

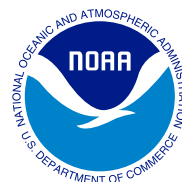
Enhanced Engagement and Risk Communication for Underserved Communities:

Research Findings and Emerging Best Practices

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ABOUT THIS REPORT

Underserved and underrepresented communities are often the most vulnerable to coastal hazards. To better understand how NOAA can effectively serve these stakeholders and develop culturally relevant and targeted resources to reach these communities, this literature review of risk communication strategies was created. Population focus areas include low-income populations, recent immigrants, ethnic communities, and rural communities. Topics explored include effective risk communication approaches, barriers to risk communication, individual or community risk tolerance, and the types of information needed for a risk communication strategy.

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Executive Summary

Coastal flood risk along U.S. coastlines is increasing due to relative sea level rise (NOAA, 2019a). Increasing mean sea levels, storm surges, and chronic coastal flooding threaten worldwide regions by inundating low-lying areas, eroding populated coastal lands, increasing salinity of freshwater resources, affecting coastal ecosystems, and converting dry lands into wetlands. The impacts of short-term increasing water levels combined with long-term sea level rise will not only cause flooding, erosion, and intrusion of saltwater into freshwater bodies, but it will also come with serious financial consequences, damaging livelihoods and coastal resources (Khan et al, 2020; Cleetus et al, 2015; IPCC, 2014).

One focus of the National Oceanic and Atmospheric Administration (NOAA) Water Initiative is to give the public access to water information so that they may take appropriate actions to address water-related risks and manage their water resources more efficiently and effectively. Water information is defined by the NOAA Water Initiative as timely, actionable information about vital water resources and is inclusive of global climate changes and the risks associated with its effects. The NOAA Water Initiative states that such risks are best communicated in a way that empowers individuals and communities to take action, however, tailored communication strategies may be needed in order to reach all members of a community.

Although many chronic flooding preparedness and adaptation guides exist, few address equity issues and appeal for inclusive engagement. The goal of this project is to improve risk communication strategies by applying best practices from research and literature in five unique flood-prone areas. In particular, this effort seeks to conduct outreach in frontline communities with underserved populations, who may require specialized or creative engagement on issues of water risk, and in particular, sea level rise hazards. Underserved populations shall be defined herein as populations having trouble accessing information and engaging in sea level rise adaptation efforts for reasons of race, religion, language group, or social status.

This report reviews risk communication and engagement best practices for underserved communities within the context of chronic sea level rise, specifically focusing on relevancy to NOAA practitioners and funders. This review provides a detailed understanding of the processes involved in risk perception, risk behavior, and risk communication. It also provides a discussion of recent practices that might be effective in promoting a better understanding of sea level rise

impacts and adaptation measures among underserved communities. The recommendations made in this report are intended for the broad spectrum of NOAA practitioners, funders, and staff to take a first step towards establishing a conversation and relationship with underserved communities at a high risk from chronic sea level rise.

The following recommendations are discussed in detail in the report.

- 1. Invest time getting to know the community**
- 2. Engage and reach out to stakeholders**
- 3. Be honest and transparent**
- 4. Empower the community**
- 5. Establish trust with a long-term investment**
- 6. Evaluate the results**



I. Introduction

Researchers define social vulnerability as “the characteristics of a person or their group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard” (Blaikie, 2003). The National Oceanic and Atmospheric Administration (NOAA) (2019b) notes that “in the U.S, about 40 percent of the population lives in relatively high-population-density coastal areas where relative sea level plays a role in flooding, shoreline erosion, and hazards from storms”. About one third of these residents are elderly, low-income, disabled, or otherwise socially vulnerable (NOAA, 2016). Global sea levels are rising and projected to continue rising at an accelerated rate in the coming decades, affecting all coastal residents, but this does not mean that all people are equally vulnerable to their effects (NOAA, 2019b; IPCC, 2014). Agencies like the Intergovernmental Panel on Climate Change (IPCC) have found that exposure, vulnerability, and resilience to climate impacts are tightly correlated to a population’s socioeconomic status (IPCC, 2014). Although there is extensive research about risk perception and communication of acute flooding events (Campbell et al, 2020; Moser and Ekstom, 2010; Moser, 2009; Morrow, 2009), communication with underserved populations have been less studied and discussed, particularly as it relates to the topic of chronic sea level rise (Khan et al, 2020; Jurjonas et al, 2020; Bhattachan et al, 2018; Akerlof, 2017; IPCC, 2014; Clark et al, 2007).

Frontline communities¹ are those located near an existing environmental hazard and, typically, are the ones who experience the first and the worst consequences of climate change (Egland and Kelley, 2020; Holland, 2017). It is important to note that not all frontline communities are necessarily underserved; the frontline communities highlighted in this paper were selected due to their high percentage of underserved populations. Educational opportunity, financial resources, unemployment, out-migration, age, and race can increase a community’s ability to respond to more frequent and intense flooding (Cleetus et al, 2015; Miller-Hesed and Paolisso, 2015). As cited by Trayler-Smith (2017):

¹ Frontline communities are defined as communities that experience “first and worst” the consequences of climate change (Holland, 2017). Although not all frontline communities are necessarily underserved; the frontline communities highlighted in this paper were selected due to their high percentage of underserved populations. For the sake of this project, the terms of climate justice communities, special communities, marginalized communities and underserved communities are used interchangeably with frontline communities. For more information please refer to the Appendix.

“Marginalized populations are those who have the smallest carbon footprint, but due to their socioeconomic status, geographic location, gender, and age, they are the ones who experience the worst effects of climate change.”

Historically, underserved populations have resided in low-lying, rural, and isolated areas whose lower value made them more affordable to live (Perry et al, 2018; Gross, 2017). Additionally, frontline communities are typically at a higher exposure to climate change-related events due to power imbalances that leave them without a voice within the political context (NAACP, 2019; Jurjonas and Seekamp, 2018; USDN, 2017). Years of systemic racism and social injustices have left government agencies at all levels struggling to build relationships and effectively communicate risk to these communities (NAACP, 2019; USDN, 2017). While wealthier communities have more resources to explore novel measures to counter rising sea levels, underserved frontline communities have fewer resources to expend on experimenting with potential solutions to defend against the impacts of climate change.

Chronic flooding events can cumulatively cause more damage than a single acute weather event, highlighting the need to communicate and educate frontline communities to plan for the effects of rising sea levels. Flooding associated with sea level rise has and will continue to impact frontline communities living in flood-prone areas, endangering lives, damaging homes, limiting people’s access to reliable transportation, and inhibiting them from providing financial resources to their families (Khan et al, 2020; Cleetus et al, 2015). However, vulnerability to actual or expected climate change effects can be decreased through adaptation (GCC, 2020; Khan et al, 2020; Agyeman et al, 2007). The Fifth Assessment Report from IPCC defines adaptation as:

“The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects” (IPCC, 2014).

Communication plays a key role in risk decision-making and response; therefore, effective risk communication is an essential component of adaptive planning (Feldman et al, 2016; Morrow, 2009; Moser, 2009; McComas, 2006). When effective, risk communication conveys trust, awareness, and understanding. On the other hand, poor or deficient risk communication contributes to distrust, misinterpretations, and misunderstandings of both, the

communicator and the message (Jurjonas et al, 2020; Cutter et al, 2012; Rowel et al, 2012). The ultimate goal of a risk communication plan is to help people make informed decisions about the risks they may face.

This literature review focuses on five different frontline communities in different coastal regions of the United States that have a high number of underserved populations at risk. Communities discussed include East Biloxi, Mississippi; Bayou la Batre, Alabama; Wilmington and New Bern, North Carolina; and Mō‘ili‘ili, Hawai‘i. Past and current discrimination and disenfranchisement within these communities have increased their vulnerability to the impacts of rising sea levels. Recommendations made in this paper aim to address the gap between equity and climate adaptation by providing the causes of these problems, in addition to providing a better understanding of the reasoning behind risk perception and risk behavior.

i. Environmental Justice

Frontline communities in the U.S have a history of being forced from their homelands. Robert Bullard, the "father of environmental justice", defines the term environmental justice as: "The principle that all people are entitled to equal environmental protection regardless of race, color, or national origin. It's the right to live and work and play in a clean environment" (Milman, 2018). With research mainly focused on Blacks², Hispanics, Asians, Pacific Islanders, and Native Americans, the environmental justice movement tries to address a statistical fact: people who live, work, and play in the most polluted environments of the country are usually people of color, ethnic minorities, and low-income residents (Skelton and Miller, 2016).

