally, this park is used for educational uses and daily recreation activities including running, swimming, sunbathing and volleyball. “The park is a major access points for the Goleta area,” said one of the participants interviewed (Interview, 2013). For several years a Goleta Beach Working Group met to plan and develop ways to mitigate against beach loss. Two strategies that emerged out of the working group were a managed retreat option and a coastal armoring option. A permeable pier addition - a form of coastal armoring - was chosen as the favorable alternative. However this option ended up receiving great opposition from the Surfrider Foundation and the Environmental Defense Center (Interview, 2013). In 2009, the CA Coastal Commission declined the county’s coastal armoring plan and encouraged the county to explore alternative options suggesting that a managed retreat option would be the most viable option for this park.

The county of Santa Barbara along with AMEC Environmental and Infrastructure, Inc. produced a public DEIR that was released in July 2013.

The DEIR outlined the short-term and long-term plans of Goleta Beach Park as well as provided alternatives to the proposed project plan. Several of the resource categories selected for analysis in the DEIR were relevant to coastal planning and SLR adaptation including historical processes of erosion at the park, coastal processes section, recreation segment, as well as the overall project goals, plans, and projected outcomes. Along with recreational amenities that are threatened by sea level rise, critical infrastructure is also being jeopardized such as major utility lines for high pressure gas, reclaimed water, and pressurized wastewater that transit the park.

Prime Erosion Zone- Park's Western End	Major Utility Lines	Recreational Amenities
<ul style="list-style-type: none"> • Parking lots • Underground Utilities 	<ul style="list-style-type: none"> • High-Pressure gass • Reclaimed water • pressurized wastewater 	<ul style="list-style-type: none"> • Free parking • Horseshore pit • Playground • Volleyball courts • Restaurant • Picnic and BBQ area • Restrooms • ADA access • Bike path • Fishing peir • Boat launch • Lawn area

Figure 3: Goleta Beach Park infrastructure, Emily Bridgewater, 2. Goleta Beach Park infrastructure that sea level rise threatens specific areas of the Park including but not limited to parking lots, underground utilities,

high-pressure gas, reclaimed water pressurized wastewater and many of the recreational amenities offered at Goleta Beach Park.

Projected Sea Level Rise

According to the California Energy Commission, based on 100-year flood event projections for sea level rise, the Goleta Beach Park area is currently at risk. Additionally, there are areas within the park that are projected to be at risk with a 1.4 meter sea level rise (California Energy Commission). The entire Goleta Beach Park area is in the zone of currently at risk for a 100-year flood event and the image 6b on the top right depicts current inundation areas.



Figure 4a Projected Sea Level Rise for Goleta Beach Park. The area in blue indicates the current area at risk from current sea level rise and the purple areas indicate the area at risk with a 1.4 meter rise in sea level.



Figure 4b Projected Sea Level Rise Legend

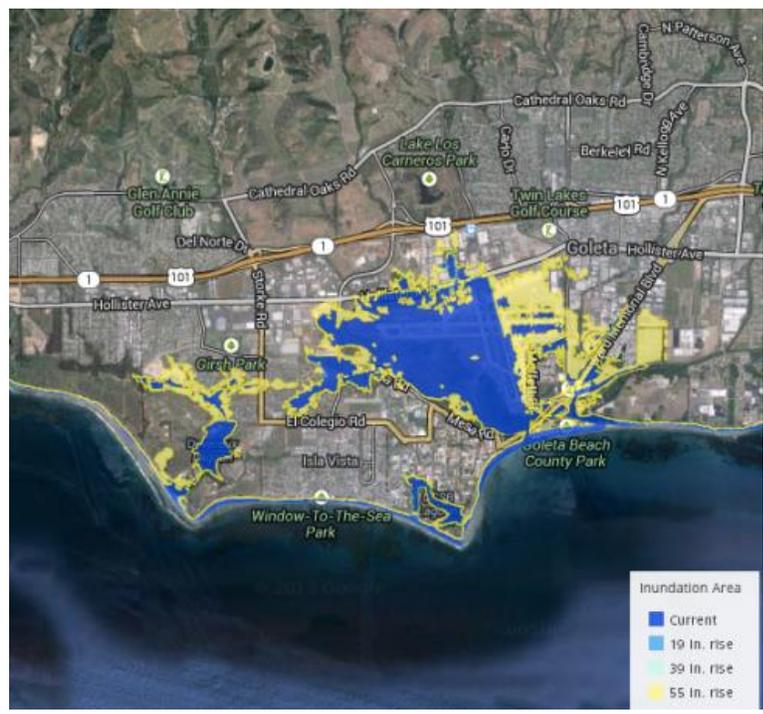


Figure 4a, 4b, 4c: Projected sea level rise for Goleta Beach Park, USGS. Image Reference order from top left to right, 4a and 4b, and 4c. The images above give the reader some context to how vulnerable Goleta Beach Park is to current and projected sea level rise.

EMPIRICAL ANALYSIS

Political and Planning Processes

The political climate surrounding Goleta Beach Park is highly contested. Managed retreat is a highly political, and, in some cases highly controversial term (Heatly, 2008). Goleta Beach Park is an example of how an adaptive strategy can create controversy and extenuate inequities among stakeholders. Additionally, identifying the power dynamics that create winners and losers among stakeholders is essential to determining the equitable and inequitable aspects within this case study. Three political aspects that I will discuss for this case study include highlighting the relationship with the California Coastal Commission, how the top-down directive for the California Coastal Commission created inequities among some stakeholders, and how the California Coastal Commission is at odds with some of the CA Coastal Act sections.

The development of this project in both the planning and implementation stages over the past decade has lead to a tenuous engagement between the Coastal Commission, County of Santa Barbara, local environmental organizations and community interest groups. As stated previously in this chapter, the California Coastal Commission deemed beach nourishment and coastal defense structures as not viable as long term approaches to sustain the current park configurations. In 2009, the California Coastal Commission denied the Country of Santa Barbara's project and plan for a permeable pier and revetment project to protect the park's current configuration and directed the County to consider a managed retreat as a realistic option for the future of the park. This decision

created some inequities among stakeholders with this top-down directive from the California Coastal Commission. Some inequities include top-down decision-making that displaces community input, local community members opposing project plans for the future of Goleta Beach Park, and the power dynamics and evolution of the decision making process of state lands that are open to public use.

Since the early 2000s, community members that comprised of a multitude of stakeholders, held meetings to discuss the future of Goleta Beach Park and the necessity for planning for the dynamics of a changing coastline. A participant that was interviewed stated that the “working group started in 2000-2001, it was a community group dealing with issues with Goleta Beach Park...that is when this thing really began” (Interview, 2013). This working group started the development towards a formal planning process that the County of Santa Barbara is currently involved with. However controversial the political environment is, it is possible to create a plan that the majority of stakeholders agree upon.

The Friends of Goleta Beach Park is a community group that opposes The Goleta Beach 2.0. The Friends of Goleta Beach Park was formed in response to Goleta Beach 2.0 and they have been instrumental by informing the public about the evolving planning process of Goleta Beach Park. Additionally, the Friends of Goleta Beach Park oppose Goleta Beach 2.0 because they are against managed retreat and in favor of armoring and protecting the park in its current state. Friends of Goleta Beach are in resistance of managed retreat of the park because they do not agree with the Coastal Commissions directive. The Coastal commission’s directive instructed the County of Santa Barbara to

look at alternative options to coastal defense and beach nourishment. Beach nourishment and coastal defense for this area from the Coastal Commissions perspective, is a short-term response to a long-term problem. One member of the Friends of Goleta Beach community group stated, “The thing that the Friends have tried to do is keep the public informed as much as possible but it is difficult. It is almost impossible until things start to happen (loss of beach, amenities etc.), then you are in this whole political storm of reaction instead of being proactive” (Interview, 2013). The Friends of Goleta Beach feel that proactive planning is necessary to ensure that this county park remains intact and resilient in the wake of a changing coastline. Proactive planning includes crafting planning for this area before problems arise.

Friends of Goleta Beach Park oppose Goleta Beach 2.0, managed retreat, entirely. The Friends contend that the proposed managed retreat project would forever change the nature and character of the park. The overall stance of the Friends of Goleta Beach is that Goleta Beach 2.0 is being driven by a political agenda that, if the planning and permitting process continues, would set precedence along the California coastline for managed retreat as a sea level rise adaptation strategy. Removing the current coastal armoring structures from Goleta Beach Park would allow the ocean to reclaim areas that were once protected for the enjoyment of over 1.5 million visitors a year. In addition to the removal of the armoring structures the beach and park would lose over 150 parking spaces and the underground utility corridor would be moved closer to Hwy 217.

In March of 2013, Friends of Goleta Beach submitted a formal Grand Jury Complaint to the Santa Barbara County Grand Jury (Rattray, 2013). The formal

complaint to the Grand Jury stated the need for future protect of Goleta Beach Park and that a managed retreat for this public access point is not the only option for this area. Michael Rattray stated, “We have submitted a formal complaint to the county Grand Jury as our county watchdog because we need more checks and balances on unwise decisions like the “managed retreat” proposal” (Rattray, 2013). The new park configurations will disenfranchise individuals that frequent this area differently because parking and amenities will be located further away from one another. For example, access to parking close to the beach and grassy areas could disenfranchise parents with small children, the elderly and disabled persons that frequent this park regularly (Lin, 2013). Additionally, families with younger children require strollers, blankets, walkers, and additional personal items that require parking that is located in close proximity to the recreational area. The Friends continue to encourage the County Supervisors to change their approach for Goleta Beach Park. The Friends main goal is that “our beach and park should continue to be enhanced and protected for current and future generations...” (Editor, Santa Barbara View, 2013).

Once the California Coastal Commission directed the County to pursue the managed retreat option, the working group that had formed in the early 2000s became fractured. The fractured interest groups became a trilogy of competing actors comprised of the County of Santa Barbara, Surfrider Foundation and the Environmental Defense Center (the legal representing body for the Surfrider foundation), and the Friends of Goleta Beach. The once collaborative working group that held common interests in unison transformed into political and social contention.

Discussions about political elements in my interviews were centered on the logistics of the planning process and the need to balance natural resources with recreational uses. Additionally, some stakeholders expressed the need for public awareness and public input in the planning process, and, how this aspect should be at the forefront of the planning process. Planning for Goleta Beach Park needs to be based on locality specific needs and circumstances. Public safety was identified as a priority for the planning process as well as a priority for the community members who have been actively involved. Access to coastal resources and amenities, protection of valuable infrastructure, and ecological diversity were all factors that county officials and county representatives deemed vital to protect and conserve.

The last political aspect that I will discuss related to this case study deals with the California Coastal Commission and the CA Coastal Act. California is fortunate to have the CA Coastal Act that outlines the environmental acts and policies state wide. However; I argue that the CA Coastal Act may not provide enough flexibility for new and emerging environmental issues that were not prevalent in the 1970s. In the next two paragraphs I will discuss two sections of the CA Coastal Act that I argue have not been adequately considered in the current decisions regarding Goleta Beach Park and the managed retreat option by the California Coastal Commission.

The first section in the CA Coastal Act deals with public facilities and distribution of public parking. According to *Section 30212.5 Public Facilities: Distribution* of the California Coastal Act, public facilities, including parking, “shall be distributed throughout an area so as to mitigate against the impacts, social and otherwise, of

overcrowding or overuse by the public of any single area” (California Coastal Act of 1976). This act states the parking facilities will not negatively impact any one area whether it be a social impact or otherwise. For Goleta Beach Park, the loss of 150 parking spaces with the proposed managed retreat project poses social impacts such as decreased access to beach facilities as well as free parking close to beach and park amenities. With the proposed removal of these parking spaces places additional stress is put on available facilities.

Moreover, the removal of 150 parking spaces will diminish the economic livelihood for the employees and owner of the Beachside Bar and Grill because less parking will be available for customers and employees. The economic loss associated with the loss of parking and livelihoods at stake of the Beachside Bar and Grill owner and employees has not been discussed and no further research has been done. This is a major oversight by the County of Santa Barbara because the county is in a lease contract with the owner of the restaurant and is legally responsible to uphold aspects of the contract relating to the specific terms of that contract.

The second section of the CA Coastal Act addresses lower cost visitor recreation and facilities. The California Coastal Act *Section 30213 Lower Cost Visitor and Recreation Facilities* outlines that “lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided” (California Coastal Act of 1976). For Goleta Beach Park, this is a no cost public beach, which includes free parking and a multitude of free amenities to enjoy. With the loss of free beach access and amenity uses,

this could increase the socio-cultural vulnerability and place-based functions that this county beach provides for the community.

To be consistent with the Coastal Act, Goleta Beach 2.0 should redraft this plan to incorporate more inclusive protective measures to lower cost visitor and recreational facilities. One member stated, “as it stands now, for the community, Goleta Beach Park low cost facilities are threatened and a lot of people are going to be disenfranchised” with the current Goleta Beach 2.0 plan and this view was shared by many other interviewees (Interview, 2013). As stated previously in this chapter, Goleta Beach Park is the only free parking beaches within the greater Santa Barbara area the provided parking close to the beach and park facilities/amenities. It is vital to protect and enhance these public services for all visitors regardless of their socio-economic status. Enhancing lower cost visitor recreation should be at the highest priority for the California Coastal Commission however; this discussion to date has not been entertained. In the future, Coastal Commission to have to weigh different priorities of the coastal act (biological protection, coastal access, etc) and as of now there is no transparent process for how they will do it. I argue that the California Coastal Commission needs to identify how this project will meet that above to sections fully and adequately in order to proceed with this project and not infringe on the CA coastal act.

Social

Highlighting the level and quality of public participation and the attachment to place for Goleta Beach Park case study is vital to understanding the nuances that emerged throughout the evolution of this project. In this section of analysis I will discuss the

various ways in which the public has been and continues to be involved with this project. Additionally, the attachment to place that public has to Goleta Beach Park is very high and the level of involvement of this project the public has displayed is closely associated with the community's attachment to place.

The level and quality of public participation for Goleta Beach Park associated with the Goleta Beach 2.0 project has been high. As stated above in the political analysis section, Friends of Goleta Beach Park oppose the managed retreat option and strongly believe that the County of Santa Barbara and the California Coastal Commission are not adequately providing the appropriate forum to address the public's concern and comments. I argue based on the information gleaned from interviews for this case study that the current standards outlined by the California Environmental Quality Act (CEQA) guidelines for public comment are not adequate and sufficient for long-range planning in regards to sea level rise for the Goleta Beach Park project. Community members, advocacy groups, and local environmental groups all exhibited the need for a higher level of engagement with the project and the need for the county to provide the appropriate forum. Inequities in this case are exemplified by whose voice is heard and accounted for – ultimately who are the winners and who are the losers. Goleta Beach 2.0 managed retreat is underway and the community members and advocacy groups that opposed the project from the beginning are ultimately the ones that lack the power to create that planning outcomes that are most favorable to them.

Another important aspect to mention about this project is that it is a top-down directive from the California Coastal Commission and because of this directive it has

guided the County of Santa Barbara and the community to a managed retreat option because it is currently best alternative for this area. Meaning that because of the close connection to place and strong community connection to this county park, I argue that managed retreat might not have been identified as a viable option. The County of Santa Barbara based on the community wants and needs might have continued to protect the beach and continue to replenish the beach via beach nourishment when needed. This then begs the question of “what is the best use of public funds in terms of long-term maintenance?” Questions like this cannot be answered in the immediate time frame

Lastly, another way of framing the California Coastal Commissions top-down, long range planning directive is by arguing that infringes on community or public access to beaches and amenities is highly controversial. Currently, the advocates for the community of Goleta and surrounding areas feel that they are losing access to beach areas and facilities that were once protected and preserved. One avid community member stated this is the “only place in Goleta that you can park right next to the sand and it is free and any hindrance of that would upset any one that has a strong tie to the place” (Interview, 2013). This quote not only links the ideas of preservation and protection of beach areas and facilities but it also links together the idea of use and attachment to place. Attachment to place is a strong connection to the area in its current or previous state. Altering the state of the area can be devastating to individuals that have history or close connections to that place whether it be from childhood, vacations, time with family or loved ones to school trips and outdoor education classes. Attachments to places are vital to social connections, networks and ones identity that is formed and transformed

throughout ones lifetime. For Goleta Beach Park preserving the current state of the park is essential for many of the community member and groups.

