TRANSLATING SCIENCE TO POLICY IN PLANNING FOR SEA-LEVEL RISE AND STORM SURGE

Monroe County, Florida with a focus on Islamorada, Village of Islands

A Report by the South Florida Regional Planning Council
Funded by the Gulf of Mexico Alliance and the National Oceanic and Atmospheric Administration
In Partnership with Monroe County and Islamorada, Village of Islands

SFRPC
South Florida Regional Planning Council

GULF OF MEXICO ALLIANCE

ISLAMORADA VILLAGE OF ISLANDS

MONROE COUNTY

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ACKNOWLEDGEMENTS

Gulf of Mexico Alliance

Laura Bowie, Executive Director
Tracie Sempier, PhD, Regional Program Manager

South Florida Regional Planning Council

Isabel Cosio Carballo, Executive Director
Alyssa Jones Wood, Project Manager
Keren Bolter, PhD, Co-Project Manager
Vince Edwards, Data Analyst
Kathe Lerch, Administrative Assistant
Shanna Haley, Intern
Jenna Slade, Intern

Project Communities

Seth Lawless, Islamorada Village Manager
Cheryl Cioffari, Islamorada Immediate Past Director of Planning
Sheila Denoncourt, Islamorada Chief Building Official
Mary Swaney, Assistant to Islamorada Village Manager
Rhonda Haag, Monroe County Sustainability Director

This publication was funded by a National Oceanic and Atmospheric Administration (NOAA) Cooperative Grant provided through the Gulf of Mexico Alliance

Completed August 2018

Table of Contents

EXECUTIVE SUMMARY

Monroe County, colloquially referred to as "The Florida Keys" or "The Keys" is a chain of islands between the Atlantic Ocean and the Gulf of Mexico is located at the southern tip of Florida. This community is characterized by heavy scenic tourism, deeply rooted locals, and the essence of the Caribbean. This document provides a summary of a vulnerability assessment done to investigate the compound risk of sea-level rise and Hurricane Category 1 storm surge in Monroe County, specifically Islamorada, Village of Islands (Islamorada/Village). Additionally, this document provides a list of recommended adaptation actions for the Village of Islamorada to reduce risk and loss from flooding.

Throughout the course of this study, the strongest hurricane ever recorded in the Atlantic brewed to the size of the state and made landfall in the United States as a Category 3 hurricane in Cudjoe Key in Monroe County. At the point of this report's publication, county-wide hurricane recovery is still underway. A tropical archipelago with no barrier islands, Monroe County is consistently vulnerable to natural hazards such as tidal flooding, hurricanes, tropical storms/depressions, and more recently- sea-level rise and other implications of global climate change.

Hurricane Irma

INTRODUCTION

This study investigates the intersection of accelerated sea-level rise and storm surge. Specifically, it aims to re-define the present and future expansion of the Coastal High Hazard Area in Monroe County and Islamorada. The Coastal High Hazard Area (CHHA) is defined by Section 163.3177(6)(a)10.a., Florida Statutes as "the area below the elevation of the Category 1 storm surge line as established

by Sea, Lake, and overland Surges from Hurricanes (SLOSH)[1] computerized storm surge model. Local governments are required to designate the CHHA on their Future Land Use Maps series and limit public expenditures that subsidize development within the CHHA.

BACKGROUND

Hurricanes pose a substantial threat to Florida's coastal communities. Sea-level rise (SLR) will increase storm surge height and development in these high-risk areas will intensify storm surge exposure. Mitigating and adapting to these growing coastal hazards requires the incorporation of resilience into all aspects of local government, from land use planning to infrastructure improvements.

In 2014, Islamorada underwent a vulnerability assessment titled Islamorada Matters which entailed an intensive multifaceted analysis, including a community resilience self-assessment. The South Florida Regional Planning Council (SFRPC) and Gulf of Mexico Alliance (GOMA) study described here, builds on the work of Islamorada Matters by adding the compounding risk factor of storm surge[2] to vulnerabilities to SLR. Driven by best-available Light Detecting and Ranging (LiDAR) data and newly released storm surge data (NOAA, 2016), the SFRPC re-defines the Coastal High Hazard Area and predicts its future expansion with SLR.

Monroe County has undergone a number of vulnerability assessments including the County's "GreenKeys!" and Monroe County's inclusion with in the Southeast Florida Regional Climate Change Compact's "Analysis of the Vulnerability of Southeast Florida to Sea Level Rise."

[1] A computerized model run by the National Hurricane Center (NHC) to estimate storm surge heights and winds resulting from historical, hypothetical, or predicted hurricanes by taking into account pressure, size, forward speed, track, and winds.

[2] Water that is pushed toward the shore by the force of the winds swirling around the storm. The advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more.

Sea-Level Rise

King Tide in Monroe County
Photo Credit: The Blue Paper

SLR in South Florida manifests itself prominently via extreme tides, elevated storm surge, and water tables exceeding ground elevations in low-lying areas. While presently infrequent, these impacts cause transportation delays, compromised drainage, property damage, erosion, complications to regional water supplies, habitat degradation, and an array of other costs and inconveniences. During the 2015 king tide, neighborhoods in Key Largo were inundated for more than three weeks. This caused damage to resident's homes, cars, businesses, and peace of mind. In the Florida Keys, flooding can isolate homes and communities from services and basic conveniences as the entire archipelago is connected by one main highway.

The Southeast Florida Regional Climate Change Compact (Compact), which is made up of Palm Beach, Broward, Miami-Dade, and Monroe Counties, reached consensus regarding a unified SLR projection for their region in 2015 (Figure 1). The Compact estimates approximately 1 foot of SLR by 2040 and at least 2 feet by 2060[3]. These two scenarios (2040 & 2060) are utilized throughout this study.

Monroe County can tell the story of rising seas better than most places, as about 90% of the County's land mass is at 5 feet or less above sea level (Nature Conservancy, 2017). The property value of land at or below 5 feet elevation is about $27 billion, with 56,000 residents and 76,000 acres are impacted (Nature Conservancy, 2017). Between 1913 and 2006, the Key West tide gauge measured 9 inches of SLR.

[3] These projections are in reference to the1992 mean sea levels, which globally have already risen almost 3 inches in 2015.

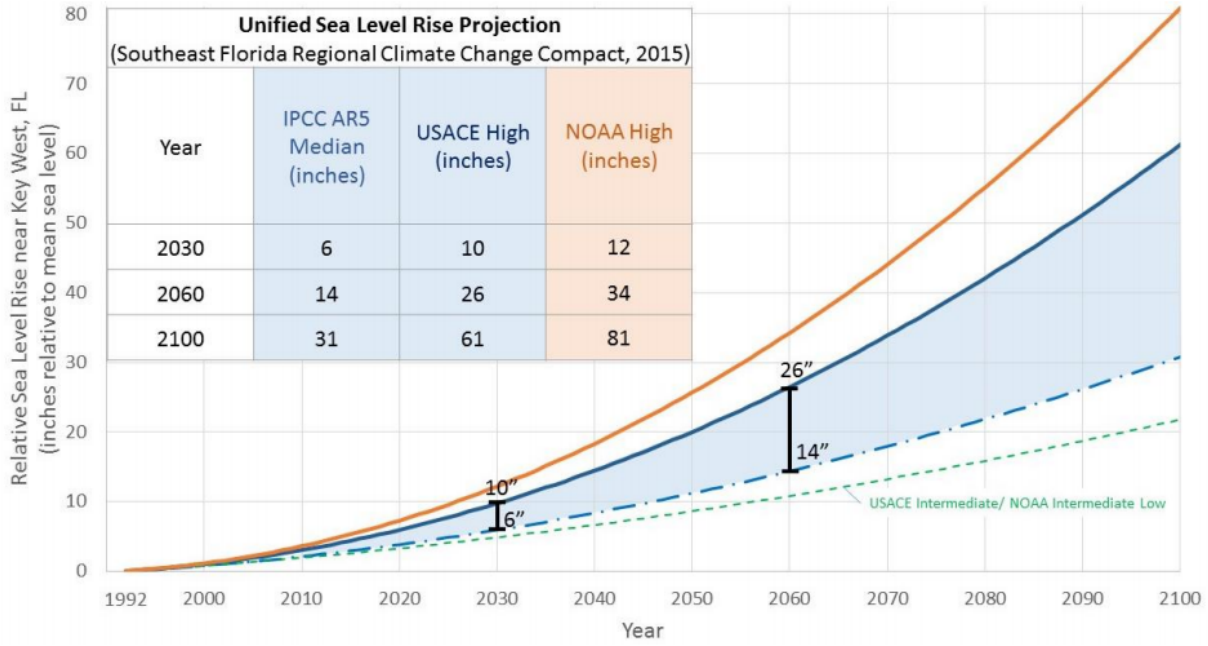


Figure 1: Unified Sea-Level Rise Projection of the Southeast Florida Regional Climate Change Compact (2015).

Hurricane Risk

Monroe County is highly sensitive to Hurricane exposure. Between the 1960's and late 2000's, Monroe County was hit by more hurricanes than any other coastal county (Wilson & Fischetti, 2010). In fact, one of Islamorada's tourist attractions is the Hurricane Monument. This limestone monument was unveiled in 1937 to commemorate the estimated 485 civilian and veteran lives lost in the 1935 Labor Day hurricane.

The Hurricane Monument in Islamorada

As anthropogenic climate change continues, experts estimate that hurricanes will increase in intensity and duration and be potentially harder to track (National Climate Assessment, 2014). If the 2017 hurricane season is any indication of what's to come (stronger and longer lasting storms with less predictable trajectories), the time is now to build capacity to be resilient in the face of these risks.

Purpose of the Study

The results of this research identify inundation for a Category 1 hurricane at current sea levels, as well as how the CHHA expands alongside two future high SLR scenarios as defined by the Compact for 2040 and 2060. This study provides insights and information to develop new policy recommendations when addressing SLR and storm surge in the years to come, including a focus on incentivizing resilience with the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS) Program.

Study Area

This study analyzed Monroe County, focusing on the Florida Keys with an in-depth analysis on Islamorada, Village of Islands. The Florida Keys are a chain of about 1,7000 islands beginning at Soldier Key, south of Biscayne Bay, and extending southwest toward Key West, and ending at the Dry Tortugas.