Environmental racism is tied to racial segregation (Milman, 2018; Hardy et al, 2017; USDN, 2017; Agyeman et al, 2007). Historical systemic racism often forced people of color, ethnic minorities, immigrants, and low-income families, to reside in low-lying areas prone to flooding, originally zoned for mixed residential/industrial use, and, in general, the least desirable land (Perry et al, 2018; USDN, 2017; Skelton and Miller, 2016; Gross, 2017; Agyeman et al, 2007). In the 1930s, federal housing policies actively and intentionally contributed to segregation, subsidizing development for middle to low-income white households and

² The word Black in this report shall be used when referring to groups in racial, ethnic, or cultural terms. For more information please refer to the Appendix.

prohibiting people of color from purchasing those homes (i.e. redlining) (Perry et al, 2018; Gross, 2017). Frontline communities are exposed to a disproportionate number of harmful conditions including: lack of greenspace, weak and/or failing infrastructure, fewer economic opportunities, higher human health problems, higher overall mortality, poor access to health care, inadequate education, fewer opportunities for safe recreation, poor quality housing, inequitable access to transit services, and community isolation or displacement (GCC, 2020; NCDEQ, 2020; Gross, 2017; Skelton and Miller, 2016; Douglas et al, 2012). The forced placement of locally unwanted land uses (i.e. toxic waste dumps, incinerators, factories, fossil fuel storages) in these communities has resulted in the devastating loss of native natural and cultural resources (Dwyer, 2020; Kehaulani Watson-Sproat, 2020; Hardy et al, 2017).

Environmental injustices also occur when governmental institutions favor strong industries and wealthy homeowners in disaster recovery and coastal hazards, with socioeconomic status and race playing a significant role in decision-making (Jurjonas et al, 2020; Boustan et al, 2020). A salient example of this was Hurricane Katrina in 2005. Katrina was one of the costliest and deadliest natural disasters in the U.S, claiming a disproportionately large number of Black lives and leaving many homes devastated in the Gulf Coast (USDN, 2017;). Recovery efforts for the disaster were slow and benefited the wealthy while often excluding underserved populations (USDN, 2017; Drimonis, 2016).

Payne-Sturges from the University of Maryland says environmental justice is an acknowledgment that people of color have been systematically excluded from decision-making and therefore unequally protected against environmental hazards (Caulfield, 2020). Chronic flood episodes derived from climate change, such as nuisance flooding, king tides, and flash flooding, can introduce severe bacterial contamination and toxic waste into communities, causing a public health hazard (Roesler, 2011). Aging municipal stormwater systems, bridges, highways, and other infrastructure systems built years ago are failing, placing communities that depend on them at a further disadvantage (NOAA, 2019b; Cleetus et al, 2015). These frontline communities are often forced to live in isolation, without resources to address environmental consequences. This lack of resources means that community members often cannot take steps to protect their homes, afford insurance that could help cover losses, or evacuate or relocate (GCC, 2020; NAACP, 2019; Cleetus et al, 2015; Cutter et al, 2012).

As noted by Hardy (2017), the colorblind approach taken by government institutions and adaptation planners has failed to design strategies that acknowledge the community's past history, background, and needs, which often leaves them without access to public resources. Additionally, members from climate justice communities have often been excluded from the decision-making process of policies and programs that might benefit them (GCC, 2020; Miller-Hesed et al, 2020; Cleetus et al, 2015). Lack of involvement in the decision-making process has increased the public's distrust in the government and has contributed to communication and engagement issues between climate justice communities and government agencies (GCC, 2020; Miller-Hesed et al, 2020; USDN, 2017). Though less responsible for climate change, frontline communities continue to disproportionately bear environmental burdens and their voices are very often ignored (University of Michigan, 2020; Trayler-Smith, 2017).

II. Communities of Interest

Members from our focused communities in Alabama, Mississippi, North Carolina, and Hawai‘i represent socioeconomic groups where few resources have been dedicated to sea level rise and adaptation research (Miller-Hesed et al, 2020; Hardy et al, 2017; Miller-Hesed and Paolisso, 2015). The communities described in this paper were chosen due to their predicted long-term exposure to sea level rise and their strong connection with NOAA through the Sea Grant Program.

Located in coastal zones with a high exposure to flooding, members from these communities are at a disadvantage due to the lack of job opportunities, migration of the youth and the wealthy to urban centers, and a legacy of racism, slavery, and appropriation of property (GCC, 2020; Miller-Hesed et al, 2020; Douglas et al, 2012). The Socioeconomic Vulnerability Index (SoVI) is a measure of county-level vulnerability to environmental hazards drawn from the U.S. Census Bureau based on socioeconomic factors such as gender, race, age, wealth, and ethnicity (CDC, 2016). The focus communities for this paper have all been identified as highly vulnerable by SoVI (CDC, 2016). In addition to being at risk of flooding, these regions share similarities like a strong attachment to religion and community life (Williams, 2020; NAACP, 2019; FSU, 2008; “Mō‘ili‘ili: A Historical Overview”, n.d).

Recent research indicates that wealthier residents are moving out of flood zones, the poor are migrating in, and that the existing population transitions into poverty following a severe weather event (Boustan et al, 2020). Frontline communities are therefore more vulnerable to climate change events and struggle the most to recover.

i. East Biloxi, Mississippi

East Biloxi is a small community located within the City of Biloxi in Harrison County, Mississippi between Biloxi Bay and the Mississippi Sound along the Gulf of Mexico. The City of Biloxi is vulnerable to the impacts of sea level rise with an elevation of about 20 feet and 18 percent of the city composed of water (NOAA, 2014). East Biloxi is the oldest community within the City of Biloxi and has a racially diverse and low-income population (FSU, 2008). According to the U.S Department of Commerce (2019), East Biloxi has a population of approximately 6,000 residents, of which 44 percent are white while 56 percent are Black and other ethnic minorities. As a result of the diverse demographics, the community faces a language

barrier due to the large number of non-native English speakers who live in the area (U.S Department of Commerce, 2019). The median household income for the region is lower than \$34,000 per person annually, falling below the U.S median average (\$60,000). Data drawn from the U.S Census Bureau (2014) also shows that the city has experienced an overall population decline since 1980. Despite this overall population decline, the low-income population continues to grow, supporting Boustan et al (2020) theory of migration of the wealthiest; in the aftermath of natural disasters the wealthier move out of flood-prone areas leaving behind a disproportionately low-income population. After Hurricane Katrina in 2005, the city was severely impacted, low-income residents being the most affected by this storm (USDN, 2017; FSU, 2008). Hurricane Katrina is a clear example of how frontline communities face greater social inequalities. Residents most impacted by Hurricane Katrina had the fewest resources to recover from the disaster (USDN, 2017; FSU, 2008). In addition, past discriminatory policies and governmental practices have contributed to trust and trauma issues when communicating risk to underserved communities (USDN, 2017). Today, low lying areas of town are largely populated by Black, low-income and immigrant residents, who experience frequent and intense flooding events like high tides and flash flooding. Working with the communities in East Biloxi will require innovative communication strategies and adaptation practices to address the current environmental and socioeconomic conditions, which are compounded by a long history of racial inequalities.

ii. Bayou la Batre, Alabama

The historic shrimping village of Bayou La Batre is located within a fragile network of bays and salt marshes and therefore is highly vulnerable to the effects of sea level rise. Its shores are situated about five feet above sea level on Alabama's coast, which is gradually being covered by water (Benjamin, 2019). Further, Bayou La Batre has suffered from various environmental disasters. In 2005, the town was devastated by a record-breaking 16-foot storm surge from Hurricane Katrina (Benjamin, 2019; USDN, 2017; Reckdahl, 2014). In 2010, the British Petroleum (BP) oil spill forced fisheries closures, decimating the town's economy and generating health problems in the population (Reckdahl, 2014). Currently, residents are suffering consequences from chronic sea level rise such as saltwater intrusion and salinization of freshwater which is essential for fisheries, aquaculture, and agriculture. The small fishing town

has an aging, low-income population with low educational attainment, and limited job training opportunities. The median household income in Bayou la Batre is about \$41,000, below the U.S median household income of \$60,000. Many citizens, especially minorities, do not have the standard of living needed to cover basic necessities. (US Department of Commerce, 2019). Similarly to East Biloxi, the town of Bayou la Batre has been experiencing an abrupt population decline in the past few years (U.S Census Bureau, 2014). While it is difficult to calculate the economic losses caused by climate change, a study by Columbia University showed that Alabama’s coastlines lost about \$158 million in residential property value in one decade due to tidal floods caused by rising sea levels and climate change (Burkhalter, 2019). In Bayou la Batre, the economic losses are close to \$7.8 million per decade. Increased tidal flooding in the past few years has resulted in home value depreciation, which is expected to continue and accelerate with sea level rise. Further, generational homes that many families rely on that were previously safe from repeated flooding are now exposed to significantly higher flood risks (Burkhalter, 2019). This forces low-income families with minimal resources to absorb repeated financial hardships.

