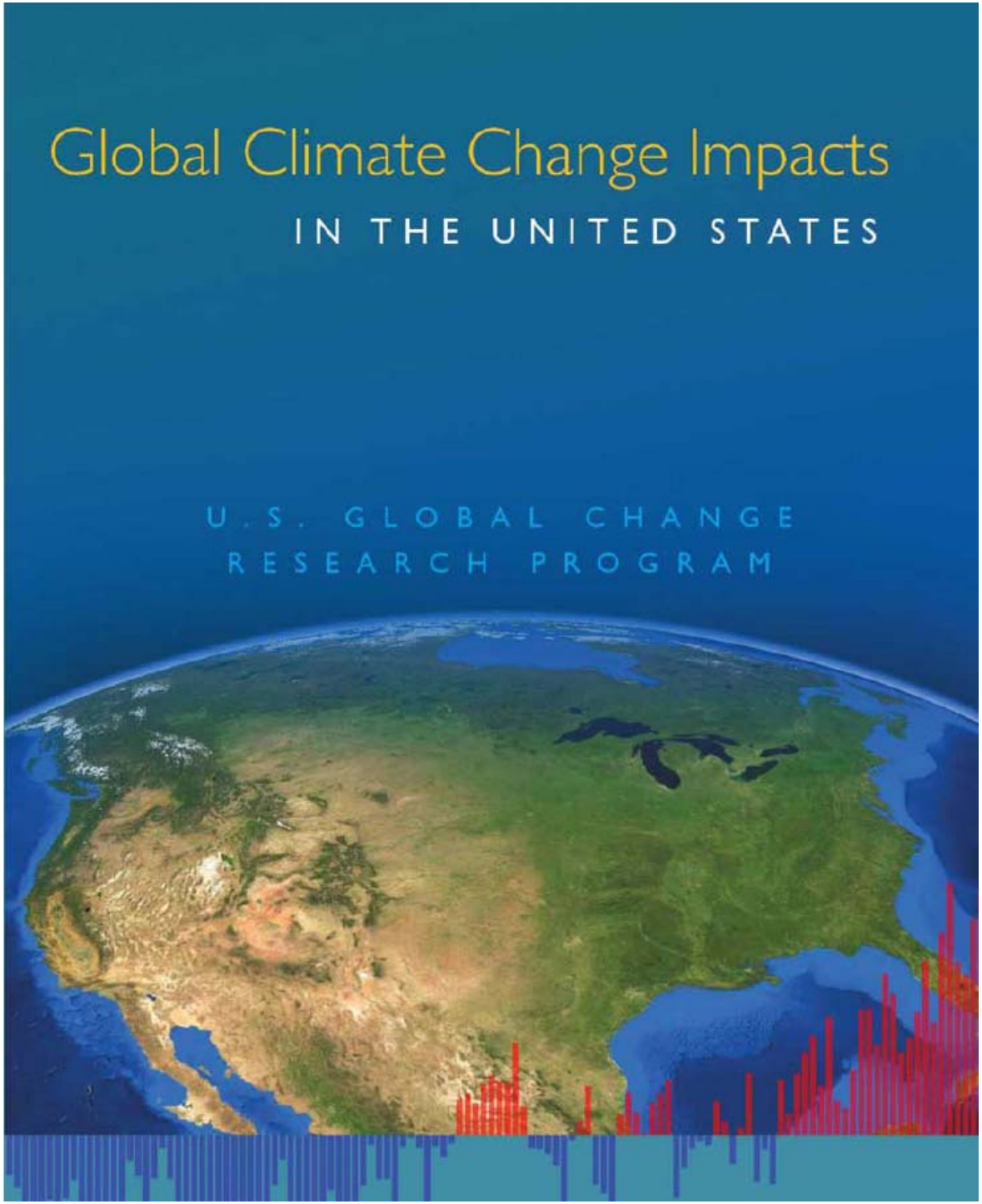

Released June 16, 2009

www.globalchange.gov

Climate Change Impacts by Sector

Water Resources .....