Economic

Managed retreat or realignment of development along the coastline can be expensive but this adaptation strategy is a more permanent strategy then coastal defense. Additionally, in some localities it is the only option. Typically, funding for these projects comes from federal contributions, public funds derived from county taxes out of the general fund, and/or grants. Goleta Beach Park is a county park that is managed and maintained by the county. A county representative stated “responsibility of Goleta Beach is in the unincorporated part of the city of Goleta therefore the responsibility of the Park falls in the hands of the County” (Interview, 2013). The cost of Goleta Beach Park managed retreat option is not quite developed in its entirety; however the projected cost is roughly \$3.5 million dollars. The economic factors that this case study exemplifies include the cost of re-aligning critical infrastructure, the economic livelihoods and county income from the restaurant on the park, and the free amenities offered at the park. First and foremost, it was difficult to find out the actual economic cost for the managed retreat project for Goleta Beach Park because additional costs emerge throughout the managed retreat process.

The Beachside Bar and Grill, that is located within the park vicinity, will experience a disruption in the number of customers and the availability of parking. Additionally, the Goleta Beach 2.0 project compromises the livelihoods of the owner and

employees of the Beachside Bar and Grill. The Beachside Bar and Grill has been in operation under the current owner for over 28 years. The owner of the Beachside states that “the Beachside Bar and Grill doesn’t come up in discussions besides its location” (Interview, 2013) and for planning for social and economic factors this is a major oversight on the county’s part. The county has a legally binding lease with the Beachside Bar and Grill and it is important to uphold that responsibility and include one of the main stakeholders, the owner of the only restaurant on the park premises, within the future planning processes of the park. The owner of the Beachside Bar and Grill expressed that he is “now concerned for [their] livelihood...I never anticipated the county ever doing anything like this that would jeopardize my business and the economic livelihood of my employees and my family” (Interview, 2013). The Beachside Bar and Grill is a twofold paycheck for the county. Meaning, the owner of the Beachside Bar and Grill earns income for the county by way of taxes and the lease to operate within Goleta Beach Park. The current lease between the County of Santa Barbara and the Beachside Bar and Grill is valid through 2020 (Interview, 2013).

There are a few indirect economic costs associated with the Goleta Beach 2.0 project. One indirect cost of Goleta Beach 2.0 may be the loss of high volume tourists to the greater Santa Barbara area because this free coastal access area and the free parking availability will be significantly smaller. Less available area to park and diminishes size of the recreational area means less accessibility for tourists to enjoy this coastal resource. At the same time, other areas of the economy are bolstered by the influx of tourists within the county. Transportation, lodging facilities, local and chain restaurants, other tourist

sites, and money spent within the county by tourists generate local tax revenues that directly benefit the county's maintenance and development projects.

Economically, managed retreat is costly – all adaptive strategies come with a hefty economic investment. The cost of this adaptive strategy will be determined by the infrastructures and amenities on site, both public and private. Federal and public funds in concert with grant opportunities will largely fund this project. However, with California and the US in a budgetary crunch securing funding for future climate related projects might be challenging.

Ecological and Biological Resources

For decades Goleta Beach Park has experienced ecological pressures and shifts from coastal processes. Some key coastal processes that affect Goleta Beach Park yearly, decadal and centennially are: beach width oscillation, El Nino events, shifts in the Pacific decadal oscillation, disruption of kelp forests, fluctuations of Goleta Beach Slough and increased erosion. Changing environmental systems creates pressures not only on the social realm such as recreation, but it also creates new areas that require monetary assistance, restoration, and new planning strategies.

The county of Santa Barbara has determined the resources within the park vicinity that the environmental impact analysis and mitigation measures should focus on. These resources include aesthetics and visual resources, air quality, biological resources, coastal resources, cultural resources, hazards and hazardous materials, hydrology and water quality, land use, noise, recreation, transportation and traffic, and utilities and public

facilities. The DEIR evaluated all of these resources in five different categories – existing conditions, regulatory framework, Project impacts and mitigation measures, cumulative impacts, and residual impacts (County of Santa Barbara, 2013). The DEIR defined impact in a 5 fold definition that takes into account the various impacts the area may experience from a range of no impact to beneficial impact to a significant unfavorable impact.

One major consideration of this project on ecological and biological resources is the adverse effects that construction may have on the habitats and bionetworks of marine and coastal species. Construction activities for managed retreat include earth moving equipment removal of parking lots and relocation and movement of amenities. The DEIR states “construction activities in the Goleta Beach Park vicinity would potentially result in a direct take or disturbance of special status species and could impact terrestrial habitat through a loss of shelter and/or foraging area” which should make this project highly contestable to local environmental groups and enthusiast (County of Santa Barbara, 2013). The Surfrider Foundation has not made a public comment at this time in regards to this section of the DEIR, but they are in favor of the overall managed retreat project (Interview, 2013). Some of the special status species include the globose dune beetle, Belding’s savannah sparrows, and western snowy plovers and in the terrestrial categories the southern tarplant and red sand verbena are within the construction footprint and could be adversely affected (County of Santa Barbara, 2013).

The ecological systems surrounding Goleta Beach Park are dynamic and profuse. Protection of ecological diversity was a major concern for all stakeholders. Other areas of

ecological concern for stakeholders include revitalization of the kelp forest, protection of coastal ecosystems for multiple recreational users, coastal access, and environmental management and incorporation of a multifaceted approach to planning. One interesting environmental finding that was gleaned from my interviews was the importance of the revitalization and restoration of the kelp forest that existed close to the beach prior to the 1990s El Nino events. During the El Nino events the kelp forest was completely decimated. The kelp forest has not been restored yet but some pilot projects are underway. Studies have shown that kelp forests add to the ecological and species diversity, as well as dissipate wave and storm energy (NOAA, 2013). Additionally, stakeholders discussed other soft environmental approaches of protecting the beach such as, planting canary date palms, permitting of geotextile berms, and implementing a pilot project that uses PVC pipes inserted in the beach area to help with drainage of wave run-up (Interview, 2013).

Innovative and alternative approaches to mitigate dynamic coastal systems are pervasive. Finding the appropriate approaches for both the immediate and long-term vitality of ecological systems is essential. It is important that short-term and long-term plans include benefits for all stakeholders and for changing environmental systems. Ecological resilience depends on keeping the basic functions and habitats intact, and, the difficulty with changing landscapes due to sea level rise and climate change present a new challenge for coastal and marine planners.

Managed retreat for Goleta Beach Park relates to ecological resilience by allowing the coastline to migrate and expand unimpeded by coastal infrastructure.

Moving coastal infrastructure away from the coastline and allowing the dynamic coastal environment to take over creates an environment that is unhindered by human hard structures.

Conclusions

Sea level rise coupled with increased storm events inducing coastal flooding increases the risk to communities and infrastructure along the coast of California. Managed Retreat, or some form of it, will be a part of future planning for some coastal communities across the globe. However, not all will need to take this leap back away from the coastline. Managed retreat can be achieved by defining the coastal hazard zones, assessing vulnerability and identifying priorities, assessing feasibilities (ownership, costs, benefits, and alternatives) and the long range planning structures for phased implementation. The overall objective for choosing a managed retreat for Goleta Beach Park as an adaptive strategy is to emphasize natural, scenic and recreation resources, reduce coastal storm damage to infrastructure, restoration of ecological systems and to allow the coastline to migrate inland unimpeded to enhance coastal resilience.

This analysis examines and highlights the barriers to a managed retreat option, such as how planning process will disenfranchise certain community members, how the cultural significance of this public beach and park is highly undervalued, and how the adaptive strategy of managed retreat for this area has created a fractured community. In addition to these barriers, this case study provided some benefits to consider that enhance a community's resilience such as the strong social capital that exists within this group of

people. In addition to these social and political barriers, it is important to consider the affects that a managed retreat project has on the local habitat and species within the project area. This case study exemplified that there are some major terrestrial and special status species that are within the construction footprint zone that maybe adversely affected by the project. In consistency with federal, state, and local policies and regulations it is crucial to consider and mitigate against these adverse effects during the construction phases.

Coastal planning and management for the future will entail collaborative efforts among all stakeholders involved. For Goleta Beach Park, the fractured community, due to differing interests and concerns for the park, may prove to be a valuable case study for future planners. Understanding sense of place and the connections that individuals have with a given area is important to factor into the equation when planning for the future. For many, Goleta Beach Park is their childhood, weekends with family, an area to surf, and a place to run. On the other hand, this is a county park managed by the county and state. Striking a balance between differing interests in the planning process is difficult. According the California Coastal Commission and County of Santa Barbara hard structures and beach nourishment are not working for Goleta Beach Park. However, community members strongly believe that managed retreat is still a futuristic plan and that current efforts should focus on saving the park the way it is. Managed retreat for this area is a reality but politically this adaptation strategy is being met with opposition.

Regulations, policies, and planning practices need to incorporate not just take into consideration, the public's comments. Public comments should be more actively

incorporated it into the planning process meaning that local, county and state planning for public access areas should incorporate public comments in a holistic and inclusive manner. It is the changing landscapes and locations of these amenities that have social and community implications – and these details should not go unattended.

Lessons Learned – Policy Recommendations

EMERGING ISSUE	RECOMMENDATION
<p>1. Top-down directive creates inequities among stakeholders regarding the outcome of the project because the top regulatory agency is mandating a definitive plan of action and the other stakeholders are marginalized in the process.</p> <p>2. For Goleta Beach Park economic inequities of managed retreat for the Beachside Bar and Grill arose throughout the course of my research, however no further research has been conducted to determine how this business will be negatively impacted by the proposed managed retreat project.</p>	<p>1. The California Coastal Commission should consider the burden that top-down directives place on local governments and community members. Top-down directives give less bottom-up planning and local creativity to plan for and mitigate the adverse effects of local sea level rise. Some questions for consideration when navigating future planning using a top-down directive include Should Communities have more say in the sea level rise adaptation plan? Should top regulatory agencies like the California Coastal Commission have the power to direct communities to a specific adaption strategy and completely deny other strategies? How do local governments meet the requirements of the regulatory agencies and the needs of the community that will be the most affected by the project? These are all questions that will need to be addressed in the future in regards to sea level rise planning.</p> <p>2. The County of Santa Barbara, the local government in this area, needs to consider all stakeholders that will be affected by Goleta Beach 2.0. Further research needs to be done to provide insight into how to adequately assist and support the Beachside Bar and Grill throughout the managed retreat project. How is the County of Santa Barbara going to provide support for this business and for the vast amounts of individuals that frequent this county park?</p>

EMERGING ISSUE	RECOMMENDATION
<p>3. Adequate amount of time, engagement, and venues for the public to provide opinions, comments, and recommendations regarding the adaptive strategy. For Goleta Beach Park case study the community members and advocacy groups involved did not feel that the county provided enough time, engagement and venue opportunities to adequately support all who wanted to participate in this comment period provided under CEQA guidelines.</p> <p>4. Did the top-down directive from the California Coastal Commission provide valuable support and direction for the future planning of this park? Was this directive necessary because this community would not otherwise choose managed retreat as a viable option to adapt to sea level rise?</p>	<p>3. Local governments and state regulatory agencies need to revisit CEQA and address how to incorporate community members and advocacy groups input in future plans that affect the community directly. Taking CEQA guidelines out of the picture, what is the appropriate amount of time for public comment? What and where are the appropriate venues to hold public meetings? Are the guidelines outlined in CEQA for public comment enough when dealing with sea level rise issues associated with a managed retreat project?</p> <p>4. Asking this question is essential throughout the evolution of any project regardless of the purpose and scope. This community may have not chosen managed retreat as a viable option to mitigate the adverse effects of sea level rise that Goleta Beach Park is and will experience further. In this case, and other like it, a top-down directive maybe necessary.</p>

BALBOA ISLAND IN NEWPORT BEACH, CA:
A CASE STUDY OF HISTORICAL COASTAL DEFENSE



Balboa Island, 1921



Balboa Island, 1928

Figure 5: Historical images of Balboa Island in the 1920s, Google Image. The images above show the growth of infrastructure on Balboa and Little Balboa Island within a 7-year time period from 1921-1928.

Introduction

In this chapter I will discuss Balboa Island and Little Balboa Island in Newport Beach, Orange County. This case study examines responses to a coastal armoring approach to adapt to sea level rise. This small island, located in Newport harbor, has for

many years, warded off high tides with the seawall that extends around the entire island. The seawall was constructed in the 1920s and 1930s, when development of this area began. Currently, the seawall has fallen into disrepair. If seawater overtops the deteriorating seawall, critical infrastructure, public and private property, as well as cultural and historical points of interest will be threatened. Through interviews and review of secondary literature, this area has been identified as a coastal community to the adverse effects of sea level rise (e.g. coastal inundation, coastal flooding, and damage to valuable infrastructure). Identifying vulnerabilities and mitigating the identified vulnerabilities such as rights to beach and coastal access, socio-cultural vulnerabilities, the physical vulnerabilities of the area, and/or the ecological vulnerabilities that are site specific can increase the overall resilience to current and future effects of sea level rise. Moreover, variables such as economic value of the area, cultural value, physical extent, monetary requirement, and time scale all play a part in the selection of what adaptive strategy is most suitable for that particular locality. Additionally identifying vulnerabilities to sea level rise coupled with proactive planning to safeguard vulnerable communities will enhance overall resilience.

To prevent the community's vulnerability, the city of Newport Beach is considering a new seawall. Unlike other areas along the coast of California, the entire seawall surrounding the island is owned by the city of Newport Beach. Newport Beach has roughly 17-18 miles of seawalls but only 4.5 miles are publicly owned and the remaining 13 miles are privately owned (Reicher, 2011). The seawalls have an estimated 10-25 years of life left so the planning process needs to start now. This case study

illustrates the competing, and sometimes conflicting, aspects of the social, economic, ecological, and political dimensions to planning for sea level rise in a high density area.

Balboa Island Background

In the late 1800s, Balboa Island was nothing more than a mudflat surrounded by swampland operating as a strategic export location for hides, tallow and other export goods (Delaney, 2007). In 1875, Balboa Peninsula was formed and established by the McFadden Brothers, who were successful commercial trade and shipping business entrepreneurs. Subsequently, in 1899 the federal government allocated funds for a new harbor because of the booming commercial and shipping trade industry. In 1902, the McFadden brothers sold the majority of the land they owned in the area including half of Balboa Peninsula to William S. Collins. Collins envisioned a very different use for this area than that of the previous owners. At this time, Collins aspired to create a resort with recreation accommodations (History of Balboa Island 2014).

Between 1902 and 1907, land in the Newport Beach waterfront area was subdivided and residences were constructed and communities were developed (History of Balboa Island 2014). This subdivision transformed the beach areas into communities and this transition established the grid system of small lots and narrow streets and alleys that still exist today. During 1908 and 1909 Collins dredged the eastern part of the Newport Bay, with the permission of the Orange county Board of Supervisors, and piled the sand and silt up on the mud flat, thus creating Balboa Island and Little Balboa Island (History of Balboa Island 2014). Collins started to advertise waterfront lots on Balboa and Little

Balboa Island for \$350.00 to \$750.00 dollars. However, lots sold for far less on the both islands even some selling for \$25.00 dollars. The original price tags for some of the bay front properties in the early 1900s of \$25.00 are now appraised today for well over 3 million dollars. Balboa Island was originally developed as a summer vacation place and continues to be today, in addition to year round homeowners.

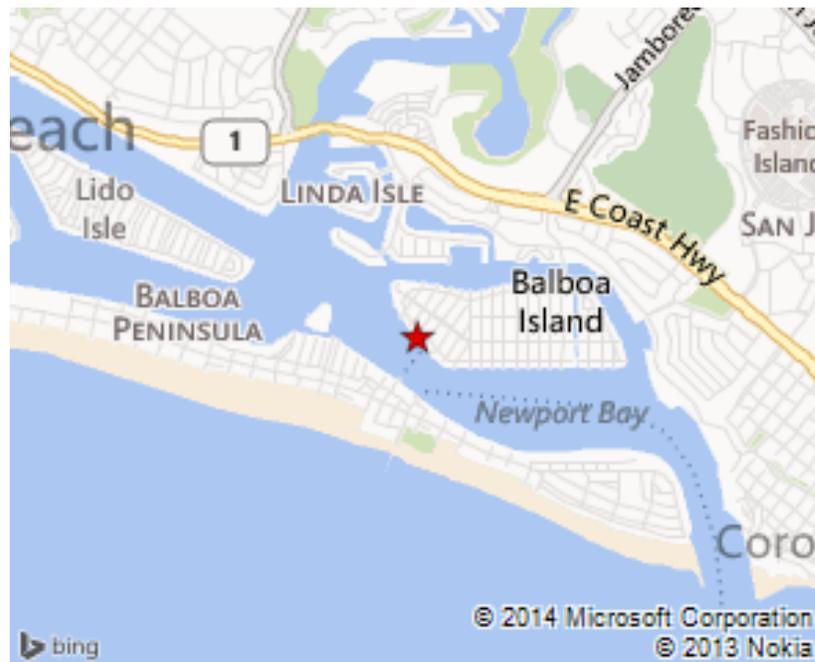


Figure 6: Balboa Island, Google Image. The image above is a map of where Balboa Island is located within the city of Newport Beach.

