

Community Vulnerability and Adaptation to Climate Change in East Palo Alto

By

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Faafetai Tele Lava.

EXECUTIVE SUMMARY

Climate change is happening and impacting lives, cities, economies and communities in all corners of the world. Climate change caused by the increase of carbon dioxide from the burning of fossil fuels is currently impacting and affecting every aspect of our lives. The land and ocean are warming, precipitation patterns are changing and sea level is rising (IPCC, 2007). The changes being seen due to climate change include increased flood events, increased number of heat waves, longer and more extreme droughts and a growing number of disasters (Scheuren, et al, 2008). The associated impacts of from these events include the loss of lives, economic losses, diseases affecting public health, water scarcity and a loss of biodiversity. Cities face the greatest risks from climate change impacts because of high population density and infrastructure assets, and the people living in these communities face the worst impacts. This research attempts to understand community vulnerability in an urban setting. The recommendations made within this paper can help focus city efforts and resources on the highest priority areas to ensure adequate adaptation measures are undertaken.

To conduct this study, I first identified my community for the assessment based on my familiarity with the area and community and because East Palo Alto is vulnerable to severe flooding. East Palo Alto's selection was supported by existing literature and the need of vulnerability information. I selected the community vulnerability assessment methodology to assess community vulnerability to climate change. The goal of the project was to assess the residents and get their viewpoints/perspectives on their vulnerabilities, the challenges they faced and the level of awareness as well as the way this community perceived climate change.

I carried out a literature review where I evaluated existing climate change vulnerability frameworks and tools for community level assessment. I then applied several concepts and frameworks to my methodology including the Intergovernmental Panel on Climate Change (IPCC) guidelines of understanding vulnerability considering exposure, sensitivity, and risk. This framework builds around Rosenzweigh et al., (2011), Urban Climate Change and Risk Assessment Framework looking at hazard, vulnerability and adaptive capacity defining vulnerability and risk. I then designed the questionnaire accordingly and carried out interviews with residents and city officials, gathering data to understand existing impacts and coping strategies.

My results are broken down into six sections. The first two sections break down the goals, approach, and methodology for the project. The third section provides an overview of the case study including baseline climate change information gathered from secondary data including government reports and project documents. In the third section, there is an in-depth discussion of how climate change and sea level rise are impacting East Palo Alto. It highlights the flooding from the San Francisquito Creek and how inundation from sea level rise is the greatest threat. The fourth section discusses the interview results. The results are presented in themes including community perceived climate change, existing adaptive capacity at the community level, existing coping strategies, and recommendations for adaptation from the community perspective. An analysis of city level capacity is discussed because it is relevant in understanding community risks and supports community capacity to address challenges and risks. A discussion of results, conclusion, and recommendations are presented in the last two sections of the report.

Based on the study results, it is evident that a community-level approach to vulnerability assessment is crucial in understanding actual vulnerabilities. Approaching climate change vulnerability from the community level engages all stakeholders and increases support and buy-in for implementation. The process can bring local government and community together to address the challenges that are imperative to the success of adaptation and resilience efforts. The analysis from the community case study shows that they are vulnerable to flooding, heat waves, extreme weather conditions affecting their health and causing displacement, which is an added burden to their livelihoods. The current community characteristics influence their capacity, making them highly vulnerable. The results clearly show that health-related issues are a priority concern for the community; and furthermore, the community highlighted increasing awareness of climate change as a strategy for adaptation.

Additional studies are recommended to carry out a city-wide community vulnerability assessment for the communities of East Palo Alto. In summary, results clearly show East Palo Alto is highly vulnerable to existing climate change, and a lack of capacity both at the city and community levels will increase the risks of climate change and sea level rise. The City has an important role and needs to focus on investing in a climate change program that can build and strengthen capacity; develop essential programs including research on climate data about East

Palo Alto, promote community-level engagement programs, and advocate for climate change policies through a participatory and inclusive process.

TABLE OF CONTENTS

1. Introduction	8
2. Literature Review	10
2.1 The need for community-based adaptation	11
2.2 Community Vulnerability	12
2.3 Community Adaptive Capacity	13
2.4 Vulnerability Assessment Frameworks	14
2.5 Barriers and Challenges to Community-level Assessment	19
2.6 Research Question	20
3. Overview of the Case Study	20
3.1 Justification	20
3.2 Location and Geography	21
3.3 Climate	21
3.4 Population	22
3.5 Socio- Economic	23
3.6 Land use and Environment	24
3.7 Climate Change in East Palo Alto	24
4. Methodology	27
4.1 Sampling method	27
4.2 Data Collection	29
4.3 Data Analysis	30
5. Results	30
5.1 Community perceived climate change	30
5.2 Perceived impacts of climate change	32
5.3 Adaptive capacity	36
5.4 Current coping strategies	38
5.5 Adaptation to climate change	39
5.6 City-level capacity	42
6. Discussions and Conclusions	44
6.1 Qualitative analysis from the case study	45

6.2	Adaptation	47
6.3	Partnership in adaptation	47
6.4	Community level engagement	48
6.5	Gaps in data and research	49
7.	Recommendations	50
8.	References	54
9.	Appendix	58

1. Introduction

The Stern Review on the Economics of Climate Change (2006) concluded that “climate change is the greatest externality the world has ever seen” (p.4). It has no boundaries and in recent years, an increasing occurrence of climate-related disasters has been recorded, and continues to devastate many countries, cities, and communities around the globe. There have been more frequent heatwaves, more frequent rainfall events, tropical cyclones, water shortages, drought and rising seas (IIED, 2009). Sea level rise is causing higher storm surges, more frequent flooding, and longer and more intense periods of drought, and intensity of extreme events (IPCC, 2014).

In the United States, the observed changes in the past 50 years include increased average temperature to more than 2°F, increased frequency and intensity of heat waves, heavy precipitation, and rising seas along most of the coast (National Academy of Science, 2010). The impacts range from coastal inundation, flooding and drought, to outbreaks of vector-borne diseases and loss of life from extreme weather events. The negative impacts of climate change and sea level rise imposes threats to natural resources, economies, health and human lives. Furthermore, there is great uncertainty regarding future changes and level of impact.

It is evident the impacts of climate change have a disproportionate effect on those of lower socio-economic levels and the consequences are frequently not borne equally amongst impacted individuals (UNDP, 2013). For example, studies suggest women and children in developing countries face higher risk of climate change related diseases and communities living in coastal areas have a higher health vulnerability to climate change (UNDP, 2013). Climate change impacts vary greatly across countries, regions, cities and communities, and those who are vulnerable are likely to suffer most. According to the United Nations Development Program report, the least developed countries with a high level of economic vulnerability and low gross national income will be most severely affected by climate change. Currently, they only account, 3.2 percent of global greenhouse gas emissions (IIED, 2009). Similarly, developing small island states are hard hit by sea-level rise and extreme events, threatening displacement and loss of sovereignty. For example, the low-lying nation of Kiribati with 102,000 people face the

likelihood of complete submersion by the end of the century-- threatening their very existence. Relocation is inevitable and people fear loss of their ancestral lands, culture, and identity as a Kiribati when forced to migrate to the unknown. These same countries are among the least responsible for climate change yet among the most vulnerable and likely to suffer because they are more exposed to the adverse impacts of climate change (IPCC, 2005).

The level of vulnerability is based on underlying social and ecological stresses, which vary considerably from place to place (National Academy of Sciences, 2010). Some countries are vulnerable due to their physical location, social capital, lack of economic stability and dependency on their natural environment. Furthermore, socio-economic factors play a fundamental role in determining the ability to cope with the impacts of climate change and sea level rise (National Academy of Sciences, 2010; IPCC, 2014; Moser and Satterthwaite, 2008).

Responding to climate change requires adaptation that addresses impacts that are already unavoidable due to past emissions (IPCC, 2014). In the United States, the adaptation process is fundamentally a risk management strategy (National Academy of Sciences, 2010). It involves the best use of available social and natural sciences to understand the likelihood of impacts and associated risks (National Academy of Sciences, 2010). The approach follows the widely adopted IPCC guidelines for assessing climate change impacts and adaptation, where risks associated with the impacts of climate change are identified and selected; adaptation measures are then evaluated and implemented. This approach is typically associated with governance top-down or is scenario-driven, which is unlikely to be helpful in planning adaptive strategies. As we understand more about climate change impacts, it is clear that impacts and the appropriate responses to those impacts need to be site specific (Bryan and Behrman, 2013). Therefore, community level adaptation has become a fundamental approach to respond to climate change and building resilience.

There is strong acceptance in the literature that the best intervention to address climate change is at the community level (Bryan and Behrman, 2013; and Smit and Vandel 2006). It empowers the people in the community and supports their capacity to respond (Maarten K., et al, 2008). Using a community-level adaptation assessment process engages the impacted community and incorporates scientific and local knowledge into the assessment. To successfully plan for climate

change and sea level rise, a community-level vulnerability, and adaptation assessment is important in understanding the key risks of the local community and allows local governments to communicate directly with the affected population to identify coping strategies that are the basis for adaptation to climate change and sea level rise.

The purpose of this research is to understand the degree of vulnerability of an urban community to climate change through the assessment of community awareness, existing coping strategies, and adaptive capacity to respond and take actions to adapt. The objective of this Master's project is to specifically understand the East Palo Alto community's vulnerabilities to climate change including sea level rise and to assess their existing capacity and coping strategies for adaptation and mitigation. This study will:

- i. Examine existing adaptation efforts and determine the level of community awareness of and engagement in adaptation planning
- ii. Identify practical steps to engage communities, policy makers and key stakeholders in developing robust adaptation action plans.

2. Literature Review

The literature review covers aspects on climate change vulnerability assessment and adaptation at the level of the community. The main emphasis of this review is to identify frameworks and tools that have been designed for community adaptation planning.

The community level approach to climate change as shown to be more appropriate approach to adaptation. It recognizes the ability of communities to organize and collectively addresses climate change at the community level. For the purpose of this research, this section will elaborate on the value of Community-Based Adaptation (CBA) and focus on the CBA framework and how it has evolved and been recognized as a significant approach to climate change adaptation and building resilience.

2.1 The Need for Community-Based Adaptation

Community-based adaptation has been widely used in developing countries where climate change continues to challenge communities that rely primarily on natural resources for their livelihoods (Satterthwaite et al., 2007). A similar approach to resource management, which is community-based resource management approach, is a means for improving socio-economic and environmental conditions (Kellert et al., 2000). Community-based resource management involves increasing community participation in the management process by having all parties work together to manage their resources. Similarly, community-based adaptation is an inclusive process with communities in the forefront of making decisions and influencing measures to respond to climate change.

Ayers and Forsyth (2009, p.5), defined *community-based adaptation* (CBA) as:

Community-based development activities that strengthen the capacity of local people to adapt to climate change, generating adaptation strategies through participatory processes, and building on existing cultural norms and addressing local development concerns which underlie vulnerability.

A key principle of community-based adaptation is organizing vulnerable communities during the engagement process while addressing the root causes of risk. The communities are the drivers of change and most often assist governments to address priority concerns as governments often want to support adaptive measures but are unsure how (Archer D., et al, 2014). Community-based adaptation provides an opportunity for urban communities to focus on social, economic and political causes of vulnerability as part of the development process (Archer D., et al., 2014). Furthermore, the CBA process can mainstream community level actions and priorities into local government planning processes. It can challenge existing institutional systems and development goals by ensuring a top-down approaches are align with local priorities (Archer D., et al, 2014).

The challenges faced by community-based adaptation includes barriers to participation, competing pressures from rapid urban development, and often defining the “community” (Archer D.,et al, 2014). The community-based adaptation planning for Oakland, California involved the Oakland Climate Action Coalition, an advocacy coalition of over 30 community-based organizations formed in 2009 (Garzon et al., 2012). Working with member organizations of the coalition who represented low-income neighborhoods and vulnerable residents, they prioritized

adaptation strategies for extreme heat, floods, wildfires, and for rising utility and food cost (Garzon et al., 2012). The study reaffirms the need for community engagement to understand and address the urgent adaptation needs of vulnerable residents and communities

2.2 Community Vulnerability

According to the Intergovernmental Panel on Climate Change 4th Assessment Report (IPCC AR4), there is high confidence of vulnerability and exposure of some ecosystems and human systems to current climate variability (IPCC, 2007). The most vulnerable are those that are highly exposed to climate change effects and with limited adaptive capacity (IPCC, 2007). The Fifth Assessment Report (AR5) recognized the importance of developing the capacity of low-income disadvantaged groups, vulnerable communities and their partnerships with local governments (IPCC, 2014). About one billion people worldwide are living in locations exposed to hazards, lack of infrastructure, insecure tenure, no access to services, no insurance against disaster and insecure livelihoods (IIED, 2014). In most cases, a local government may lack the capacity to meet needs and services for residents and does not have the resources for adaptation and risk reduction.

