

Sea-level Rise in the Heartland: The Potential for In-migration

Prepared by the University of Florida and
Central Florida Regional Planning Council
For the Florida Heartland
Consisting of DeSoto, Glades, Hardee, Hendry,
Highlands, and Okeechobee Counties



555 E Church St,
Bartow, FL 33830
www.cfrpc.org

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SEA-LEVEL RISE IN THE HEARTLAND: THE POTENTIAL FOR IN-MIGRATION

The possible impact of future inland migration from coastal communities in Florida as a result of sea-level rise (SLR) was an issue explored in the Heartland 2060 project. Although many unknown factors would influence the potential for such migration, it is possible at least to model some physical land use changes that might occur, and that could potentially displace population along Florida's coastline. Although the Florida Heartland (DeSoto, Glades, Hardee, Hendry, Highlands, Okeechobee, and Polk Counties) does not have any coastal counties, the potential exists for these inland counties to experience in-migration and resettlement of displaced coastal populations. This contingency formed the catalyst for this investigation.

Using GIS and hazard modeling software, an estimate was made of how many acres of land and the number of people that might be affected by the impacts of a 1-meter rise in sea level and a 100-year storm surge along Florida's coastal counties stretching from Pasco to Brevard counties. After the estimating the potential displaced population, a determination was made as to how many of these displaced people might migrate and resettle in the Heartland.

This information was initially to be used as a separate population projection scenario in the Futures modeling, but following the outcome of this investigation, the additional scenario was discontinued. It was determined that a SLR event of this magnitude would result in the relocation of less than 1 percent additional population (above the current population projections) to the Heartland Counties by the year 2060. It was determined that this amount was insignificant in context with the goals of this project, and the potential outcomes of the Futures modeling in general. Following is a summary of the methods used in this estimation.

Estimating Lands Affected by SLR and Storm Surge

According to a 2010 report by the Florida Oceans and Coastal Council on Climate Change and Sea-Level Rise in Florida (http://www.flseagrant.org/wp-content/uploads/2012/02/Climate_Change_and_Sea_Level_Rise_in_FL.pdf), it is highly likely that global sea-level will rise by 0.5 to 1 meter and possibly as much as 2 meters by the year 2100 (p. 3). Additionally, SLR will exacerbate the effects of storm surges and wave action from hurricanes in coastal communities that are already vulnerable to flooding (p. 11).

Using this information as a guide, a future flood hazard model was created using the Federal Emergency Management Agency (FEMA) Hazus-MH software and ESRI's ArcGIS

software to model the effects of a 100-year storm surge on selected coastal Florida counties under the conditions of a 1-meter rise in sea-level. Coastal counties were selected for modeling based on their proximity to the Heartland Region; all coastal counties directly to the east, south and west were included in the model whereas those to the north were not. It was presumed that these counties posed the most potential for resident relocation to the Heartland following sea level rise displacement. Map 1 – Estimate of Lands Affected by Future SLR and Storm Surge, shows the lands in those counties that would be impacted by flooding under the models conditions.

