

# Climate Change in Coastal Florida: Economic Impacts of Sea Level Rise



# CLIMATE CHANGE IN COASTAL FLORIDA: ECONOMIC IMPACTS OF SEA LEVEL RISE



## Context

Florida's economy and way of life are closely tied to its coasts. The vast majority of Floridians (80%) live or work in one of the state's 35 coastal counties—most of them within ten miles of the coast. In addition, tourism is a major sector of the state economy that is also strongly linked to its coastal resources. In 2005, nearly 86 million tourists visited Florida, generating more than \$63 billion in revenue (roughly 10% of Florida's economic output) and creating more than 944,000 jobs. Finally, Floridians are highly vulnerable to property losses and other adverse impacts from hurricanes. Damages from recent storms, including Hurricane Wilma in 2005, have run into the hundreds of millions and even billions of dollars.

Value of Land at Risk in Three Florida Counties Using IPCC's Sea Level Rise Scenarios (in 2005\$)

County	Variable	Sea Level Rise (SLR) Scenarios <sup>a</sup>				
		0.16 feet	0.33 feet	0.49 feet	0.98 feet	2.13 feet
Dade	Value of land at risk	\$1.05 B	\$1.4 B	\$2.33 B	\$4.81 B	\$12.3 B
	Area at risk <sup>b</sup>	5,486	5,861	7,903	11,627	26,467
	Per-acre value	\$0.19 M	\$0.24 M	\$0.29 M	\$0.41 M	\$0.47 M
Duval	Value of land at risk	\$10.4 M	\$13.7 M	\$19.6 M	\$344 M	\$572 M
	Area at risk <sup>b</sup>	1,855	1,868	1,878	10,625	18,743
	Per-acre value	\$5,624	\$7,354	\$10,462	\$32,384	\$30,508
Escambia	Value of land at risk	\$126 M	\$136 M	\$148 M	\$194 M	\$499 M
	Area at risk <sup>b</sup>	798	899	962	1,863	5,209
	Per-acre value	\$0.16 M	\$0.15 M	\$0.15 M	\$0.10 M	\$95,760

a. Values calculated for years 2030 and 2080. However, the overlap between the mid-2030 scenario and the low 2080 scenario (both 0.33 ft, or 0.1 m) is redundant, and since property value changes over time are not considered, the years are not shown here. b. Unit: acres.

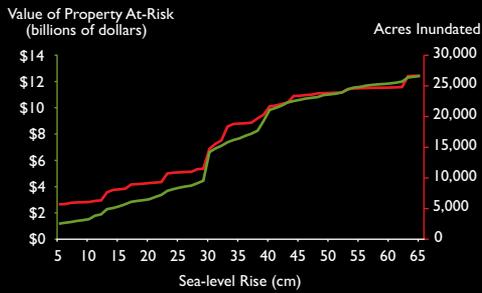
### Global warming is expected to cause:

- Sea level rise
- Increased frequency of major storm events

### These changes would lead to:

- Salt-water intrusion affecting drinking water supplies
- Higher storm surge and increased risk of flooding
- Erosion of beaches and barrier islands
- Greater property damages
- Adverse impacts on coastal ecosystems including fisheries.

## Property at Risk of Sea Level Rise in Dade County



## Effect of Storm Surge and Sea Level Rise on Future Damage Costs

County	Hurricane	Storm surge (in ft.)	Historical damage cost	BSRC SLR estimates (in ft.)	Damage cost	IPCC SLR estimates (in ft.)	Damage cost
Dade	Wilma	7.00	\$2.21 B	1.02	\$2.48 B	2.13	\$2.9 B
Dixie	Dennis	9.00	\$0.06 M	0.90	\$0.07 M	2.13	\$0.08 M
Duval	Frances	5.90	\$72.3 M	0.83	\$80.15 M	2.13	\$98 M
Escambia	Dennis	12.00	\$70.7 M	1.13	\$84.51 M	2.13	\$95M
Monroe	Wilma	2.76	\$215.3 M	1.02	\$298 M	2.13	\$370 M
Wakulla	Dennis	9.00	\$4.42 M	1.05	\$5.73 M	2.13	\$6.9 M