The first seawall was built in 1909. This seawall was a wooded bulkhead that protected only part of the island. The wooden bulkhead seawall was partially replaced by a cement barrier in 1912. In 1916, Balboa Island became apart if the city of Newport Beach and the islands started to grow rapidly thereafter. In 1918, the Balboa Island Improvement Association (BIIA) was formed. The BIIA was a motivating force in

working with the city of Newport Beach to advance the infrastructure on both islands. During this time the city of Newport Beach repaired the wooded bulkhead, the ferry service was improved, and basic city services were established.

By 1921, homes began to fill up Balboa and Little Balboa Island as well as the surrounding areas around the Newport Harbor. Roads in the surrounding area and on both islands were largely under developed and most people still arrived by rail and took the ferry. The seawall that still exists today, surrounding Balboa and Little Balboa Island, was built in 1922. Additionally, the Grand Canal wooden bulkhead was rebuilt in concrete in 1929 and the present day bay front bulkhead, boardwalks, and public piers were completed in 1938.

During the 1920s and 1930s many movies were shot on Balboa Island. During WWII the Coast Guard used the Nearby Collins Island (See image above)¹⁰, however, Balboa Island remained a residential community. Over the decades Balboa Island and Little Balboa Island has developed an exclusive community, which is home to professionals, celebrities, retirees, students, vacationers, and families while retaining its historical small town charm and feel. During the summertime there was a large influx of visitors, tourists, and people who flock to the island to experience the historical and cultural attributes that these little islands have to offer. In the summer months joggers, vacationers and tourists line the bay front areas and streets. As one interviewee

¹⁰ This map is from the following website <http://www.newportfranko.com/>.

expressed, “during the winter months, sometimes all you hear is the occasional seagull and the movement of the ocean water” (Interview, 2013).

Balboa Island and Little Balboa Islands seawall represents approximately 11% of the entire seawall waterfront in the city of Newport Beach (City of Newport Beach, 2014). The approximate perimeter of the seawall surrounding both islands is 3 miles. Information relating to demographic and statistics for Balboa Island based on the 2009 consensus roughly 3,300 residents living in approximately 1,600 homes on Balboa and Little Balboa Island year round (Balboa Island Demographics and Statistics, 2014). The following is a list of businesses and services on Balboa and Little Balboa Island a total of 28 apparel and accessory stores, 12 art, home, and/or design shops, 23 gift/specialty shops, 21 restaurants/ fun food eateries, and 18 professional businesses and services are provided on the islands (Balboa Island’s main website, 2014). Balboa Island and Little Balboa Island hosts a wide array of businesses and specialty shops.

Projected Sea Level Rise and Planned Armoring

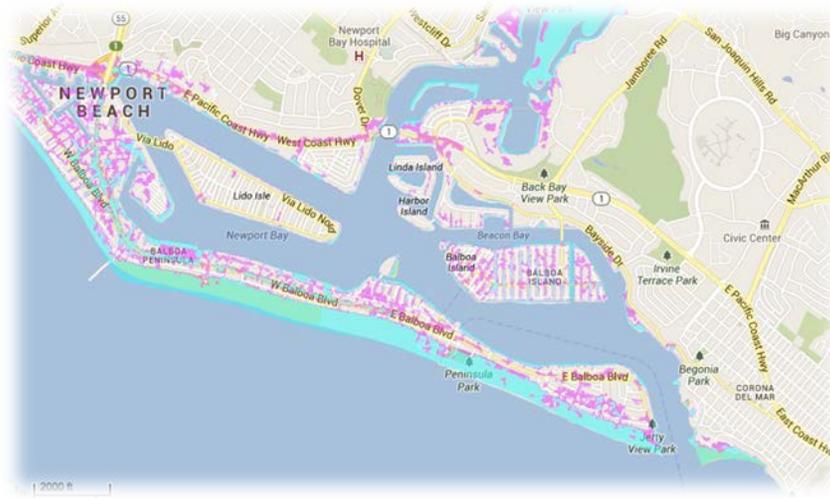


Figure 7a Projected Sea Level Rise for Balboa Island. The image above outlines the current areas at risk to sea level rise in blue and the purple area on the map indicates the future areas at risk to sea level rise with a 1.4 meter increase in sea level.

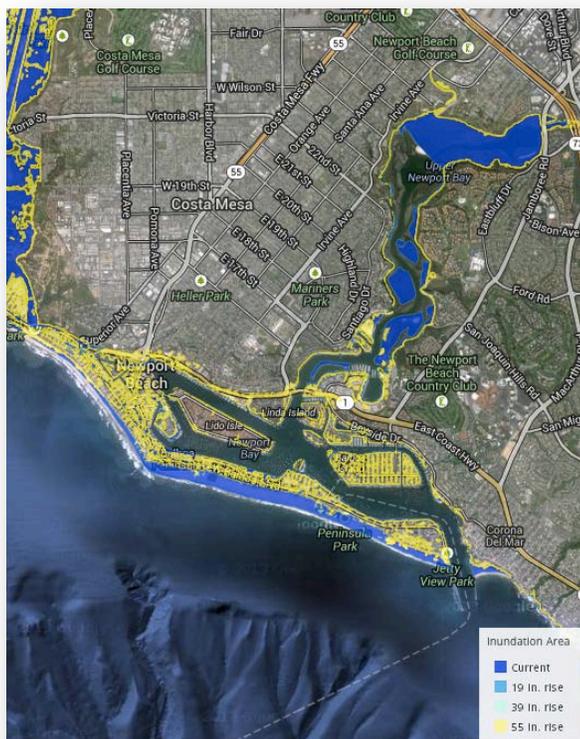


Figure 7b Projected Sea Level Rise for Balboa Island. The image identifies the areas at risk currently and in the future to sea level rise.

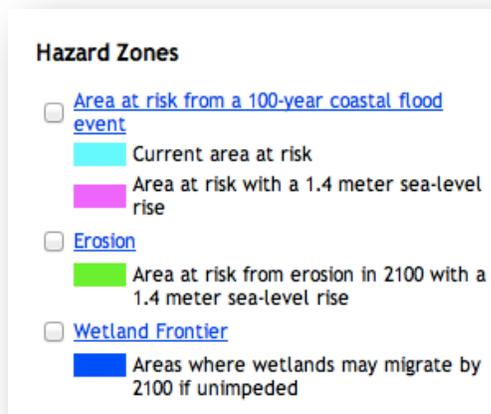


Figure 7c Projected Sea Level Rise for Balboa Island legend, USGS.

Figure 7: Projected sea level rise for Balboa Island, USGS.

According to California Energy Commission website, 100-year flood coastal flood event projections of sea level rise for the Balboa Island includes areas that are currently at risk as well as areas that are projected to be at risk with a 1.4 meter sea level rise (See above images). It was important to include information on the specifics of sea level rise and inundation for this area to establish relevance and importance of this study. The sheer fact that this area has historically defended its coastline, it is important to identify the areas that are in the current area of inundation and the future areas that will be affected by sea level rise. By replacing the current seawall surrounding Balboa Island and Little Balboa Island it will, with a higher elevation and structurally sound design, mitigate some of the adverse effects of increased flooding and overall sea level rise in the process.

EMPIRICAL ANALYSIS

Political and Planning Processes

The political climate surrounding Balboa Island and Little Balboa Island is very different than the dynamics surrounding the political arena and planning processes in the Goleta Beach Case study. Three political aspects that I will discuss for this case study include highlighting the relationship with the California Coastal Commission, tensions between local acts and state agencies, the need for collaborative efforts in the decision making process, and the equitable and inequitable aspects of the long legacy of protection of Balboa and Little Balboa Island.

The first political aspect that I will discuss highlights the relationship with the California Coastal Commission and the proposed project. At this time the planning for this project is still in its infancy as previously stated in this chapter. The relationship with the California Coastal Commission and the City of Newport Beach is not fully developed for this project because the City of Newport Beach is not at the permitting stages. After interviewing an array of stakeholders for this project, an overwhelming majority did not express concern for the project's approval by the California Coastal Commission. A county representative stated "Balboa Island and Little Balboa Island have a legacy of protecting the businesses, homes, and public access areas [so] rebuilding the seawall that surrounds both islands will not be an issue for this area" (Interview, 2013). I argue that protecting the legacy of over 70 years of coastal defense is essential for the high cost homes, residents, business owners, and the tourist industry for this area.

The second theme that I will discuss pertains to the conflicts that emerged due to tensions between local planning processes, state acts and state agencies. As discussed above, the City of Newport Beach is responsible for the repairs and maintenance of the seawalls surrounding Balboa Island and Little Balboa Island. City Councilman Ed Selich discussed in an interview with Mike Reicher from the Los Angeles Times that the cost is large for the seawall improvement but "the costs are a worst-case situation" (Reicher, 2011). Additionally, Councilman Ed Selich discussed that the current sea level rise projections may not come to fruition so the current mindset for the rebuilding of the seawall would incorporate a phased approach. With this phased approach the seawall would be structurally repaired in the preliminary stages and future renovations would

incorporate a heightening of the wall overtime to keep up with the rising tides. This process is still in its infancy so at this time this is the current planning strategy.

Another critical variable that I gleaned from interviews is that there is a need for a collaboration of multiple stakeholders needs to take place to pave the way for a more straightforward mitigation strategy in the future. The current problem is that coastal communities are at a crossroads because they have been directed by the California Coastal commission to implement sea level rise planning into their general plans. However, the current Coastal Act regulations create discord between local agencies' responses to protect private properties and the need for the Coastal Commission to follow the Coastal Act. One interviewee stated that "we have a wish list of things that we need done but [currently] we don't have a mechanism for getting them done" (Interview, 2013). Stakeholders interviewed think that part of the solution lies within an integrated approach to restoration, maintenance and protection. An example of this would be to advance the restoration of the Upper Newport Bay Nature Preserve and Ecological Reserve at the same time as the maintenance and construction of the seawall. The Upper Newport Bay Nature Preserve and Ecological Reserve are located farther inland than that of Balboa Island (See image below).

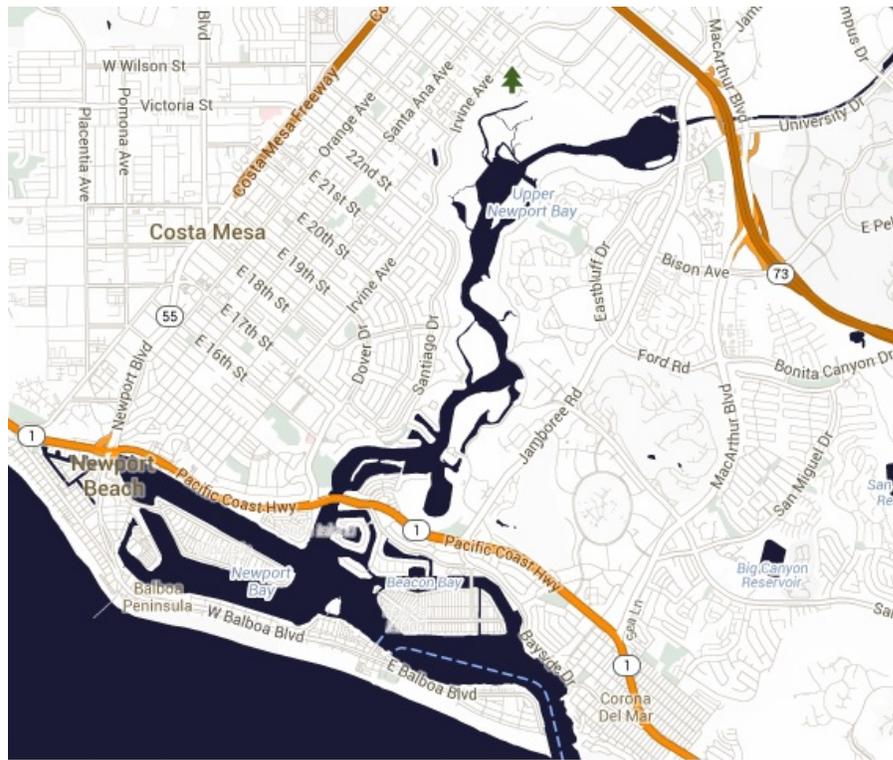


Figure 8: Balboa Island and Upper Nature Reserve and Ecological Reserve. The figure shows where Balboa island is in relation to the Upper Nature Reserve and Ecological Reserve located within the city of Newport Beach.

The final political aspect that I will discuss deals with the equitable and inequitable aspects of the long legacy of protection of Balboa and Little Balboa Island. Protecting high cost homes, historical points of interest, and coastal access and recreation are essential to the livelihoods, cultural ties to a place, and preservation of public rights of use; however, should protecting these vulnerable areas continue? At what cost? Should the local government be responsible for protecting homes that are extremely vulnerable to sea level rise? These are questions that will become even more essential to determine in the future. For many areas, defending maybe the only option but defending may not be the best solution to adapt to sea level rise along the coast.

The planning for this process is still in its infancy. Planning for long-range projects takes time, however, at this time the public is not heavily involved. One interviewee said, “When plans start to solidify the public will become more actively involved” (Interview, 2013). Public participation in general with other projects on Balboa Island and Little Balboa Island and the great Newport Bay region has been high. It is projected that throughout the evolution of this project public participation will increase.

Social Vulnerabilities

Three social aspects of key importance for this case study include stakeholders insisting on the preservation of the access to docks, boardwalks, and beach areas; the need for the visual aesthetics to remain as is or enhanced where available; the social engagement with climate change and sea level rise science; and the protection of cultural/historical sites. These variables relate to the social nuances of this case study that extenuate the social vulnerabilities of the area. Additionally, preservation and protection of these important social aspects decreases the community’s vulnerability to current and future impacts of sea level rise.

Access to docks, boardwalks, and beach areas is one of the most vital concerns for the community members and tourists that frequent Balboa Island and Little Balboa Island. Balboa Island and Little Balboa Island provide recreational opportunities for many different outdoor enthusiasts. Recreation activities both past and present, in this area include going to the beach, birding, fishing, paddle boarding, jet skiing, sailing, and other water sports. According to *Sections 30220, 30221, 30222, and 30224* of the California

Coastal Act, protection of certain water-oriented activities, protection of public or commercial recreational activities, and recreational boating uses are encouraged and should be protected in coastal and inland water areas (California Coastal Act of 1976). Consequently, in light of the California Coastal Act sections described above, with the protection of water related activities and the appropriate facilities that support these activities, Balboa Island and Little Balboa Island can retain their dynamic recreational activities.

Secondly, preserving visual aesthetics is another major concern for homeowners, residents, renters, visitors, and tourists alike on Balboa Island and Little Balboa Island. It is important for all stakeholders that the new or rebuilt seawall is visually appealing. In addition to the visual aesthetics of the new seawall it is also important that the new seawall does not obstruct or impede on the publics and/or homeowners view of the Newport harbor area. According to the California Coastal Act Policy *Section 30251* the scenic and visual characteristics of coastal areas shall be considered and protected as a resource (California Coastal Act of 1976). Additionally, the Coastal Act states that the new development should restore and enhance, when available, the visual aesthetics and quality of the area. In addition to the Coastal Act protecting visual aesthetics the City of Newport Beach General Plan *NR 20.1 Enhancement of Significant Resources and New Development Requirements, 20.4 Public View Corridor Landscaping, and 20.5 Public View Corridor Amenities* dictates the specific requirements in the general plan for public and private scenic and visual resources. In accordance with the Coastal Act and the Newport Beach General Plan the proposed rebuilding of the 1920s and 1930s seawall that

currently surrounds Balboa Island and Little Balboa Island will not impede on the visual aesthetic of scenic and visual importance. By upholding the California Coastal Act the protection of visual aesthetics for both the public and residents will remain unimpeded by the construction of the new seawall surrounding both islands.