There are many definitions of vulnerability in the literature for many different uses. But a relatable definition for communities is the “susceptibility of a given population, system or place to harm from exposure to the hazard and directly affects the ability to prepare for, respond to and recover from hazards and disasters” (Cutter et al., 2009, p.2). Similarly, the definition of The United Nations Office for Disaster Risk Reduction (UNISDR) define vulnerability as “the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard” (UNISDR, 2009. p.30). Both definitions center around community characteristics, exposure, and adaptive capacity.

Moreover, the ability to cope with climate risks relies heavily on livelihood assets, including financial resources, human capital including natural, social and political capital. (Moser and Satterthwaite, 2008). Natural capital is the stocks of environmental assets such as access to water, air quality, food, and biodiversity. Human capital includes knowledge and level of education. A Higher level of education financial capital is the availability and accessibility of financial instruments for stability, and social capital involves local networks and social

mobilization (Eakin and Lamos, 2006). Having access to these assets results in stellar adaptive capacity to respond to climate change while a lack of any of these assets make adaptation more difficult. The availability of these assets determines the level of adaptive capacity to respond.

The level of adaptive capacity to respond or adapt to climate change is a reflection of the resources and available institutions (Smit and Wandel, 2006). *Adaptive capacity* is “The ability of systems, institutions, humans and other organisms adjust to potential damage, to take advantage of opportunities, or respond to consequences.” (IPCC: AR5, 2014). For assessing community vulnerability, a definition by Romero-Lankao (2014), simplify adaptive capacity as the

Populations ability to perceive risk and to avoid or lessen the negative consequences of multiple hazards they are exposed to base on individual and household/neighborhood access to assets (Romero-Lankao et al., 2014, p.2).

Therefore, the literature implies that the level of capacity to adapt is influenced by the perception of risks and access to the livelihoods assets including services provided by local government, employment opportunities, financial opportunities and community support. Understanding how people perceive risk can provide opportunities to develop appropriate strategies for local circumstances addressing development and climate related risks (Lopez-Marrero and Yamal, 2010).

2.3 Community Adaptive Capacity

Smit and Wandel (2006), discussed the relationship between adaptive capacity and coping ranges. Coping range is the capacity of a system to accommodate variations in climatic conditions (IPCC, 2007). Communities can adapt to regular and moderate changes in climate because it is within their coping range. However, if exposure involves extreme events outside the coping range, then it will equally exceed the adaptive capacity to respond. Smit and Wandel (2006) conclude that “adaptation are a manifestation of adaptive capacity and determinants are not independent of each other.”

Perceptions of risk are one of the determinants of adaptive capacity. According to Gronthmann and Reusswig (2006), the higher level of risk concerning a hazard would positively influence adaptation to that hazard. Smit and Wandel, (2006) also stated, if a risk related to a hazard is low

or not experienced as a threat then it may unlikely result in any adaptation actions taking place. The perception of risk is also influenced by direct and personal experience or proximity to the perceived climate change (Lujala, 2014). A comparison study by Lopez-Marrero and Yamal (2010), between two flood prone Puerto Rican communities Mansion Del Sapo and Martinillo looked at flood concerns within everyday life and concluded that equity, health and drug concerns were perceived as more important than floods. Floods were considered less important and less severe in Martinillo compared to Mansion Del Sapo because of the differences in the perception of risks between the two communities. These differences are due to demographic characteristics, household compositions and greater or lesser exposure to floods.

Accessibility to livelihood assets determines the level of adaptive capacity including human, physical, financial, social and natural capital (Moser and Satterthwaite, 2008). An example by Romero-Lankao et al., (2014) describes households that own their homes tend to invest more in home improvements and increases capacity to withstand hazards. They are in a position to negotiate needed infrastructure. Adaptive capacity and livelihood strategies also rely on activities of other institutions. For example, the ability of the government to provide public services and goods influences the levels of risk from climate change, in particular for those with limited incomes and assets (Moser and Satterthwaite, 2008). These may include provisions for quality infrastructure and disaster preparedness programs providing an enabling environment for households and communities. Provision of these assets to communities facilitates capacity building for adaptation to climate change. According to the resilience literature, a higher level of adaptive capacity a system or population has, the greater the resiliency to climatic stress.

2.4 Vulnerability Assessment Frameworks

Vulnerability assessment is the process of identifying, quantifying and prioritizing the vulnerabilities' in a system (IPCC, 2007). It is often done in spatial terms (mapping) or sector specific assessing vulnerable sectors for example water sector or groups and applying Geo-Information Systems. It includes significant non-climatic developments/conditions (IPCC, 2007), that affect adaptive capacity. Because vulnerability cannot be measured directly, it involves a process of identifying indicator variables, which point to the construct of vulnerability and aggregating them. For example, the Bay Area Housing and Community Multiple Hazards Risk Assessment Project by the Association of Bay Area Governments (ABAG) analyzed

vulnerability to earthquakes and sea level rise (ABAG,2015). The study focused on housing and community vulnerability, which according to ABAG are important determinants of capacity and resilience to earthquakes and flooding (ABAG, 2015). They have selected ten indicators that looked at housing and community characteristics to measure vulnerability as shown in Table 1. The indicators collectively present a summary of the community’s vulnerability profile for planning purposes.

Table 1: Indicators of Community Vulnerability

Adapted from Bay Area Housing and Community Risk Assessment Project, 2015

Indicator	Measure
Housing cost burden	% household monthly housing >50% of gross monthly income
Transportation cost burden	% household monthly transportation costs >5% of gross monthly income
Transit dependence	% households without a vehicle
Home ownership	% not owner occupied housing
Household income	% households with income less than <50% AMI
Education	% persons without a high school diploma > 18 years
Racial/Cultural Composition	% non-white
Non-English speakers	% households where no one ≥ 15 speaks English well
Age – young Children	% children < 5 years
Age- elderly	% elderly, > 75 years

Furthermore, community vulnerability assessment has many uses and purpose. It is carried out to identify mitigation targets, the most vulnerable groups, to raise awareness, to allocate funds, to monitor climate change policies, and for scientific research (Hinkel, et al., 2011). There are many issues to consider when conducting a vulnerability assessment, including the framework to use , the concept to follow such as if the process is participatory or expert-driven or both, and what the data needs are and what method of data collection should be used. There are numerous

existing methodologies and frameworks that can be used, however, it is crucial to be clear on what is measured and what framework to use.

There have been two approaches used to try and understand vulnerability and adaptive capacity in regards to climate change. Firstly, the top-down approach was used widely by many countries to report and communicate their greenhouse gas emission and vulnerabilities to the United Nations Framework Convention on Climate Change (UNFCCC). This methodology relied heavily on global projections and scenarios to understand climate change risks. The IPCC guidelines used were helpful in identifying vulnerable sectors, projections were based on future scenarios with high uncertainties. The approach is politically driven and directed to fulfill obligations to the United Nations Framework Convention on Climate Change. Secondly, the community vulnerability assessment methodology, a bottom-up approach, is now widely used to determine vulnerabilities and future risks at the community level (IPCC, 2014). It identifies exposures, sensitivities and adaptive capacity that are community specific. For this method, the researchers facilitate the process while the community identifies exposure and sensitivities pertinent to them (Smit and Vandel, 2006). It requires an active involvement of stakeholders, information collection, and engaging decision makers. It is a way of empowering communities through a participatory approach.

The Community-based vulnerability assessment is useful for capturing additional data as it involves integrating the local knowledge that builds an understanding of stressors and coping capacities. It can be done only at the community or city level, and methods can include focus group discussions, household surveys, questionnaires, and participatory mapping. The methodology and tools used are determined by the needs of the assessment; either political or project driven.

To assess vulnerability in urban cities, the urban climate change vulnerability, and risk assessment framework by Rosenzweign et al. (Fig 1) is widely used by many cities.

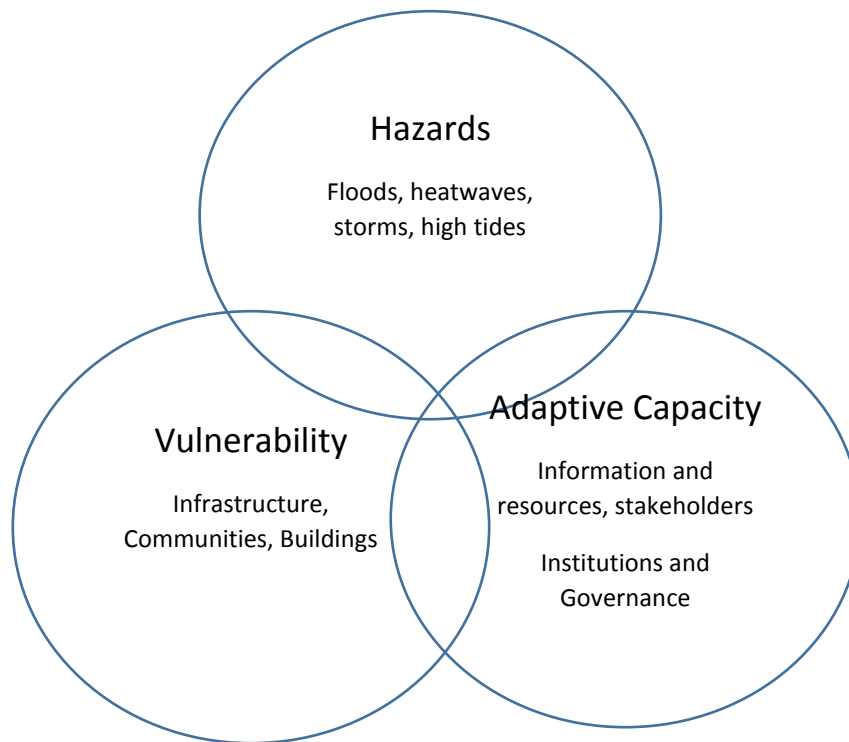


Figure 1: Urban climate change vulnerability and risk assessment framework adapted from Mehrotra et. al, 2009.

Urban city vulnerability is determined by physical and social conditions including the size and density of the city, topography, the percentage of the population in poverty and the gross domestic product (Rosenzweigh et al., 2011). The focus is on the determinants listed above, and the adaptive capacity of the city is determined by the agents of change including information, resources, institutions and governance (Rosenzweigh et al., 2011).

Another framework for assessment is assessing social vulnerability or social impacts of climate change. This is commonly done through community-level mapping and where residents/communities are involved providing information for the assessment. When conducting a social impact study, the International Institute for Environment and Development suggest the following questions seen in Table 2 as the basis for understanding social vulnerability. (Archer et

al., 2014). This framework is commonly used to assess the vulnerability of informal settlements in developing countries. However, the concept is widely used to determine vulnerability.

Table 2: Questions to Assess Social Impacts adapted from Archer, 2014

Question
1. Who lives or works in locations exposed to hazards? (Flooding; sea level rise; landslides and coastal inundation).
2. Who lacks risk reducing infrastructure or services? (Drainage; sewers; flood walls and no emergency services).
3. Whose homes and neighborhoods face greatest risks when impacts occurs?
4. Who is least able to cope to with impacts? (Population with limited income and lack of health care; certain occupational group)
5. Who is least able to avoid impacts?

These questions are important and relevant when understanding community vulnerability, coping strategies, adaptive capacity and adaptation needs. Those with limited income, lack of health care or assets may not able to adapt. The ability to cope is also affected by age, health status, disability, and social status. Older age groups with limited strength and mobility are vulnerable. The questions posed will provide information that is important when planning for community adaptation.

At the city level, the United Nations Human Settlements program (UN-Habitat) developed a series of tools to help urban planners to take action on climate change at the local level. The Planning for Climate Change tool and framework is a value-based approach to incorporate local community values and engage key stakeholders through a participatory process which encourages mainstreaming climate change in existing strategies and policies (UN-Habitat, 2014). It is a strategic approach to support climate change planning in cities and urban centers, helping planners make the best decision possible with the resources available. The plan considers the

same basic issues of exposure, sensitivity, and adaptive capacity. Furthermore, it emphasizes the need to work closely with disaster preparedness programs. The framework allows for cities with greater capacity and financial resources to broaden methodology, while cities with limited resources can explore basic approaches (UN-Habitat, 2014). This plan was widely used in developed and developing countries supported by the United Nations Framework Convention on Climate Change (UNFCCC)

2.5 Barriers and challenges to community-level assessment

The literature supports the importance of community level assessment and community level engagement as a planning strategy for adaptation and response to climate change. It provides opportunities to engage those at risk and integrates local knowledge with the scientific and technical data pool. Engaging the community provides an understanding of the magnitude of risk and the extent of exposure of vulnerable communities. However, faced by barriers cities often resort to the top-down approaches to planning, which is not in the best interest of the communities. This approach often fails to include local communities in the policy making process and the implementation of adaptation measures.