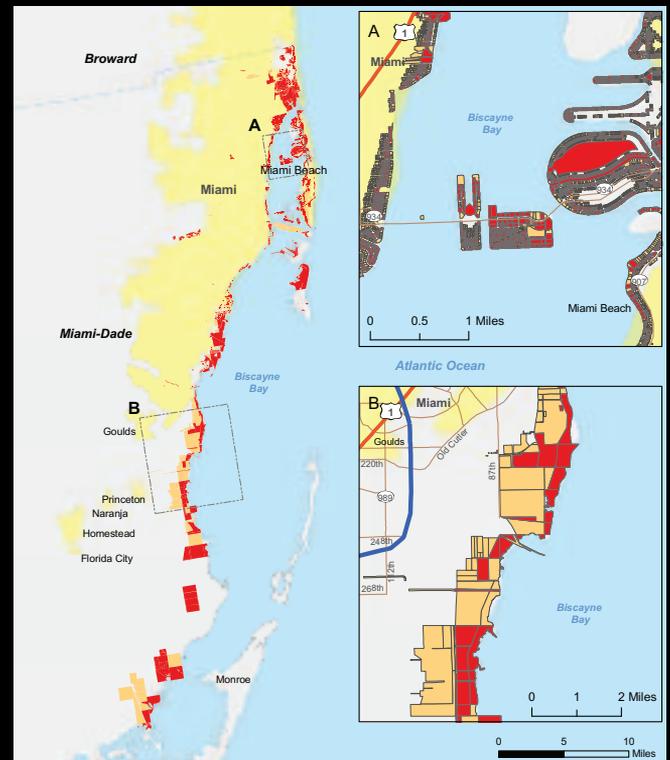
# Key Findings

## I. Sea levels will rise...

Estimates developed by Florida State University (FSU) suggest Florida's coasts will experience sea level rise in the range of 0.23–0.29 feet by 2030 and 0.83–1.13 feet by 2080. These estimates are lower than the estimates of global sea level rise generated by the Intergovernmental Panel on Climate Change (IPCC) in 2001. The IPCC's 2001 estimates for global sea level rise are in the range of 0.16–0.49 feet by 2030 and 0.33–2.13 feet by 2080.

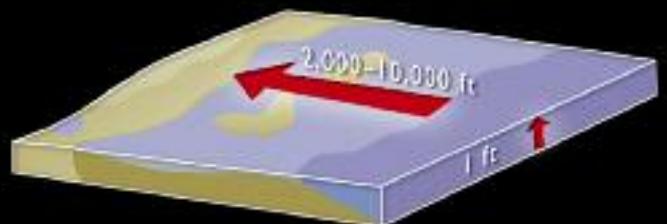
The FSU estimates extrapolate from current trends in sea level rise, whereas the IPCC projections are based on modeling. Both estimates may be conservative, however. The most recent IPCC report acknowledges that rapid melting of major ice sheets, such as the Greenland ice sheet, could result in higher rates of sea level rise in the future.

## Land in Red is at Risk Due to Sea Level Rise in Dade County



The sea-level rise projections for this area range from about 0.16 feet to 2.3 feet within this century, with additional increases later.

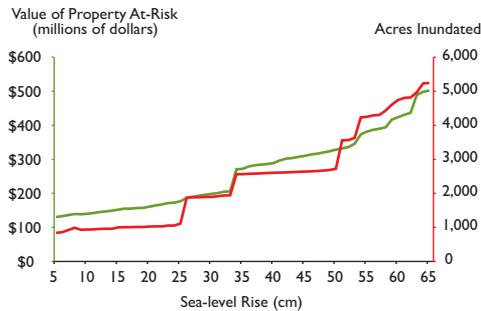
## Sea Level Rise and Coastal Inundation



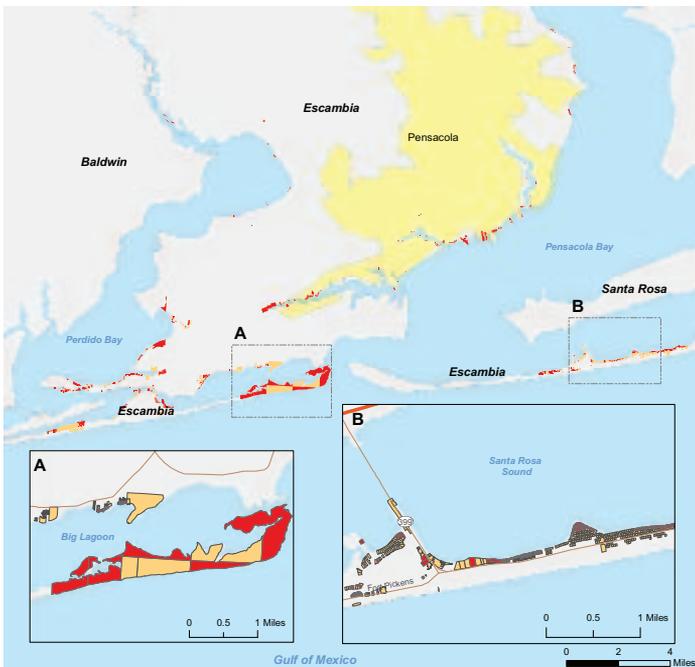
A one-foot rise in sea level can cause the inland movement of the shoreline by 2,000 to 10,000 feet when the land is as flat as the Florida coast.