These manmade islands have always defended against ocean waters since they were created. However, some controversy still exists. The controversy does not lie within the plans and implementation of new seawall but within the science of sea level rise. Some stakeholders are skeptical that sea level rise will occur, while others disagree with the variability of sea level rise projections and others do not believe in the validity of the science of sea level rise at all. Regardless of the differing beliefs and skepticisms surrounding the science of climate change and sea level rise, the City of Newport Beach has “deemed [it] necessary to provide structural integrity, to address sea level rise, and to protect the island from flooding...” by repairing and even replacing the seawall surrounding both islands ([City of Newport Beach](#), 2014).

A City of Newport Beach employee states that “no one wants to talk about high cost homes that cannot or do not want to move [relocate] away from the coast and [for Balboa Island residents they want the city to] protect the area as much as possible” (Interview, 2013). For Balboa Island and Little Balboa Island, as well as many other places in Southern California, managed retreat is not an option. Protection of these areas is the only way to retain the value of the resources. In addition to protecting resources, rebuilding the seawall surrounding Balboa Island and Little Balboa Island will enhance the safety and resilience of coastal communities.

Lastly, the protection of cultural/historical sites was identified through secondary literature and interviews as a critical aspect that drives the continued adaptive strategy of coastal defense for these islands. Historical restaurants, buildings, and original infrastructure that have remained intact on the island for over 75 years are a priority to preserve. “I’ve lived here since 1954 and I want to grow old here, see my grandchildren grow up and enjoy the summer life just as my children have” (Interview, 2013). Cultural connections and ties to this area have created strong social ties within the community to actively protect current and future activities on Balboa and Little Balboa Island. Additionally, it is critical to protect vital infrastructure from flooding and coastal inundation damage. However, some original features and designs will need to be rebuilt to meet present day planning and zoning regulations. For example, the city plans to modify the boardwalk, street ends and drainage structures.



Figure 9: Balboa Island 2010 Storm, Mike Reicher, August 14, 2012. The figure above shows the destructive storm that swept through Balboa Island in 2010. The storm flooded the majority of the island and damaged many homes, businesses and public access areas.

A damaging storm in 2010, that flooded beach areas, streets and sidewalks, and some homes, cultivated a shift in attitudes towards the danger of sea level rise and coastal flooding. This shift occurred because city officials and planning personnel recognized the vulnerability of this small community during the 2010 storm. The shift in attitudes was initiated in a top-down from the city of Newport Beach council and planning departments. However, it is important to mention that residents are in favor of rebuilding the seawall. Controversies regarding sea level rise projections and the science surrounding sea level rise are contested but the need to protect is uniformly agreed upon based on experienced island flooding from storm and high tide events (Interview, 2013). The picture above is from the LA Times and captures only a small fraction of the severity of the storm (Reicher, 2012). Additionally, Marvin Berenson, a professor and author, states in an article that “following a major storm that flooded Balboa Island in December 2010 a change in attitude toward the danger of rising seas prompted cities...[such as] Balboa Island to reconsider how to protect their city which lies just a few feet above sea level” (Berenson, accessed January 13, 2014). Prior to the 2010 storm the city of Newport Beach was not actively planning for the adverse effects of sea level rise (Barboza, 2012). Since then, long range planning for coastal inundation, coastal erosion, and coastal armoring plans are underway.

Economic

Coastal defense is an expensive adaptive strategy. The cost to rebuild the seawall is roughly \$68 million dollars, a hefty price tag for such a small area. The city of

Newport Beach has identified funding from grants both federal and state, but they also believe that money needs to come from other sources. One interviewee said “it is the city’s responsibility to find funding and get the project done” (Interview, 2013). The cost of coastal defense is great, however, it is a necessity to protect these high cost homes. Some questions emerge when discussing the necessity to protect, retreat or restore areas along the coastline to adapt to sea level rise. These questions include Why Is it necessary to protect high cost homes but not other things? What do we protect and what do we retreat? These questions point to the broader questions of equity – who are the winners and losers? Who has the right to protect and stay protected for sea level rise and who has to move or retreat? These questions when answered will uncover important nuances about equity, power, and money in the future.

Ecological Values and Current Environmental Issues

As previously stated in the Goleta Beach Case Study, protecting ecological bionetworks since the 1970s has become commonplace throughout the United States and worldwide. Environmental hazards that affect Balboa Island and Little Balboa Island, and the greater Newport Harbor and Balboa Peninsula, include storm surges, coastal erosion, tsunamis, rough waves, geologic hazards such as liquefaction, coastal flooding, underground oil fields – oil leaks, and underground storage tanks leaking, water/sewer contamination. Beach nourishment is commonplace in the Newport Beach region. Additionally, extreme high, high tide events could flood the islands entirely given the

current lower elevations of the seawall and structurally weaker points of the 75-85 year old original seawall.

Newport Beach area has many emerging environmental issues including water quality, over irrigation, loss of beach, coastal erosion, water conservation issues, canyon stabilization and invasive species. However, for Balboa Island and Little Balboa Island the pressing concern is to manage flood and inundation during high tide events and storms.

Lessons Learned – Policy Recommendations

EMERGING ISSUE	RECOMMENDATION
<p>1. The need to continue to protect the legacy of coastal protect for high cost homes, cultural and historical points of interest and coastal access and recreation area for Balboa and Little Balboa Island.</p> <p>2. Is California Coastal Commission impartial when making decisions about the best adaptive strategy for the area?</p>	<p>1. The California Coastal Commission should consider the inequities that occur when certain areas are allowed to protect vs. the areas and communities that have to retreat. Should protecting these vulnerable areas continue? At what cost should? Should the local government be responsible for protecting homes that are extremely vulnerable to sea level rise? How do local governments meet the requirements of the regulatory agencies and the needs of the community that will be the most affected by the project? These are all questions that will need to be addressed in the future in regards to sea level rise planning.</p> <p>2. The California Coastal Commission should consider the need to protect vs. retreat more methodically. How is it equitable for the California Coastal Commission to direct one area to a managed retreat strategy while approving coastal defense for another area? Is this equitable? Why did the California Coastal</p>

EMERGING ISSUE	RECOMMENDATION
<p>3. The need for coastal defense for many area in Southern California is the only option to adapt to sea level rise however; the need to protect high cost areas and homes is largely lacking the overall discussion of sea level rise. Why?</p> <p>4. The City of Newport Beach is obligated by law to protect the homes, businesses and historical/cultural landmarks but if the California Coastal Commission denies the permits to repair the seawall how is the city going to move forward?</p>	<p>Commission direct Goleta Beach Park to a managed retreat option, yet they might be in support for the repair of the seawall for Balboa and Little Balboa Island? Does it seem like the California Coastal Commission is favoring more economically developed places? What do we pay to protect and what do we pay to retreat?</p> <p>3. Protecting high cost real estate in the future is going to be a necessary component for all coastlines around the world. However, who and what are going to be protected are very different questions. Economics and class play a role in determining what, where and for how long area will be protected.</p> <p>4. The California Coastal Commission should consider the local laws pertaining to sea level rise and coastal areas in combination with the CA Coastal Act when determining the most appropriate adaptive strategy for the area or approving or denying coastal plans. Asking this question are essential throughout the evolution of any project regardless of the purpose and scope. What if the California Coastal Commission denies the permits for this project and directs the City to seek a managed retreat option? What will the community do? Where will they go? What will be the economic remedy the City of Newport Beach provides this community? These are questions that future planners will be faced with.</p>

NAPA PLANT SITE RESTORATION: CASE STUDY OF ADAPTIVE RESTORATION

“The project will restore natural habitats for the benefit of plant and animal species that depend on the area while maintaining flood protection and providing public access and recreational opportunities compatible with wildlife and habitat goals” (URS, 2006).

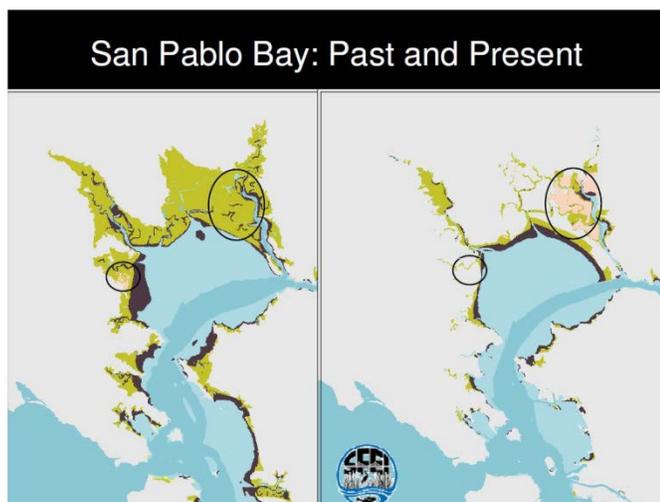


Figure 10: San Pablo Bay: Past and Present, Renee Spenst, Ducks Unlimited.

Introduction

In this chapter I will discuss the Napa Plant Site Restoration project in Napa County. This chapter examines responses to an adaptive restoration approach to adapt to sea level rise. Wetlands serve and provide our ecosystems with many functions. They provide vital wildlife habitat, shoreline protection, cleanse pollutants, they work as a sponge to buffer the impacts of floodwaters and offer recreation and educational opportunities for the public. Wetlands are important landscape features because they hold

and slowly release flood water and snow melt, recharge groundwater, recycle nutrients and provide vital recreational opportunities for many individuals. Since the 1970s several wetlands and estuary areas regionally, nationally, and worldwide have been restored and strengthened in order to ensure the health and security of both human and ecological systems (Cowardin and Golet, 1995). Wetlands also offer a multitude of ecological, economic, and social benefits to surrounding ecosystems in addition to the ecological services that wetlands provide. Wetland restoration, as stated in the literature review chapter, is an adaptive strategy used to mitigating some of the adverse affects of sea level rise.

An example of many of the San Francisco Bay Area wetlands can be found along Highway 37 (the flyway Highway) linking Vallejo to Novato in the North Bay (USR Corps, 2006). Some characteristics of these wetland areas include open water, shallow lagoons, shallow or intermittently flooded land and vegetated areas with grasses that are only sometimes or occasionally wet (Cowardin and Golet, 1995). Wetlands are essential to biodiversity and human health and since the 1970s restoration efforts have gained momentum.

The diverse hydrologic system of the San Francisco Bay Estuary region supports multiple uses, habitats, and bionetwork needs. The Bay region drains water from approximately forty percent of California from the Sacramento River, San Joaquin River, and from the Sierra Nevada mountains (Wilson, 2009). Both the Sacramento and San Joaquin rivers flow into the Suisun bay, which then flows through the Carquinez Straight to meet with the Napa River at the entrance of the San Pablo Bay (See image below)

(Wilson, 2009). The San Pablo Bay is in the northern portion of San Francisco Bay. Including all of the sub-bays, wetlands, and estuaries the San Francisco Bay covers roughly 1,600 square miles (USR Corps, 2006). Over the years, this hydrologic system has provided California and the nation with abundant economic and recreation activities.

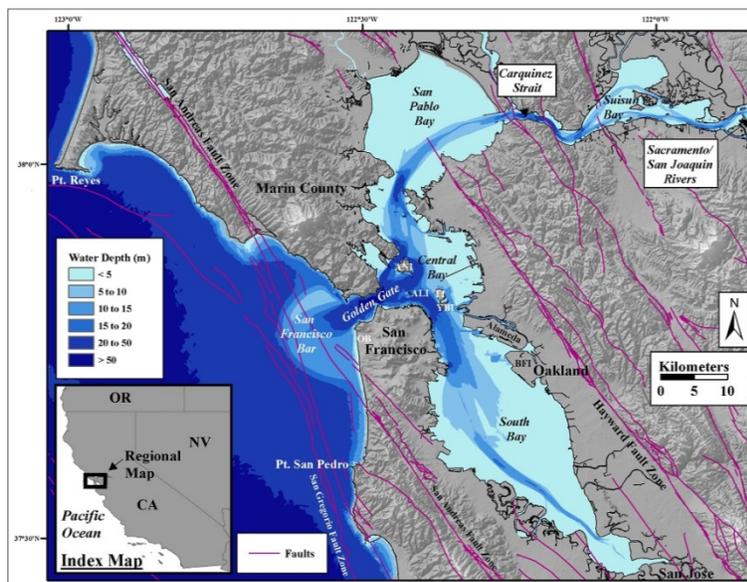


Figure 11: Hydrologic system in the San Pablo Bay Region, Wilson 2009. The figure shows the hydrologic system of the San Pablo Region as well as the great San Francisco Bay area.

Roughly 90% of the historic tidal wetlands that surrounded the San Francisco Bay region up until the 1800s have been destroyed or severely damaged (Van Dyke, 2005). By the 1960s, approximately a third of the San Francisco Bay wetlands and salt marshes were lost to land fill and diking – and the estuary regions were converted into other land uses. Since the 1960s awareness of the ecological services wetlands provide has dramatically increased and they are now a highly valued habitat. The California Coastal Conservancy, California Coastal Commission, and the San Francisco Bay Conservation

and Development Commissions regulate, protect and preserve coastal and estuary habitats. In addition to these agencies, the San Francisco Bay Joint Venture, one of the 18 national habitat Ventures, has been working to protect and restore the region's wildlife habitat for over 25 years (San Francisco Bay Joint Venture, 2014). Restoration efforts in the San Francisco Bay Area include protecting wetland habitats of all variants – rivers and streams (riparian corridors), coastal shorelines, seasonal ponds, and bay habitats – to benefit fish and other wildlife, waterfowl, as well as recreational and educational endeavors for the public.

Restoration of wetland areas has incorporated a variety of methods. Restoration has and can mean re-establishing the natural state or original condition of an area that has been altered, destroyed or depleted (Nuttall et al., 1997). However, in the last 15 years, restoration has taken on a different meaning and method. Restoring wetland areas now focuses more on enhancing or revitalizing the environmental functions of wetlands in order to provide and facilitate current and anticipated needs of both human and natural environments. Restoration efforts and projects often combine a diverse array of stakeholders, considerations, objectives and methods. Some considerations include the removal of non-native plants and planting native ones, creation of habitat for a variety of wildlife, and removing hard structures that prevent natural water flows and hydrological systems.

Napa Plant Site Background

Prior to European settlement, the Wappo Indians occupied many areas in the Napa County region including the Napa Plant Site region. The Wappo Indians were a Napa tribe of Native Americans that once shared the lush green valley with deer, grizzly bears, and elk (Van Dyke, 2005). With the onset of colonization in California, Wappo Indians were completely dispersed and absorbed into Spanish Missions (Cook, 1976). Upon settlement, the area quickly became a site for cattle and hay production due to the rich soil, level land, and water availability. Levees and dikes were built to dry up wetland areas to provide for the cattle and agriculture industries in the 1850s (Van Dyke, 2005). Until recently, this area has been a site for economic exploration and extraction coupled with environmental degradation (Van Dyke, 2005).

The first restoration plan, in the SF Bay region, was in 1993 when the Governor and the U.S. Environmental Protection Agency approved the *Comprehensive Conservation and Management Plan* (CCMP) for the San Francisco Estuary (USR Corps, 2006). The CCMP provided a multitude of recommendations aimed to improve the estuary, wetlands, and saltmarshes in the SF Bay region (USR Corps, 2006). The CCMP was the first management and restoration plan that was drafted to provide a framework for projects in the SF Bay area. Additionally, the CCMP outlines the need for aquatic resources, wildlife habitats, and how wetland management and restoration can assist in flood protection, endangered species mitigation and pollution prevention and reduction. One of the responses to the recommendations and actions to improve the overall health of bionetworks surrounding the SF Bay region was the publication of the *Baylands*

Ecosystem Habitat Goals in 1999. *Baylands Ecosystem Habitat Goals* was a report that was authored by a panel of scientists which outlined the particular “kinds, amounts, and distribution of wetlands and other habitats” that are critical to sustain and protect the area’s fishing and wildlife resources (San Francisco Bay Area Wetlands Ecosystem Goals Project, 1999; 2). Wetlands are transition areas between dry land and open water areas. Wetlands expand and recede due to the oscillating nature of the ocean tides.

The San Francisco Bay area in the 1800s had over 200,000 acres of tidal marshes and wetlands (San Francisco Bay Joint Venture, 2014). Today, roughly 40,000 acres exist and it is essential for a healthy bay to restore these ecological resources (San Francisco Bay Joint Venture, 2014). To date roughly 15,000 acres of wetlands and tidal marshes in the SF Bay region have been restored. Collaborative efforts from various stakeholders including public support, conservation agencies, state agencies, and the scientific community have and continue to enable restoration and enhancement of ecological vitality and functions in the SF Bay region.