iii. Wilmington, North Carolina

North Carolina ranks third in the U.S. for land area susceptible to being underwater due to sea level rise, and sixth in the number of housing units located within those susceptible areas (Strauss, Ziemplinski, Weiss, & Overpeck, 2012). Wilmington is already suffering from frequent flooding events and is very likely to experience between 1.2 feet to 3.3 feet of sea level rise by the end of the century, (Cliffon and Kelly, 2020). Nuisance flooding, or “sunny day flooding”, has been increasing in recent years (NOAA, 2019a). In the 1960s, Wilmington experienced two sunny day flood events per year. In 2015, Wilmington experienced 48 flooding events (Pilkey, 2019). By 2100, nuisance flooding is predicted to be an everyday event, damaging infrastructure systems, limiting access to reliable transportation, and increasing health risks from pollutants in the water (Cliffon and Kelly, 2020; Billings et al, 2017). Wilmington is known as a beach and fishing destination but has also been known for its history of racial tension (Sharpe, 2015). About 30 percent of the city’s population is composed of Black and Hispanic communities that are historically underserved with information and infrastructure (U.S Department of Commerce, 2019; Billings et al, 2017). Wilmington has a median household income of \$45,000 per person, below the state U.S and median average. The highest percentages of those living in poverty are

majority ethnic minorities and people of color (US Department of Commerce, 2019). Black communities have been victims of racial discrimination and many of them are located in the most flood-prone, and the most isolated zones of the Carolina floodplains, putting them at risk of flooding caused by sea level rise and in regions inundated with toxic pollutants (Cliffon and Kelly, 2020; Billings et al, 2017).

iv. New Bern, North Carolina

The city of New Bern is located in the Albemarle-Pamlico Peninsula, a very low-lying region. In the late 1800s, New Bern was the largest region populated by Blacks in North Carolina. Today, the city remains a pillar for many Black communities (Sharpe, 2015). New Bern is home to almost 30,000 citizens of which 47 percent are Black and Hispanic minorities. (US Department of Commerce, 2019). This rural city also has a history of intergenerational income and wealth inequities, divides that are exacerbated by natural disasters (Raven Wallace, 2019). According to the 2020 North Carolina Climate Risk Assessment and Resilience Plan, the rural city of New Bern and other areas with a higher proportion of frontline communities like Wilmington, are more likely to be exposed to storm surges and other flooding events (NCDEQ, 2020). The public housing development of Trent Court in New Bern is an example of class and race issues that many American cities struggle with today. After Hurricane Florence in 2018, many Black, low-income, disabled, and elderly populations lost their homes and possessions and did not have resources readily available for the needed recovery process. While underserved communities living in the city were displaced by the frequent storms and floods, wealthier whites residents also living in the area were able to recover faster (Raven Wallace, 2019). Many low-income families are at risk of losing their homes to flooding, while common daily activities like accessing public transportation and public green spaces are also frequently being affected by nuisance flooding (NCDEQ, 2020; Billings et al, 2017). As sea levels continue to rise, sunny day flooding will occur more often and will extend to higher elevations.

v. Mō'ili'ili, O'ahu, Hawai'i

In the Pacific Islands, sea level rise threatens shallow coral reefs, coastal ecosystems, and aquifers, increasing shoreline erosion, saltwater intrusion, and pollution (Hawai'i Climate Change Mitigation and Adaptation Commission, 2017 ; IPCC, 2014). The Hawai'i Sea Level

Rise Vulnerability and Adaptation Report 2017 states that Hawai‘i may expect an increase of over three feet of sea level rise by 2100 (Hawai‘i Climate Change Mitigation and Adaptation Commission, 2017).

Today many Native Hawaiians and other underserved populations reside in low-lying areas along the coastline prone to natural disasters such as flooding and tsunamis and continue to be politically and economically marginalized (Kokal, 2020). According to recent data from the Missouri Economic Research and Information Center (MERIC, 2019), Hawai‘i had the highest cost of living in the United States in 2019 and an average poverty rate from 2016 to 2018 of 13.7 percent, compared to the national average rate of 12.3 percent for the same period (U.S. Census Bureau, 2018). Frontline communities in Hawai‘i face challenges such as unemployment, lack of education, and in the case of some immigrant populations, discrimination for not knowing the English language (Hofschneider, 2018). Kokal (2020) suggested consistent displacement of marginalized communities is not a coincidence. It is a reflection of the systemic racism faced by Native Hawaiians and other marginalized communities for many years.

Some of these complex dynamics can be seen at play in the community of Mō‘ili‘ili, a highly diverse urban neighborhood in Honolulu composed of the working class, immigrants, students, and other transient populations (“Mō‘ili‘ili: A Historical Overview”, n.d). The community of Mō‘ili‘ili is located roughly between McCully Street and Kapahulu Avenue and stretches from the Ala Wai Canal on its southern end up to the University of Hawai‘i. The Ala Wai Canal was artificially created nearly 100 years ago in an attempt to drain wetlands in the area (Finnerty, 2019). Its construction caused substantial alteration in the natural path of water, which once slowly moved from mountains to sea but now flows through a series of natural and channelized streams and converges in the man-made Ala Wai Canal before flowing into the ocean.

Due to climate change and rising sea levels, this conveyance system is at risk of being overwhelmed and compromised, positioning seaward portions of the watershed at risk from flooding (Finnerty, 2019). Mō‘ili‘ili has been identified as particularly at risk of sea level rise induced groundwater inundation and water pollution due to its karst geology and history of using fill to support development, which could cause extensive inundation in densely populated neighborhood areas. Flood waters in this community are likely to emerge first during high tides, causing periodic nuisance flooding, before escalating over a number of decades to permanent

inundation. Sea-level rise induced flooding may impair and impact roadways, infrastructure, evacuation routes, private homes, and public health. The U.S Army Corps of Engineers has modeled that economic damages caused by flooding within the Ala Wai watershed from a 100-year storm could surpass \$1.4 billion (US Army Corps of Engineers, n.d).



Figure 1. King tides overtop the walls of the Ala Wai Canal in Mō‘ili‘ili, Hawai‘i (Hawai‘i and Pacific Islands King Tides Project, n.d).

III. Risk Perception

To fully understand an individual's or community's response to a risk, it is important to first understand their perception of sea level risks. Morrow (2008) argues that risk is a social construct, and perception is the core issue. Motivation to act is influenced by risk perception, event probability, severity, and perceived self-efficacy to take action (Morrow, 2008). To achieve effective risk communication, it is important to understand that risk means different things to different people. Climate change risk perception research has found that greater scientific understanding does not always lead to greater public concern (Akerlof et al, 2017; Cutter et al, 2012). Similar to climate change communication, sea level rise risk communication presents challenges involving complex science, uncertainty, and invisibility (Covi and Kain, 2015).

Despite being the most affected by climate change, marginalized groups are typically perceived as the least concerned by large segments of the US public (Egland and Kelley, 2020; Pearson et al, 2018). Stereotypes from outsiders suggesting these communities cannot be seen as environmentalists may pose a barrier to public engagement by discouraging them to be involved in environmental initiatives (Pearson et al, 2018). It is important to note that minority status, economic disadvantage, and weak social support structures are not necessarily synonymous, it is possible for economically disadvantaged populations or communities to have a strong social support structure. Although systems with strong social support are important for helping to reduce vulnerability to hazards, this cannot be achieved without the public willingness to perform. For this reason, it is important to understand different barriers that prevent these communities from taking action.