Estimating Future Population Affected by SLR and Storm Surge

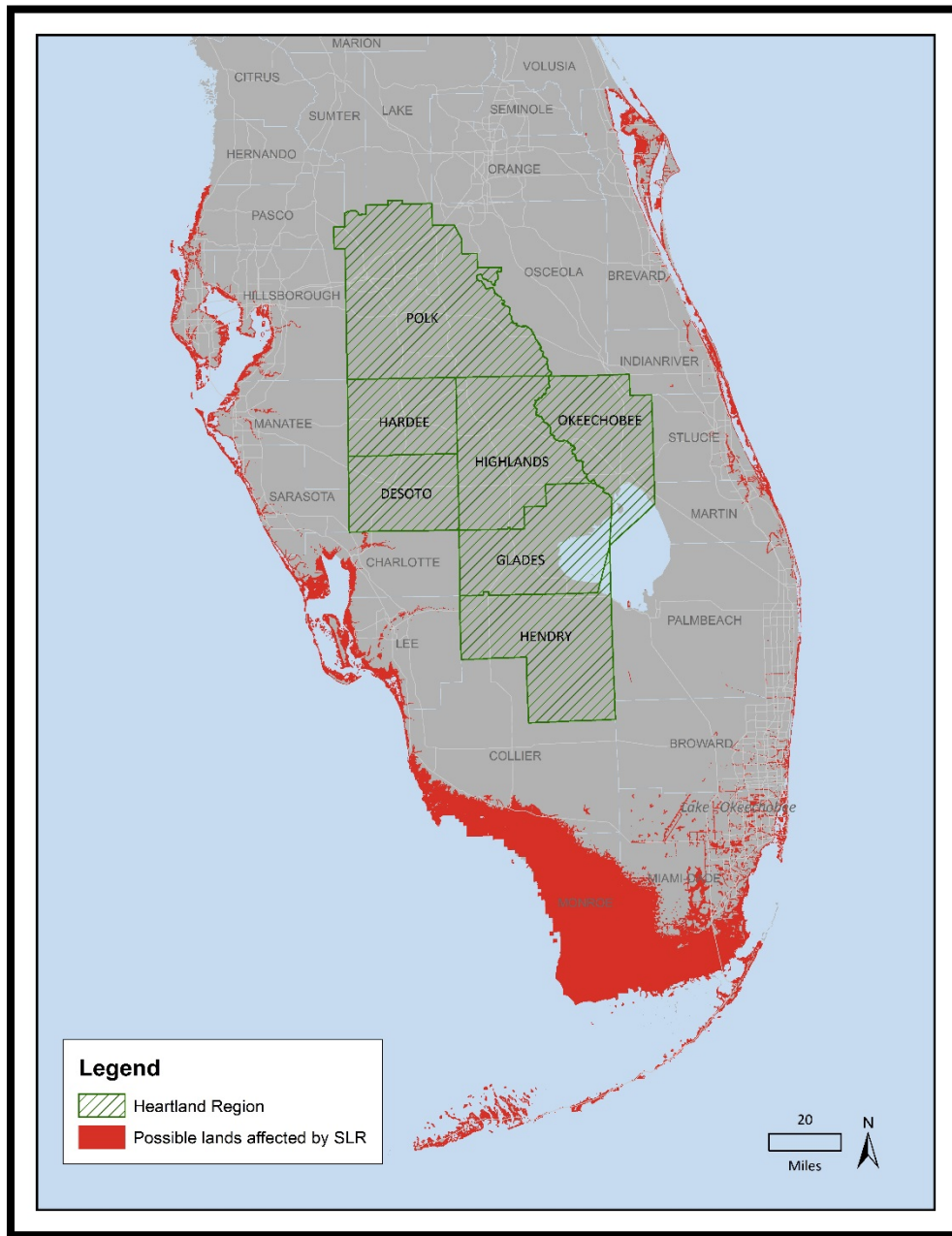
Using the affected land area predicted in Map 1, an estimate of how many people would be impacted in the future was made using population data from the 2010 Census and projected population data for the year 2060, which was derived from the University of Florida's Bureau of Economic and Business Research (BEBR) population projections.

An estimate of the percentage of each county's 2010 population that would be affected was calculated. This was done by calculating the percentage of acres in affected coastal Census block-groups and then applying those percentages to the Census data of total population residing in those block-groups. The percentage of each county's total population that would have been affected in 2010 was then calculated. The county-wide percentages were then applied to the BEBR 2060 High population predictions for each county to show potentially how many people would be affected if the same proportion of the population continued to reside in those locations. The BEBR 2060 High population projections reflect a most-displaced-scenario because these are the high end of what BEBR projects the population in 2060 might be. Table 1 summarizes the results.

Table 1: Estimate of Future Population Affected by SLR and Storm Surge

County	% of 2010 Population Affected	2060 Projected Population	2060 Population Affected
Brevard	1.89	982,412	18,556
Broward	0.79	2,664,162	21,027
Charlotte	6.61	292,217	19,311
Collier	8.29	812,392	67,325
Hillsborough	1.54	2,901,050	44,541
Indian River	4.51	328,111	14,798
Lee	3.71	1,906,217	70,647
Manatee	1.87	745,412	13,969
Martin	4.91	295,698	14,518
Miami-Dade	8.12	4,415,632	358,653
Monroe	21.46	83,105	17,836
Palm Beach	0.38	2,730,059	10,381
Pasco	2.29	1,338,067	30,637
Pinellas	4.17	1,154,992	48,189
Sarasota	1.48	775,960	11,476
St. Lucie	2.24	904,528	20,279
Total	-	22,330,014	782,145

Map 1 – Estimate of Lands Affected by Future SLR and Storm Surge



Estimating Relocation Potential

The next step was then determining how many of the displaced residents might relocate to one of the seven Heartland counties. This was accomplished in hierarchical steps. Local expertise was used in determining where resettlement might occur. First, from the coastal counties experiencing displaced population, the percentage that might relocate to another

county in Florida was estimated; these were called “Florida-Resettlers”. This step was important, because Florida has a high number of people that have come from another state. It is possible they might relocate back to their home state if a significant displacement ever occurs, such as a major hurricane or storm surge event. Of these Florida-Resettlers, a determination was then made as to how many of these people would relocate to the Heartland; these were called “Heartland-Resettlers” as indicated in Table 2.