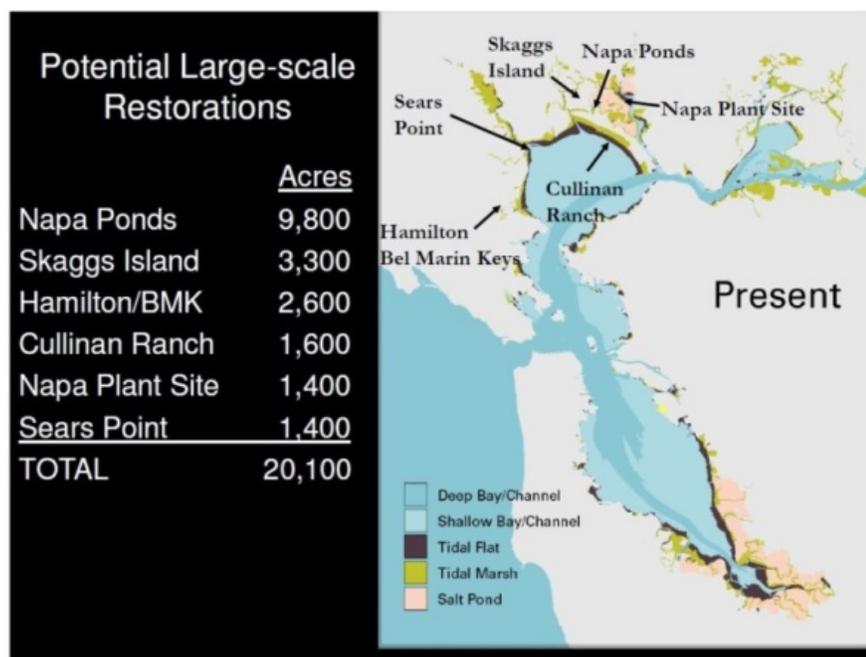
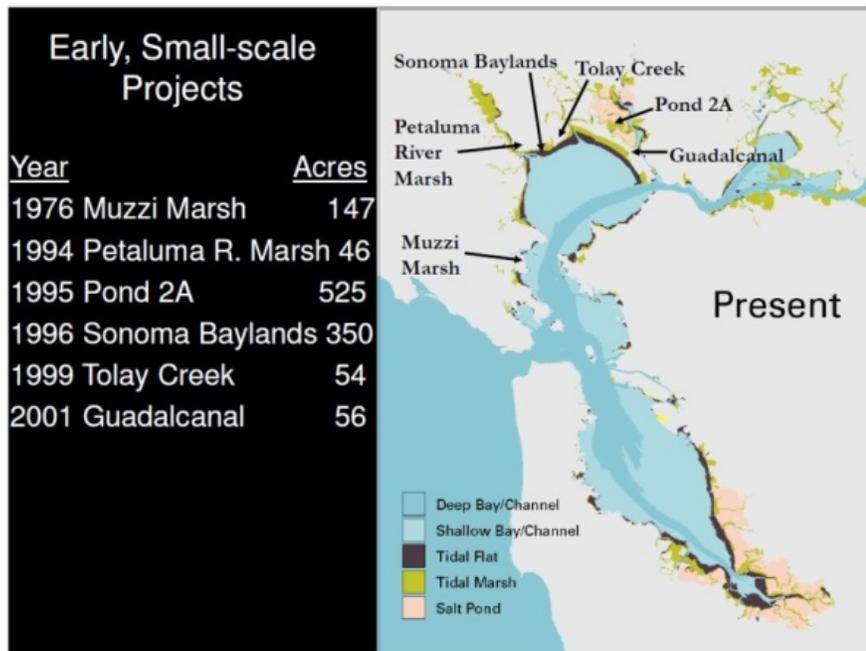


Figure 12: Restoration Projects in the San Pablo Bay Region, Wilson 2009.

Napa Plant Site is a wetland/tidal marsh area located in the northern edge of the San Pablo Bay region, which is a part of the northern portion of the San Francisco Bay. The San Pablo Bay National Wildlife Refuge is part of the 48,000 acre marsh. The United States Government designated 13,000 acres for this refuge to protect natural habitats, wildlife and species, and to maintain plant and insect species within the area (Wilson, 2009). This thesis will only focus on the Napa Plant Site restoration project, which is roughly 1,400 acres in size. The reasons behind choosing this site above all other restoration efforts in the greater SF Bay region was because this site is owned, managed, and operated by a state agency in coordination with non-profits, other state agencies, public supporters and city employees. Additionally, another factor that determined the selection of this site was that this project is completed, however monitoring and maintenance of this site is ongoing.

Cargill Salt Company owned the Napa Plant Site until 2003 when the California Department of Fish and Wildlife purchased the land. The Napa Plant Site fits into the California Department of Fish and Wildlife lands which extend on both sides of the Napa River. Additionally, adjacently north east of the Napa Plant Site, resides the Napa County Airport. Throughout the literature and my field research it is unclear why this area is called the Napa Plant Site. However, in my opinion the name refers to the previous usages of this land as a processing area for the surrounding Cargill Salt Ponds.

There are multiple wetland restoration sites in SF Bay, some large and some small. Some early, small-scale restoration projects include Muzzi Marsh in 1976,

Petaluma R. Marsh in 1994, Sonoma Baylands in 1996 and Tolay Creek in 1999 to name a few (See figure 12) (Wilson, 2009). Large restoration sites include the Napa Ponds, Skaggs Island, Hamilton/BMK, Cullinan Ranch, Napa Plant Site, and Sears Point (See figure 12) (Wilson, 2009). Figure 12 showcases potential restoration areas and was created in 2009 by Betsy Wilson (a Coastal Conservancy employee) and since then the projects listed above are in various stages of completion (Wilson, 2009). All sites that have been identified as potential restoration sites are in the process of restoration, either in the evaluation, permitting, or restoration stages.¹¹

Restoration projects in the San Pablo Bay region are diverse in scope and scale. However, the basis for the restoration is similar-restoring basic ecological functions to tidelands and tidal marshes to enhance ecological, economic, and social resilience in the midst of a changing climate.

Restoration of the Napa Plant Site was carried out by a number of stakeholders including California Department of Fish and Wildlife, Ducks Unlimited, Coastal Conservancy, California Coastal Commission, United States Army Corps of Engineers, and Bay Area Conservation and Development Commission.¹² California Department of Fish and Wildlife worked in combination with Ducks Unlimited and the Resource Legacy

¹¹ For further information regarding the broader restoration efforts in the San Pablo Bay region and the greater SF Bay region please refer to the following sites: San Francisco Bay Joint Venture: www.sfbayjv.org, South Bay Salt Pond Restoration Project: www.southbayrestoration.org/, San Francisco Estuary Partnership: www.sfestuary.org, Don Edwards San Francisco Bay National Wildlife Refuge: www.fws.gov/desfbay/

¹² For a full list of Napa Plant Stakeholders refer to Appendix A.

Fund to acquisition funding for this project. The Restoration of the Napa Plant Site was broken up into 3 units, the North Unit, Central Unit and South Unit.

In 2003, the beginning stages of the project, operations were carried out to desalinate the area, reduce plant operations footprint, and prepare all units for restoration. Restoration project goals included restoring tidal action, desalination, reintroduction of species, promote environmental benefits and reduce impacts, provide recreational opportunities, minimize ecological risk, maintain flood protection, and create a restoration design that is cost effective and self-sustaining (URS, 2007). Project design included restoring tidal action to over 1,000 acres, enhancing habitats for to endangered species and other wildlife, and to provide recreational and educational opportunities (URS, 2007). Achievement of the Napa Plant Site project restoration goals and design has been a success to date; however monitoring and maintenance are ongoing. Permitting and environmental documents were drafted and completed between 2003 and 2007 for this project. From 2007 to 2009, design completion, bidding, and construction were carried out (Wilson, 2009). In 2009, the Napa Plant Site restoration efforts were completed. The project to date has reduced salinity, reintroduced wildlife and aquatic species to the area, increased sedimentation, managed ponds for migratory birds, and increased public access. However, educational opportunities are still in their infancy stages due to lack funding (Wilson, 2009). As stated above, the property owners, the Department of Fish and Wildlife carry out ongoing maintenance and monitoring of this area.

Projected Sea Level Rise

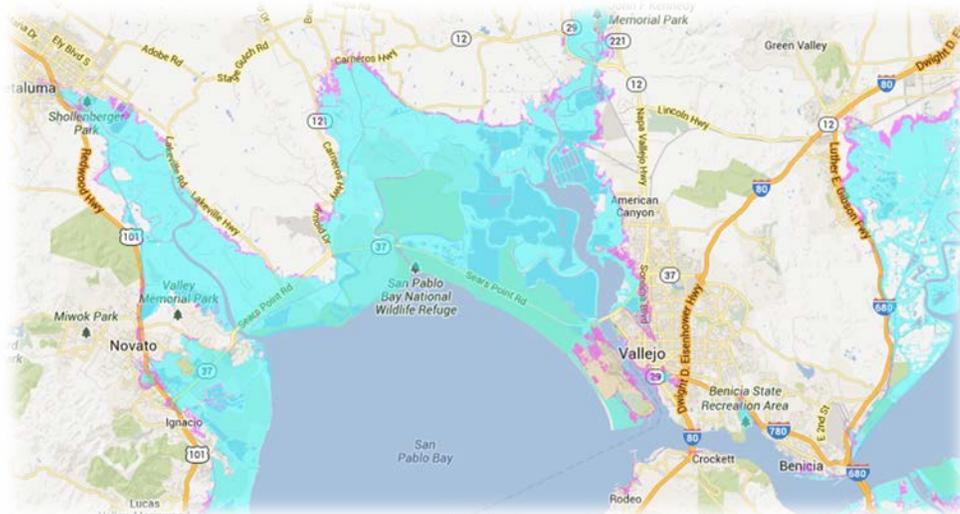


Figure 13a Projected Sea Level Rise for Napa Plant Site. The figure indicates the areas at current risk in blue and future risk in purple to sea level rise.



Figure 13b Areas where wetlands will migrate to by 2100

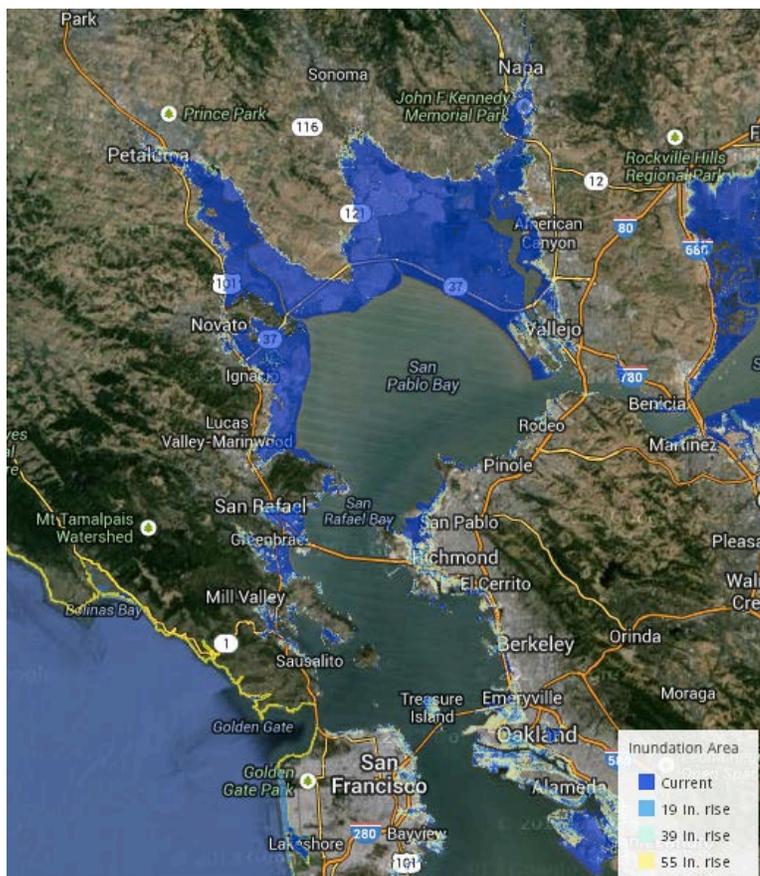


Figure 13c Projected Sea Level Rise for Napa Plant Site. The figure shows the current and future areas at risk to sea level rise.

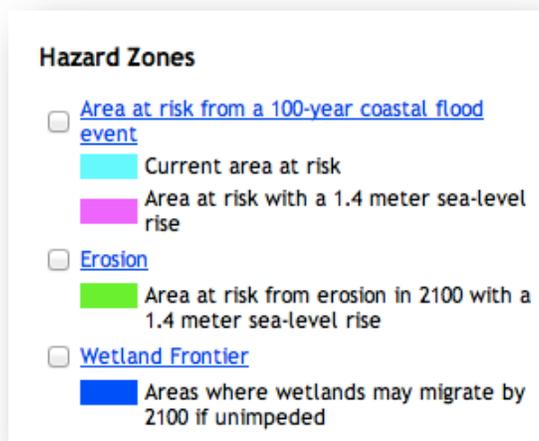


Figure 13a, 13b, 13c, 13d: Projected sea level rise for the Napa Plant Site, USGS. Image reference in order from top left to right, 13a and 13b, and bottom left to right, 13c and 13d.

According to California Energy Commission, based on a 100-year flood event, the Napa Plant Site is currently at risk. Additionally, there are areas of the Napa Plant Site that are projected to be at risk with a 1.4 meter sea level rise. The image on the top right depicts where the wetland areas may migrate to if unimpeded by 2100. Restoration of this wetland is increasingly important because the restoration site is in the current area of inundation. I argue in this chapter that restoring this wetland area will help mitigate some of the adverse effects of increased flooding and overall sea level rise in the process.

EMPIRICAL ANALYSIS

Political and Planning Processes

Unlike managed retreat, communities and agencies for the most part welcome wetland and tidal marsh restoration projects. With the omnipresent images and press

about, damaged wetlands, mangroves, and coastal estuaries, restoration has become a positive activity for communities and agencies alike. Restoration efforts for the Napa Plant Site remain positive because there are few to no drawbacks. Additionally, I believe that there was no political controversy because California Department of Fish and Wildlife is state agency and the site area being restored has little private property surrounding the site area. The restoration efforts for this case study included multiple stakeholders¹³ but there was little to no controversy or political contestation. However, a few political and planning issues emerged throughout the course of this research.

The first political issue that was discussed in a handful of interviews was regarding funding for the acquisition of the Napa Plant Site from the Cargill Salt Company. One interviewee said that the contestation lied not within the efficacy of the project but if this project was a “good use of public dollars for long term sustainability and management” (Interview, 2013). Using public funds for restoration efforts sometimes can be difficult, especially if public access to these areas is limited. In the end, this project was deemed sustainable for long-term management because funding was acquired from multiple sources, which mitigated the political issues. With the use of public funds and the public support surrounding this project, public access for recreation was a topic of discussion through the planning and permitting stages of this project.

¹³ For a complete list of stakeholders please refer to Appendix A.



Figure 14: Public Access and Recreational opportunities for the Napa Plant Site, Ducks Unlimited, 2010. The figure above shows the Public access and recreational opportunities for the Napa Plant Site Restoration Project.

As discussed in the social analysis section, public access and recreational use is a critical component to the majority of restoration efforts in the greater SF Bay Region. The “biggest political and planning issue besides funding has been over public access ...” explained one interviewee (Interview, 2013). Issues arose surrounding this case study about public access, primarily, what public access should look like and what is the adequate amount/types of public access? The Bay Area Conservation and Development Commission worked in coordination with the Department of Fish and Wildlife to meet all public access requirements. The Bay Area Conservation and Development Commission was the driving force in insisting that adequate public access was provided. Through the planning, Environmental Impact Report/Environmental Impact Statement (EIR/EIS) and

permitting stages of the project these questions were addressed. The image above (Figure 15) is a map of the public access and recreational opportunities in the Napa Plant Site.

