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Florida's economy is driven by our oceans and coasts. Florida coastal counties generate about 80 percent of the state's revenues, and tourism to the Sunshine State supports more than 265,000 jobs. Residents and tourists alike rely on a myriad of natural treasures for their quality of life - recreational and commercial fishing, boating, diving, coastal protection and beach-going.

The health and sustainability of coastal habitats controls the future of Florida's economy. Yet, our coastal communities are vulnerable. Projected sea level rise in the coming decades will affect everyone in Florida. Coastal habitats will be substantially altered and coastal facilities, roads, businesses and residences will be compromised.

The Nature Conservancy has modeled the projected impacts of predicted sea level rise on coastal habitats in several large estuaries along Florida's Gulf Coast. This work can help local communities develop better strategies for reducing their risk to storm surge and sea level rise.



BOB BENDICK Gulf of Mexico Program Director The Nature Conservancy

The Nature Conservancy Dear Friend,

Florida is a gift to residents and visitors alike. People save to vacation and retire here, and Florida continues to attract new families from other places. This results, in part, from our sunshine, beaches, and outdoor recreation including opportunities to enjoy diverse fish and wildlife in beautiful natural settings.

But Florida's 1,200 miles of coastline and low-lying topography, which make it so attractive, also put the state's coastal assets in jeopardy from storm surge. The Nature Conservancy's research with many partners in Florida and around the world indicates that healthy natural systems and natural features can help mitigate the risk from storms—risks that are increasing with rising sea levels.

For more than 50 years, the Florida Chapter of The Nature Conservancy has pursued policies and projects that are good for both human and natural communities. These projects are longterm investments that have added value to the quality of life in Florida. Researching the impact of projected sea level rise on coastal communities is another example of this work.

So, in this report we are sharing information about the impacts of projected sea level rise on various coastal habitat types along Florida's Gulf coast and suggest steps that Gulf coast communities can take to reduce the impacts of the expected changes, and reinforce the resilience of natural habitats.

Let's continue to work together to ensure that we help safeguard our coastal communities in Florida and ensure a bright future for residents and tourists alike.

Warm regards,

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Bob Bendick Gulf of Mexico Program Director The Nature Conservancy

# Project Study Areas

Sea level continues to rise and is expected to accelerate over the next century. Higher sea level will affect coastal habitats in estuaries and could leave coastal communities more vulnerable to storm surge and flooding.

The Nature Conservancy has modeled the projected impacts of predicted sea level rise on coastal habitats in several large estuaries along Florida's Gulf Coast, utilizing the Sea Level Affecting Marshes Model (SLAMM) and the highest resolution elevation data available. The studies were conducted in Pensacola Bay, Choctawhatchee and St. Andrew's Bays, Apalachicola Bay, Southern Big Bend, Tampa Bay and Charlotte Harbor (listed north to south.)

#### Project Study Areas for Assessment of Sea Level Rise Impacts on Coastal Habitats And Development of Adaptation Strategies



# The Estimated Impact of Three Feet in Sea Level Rise

## Understanding the impacts can help communities mitigate risk to rising sea levels.

No one knows exactly how fast sea level will rise. Several scientific studies report that sea level could rise from between eight inches to six or more feet by the year 2100. Here we report the results of a moderate sea level rise scenario, three feet. The Nature Conservancy modeled potential changes in sea level rise by 2100 to a variety of coastal habitats. A three foot rise in sea level will have profound impacts on coastal cities in Florida. These impacts will be more severe if no attempts are made to moderate the impacts of sea level rise on adjacent coastal habitats. The loss of coastal forests, undeveloped dry lands and tidal flats may leave coastal communities more vulnerable to larger areas of storm surge and coastal flooding impact - and will also affect the species that depend on these habitats. However, with proper planning, coastal communities can prepare themselves to help mitigate some of the risk from sea level rise.

## Projected Sea Level Rise Impact on Coastal Forests: 171,000 Acres

Coastal forests are likely to experience the greatest change from sea level rise. More than 267 square miles of coastal forest – about the size of Pinellas County – could be lost with approximately three feet of sea level rise by the year 2100. Much of this coastal forest is projected to transition into marsh as the soils become too salty and/or too wet to support the trees typically found in coastal forests.

#### LOSS OF COASTAL FORESTS WITH THREE FEET OF SEA LEVEL RISE BY 2100: 171,000 ACRES.



Each tree represents approximately 5,000 acres of habitat loss.

#### Projected Sea Level Rise Impact on Undeveloped Dry Land- 70,000 Acres

The second greatest change to coastal habitats is likely the loss of undeveloped dry land. An area a little larger in size than Orlando – more than 109 square miles of undeveloped dry land – could transition to a variety of coastal wetland types including marsh, tidal flat and mangrove forest.

#### LOSS OF UNDEVELOPED DRY LAND WITH THREE FEET OF SEA LEVEL RISE BY 2100: 70,000 ACRES.

Each cabbage palm tree represents approximately 2,000 acres of habitat loss.





#### Projected Sea Level Rise on Tidal Flats – 63,000 Acres

A projected loss of more than 63,000 acres of tidal flats – an area area larger than Tallahassee – poses the third greatest sea level rise impact to coastal habitats. Many species of wading birds, invertebrates and fish depend on tidal flats for food and shelter. A potential benefit of this newly submerged land is that some of it may eventually become seagrass beds, but whether this can or will occur is unknown.