Table 2: Estimate of Future Population Affected by SLR and Storm Surge

Name	“Florida-Resettlers”	“Heartland-Resettlers”
County	Likelihood of SLR-displaced population relocating to another county in Florida	Likelihood of displaced population relocating to another county in Florida migrating to Heartland
Brevard	25%	1%
Broward	30%	10%
Charlotte	25%	20%
Collier	10%	15%
Hillsborough	25%	20%
Indian River	25%	5%
Lee	10%	25%
Manatee	25%	5%
Martin	10%	5%
Miami-Dade	50%	1%
Monroe	75%	1%
Palm Beach	10%	1%
Pasco	15%	5%
Pinellas	50%	10%
Sarasota	10%	5%
St. Lucie	10%	5%

Then determinations were made as to how much of this population that would relocate to the Heartland would resettle in each of the seven Heartland counties. These determinations were made using local knowledge of quality of life, lifestyle similarities between counties, and other factors specific to each county as provided in Table 3.

**Table 3:
Estimated Likelihood of Heartland-Resettlers Relocating to a Particular a Heartland County**

Percentage (%) of Heartland Relocations by Origination and Destination County

County	DeSoto	Glades	Hardee	Hendry	Highlands	Okeechobee	Polk
Brevard	5%	5%	5%	5%	5%	10%	65%
Broward	1%	5%	1%	5%	5%	10%	73%
Charlotte	40%	10%	5%	10%	10%	1%	24%
Collier	2%	15%	1%	30%	5%	1%	46%
Hillsborough	5%	1%	10%	1%	5%	1%	77%
Indian River	1%	1%	1%	1%	10%	40%	46%
Lee	5%	15%	1%	25%	15%	1%	38%
Manatee	10%	1%	15%	1%	10%	1%	62%
Martin	1%	5%	1%	10%	10%	40%	33%
Miami-dade	1%	2%	1%	2%	5%	5%	84%
Monroe	1%	2%	1%	5%	5%	5%	81%
Palm Beach	1%	15%	1%	15%	10%	25%	33%
Pasco	1%	1%	1%	1%	5%	1%	90%
Pinellas	1%	1%	1%	1%	1%	1%	94%
Sarasota	20%	1%	2%	1%	15%	1%	60%
St. Lucie	1%	1%	1%	1%	15%	50%	31%

For example, in Manatee County, it was determined that of the displaced population, 75% would stay in Manatee County. There is a significant amount of developable land in the eastern part of the county, and most of the displaced population was assumed to resettle further inland. However, some of the population would become Florida-Resettlers (25%), and would relocate to other Florida Counties. Specifically 5% of the Florida-Resettlers were assumed to become Heartland-Resettlers. Eastern Manatee County is very similar to Hardee, DeSoto, or southwestern Polk Counties. Therefore it was determined that of the Heartland-Resettlers from Manatee County, 15% would relocate to Hardee County, 10%

each to DeSoto and Highlands Counties, and the bulk of the remainder (62%) would resettle in Polk County. A negligible amount was assumed to probably resettle in the other counties.

After all the determinations were made, the amount of resettlement in the Heartland was compared to the working population projections as indicated in Table 4. Overall, the contribution of displaced resettlers to the Heartland was determined to be less than 0.6% of the total population in the year 2060.

County	% Increase to 2060 Population Projection
DeSoto	1.17%
Glades	2.35%
Hardee	0.97%
Hendry	1.62%
Highlands	0.42%
Okeechobee	0.59%
Polk	0.51%
Heartland	0.59%

It was determined that the overall amount of resettlement to the Heartland was negligible given the 50-year population projection horizon, and that any resultant scenario modeling would not produce significant differences from those using the base population projections. Therefore the scenarios using the population projections modified by SLR-displaced populations were discontinued.