Engaging in community-level assessment process requires financial and political stability as well as technical and institutional capacity. It also requires time and commitment from the community who need to lead and participate in the process. In addition, engaging the community means that the community needs to be at the table where decisions are made. It also requires a level of awareness and understanding of the community itself as well as an understanding of what the community perceives as risk.

The literature review highlights the various barriers and challenges, which are unique to communities. Defining the community is challenging and presents its own barriers including language barriers, mistrust, fear and different priorities. Additionally, it requires financing, technical capacity and time. Furthermore, there are competing pressures from development that can hinder progress and requires government support for action (Archer, 2014).

2.6 Research Question

This study aims to understand the impact of climate change on the communities in the city of East Palo Alto. It focuses on the level of awareness and level of capacity to address existing and future climate change. The key research question is - How do the perceptions of the East Palo Alto community of the environmental, social and economic impacts of climate change influence their capacity to be adaptive and responsive to projected risk?

The outcome will provide an understanding of the current vulnerabilities, strategies or lack thereof, barriers and a possible framework for building community resilience.

By looking at the city at the community level in East Palo Alto allows analysis of response at different levels of government. More importantly, comparison analysis at the city and community levels will identify gaps and information needs that can guide a more strategic approach for the city to address climate change and sea level rise while addressing any urgent needs within the community. Understanding the existing vulnerability and adaptive capacity, and identifying needs will provide city planners, decision makers and community leader's information to initiate a program that will integrate and facilitate the process of mainstreaming climate change issues and vulnerable

3. Overview of the Case Study

3.1 Justification

East Palo Alto was selected for this case study since the city is exposed to severe flooding and coastal inundation. There are communities in East Palo Alto that are located at the mouth of the San Francisquito Creek and are susceptible to both fluvial flooding and coastal inundation. Observation describes a correlation between fluvial and coastal flooding that occurs when there is intense rainfall runoff from the hills and storm surge from the Bay high tides (SFCJPA, 2013). In 1998, the Creek overflowed, causing \$28 million in documented damages to homes and business in Palo Alto, East Palo Alto and Menlo Park (SFCJPA, 2016).

Despite the exposure and risk, there is limited efforts geared towards engaging vulnerable communities in addressing climate change due to lack of awareness, institutional capacity and financial resources. The Climate Action Plan adopted in 2011 focuses only on greenhouse gas inventory and mitigation targets. It is based on the Local Governments for Sustainability (IGLEI) initiative, a 5-milestone process. This process conducts a greenhouse inventory, sets a reduction target, establishes a climate action plan and then implements and monitors the plan (KEMA, 2011). While it serves the purpose of setting baseline data for greenhouse gasses, it only generalize vulnerability to climate change. There is a notable lack of community involvement in the Climate Action Plan with only five meetings over a span of 5 months to facilitate buy-in. These five meetings included a community kick-off meeting, a meeting with city Councils, Planning Commissioners, and advocacy groups. These meetings were held by the city staff and the KEMA consultancy firm hired by the city to do the Climate Action Plan.

3.2 Location and Geography

The City of East Palo Alto is located in the southeast corner of San Mateo County as shown in Figure 2. It is between the city of Palo Alto and Menlo Park. It has a total land area of 2.6 square miles. Highway 101 runs through East Palo Alto with the Dumbarton Bridge access to the East Bay. With easy access and surrounding capital possibilities, East Palo Alto remains disadvantaged compared to neighboring cities in regards to economic stability. East Palo Alto was part of unincorporated San Mateo County until 1983 it became an incorporated city with official boundaries.

3.3 Climate

The climate of East Palo Alto is characteristic of a Mediterranean climate similar to the rest of the San Francisco Bay region (City of East Palo Alto, 2010). The main features include warm, dry summers and mild winters with average annual rainfall of approximately 15 inches that falls between November and April (City of East Palo Alto, 2010). The average temperature is 58 degrees Fahrenheit with temperatures varying between 48-78 degrees Fahrenheit during the months of May through September (City of East Palo Alto, 2010).



Figure 2. Location Map of East Palo Alto. Adapted from East Palo Alto Draft General Plan, 2016.

3.4 Population

In 2010 Bay Area Census Data, East Palo Alto has a total population of 28,155 with a diverse racial makeup with 64% Hispanic/Latino, 16% Black, and 11 % Asian/Pacific Islander (Bay Area Census,2010). Over 40% of residents are foreign born with most residents being from Mexico. 80% of the foreign-born population are not yet U.S citizens (YUCA, 2015). East Palo Alto’s population grew by 26 percent through the 1990s and decreased approximately 4.5 percent between 2000 and 2010 due to the economic downturn (City of East Palo Alto, 2010). According to the Association of Bay Area Governments (ABAG) projections, East Palo Alto population is projected to reach 43,400 by 2035 (ABAG, 2015).

Table 3. Summary of East Palo Alto Land Area and Population retrieved from Bay Area Census 2010.

Area	2.6 (square mile)
Population	28,155
Density	11,788 (square mile)
Number of Households	6,940
Average household size	4.03

3.5 Socio-Economic Changes

There has been a significant increase in both population growth and development in East Palo Alto in the last ten years. The city is primarily a residential community with a mix of small industrial and commercial businesses (City of East Palo Alto, 2010). The residents are resource constrained due to the high number of low-income families who face high housing and transportation costs. The average income is just over \$49,000 per household with 14 percent of families living below the poverty level (Bay Area Census, 2010), and 19.4 percent of the population is unemployed (Employment Development Department, 2011).

Many of the residents are employed in low-wage service jobs supporting high technology companies in the surrounding cities of Menlo Park, Mountain View and Palo Alto (YUGA, 2015). 30% of households are low-income, earning less than 50% of the area's median income (ABAG, 2015). A growing concern in East Palo Alto is the increased cost of housing with 15% of all households in East Palo Alto spending 50% or more of their income on housing and 17% on electricity bills (ABAG, 2015). Renters make up 57% of the housing market in East Palo Alto, which is high compare to the County of San Mateo as a whole whose percentage is 41% (ABAG, 2015).

The majority of East Palo Alto residents lack access to health care services, and residents have to travel to nearby cities Redwood and Menlo Park to go to a hospital (ABAG, 2014). The Ravenswood Family Health Centre, a nonprofit, was established to improve the health care of the community and to provide culturally sensitive services for all; regardless of the ability to pay or immigration status. In 2014, 70% of patients at Ravenswood were residents of East Palo Alto with 51% of patients served being uninsured (Ravenswood Annual Report, 2014). Furthermore,

73% of patients live at 100% of Federal Poverty Level, and 95% are Latino, African American and Pacific Islanders (Ravenswood Annual Report, 2014).

3.6 Land use and Environment

East Palo is going through the process of updating the City's 1999 General Plan that guides the growth and development in East Palo Alto. According to the updated General Plan, the city is completely built out except for open space and marshlands. It is mostly residential with limited commercial land and a significant number of industrial business who have contaminated land.

Over 20% of city land is categorized as a natural community or habitat, including northern coastal salt marsh, non-tidal diked salt marsh, brackish marsh, open water, non-native grasslands and riparian woodlands. Most of these are protected and located near the Bay Shoreline and along the San Francisquito Creek (ABAG, 2015)

The San Francisquito Creek remains one of the only streams in San Francisco Bay that is not confined to a man-made channel (SFCJPA, 2010). It is a perennial stream that originates in the foothills of the Santa Cruz Mountains with a watershed of about 45 square miles. (SFCJPA, 2010). The creek flows and passes through the communities of Menlo Park, Palo Alto, and East Palo Alto before draining into the South Bay (SFCJPA, 2010). It provides recreation opportunities for communities in the urban environment and habitat for many rare and threatened species including the steelhead trout.

3.7 Climate Change in East Palo Alto

East Palo Alto is expected to be exposed to climate change and sea level rise, however, the uncertainties of climate change projections make it clear the exact consequences. It is expected that sea level rise and extreme precipitation will only worsen flood events that occur now. The City is highly vulnerable to sea level rise and an extreme downpour of precipitation (IRM, 2011). The continuous trend of increased temperature and heat waves have and will continue to impose threats to the communities and residents in East Palo Alto.

Sea level rise projections for California developed by the National Research Council indicates an increase in sea level for the California Coast. These projections were developed taking into

account global and regional factors (National Research Council, 2012). They (National Research Council) projected sea levels will rise to 4-30 cm by 2030, 12-61 cm by 2050 and 42-167 cm by 2100. Given the uncertainties associated with projection models, a uniform outcome projected increase of sea level has risen and will continue at a faster rate.

Increasing sea level has increased the risk of flooding and coverage from storm surges and king tides. According to ABAG, 2015, sea level rise in East Palo Alto will diminish the capacity of the storm water system to collect and discharge runoff due to higher tides and rising groundwater levels. Because East Palo Alto's economic activities, infrastructure, and settlement are located along the coast, it makes it vulnerable to coastal erosion and inundation from sea level rise.

The revised FEMA flood maps for East Palo Alto released on August 2015 indicates vulnerability to coastal flooding. The updated maps include new Coastal Hazard analysis to define the annual chance of a 100 and 500-year coastal flood events (FEMA, 2015). Concerning the updated flood maps, approximately 49% of the City is now covered under the FEMA regulated flood areas and 550 homes were added to the list of homes requiring flood insurance (FEMA, 2015). Moreover, a study by the U.S Corp of Engineers clearly showcases a 50-year inundation scenario indicating a high risk of inundation from sea level rise and flooding especially in the Gardens Area of East Palo Alto as shown in Fig 3 in the Appendix. According to East Palo Alto Environment Manager, flooding from the San Francisquito Creek is the greatest single threat to the Gardens communities in East Palo Alto and a serious safety matter. Communities in East Palo Alto are in the lower end of the stream and are vulnerable to both fluvial and coastal flooding. The San Francisquito Creek floodplain mapping shows a 100-year flood inundation scenario where the Garden Community of East Palo Alto will be inundated by flood waters.

According to the observations, there has been a strong relationship between extreme rainfall runoff from the hills and storm surge from the Bay during flooding events. In 1998, the Creek overflowed, causing \$28 million in documented damages to homes and business in Palo Alto, East Palo Alto and Menlo Park (SFCJPA 2016). Other significant flood events occurred in 1955, 1958, 2002 and 2006 (ibid). The Santa Clara Valley Water District categorized the 1998 flood a

45-year flow while the US Army Corp of Engineers estimated the damage to a 100-year flood flow will cause 25 times the financial damages.

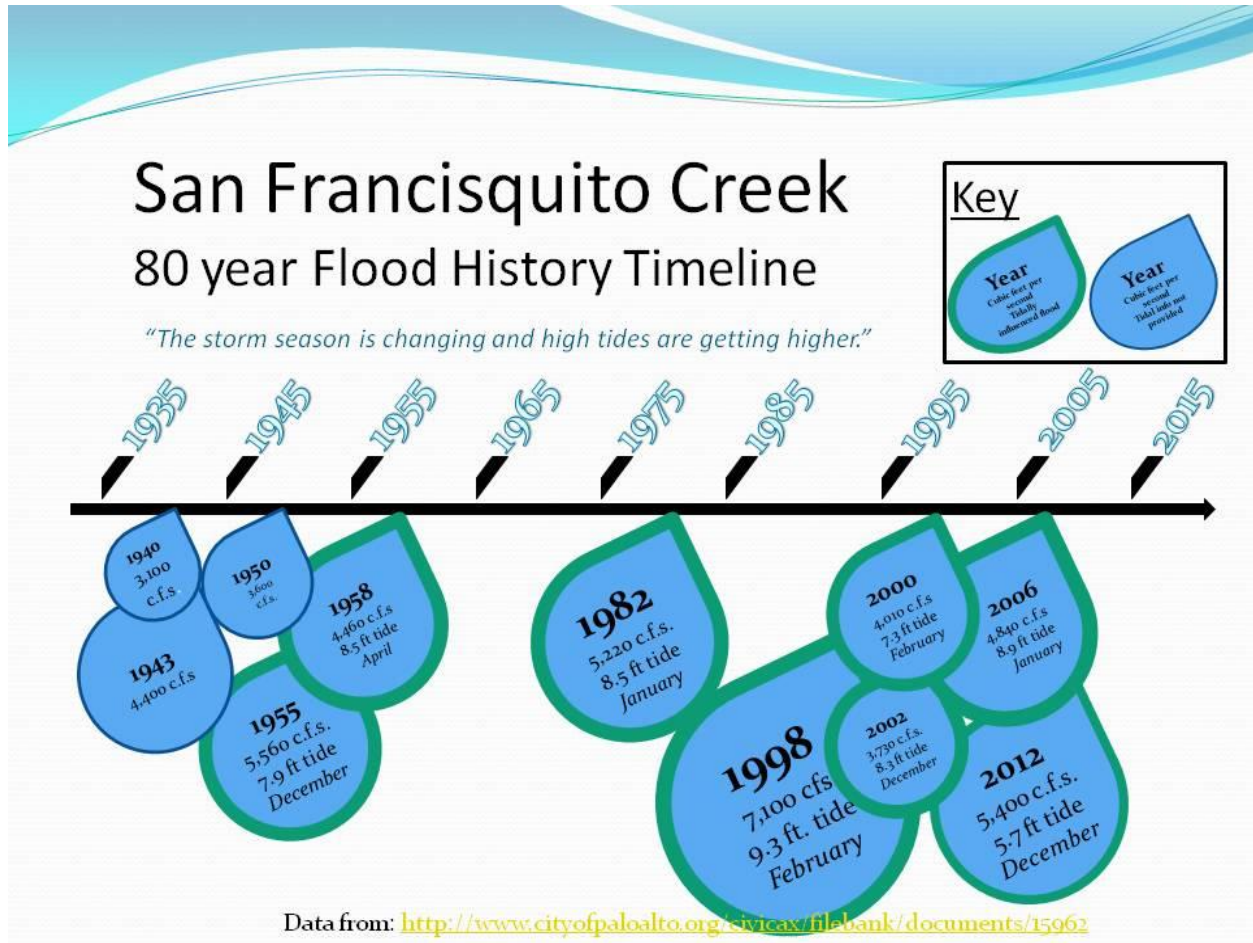


Figure 4. Flood History Timeline of the San Francisquito Creek (2015), Artist: Michelle Daher, City of East Palo Alto

Daher, M (2015) in Figure 4, illustrates clustering of flooding activities from the San Francisquito Creek in East Palo Alto. It shows the incidence of tidal influence and flash flooding which combines share the majority of flooding issues for the community.