Protecting and restoring wetland and tidal marshes should be a critical component in national and global strategies to adapt to climate change particularly sea level rise (Alexander et al., 2012). Restoring degraded wetlands and tidal marshes increased the adaptive capacity of these ecosystems and their dependent communities (both human and animal) to absorb and adjust to a changing environment. Pursuing wetland restoration actions that enhances resilience is critical to the health and sustainability of socio-ecological systems. Furthermore, it is important to craft the appropriate wetland restoration designs that incorporate regional and local characteristics and needs in order to properly enhance the resilience of that specific community.

Planning for long term effects of sea level rise is difficult. Models depicting the future, scenario simulations and projection maps of future sea level rise are very hard to interpret and understand the future landscape changes to the area. “People have a difficult time getting motivated to plan for sea level rise for a number of reasons...it’s a hairy problem that does not have an easy solution” stated one interviewee (Interview, 2013). It is complex to understand future landscape and environmental changes not because it is complicated to understand or envision. It is difficult because the drastic effects of future sea level rise are not currently experienced and it is complex to imagine different conditions.

Wetland restoration is essential to protect coastal communities, both human and ecological systems. In addition to restoration of the current area, identifying areas of

future migration is important to providing long-term protection. Wetland and tidal marshes are coastal communities' first line of defense from storm surges and coastal inundation. Restoring these basic ecological services is vital to the resilience of coastal communities grappling with sea level rise.

Social

From an analysis of interviews and planning documents, I selected five social aspects of key importance to this case study. The five social aspects include protection of recreation areas, facilitating educational opportunities, human health and sustainable livelihoods, protection of private farmland/public access with the design of the restoration, and community education about wetland/tidal marsh restoration. These aspects were identified in interviews and secondary literature as vital to the success of the restoration efforts and project goals. Additionally, another key aspect to discuss was the very low public participation for the Napa Plant Site Restoration project.

Wetlands provide recreational opportunities for many different outdoor enthusiasts. Whether you are a birder, fisherman, plant lover, or hiker, wetlands provide exceptional habitats to experience the outdoors. Recreation activities, both past and present, in this area include hunting, fishing, boating and birding. According to *Sections 30220, 30221, 30222, and 30224* of the California Coastal Act, protection of certain water-oriented activities, protection of public or commercial recreational activities, and recreational boating uses are encouraged and should be protected in coastal and inland water areas (California Coastal Act of 1976). One interviewee stated, “public access for the

community was a fundamental component to this project and was necessary because wetlands provide a perfect environment for people to experience the outdoors” (Interview, 2013). Regulatory agencies as well as active community members insisted on adequate public access. The Napa Plant Site restoration project provides additional recreational opportunities such as a small craft hand launching area, hiking and bicycle trails, and a future site for an environmental education center.

Facilitating educational opportunities was identified as one of the foundational social variables to enhance as a result of this project. California Department of Fish and Wildlife identified the need to create and build an educational center in combination with this restoration project, however to date this has not come to fruition. The purpose of the education center was to increase awareness of the ecological importance of wetlands, as well as possibly provide a facility for elementary and middle school class field trips. “Wetlands provide a necessary service to our environment ... [and] the broader community is largely uneducated about the important services these ecosystems provide,” stated one interviewee (Interview, 2013). Incorporating an educational center, for both school aged children and adults alike, in hopes to increase educational outreach on the benefits and services that wetlands provide is important not only for the Napa Plant Site but for the greater SF Bay region.

The ability of wetlands to filter and supply fresh water enhances the public health of urban, rural, and coastal communities. With the increase of pervasive pollution both on land and in waterways, restoration efforts that enhance the natural filtering functions of wetlands becomes increasingly important (Alexander, 2012; Stralberg et al., 2011; Lotze

et al. 2006; and Knowles, 2010). In addition to the fresh water supply provided by wetland filtration systems, many communities are dependent upon the services that wetland ecosystems provide for their subsistence and economic livelihoods, which further heightens the urgency and importance of restoring degraded wetland areas (Alexander, 2012).

Additionally, restoring degraded wetlands can enhance sustainable livelihoods and increase resilience for humans and ecosystems alike. Restoring degraded wetlands is an opportunity for society to recover valuable benefits that wetlands provide while enhancing human health and well-being. This can be achieved by restoring the degraded wetland so that the ecosystem can perform its basic function by reducing the risk from storms and other extreme events, improve flood and water security throughout the ecosystem, and enhancing the wetland capacity to mitigate and adapt to climate change and sea level rise. As mentioned in the above section, the Napa County Airport is adjacent to the North Unit, which is in the upper northeast section of the Napa Plant Site. By enhancing this area, wetlands will serve as a buffer from storm events that would otherwise flood and damage areas of the Napa County Airport. However, because of the Napa County Airport, this area is not able to migrate and expand in the future unless the airport was relocated.

Another important social aspect that was identified throughout this project was the need to protect private farmland and public access with the design of the restoration. “With reintroducing tidal action it subsequently increases sediment flow into these areas ... [these] wetlands can expand and grow rapidly after they are reestablished,” stated one

interviewee (Interview, 2013). Mitigating the expansion of wetlands in such a way that restored areas do not migrate and take over neighboring private property or public access areas throughout the Napa Plant Site Area by accident, was critical to this project. When maintenance efforts are lax, vegetation grows and propagates across property boundaries and grows over hiking pathways. This restoration project created maintenance efforts to mitigate against overgrowth and migrating vegetation.

In addition to the other social aspect, this project identified the need for community education about wetland/tidal marsh restoration to the broader community. Public hearings and meetings were regularly held throughout the duration of this project. However, public participation was minimal at most. An overwhelming majority of the public was in favor of the restoration project, but not many people frequented public meetings. This project has bolstered education through public meeting and hearing throughout the project and during these meetings. The California Department of Fish and Wildlife provided adequate opportunities for questions, responses, and concerns about the Napa Plant Site. With the increased recreational and educational areas throughout the Napa Plant site, community members can access the boat launching facilities, trails, and bird watching areas. Additionally, this project created a sense of community gathering and enjoyment that in turn enhances resilience. Resilience is enhanced because the sense of community is tied to a localized place that can strengthen the capacity of that system and individuals to rebound from a disturbance to their environment. Ecological and community resilience are closely tied together because community (or human) activities impact the environment and versa.

During all interviews for this site, I asked if there have been any public controversy surrounding restoration efforts for the Napa Plant site and all participants said no. According to one interviewee, “anytime you are talking about the land/green interface there is a potential for competing resources and land users to be in conflict with one another...there is more occurrence of this in the projects in the south bay” (Interview, 2013). When discussing wetland and land interfaces (where the wetland ends and the land and infrastructure begin) it is important to uncover the differing needs and opinions from the variety of stakeholders involved. Changing environments change users’ interactions with that landscape. Even though the majority of wetland restoration efforts increases multiple user access, and, enhances the overall health of the wetland some individuals, animals, fish, and plants marginalized in the process. Some individuals, animals, fish and plants can be marginalized because construction activities disrupt the current habitat and ecosystem functions. Once construction is completed these species (animals, fish, and plants) reemerge and multiple in number and size (Alexander, 2012).

As mentioned in the first paragraph public participation in this project was very low for a number of reasons. The first reason being that there are little to no residential, commercial or private properties surrounding the project site and for this reason the need for public involvement was decrease. However, that is not to say that the overall community is not concerned for the future of this open area and the restoration of ecological sites. Secondly, this property is owned by California Department of Fish and Wildlife who purchased the land from Cargill Salt Company in 2003 which means that this area is owned and operated by a state agency. The reason for low participation is not

closely associated with the fact that this project was owned, run and operated by a state agency but some conclusion can be made to the extent that there was little to no controversy with the scope, scale and operators of this project. If there were problems or controversies the public would have been more actively involved during the evolution of the project or there would be some backlash now. Lastly, I would argue that environmental restoration for the most part is upheld and promoted by the general public thus eluding to the low amount of public participation.

Economic

The funding for this project came from various sources. California Fish and Game purchased the Napa Plant Site, and numerous additional acres in this region, from Cargill Salt Company in 2003 (Environmental Science Associates, 2014). The cost of restoration efforts for the Napa Plant Site was roughly \$13.4 million dollars for the North and Central units, and no funding at this time has been identified for the central unit (Environmental Science Associates, 2014). No funding for the Central Unit was specifically identified because outside funders were not acquired and the funding for the restoration of this unit came solely from the California Department of Fish and Wildlife. Hours expended to date from all efforts and partners on this project are roughly 16,000 hours and the total number of people employed to date has been 57 people (Ducks Unlimited, 2014). Funding came from state and federal grant money as well as assistance from Ducks Unlimited and Bay Conservation and Development Commission. Cost of

restoration efforts is much lower than the other two adaptive strategies (managed retreat and coastal defense) discussed in this thesis.

The economic cost of this project was discussed throughout all interviews and identified in secondary literature. According to one interviewee wetland restoration “can be a very cost effective adaptive strategy because you are improving two very important ecological functions...the basic functions of the wetland and improvements to the habitat for migratory birds and endangered species” (Interview, 2013). Additionally, another interviewee stated “costs can be a truly driving factor of this...holding back the ocean with hard structures is very expensive” (Interview, 2013). Wetland restoration is very cost effective in the long term.

Restoring wetlands before the onset of extreme sea level rise impacts mitigates the near term costs associated with sea level rise. Some near term costs include flood damage to infrastructure and land, decreased accessibility of roads, public access trails and hunting and fishing areas. It is important to point out that for many areas in the SF Bay estuary region near term¹⁴ effects of sea level rise will have expensive flooding costs and consequences. With increasing the ecological functions that wetlands provide through restoration efforts, near term costs of sea level rise will decrease (Interview, 2013; Alexander, 2012).

¹⁴ Near term meaning in the short term the effects of sea level rise will have expensive flooding costs and consequences if planning efforts do not mitigate these changes.

Ecological and Biological Resources

From interviews and secondary literature I have identified seven ecological variables or benefits from this restoration project. The six ecological variables include restoration will buffer some of adverse effects of sea level rise, restoring tidal action to over 1,000 acres, benefits to endangered species and other wildlife, maintaining flood protection, tidal marshes grow as sea level rise grows, tidal Marshes capture carbon, and the projects restoration design uses historic slough pattern as a basis for the location and extent of restoration efforts.

Ecological restoration will buffer some of the adverse effects of sea level rise, particularly flooding due to excess water in the system. Ecological restoration provides flood protection because wetlands work as a sponge during heavy rainfall periods. Soaking up and filtering large amounts of water is a primary function of wetlands, and with the onset of climate change and predicted sea level rise it is important to utilize this ecological service. Once wetland and tidal marsh areas soak up excess water these ecological features slowly release the water back into the bay estuary regions. Wetlands and tidal marsh areas are the first line of flood defense and will help protect hard structures such as levees from storm surges and wave energy. Maintaining flood protection for this area is important for residents and wildlife. When flooding occurs, infrastructure such as roads, hospitals, homes, farmland and grocery stores are affected. Over the past 40 years, flood damage in Napa County has cost over \$500 million dollars in property damage (Egan, 1998).

The only critique that interviewees discussed is that lower elevation wetlands or tidal marshes may not be able to grow and naturally increase in elevation as fast as the increased height of projected sea level rise. One interviewee stated, “this can be addressed by increasing the height of the wetland area with soil and vegetation fill” above the projected height of sea level rise. In the future, coastal ecosystems will change and migrate to different areas – this is a change that is expected and concrete. Coastal environments shift seasonally and decadal regardless, and, with anthropogenic forces affecting these shifts based on the intensity, occurrence, and duration, ecological and human environments may rebound or transition at a slower rate. This can be mitigated by increasing the elevation of the wetland gradually to give these areas a head start based on the projected elevation of future sea level rise.

Restoring tidal action to over 1,000 acres was a fundamental aspect of this project. Restoring tidal action means taking out levees and earthen structures in order to allow the hydrologic cycle to flow and migrate to this area again. Taking down levees and allowing tidal action back into these areas, benefits wildlife, endangered species, water quality as well as the overall health of the entire bay (A Project to Save the Bay, 2014). “After the construction phases were completed, the salinity of the area was stabilized, wildlife, fish species and vegetation increased in number and size, and the area rapidly rebounded” stated one interviewee (Interview, 2013). Tidal action is necessary to flush water, build sediment, which in turn provides services to vegetation, fish and wildlife habitats and the system as a whole. Reintroduction of tidal action is important for

the overall restoration efforts and it is vital to ensuring the health of these wetlands, so that they can perform at their highest ecological ability.



Figure 15: Endangered species that frequent the Napa Plant Site, Wilson 2009. The figure above showcases all of the Endangered species that frequent the Napa Plant Site.

Restoration of this wetland area has enhanced the frequency and numbers of endangered species, wildlife, fish, and plant species that exist in the Napa Plant Site area. Sacramento Splittail, Chinook Salmon, Shimofuri Goby, American Shad, Prickly Sculpin, Tule Perch and Striped Bass have been reintroduced into these areas and continue to flourish (Wilson, 2009, See image above). Additionally, California's fisheries rely on the SF Bay as a nursery for California's Dungeness crab, California Halibut, and Pacific salmon fisheries (Van Dyke and Wasson 2005). The marsh areas provide habitat to endangered species and provide key filtration of sediments and pollution from rivers. Restoration of wetland areas leads to dynamic habitats and plant and animal life within the area. A subsequent outcome of this is that it contributes to enhanced socio-economic resilience among coastal communities by increasing the availability of recreational

opportunities, ecological diversity, and habitats for wildlife and plants that are used for subsistence food sources.

Enhancing wetland services and functions increases resilience. Wetland services and functions increase resilience because the system is reliant upon multiple services instead of just a few functions. For example, the restoration efforts for the Napa Plant Site increased the number of fish and plant species that reside in and frequent this area. With the increased species, both plant and animals, this area is higher in productivity and the additional species provide services for one another. Resilience is dependent upon the interactions between species and the ability for these species to remain intact after a disturbance occurs. The services that species provide for one another creates a network of functions that is resilience because species function as a group.

The Napa Pant Site restoration efforts were designed using historic slough pattern as a basis of location and the extent of restoration. Additionally, during and after flood events wildlife habitats and fisheries become disturbed throughout the landscape where flood waters expand. Restoring tidal marshes and wetlands can increase the flood carrying capacity in surrounding waterways such as flood control channels, local creeks, and rivers. Maintaining overall flood protection is vital to the resilience of the local ecosystems and surrounding communities because it safeguards these ecosystems and communities from the onset of floodwaters and other disturbances that occur in combination with flood events.

In addition to maintaining flood protection, enhancing wetland areas is vital to combating the adverse effects of sea level rise because tidal marshes and wetlands grow

as sea level rise grows. As tidal marshes develop through the deposits of sediment from higher elevations and during flood events, the tidal marsh grows in elevation and size. Once the tidal marsh or wetland is established vegetation begins to grow. As sediment washes into new areas, it accumulates and a tidal marsh is established and grows further in size. Tidal marshes, once established, become very proficient sediment traps and tend to preserve themselves as they age (as long as there is enough available sediment) (Stralberg et al., 2011 Knowles, 2010). Therefore, wetland and tidal marsh areas can expand and keep pace with sea level rise, as long as the wetland has the availability grow and migrate unimpeded.

The California Department of Fish and Wildlife, as of now, has not identified areas for migration and expansion of the wetland area for this restoration project. However, with saltwater incursion and higher tide levels, surrounding farmland may be deemed unproductive and Fish and Wildlife may look into purchasing these areas as sites for restoration and migration of current wetlands in the future.

Tidal marshes are biologically productive ecosystems and for this reason tidal marshes can capture carbon at a faster rate than that of freshwater marshes. Additionally, tidal marshes may be more efficient per unit area than trees when it comes to capturing and removing carbon from the atmosphere (Knowles, 2010). As tidal marshes grow with rising tides they will continue to capture carbon dioxide out of atmosphere. While specific research on the exact amount of carbon the Napa Plant Site will sequester has not been quantified. However, it is apparent that a significant amount of carbon will be captured by the restoration efforts of this project.