Barriers are defined as obstacles that can be addressed with concerted effort, creative management, change of thinking, prioritization, and related shifts in resources, land uses, institutions, etc. (Moser and Ekstrom, 2010). What an individual or group of individuals will do depends on what they think they can do and what they want to do. Described below are some of the major impediments for risk communication, particularly with underserved groups.

i. Trust and Credibility

Lack of trust among low-income and minority populations towards government agencies may be a barrier to traditional risk communication systems limiting their effectiveness and

leading to an unstable information environment (GCC, 2020; Miller-Hesed et al, 2020; Rowel et al, 2012). Siegrist and Cvetkovich report that when the public has low knowledge about the risk situation, trust plays an important part in public perceptions about the severity of that risk (2002). Trust and credibility for effective communication depend on whether the message recipient perceives the message source as trustworthy and believable (Meredith et al, 2008). Past experiences with discrimination and abuse have resulted in frontline communities being skeptical of “outsiders” and “experts” (GCC, 2020; Miller-Hesed et al, 2020; USDN, 2017). Therefore, it is necessary to frame messages in a way that are relevant to them and/or partner with local trusted organizations (Rowel et al, 2012; Agyeman et al, 2007). Governments are often perceived to have failed to maintain promises and provide accurate emergency response plans. This continues to create distrust of government agencies by marginalized communities. It is important to highlight that without the right messenger, even the most well-crafted risk messages will go unheard (Moser, 2009). Approaching the public without a relationship or a connection in the community can do more harm than good. Acknowledging past mistakes and oversights by government agencies is a step to address distrust and communication issues but sometimes, it is necessary to partner with local organizations (i.e. neighborhood organizations, grassroots organizations, faith-based organizations, etc.) within the community to increase the sense of trust (GCC, 2020; Miller-Hesed et al, 2020; NAACP, 2019; Miller-Hesed and Paolisso, 2015; Rowel et al, 2012). Successful risk communication takes time and effort. Consistent engagement with communities and ongoing sharing information creates long-term relationships and encourages trust in the messenger, the agency, and in the process (Jurjonas et al, 2020; Plate et al, 2020).

ii. Lack of Knowledge and Communication Techniques

It is crucial for underserved communities to fully understand the hazard of extreme events under current and future sea levels. A lack of scientific knowledge regarding a problem influences the understanding of the risk (Covi and Kain, 2015; Moser, 2009). Therefore, successful adaptation and resilience measures for coastal communities depend on good communication (Feldman et al, 2016; Morrow, 2009; Moser, 2009; McComas, 2006). Even though the topic of sea level rise perceptions has been minimally explored compared to episodic floods, human behavior related to the risks of chronic sea level rise remains largely unknown (Khan et al, 2020; Jurjonas et al, 2020; Bhattachan et al, 2018; Akerlof et al, 2017) and past

research has shown the need for better education and outreach (Bhattachan et al, 2018; Covi and Kain, 2015). A study with a low-income, Black community in Wilmington, Delaware showed that although the group believed sea level rise was a “very serious” problem for the community, they also expressed little to no knowledge on the matter (Perez and Egan, 2016). The population expressed having more pressing issues such as unemployment, education, crime, and adequate housing, yet they were aware of the risk of sea level rise. Another study with a rural low-income community in North Carolina also revealed the participant’s concerns about sea level rise were high despite little understanding of the science behind the problem or the potential solutions (Jurjonas and Seekamp, 2018). In each of these scenarios, the communities were concerned about sea level rise and the associated risks; however, they were not armed with the knowledge of the causes of sea level rise or potential solutions. It is therefore essential to understand the residents’ level of expertise in the subject to frame an adequate communication system (Covi and Kain, 2015).

A vital step then would be creating an adequate understanding of the problem in a way that is transmitted as an opportunity for empowerment in the community (GCC, 2020). Information on climate change and sea level rise can be translated from a scientific level to language that is more easily understood (Khan et al, 2020). Those who do not understand the impacts from rising sea levels could exacerbate the effects of extreme water levels (i.e. tides, waves, surges) via maladaptive solutions (e.g. bulkheads) or uninformed building (e.g. building below recognized future flood levels), or the lack of knowledge may create a sense of acceptance/resignation and may cause people to underestimate the risks (Covi and Kain, 2015). In addition to information on climate change, communities need information on how it will impact them and the different resources available to assist them (FEMA, 2019). The lack of knowledge of local adaptation options could also lead to feelings of powerlessness among marginalized populations.

Conventional risk communication efforts are often not designed for underserved populations (Douglas et al, 2012; Agyeman et al, 2007). Most of the traditional risk communication systems are designed for a general audience, not taking into consideration that underserved populations may understand risk messages differently (GCC, 2020; USDN, 2017). This can result in parts of the population not understanding the message or distrusting the messenger, leading to risk communication failure. To be most effective, risk messages should be

communicated in unique and specific ways that relate to concerns, circumstances, and cultural perspectives of the communities in question (Agyeman et al, 2007).

iii. Mental Models and Emotional Responses

Mental models work as internal explanations or thoughts on how something works in the real world and are thinking tools used to make decisions, influencing perception, and behavior. They are frameworks for thinking, to simplify complex things and reason through them (Shapiro, n.d). Everybody has mental models. These models are formed over time, through experiences and social interaction (Morrow, 2009). For example, supply and demand is a mental model to help understand the concept of economy. Although they are useful simplifications, they can also misguide people's understanding of risks. For example, some people can perceive increased global mean temperatures as something pleasant (Helgeson et al, 2012).

Individuals learn about climate change impacts in one of two ways, and typically through a combination of both: through indirect and mediated forms of communication from others (i.e. the media, peers, neighbors, community members, staff, teachers, etc.) or directly, through experiencing changes in the environment (Moser, 2009). Recent research and diverse authors argue that second-hand experience (information) is less likely to produce action than direct knowledge (experience) and social interaction (Douglas et al, 2012; Harvatt et al, 2011; Morrow, 2009). Harvatt et al, (2011) imply that previous risk communication approaches have failed because, in the past, risk communicators remained focused on education rather than engagement in the decision-making process (2011). The combination of both is what forms the mental models. It is important to consider how people understand and form mental representations of sea level rise; these mental models explain and can predict behavior (Helgeson et al, 2012; Morrow, 2009). Effective risk communication begins with a deep understanding of the mental models of the audiences that will be analyzed (Thomas et al, 2015). Understanding mental models can help to address the gap in how experts and non-experts interpret issues in different ways (Akerlof et al, 2017). Based on this approach, a study was conducted to understand public perception of sea level rise on the Severn Estuary, an ecologically sensitive area in the United Kingdom (Thomas et al, 2015). Experts and non-experts' mental models were similar in some areas but the non-experts, despite having experienced consequences from sea level change, did not think sea level rise was a matter of large concern. The reason for this behavior can be tied to

the poor or deficient use of mental models. While residents from the estuary experienced consequences associated with sea level rise, they still believed these impacts were occasioned from something else. Deficient mental models can lessen the perceived risk and, in consequence, prevent people from taking action (Helgeson et al, 2012). Previous research of mental models in sea level rise shows that a large part of the population is still uncertain about the science and the understanding behind sea level rise (Akerlof et al, 2017; Thomas et al, 2015; Helgeson et al, 2012). Comparing mental models between experts and non-experts within the community leads to understanding gaps or uncertainties in sea level rise. Also, learning about the mental maps in the community can help communicators to better understand the language/vocabulary, existing connections, values, etc. that can be further used to tailor messages.

The way the risk message is delivered is very important. Communication is more effective when there is a balance between providing accurate information and delivering it in a way that does not cause panic or anxiety (Akerlof et al, 2017; Covi and Kain, 2015; Moser, 2009). Sea level rise messages invoking fear or guilt may cause people to turn away from the conversation, while messages that acknowledge the fear but focus on possible solutions can increase people's willingness to learn and participate in the solution-planning process (Barisky, 2015). Psychological defense mechanisms such as optimism (i.e., thinking sea level rise effects will not affect them) and denial or avoidance have been cited as barriers towards engagement (Covi and Kain, 2015; Moser, 2009). These kinds of emotional responses may decrease through the use of tailored visualization tools that help make the concept seem more tangible (Plate et al, 2020; Cutter et al, 2012; Barisky, 2015; Moser, 2009). Visualization tools need to be tailored to the unique mental models, cultural aspects, and educational specifics of the community.

One successful way to avoid these kinds of emotional responses and deficient mental models is to communicate risk on an asset-based rather than a problem-based approach. An asset-based approach focuses on the strengths and skills of the community and can be used for problem-solving (Agyeman et al, 2007). The first step in this approach is to recognize what makes the community strong, not looking at what they need but rather on what they have. This is achieved by asking questions and learning about the community's and its members' unique stories (TED, 2011). Motivations to act can be discovered from these stories and an asset-mapping can be conducted. An asset-map should include tangible (i.e. parks, churches) and intangible (i.e. experiences, skills, knowledge, passions) resources from the community (GCPH,

2012). The mapping process is intended to increase knowledge, enhance new connections, relationships, and possibilities between individuals, and between individuals and organizations (GCPH, 2012). Regardless of the method employed to communicate risk, it should be channeled to increase empowerment within the community.