Monroe County has a population of 75,901 people, with about 20% of the population being 65 or older. From 2000 to 2010, the population of Monroe County has decreased by about 6,500 people. Property value below 3 feet in Monroe County totals about $5.6 billion (Climate Central, 2017).

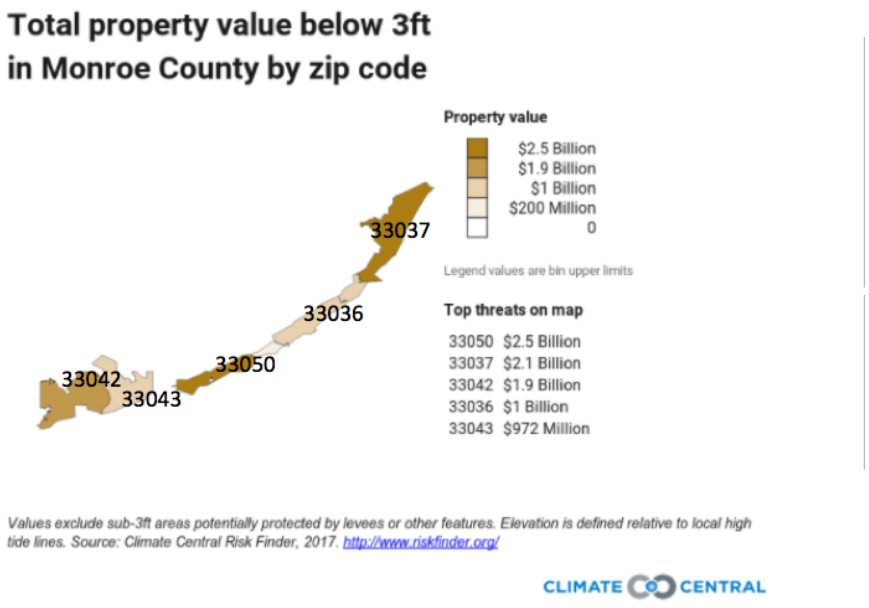


Figure 2: Property Value below 3 feet in Monroe County (Climate Central, 2017)

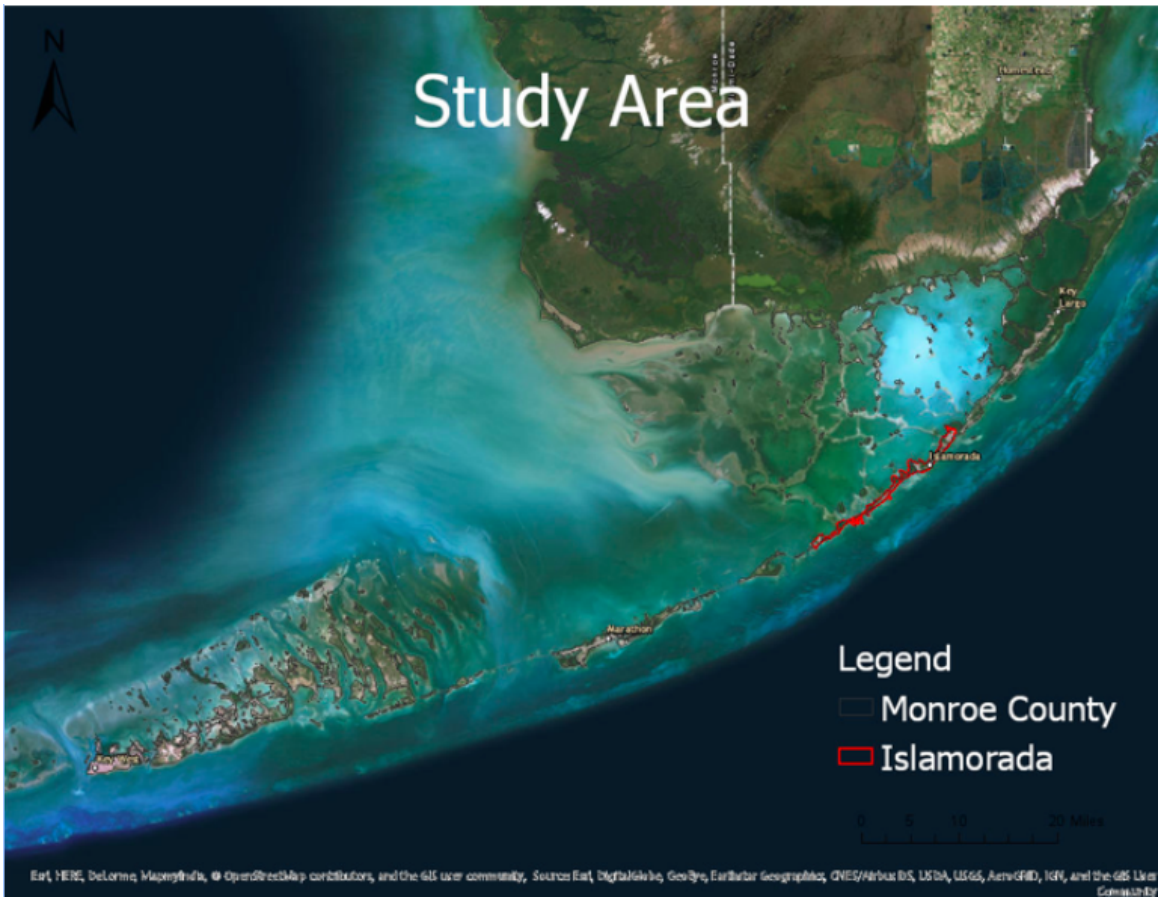


Figure 3: Study Area

The main focus of this study is on Islamorada, Village of Islands. Islamorada has a population of 6,386 people with 39.32 miles of paved roads and right-of-ways (Islamorada Matters, 2014). Islamorada also holds 5,038 homes and 2,102 businesses (Islamorada Matters, 2014). There are 50 miles of shoreline, 28.9 acres of geological sites, and 105 acres of parks (Islamorada Matters, 2014). The elevation for Islamorada differs drastically in some areas,

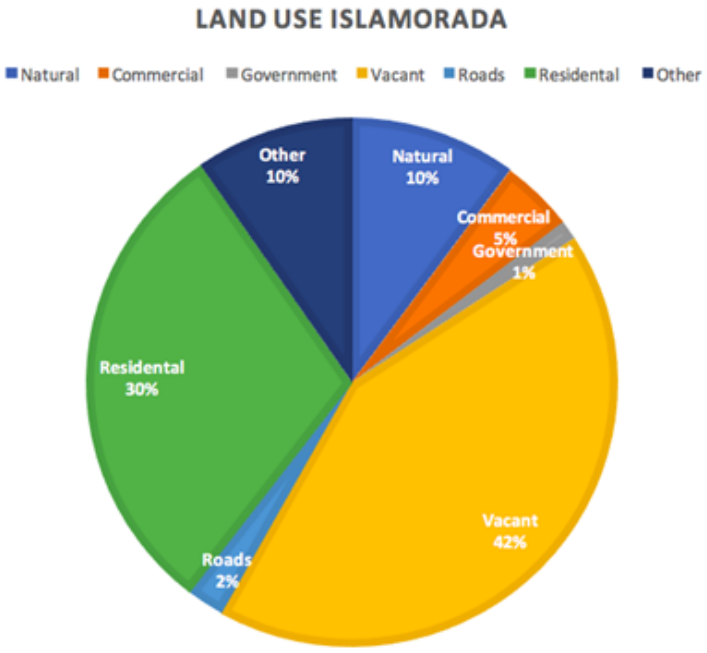


Figure 4: Land Use in Islamorada (FDOT, nd)

with some elevations less than 1 foot above sea level while the majority ranges from 3-6 feet. Approximately 42% of Islamorada's land use is vacant parcels (Figure 4).

Islamorada Mobile Home Park Post-Irma

Monroe County reports that, countywide, 1,179 homes were destroyed by Hurricane Irma (August 2017), and another 2,977 homes and 55,000 housing units suffered major damage. Monroe County's affordable housing- mobile homes- were especially hard-hit with 666 destroyed and 378 suffering major damage. Countless hotels, restaurants, businesses, and shops were also damaged or destroyed. Given that Monroe County's economy is dependent on tourism, and thus service industry jobs, this loss of workforce housing and places of employment has extreme implications on the overall economy of the County. County-wide, the median gross rent in 2016 was $1,689. Monthly per capita income is $3,863.75.

Online Webtool for the Study

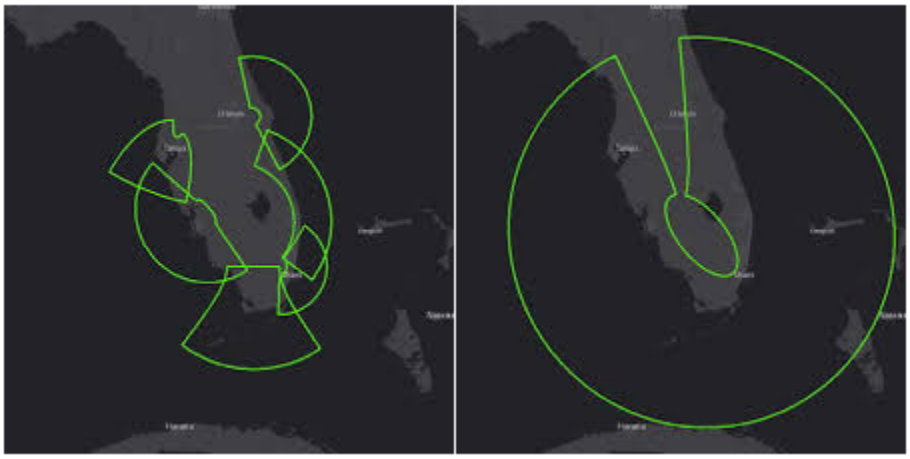
This study accompanies a ESRI Online StoryMap which can be found at https://arcg.is/1b0Oq0e. This interactive tool allows interested parties to view the expanded CHHA results at address-level specificity.

METHODS

This study takes a mixed method approach to provide context to the data-driven modeling results through stakeholder engagement and key informant interviews. This research model allows us to define the quantitative spatial boundaries of risk and the qualitative, social perceptions of risk.