Energy Supply and Use .....

Transportation.....

Agriculture.....

Ecosystems .....

Human Health.....

Society .....

Key Findings

1. Global warming is unequivocal and primarily human induced
2. Climate changes are underway in the U.S. and projected to grow
3. Widespread climate-related impacts are occurring now and expected to increase
4. Climate change will stress water resources
5. Crop and livestock production will be increasingly challenged

Key Findings Continued

6. Coastal areas are at increasing risk from sea level rise and storm surge
7. Risks to human health will increase
8. Climate change will interact with many social and environmental stresses
9. Thresholds will be crossed, leading to large changes in climate and ecosystems
10. Future climate change and its impacts depend on choices made today

Regional Climate Change Impacts

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Southeast 111

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Southwest 129

Northwest 135

Alaska 139

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Regional Highlights from

Global Climate Change Impacts in the United States

www.globalchange.gov/usimpacts

Southeast

The annual average temperature in the Southeast has risen 2°F since 1970, with the greatest seasonal increase in the winter months. There has been a 30 percent increase in fall precipitation over most of the region but a decrease in fall precipitation in South Florida. Summer precipitation has decreased over almost the entire region. The percentage of the Southeast in moderate to severe drought increased over the past three decades. There has been an increase in heavy downpours. The power of Atlantic hurricanes has increased since 1970, associated with an increase in sea surface temperature.

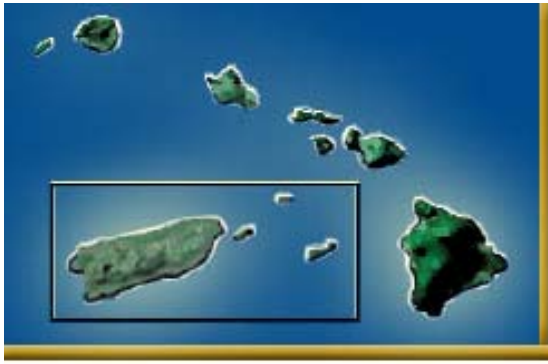
Key Issues

Projected increases in air and water temperatures will cause heat-related stresses for people, plants, and animals.

Decreased water availability is very likely to affect the region's economy as well as its natural systems.

Sea-level rise and the likely increase in hurricane intensity and associated storm surge will be among the most serious consequences of climate change.

Quality of life will be affected by increasing heat stress, water scarcity, severe weather events, and reduced availability of insurance for at-risk properties.



Regional Highlights from

Global Climate Change Impacts in the United States

www.globalchange.gov/usimpacts

Islands

Climate change presents U.S.-affiliated islands with unique challenges. Small islands are vulnerable to sea-level rise, coastal erosion, extreme weather events, coral reef bleaching, ocean acidification, and contamination of freshwater resources with saltwater. The

Key Issues

Island communities, infrastructure, and ecosystems are vulnerable to coastal inundation due to sea-level rise and coastal storms.

The availability of freshwater is likely to be reduced, with significant implications for island communities, economies, and resources.

Climate changes affecting coastal and marine ecosystems will have major implications for tourism and fisheries.

Regional Highlights from

Global Climate Change Impacts in the United States

www.globalchange.gov/usimpacts

Coasts

Global sea level has already risen due to the warming-induced expansion of the oceans, accelerated melting of most of the world's glaciers, and loss of ice on the Greenland and Antarctic ice sheets. Sea level is currently rising at an increased rate. A warming climate will cause further sea-level rise over this century and beyond. Rising sea level is already eroding shorelines, drowning wetlands, and threatening homes, businesses, and infrastructure. The destructive potential of Atlantic hurricanes has increased in recent decades in association with increasing sea surface temperatures. In future decades, it is likely that hurricane rainfall and wind speeds will increase in response to global warming. Coastal water temperatures have risen and the distributions of marine species have shifted. Ocean acidification resulting from the uptake of carbon dioxide by ocean waters threatens corals, shellfish, and other living things that form their shells and skeletons from calcium carbonate. These and other forces converge and interact at the coasts, making these areas particularly sensitive to the impacts of climate change.