IV. Risk Behavior

Compared to episodic floods, human behavior related to the changes from sea level rise (often a chronic, long-term impact) remains largely unknown (Jurjonas et al, 2020; Khan et al, 2020; Bhattachan et al, 2018; Akerlof et al, 2017). Having an accurate perception of the risk does not always lead to or ensure effective prevention, mitigation, or defensive action (Morrow, 2009). Risk information needs to be followed with actionable guidance so people know how to act (Campbell et al, 2020). Actions and behaviors depend not only on how the risk is perceived but also by understanding how people make decisions about those risks. Morrow (2009) tells us the risk-decision process can be broken into four steps: perceiving the situation, considering possible courses of action, considering which is in your best interest, and taking action.

After the situation is perceived, people will assign a level of risk to decide if it is acceptable. According to the expected value theory, benefits and costs need to be analyzed to decide which scenario is the most acceptable option. Often, the chosen option will be the one that has more benefits.

Underserved and underrepresented communities experience numerous challenges that can affect their ability to respond to climate change hazards such as sea level rise. These challenges may include language and cultural barriers, lack of knowledge of the hazard, limited social networks, access to fewer resources, marginalization, and inadequate familiarity with local organizational structures that provide disaster support (Miller-Hesed et al, 2020; Cleetus et al, 2015; Miller-Hesed and Paolisso, 2015; Douglas et al, 2012). A combination of these barriers can limit a community's ability to respond to a hazard. Past experiences can increase the capacity to address coastal hazards through traditional knowledge however, sea level rise is still a novel phenomenon for many communities.

i. Cultural Risk Theory and Traditional Knowledge

Established in 1983 by anthropologist Mary Douglas and Wildavsky, the Cultural Risk Theory emphasizes the importance of the cultural context in which risk perceptions are formed. The human sense of belonging is often tied to cultural adherence and social learning. Culture risk theory aims to explain how involuntary decisions are made based upon surroundings associated with different ethnicities (Mullins and Soetanto, 2013; Morrow, 2009). Furthermore, cultural

values can influence how people respond to climate change, and the likelihood of a pro-action behavior (Mullins and Soetanto, 2013).

Communities are often their own experts, residents know what is needed and how to care for themselves and for others in the community (Egland and Kelley, 2020). Land attachment, cultural traditions, historical identity, and local heritage are often key factors that can motivate community capacity building. Indigenous societies and rural communities have experienced changing and extreme climates for generations and possess valuable knowledge about an environmental change that is well embedded in cultural, social, and subsistence systems (Mercer et al. 2008). Experiential community knowledge is a valuable tool for developing the most effective ways to mitigate the potential effects of sea level rise and flooding (Jurgonas et al, 2020; Perez and Egan, 2016). Although cultural and social influences are not the only determinants for risk behavior they do play an important role. Experiential and traditional knowledge within these communities need to be respected and should be used when addressing risk factors and communication.

V. Risk Communication

Risk communication is broadly understood as an iterative exchange of information among individuals, groups, and institutions related to the assessment, characterization, and management of risk (McComas, 2006). The information and the process of communication are both vital in communicating climate change risk. While the public can perceive climate change as occurring, many people are still unclear about causes and solutions, and, in many cases, see the effects as distant in time (Covi and Kain, 2015; IPCC, 2014). Sea level rise communication, just like climate change communication, can be challenging due to the intangible nature of the phenomenon (Khan et al, 2020; Covi and Kain, 2015). It is hard to communicate a low probability weather event, but it is even harder to communicate an “invisible” climate effect such as sea level rise, even if the impacts may be catastrophic (Akerlof et al, 2017; Covi and Kain, 2015). Often, coastal communities do not have communication and/or engagement tools available to help their residents understand the threat of sea level rise (Akerlof et al, 2017). Underserved populations are often hard to reach due to the lack of systematic relationships between the government and these communities (GCC, 2020; Cleetus et al, 2015). Risk communicators need to bridge the gaps between the scientific and public understanding of risk and provide a process to address the concerns of both parties (Covi and Kain, 2015). Adrienne Hollis, an environmental justice expert, states that when working with frontline communities, the most important guideline to follow is that communities should speak for themselves (Stovicek, 2019). Historically, frontline communities have not been granted a space where they can share their opinions and knowledge on sea level rise (Stovicek, 2019). Frontline communities need to have a word on what they have first-hand experienced. Despite reporting high levels of environmental and sea level rise concerns, underserved groups are often perceived as least concerned in environmental threats by large segments of the US public (Egland and Kelley, 2020; Pearson et al, 2018). Climate change and environmental knowledge often come from personal experiences, observations, and research (Khan et al, 2020; Plate et al, 2020; Miller-Hesed and Paolisso, 2015). Community members have useful information that can help improve the site characterization and the knowledge of the community’s needs, they have lived in the region for generations and they know their land (Egland and Kelley, 2020). Those who suffer the greatest consequences of climate change are often those with the greatest lived knowledge, yet their perspectives are frequently undervalued. (Vickery and Hunter, 2016).

i. Communication Mediums

Climate change and sea level rise information can be very technical and difficult to interpret for people that are not familiar with the subject, causing misunderstanding and misinterpretation. Although some studies support the use of charts, graphs, and maps to communicate sea level rise (Plate et al, 2020; Akerlof et al, 2017), these studies were not focused on frontline communities and did not take into account cultural and educational factors that influence the effectiveness of these communication tools. Campbell et al. (2020) determined that among marginalized populations maps and graphs are less intuitive and impactful and that overall community members prefer photographs and illustrations. Visuals that are local, place-based and familiar help change the idea that climate change is a distant phenomenon and also facilitate audience participation (Akerlof et al, 2017; Barisky, 2015). Wadey et al (2015) reported increased engagement and concern in sea level rise effects using visualization tools such as coastal flooding simulations. Research within the community can help identify communication preferences and trusted sources. For example, different studies (Moser, 2009; Plate et al, 2020) found TV meteorologists are often viewed as trusted sources and play a large role in the decision-making process. Age may also be a factor in the preferred method of accessing resources for adaptation. Current means of information distribution used by government and non-government agencies rely on radio, television, newspapers, and the internet. The use of the internet in underserved communities has increased in recent years, this tool could increase the chances of reaching them (Campbell et al, 2020; GCC, 2020). Nonetheless, special attention needs to be taken when using the internet as a way to communicate risk since many residents do not have access to internet services or are not familiar with the use of this non-traditional method.

a. Social Media

In recent years social media has emerged as an important risk communication tool. Government agencies have used internet-based applications as an effective method for the sharing of formal and informal sources of information including flooding advisories and resources to diverse audiences (Feldman et al, 2016). Instagram, Twitter, Facebook, and other social media platforms play an important role in risk communication for preparedness, response, and recovery (US Homeland Security, 2018). It is notable that in this environment false

information can be spread rapidly, but social media is also a nimble tool that allows for quick, informal responses as compared to a traditional press release. Some federal agencies in recent years have used social media to debunk rumors and clarify false information (US Homeland Security, 2018). Although the use of social media to communicate climate hazards has been increasing (NAACP, 2019; EPA, 2016; Feldman et al, 2016), not everyone has access to reliable internet and/or social media for various reasons, therefore, social media should not be the only method used to communicate or engage with the public.

ii. Community-Based Engagement

Risks are shared and experienced collectively within communities. People often look for help, guidance, and information from their social networks and may rely more on these networks rather than official communication (Harvatt et al, 2011; Meredith et al, 2008). Interaction with the community can help smooth risk communication processes. Community-based adaptations to climate change use a bottom-up approach to ensure that implementation strategies consider communities' needs (Plate et al, 2020). The process of community-based engagement should be based on and guided by the needs, knowledge, and capacities of communities to people to plan for and adapt to sea level rise impacts (Khan et al, 2020).

Reaching frontline communities where they are located is important in effective risk communication. People from underserved communities are less likely to attend state or local meetings because of the lack of advance notice, transportation, childcare, and limited time off. It is therefore essential for risk communicators and outreach professionals to engage at the local community level (GCC, 2020). Examples of community engagement efforts include workshops, focus groups, meetings, and online forums. One strategy for promoting engagement is to emphasize small group discussions and interaction, community members may feel intimidated in large public meetings with formal discussions (EPA, 2016). Group work encourages participants to remain engaged and promotes collaboration (Jurgonas and Seekamp, 2018; Plate et al, 2020).

a. Tailoring Messages for Underserved Populations

When working with underserved communities it is crucial to tailor messages to the specific communities' needs, priorities, and knowledge level on sea level rise. Tailoring messages to each community is resource-intensive and many government agencies are not

trained in messaging for specific populations (Meredith et al, 2008). Communicators should use non-technical information, as highly technical information can lead to misunderstandings and difficulties in the trust-building process (Campbell et al, 2020; NAACP, 2019; Meredith et al, 2008). Even within the same community, messages may need to be tailored. For example, messaging for older adults or people who may not speak English may be needed (Meredith et al 2008).

