SEA LEVEL RISE IMPACTS ON THE PUBLIC HEALTH OF VULNERABLE POPULATIONS IN SOUTHEAST FLORIDA

April 13th, 2015 Steering Committee Meeting
Update on FIHI/FAU Kresge Grant
AGENDA ITEMS

- Welcome
- Presentation of Quarterly Deliverables, Summary and Review
  - Introduction
  - Research Hypotheses, Goals and Definitions
  - Presentation Fred Bloetscher Research
  - Adaptive Capacity Diagram
  - Outreach Plan
  - Findings
- Recommendations
- Discussion and Advising
Meeting Goals

By the end of the meeting members will:
- Contribute insight for 2015 First Quarter products
- Review and provide feedback on Outreach Plan
- Consider additional next steps
ORIGINAL RESEARCH OBJECTIVES

(1) Identify the communities in Southeast Florida (Palm Beach, Broward, Miami Dade and Monroe counties) that will be most vulnerable to sea level rise impacts in the coming decades

(2) Identify specific potential public health risks and correlate these risks to identified populations under a 2030 and 2060 SLR scenario

(3) Share this information with local decision makers to create more robust adaptation plans that include human health considerations; and

(4) Develop a technical assistance guidebook and toolkit that can be shared with other coastal communities.
HYPOTHESES:

- If the prospects of socioeconomically vulnerable populations are not improved, these populations are more likely to suffer more severe non-chronic health impacts related to sea level rise than geographically vulnerable populations who tend to be more affluent and have a greater range of options and opportunities.

- If adaptive management practices and investments are not put in place to create a built environment that is resilient to sea level and ground water rise in geographically vulnerable locations, and to preserve as much land as possible for future use, socioeconomically vulnerable populations are likely to be displaced by more affluent residents. Over time, these affluent residents will abandon geographically vulnerable locations for new locations that are less vulnerable to these impacts and currently populated by socioeconomic vulnerable populations.
RESEARCH OBJECTIVES

- Identify the communities in Southeast Florida (Palm Beach, Broward, Miami Dade and Monroe counties) that will be most vulnerable to sea level rise impacts in the coming decades.
- Identify specific potential public health risks and correlate these risks to identified populations under a 2030 and 2060 SLR scenario.
- Share this information with local decision makers to create more robust adaptation plans that include human health considerations.
STUDY GOAL ONE

- Discuss displacement of vulnerable populations to vulnerable land
  - Communicate Sea Level Rise impact on vulnerable communities in Southeast Florida
  - Communicate impact on Public Health in vulnerable populations
  - Combine layers – health, physical, socio-economic vulnerability
  - Deliver impact statement and select 3 objectives/impact statements
  - Additional increased vulnerability to displacement to more geographically vulnerable locations and health
STUDY GOAL TWO

- Determine policy and physical solutions to reduce socioeconomic vulnerability and health vulnerability
  - Better understand the intersection between health vulnerability, vulnerable populations, and vulnerable land dynamic - how to prevent progression toward increased vulnerability
  - Less resources may approximately equal adverse health impacts;
Definitions

- Geographically Vulnerable: land may flood regularly with 3 feet Sea Level Rise
- Socioeconomically Vulnerable Population: based on variables including geographic/geology, SES, older, lower income, language, lower education level
- Vulnerable health: vector/waterborne impacts associated with flooding
Tide Trends

High and Low Tides for Virginia Key (Source NOAA)
<table>
<thead>
<tr>
<th>Layer</th>
<th>Base</th>
<th>Secondary</th>
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<tbody>
<tr>
<td>1</td>
<td>LiDAR Topography</td>
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<td>2</td>
<td>Groundwater Contours</td>
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<td>3</td>
<td>High, high tides and critical tide conditions</td>
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<td>4</td>
<td>Census Data</td>
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<td>Population numbers</td>
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<td>Property Specific data (property Appraiser or Tax Collector)</td>
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<td>Land area</td>
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<td>Homestead exemptions</td>
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<td>7</td>
<td>Economic Centers (Census)</td>
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<td>FEMA Flood Maps</td>
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<td>Repetitive Loss maps</td>
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<tr>
<td>9</td>
<td>Emergency Response Codes</td>
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<td>10</td>
<td>Health Impacts</td>
<td></td>
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</table>
GEOGRAPHIC VULNERABILITY - MIAMI-DADE/BROWARD
GEOGRAPHIC VULNERABILITY MONROE COUNTY
# Geographic Vulnerability