Quantitative

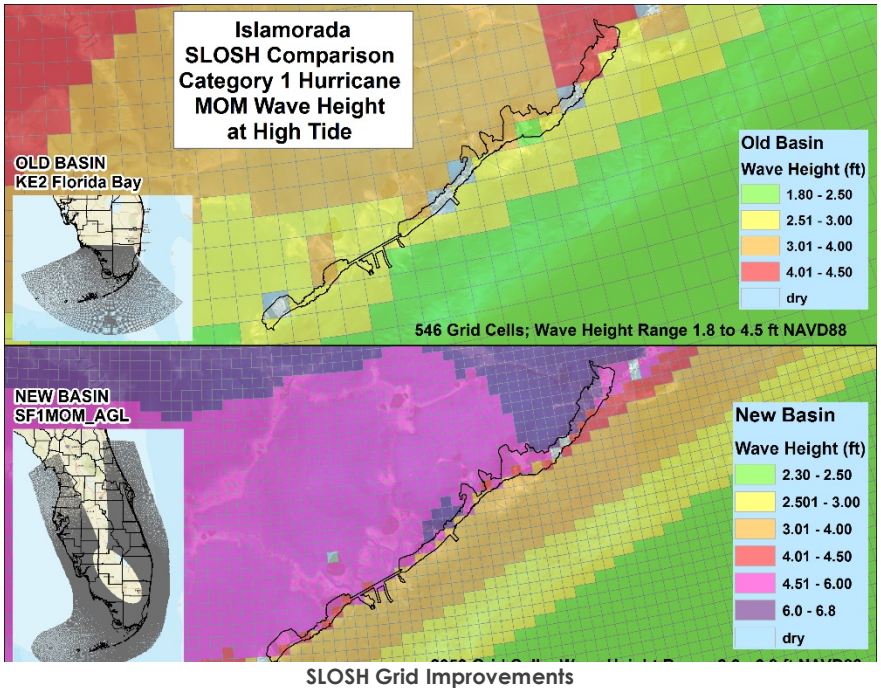
In order to provide crucial information on the results of SLR to storm surge, a GIS analysis was used with LiDAR data for elevation, current sea levels, and projections for 2 SLR scenarios for 2040 and 2060, and data from the new SLOSH super basin. This method follows the National Oceanic and Atmospheric Administration's Mapping Coastal Inundation methods.



South Florida SLOSH Basins

Prior to 2016, South Florida's SLOSH model was composed of 6 separate basins which overlapped and created data problems (above left). In 2016, the National Oceanic and Atmospheric Administration National Hurricane Center (NOAA) released a new SLOSH "Superbasin" for South Florida (above right). Not only did the new Superbasin allow for data to flow without interruption from overlapping basins, but it also increased resolution and took into consideration the buffering effects of mangrove habitats.

Even with the improvements in SLOSH grid resolution, the grids can still be up to half a mile in length and width. The grid needs a single value for surge height assigned to each cell, thus the grid cell must be transformed into points before the SLOSH data can be compared to the LiDAR data. The



SLOSH Grid Improvements

SLOSH cells were converted to points by using the "feature to point" tool. Cells that were assigned a value of 99.9 are "dry", meaning the surge height in this area is zero, and the cells were removed. To smooth out the surface, the "Spline" tool was used to interpolate the points.

After interpolating the points, the data was then ready to be compared to LiDAR elevations to determine inundated areas. This was done by using the raster calculator, which subtracts the LiDAR DEM from the interpolated surface.

This method produced a raster layer representing the inundated areas. Areas containing a positive value (including zero) represented areas inundated by water. Areas containing a negative value indicate that the land elevation is higher than the surge height, and therefore the land is dry. This "wet" raster layer was then converted to polygons, using the raster to polygon tool, to depict the areas inundated by storm surge.

Qualitative

Interview requests were sent to twenty-five individuals, with a positive response rate of 16%. These requests were sent to individuals identified as key stakeholders within the following sectors of the Islamorada community: Retail, Resort/Hospitality, Real Estate, Construction, Chamber of Commerce, Social Services, Non-Profit, Charter Boat/Ecotourism, Environmental Education, Senior Living, and local Government (elected and staff members). Participants include: Cheryl Cioffari (Islamorada's immediate past Director of Planning), Sheila Denoncourt (Islamorada's Chief Building Official), James Mooney (Village Councilman and immediate past Mayor of Islamorada), and Chris Sante (Mayor of Islamorada).

An interview instrument was developed following extensive research into vulnerability to natural hazards. The instrument split ten questions into sections focusing on the components of vulnerability: exposure, sensitivity, and adaptive capacity. Participants were informed that their responses could be kept confidential if they so desired and that the goal of the interview was to determine the social vulnerability of Islamorada. Furthermore, they were informed that the social vulnerability (ascertained through their interviews) would be paired with the spatial vulnerability as determined through SLOSH modeling, and thus a more robust understanding of Islamorada's vulnerability to storm surge and SLR.

Interviews had an average duration of 50 minutes and were done over the telephone. In depth, but not verbatim, transcripts were taken during the course of the phone call. Those transcripts were reviewed immediately afterword to correct punctuation or typing errors.

Analysis of transcripts was done via "Grounded Theory" (Charmaz, 2006). Grounded theory is a qualitative method of analysis done through a process of constant comparison of three sets of codes assigned to the data (Punch, 2014). The coding process includes open coding, axial coding, and selective coding which results in apparent theories associated with the data (Punch, 2014). This analysis was done through the use of NVIVO 11 Pro software, as is commonly used for similar qualitative inquires. This method was selected due to the project manager's expertise in the method and its application throughout many social science questions regarding environmental conditions, perceived risk, and ecosystem services.

RESULTS

Monroe County Modeling

The Lower Keys have a lower than average elevation, with most sitting around 5 feet. The lower elevations make the Lower Keys more vulnerable to storm surge, with most of the islands being inundated from storm surge at current sea levels. However, Key West, with a maximum elevation of 18 feet, sees little effects at current sea levels and does not become impacted from storm surge until there is at least 2 feet of SLR.

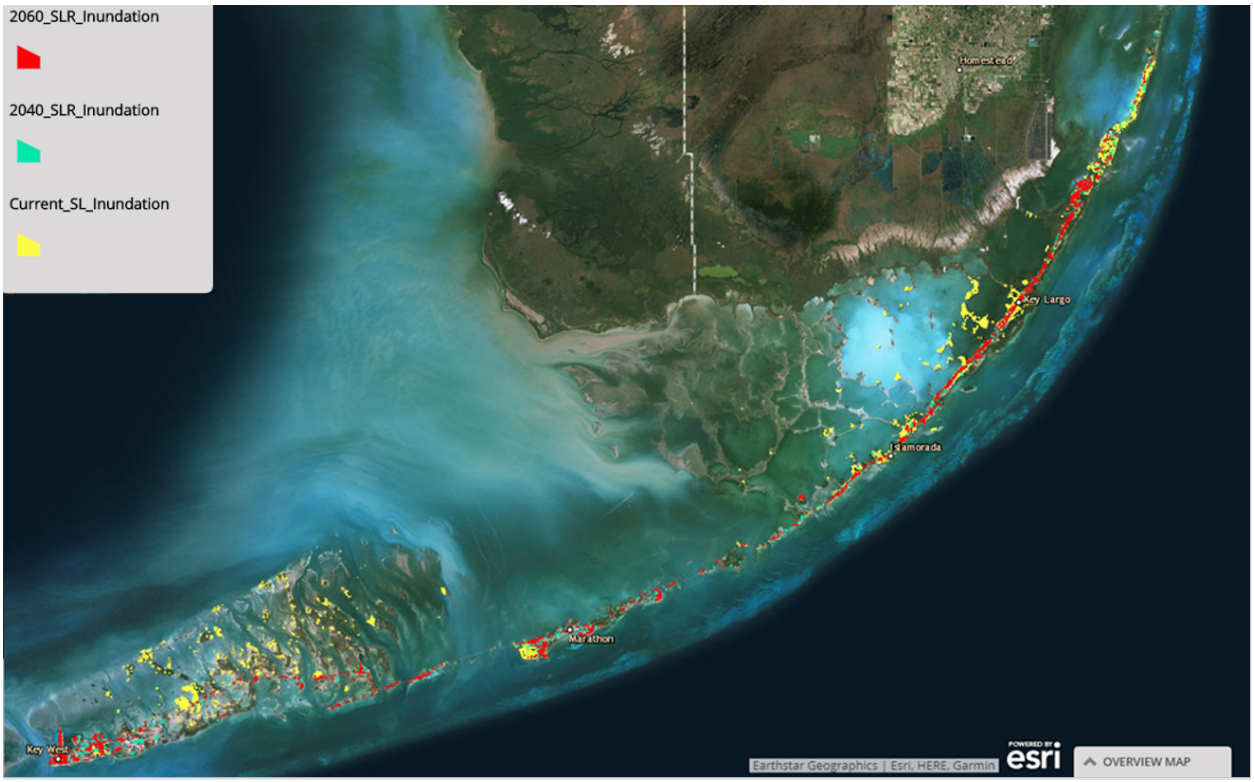


Figure 5: Monroe County Results

The Upper Keys, having a higher average elevation, feel the effects of sea-level rise more gradually. As the sea levels rise, the areas inundated slowly grow with a tipping point between 1 and 2 feet of SLR.