In the recent past, government agencies have tried to be more thoughtful in their communication and engagement programs with underserved communities (FEMA, 2019; EPA, 2016). While the Environment Protection Agency (EPA) spreads disaster information in different languages and formats, underserved populations have reported difficulties in accessing appropriate information, services, and support (FEMA, 2019; Miller-Hesed and Paolisso, 2015; EPA, 2013; Rowel et al, 2012). In January 2019, the Federal Emergency Management Agency (FEMA) created the “Building Cultures of Preparedness: A report for the emergency management higher education community.” The document follows a bottom-up, culture-based approach and attempts to enhance levels of preparedness among individual households, communities, and various organizations outside the emergency management agency. The report proposes four guiding principles: 1) Developing trust by understanding the culture, context, and history of communities outside the context of disaster. 2) Bringing the cultural perspectives of all stakeholders to the table. 3) Acknowledging how the different stakeholders carry their own cultural norms and act with their own culturally embedded assumptions. 4) Supporting local practices around the ways people are already prepared and enhancing these efforts using culturally aware strategies. The report highlights good points such as the use of a bottom-up approach and the inclusion of local voices to the decision-making process but lacks information on long-term (chronic) weather events.

Designing guides to approach frontline communities with underserved populations does not necessarily require creating a new set of rules to communicate with, but rather adapting existing guides to include a particular community’s needs and knowledge level. An example of this is a guide prepared by the Natural Hazards Center at the University of Colorado Boulder to communicate the disaster life cycle across underserved populations. The goal of the guide is not to create a new set of rules to communicate with vulnerable populations but rather to prove that general, widely accepted rules for risk communication can be adapted and used for underserved

communities. This guide suggests the use of three overarching principles (Campbell et al, 2020):

1. Communicate through familiar and trusted messengers
2. Provide clear, actionable information
3. Tailor message and information pathways for target audiences

Methods for delivering risk messages include visual tools, social media, television, radio, newspapers, focus groups, workshops, and storytelling groups.

EPA is also aware of the importance, challenges, and differences in engaging with underserved populations. As a way to motivate other agencies to consider and incorporate environmental justice as part of their methodologies, the Federal Interagency Working Group on Environmental Justice and the NEPA Committee created the “Promising Practices for Environmental Justice Methodologies” (EPA, 2016). Although the report was not designed to serve as a formal guide, it does provide a series of recommendations through different categories to improve agency-community relationships. Recommendations include early engagement with the community, establishing community advisory committees, creating ways to receive inputs from residents, exploring non-traditional communication methods such as social media, online forums, and webinars, making information readily available, and encouraging communities to propose their own alternatives.

Also trying to address the challenges of translating complex climate science into policy and actions, Khan et al, (2020) created a framework called COREDAR (“Communicating Risk of Sea level Rise and Engaging Stakeholders in Framing Community-based Adaptation Strategies”). The authors propose a step by step “checklist” approach to communicating the complex science of sea level rise in a simplistic way that engages diverse stakeholders in urban and rural community-based engagement and decision-making processes. Steps in the checklist include, identifying vulnerable communities and stakeholders, communicating sea level rise risk, framing community-based adaptation strategies to sea level rise, and mainstreaming community-based adaptation strategies. Each one of the steps has its own data recording sheet to help guide the process and interpret the results.

| Step 5- Identifying vulnerable communities and stakeholders | | | | | |
|---|--|---|--|--|---|
| Name of the chosen vulnerable region of the urban coastal city to short-term SLR impact | Identifying and prioritizing stakeholders to the predicted impact ___m SLR | Name of the stakeholders and quantity numbers | Name of the chosen vulnerable region of the urban coastal city to long-term SLR impact | Identifying and prioritizing stakeholders to the predicted impact ___m SLR | Name of the stakeholders and quantity numbers |
| | <i>Key Stakeholders</i> | | | <i>Key stakeholders</i> | |
| | <i>Primary stakeholders</i> | | | <i>Primary stakeholders</i> | |
| | <i>Secondary stakeholders</i> | | | <i>Secondary stakeholders</i> | |
| | <i>Tertiary stakeholders</i> | | | <i>Tertiary stakeholders</i> | |

Figure 3. Example of the COREDAR checklist to identify communities and stakeholders within the community (Khan et al, 2020).

As stated by multiple authors (Campbell et al, 2020; GCC, 2020; FEMA, 2019, EPA, 2016; Barisky, 2015; Meredith et al, 2008) the step by step approach emphasizes the use of appropriate framing, compelling visuals, and accessible language to effectively communicate sea level rise, as well as the importance of engaging frontline communities in the planning process of appropriate adaptation strategies to sea level rise at the local level of the given coastal region

b. Inclusion of Local Voices

It is important to note that most current climate change communication plans do not address or consider the needs of frontline communities (GCC, 2020; Plate et al, 2020; California Coastal Commission, 2019). The Georgetown Climate Center (2020) advises that equity and resilience require investment in the implementation of programs and policies requested by communities. These programs should address climate change and sea level rise concerns and also, other daily challenges such as health, household, education, transportation, economic finances, and gentrification. The goal of involving communities is to facilitate information exchange and processes that enable communities to understand potential problems, evaluate future risks, identify reasonable options, and develop adaptation actions in response to changing environmental conditions (Moser and Ekstom, 2010). Enhancing self-determination and self-governance in frontline communities fosters education and empowers communities to take action against sea level rise hazards (Kehaulani Watson-Sproat, 2020).

A successful example of incorporating local voices in the decision-making process is the West Kaua‘i Community Vulnerability Assessment. The assessment was developed by the

University of Hawai‘i Sea Grant College Program and the Department of Urban and Regional Planning, and was completed with the help of the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) Process. The report presents profiles of assets, facilities, and resources identified by the community as management concerns. It describes vulnerability to three primary coastal hazards: coastal erosion, passive flooding, and annual high wave flooding. Through a series of workshops, community members, asset and resource managers engaged in dialogue about current and future weather and climate threats and summarized their specific local knowledge and experience about how the community could be impacted. These workshops were open to all members of the community. The use of the VCAPS process and the inclusion of local voices in the assessment led to a better understanding of the risks within the community. VCAPS is open source technology and freely available but it has some limitations. This is a time-consuming and labor-intensive process and trained facilitators are needed for its application. Many times underserved communities do not have the financial resources or time to do this, therefore, it is essential to plan a schedule and budget considering these factors.

Hiring someone from the community can also help establish community-agency relationships. Cultural brokers or community leaders are respected figures in the community with the ability to bridge gaps by bringing people together (GCC, 2020; Jurjonas et al, 2020; Plate et al, 2020; FEMA; 2019; Rowel et al, 2012). Recruiting these individuals can help outside organizations and local communities connect, build trust, and share knowledge (FEMA, 2019; Jurjonas and Seekamp, 2018). Traditional leaders, church leaders, youth and women’s group leaders, school teachers, and other influential figures can act as facilitators and ‘cultural translators’, educating others in the community about sea level rise by connecting scientific concepts with traditional and local knowledge (FEMA, 2019; Rowel et al, 2012). Characteristics of cultural brokers include knowledge, expertise, and leadership within the specific social group. These leaders can be typically identified by networking in the community (Campbell et al, 2020; Plate et al, 2020). The use of agreement contracts or memorandums of understanding is highly encouraged to avoid misunderstanding among all parties (Stovicek, 2019 and Rowel et al, 2012).

c. Incorporation of Local Practices

Often, decision-makers engage or communicate plans with the community when the process is almost completed. Trust and collaboration can be earned more readily when the community's opinions are considered in the decision-making process and when they are engaged starting at the beginning of the planning process (Campbell et al, 2020; Jurjonas et al, 2020; Khan et al, 2020; Plate et al, 2020; GCC, 2020; EPA, 2016; Covi and Kain, 2015; Hesed and Paolisso, 2015; Douglas et al, 2012; Morrow, 2008).

An article made in partnership with the First Nations Development Institute acknowledges the importance of incorporating local practices in the community engagement process (Kehaulani Watson-Sproat, 2020). The article suggests building community capacity by teaching and allowing communities to identify their own solutions to problems without relying on external resources. Providing jobs in the fields of natural and cultural resource management gives young people opportunities to partake in meaningful work in their own communities.

Youth and older adults are frequently harder to engage (Campbell et al, 2020). In order to increase youth population participation in climate change adaptation measures and to create connections between different age groups, researchers in the Solomon Islands organized a photo-film contest. In the photo film, the youth participants interviewed and recorded the elders talking about the changes they have seen, and advice for facing these changes, including local practices and techniques from the past (traditional knowledge) that they could pass on. The youth then took photos of their communities, and the things they thought best represented their life in order to complement the elder's story. The final film was shown at the Festival of Pacific Arts. This activity was received with enthusiasm and was a way to increase the youth's interest in climate change adaptation (Abernethy et al, 2012).