## 33040 (Key West)

### Summary < 0 Storage

<table>
<thead>
<tr>
<th>ZCTA5CE10</th>
<th>Current</th>
<th>1ft SLR</th>
<th>2ft SLR</th>
<th>3ft SLR</th>
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<tbody>
<tr>
<td>33040</td>
<td>41.4%</td>
<td>53.6%</td>
<td>68.4%</td>
<td>81.2%</td>
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</tbody>
</table>

### Maps

- **Zip Code 33040 (Current)**
- **Zip Code 33040 w/1ft. SLR**
- **Zip Code 33040 w/2ft. SLR**
- **Zip Code 33040 w/3ft. SLR**
GEOGRAPHIC VULNERABILITY
Palm Beach County
### Southeast Florida Vulnerability Index: Health and Social Denominators

<table>
<thead>
<tr>
<th>Sub-index</th>
<th>Burden of Disease</th>
<th>Socio-economic vulnerability</th>
<th>Physical vulnerability to SLR</th>
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</thead>
<tbody>
<tr>
<td>Number of cases in ED</td>
<td>Asthma</td>
<td>Age</td>
<td>Percent area vulnerable to 1, 2 and 3 ft of SLR</td>
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<tr>
<td>Number of hospitalizations</td>
<td>COPD</td>
<td>Race/Ethnicity</td>
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<tr>
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<td>Diabetes</td>
<td>Income</td>
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<td>Heart failure</td>
<td>Education</td>
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<td></td>
<td>Myocardial infarction</td>
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<td>Pneumonia</td>
<td>Poverty</td>
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<td></td>
<td>Serviced population</td>
<td>Family structure</td>
<td></td>
</tr>
</tbody>
</table>

**Data sources:**
- FL Department of Health
- UDS Mapper

**Data sources:**
- 2010 Census
- American Community Survey 2007-2011

**Data sources:**
- NOAA
- FGDL
# Southeast Florida Vulnerability Index: Health and Social Denominators

## Sub-index: Burden of Disease

Variables:
- Number of cases
- Crude rate per 100,000
- Age-adjusted rate / 100,000
- Confidence intervals
- Relative SE
- # of Health Centers Serving ZCTA
- Total # Health Center Patients
- Unserved (by Health Centers) Low-Income Population
- Health Center Penetration of Low-Income Population
- Health Center Penetration of Total Population

## Sub-index: Socio-economic vulnerability

Variables:
- Percentage of population over age 65
- Percentage of population over age 75
- Median Household Income
- % Low-Income Population
- Percentage of Housing Units that are Mobile Homes,
- % Pop in Poverty
- Percentage of households receiving Public assistance,
- Percentage of total population that are White
- % Non-White
- Percentage of population that does not speak English well
- Percentage of population over 25 with less than 8th Grade education
- Percentage of population over 25 with less than High School education
- Percentage of households that consist of single persons over 65
- Percentage of population with disabilities
FLOOD PRONE w/GIARDIA RISK TODAY
DISEASES ASSOCIATED w/ CLIMATE

- Giardia (flooding)
- Cryptosporidiosis (flooding)
- Dengue (water)
- Chikungunya (water)
Koopman and Longini, 1994

Overall Cumulative Infection Rate: (Slope = the ecological measure of effect)
Risk Difference: (Value = the individual measure of effect)