It is important to point out the uncertainties and lack of data regarding precipitation changes in East Palo Alto. However, there is a clear trend of increase in intensity and variability in precipitation events. The changes in precipitation and extended periods of drought associated with ENSO Oscillation Phenomenon have a direct impact on precipitation received.

4. Methodology

The purpose of the community vulnerability assessment in East Palo Alto was to characterize the perceptions of vulnerability to climate change, current coping strategies, and identification of appropriate strategy. This research is guided by the vulnerability assessment framework widely used and supported by the Intergovernmental Panel on Climate Change (IPCC). It assesses three key determinants of vulnerability, which includes exposure, sensitivity, and adaptive capacity (IPCC, 2007).

I used two methods for this research, first by using interviews as the main method to collect primary data from residents and second through the analysis of secondary data. Interviews were carried out during the months of January to February 2016.

4.1 Sampling Method

For the purpose of this study, two target groups were interviewed during field interviews. The first group comprised the residents living in East Palo Alto and the second group consisted of city officials including planners, project managers, and community leaders. The residents were selected to obtain information and data on the community's perception of climate change and existing adaptive capacity. The city officials and community leaders were selected to provide insight and information on climate change related projects, programs relevant to the city and communities of East Palo Alto.

I conducted semi-structured interviews for this assessment, and I used a stratified purposeful sampling method to select my sample. I specifically targeted residents from "The Garden" (refer to Figure 5) a neighborhood in East Palo Alto that is highly impacted by flooding and inundation from the San Francisquito Creek. A resident database was used to identify residents' addresses and were selected randomly using a 4- point system with every fourth address being selected to conduct the interview. The selection process was clear, however, over the span of two weeks during the fieldwork for interviews, the majority of selected addresses did not agree or were not available for the interviews. I reached out to 50 residents but only 20 residents from the Gardens neighborhood (the target neighborhood) consented to be interviewed. Therefore, I conducted ten

interviews from other neighborhoods in East Palo Alto as indicated on the map with the red dot(s).

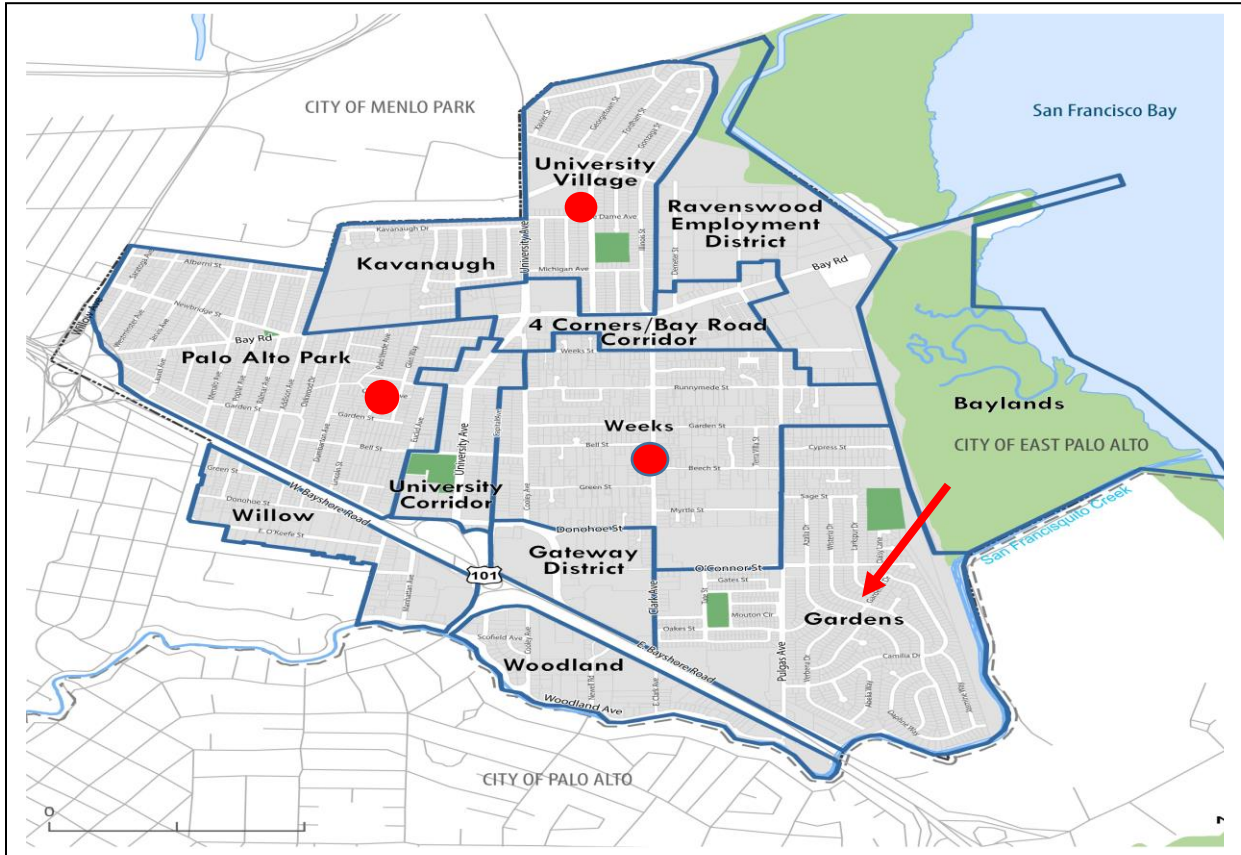


Figure 5. Map of East Palo Alto neighborhood with interview sites. Adapted from East Palo Alto Draft General Plan (East Palo Alto, 2016).

The second round of interviewees were conducted with eight individuals including city officials and planners, and non-government organizations/community leaders. I contacted ten people, of which, only eight were willing to participate. These individuals were selected because of their roles and influence/s in the City planning processes and policy development, including projects.

Table 4: Interviews Conducted

Affiliations	Number
Public from the Garden neighborhood	20
Other neighborhoods	10
City Representative	3
County/Regional Project Managers	3
NGO/Community Leaders	2

The sample consists of a diverse group of residents including Pacific Islanders, Latinos, African American and Caucasian residents. 60% of respondents were female with 40% respondents being male. The majority of interviewees were the main decision makers within the families.

The sample may be biased because, during the fieldwork period, the interviews did not follow as planned. There were constraints during the fieldwork, which included but were not limited to lack of participation due to fear, language barriers for those who did not speak English and unanswered doors. Personal safety was also a concern in the selected neighborhoods and so in some areas, I was unwilling knock on doors in certain parts of the neighborhood. When that occurred, I requested help from a local resident who knew the neighborhood well. She is long time resident of East Palo Alto who works at the senior center for years and is involved with community work, serving the elderly population as a caregiver.

The majority of the respondents interviewed were low-income families and may not represent the middle and upper class in East Palo Alto. The sample size is small to represent the city, however, the characteristics of the selected sample is representative and consisted of families in the most vulnerable community (Gardens), and from the surrounding neighborhoods.

4.2 Data Collection

Primary data were collected from interviews with residents and city officials. The interview questions were in semi-structured and open-ended format. The questions were designed to understand the respondents' perception/s and their understanding of the issue of climate change. Data collected includes local insight based on personal experiences. The attributes of climate

change for which they are particularly sensitive too were noted, and the ways they dealt with or coped with climate change was documented (See Appendix 2 for interview questions).

The interview process started with explaining the objectives of my study and the process to the interviewee. The respondents were uncomfortable with audio recording, so I recorded their responses using a note-taking process. All notes written were, reviewed and confirmed by the interviewees before signing the consent form towards the end of each interview session. The notes from the interview were transcribed and imported to NVivo 10 for analysis.

Secondary data was collected from secondary sources to illustrate the impact of climate change and sea level rise. The secondary data was collected from a comprehensive review of existing government reports, project documents, and scientific studies.

4.3 Data Analysis

Qualitative data from interviews were analyzed and the results were coded using a node structure, and presented in frequency graphs under selected themes as shown in Appendix 3. During the analysis, I was looking for residents perspectives on urgent climate change issues. I wanted to learn what climate change they experienced and observed, the level of awareness if any and identify existing coping strategies and barriers. The analyzed data presented are results from the residents' interviews, a total of 30 residents. However, due to the nature of the research, the results shows multiple responses from interviewees on certain questions. Data collected from city official interviews were analyzed and discussed in the text supporting secondary data.

5. Results

5.1 Community Perceived Climate Change

My analysis sought to understand the community's perception, experience and understanding of climate change and the associated risks. The purpose was to understand local knowledge about climate change and how it has impacted their livelihoods. The data was collected by conducting 30 interviews with a representative sample of East Palo Alto residents. The responses to the interview questions were transcribed and coded into nodes for themes that were emerging as

shown on Appendix 3. The frequency of nodal responses to the open-ended questions are listed in Table 3 and shown in Figure 6.

Table 3: Responses to Perceived Climate Change for East Palo Alto

Observed Climate Change: Resident Responses	
Number of respondents = 30 Residents	
Node	Frequency
Climate variability	17
El Nino	2
Heat waves	9
Intense Rainfall	9
Ozone	1
Changing Seasons	3
Drought	15
Sea level rise	1

The respondents were asked during the interviews if they think the weather was changing, and if yes, how it has changed. All of the thirty respondents recognized that the local climate is changing, and the most frequent change they saw was climate variability and extremes. Many responded with more than one observed change in weather and climate, including the increasing number of heat waves, the intensity of rainfall, and the long periods of drought. The most cited climate change was climate variability, which was selected by 17 out of 30 respondents.

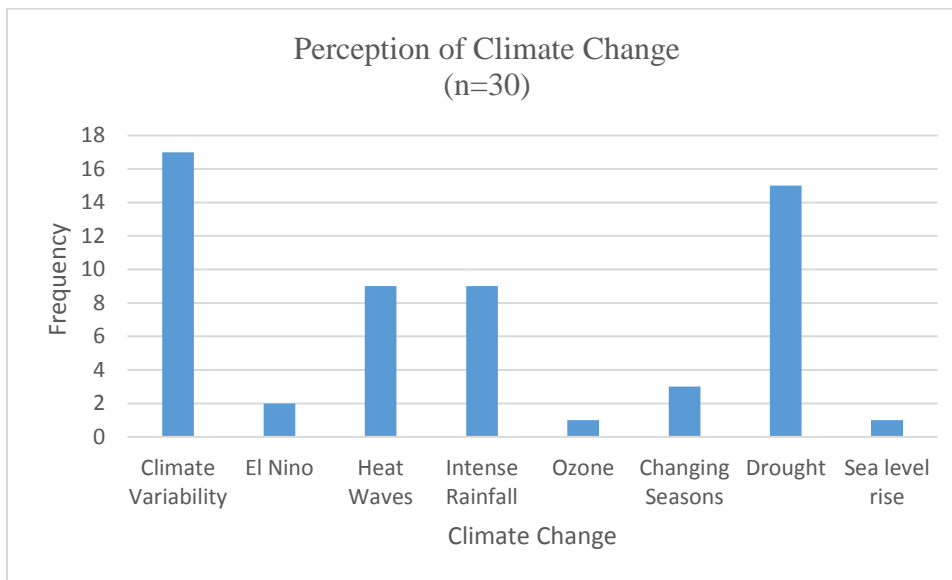


Figure 6: Responses to observed local climate change.