## Property at Risk of Sea Level Rise in Escambia County



## Land in Red is at Risk Due to Sea Level Rise in Escambia County



**Legend**  
 ■ Parcels at Risk from a 25cm Sea-Level Rise; FSU (2080)  
 ■ Parcels at Risk from a 65cm Sea-Level Rise; IPCC (2080 - High)  
 ■ Urban Areas

## 2. ...causing more frequent storm surge events,

As sea level rises, coastal Florida could expect a dramatic increase in the frequency of major storm surge events, even if hurricane intensity and frequency remain unchanged. For instance, the 7-foot high storm surge experienced in Dade County during Hurricane Wilma would—under present conditions—be expected to recur only once every 76 years. With a sea level rise of 1 foot, the expected frequency of a similar storm surge increases three-fold—to once every 21 years.

If sea level rise exceeds 2 feet (the high end of the IPCC range for 2080), the predicted frequency of a 7-foot storm surge in Dade County increases further, to once every 5 years.

## 3. ...increased storm damages,

As major storm surge events become more frequent, one would expect to see an increase in associated damages. Extrapolating from insurance data on damages from past storms in six coastal counties, the FSU researchers found that changes in sea level could increase damage costs associated with similar-intensity storms in the future anywhere from 10 to 40 percent depending on the extent of sea level rise assumed and other factors.

## Land in Red is at Risk Due to Sea Level Rise in Duval County

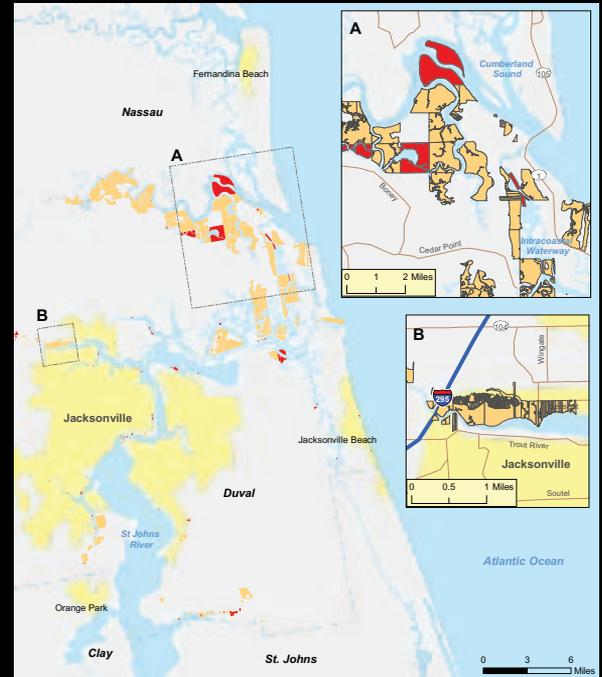


### 4. ...larger areas at risk for inundation,

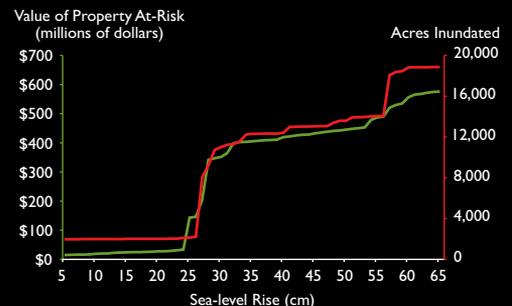
Because of Florida's topography, even a modest change in sea level means a dramatic change in the area of land at risk for inundation. If sea level rise is limited to 0.16 feet (the IPCC's 'low case'), 5,500 acres in Dade County alone would be at risk for inundation, according to estimates developed by the FSU researchers. If, on the other hand, sea level rise is closer to 2.13 feet (the IPCC's 'high case') nearly 26,500 acres in Dade County could be at risk.

### 5. ...and more property in harm's way.

Combining a GIS (Geographic Information System) model with data on current property values, the FSU researchers developed estimates of the value of land susceptible to inundation under different scenarios. Their results suggest that potential property losses would increase in direct correlation to rising sea levels over time. In the low, 0.16-foot sea level rise scenario, FSU estimated that property losses in Dade County alone could total \$1.05 billion (in 2005\$). In the higher, 2.13-foot sea level rise scenario, estimated property losses for Dade County increase to \$12.3 billion. These results, which do not account for future increases in coastal population or property values, suggest that significant property values in Florida's coastal areas could be at risk, especially if future sea level rise is in line with the high end of current projections.



### Property at Risk of Sea Level Rise in Duval County



### Limitations of the Analysis

Estimates of future sea level rise vary widely because there is still substantial uncertainty about this category of climate-change impact. Linking changes in sea level to future storm impacts and damages compounds these uncertainties. Because the FSU study did not account for changes in property values over time or the likelihood that population and development along the coast would continue to grow it likely understates future impacts from sea level rise. On the other hand, the study also did not account for adaptation measures that might be undertaken by property owners to reduce losses or damages in the future. Finally, the study does not address the possibility that global warming will likely increase the intensity or severity of Atlantic hurricanes—all of the damage estimates are based on changes in expected storm surge due solely to sea level rise. Accounting for a likely increase in storm intensity would almost certainly push damage estimates higher, perhaps significantly.



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