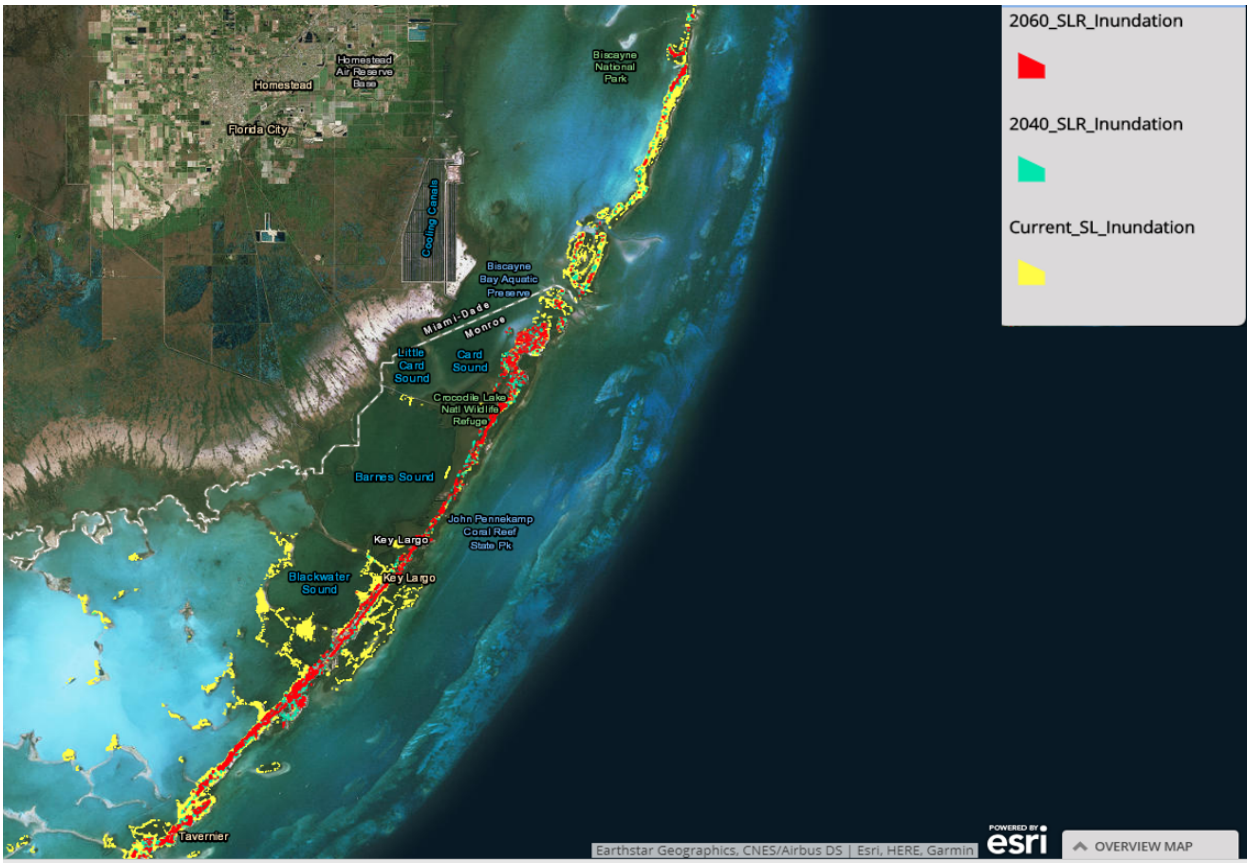


Figure 6: Key Largo and Tavernier

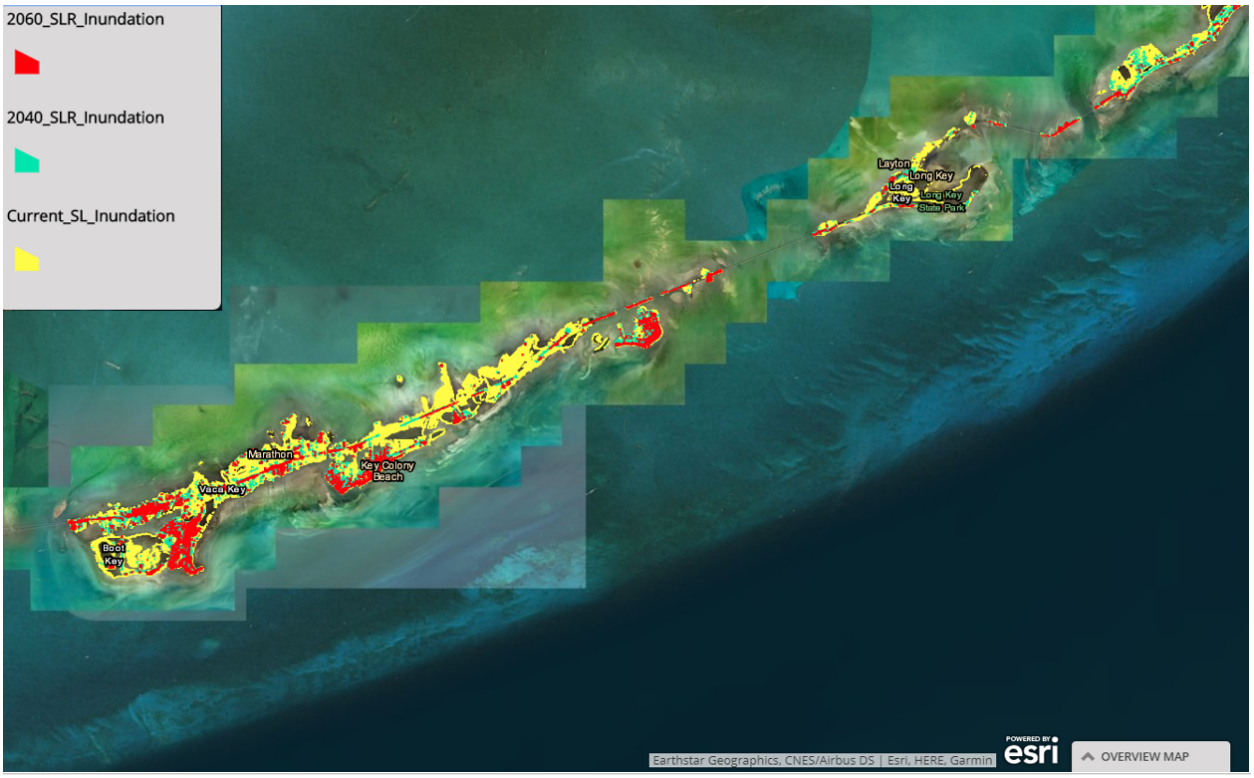


Figure 7: Middle Keys

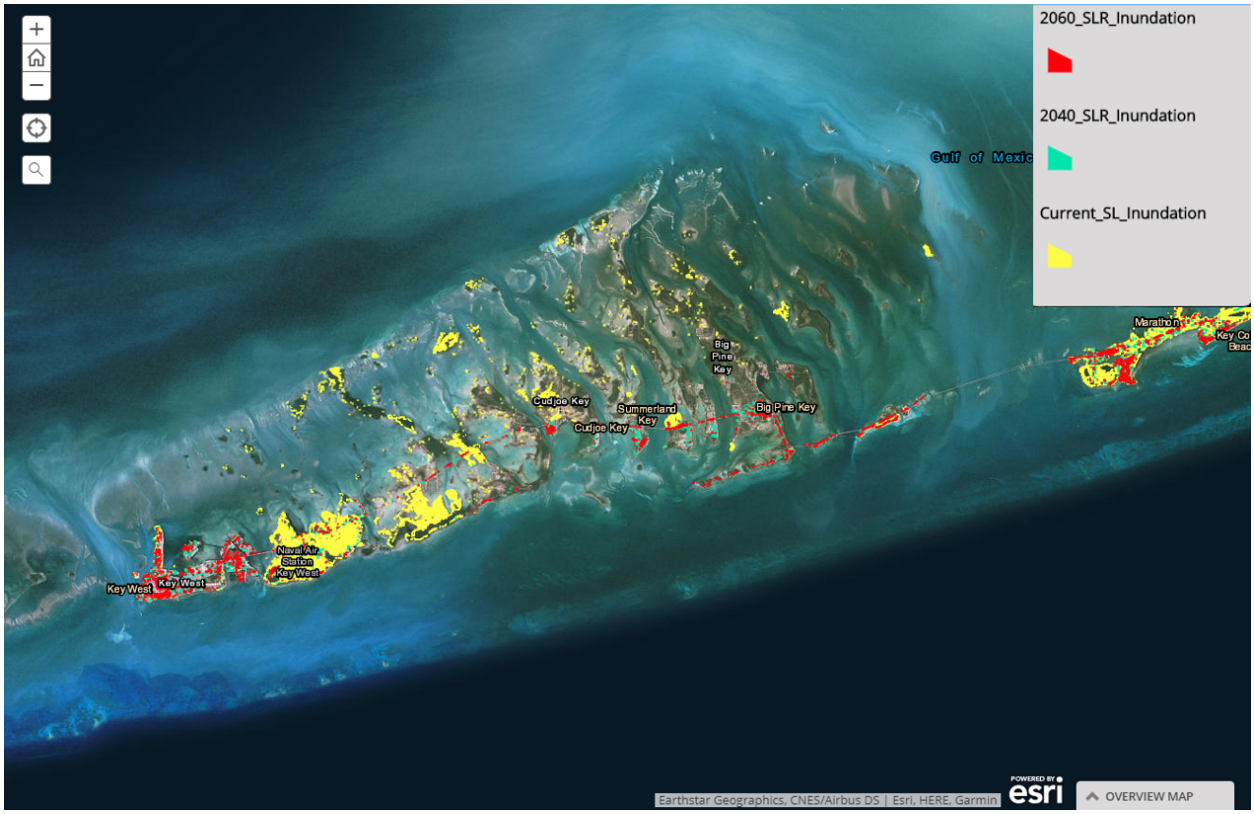


Figure 8: Lower Keys

These results show that there is a tipping point between 1 and 2 feet of sea-level rise. There is minimal change between current sea levels storm surge inundation and 1 foot of SLR inundation. There is a drastic change between 1 foot of SLR and 2 feet of SLR.

Islamorada Modeling

As the sea levels increase, so does the CHHA. Higher storm surge occurs with wide, gently sloping continental shelves, while lower storm surge occurs with narrow, steeply sloping shelves.

Along the Gulf Coast, areas are particularly vulnerable to storm surge because the ocean floor gradually deepens offshore. Islamorada's Gulf Coast has a mean surge value of 5.1feet for a Category 1 hurricane. While the Atlantic side of Islamorada has a steeper shelf, and storm surge is not as high. The Atlantic side has an average storm surge value of 3.3 feet for a Category 1 hurricane.