#### Other Changes

Other coastal habitats modeled across the study areas included inland freshwater marsh, tidal swamp, cypress swamp, ocean beach and estuarine beach. Net of habitat change includes a projected increase in mangrove forests, which may provide a net benefit to adjacent coastal communities if allowed to expand as sea level rises. As mangrove forests mature, their structure can help reduce the intensity of wind and wave energy associated with coastal storms.

Planning for the future can help protect our quality of life.

For a visual representation of select results, see the Future Habitats App at http://maps.coastalresilience.org/gulfmex/

Mapped results can be explored at multiple scales on computers and iPads.



## Ten actions to help protect coastal communities from sea level rise.

The following strategies were suggested by local planners, natural resource managers, scientists and other community leaders from each study site as actions to help communities adapt to sea level rise.

- 1. Reduce building of vulnerable structures in high risk areas.
- 2. Use disaster relief dollars to relocate structures to less vulnerable areas rather than rebuild in vulnerable sites.
- 3. Protect undeveloped upland and wetland buffers now to allow for coastal wetlands migration with sea level rise. Avoid building on those vulnerable sites in the future.
- 4. Create a funding source to acquire lands and vulnerable properties that are projected to be affected by sea level rise.
- 5. Foster the conservation and restoration of natural infrastructure (habitats) to protect shorelines where possible as an alternative to or in complement with grey infrastructure (e.g., bulkheads, seawalls).
- 6. Manage/maintain freshwater flows and sediment inputs that help preserve coastal wetlands to the greatest extent possible.

- 7. Anticipate and take action to assist species that will experience temporary habitat bottlenecks resulting from sea level rise, for example, beach nesting shorebirds and sea turtles. Explore methods for accommodating the species that may lose habitat.
- 8. Consider projected sea level rise impacts when planning for the replacement and/or repair of roads, and water, sewer and drainage systems in vulnerable areas this will be less expensive than responding to emergency infrastructure needs and will reduce service interruptions.
- 9. Educate people of all ages in every sector of society about the issues and predicted consequences of sea level rise and coastal hazards so that they can take take appropriate actions and urge decision-makers to do the same.
- 10. Improve communication about sea level rise vulnerability and potential solutions among and between private and government sectors and the community to expedite a proactive response.



# Habitat Change Summary

The chart below illustrates the projected impacts of three feet of sea level rise on coastal habitats in the study areas.

## **Change in Coastal Habitat with Three Feet\* of Sea Level Rise by the Year 2100**

Coastal Habitats/ Study Areas	Pensacola Bay	St Andrews/ Choctawhatchee Bays	Apalachicola Bay	Southern Big Bend	Tampa Bay	Charlotte Harbor	TOTAL
	ACRES	ACRES	ACRES	ACRES	ACRES	ACRES	ACRES
Coastal Forest	-15,835	-26,291	-51,538	-60,922	-5,963	-10,713	-171,263
Undeveloped Dry Land	-2,648	-11,444	-7,621	-22,402	-9,558	-16,616	-70,287
Tidal Flat	4,375	8,584	7,462	3,294	-36,146	-50,716	-63,147
Inland Freshwater Marsh	-2,590	-2,040	-10,821	-1,872	-682	-1,103	-19,107
Tidal Swamp	-2,430	0	-8,295	-872	0	-929	-12,526
Cypress Swamp	-913	-210	-1,591	-347	-88	-70	-3,220
Ocean Beach	-954	195	-232	98	-322	-496	-1,711
Estuarine Beach	42	-1,466	408	141	-61	93	-843
Tidal Freshwater Marsh	3,786	-466	5,691	-29	-100	0	8,881
Brackish Marsh	941	-4,391	19,358	264	-444	0	15,728
Mangrove	0	0	0	-300	11,003	20,389	31,092
Transitional Saltmarsh	2,985	17,995	7,613	28,645	-34	1,223	58,427
Saltmarsh	8,939	12,106	25,953	38,884	-3,683	-845	81,352
Net change in wetlands**	-1,656	4,016	-5,992	6,983	-36,521	-43,167	-76,337

\* Results are for a 1 meter increase in sea level rise which equals 3.28 feet.

\*\*Developed dry land excluded

## Key

More than 1,000 acres lost

One to 1,000 acres lost

No change

One to 1,000 acres

More than 1,000 acres gained

# Project Resources

The Nature Conservancy Florida Chapter would like to thank the Environmental Protection Agency for providing some of the funding to conduct this research. Also, The Nature Conservancy thanks its partners who helped us complete this forward-thinking document to secure a safer future.



- Geselbracht, L., K. Freeman, A. Birch, D. Gordon, A. Knight, M. O'Brien, and J. Oetting. 2013. Modeling and Abating the Impacts of Sea Level Rise on Five Significant Estuarine Systems in the Gulf of Mexico, Final Report to the U.S. Environmental Protection Agency – Gulf of Mexico Program, Project # MX-95463410-2. The Nature Conservancy.
- Geselbracht, L., K. Freeman, E. Kelly, D.R. Gordon and A. Birch. 2013. Retrospective analysis and sea level rise modeling of coastal habitat change in Charlotte Harbor to identify restoration and adaptation priorities. Florida Scient. 76(2): 328–355.
- Freeman, K., L. Geselbracht, D. Gordon, E. Kelly, L. Racevskis. 2012. Understanding Future Sea Level Rise Impacts on Coastal Wetlands in the Apalachicola Bay Region of Florida's Gulf Coast. The Nature Conservancy for Florida Department of Environmental Protection, DEP Agreement No. CM112.
- Warren Pinnacle Consulting. 2011. Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to Saint Andrew and Choctawhatchee Bays. Prepared for The Nature Conservancy.

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Protecting nature. Preserving life."



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