Figure 2. Youth from Saeraghi community interview elders about the changes they have witnessed. “I give some advice to the young people. We must look after the land and sea that belong to us, no matter if any climate changes that happen or not. We need to make sure everything is safe and secure for our communities.” (Abernethy et al, 2012)

Achieving environmental sustainability with frontline communities is only possible by restoring and maintaining ancestral places and practices (Kehaulani Watson-Sproat, 2020). Climate Justice communities across the U.S. frequently have had outsiders deplete their resources and commercialize their natural landscapes minimizing their incomes, services, and opportunities to focus on chronic issues as they are immersed moving from one emergency to the next. It is therefore essential to restore connections between residents and the natural resources to which they trace their genealogies (Kehaulani Watson-Sproat, 2020).

d. Partnerships with Local Organizations

Historically, in North Carolina, programmatic efforts in resilience have not engaged with organizations that interact day to day with frontline communities, such as public schools, social service, and healthcare providers, houses of worship, faith-based organizations, and public transit systems (NCDEQ, 2020). This finding is also supported by Rowel et al (2012), who found that grassroots organizations have largely remained an underutilized resource for state and local health departments and emergency management agencies. This is partly because of the lack of

pre-existing relationships with these organizations, as well as the lack of well-planned programs and agreements prior to emergency situations. To help address this challenge, the authors created “A Guide to Enhance Risk Communication Among Low-Income and Minority Populations”. This guide details principles to begin community engagement efforts including being clear about goals and objectives with the residents, gathering knowledge of the community's history (i.e. online articles, books, attending town-hall meetings, etc.), promoting self-efficacy, partnering with local organizations, and recognizing and respecting the community’s diversity.

Grassroots organizations have a long history of working with frontline communities and are more likely to understand the specific needs and challenges of these communities. The Greenlining Institute (2019) proposes the use of a community engagement plan to enhance communication with at-risk communities. The guide suggests that at a minimum, community engagement plans should include: a description of key stakeholders and local organizations serving in the area, a history of residents’ engagement, a clear timeline, a list of roles and responsibilities between the community and the communicators, a list with the residents’ needs and concerns, and information on how the public will remain informed.

Ethnic minorities are often socially and culturally bonded by worship and fellowship (Miller-Hesed and Paolisso, 2015; Douglas et al, 2012; Jurjonas et al, 2020). Religion plays an important role in many communities. A large number of Black and Hispanic communities attend church regularly or are connected to the church through family and friends (Miller-Hesed et al, 2020; NAACP, 2019; Miller-Hesed and Paolisso, 2015; Douglas et al, 2012). In the absence of trust in federal and state agencies, faith-based organizations like churches can provide important communication channels.

A study conducted in the Eastern Shore of the Chesapeake Bay showed that community members consistently rely on family and friends for information related to climate change impacts. The study emphasized the importance of the social and political isolation of three Black communities that prevented them from taking action on collaborative adaptation measures against flooding from sea level rise (Miller-Hesed and Paolisso, 2015). A follow-up study was conducted as a way to bridge the gap between rural Black communities with government agencies and by engaging faith-based communities in coastal resilience. Twelve members from churches in Maryland were recruited. Collaborative learning activities were tested through interviews, workshops, and community meetings. The study confirmed that collaborative

learning between churches and government increased the understanding of capacities and limitations in addressing environmental challenges, increased trust and social networks, expanded engagement with a greater diversity of stakeholders, increased opportunities for new conversations, and stakeholder empowerment. Limitations in this process were time and effort, specialized language, identifying common goals, grappling with the newness of climate change, and overcoming institutional barriers. The collaborative learning process overall improved trust between stakeholders and church members who expressed interest in continuing collaborations to address environmental challenges (Miller-Hesed et al, 2020).

iii. Trainings, Just Compensations, and Budgets

Research shows that training of individuals delivering risk messages can increase trust in stakeholders (GCC, 2020; EPA, 2016; Meredith et al, 2008). Multiple authors advise providing a base level training on equity and environmental justice for the project team involved in the risk communication and engagement project (GCC, 2020; California Coastal Commission, 2019; EPA, 2016). To achieve adequate training for agency staff, third-party consultants can help develop different skills to understand how to talk about racial equity and implement equity principles during community engagement and decision-making (GCC, 2020). Financial support for community members leading and participating in the community engagement processes is also suggested by others (GCC, 2020; Perez and Egan, 2017; Clark et al, 2007). Compensating community members for time and effort expended has been shown to increase the number of participants as well as the level of engagement in community-based events. For this reason, budgeting is a key element to ensure success in the process of risk communication and building community resilience. It is important to recognize that community participants bring their own set of expertise and experience to projects and that they should be compensated fairly for their contributions. Dedicated funding for underserved communities and chronic sea level rise projects can open doors for more equitable engagement and future community-driven efforts. Furthermore, community engagement projects should also be considered high priority in local, state, and federal government budgets at the outset of climate adaptation initiatives (GCC, 2020; Miller-Hesed et al, 2020). To give communities a voice in the decision-making process, the Georgetown Climate Center (2020) proposed the use of participatory budgeting processes where

residents have the opportunity to share how they would like to see funding spent in their neighborhoods.

VI. Best Practice Recommendations

Commonalities found in the review of different case studies, research papers, and past recommendation guides have resulted in “Best Practices Recommendations”. These recommendations reflect recent efforts that have been drawn upon to effectively connect and communicate with underserved frontline communities. It is important to note that all communities are different and therefore, further analysis is needed to address specific communities' needs and concerns. These recommendations are intended to serve as the first step towards communication and engagement. They provide an overview of actions and considerations intended to help NOAA funders and practitioners improve communication and engagement with underserved communities.

1. **Invest time getting to know the community.** Understanding the local context is a key step in the risk communication process (GCC, 2020; Campbell et al, 2020; The Greenlining Institute, 2019; Miller-Hesed and Paolisso, 2015; Douglas et al, 2012; Rowel et al, 2012). Risk communicators need to become educated about the target community’s culture, beliefs, norms, social networks, and languages. Learn the terminology the community is comfortable with and uses to refer to themselves. Also, communicators should learn and understand the community’s history, know details of their past relationships with federal agencies, and identify the community’s values and concerns related to sea level rise. Information about the community’s background needs to be known beforehand. It is not the responsibility of the community to educate risk communicators on their history. Communicators can look for this information through different sources like online resources, articles, and books. Communities may have participated in prior community-engagement processes that were not successful, creating feelings of exclusion.
 - a. Funders
 - i. Develop funding timelines and milestones that allow for this kind of work on the front end of project timelines.
 - ii. Build in time for collaborative project development and partnership with the community by allowing for longer funding application periods (i.e. the

time between opportunity announcement and proposal submission deadline).

- iii. Encourage background information on communities to be included in proposals and encourage partnership with organizations already working in the community.
- iv. Give extra weight to proposals that demonstrate a clear existing (preferably long-term) relationship with a community and in which community representatives play a leadership role.

2. **Engage and reach out to stakeholders.** Information gaps may originate from inadequate outreach. Outreach to build knowledge is critical in the risk communication and adaptation process (Jurjonas et al, 2020). Meeting with stakeholders in comfortable and familiar places can help address trust and cultural gaps (The Greenlining Institute, 2019). Risk communicators need to go to the communities, identify local leaders, and potential trusted spokespersons. Meet with community members at times and places that are convenient for them. Consider hiring a cultural broker from the community to lead the risk communication process as it can increase participants' trust as well as the success of the project (Jurjonas et al, 2020; Miller-Hesed et al, 2020; Rowel et al, 2012). Explain locally relevant and observable impacts, propose community-driven solutions, and stress the benefits of community engagement. Risk communicators need to resonate with the community's cultural practices and traditions (Kehaulani Watson-Sproat, 2020). Communicate with respect to pre-existing values and beliefs. Let the community speak and reveal their opinions, fears, and concerns. Use different tools to communicate sea level rise risk, from traditional methods such as low tech maps, simulations, videos, pamphlets, and newspapers, to non-traditional methods like storytelling, social media, webinars, and online meetings. Traditional communication methods like face-to-face and in-person outreach may be challenging in the COVID-19 era (GCC, 2020), therefore, the implementation of new non-traditional communication methods may be necessary. Encouraging stakeholders to express and share their first-hand experiences can help others engage in discussions.