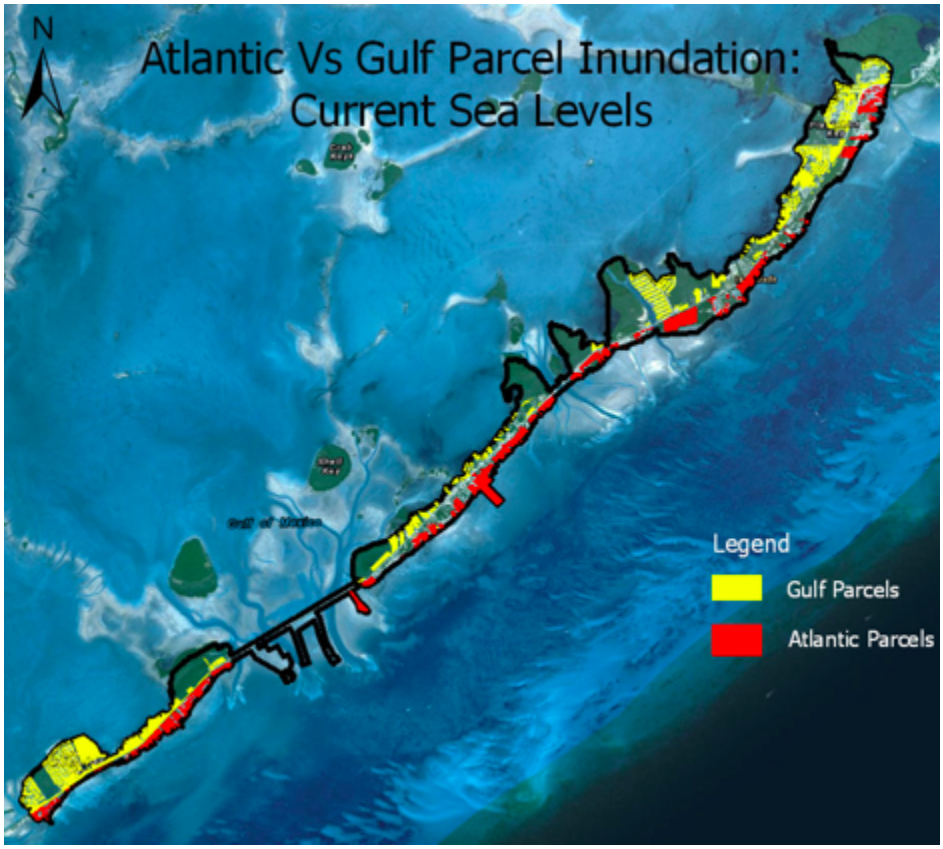


Figure 9: Islamorada Parcels Inundated under Current Sea Level CHHA

The Gulf of Mexico side of Islamorada has 3,625 parcels with a mean elevation greater than 1 foot and 2,695 parcels with elevations less than 5.1 feet. The

Atlantic Ocean side of Islamorada has 1,605 parcels with a mean elevation greater than 1 foot and 668 parcels with mean elevations less than 3.3 feet.

A Category 1 storm that produces an average storm surge of 5.1 feet Gulf side and 3.3 feet Atlantic side will inundate 50% of Islamorada's parcels.

With only 2 feet of SLR, the residents of Islamorada are extremely susceptible to inundation from a Category 1 hurricane. There is a large increase in the land inundated between the 2040 1-foot rise and the 2060 2 feet rise. While these results are extreme, they provide further evidence for the need to expand the CHHA in Islamorada and to prepare for the expansion of it in the years to come.

Qualitative

The interviews resulted in 339 unique codes. Six selective codes emerged: Preferred Adaptation Options, Persistence in High-Risk Areas, Obstacles to Adaptation, Identifying Sensitive Assets and Populations, Community Depends on Environment for Tourism, and Prioritizing Storm and Flood Resistant Affordable Housing as Resilience.

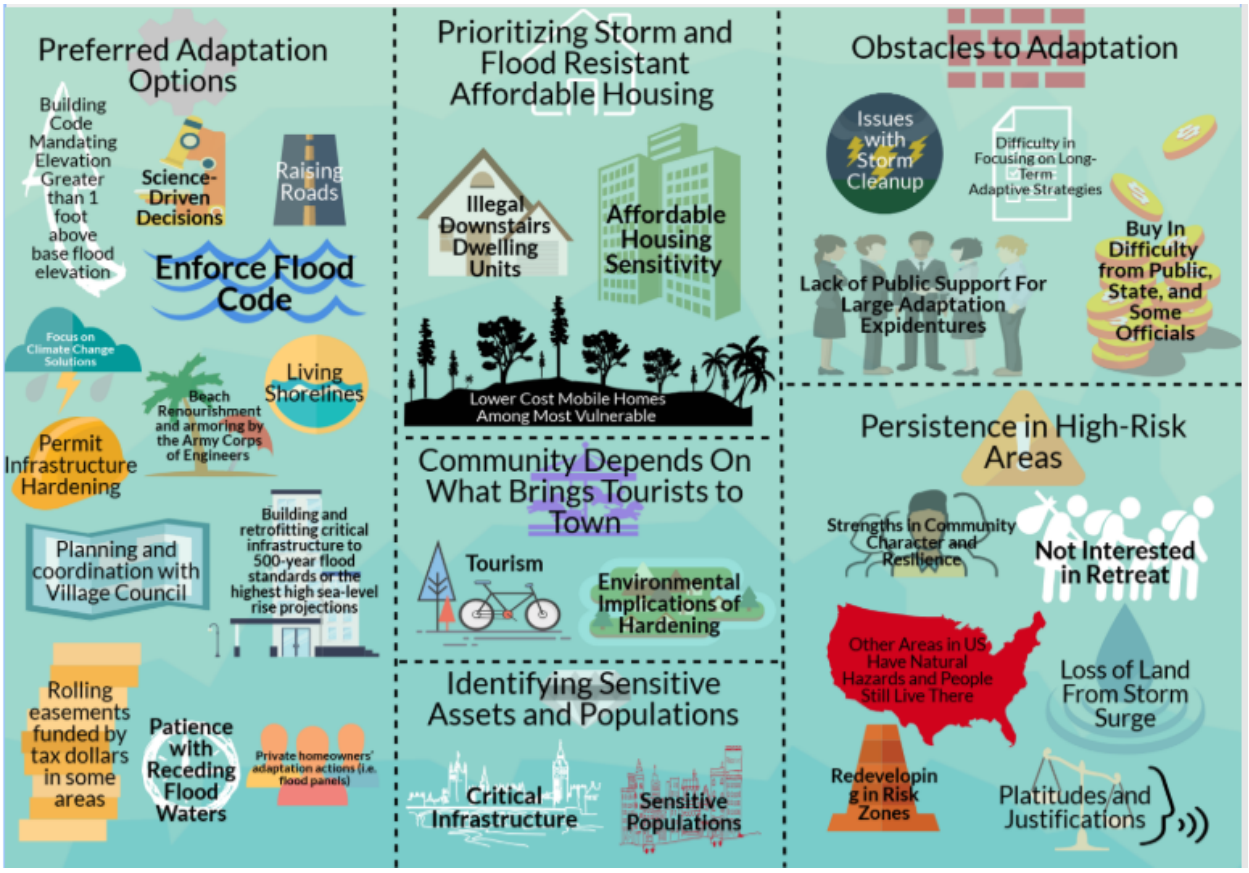


Figure 10: Qualitative Results Visualized

The most mentioned adaptation option across all interviews was mandating that building codes require building elevations greater than 1 foot above base flood elevation, followed by actions taken by private homeowners. Both hardening infrastructure and green infrastructure options were discussed as valuable adaptation opportunities. Currently, Islamorada's Comprehensive Plan and associated codes do not permit hardening of coastal infrastructure nor dredging of the "backcountry" (Gulf side), both of which were mentioned by more than one participant as a necessary and effective adaptation action.

By in large, the participants are rooted in place and are unwilling to consider retreat from the Florida Keys as a viable option. Instead, participants noted that property values have not lowered due to risk or storm damage, living with the water and risk of flooding is part of the Keys' culture, and that Islamorada is forced to continue re-developing in areas impacted by storm surge or flooding because "high risk areas are anywhere with a coast." In fact, one participant noted that they would be happy to park their car in Homestead (an hour's drive by car) and drive a boat to their home which they would equip with bio-composting toilets and a reverse osmosis system if it meant they still can live in Islamorada. The culture of the Keys regarding storm, flood, and sea-level rise risks is that of "bring it on" as participants stated. Participants stated that they believe its "human nature" to challenge adversity rather than accept defeat. In fact, participants noted that the only tipping point for remaining in the Keys, despite the risks, is the eventual removal of Flood Insurance in the area.

Participants identified obstacles as a general unwillingness to pay for long-term, expensive, public adaptation options that they themselves would not see the benefit of. Additionally, these obstacles include a need for more buy-in from elected officials, a small sector of the public and Village staff who deny climate change is occurring, and issues associated with illegal dumping and removal of native plans following storm damage events.

Special attention was paid to sensitive populations, primarily the working poor who support tourism within Islamorada. According to the participants, these individuals live in "illegal" downstairs apartments and in mobile homes which are largely not compliant with flood requirements. In addition, Village staff wished to bring attention to outdoor laborers, specifically day laborers and landscapers, who would suffer from extreme heat as a product of global climate change. Participants expressed concern regarding the working-class residents who support the local tourism economy through service industry jobs.

Participants listed parts of the community which they consider to be critical infrastructure which should be prioritized in the aftermath of a storm or flood event and also in adaptation: beaches, electric service, fire rescue, grocery stores, hospitals, resorts, affordable housing, roads, schools, wastewater management,

freshwater resources, and sewer systems. Aspects of this list which are not usually listed as critical infrastructure illustrate the unique tourism-based economy in Islamorada. Without resorts, beaches, and workforce housing the Village cannot survive. In the words of Islamorada's Mayor James Mooney, "without tourists there are not enough of us [local residents] to sustain the businesses that exist." The results of this qualitative inquiry were used in the site inspection shown below. Participants expressed a desire to fortify these aspects of local infrastructure to the highest level possible, be that a 500-year flood by FEMA standards or the Highest Sea-Level Rise projection.