Lessons Learned – Policy Recommendations

EMERGING ISSUE	RECOMMENDATION
<p>1. Is ecological restoration a good use of public dollars? Is this a good use of public funds for long-term sustainability and management?</p> <p>2. Does providing adequate public access for adaptive restoration projects make the project too expensive and less feasible to execute? Or does providing public access increase the success of the project over time?</p> <p>3. Overwhelming majority of the public was in favor for this adaptive restoration project.</p>	<p>1. The state regulatory agency that is involved with the restoration efforts, either the BCDC or the California Coastal Commission, should consider if the project is a good use of public funds overall. These questions emerged throughout the course of this case study and they are vital to determining whether or not the project at hand is viable for long-term sustainability and management. Using public funds for restoration efforts sometimes is difficult especially if public access is limited.</p> <p>2. The California Coastal Commission or the BCDC should the amount of public access provided within the project and if providing high public access and usages drives up the cost of the overall project. Providing public access areas in estuary and coastal areas is essential for all new construction/restoration efforts. What is difficult is determining what public access should look like, where it should be and what is the adequate amount of public access? These questions are determined by a site/project specific basis and at times it is difficult to determine how to answer all of these questions.</p> <p>3. What is different about adaptive restoration in comparison to coastal defense and managed retreat? Does the amount of conflict/controversy depend on the adaptive strategy or is it site specific based on the specific community? These questions are important to explore. Interesting nuances arise when questions like these are explored. These questions in</p>

<p>4. Cost can be a driving factor to choosing adaptive restoration as a viable option to adapt to sea level rise.</p>	<p>the future will be important for planners to answer.</p> <p>4. The California Coastal Commission or the BCDC should consider the need to restore wetland, tidal marshes, and estuary areas because it is very cost effective. Wetland restoration is very cost effective both ecologically and economically. Where available wetland restoration should be considered. Not all localities along the coast of California can pursue an adaptive restoration strategy but where applicable this strategy can be a money saving venture. Planners in the future need to determine when and where restoration efforts can be pursued and the associated costs to the proposed project plans.</p>
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CONNECTING THE LITERATURE: VULNERABILITY AND RESILIENCE WITH
CASES STUDIES OF ADAPTIVE STRATEGIES TO SEA LEVEL RISE ALONG THE
COAST OF CALIFORNIA

Vulnerability and Resilience in Action

The three case studies highlighted in this thesis illustrate some of the nuances and differences within sea level rise planning along the coast of California. The first outcome of this study identifies that there is not one planning process that will be applicable statewide or even nationwide. However ideas and insights from past planning projects can contribute to future planning efforts. The second outcome, relates to site specific planning that is crafted to the localized needs of the community, local, state, and federal agencies; however difficult it may be, it nevertheless creates a positive outcome. Crafting a local sea level rise plan that is a combination of multiple strategies (managed retreat, coastal defense, and adaptive restoration) discussed in this thesis is the most effective way to mitigate the adverse effects of sea level rise. In the following paragraphs, I will bridge connections between vulnerability and resilience theories, discussed in my literature review, to my case studies.

For all three case studies (Goleta, Napa, and Balboa) the following were identified as similarities: preservation of public recreation, access and use, protection of property and/or infrastructure, and protection of cultural and/or historical points of interest. Some differences include implementation of educational opportunities, protection of free parking, and protection of the local tourist industry. As stated previously in the literature review chapter, vulnerability characteristics, such as loss of access, loss of or damage to recreational areas, damage to both public and private infrastructure and property,

degraded cultural and historical areas, and damage to the local ecosystem, will enhance the social and ecological vulnerability of that given area. Crafting sea level rise plans that combat these characteristics that make certain communities vulnerable, will in turn, enhance the resilience and ability for that community to remain intact after a disruption occurs.

Ideas of how to enhance resilience and decrease vulnerability through planning and implementation emerges through fusing together the discussion above about the social variables among all three cases studies, with the three adaptive strategies of managed retreat, coastal armoring, and adaptive restoration. The social variables listed above can be enhanced through planning for sea level rise for each adaptive strategy. Managed retreat requires the moving back away from the coastline, however, the relocated area can enhance all social variables by planning for and creating new opportunities for recreation, parking, and protection. Similarly, coastal armoring creates protection of recreational areas, parking, and protection of local tourist economy by defending the shoreline from the dynamic coastal environment. Wetland restoration planning and implementation can actively plan for recreational uses, parking, and access within the design phases to ensure that these factors are adequately enhanced. Locality specific planning that ensure that the above social variables are enhanced throughout the planning process will subsequently enhance the resilience of the area while decreasing the localized vulnerability.

The economic analysis section for each case study showcases the differences in financial investment for each adaptive strategy. For the Goleta Beach Park case study the cost of managed retreat, as the project stands right now, is roughly \$3.5 million dollars.

The current economic investment, for the Napa Plant Site Restoration totals approximately \$13.4 million dollars. The coastal defense strategy for the Balboa Island case study is currently totaled at \$68 million dollars, the largest economic venture out of the three cases. Coastal communities are vulnerable to sea level rise for a number of different reasons. However, economic vulnerability is often the one characteristic that is difficult to adequately safeguard against. Funding sources, to carry out each of these projects, are difficult to acquire. Without the proper and available funding, the planning, permitting, and environmental assessment documents cannot be drafted. Economic resilience reinforces the socio-cultural ties to the area by ensuring the protection and preservation of that specific place.

The second aspect of the economic analysis is the economic value of what is vulnerable. For Goleta Beach Park the economic value that is vulnerable is the preservation of low cost beach access and the value of the beach experience in its current location. Additionally, for Goleta Beach Park the economic value associated with the restaurant owner and the employees that work there. For Balboa Island, the economic vulnerability is associated with the high value homes, businesses, docks, and public access areas and the vulnerable economic values associated with that specific locality. Lastly, for the Napa Plant Site the economic vulnerability is associated with the infrastructure that is threatened due to flooding because the wetland buffer was depleted. Identifying the economic costs associated with the adaptive strategy as well as the economic value of the area that the adaptive strategy is either protecting or enhancing is important to identify when crafting sea level rise planning strategies.

Assessing the vulnerability of both economic aspects, cost of the adaptive strategy and the economic value of assets, is essential to crafting adaptation plans that create more robust and resilient areas after the planning and implementation phases. Planned managed retreat can effectively ensure the safety of the economic value of the assets within the locality. Additionally the cost of implementing managed retreat and relocating infrastructure and public access points is relative to the cost of the economic assets that are protected. For coastal defense the cost of armoring is comparable to the value of the assets needing protection. Additionally, the cost of wetland restoration is far less than the cost of repair due to flood damage. Safeguarding against economic vulnerability among all strategies enhances the resilience of the local assets and the costs associated with sea level rise planning.

The third category of analysis, ecological and biological resources, is showcased in all three case studies as an important and necessary component to all adaptive strategies. Protection against coastal flooding, eroding beaches, and damage to vital coastal ecosystems is essential to retain ecological and biological resources. However, the planning, implementation, and protection for each adaptive strategy needs to enhance the diversity of ecological and biological resources in the process. Increased resilience of ecological systems is important because the health of ecological systems is vital when planning for sea level rise. Cultivating a diverse ecological system that is not reliant on just one or two functions to rebound after the disturbance is also important. The diversity of the system increases the chances of the localized environment to rebound and stabilize.

Throughout the planning processes for all three adaptive strategies enhancing ecological and biological resources is a vital component for all adaptive strategies. Planned managed retreat enhances ecological and biological resources because infrastructure and public recreational and access uses are relocated away from the dynamic coastline. Additionally, the changing coastlines with associated biotic and abiotic functions are able to migrate and shift unimpeded. For coastal defense the majority of ecological and biological resources are associated with enhancing or restoring these functions in other areas. With enhancing adjacent areas near the coastal defense structures, ecological and biological resources become less vulnerable and high value infrastructure is protected in the process. An example of enhancing biotic and abiotic diversity was highlighted in the Napa Plant Site Restoration case study. As mentioned on in the Napa Plant Restoration chapter increased species diversity, habitat restoration for endangered species and restoring tidal action increases the resilience of the system from future environmental disruptions.

Policy and planning processes was the fourth and final category of analysis. The political underpinnings in each case study were very different from one another. A wide array of political and public controversy was exhibited. In the Goleta Beach case study, of managed retreat, the politics of planning and community involvement was the most controversial. Out of the three adaptive strategies highlighted in this thesis, managed retreat was the most contested strategy. Moving infrastructure and letting the ocean reclaim land is a difficult decision because the area holds embedded cultural significance

for the local community and tourists alike. Regardless of place specific cultural ties, in some cases, managed retreat is the only adaption strategy available.

Coastal defense for Balboa Island and Little Balboa Island provided some key insights about the planning and political stances surrounding a coastal defense strategy. Coastal defense has and continues to be the primary political response when coastal infrastructure is threatened. Balboa Island case study provided insights into the differences between public and private seawalls and the responsibility the city has to the public to protect infrastructure and public access. Protecting homes and coastal infrastructure from sea level rise will not always be the most appropriate planning strategy but when suitable it is important to protect valuable resources.

For adaptive restoration in the Napa Plant Site, the political and planning processes exemplified that wetland restoration for the most part is not contested. Wetland restoration is not contested because there are very few drawbacks and marginalized groups associated with the restoration efforts. Planning for adaptive restoration is non-controversial as long as adequate public access and recreational uses are supported throughout the planning process.

Political and community engagement with planning for sea level rise is very new. Procedures and planning for sea level rise adaption, on all planning levels, is still contemporary. Mainstream designs for managing a changing coastline are not established nor would they be useful because each locality is vulnerable in different ways. Additionally, site-specific vulnerabilities require different mechanisms to enhance

resilience. Moreover, each place along the coastline of California, and nationwide, will require different procedures and planning strategies.

Reflection's of Preliminary Hypotheses

Reflecting on my preliminary hypotheses on page 16; my predicted variables were upheld, for the most part, in the field. The following areas were upheld by my preliminary hypotheses; the physical extent of adaptive restoration, the economic value/cost for all adaptive strategies, cultural value of all three adaptive strategies, the historical value of all three adaptive strategies, the dependence of public funds for coastal defense and managed retreat, the public safety variable for all three adaptive strategies and the time scale variable for all three adaptive strategies. These areas that were upheld by my hypotheses are based on site-specific information relative to the associated adaptive strategy.

Variable	Coastal Defense		Adaptive Restoration		Managed Retreat	
	Hypothesis	Finding	Hypothesis	Finding	Hypothesis	Finding
Physical extent	Small	Varies	Large	Medium-Large	Large	Varies
Value	Average-High	Average-High	Average-Medium	Average-High	Varies	Varies
Economic	High	High	Medium	Low-Medium	Depends High value private area vs. Public access	Varies
Cultural	High	High	Medium	Medium-High	Depends	Varies
Historical	High	High	Medium-High	Low-Medium	Depends	Varies

Table 3 Preliminary Hypotheses Revisited. Table 3 above showcases my hypotheses developed prior to doing my field research and my findings after all data was collected.

After my analysis of all three case studies, I revisited these hypotheses and found three areas with differing conclusions. The three areas are the physical extent for the coastal defense and managed retreat adaptive strategies, the capital requirement for the managed retreat strategy, and the dependence of public funds for the adaptive restoration strategy.

The physical extent for the coastal defense and managed retreat adaptive strategies exhibited different results than what I predicted. For the coastal defense strategy the physical extent of the area does not have to be small. Large areas along the coast of California are defended by the dynamic coastal environment. As mentioned at the beginning of chapter 5 coastal defense is prevalent and widespread. Additionally, managed retreat as hypotheses in the preliminary stages of my research was not consistent with the findings throughout participant interviews and review of secondary literature. The physical extent of managed retreat is not intrinsically associated with large areas retreating from the coastline. Small areas including both public and private can retreat inland to safeguard against coastal erosion, coastal flooding and the onset of sea level rise.

Secondly, the monetary capital requirement for the managed retreat strategy in hindsight was very different than what I hypothesized. I identified that the monetary capital requirement for managed retreat was low in comparison to the other two adaptive strategies. For Goleta Beach Park case study this was the circumstance in comparison to the two other adaptive strategies and their economic investments. However, this is not universally applicable for all managed retreat options nationally and globally. In some

cases, as mentioned in the Goleta Beach case study, managed retreat can cost as much as \$350 million dollars.

The dependence on public funds for the adaptive restoration strategy was predicted to be low. This, however, was not the case once I was immersed in the literature and information gleaned from interviews. The majority of funding, as mentioned in the Napa Plant Site Restoration chapter, came from public funds and sources to purchase the land from Cargill Salt Company in 2003. Furthermore, this is not true for all adaptive restoration sites. Funding sources for restoration efforts can come from private sources, but more often than not these private investments are accompanied by public funds.

The variables chart on page 16 is not a concrete chart or a means to universally analyze adaptive strategies regionally, nationally, and/or globally. However, some of the variables are commonly applicable. Identifying localized variables sets the foundation to plan, mitigate and safeguard vulnerable populations and ecological resources. The variables chart that was create as the premises for this research once modified with the above variations can serve as a guide for local governments, community members, and agencies planning for sea level rise in coastal areas. Determining what the most effective strategy or a combination of strategies to use is a necessary step in the planning process. Utilizing the variable chart created for this thesis to serve as a guide to determining the most appropriate course of action may be a vital option in the future. Additionally, each case study expanded the scope of the preliminary hypotheses based on the localized needs. For example, ecological and biological diversity, public access and recreational

uses, and unearthing the root of place specific controversies were uniformly exhibited in all three case studies.

Overarching Recommendations

Table 4: Overarching Recommendations

OVERARCHING RECOMMENDATIONS
1. Regional integrative approaches to adaption to seal level rise are essential
2. The California Environmental Quality Act process for public comment and suggestions is not all-inclusive
3. Bolstering ecological diversity is necessary when adapting to sea level rise
4. There is a need to create a systematic mechanism (codified or established process) for multiple agencies to discuss, plan, and implement sea level rise adaptation plans
5. The current coastal armoring discussion needs to accurately identify the need to protect high value resources not just direct the discussion to alternative adaptive strategies

Table 2: Outlines the recommendations that emerged throughout the evolution of the research and writing of this thesis. In the following paragraphs below you can find further discussion about each of these recommendations.

Future recommendations that emerged throughout the course of this research include regional integrative approaches to adapting to sea level rise, the California Environmental Quality Act (CEQA) process for public comment and suggestions is not all-inclusive, bolstering ecological diversity is necessary when adapting to sea level rise, there is a need to create a mainstream mechanism for multiple agencies to discuss, plan, and implement sea level rise adaption plans, and the current coastal armoring discussion needs to accurately identify the need to protect high value resources not just direct the

discussion to alternative adaptive strategies (see table 2 above). While these recommendations solely emerged within the bounded limits of this study, these suggestions are broad in scope and scale.

The first recommendation arose during my research with the Napa Plant Site Restoration. Bay and estuary regions are often large in scale and to fully meet all project objects an integrative approach is necessary. For example, as mentioned in the Napa Plant Site case study the larger SF Bay estuary region has numerous restoration projects both completed and active. Furthermore, large areas that are similar to the SF Bay area should incorporate an all-inclusive integrative approach to restoration and adaptive strategies, because it is hard to manage restoration efforts without coordination given the large expansive area. Many restoration efforts in the SF Bay area exemplify these coordination efforts. However, broadly, this idea of all-inclusive restoration throughout the secondary literature was lacking. Additionally, multiple interviewees identified this as a positive step towards regional resilience. Without regional coordination efforts adaptive restoration projects can be negatively affected by areas that are not currently undergoing restoration and that are not as biologically productive. Additionally, cooperative restoration efforts provide agencies and communities with regional stability to successfully carry out the objectives for each individual restoration project.

Throughout the duration of my field research and secondary literature research for the Napa Plant Site, the specific ties to sea level rise and adaptive restoration were not clearly articulated and pronounced. The specific ties to enhancing the resilience of the Napa Plant Site in direct relation to sea level rise was not at the core efforts of the

restoration project. However, some interviewees identified the overarching benefits of restored wetlands in correlation with sea level rise.

The potential benefits of wetland restoration efforts in terms of enhancing resilience to sea level rise include increased buffers to storm surges, wave energy, and increase tide height, wetlands grow and expand as sea levels rise passed on the current predicted sea level rise projects, tidal marshes capture carbon which is another way to bolster climate change efforts, and lastly restoration efforts enhance local and regional resilience because the area is not solely reliable on one or two functions and species (Magnusson, 2006; Morris et al. 2002; Josselyn et al. 1994). By strengthening the above restoration efforts the system will become more capable of adapting to the adverse effects of sea level rise (eg. storm surges, flooding, increased sediment supply etc.) because the system is functioning at optimum capacity.