- a. Funders

- i. Allow/encourage flexibility in the budget to support community member travel.
 - ii. Allow/encourage flexibility in the budget to support hiring members of the community to lead on-the-ground outreach/communication efforts and to provide honorarium to other community members dedicating time and effort to the project.
- 3. **Be honest and transparent.** Clarify and articulate the goals of the project and be clear about the promises and outcomes. Consider carefully the full impact of the project including potential negative consequences for the community. Keep the community informed throughout the whole process. As the project advances, make new information readily available to them. Creating a clear schedule with timelines, roles, and responsibilities is highly recommended. Accountability is crucial to build and maintain trust with communities (California Coastal Commission, 2019; USDN, 2017). Be honest about what you do not know and create an open space for audiences to share their opinions. Memorandums of understanding or agreement contracts that establish the relationship rules and responsibilities can be useful to make sure everyone is accountable from the beginning (Stovicek, 2019 and Rowel et al, 2012). Communication between stakeholders needs to be consistent, clear, and appropriate to their knowledge level.
 - a. Funders
 - i. This level of communication requires time; therefore, budget should be inclusive of someone whose purpose is to do this work.
 - ii. During the proposal process ask how these issues will be addressed/maintained.
- 4. **Empower the community.** Often government agencies inform communities about their decisions and plans, instead of engaging them as decision-makers in the project. Due to historical under-representation and segregation, it is crucial to incorporate these frontline communities in coastal planning decisions and projects that can have implications for their neighborhoods and families (California Coastal Commission, 2019). Government agencies need to act as facilitators rather than experts. Frontline communities are their

own experts and should be empowered to guide and have a meaningful role in the adaptation process. Be prepared to alter adaptation strategies and approaches based on community feedback. Celebrate the strengths and contributions of the community to build resilience. Provide people with actions they can take in their everyday lives to be part of the solution. As community members become more knowledgeable and empowered about sea level rise, they are more likely to advocate for solutions and play an important role in community-driven engagement. Empowerment of the community will increase people's sense of confidence, self-efficacy, and trust among other community members.

a. Funders

- i. Celebrate and acknowledge progress through awards - both accolades and fiscal.
- ii. Include implementation funding in risk communication/resilience awards intended for communities to enact solutions they have developed which will further increase people's sense of confidence, self-efficacy, and trust while providing concrete examples of change and solutions.
- iii. Provide flexibility for project activities and outputs to adapt to community feedback over the course of project implementation including flexibility to extend project timelines.

5. **Establish trust with a long-term investment.** Translating knowledge into actions as well as building trust and community relationships occurs over a long time period. Familiarity with agencies increases trust and accelerates the planning and implementation process. Timelines and budgets will vary for each community project, but federal and state agencies need to plan realistic timelines that ensure long-term commitment with the communities. Trust relationships also involve flexibility and adaptability to respond to the community's needs. Do not initiate a relationship with a new community if you are not prepared for the level of commitment required to maintain that relationship in the long-term.

a. Funders

- i. Support targeted efforts that may only build or maintain relationships with one community or neighborhood.

- ii. Fund long-term partnerships (i.e. 5 years or more) that allow for deeper partnership and the time needed to establish trust.
- iii. Allow for budgets with flexibility so that the project can adapt to meet the needs of the community as defined by the community.

6. **Evaluate the results.** Sharing lessons learned and evaluating the effectiveness of the risk communication process can improve future messaging efforts and opportunities to advance equity (GCC; 2020). Track impacts of communities over time and document any unresolved issues. There has previously been little formal evaluation for risk communication efforts with frontline communities (Jurjonas et al, 2020; Khan et al, 2020; Bhattachan et al, 2018; Akerlof et al, 2017; IPCC, 2014; Clark et al, 2007). Evaluation of risk communication programs and the impact of risk communication efforts are critical but systematic efforts are currently lacking (Meredith et al, 2008).

a. Funders

- i. Require formative and summative evaluations of risk communication projects.
- ii. Support sharing among communicators and evaluators so that findings can be translated to the broader sea level rise communication research, practice, and evaluation communities.

VII. Conclusion

This literature review highlights the need to address chronic sea level communication in a holistic and systematic way that integrates science with a community's needs and knowledge. Effective risk communication is a powerful tool to create more equitable policies, address inequality, and enhance community resilience (GCC, 2020; The Greenlining Institute, 2019; Moser, 2009). Often, risk communication efforts are compromised due to strict timelines, tight budgets and community-engagement challenges (Hesed et al, 2020; Plate et al, 2020; Cleetus et al, 2015; Meredith et al, 2008; Agyeman et al, 2007). As climate change and sea level rise impacts continue to accelerate, efforts need to be taken to prepare and protect the most at-risk communities. Former adaptation efforts have focused on top-down approaches with little attention to underserved communities and as a result, have failed to adequately communicate risk to these communities (Khan et al, 2020; Plate et al, 2020; FEMA, 2019). Investing in local leadership is considered essential to connect scientific knowledge with local ways to understand environmental behavior (GCC, 2020; Campbell et al, 2020; Kehaulani Watson-Sproat, 2020; FEMA, 2019; Rowel et al, 2012). Effective risk communication engagement requires the government and communities to work together as equal partners. **The community should guide the process, providing expertise and vision from and for their neighborhoods, while the government provides scientific and technical expertise as well as implementation support.** True change requires continuous action. Building trust with communities takes a long time and should be approached with sensitivity. Short-term engagement cannot solve all inequalities but is an important step to relationship-building between frontline residents and risk communicators (GCC, 2020).

Although coastal risk management practices address chronic sea level rise, there is a focus on acute water levels extremes such as storms and extreme weather events (Khan et al, 2020; Akerlof et al, 2017; Covi and Kain, 2015). Public opinion on sea level rise is still in the early stages of development across the globe (Khan et al, 2020; Jurjonas et al, 2020; Bhattachan et al, 2018; IPCC, 2014). There is a growing body of literature exploring the issues of risk communication for underserved populations, but there is still a need for research addressing the gap between theory and practice. Multiple authors and agencies (Campbell et al, 2020; GCC, 2020; Khan 2020; FEMA, 2019), recognize that there is no "one size fits all" approach for communicating risk and ensuring equity. Each community is different, therefore each requires a

unique approach. Risk communication strategies should be flexible and require adaptation for each community's needs and priorities.

It is important to learn from the past. The 2020 protests for racial justice and police reforms are a reminder of the structural racism that exists in government institutions resulting in large social inequities. If social and climate injustices are not fully addressed, racism is very likely to prevail (Hardy et al, 2017). Sea level rise adaptation should encompass equity in the whole process, from risk assessment and decision-making to planning, implementation, monitoring, and evaluation. An equitable process will include community engagement needs in all the steps of the adaptation process. Frontline communities have tried for decades to speak to politicians, policymakers, and environmental organizations with past failed encounters affecting their willingness to share personal experiences with sea level rise related flooding. Investments in these communities require a long-term commitment to healing the pain originated from a legacy of injustices.

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IX. Appendix

Glossary

Language describing minority groups can be challenging as terms are constantly evolving over the course of time. Words used in this paper try to be respectful and inclusive with minority groups by going beyond the denotation (literal definition) and also considering the connotation (feeling invoked by a word in an audience). Terms defined in this section are intended to clarify and for a better understanding of the context in which they are used.

Black people

Recognizing that not all persons trace their lineage to the African continent, for this paper the word Black with a capital B is used. Black persons are described in this paper as a group of individuals having dark pigmented skin. The term is used when referring to groups in racial, ethnic, or cultural terms. Ultimately, it is highly recommended to ask the communities what is their preferred term to refer to them.

Frontline communities

Frontline communities are defined as communities that experience “first and worst” the consequences of climate change (Holland, 2017). Although not all frontline communities are necessarily underserved; the frontline communities highlighted in this paper were selected due to their high percentage of underserved populations. Underserved populations can be communities of color, tribal nations, low-income communities, and other minority communities that experience systemic oppression and are overburdened with climate change consequences. For the sake of this project, the terms of climate justice communities, special communities, marginalized communities, and underserved communities are used interchangeably with frontline communities. As mentioned before in the paper, it is highly recommended to learn and allow communities to use their preferred terminology to refer to themselves.

Environmental Racism

The disproportionate and intentional impact of environmental hazards on low-income and minority populations. Can be manifested through policies, rules, and regulations that benefit some populations (often white communities) while abandoning others (Milman, 2018; Hardy et al, 2017). Placement of communities in locally unwanted land uses (i.e. toxic waste dumps, incinerators, factories, fossil fuels storages), the lack of green spaces and the exclusion of

underserved populations from the leadership of the environmental decision-making process are only a few examples of environmental racism.

Government agencies

Refer to all level (federal, state, and local) government agencies including NOAA.

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