The selective "prioritizing storm and flood resistant affordable housing as resilience" emerged through extensive comment regarding the damage mobile home parks and illegal downstairs apartments suffered from Hurricane Irma. All participants agreed that Islamorada is in need of flood code compliant affordable housing options. However, many participants noted that Islamorada doesn't have the land area to provide the necessary amount of affordable housing. In efforts to become more resilient to storm surge and sea-level rise, elevated and code compliant affordable housing must be prioritized along with the fortification of other critical infrastructure.

Site Inspections

The Project Manager carried out site inspections of areas projected to be inundated by the expanded CHHA in March 2018. A map and associated pictures of locations can be found here.

Social Vulnerability

Including both spatial and social vulnerability in vulnerability assessments is a best practice. In 2003, Susan Cutter developed the Social Vulnerability Index (SoVI) which is utilized by the Federal Emergency Management Administration, the Center for Disease Control, and the Florida Department of Health among other agencies. The SoVI Index utilizes 30 socioeconomic variables, provided by the U.S. Census Bureau, which have been shown to impact a community's ability to prepare, respond, and recover from a variety of environmental hazards, including natural hazards such as flooding. Figure 11 shows Islamorada's SoVI score by census tract.

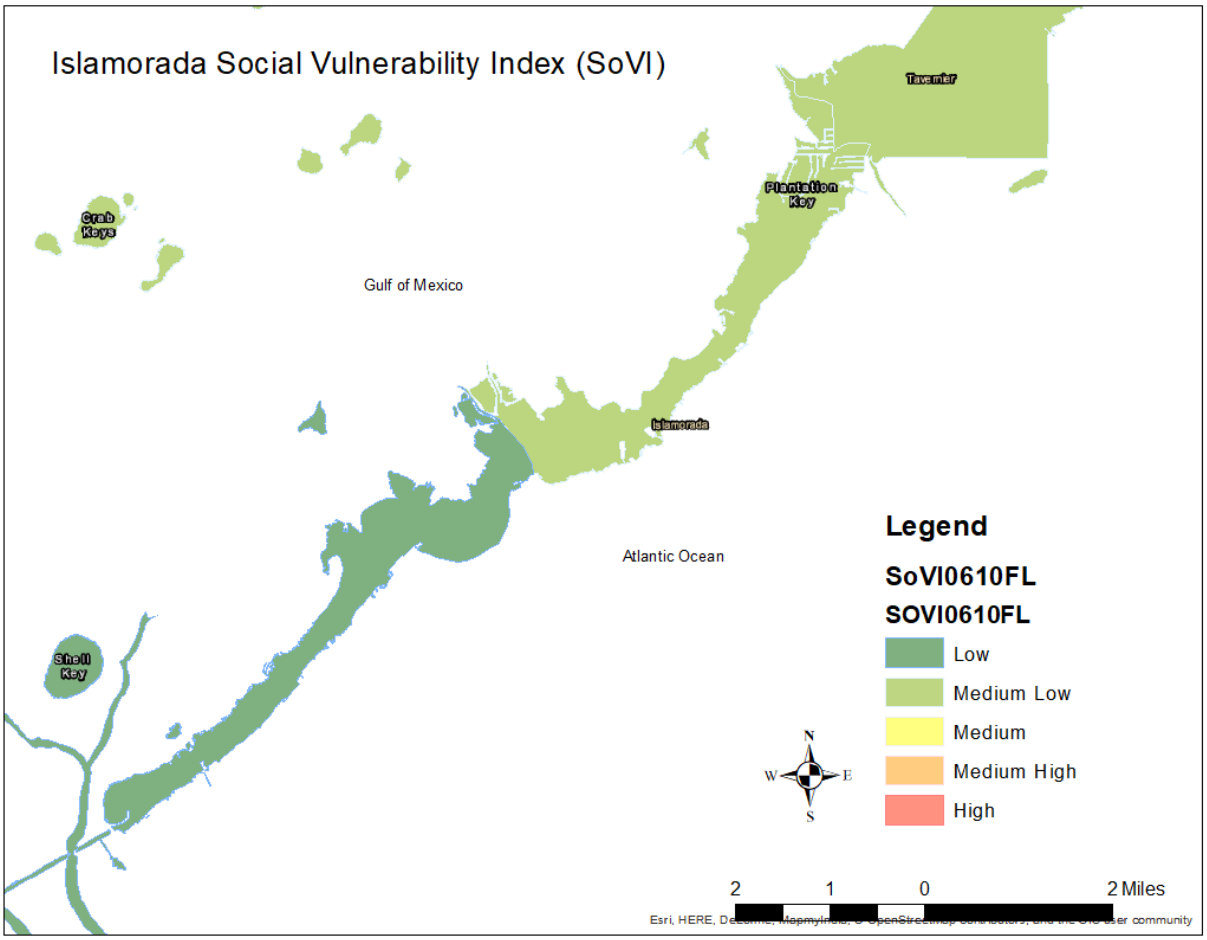


Figure 11: Social Vulnerability of Islamorada by Census Tracts (SoVI 2006-2010 Florida)

Workshop

On March 8, 2018 the SFRPC, in partnership with the Village of Islamorada, hosted a "Community Resilience Workshop" which was open to the public. This workshop focused on communicating SLR and storm surge risks to local leaders and residents. The goal of the workshop was for community members to build capacity to be resilient to future risks. Monroe County Mayor David Rice introduced the day's discussion by connecting future risks with the risks overcome by early Monroe County settlers. Following the introduction were presentations by Dr. Keren Bolter (Arcadis), Leah Stockton (United Way of the Florida Keys), Vicki Boguszewski (Yogi in Ya Public Health Consultant), Chris Bergh (The Nature Conservancy), and Elmira Leto (Samuel's House). Patxi Pastor, of the Celebration of the Sea Foundation and Keysstrong.org, then convened a panel discussion which focused on increasing Islamorada's resiliency to SLR and storm surge. An audience of over 50 individuals attended including community leaders, elected officials, municipal staff, non-profit professionals, and the general-public.

Video of the workshop, meeting agenda, and notes can be found on the interactive web portal.

DISCUSSION

As Mayor Rice alluded to, the Monroe County area has persevered amidst natural disasters for almost 200 years. Today, facing unprecedented and uncertain risks from SLR, the community is provided with an opportunity to take proactive steps to thrive.

Participants identified an unwillingness to pay for adaptation when the results won't be realized within their lifetime. Even though adaptation can cost a tremendous amount of tax-payer money, the cost of inaction is higher. A report from the National Institute of Building Sciences found that for every $1 spent on disaster resilience, society saves $6. Furthermore, a recent study done by the Union of Concerned Scientists estimates that 1,497 homes, valued at approximately $1.08 billion within Islamorada's 33036 zip code will be inundated by chronic nuisance flooding by 2060 according to NOAA's High Projection of 2 feet SLR. According to 2010 Census counts, this is 26% of the housing units in Islamorada. These inundated properties are projected to put $10.4 million of property taxes at risk. If these chronically inundated homes become abandoned physically and financially, Islamorada is at risk of losing 33% of taxable real property value for its budget. With available ad valorem taxes projected to decrease with chronic flooding, the time is now to invest in Islamorada's resilience and claim the 1:6 return on investment.

The results from our interviews and workshop are clear that Islamorada residents do not accept retreat as a viable option. Participants noted that the only conceivable tipping point in favor of retreat would be the loss of the subsidized National Flood Insurance Program (NFIP). Regardless, Islamorada has taken proactive steps to establish a Conservation Easement Program in 2005, placing 71 properties into the Program and starting the managed retreat of 8.98 acres. Investing in this adaptation measure maximizes co-benefits provided by natural infrastructure in a nature-based tourism locale. Very few places in the United States have established a Conservation Easement Program as an adaptation measure, mostly due to fear of takings issues. Islamorada, on the other hand, has been successful in maintaining this Program for over a decade.

The data displayed in this report speaks for itself and identifies a hazard tipping point of 2 feet of SLR. Socially, the tipping point has been identified as the loss of NFIP. With the persistence to stay amidst certain and uncertain risks, time is of the essence to fund adaptive capital improvements, develop differently, and educate residents of the risks related to SLR and storm surge.

RECOMMENDATIONS

Planning and Policy

This report supports the recommendations made in Islamorada Matters. Provided below are the supplementary recommendations:

Timeline of Policy Recommendations

2019

- Increase Freeboard
- Expand existing coastal defenses
- Review Hazardous Waste Facilities
- Begin employee and elected official climate literacy training

2020

- Prioritize stormwater parks
- Push for Lower Matecumbe Conservation Easements
- +20% Capital Improvement Funding to armor critical infrastructure
- Draft a Post-Disaster Redevelopment Plan
- AAA Overlay
- Designate Lower Matecumbe an AAA
- Incorporate LID into building and landscape code

2021

- Work with FDOT to elevate and improve drainage of roadways on Lower Matecumbe Key
- Employ bioswales, flow-through planters, etc on local roadways
- Establish 50 year planning horizon with 2060 SLR projection
- Partner with FDEP to review solid waste facilities and their elevation certificates
- Amend Comprehensive Plan for Peril of Flood

2022

- Put all existing Village owned wetland into a Land Trust
- Begin coordination with Monroe County to expand the Land Trust
- Contract carbon finance experts to earn income from land trust management

2023

- Review work done thus far
- Continue to build acreage of Land Trust and properties under Conservation Easement

2024

- Attain accreditation for the Land Trust via Land Trust Accreditation Commission
- Revisit public attitudes and priorities related to Avoid, Protect, Accommodate, and Retreat strategies

By end of FY2019

- Amend the Village Code of Ordinances Chapter 6, Article II to include an additional 3 feet of freeboard required for new buildings.
- Expand existing natural coastal defenses on undeveloped land which are shown to be inundated by SLR and storm surge (Appendix A).
- Order the immediate review of any hazardous waste facility (transfer station, debris staging areas, businesses with registered underground storage tanks, or other potential sources of hazardous waste) within projected inundation area or areas flooded within the past 5 years to ensure seepage has not occurred and the waste is contained as mandated by the Florida Department of Environmental Protection (FDEP) (Appendix A).
- Begin employee and elected official climate change literacy training which will be a required part of onboarding for future employees. Examples or models for this training include: US Global Change Research Program's "The Essential Principles of Climate Literacy, "US Forest Service "Climate Change Science and Modeling" module, and US EPA "Climate Change Adaptation Introductory Training."
- Prioritize the inclusion of Lower Matecumbe in the Conservation Easement Program.