Cumulative Infection Rate in Unexposed

Model Parameter Values
$\beta = 0.49$
$Cu = 1$
$Ce = 0.1$
$d = 0.5$

Koopman and Longini, 1994
GIARDIA INFECTIVITY
(INFECTION RATE/1,000,000)
Conceptual Model: Intersection of Social-Terrestrial Vulnerability Today

Social Vulnerability

Geographic Exposure

Adaptive Capacity

Disease – vector/water (not acute/chronic conditions)
INTERSECTION OF SOCIAL-GEOGRAPHIC VULNERABILITY T=T1 (FUTURE)
INTERSECTION OF SOCIAL-TERRESTRIAL VULNERABILITY T=t2 (FUTURE – TIPPING POINT?)
Findings

- Ground Water & Sea Level Rise Applied = geographic vulnerable
- SLR is a 100 year issue
- Vulnerable population and vulnerable land are currently not correlated
- Lack health data especially vector/waterborne data
- Concern is socially vulnerable people don’t have resources to react
- PhD students will provide other health implications
RESULTS PLANNING AND GOALS

- Must redefine vulnerable to veer away from traditional definition
- Geographic vulnerability does not generally match social and health vulnerability
- Note there is no relationship between vectors and SES vulnerability
- Giardia, Cryptosporidium. Vector diseases are more likely indicators as these can affect anyone in low lying areas
The take-home message is SE Florida’s health future vis-a-vis SLR is a function of four variables including adaptive capacity.

Adaptation takes different forms depending on location.

- We can install more coastal salinity structures, raise road beds, abandon some local roads, increase storm water pumping, add storm water retention etc. to address many of the problems.
- Or we implement health education, alter development patterns.
- Better monitoring/reporting of disease.
What is Needed?

- Planning Now for 50+ years out to reduce risk.
- Adaptation is coordinated
- Strategies must be incremental
- Local, but some issues require regional, state and federal input, cooperation, communication and dollars – need to identify now.
OUTREACH PLAN DISCUSSION

- Should be populated with current information regarding grant progress. This can help identify missing pieces in the project, this can also serve as a format to use at the upcoming conferences.
- The state outreach will be at the APA Conference
- A webinar will be conducted and is currently being developed
- National outreach will be potentially through the National Public Health Institute who requested the SLR research be presented in New Orleans.
- The Arctic summit meeting is another potential opportunity to present SLR research. Karen and Fred assisting with planning
- The FAU conference will serve local outreach
- Sunday Karen will be presenting High Water Line information in frog alley, Delray
- SLR has reached out to Catalyst for a meeting
OUTREACH

- Local: AWL/Co-planners
- Regional: ACC
- State: FAMA
- Outside: Arctic Summit
- Grantee Collaboration: Kresge
- Journal publications
- Steering committee will be part of the dissemination plan
- Create interactive session (include visuals, practical application, brainstorming)
AUDIENCE

- Policymakers
- Planners
- Public Works professionals
- Managers
MESSAGES
- Importance of Ground Water & Sea Level Rise
- Vulnerable populations will be displaced to vulnerable land
- Define vulnerable in this context
RECOMMENDATIONS:

- More health data collection and monitoring
- Model population migration
- What is the tipping point? This requires further study
- Better Modeling for health impacts – data lacking
- What do we look for in health impacts?
- Make projections based on findings – some models from students
RECOMMENDATIONS

- Consider at-risk communities often have ‘two homes’ (i.e. still consider native country home) and have experienced similar issues in respective countries that can relate to current South Florida issues.
- Explore the impact of population migration on socioeconomically vulnerable population – these require further study
- Explore the mental health impact
- Explore items that limit the ability to respond
CALL TO ACTION

- Redevelopment Message/Physical Vulnerability Problem
- Importance of drainage to avoid self inflicted problems
- Plan for the ability to diminish impacts to both socioeconomically and geographically vulnerable populations
- Raise awareness among key stakeholders and policymakers of the correlation between non-chronic health impacts and socioeconomic and geographic vulnerable populations
Questions?