The current CEQA process is not conducive to active public participation in the planning and implementation processes for sea level rise planning. This recommendation came to fruition in the Goleta Beach Park case. Numerous interviewees from the Goleta Beach Park case study expressed that the planning process for managed retreat was not all inclusive of public comments, suggestions, and overall input. The County of Santa Barbara followed the CEQA process diligently holding public hearings and accepting public comment throughout the duration of the Environmental Impact Report (EIR) process. The process for public comment and suggestions in CEQA needs to be revised for an integrative approach to localized planning that is representative of all stakeholders involved to adequately plan for sea level rise in the future.

Revisions to the current CEQA process could take on a multitude of forms ranging from the community creating bottom up planning solutions through a variety of workshops and meetings to extending the public comment period of the current CEQA regulations supplying additional time for public comment and suggestions. For this recommendation, I argue that there is no one size fits all approach however, top down regulation should be a minimum requirement not a maximum for including public comments and participation. Meaning that the maximum allotted time and effort that local, state, and federal agencies are required to provide is not enough. In addition to the minimum requirement, local governments should be directed to support community initiative and planning suggestions at their discretion, above and beyond the minimum requirement. Although this recommendation is lofty, it is not impossible to achieve.

Bolstering ecological diversity is necessary when adapting to sea level rise. Ecological diversity is essential to resilience of coastal ecosystems. A diverse ecological system has a higher level of resilience, because the system is not reliant on just one or two groups of organism or species. As exemplified in the Napa Plant Site case study, the larger regional biodiversity and the ecosystem stability were improved. The Napa Pant Site restoration was enhanced with the reintroduction of tidal action, and habitat restoration for endangered species and other wildlife. In addition, restoring tidal action decreased the salinity of the Napa Plant Site, which, in turn, improved the vegetation and abiotic organism that thrived in this area prior to levee, and dikes were established. Moreover, restoration efforts of tidal marshes and wetlands contribute to sea level rise mitigation as well as sequester carbon to assist in state climate change efforts. With

enhanced ecosystem functions and services wetlands provide natural buffers to the adverse effects of sea level rise by absorbing excess floodwaters and growing as sea levels rise. Strengthening ecological resilience in turn enhances the systems resilience to combat the adverse effects of sea level rise.

The next recommendation focuses on the current planning procedures that local governments go through to enact new planning policies in coordination with regional, state, and federal agencies. The current California Coastal Commission sea level rise directive requires that all local governments plan for sea level rise along the coast of California. However, it is often difficult to plan for sea level rise because there is no overarching mechanism that allows for the protection of coastal resources as well as protection of valuable coastal infrastructure. One of the main issues that arose throughout the course of the Balboa Island case study was that local governments are in a predicament with the current planning mechanisms in California. The City of Newport Beach is in a bind because the local government needs to protect public and private infrastructure as well as provide coastal access, and, at times these necessary plans are at odds with the California Coastal Act. Providing an all-inclusive mechanism for state, regional and federal agencies to discuss and draft a straight forward planning strategy for sea level rise is necessary. What is necessary is a collaborative strategy to approaching emerging issues that create new areas of contestation with old policies and acts. Providing this collaboration is necessary because right now the system is not supportive of all variants of planning needed to proactively plan for sea level rise.

The last and final recommendation that arose throughout the course of this research focuses on the need to actively protect high value coastal infrastructure that is threatened due to sea level rise. Along the coast of California high value homes and infrastructure are currently at risk to current sea level rise inundation and coastal flooding. Moreover, the discussion surrounding adaptation strategies are primarily focused on high value real estate, both public and private, in Southern California. High value homes and infrastructure in Southern California have been historically protected and defended against the dynamic coastal environment. As discussed in the Balboa Island case study, it is a requirement for local governments to ensure protection of valuable resources. While reviewing secondary literature throughout the course of this thesis, more often than not, the discussion was directed to alternative adaptive strategies primarily managed retreat. Managed retreat is not a plausible adaptation strategy for all localities grappling with sea level rise and coastal inundation. The recommendation here is to actively plan and identify high value resources that require further protection and appropriate the necessary resources to allow the protection of these resources. Thorough discussions are needed regarding defending expensive high value resources, homes, and infrastructure and what that will look like along the coast of California. Not just shifting the conversation to a managed retreat strategy because some place cannot go anywhere and should defend as long as possible.

On November 2, 2013, President Barak Obama's Executive Order establishes a Task Force on Climate Change Preparedness and Resilience (TFCPR) in order to find federal funding to allocate to mitigate climate change efforts throughout the nation (Posel, 2013).

The TFCPR is more focused on collaborative efforts with “state, local and tribal leaders from across the country...[to build] climate preparedness and resilience in their communities” (Posel, 2013). The current projected United States fiscal deficit for 2013 is at \$900 billion dollars (Office of Management and Budget, 2013). Funding for basic public services is difficult within a nation that has been in a fiscal deficit for years. In a nation where public education, health services, and basic public access areas are suffering because of lack of funding, it is unlikely that sea level rise funding will be a top priority for pre-impact mitigation. It is likely that the majority of the acquisition of funding will occur in the rebuilding, rebounding, and post climate related impacts on the specific locality. With a top down mandate to sea level rise planning and preparedness, it is necessary to provide access to funding for local and state governments to update current local coastal programs, and, acquire that appropriate permits to initiate these mitigation plans.

Additionally, as I have mentioned above, crafting the appropriate planning strategies for local communities along the coast of California may incorporate a combination of the three adaptive strategies discussed throughout this thesis. Each adaptive strategy is necessary and vital to the resilience of coastal communities along the coast of California. Regardless of the specific approach coastal communities utilize, all three adaptive strategies are necessary moving forward and planning for resilient communities along the coast of California.

CONCLUSION

Planning for sea level rise is essential for the safety of coastal communities and ecosystems. With the California Coastal Commission sea level rise directive, coastal communities along the coast of California are starting to make necessary planning strategies for the future impacts of sea level rise. Preparing communities for current and future impacts of rising tides takes time and requires a multifaceted approach. It is also important to have a platform for discussion that incorporates all stakeholders' needs and concerns throughout the planning, implementation, and maintenance stages. This is important because resilient communities are essential to combating the adverse effects of sea level rise. Providing the necessary forum to discuss, plan, and implement the appropriate planning approach is essential to crafting a planning strategy that is based on the community's needs.

In closing, I would like to highlight a finding that relates to each of the adaptive strategies that has guided the focus of my thesis – managed retreat, coastal defense, and adaptive restoration. The first adaptive strategy, managed retreat, illustrates the contested nature of letting the ocean reclaim land that has been developed. Taking a step back, and allowing nature to migrate unimpeded is something new for capitalistic and neoliberal societies. Especially in the western world where we have built as close as possible to shorelines using materials that are not easily movable. Additionally, it is difficult for communities to make a conscious decision to leave, move, or let a historically or culturally significant area slip away with the tides.

The second adaptive strategy, coastal defense, showcased the need to protect high value resources, specifically historically defended high value homes. Current discussions surrounding sea level rise, more often than not, promotes managed retreat as the preferable options. For many Southern California localities, and other places regionally and globally, there is no place to retreat to and defending is the only option. It is necessary for agencies, communities, and all stakeholders involved to consciously hold conversations about defending valuable resources, both public and private, to holistically plan for the protection of coastal assets.

The third and final adaptive strategy, adaptive restoration, demonstrated the need to actively collaborate restoration efforts regionally. For the entire SF Bay estuary region, collectively and collaboratively managing restoration efforts in coordination with one another creates regionally resilience and stability to mitigate vulnerabilities to sea level rise. Additionally, collaborative restoration unites funding, stakeholders, and increases efforts uniformly. Adaptive restoration planning may not actively relate to preparing for climate change, but this planning strategy nevertheless enhances a systems resilience in the event of sea level rise.

Planning for an uncertain future based on anticipated projections of sea level rise is difficult but necessary. The three adaptive strategies discussed in this thesis provide an overview of the current planning strategies utilized to adapt to a changing coastline. Identifying site-specific vulnerabilities and ways to enhance the resilience combating these vulnerabilities through effective planning is vital to coastal communities along the coast of California. Thinking outside the box, incorporating new strategies to adapt, and

utilizing new tactics to craft policies that enhance resilience is essential. Most communities along the coast of California are vulnerable. However, collaborative planning for sea level rise, including stakeholders and multiple adaptive strategies, is necessary to protect, enhance, and take a step back for the rising tides.

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APPENDIX A: STAKEHOLDERS FROM EACH CASE STUDY

GOLETA BEACH, SANTA BARBARA, COUNTY CA

BEACON (The Beach Erosion Authority for Clean Oceans and Nourishment)

City of Goleta

City of Santa Barbara

Friends of Goleta Beach

CA Coastal Commission

Long Range Planning Division for the County of Santa Barbara

Development Review for the County of Santa Barbara

Council members from both Goleta and Santa Barbara

Santa Barbara County Second District Supervisor

ESA PWA

Surfrider Foundation

NAPA PLANT SITE RESTORATION, NAPA COUNTY, CA

Department of Fish and Wildlife

San Francisco Bay Conservation and Development Commission

Regional Water Quality Control Board, San Francisco Bay Region

Wildlife Conservation Board

Resources Legacy Fund Foundation

Susanne von Rosenberg, GAIA Consulting, Inc.

Ducks Unlimited

San Francisco Bay Estuary Field Station

Cargill, Inc

Philip Williams Associates

California State Coastal Conservancy

San Francisco Bay Conservation and Development Commission

BALBOA ISLAND SEAWALL RECONSTRUCTION, ORANGE COUNTY CA

City of Newport Beach

Civil Engineering Department

City Managers

Public Information Manager Spokesperson

Planning Commission

Public works Department

City Council Members

City Harbor Commission

Everest International Consultants, Inc.

Flow Simulation, LLC

URS Corporation

President of the Balboa Island Newsletter

APPENDIX B: EMAIL TO PARTICIPANTS

Dear (enter in the name of participant),

Hello, my name is Emily Bridgewater. I am a graduate student at Humboldt State University in the Environment and Community M.A. program. I am contacting you to inquire about the possibility of interviewing you for my thesis research. My thesis research topic is about *responses to sea level rise along the coast of California*. The overall purpose and goal of this research is to understand how local governments are attempting to address the impacts of sea-level rise along the coast of California.

The interview will take approximately 30 to 60 minutes. The interviews will take place in a location most comfortable for you, whether that is online, in person, or over the phone. This is a voluntary interview process and no compensation will be provided in return for your cooperation. My interview questions are about adaption planning and strategies regarding sea level rise. Below, I have provided a brief list of questions that I will ask during our interview if you choose to participate in this research. I have also attached my thesis abstract to this email.

I look forward to hearing from you and if you have further questions regarding my research or questions about the interview process please feel free to contact me for further discussion.

Interview Questions:

1. Is climate change going to affect your county?
2. Who are the stakeholders involved?

3. What was the process that leads you to determining how, what, and when the plans for sea level rise would be started?
4. At what point did your local government initiate discussions, concerns, and plans of action to mitigate/adapt to sea level rise?

Along with these questions, I will also ask specific questions pertaining to (insert CASE STUDY).

All the Best,

Emily Bridgewater

[Environment and Community M.A. program candidate](#)

B.A. Global Studies with a concentration in Global Environmental Policy

Event and Meeting Planning Certificate – Completed 2009

Green Building Certificate – Completed 2012

Sustainable Development and Climate Change Certificate – Completes 2012

Coastal Naturalist Training Certificate – Completed 2013

APPENDIX C: INFORMED CONSENT

CONSENT TO ACT AS RESEARCH PARTICIPANT

Project Information:

This study involves research conducted by Emily Bridgewater, graduate student in the Environment and Community Program at Humboldt State University. The overall purpose and goal of this research is to understand how local governments are attempting to address the impacts of sea-level rise, what "adaptive practice" scenarios are local governments employing, and community responses to government action (or non-action) to sea-level rise the along the coast of California. The duration of all interviews is 30-60 minutes and the participant has the liberty to not state their name, job title, and can stop participating in this research at anytime. Each local government official and community member will be contacted in person, by phone, and /or email prior to all interviews and this consent form will be distributed via method of interview. Each local government official will be contacted in person, by phone, and /or email prior to all interviews and this consent form will be distributed at the time of the interview.

Informant Consent:

I, the informant, understand that the project described above presents no anticipated risks and/or discomforts and that it has possible benefits, such as a disseminated guidebook of "best practice" scenarios for local governments to implement to adapt to global sea-level rise and strategies for local community members to actively participate in the planning process.

I understand that, Emily Bridgewater, will answer any questions I may have concerning the investigation or the procedures at any time. I also understand that my participation in any study is voluntary and that I may decline to enter this study or may withdraw from it at any time without jeopardy. I understand that the investigator may terminate my participation in the study at any time. The participant will receive no compensation for their time, information, and compliance with this research. The information given by the participant will remain completely anonymous and all information will be coded and kept in a safe location. The participant can choose whether or not to state their name during the interview process however their name will not be used the thesis research. All information shared in any method will be kept completely anonymous, and participant's participation in the interview will have the option to refrain from stating their name for the voice recorder. There are no foreseeable risks to the participant and the researcher.

If I have any questions about this research, I may contact:

Emily Anne Bridgewater

Graduate Student

Environment and Community Graduate Program

Humboldt State University

Phone: (707) 583-3200 Email: eab613@humboldt.edu

OR

Faculty Advisor:

Dr. Mark Baker

Professor, Humboldt State University

Work phone: (707) 826-3907 Email: j.mark.baker@humboldt.edu

I understand that I will not be receiving any compensation for participating in this study.

If you have any concerns regarding this project, or any dissatisfaction with any part of this study, you may contact the IRB Chair, Dr. Ethan Gahtan, at eg51@humboldt.edu or (707) 826-4545.

If you have questions regarding your rights as a participant, you may report them to the IRB Institutional Official at Humboldt State University, Dr. Rhea Williamson, at Rhea.Williamson@humboldt.edu or (707) 826-5169.

By checking this box, I acknowledge the information stated on this form.

Name _____

Date _____

APPENDIX D: EXAMPLE INTERVIEW QUESTIONS

1. What is your relationship with the environment?
2. What has led you to this career path?
 - a. Probe-How did you get interested in the field?
 - b. Probe-How long have you been working in this field?
3. What can you tell me about the Napa Restoration Project near American Canyon?
 - a. What is the proper title to refer to this project?
 - b. How large is the property?
 - c. How long ago did this project get underway?
 - d. Where has the funding come from to support this project?
 - e. Who are the stakeholders involved?
 - f. What benefits to sea level rise/storms/flooding/climate change does restoring tidal wetlands have on the local area? Why is it important?
4. What areas are sensitive to sea-level rise/Flooding?
5. What are the motivating factors that drive communities to start planning/implementing adaptive practices?
6. Is there active participation from local community members surrounding discussions, policy formation/creation, or any aspect surrounding sea-level rise and its effects on the local community?
7. Has the decision surrounding sea-level rise created controversy?
 - a. What are the controversies?
 - b. Who are the actors?

8. Who are the active community, government, non-governmental, business actors that are outspoken regarding the local decisions surrounding sea level rise mitigation/adaptation?
9. Was there local input in this decision?
 - a. How many community members or groups would you say?
10. Who are other key actors in the discussions surrounding sea-level rise?
11. Are there documents that you are willing to share with me?
 - a. Probe-Minutes of meetings
 - b. Probe-Strategies you are/will be share?
 - c. Probe-Or is there somewhere you can refer me so that I may get a sense of how that conversation unfolded?
12. What other local government officials, organizations, or active participants would you suggest that I speak with?
13. Would you be willing to participate in a follow up interview if needed?

APPENDIX E: FUTURE QUESTIONS FOR INQUIRY

1. What is the difference within planning strategy for public and privately owned seawalls? What formal policies are mandated for these strategies?
2. Broader implications efforts to enhance resilience in coastal areas internationally that can be gleaned from my case studies?
3. 100 years from now farmland in wetland/marshland areas may not be lucrative therefore a marriage between two adaptive strategies maybe most beneficial...managed retreat of farmland areas move out buying out ... and a wetland/tidal marsh restoration of these areas back to their original intended function...This may be the way of the future for some if not most of these areas.
4. Upper level policy directives (from the California Coastal Commission, or BCBD or other state and federal agencies) is it easier to mandate managed retreat for areas that have less population such as Balboa Island vs. Goleta Beach? Do open public access areas that are managed by the county or state become targets for implementing a managed retreat approach because there is no private ownership of these areas?
5. Choosing case studies that have already completed each strategy may be beneficial for future studies?
6. Conducting another study when all three localities are finished with planning and implementation phases of these projects?