The perceived local climate variability shared by the residents includes fluctuations in temperature and rainfall. The respondents discussed the changes on how the weather is becoming more unpredictable. One respondent from Cooley Avenue said “it is very hard to know exactly if it’s going to rain or not. It is almost as if the seasons are changing.”

Another resident discussed variability with the intense cold weather during winter and intense heat during summer. Others cited some confusion with the climate moving from extreme cold to hot, and extremely hot to cold. According to the interviewees, these changes have become more frequent and intense.

Drought was the second most frequent response and the residents were concerned with the lack of rain and the long periods of drought. During the interviews, California was experiencing its worst drought in the last four years. Interviewees indicated the impact of drought on their daily lives, such as having to comply with mandated water conservation usage. Nine out of 30 respondents discussed heat waves and intense rainfall. The same respondents fear the intensity of rain during short periods of time and heat waves during summer. The intensity of rainfall was widely discussed among respondents living close to the San Francisquito Creek in the Garden neighborhoods. They discussed the intense downpour of rain during winter and the resultant impacts of flooding. One respondent discussed the lack of rain throughout the year and then noted, “There has been more rain in one week than in one whole year.” (Interview 3)

Two of the respondents discussed the El Nino rains predicted for 2016 and feared it would not be sufficient to replenish water resources. Only one respondent mentioned sea level rise in connection with climate change. His reference to sea level rise was due to the 1998 flooding event that devastated his neighborhood. He recalled the high tides during the event and believed rising seas were the reason for widespread flooding because the overflow from the creek was not able to be discharged fast enough.

5.2 Perceived Impacts of Climate Change

To assess the impacts of climate related risks to the community of East Palo Alto, the interviewees were asked to share their experience of how climate change is impacting their daily lives, if at all. They were asked if they were affected by weather or climate related conditions.

The results show a significant impact of climate change on human health; specifically, flooding has adversely affected their lives by causing extensive property damage, displacement, and financial burden.

According to the Intergovernmental Panel on Climate Change (2014), an increase in temperature poses a risk to human health from heat stress and vector-borne diseases. The increase in rainfall and flooding provide favorable conditions for waterborne diseases. The East Palo Alto community is exposed to these threats due to flood events and heat waves. According to the respondents 25 out of 30 perceived health concerns were the main concern with regards to climate change impacts as illustrated in Figure 7.

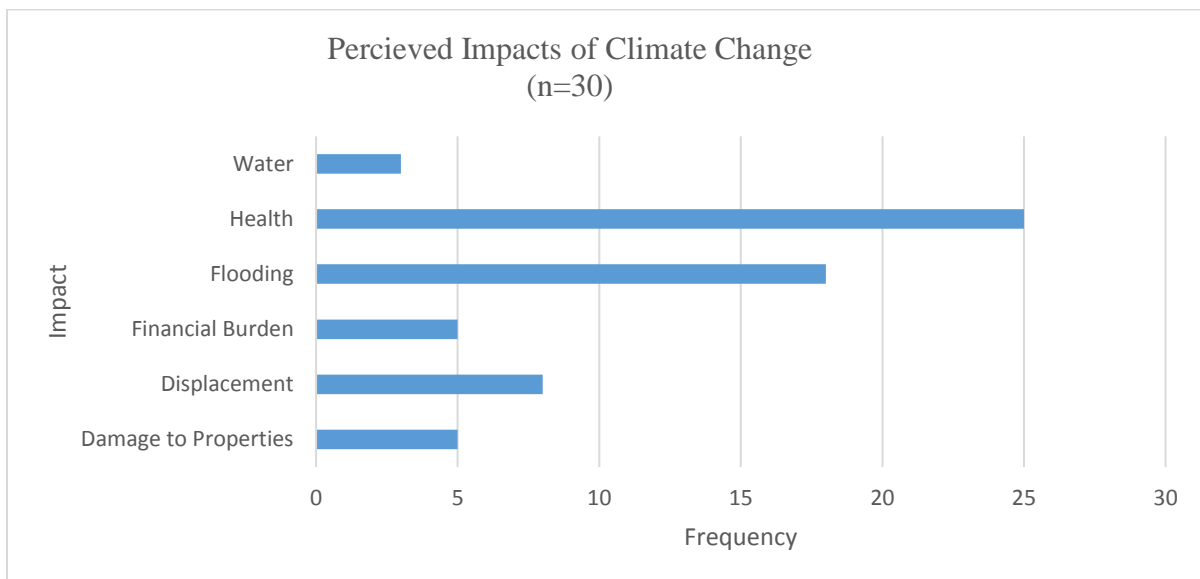


Figure 7: Summary of Climate Change and Impacts identified by the Community in East Palo Alto

The community has identified health-related issues as a significant vulnerability they are facing from climate variability and extremes. According to the respondents, the changing climate is causing an increased incidence of flu outbreaks and allergies. The majority of community respondents (25 out of 30) have directly linked their health issues to the changing climate. Four of the respondents considered climate change to be the cause of a frightening trend of children becoming more vulnerable to diseases. They felt that the changing climate is making children more susceptible to colds and allergies. Other perceived threats to health include heat stress

from heat waves. Many of the seniors interviewed in the 60+ age group referenced heat stress affecting their health. Three respondents who are construction workers explained the nature of their work and how they are continually exposed to extreme weather conditions. Additionally, their ability to carry out work is partially dependent on the weather; poor weather can sometimes lead to income loss. The construction workers also stated that even if they get sick, they still have to go to work, because they are the family breadwinners. As one respondent clearly stated,

“The changing weather is causing sickness--especially the flu. When it happens--which is very often these days--I am forced to go to work sick because I have to go to work”. (Interview 2)

One of the concerns to health mentioned by one respondent was the threat of molds growing in homes after flooding. She believes families whose homes were flooded have this problem, which is a significant safety and health concern. As a community leader herself, she fears for the safety of the community and encourages the implementation of a program to address this matter.

Flooding is the second major threat perceived by the community. When I asked if they were affected by climate-related stress, 18 of 30 community respondents refer to flooding as a major threat to their livelihoods. The past flood events in 1998 and 2012 destroyed many of the affected neighborhood properties and homes from floodwater inundations. A respondent from the Gardens neighborhood states

“The 1998 flooding was devastating, the water was about 4ft high and impacted most of the houses in our neighborhood.” (Interview 10)

The same flooding caused millions of dollars in property damages and forced hundreds of people to be evacuated (East Palo Alto, 2014). One respondent shared how his home was flooded, and his car was damaged. Damages to properties and unsafe environment during flooding have led to displacements, which the resident’s perceived as impacts of climate change.

Displacement during any flooding event, such as the experience of the above respondent and others in the neighborhood, is a significant impact of climate change, according to the respondents. Some families were evacuated by the City to Safe Centers schools and churches, while they waited for the floodwaters to disappear. Other families were displaced and evacuated to other cities to find shelter with their relatives and families. Still, other families shared how they sheltered with neighbors and other relatives who were displaced by flooding. The City

representative reflected on the city's disaster preparedness efforts and their collaboration with San Mateo County to implement the Disaster Preparedness Program. This initiative targeted the elderly population because the elderly in East Palo Alto are not as mobile, and most live by themselves.



Figure 8: San Francisquito Creek near maximum capacity adjacent to homes in the Gardens
Source: City of East Palo Alto, 2010

Another concern from the respondents was the added financial stress caused by flooding. The cost of clean-up after the floods and rebuilding causes financial distress, especially for residents with no flood insurance. Five respondents cited the financial burden due to flooding as a major concern. For example, one respondent took up an extra job to help rebuild and pay for damages to his home and properties.

An indirect impact of flooding in the community is the vulnerability to robberies in the neighborhoods. One family refused to be evacuated during the 2012 flood event because they did not want to risk their home being targeted by looters, which was a very common occurrence around this time. The concern is a reflection of the characteristics of the neighborhood with high

crime rates and economic instability. It certainly caused added stress to residents, because they worry for their safety and for the safety of their property and belongings.

5.3 Analysis of Adaptive Capacity

The adaptive capacity of the Community is determined by their ability to perceive risks and to avoid negative consequences depending on access to assets (Romero-Lankao et al., 2014). To understand the level of capacity that exists, the respondents were asked to share how climate change impacted them and how they dealt with the problems (Refer to Questionnaire, Question 11 -13). This analysis considers the existing capacity of the community based on the availability of resources, information, and support systems. Based on the interviews conducted, the adaptive capability of the community is constrained because of existing socio-economic factors. As shown in Figure 5, the high cost of living, financial burden, and high cost of housing are impacting their livelihoods

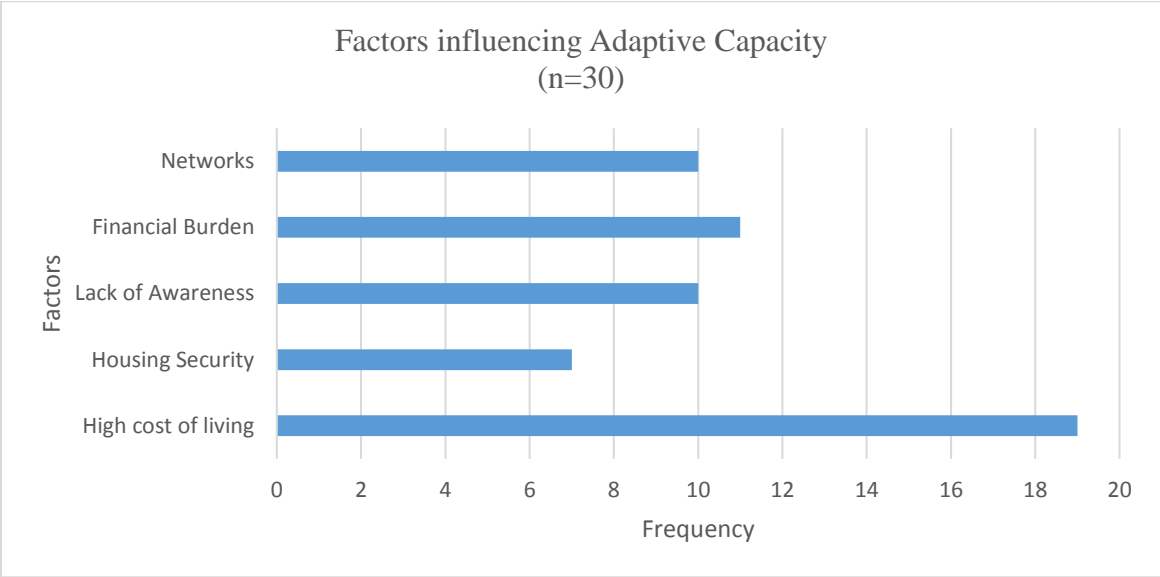


Figure 9. Determinants of Adaptive Capacity

The majority of respondents mentioned that the increase in the cost of food, gas, utilities, medical expenses, and rent all contribute to their existing economic struggle in East Palo Alto.

Others mentioned working two or three jobs just to provide for their families. Financial stability was the common response when asked about related stresses that affected their livelihoods. More than half of the respondents refer to financial stability as a burden. Many are struggling to support their families financially, and their local government only has limited assistance available.

The increase in rents was cited as the driving force behind working two jobs or long hours even if that meant being exposed to health hazards from climate extremes. The majority of respondents believe that the increase in housing costs is influenced by the new Facebook Campus and economic development. These developments represent a displacement threat for many respondents, due to what they feel is the start of gentrification in East Palo Alto. Four of 30 respondents believe that the majority of the people of East Palo Alto are already faced with gentrification as an immediate concern.

“It just worries me that I might not be able to live here anymore. It is getting expensive.” (Interview 6)

“It is very costly to live in East Palo Alto. I lived here for more than 30 years, and the rent has increased tremendously”. (Interview 1)

“We have to think about our generations ahead. We need to deal with housing issues to maintain affordable housing, and to be at the table to voice concerns; not all people will be at the towns’ halls”. (Interview 32)

The lack of awareness on the issue of climate change has been highlighted as a concern for adaptation (UNDP, 2013). Several respondents (10) have some degree of awareness of these issues, and all 30 from community interviews believe the city should do more to increase awareness and to assist them in preparing for climate change. The respondents were concerned about the lack of community programs to discuss climate change. The only information they receive is weather reports on the news, Facebook, or general climate information about a pressing issue for the region such as the drought and El Nino. When I asked if they have any information about the San Francisquito Creek Project, only two of thirty responded with some knowledge about the levee that needs to be built. Overall there is a profound concern with the lack of community awareness and involvement. A community leader raised the concern about the need to protect the community and encouraged community involvement:

“We have to protect the community. There is little or no communication at the community level. The community is not aware of what is happening. Let’s take for example the Levee Project. It is going to be a big project, yet I don’t believe the impacted families have been involved in the planning process. It needs to go down to the community level”.
(Interview 32)

Finally, a few respondents referred to their family ties as their network support system in time of need and for emergency. Many mentioned getting support from their relatives to provide for their families, as well as support during and after the floods. These responses were common among the Hispanic and Pacific Islanders. They evacuate and migrate to their families in other cities and safer neighborhoods of East Palo Alto for shelter, food and financial security. Others in the same community have offered to provide support and shelter for those families who have been impacted by flooding. Others mentioned hosting families for longer periods of time following the floods.