By end of FY2020

- Prioritize the expansion of high quality native habitats and/or stormwater parks in Village owned parcels of land which are modeled to be inundated (Appendix A). Do this via conservation easements and engagement with environmental scientists and/or local groups such as the Nature Conservancy.
- Focus conservation easements in present-day and future CHHA areas. Within those areas, focus on Native Residential zoned properties.
- Create an "Adaptation Action Area" overlay zone composed of the projected expansion of the CHHA. This zone will be associated with larger coastal setbacks than previously required for all new development, increased elevation requirement above Base Flood Elevation (BFE), and the strong incentivization of resilient affordable housing within any major project within the overlay zone.
- Update the Capital Improvement Element of the Village's Comprehensive Plan to incorporate an increase of at least 20% more funding for the armoring of critical facilities (e.g. water/sewer, electric grid, healthcare facilities, telecommunications infrastructure, schools, and social services) which are projected to be inundated. Carry out these improvements within a 10-year time frame.
- Draft a Post-Disaster Redevelopment Plan which includes SLR as a hazard and is in coordination with the Monroe County Post-Disaster Redevelopment Plan (PDRP). Ensure that the hospitality and tourism industry is included as stakeholders in the PDRP process, among other stakeholders.

- Update the Stormwater Master Plan to include this study's results.
- Designate all of Lower Matecumbe as an Adaptation Action Area.
- Incorporate Low Impact Development site design techniques into building and landscape code.
- Institute a resident marine debris education program focusing on debris around properties which would become marine debris in the event of storm surge or flooding.
- Re-run the Sea-level Rise Affecting Marshes Model (SLAMM) with any new data to estimate impacts or changes to habitats.

By end of FY2021

- Work with Florida Department of Transportation, District 6 Emergency Management Office to identify potential funding to elevate and improve drainage of roadways on Lower Matecumbe which are frequently washed out in storm events.
- Employ urban design stormwater management best practices such as bioswales, flow-through-planters, pervious strips, and pervious roadway materials for improved drainage on local roadways.
- Establish a 50-year planning horizon in the Capital Improvement Element which is situated within the 2060 SLR Scenario or other best available data.
- Partner with FDEP to order a review of the solid waste facilities within the Village and their elevation certificate versus SLR and storm surge. Ensure that these facilities are protected from inundation and storm surge.
- Amend the Coastal Management Element of the Comprehensive Plan to reflect risks modeled in this work and the requirements set forth in Peril of Flood law.

By end of FY2022

- Put all existing Village owned mangrove or wetland habitat into a Land Trust (Florida Keys Coastal Land Trust). The Land Trust shall ensure that the existing coastal defenses are not developed nor hindered by nearby shoreline hardening.
- Begin coordination with Monroe County and other municipalities to expand the Florida Keys Coastal Land Trust to other locations throughout the county.
- Contract work with carbon finance experts, like those at Tierra Resources or Finite Carbon, to earn income from Land Trust Management to further conservation goals and fund the Land Trust.

By end of FY2024

- Attain Accreditation for the Florida Keys Coastal Land Trust via Land Trust Accreditation Commission.

Adaptive Capacity

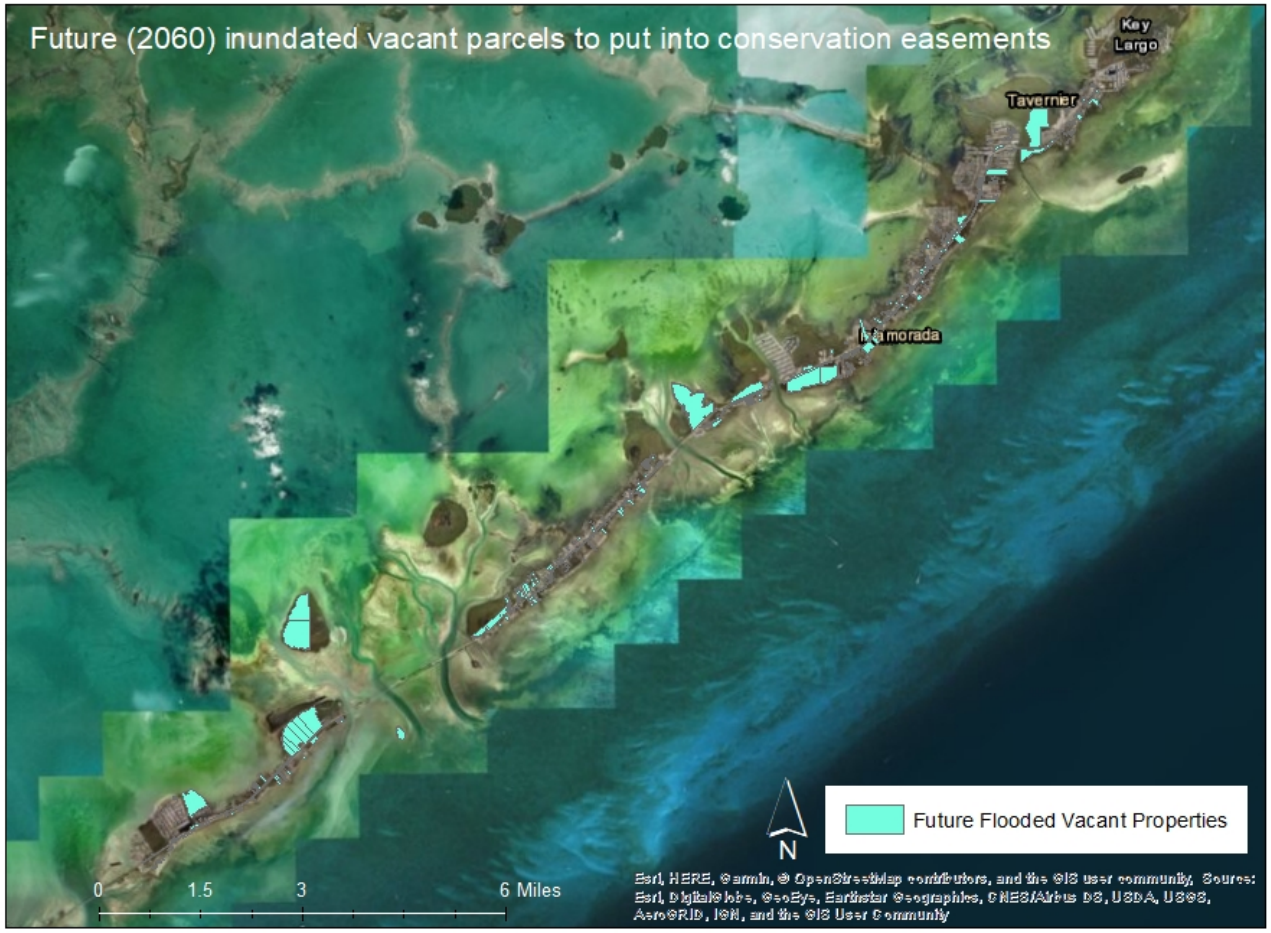
- Continue to enhance reef structures (coral, oyster, sponge, etc.) offshore as a buffer for storm surge. This would include continued attention to the Coral disease which is plaguing reef-building corals in the Florida Reef Tract.

- Continue to work with the Army Corps of Engineers to re-nourish and re-plant beaches.
- Increase public outreach regarding risks and opportunities provided by a changing climate.
- Encourage radical creativity via an annual "Reimagining Islamorada" art or essay contest which considers possible futures and landscapes with rising sea levels. Examples include Dover Rising Waters and the Trinidad and Tobago Climate Change Art Competition.
- Continue striving for a better FEMA CRS score as a community.
- Implement Litter Prevention Sculptures in areas not within the CHHA. Keep Golden Isles Beautiful (Georgia) provides an example. Make the sculptures tourist attractions by keeping with the Florida Keys Kitsch style, yet ensure the sculptures are well secured and do not become marine debris themselves in the event of a hurricane.

