### Background
Current projections for sea level rise related to anthropogenic climate change predict, even in the most conservative of estimates, at least a 2-foot rise by the end of the century. However, vulnerability to sea level rise cannot be simply equated to slowly filling elevation contours. Coastal metropolitan areas are each uniquely vulnerable as “a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity” (IPCC, 2007). The Miami Metropolitan Area, in Southeast Florida, is distinctly vulnerable, as a function of its particularly low elevation, porous limestone bedrock, and a unique combination of other social, economic, and environmental variables. To interpret and analyze the vulnerability of Urban Southeast Florida to rising seas demands the construction of a model as unique and complex as its distinct characteristic attributes.

### Methodology
To create a complex vulnerability index for sea level rise (SLR) in Urban Southeast Florida required the identification of pertinent variables and the calculation of their respective weights. The following ten variables were identified as potentially significant to SLR vulnerability.  

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Mean Value (Old Deviation)</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation US feet above sea level</td>
<td>9.06336 (6.34102)</td>
<td>Lower elevations are at greater risk of coastal flooding.</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>26.5011 (24.4320)</td>
<td>Soils that are more permeable are better able to absorb surface water and alleviate local effects.</td>
</tr>
<tr>
<td>Location within Flood Zone</td>
<td>21.6569 (23.1159)</td>
<td>Location within FEMA defined 100yr flood zone is intended to be directly reflective of a high probability of flooding events.</td>
</tr>
<tr>
<td>Median Income</td>
<td>5898.17 (4386.44)</td>
<td>Areas of high median incomes generally feel the social and economic impacts of flooding events.</td>
</tr>
<tr>
<td>Percent Renters Occupied Households</td>
<td>6293.1 (3317.2)</td>
<td>Lower income population is less likely to take preemptive protective measures and is less able to cope with capital destruction of flooding events.</td>
</tr>
<tr>
<td>Population Density per sq. mile</td>
<td>27.6746 (26.8444)</td>
<td>Areas of greater non-white populations are at greater risk of institutional inequalities in flood preparation and disaster relief.</td>
</tr>
<tr>
<td>Non-White by Race</td>
<td>36.3587 (29.2074)</td>
<td>Areas of greater Hispanic populations are at greater risk of institutional inequalities in flood preparation and disaster relief.</td>
</tr>
<tr>
<td>Impervious Surfaces</td>
<td>36.7634 (33.3601)</td>
<td>Renters are less likely to make capital investments preparing for flooding, and as a result are impacted greater by disaster events.</td>
</tr>
</tbody>
</table>

### Analysis

#### Independent Variable Description
- LDV_ACRES
- M_ELEV_F
- M_SOIL
- POP_DEN
- M_SOIL
- MED_INC
- PCT_HISP
- PCT_RENT
- EPOCH

#### Coefficient Mean Value Outcome

<table>
<thead>
<tr>
<th>Dependent Variable Description</th>
<th>Mean Value (Old Deviation)</th>
<th>Number of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerability Index</td>
<td>779875</td>
<td>300020</td>
</tr>
<tr>
<td>EPOCH</td>
<td>150021</td>
<td></td>
</tr>
</tbody>
</table>

#### Not as Predicted
- Lower elevations are correlated with higher land value.
- Non-white population is correlated with lower land value.
- Higher median income is correlated with lower land value.
- Higher percentage Hispanic population is correlated with higher land value.
- Higher number of renters is correlated with lower land value.

#### As Predicted
- Greater soil permeability is correlated with lower land value.
- Areas of greater Hispanic populations are at greater risk of institutional inequalities in flood preparation and disaster relief.
- Areas of greater non-white populations are at greater risk of institutional inequalities in flood preparation and disaster relief.

### Discussion
Much of the results of this spatial regression were counterintuitive to assumptions about social, economic, environmental, and physical indicators of vulnerability to sea level rise in Urban South Florida. Specifically, the highly significant negative correlation between Elevation and Parcel Land Value by Acre is indicative that land value does not necessarily reflect vulnerability to sea level rise by elevation alone. This could be interpreted as an indicator that land value is not as good as an independent variable to weight metrics for sea level rise vulnerability though spatial regression as hypothesized; given the assumption that it would reflect the temporal lag effects of flood insurance premiums and past flooding events.

However, these results could also be indicative of the unexpected outcome that land value in Urban Southeast Florida may not yet reflect true vulnerability to sea level rise. Even thinking about elevation alone, much of the highest valued land in the Miami area is nearest to beaches and waterways, such as the cities of Miami Beach and Palm Beach. This phenomenon does not reasonably reflect the possibility of flooding due to a changing climate. Rather, it could be indicative of hedonic effects, market rigidities and consumer ignorance. This outcome alone validates the need for complex, multivariate models for mapping vulnerability to sea level rise in coastal urban areas.

### References
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