5.4 Current Coping Strategies

To understand community adaptive capacity and the ability to plan and adapt to climate change, it was vital to ask the residents about their current coping strategies and how they had adapted to past climate-related risks and if they have any existing strategies for the future. The information was collected from the responses when asked how they responded to the impacts of climatic events. The majority of responses were actions taken to respond to flooding and climate variability including intense cold and heat waves.

At the community level, it was difficult to determine current coping strategies. The majority of responses were “we just adapt and go on”. The commonality was when they referred to heat stress or intense coldness when they adjust by staying indoors or dressing appropriately. When there is a heat wave they turn on the air condition or turn on the heater when it is too cold. Others discussed concerns for their elderly during heat waves and responded positively by taking care of their elderly during extreme heat.

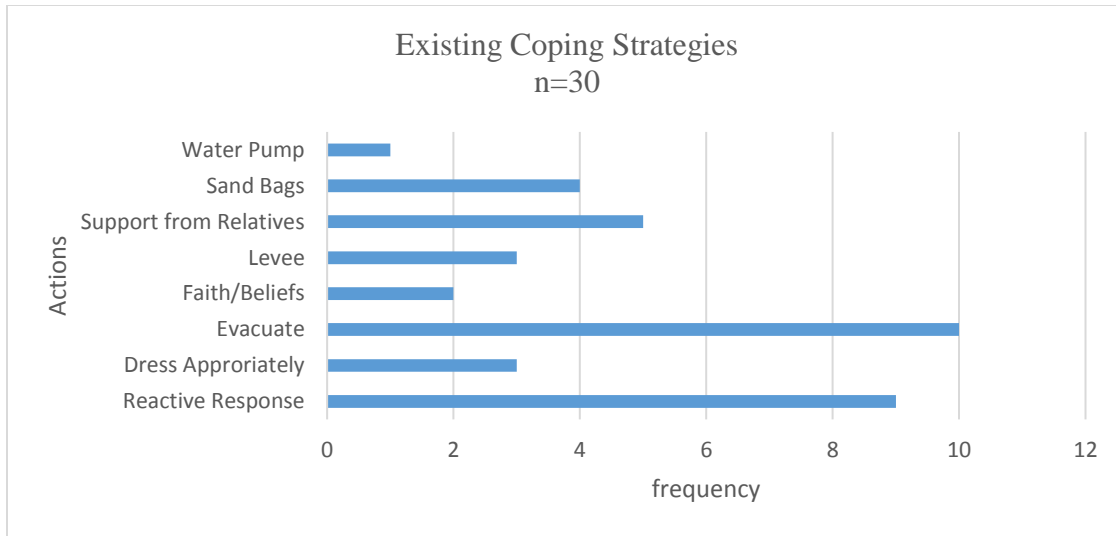


Figure 10. Community existing coping strategies in response to climate variability and extremes.

Responding to flooding, the respondents from the Gardens neighborhood rely on sandbags provided by the City. Three homes where the interviews took place had sandbags outside their homes. One family has adapted by purchasing a water pump which pumps the water from the yard to the street. Some families migrated or were evacuated to their relatives' and friends' homes during the 1998 flood event, and others sought shelter and lived with their families for weeks following the floods. Three respondents discussed the levee as a coping strategy, but feared it may fail as it did in the past.

Another common theme explored during the interviewees was the respondent's faith and beliefs that God will protect them during flooding. Some believe strongly that they have been protected and it is their faith and hopes that they will be safe from any harm or threats as it did in the past.

5.5 Adaptation to Climate Change

During the interviews, residents expressed their concerns about the lack of action on the part of the city and raises the immediate need for attention on climate change related issues and they suggested ways forward for adaptation. It was evident from the interviews the need for community awareness to understand the impacts associated with climate change and the causes of climate change. The level of awareness of "climate change" is very limited and perception portrays general information they hear or see on television, social media and newspapers. Some

respondents listed intense rainfall caused by the El Nino rains, but when ask how and what causes the changes and received a “don’t know response”.

The lack of information and involvement is a concern among the respondents. All of the 30 respondents recognize the need for the local government to do more to increase awareness and understanding of climate change related risks. Recommendations gathered from the interviewees to the City include a constant flow of information through flyers, newsletters, community meetings and a door-to-door program. One of the 30 respondents suggested that the city should do a citywide survey and invest money in developing a plan for climate change. A well-known community leader in East Palo Alto declared the need for community awareness for strengthening capacity to adapt to climate change.

“While I believe that we have always been resilience, we are a diverse community and have unique networks. But we need to understand what climate change is and learn how to fight it.” (Interview 32)

Two of the respondents discussed the need for the city to build water tanks. The suggested adaptation option was to solve both the flooding and drought problems. A senior resident from the Gardens raised concerns about the flooding and the need for the City to consider building water tanks to collect water that can be treated for the city to use, which would also reduce water flow during flooding. One other resident supported the water tanks, and her concern was to secure sufficient supply of clean water for the city, in terms of uncertainties such as droughts in the future.

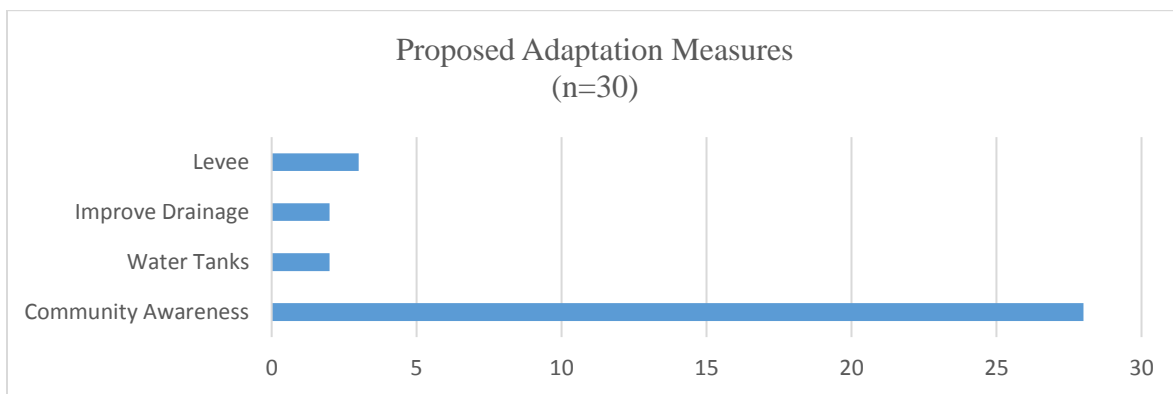


Figure 11. Community recommendation for adaptation to flooding and climate change

“Maybe for an adaptation project, we could invest in improving our well for water supply and build city tanks to collect excess water and treat for water use and consumption.” (Interview 14)

The City representative confirms the need for water tanks. In her statement, she confirmed the need to deal with water issues during the drought.

“With Water issues, during the drought we are trying to secure resources to maintain The Gloria Bay Well and we hope to install the tank in the ground to store water. We hope to secure state funding for water storage and aim to be self-sufficient with water resources”. (Interview 34)

East Palo Alto has also cut back on their water use during the drought and the communities have responded positively by meeting the conservation requirements. However, a community leader raised equity concerns.

“During the drought, we were forced to cut back on our consumption, and yet the people of East Palo Alto consumed less even before the drought was a problem. We were consuming 66 gallons compared to 150 gallons in Palo Alto.” (Interview 32)

Despite the fact that the majority of the respondents refer to health as a significant impact of climate variability and extremes, not one recommendation of a solution was mentioned by the residents. The common response to health risk was reactive response where respondents seek medical services, and at most times included traveling to nearby hospitals in neighboring cities for medical help. It raises concern for East Palo Alto because the high unemployment and low-income status affects the ability of residents to pay for medical services; especially when 30% household income is spent on rent (Draft General Plan, 2016).

Other respondents (three of thirty) explained the role their faith plays during flooding as a foundation for their response.

“Financially we are not able to prepare, but we always have faith and belief that God will protect us.” Another community leader added, “We here in East Palo Alto always have faith in God, to protect and keep us safe.” (Interview 15)

5.6 City-level capacity

On the contrary, community members have little faith in the City to provide adequate support to respond to climate change. City-level capacity refers to the ability of the local government to meet infrastructure needs, services and urban management needs. In this case, the capacity to take action and implement necessary measures to address climate change. A pleading challenge was made to the City to do more and to strengthen their capacity to address climate change issues. Two of thirty residents shared their views that the City could not do more because the City does not have the financial capability to provide it. This view was confirmed by a City representative, who stated that the city of East Palo Alto is working with the Federal Government, neighboring cities and the County to seek funds to help the city with its programs. Two of three city officials confirmed the lack of financial capacity for the city to hire more staff regardless of the need to hire more people to plan for climate change.

Nevertheless, in the efforts to address climate change in East Palo Alto, the City is collaborating in a regional effort to assess vulnerability to sea level rise (San Mateo County Sea Change Project). Other collaborations include the San Francisquito Creek Project managed by the San Francisquito Creek Joint Power Agency. The City is working with Canopy, a nonprofit organization, to increase the number of trees in the City. Also, it has partnered up with Green Foothills to celebrate Earth Day, an opportunity to engage and increase awareness in the community. In retrospect, the City is dependent on other institutions for critical issues because the City lacks the financial and institutional capacity to lead.

To minimize the impact of flooding, the city has led efforts to clean the creek so that the water can flow freely and added materials and sandbags to strengthen the existing levee while waiting for the flood protection project to start. According to the Director of the Joint Power Agency responsible for the Creek Project, the delay to the project was caused by the process of obtaining much-needed permits from the four different State government agencies, which include Regional Water Quality Board, Federal Government Corp of Engineers, Fish and Wildlife and Bay Conservation and Development Commission. The City of East Palo Alto has invested \$800,000 in the \$37 million San Francisquito Creek Project to help strengthen the existing levee (SFCJPA, 2016). The nature of the San Francisquito watershed makes the project difficult due to the many

jurisdictions involved, including five cities, Stanford University, two counties and regional agencies. According to the city representative,

“San Francisquito Creek during a flash flood still represents the most singular immediate threat, even upon this project’s completion.”

According to the City Official that was interviewed, the city needs to address drainage problems. The City has five pump stations with one discharge station at the Creek that is the O’Connor Pump Station. However, there is a concern about the ability of the discharge station to function properly under extreme events. According to the city representative, this is the only discharge point for the majority of the community who are vulnerable to flooding and other discharge points or outfalls are inundated with bay water on a continuous basis making them less than useful. Most sites do not discharge at all which affects thousands of people and continues to be an ongoing problem for schools near the bay. This issue was also mentioned by community respondents where 4 out of 30 interviewees shared their views from past floods and concerns that a poor drainage system contributes to the flooding problem due to the water not discharging properly.

Other efforts offered by the City are the free distribution of sand bags and disaster preparedness workshops. The City representative emphasizes targeting the senior population as a concern due to limited mobility. Flyers and checklists were made available to the public. In addition, the city has formed a partnership with Canopy to support tree planting activities to increase the number of trees to reduce heat island effect, combat pollution, and greenhouse emissions while improving air quality in East Palo Alto. Canopy to date has planted more than 1,200 trees in the city, parks, neighborhoods and schools.

According to the respondents from the County health planners, there are no programs related to health and climate change and collaboration is almost impossible due to the lack of institutional and technical capacity.

Due to the expected impacts described above, the city has included climate change in its updated General Plan for 2035. This plan is currently under review and climate change mitigation and adaptation are included in the Parks and Open Space Element Goal 8 (Draft General Plan, 2016). The General plan lists twelve policies under goal 8 of the Parks and Open Space Element, for

implementation with the intent to build resiliency and minimize the risks of climate change. Policies include the implementation of the Climate Action Plan and the development of adaptation strategies to reduce the community's vulnerability. The General Plan recognizes the health impacts and the need to develop strategies to reduce heat island effect (Draft General Plan, 2016). However, the implementation section of the General Plan lacks any direction or timeframes for policy development listed under Goal 8 of the Parks and Open space element.

It is clear the city and communities are vulnerable, however, there is no clear direction or prioritization to address the threats and risks imposed by climate change and sea level rise. There is clearly lack of capacity at the city level to understand the risks and need for urgent response.

6. Discussion and Conclusions

This study set out to explore the concept of a community-based approach to climate change adaptation in urban settings in East Palo Alto and identified the nature of vulnerabilities to climate change and sea level rise. Its purpose was to better understand the level of adaptive capacity a specific urban community had to respond to climate change. Generally, literature on this subject concludes that community-based adaptation is crucial to the adaptation process because it can help identify the most vulnerable people and the causes of their vulnerability. Moreover, the study sought to investigate whether a community-based approach can assist in better planning for adaptation. By taking on a community participation approach, my study sought to answer the following research question.