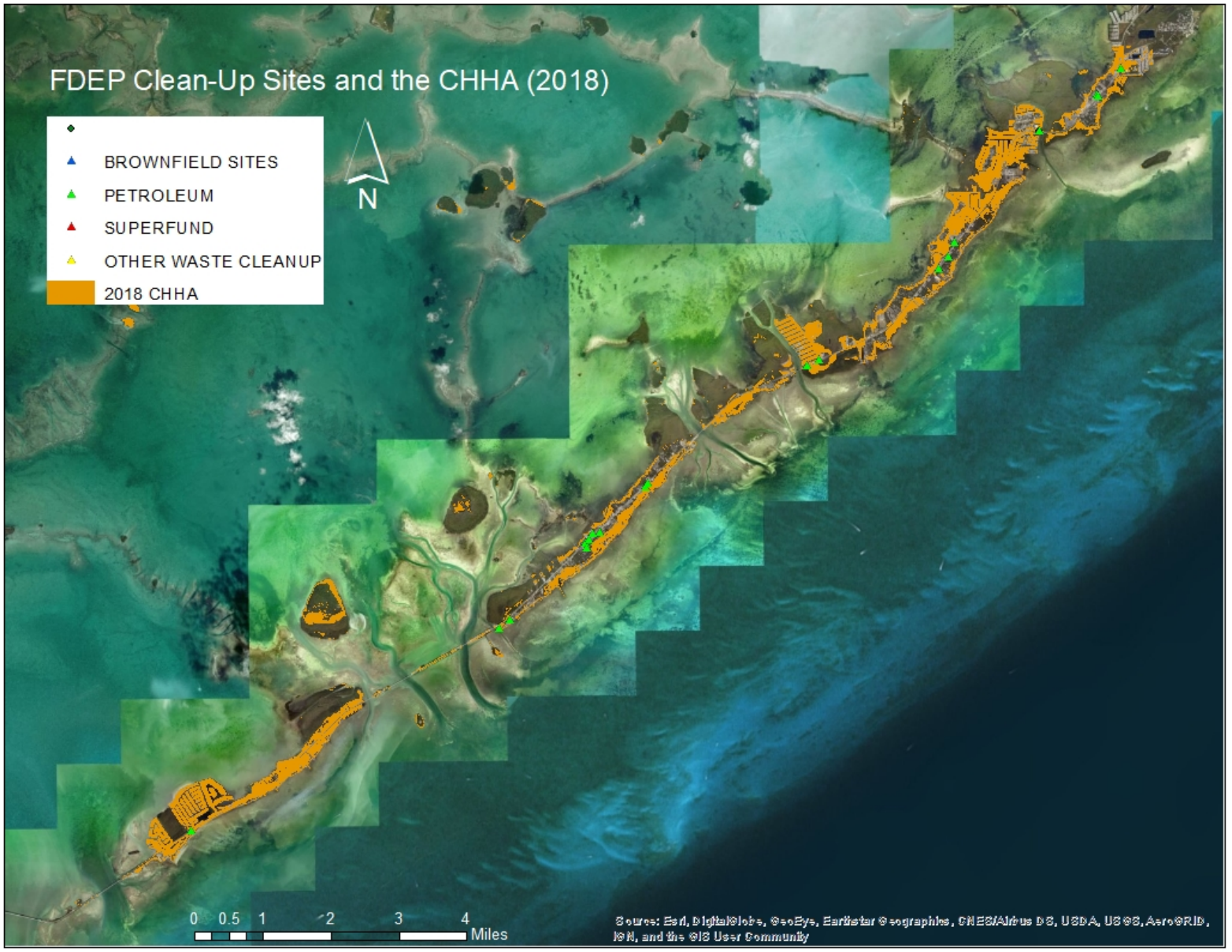
Appendix

A: Maps

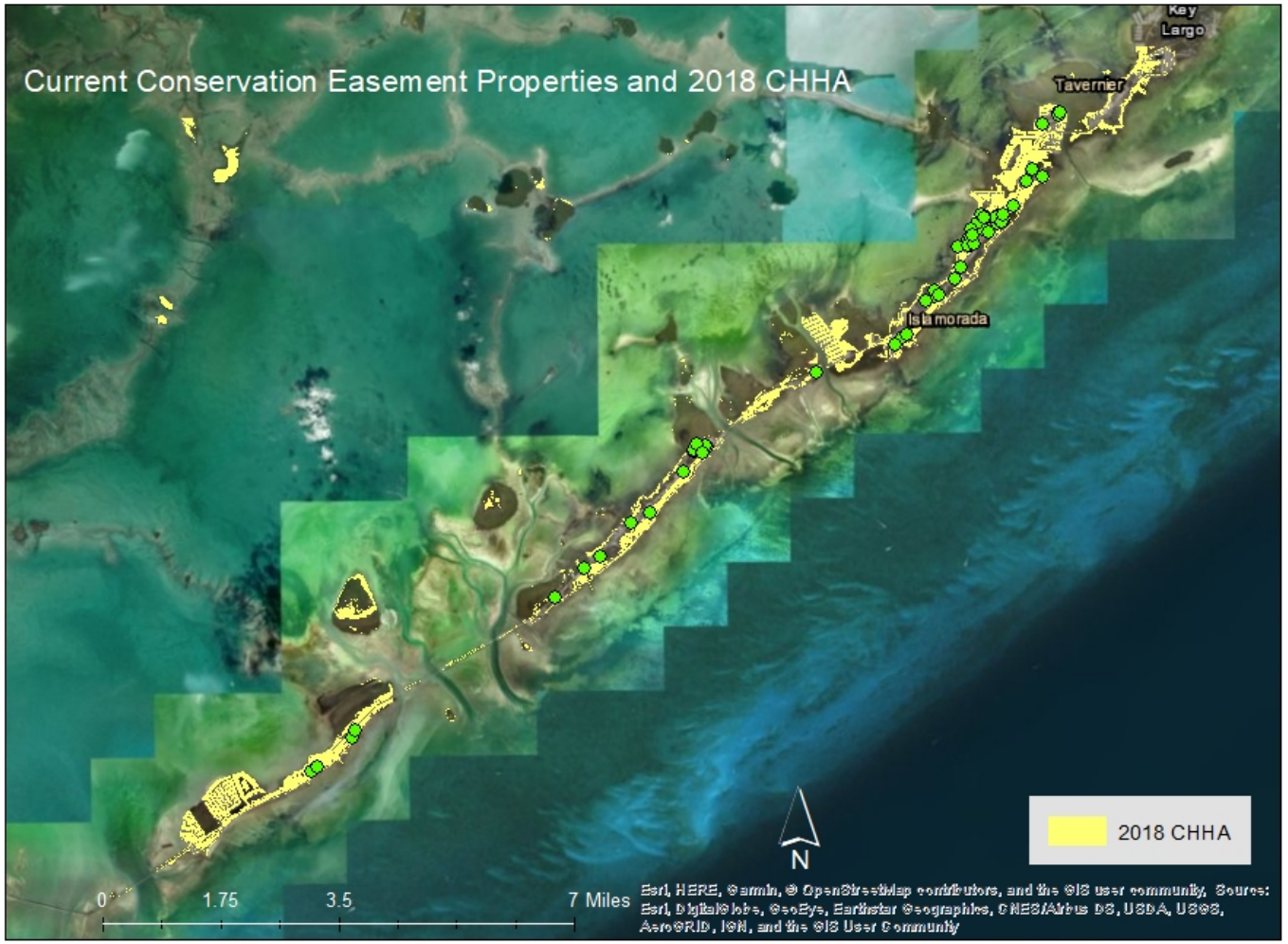
1) CHHA and Vacant Properties



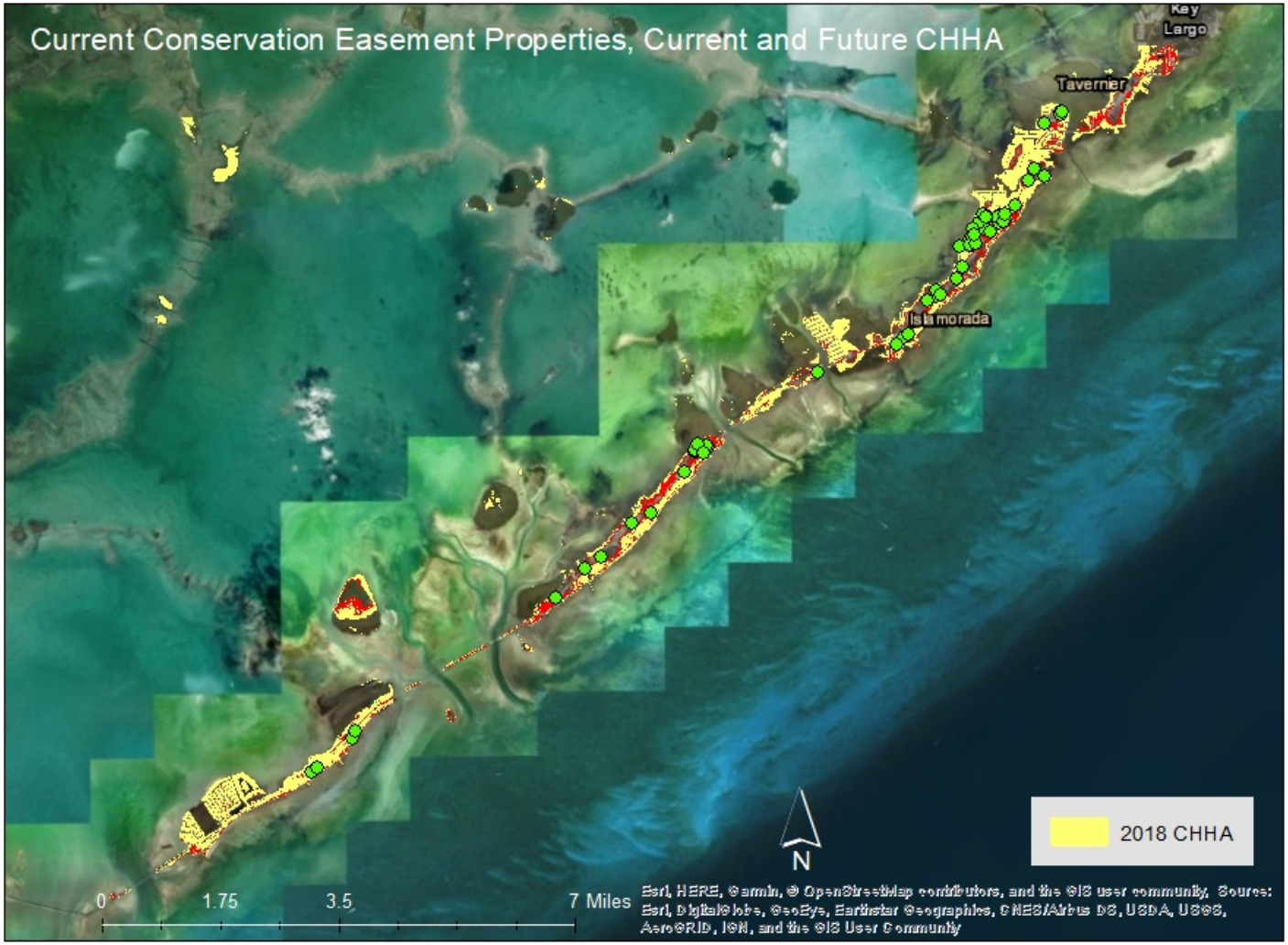
2) FDEP Hazardous and Clean-Up Sites and the Coastal High Hazard Area



3) Properties Currently under Conservation Easement and Present Day CHHA



4) Properties Currently under Conservation Easement and CHHAs (Islamorada and subsequent South to North Close-Ups)




Lower
Matecumbe
Key
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user co
Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the


Upper
Matecumbe
Key
Esri, HERE, Garmin, © OpenStreetMap contributors,
DigitalGlobe, GeoEye, Earthstar Geographics,
GIS User Community


Plantation Key
Windley Key
Fossil Reef Geological
Windley Key
Plantation
Islamorada
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community, Source
DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID
GIS User Community


Key Largo
Plantation Key
Tavernier Creek
Plantation Key