How do the perceptions of the East Palo Alto community of the environmental, social and economic impacts of climate change influence their capacity to be adaptive and responsive to projected risk?

The results of my study shows what the community of East Palo Alto perceives as their risks and vulnerabilities. Perception is influenced by a person's experience and individual livelihoods. Perception is also influenced by local knowledge, experience, and local observations that are critical to a person's understanding of climate change and the related vulnerabilities and risk. My results show that the majority of respondents perceive climate change as a health risk and view

flooding as a threat to their lives and property. These results stem from the experience of community members and represent what they face daily.

It is surprising given the lack of effort by the local government to increase community awareness about climate change that the majority of the respondents clearly map out connected impacts due to impinged livelihoods. As discussed by Smit and Vandel (2006) and Moser and Satherthwaite (2008), livelihood assets determine the level of adaptive capacity. My research clearly indicates limitations on adaptive capacity due to strains on livelihood assets in East Palo Alto. The lack of resources and financial hardship from the increasingly high cost of living continues to threaten livelihood in East Palo Alto communities.

6.1 Qualitative Analysis from the Case Study

My findings suggest that the community of East Palo Alto is vulnerable to flash floods, heat waves, and drought. Projections by IPCC (2007) indicate that under climate change conditions more intense and shorter duration of precipitation will occur, leading to higher frequency of flash floods. Furthermore, densely populated areas such as East Palo Alto, located near rivers are considered to be highly vulnerable due to the combination of location near riverbeds and high population density (IPCC 2007; National Academy of Sciences, 2010). The past studies by ABAG 2015, FEMA 2016, SFCJPA 2010, arrive at the conclusion that, East Palo Alto has a higher risk to flooding and sea level rise. Sea level rise is of immediate concern because of the location and exposure. Projections of sea level by ABAG (2015) studies suggest an increase of 24 inches in sea level will inundate parts of the East Palo Alto coastline. Also, flooding is the greatest threat to the City and its residents, because it displaces people, threatens lives, and imposes a high economic cost for recovery. Additional costs such as flood insurance premiums, flood event clean-up, hospital visits, and property damage are all added burdens, which make it hard to improve adaptive capacity.

“Flooding is the most important issue in East Palo Alto and with climate change, it will exacerbate flooding. When it floods, it can flood up to four days and so communities are threatened by flooding. People don’t know yet, but according to FEMA, they have to buy flood insurance and most people cannot afford an extra 800 to 1500 a year, so the flood insurance is an added stress to the people” (Interview 32)

The community identified health vulnerability as a significant impact of climate change. According to the results from the interviews, the community observed and experienced an increasing number of flu outbreaks, long duration of allergy season, and occurrence of other health related problems from exposure to unfavorable working conditions caused by extreme weather events. With no concrete secondary data to support the increasing trend of health hazards from climate change in East Palo Alto, the data collected from the interviews suggest there is a growing concern on health impacts at the community level; this provides additional knowledge to understanding local vulnerability. What is more concerning is the unavailability of health services and the lack of programs to address health impacts according to statements from residents interviewed. The community placed health risk was the main concern because of direct impact on individuals and the risk to children's health. They are directly exposed to climate extremes and they are experiencing an increase in health problems influencing their perception as implied by Smit and Vendal 2006 and Lujala 2014. Where, if the level of risk is low or not experienced then it's unlikely an issue while direct personal experience or close proximity to the impacts of climate change can result in perceiving higher risk of climate change. Health issues being the highest risk from the study, further supports the value of perception of risk and local knowledge.

The lack of awareness and resources influences adaptive capacity at both the city and community level (IPCC, 2007). The assessment by ABAG (2015) highlights the same limitations with communities exposed to flood hazards that are vulnerable due to social status. Social status indicators include wealth, housing cost, transportation cost, education, and language barriers. The criteria selected as indicators reflects the nature and diversity in East Palo Alto, especially the disadvantage poor population vulnerable to flooding and earthquakes. Comparatively, the results from this study suggest similar conclusions that adaptive capacity can be limited by high cost of living, lack of awareness, financial burden, and housing security--all of which impact vulnerability. The findings suggest adaptation strategy should address social vulnerability as suggested by Archer, 2014; ABAG, 2015; and Lujala, 2014, because adaptation is about addressing social drivers of vulnerability and not just the physical impacts.

Community coping capacity is highly influenced by social stability. The majority of responses showed more concern about financial stability and housing needs. The increase in rents and

homes is adding stress and burden to the same vulnerable population. The majority of respondents have no financial means to adapt if a disaster were to occur tomorrow. This makes them more vulnerable to the impacts of climate change and increases their dependency on government institutions for assistance. Hence, vulnerability is coupled with social and economic hardships.

6.2 Adaptation

The community in East Palo Alto cannot adapt on their own. The threats and exposure to flooding and health risk combined with the limited capacity to cope increases their vulnerability. The study sought from the residents their perspective on adaptation. Adaptation response included evacuation during flooding, reactive response to climate variability and extremes, or resorting to their families and networks for support. These measures are not comprehensive enough-- especially with social and financial hardships they face daily. Livelihood challenges in East Palo Alto also hinder adaptation. Community-based adaptation strategies must be identified and integrated with social and economic development opportunities.

The adaptation concept here addresses capacity of residents to respond. The findings from the community perception indicate the need to increase their awareness on climate change issues and adaptation measures. Increase in community awareness is ranked the highest as an adaptation measure. Residents interviewed want to understand the implications and how it will impinge on their livelihoods and how they can address climate change.

Existing barriers on adaptation include the lack of information and data, financial resources, and institutional structure. The local government needs to address these limitations at the city level to enable progress. Capacity building is necessary to strengthen and promote awareness of East Palo Alto vulnerability to climate change and sea level rise.

6.3 Partnership in Adaptation

The findings from my research during interviews with both the city officials and residents suggested that there is limited resources available at the government level to provide support and financial resources to address climate change. There is almost no communication or shared knowledge between the government and communities on climate change issues except for

resource management programs which include water conservation issues. Efforts by the Joint Power Authority and San Mateo County Resilience Program are effective steps since Joint Power Authority deals with the levee directly while the county program is building awareness on sea level rise.

The literature suggests the importance of involving local governments to lead while working with communities (UN-Habitat, 2014). Local government support is necessary for action and getting the support may require community action (Archer, 2014; Smit and Vandel 2006). Awareness of climate change at all levels (city leaders, staff, community leaders, households) is required and will lead to progress. The result of this study shows that the city of East Palo Alto has limited capacity to prioritize climate change as an urgent threat while relying on other programs and partners to take action.

6.4 Community-level engagement

The findings of this study suggest that there is value in community level engagement assessment to climate change which can be applied to any impacted communities including communities in urban cities. Ayers and Forsyth (2009), discussed adaptation in a local and place-based context and suggest community level can address specific nature of vulnerability because it takes place where climate change impacts lives and livelihoods. Furthermore, the process can empower communities with local government support while building and strengthening partnerships. It can potentially, lead to actions that can be integrated and supported by city-level planning in partnership with the community.

The results from the study provide opportunities for the city and the community to collaborate. Evidently, from the interviews, there is a lack of trust in the local government because of inaction on climate change. The city lacks the ability to provide and engage with the community and may lead to limiting community capacity. Hence, engaging communities and open dialogue can help both sides support each other. It is also crucial for the city to work with the community at their level while building the trust. East Palo Alto is a diverse community which could add difficulty in facilitation, due to different languages and cultural norms. It also means there are various networks in the community that will need to be included.

What is interesting is that both residents and city officials are aware that neither have the financial, capital, institutional, or human capacity to plan for climate change. The city recognizes the many social problems that exist, and the community understands the lack of financial resources preventing the city from acting. Common understanding can bring the community and the local government together to start a conversation and work together to find solutions.

Moreover, an important finding was that most of the respondents did not have proper training and or acceptable level of awareness on climate change. The existing level of understanding is from the perception of risk, but when ask if they understand what climate change is, there is limited understanding. The experience and local knowledge of events and adaptation are relevant. It identifies community values and perception of risk. This analysis can reflect on some of those perceptions. It is clear the community is dealing with much more than climate change, however it shows that climate change impacts will increase the existing burden on the communities if nothing is done to address the impacts while building resilience.

It was also interesting to note how other social issues were, considered to be more prominent concerns compared to flooding and climate risks. The results show vulnerability to flooding, but what was more concerning are the social and economic statuses that affect most respondents. Availability of these findings to city planners can be useful for planning purposes.

6.5 Gaps in Data and Research

In order to assess vulnerabilities, it is important to have climate datasets to determine the changes and future trends. For East Palo Alto, there is a need to improve understanding of impacts of extreme weather events on human health and how the impacts change with frequency and intensity. The results of the study indicate a growing concern for health impacts due to climate change, however, studies to support the case of East Palo Alto to draw conclusion was nonexistent even though literature reveal a direct impact of climate change on health.

Other information gaps encountered while conducting this study include information gaps on climate impacts on health/climate related diseases, and future climate variability, in East Palo Alto. The data gaps have illustrated a need for further research on these issues, especially including community vulnerability studies.

7. Recommendations

Given the current and projected local climate change and sea level rise in the East Palo Alto community, coping strategies are limited to curbing existing problems and mitigating future changes. The findings of this research support the need for community-level adaptation planning for climate change. It is crucial to identify the needs and priorities of the community and adjust adaptation strategies to meet those needs. Moreover, there is an urgent need to integrate community needs and vulnerabilities into local government policies and programs. The community-based framework of assessment and prioritization can and will help the city move towards a resilient future.

The community of East Palo Alto will benefit from investing in institutional capacity building and mainstreaming climate change into existing policies and strategies. It is urgent to implement a vulnerability assessment that is inclusive of the communities through a participatory process. This will allow the planners and decision makers to understand the level of vulnerability and work with the communities to build resilience through strategizing programs.

Several recommendations can be made based on the outcomes of the interview data analysis, literature review, and climate change projections. My research was to identify a possible way forward for the city of East Palo Alto to better plan to mitigate the impacts of climate change. Given East Palo Alto's vulnerability to flooding, extreme weather events and limited existing coping capacity, the City and communities in East Palo Alto will benefit from a city-wide community-based vulnerability assessment. Implementing a community-based assessment will engage all key stakeholders--especially the most vulnerable communities--in the process. The study shows East Palo Alto community is at risk and with limited action to address vulnerability. Conducting community vulnerability assessment can lead to changing behaviors, and developing partnership and networks contributing to resilience (Archer et al., 2014). This will result in understanding actual vulnerabilities and prioritizing adaptation measures appropriate to address urgent needs.

One emerging issue is the availability of data and existing information gaps. It is necessary at the government level to move towards approaches that build an understanding of risk and filling data

gaps. One measure to address this is to engage communities in research to improve understanding of impacts of extreme events and climate variability on health. Additional research is necessary for the communities to identify exposure and risks to health posed by future climate changes. It is crucial to engage those most at risk and important to document and integrate local knowledge on vulnerabilities and adaptation. It can organized communities and local government to address root cause of risk.

Public awareness should be prioritized in order to allow the community to understand their vulnerabilities and embrace practical measures to reduce impacts of flooding and climate extremes and variability. Increasing knowledge and understanding will enhance the capacity to cope and to respond. By understanding and being able to identify the root causes of risk, communities will be able to respond appropriately.

There are many potential pathways for communication, and all should be used to maximize awareness, including social media, newspapers, newsletters, television, posters, flyers, community meetings, and awareness days.

My proposed framework (Figure 12) is an attempt to identify the urgent and necessary actions needed for the city of East Palo Alto to take in order to properly respond and prepare for climate change and sea level rise. At the city level, they need to consider investing resources in creating a full-time staff and dedicated team to lead the process. The City of East Palo Alto does not have an officer or staff member to work on climate change programs nor do they have a sustainability officer to prioritize climate change work. The proposed Climate Change Unit will focus solely on tapping into available funding sources, as well as being tasked to develop a much needed climate change program for the city.

The dedicated unit or officer must priorities and implement programs in the community to build awareness on climate change. The vulnerability assessment will identify priorities and key vulnerabilities including community, health and water sectors. The local government or City will be able to collaborate closely with the community via existing community partners; regional stakeholders and especially community leaders. Regional stakeholders can provide technical and financial and institutional support. Findings from the assessment can be mainstreamed and be developed into a climate adaptation strategy to facilitate implementation of appropriate and

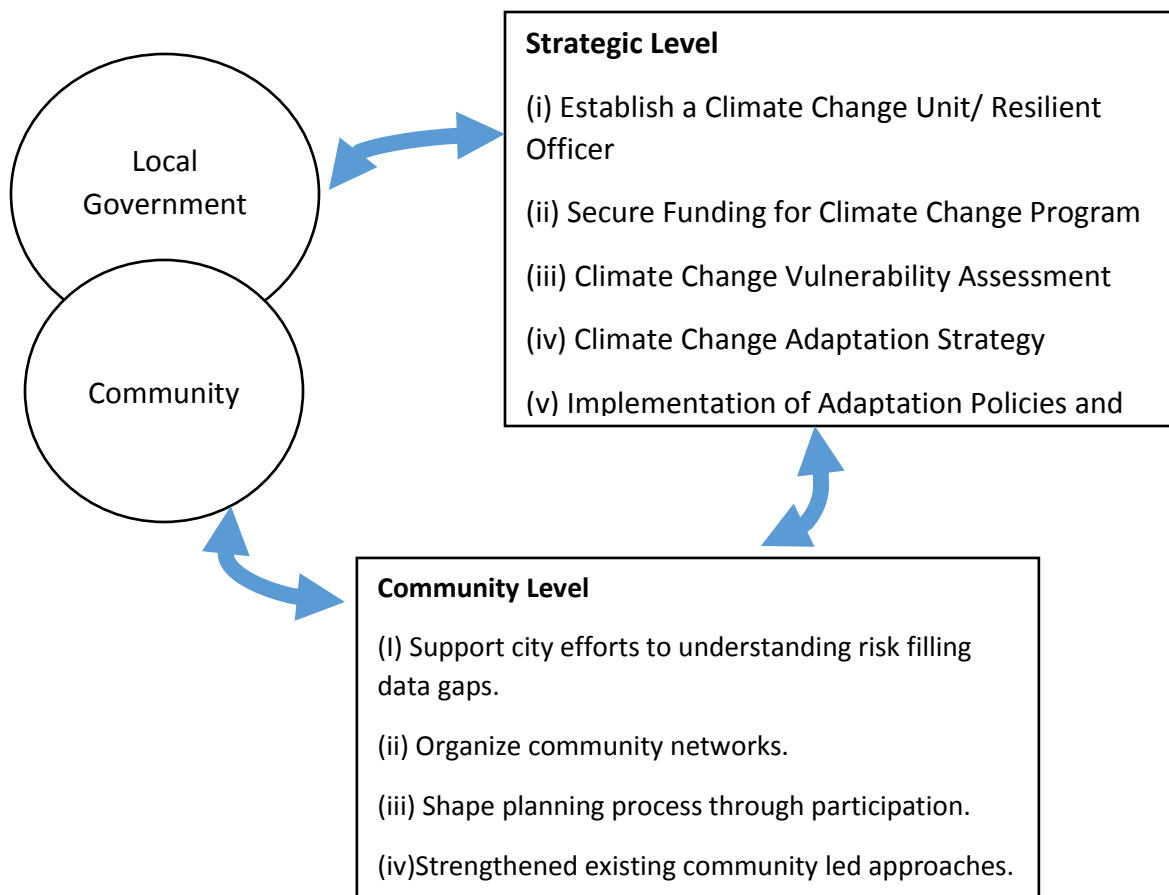


Figure 12. Proposed Framework for East Palo Alto. Note: The goal is to empower East Palo Alto City and community to adapt a participatory bottom-up and top-down approach to climate change adaptation.

effective adaptation and mitigation measures. It will require strong institutional arrangement to coordinate the process. All relevant stakeholders need to come together during the assessment process to prioritize sectors or communities to address. The results of my study can priorities health impacts as an area to be addressed concerning climate change. Once priorities have been identified, the next step would be to secure funding and strengthen partnerships with state and federal agencies to support the East Palo Alto adaptation strategy. Consequently, this strategy will address the urgent needs of building resilience to climate change and sea level rise. The strategy will achieve this by setting goals and targets for the local government and communities to address.

The City of East Palo Alto and its communities require adaptation at the community level to successfully respond to climate change threats and projected impacts. Given its vulnerability and limited adaptive capacity, they need to organize to strengthen existing networks and institutions. The impacts of climate change and socio-economic challenges present in East Palo Alto require collective action to identify and adopt adaptation measures, with much-needed city-level leadership.

The information gathered in my research undoubtedly illustrates that residents are faced with competing livelihood challenges. The continual increase in the cost of living with limited income poses a burden and added stress. The skyrocketing cost of housing and rent results in residents barely able to support their families financially. The multiple and competing challenges and the lack of information and awareness on climate change further limit actions and deprioritize addressing climate change in East Palo Alto.

The framework of community-based adaptation suggests feasible strategies to address climate change at a local level. It ensures top-down approaches are aligned with community priorities. It is not isolated from city-level but rather integrated and mainstreamed. Although more costly and time-consuming than top-down approach, my research indicates that community-based adaptation framework better identifies vulnerabilities and prioritizes appropriate urgent adaptation measures.

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Appendix 1

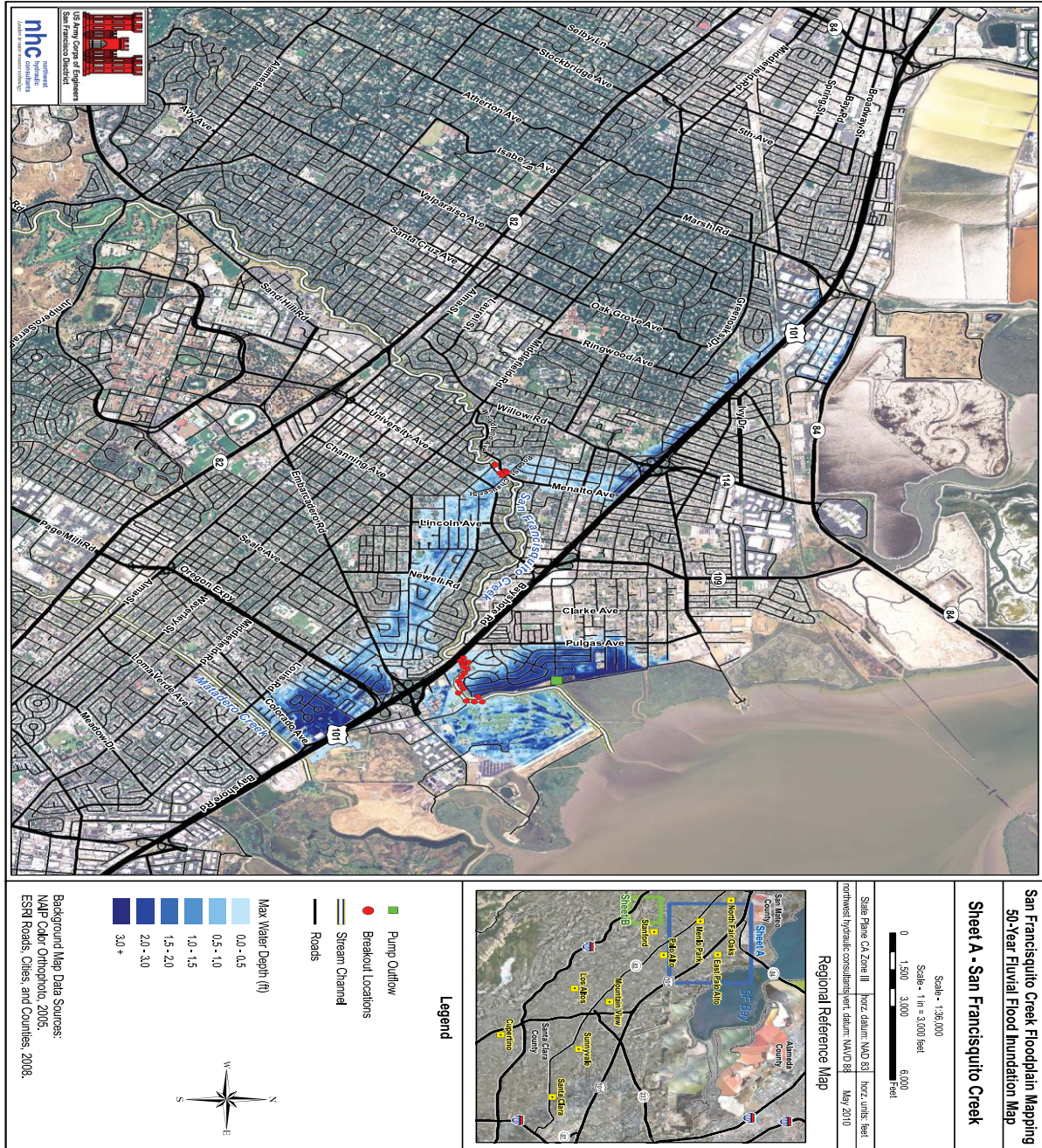


Figure 3. San Francisquito Creek Floodplain 50 year flood. Adapted from SFJPA, 2016

Appendix 2

Interview Questions

Semi Structured Interview Questions for Residents

General Questions about Climate Change

1. Is the weather changing, what do you think?
2. If it is changing how has it changed?
3. What aspect of the change in climate do you feel affects you most (variability, intensiveness, frequency etc...). Explain:
4. What does it affect?
5. Do you have knowledge and awareness of climate change risks?
6. How do you receive climate information in your community?
7. It is serving the communities needs in terms of climate information or there is a need to be improved?
8. List down how it can be improved?

General questions about Vulnerability and Adaptive Capacity

9. What are the various related stresses that affect your livelihood?
10. What aspect of your livelihood does it affect?
11. Are you affected by weather/climate or climate-related conditions (e.g water, erosion)?
12. If yes, which years, over the last 10 then ask how and in what way to identify vulnerabilities?
13. How did you deal with those problems?

Interview Questions for Officials

1. How exposed is the sector to the impacts of climate change
2. Is the sector subject to existing stress
3. Will climate change cause the demand for a resource to exceed its supply
4. Does the sector have limiting factors that may be affected by climate change?
5. What is the “impact threshold” associated with the system?
6. Are there barriers to the sectors ability to accommodate changes in climate
7. Is the system already stressed in ways that will limit the ability to accommodate changes in climate?
8. Is the rate of projected climate change likely to be faster than the adaptability of the system
9. Are there efforts already underway to address the impacts of climate change and sea level rise?
10. Do you have appropriate mechanisms to address climate change risks?
11. Do you have the ability to implement appropriate climate change adaptation and mitigation mechanisms?
12. How supportive is the government to include communities in adaptation planning?
13. What is the sectors broader goal for adaptation and mitigation?

Appendix 3

Node Structure

Name	Sources	References	Created On
Adaptation			3/21/2016 10:39 PM
Adaptation and Coping Strategies	26	40	3/23/2016 6:51 PM
Reactive Response	9	9	3/23/2016 6:51 PM
Dress Appropriately	3	3	3/23/2016 6:51 PM
Evacuation	10	11	3/23/2016 6:51 PM
Faith in God	2	2	3/23/2016 6:51 PM
Levee	3	3	3/23/2016 6:51 PM
Relatives	5	7	3/23/2016 6:51 PM
Sand Bags	4	4	3/23/2016 6:51 PM
Water Pump	1	1	3/23/2016 6:51 PM
Recommendations			3/23/2016 7:24 PM
Improve Drainage	2	3	3/23/2016 7:27 PM
Levee	3	3	3/23/2016 7:31 PM
Recommendation for Community Outreach	28	37	3/23/2016 7:25 PM
Water Tanks	2	4	3/23/2016 7:26 PM
Adaptive Capacity	28	61	3/21/2016 9:39 PM
Awareness	10	10	3/22/2016 10:44 AM
Financial Burden	11	11	3/22/2016 11:04 AM
High Cost of living	19	23	3/21/2016 9:39 PM
Housing	7	7	3/21/2016 9:39 PM
Networks	10	10	3/22/2016 11:20 AM
Community Perceived Climate Change	29	69	3/21/2016 9:29 PM
Climate variability	17	22	3/21/2016 9:36 PM
Drought	15	19	3/21/2016 9:45 PM
ElNino	2	4	3/21/2016 9:48 PM
Extreme Heat	9	10	3/21/2016 9:36 PM
Intense Rainfall	9	9	3/21/2016 9:35 PM
Ozone	1	1	3/22/2016 1:11 AM
Sea Level Rise	1	1	3/22/2016 7:18 AM
Season	3	3	3/21/2016 11:20 PM
Impacts of Climate Change	30	116	3/21/2016 9:31 PM
Damage Assets	5	5	3/22/2016 7:32 AM
Displacement	8	10	3/22/2016 7:30 AM
Financial Cost	5	8	3/22/2016 12:06 AM
Flooding	18	42	3/21/2016 9:32 PM
Health	25	48	3/21/2016 9:32 PM
Water	3	3	3/21/2016 9:32 PM
Information			3/21/2016 9:50 PM
Flyers	2	2	3/21/2016 9:52 PM
Newspaper and Television	17	20	3/21/2016 9:52 PM
Recommendation for Community Outreach	28	37	3/21/2016 9:56 PM
Social Media	3	3	3/21/2016 9:51 PM