Key Issues

Significant sea-level rise and storm surge will adversely affect coastal cities and ecosystems around the nation; low-lying and subsiding areas are most vulnerable.

Higher water temperatures and ocean acidification due to increasing atmospheric carbon dioxide will present major additional stresses to coral reefs, resulting in significant die-offs and limited recovery.

Sea Level Rise and Inundation Community Workshop Executive Summary

December 3 to 5, 2009
Lansdowne, Virginia

Dr. Jerry Schubel, Aquarium of the Pacific, Chair
Margaret Davidson, NOAA Coastal Services Center, Co-host
Dr. John Haynes, USGS Coastal Marine Geology Program, Co-host

Abbreviated Framework

Define the Problem and State It Richly

I. Explore the issues of sea level rise and inundation with the community to develop a shared vision of what is at risk and the qualities stakeholders want to protect in the face of a rising sea

II. Identify the geographic scope of the project area and the time scales of concern

III. Identify and recruit critical partners and stakeholders, including nontraditional partners, and clarify roles and responsibilities

Gather the Data, Information, and Tools

IV. Characterize the current and future states of sea level rise and inundation for the project area

V. Identify critical data, information, and tools that need to be refined or developed to reduce uncertainty

VI. Secure or develop the necessary data, information, and tools

Identify and Explore Alternative Strategies

VII. Identify and evaluate the various strategies for dealing with the projected sea level rise and inundation scenarios to protect the qualities identified in step I

Build and Sustain Capacity and Support

VIII. Develop and continually support a comprehensive communication strategy

IX. Build the institutional capacity and the political will to execute the strategies selected

X. Institutionalize the program and keep current

DATA

•Data to understand land forms and where and how water will flow: This includes geomorphology, topography/bathymetry (LiDAR), vertical datums, etc.

•Monitoring data and environmental drivers: This includes tides, water levels, waves, precipitation, historical and predictive shoreline erosion data, local sediment budget, etc.

• Consistent sea level rise scenarios and projections across agencies to support local planning: This includes not only the amount of sea level rise projected within a given area, but also storm frequency information and general timeframe within which these changes are anticipated.

• Data to characterize vulnerabilities and impacts of sea level rise: This includes population data, land use, buildings and critical infrastructure, natural resources, economic information, etc.

• Community characteristics: This includes demographics, societal vulnerabilities, economic activity, public attitudes and understanding of risks, etc.

• Legal frameworks and administrative structure: This includes zoning, permitting regimes, legislative restrictions, etc.

TOOLS

- Communication tools for stakeholder engagement, visioning, and consensus building
- Tools to monitor and model current and future states
- Visualization and scenario-building tools
- Implementation

Findings and Recommendations:

• Communities have experience with storm and hazardous events and the response typically is to return to normal. With sea level rise there will need to be a shift in perception and response from storm events to sea level rise, and the people must collectively arrive at a new vision for their community in light of a changing environment.

•Many communities are ready to take action

•No single agency is responsible for info and guidance on SLR

•Federal and state agencies need to set standards

•SLR adaptation planning is an iterative process in which science and policy must be tightly coupled from the beginning

•Planners should share their experiences with others involved in similar efforts

PREPARING FOR CLIMATE CHANGE

A Guidebook for Local, Regional, and State Governments

Sept. 2007

Written by
Center for Science in the Earth System (The Climate Impacts Group)
Joint Institute for the Study of the Atmosphere and Ocean
University of Washington

King County, Washington

With an Introduction by King County Executive Ron Sims

King County

In association with
ICLEI
Local Governments for Sustainability

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"Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the Year 2100"

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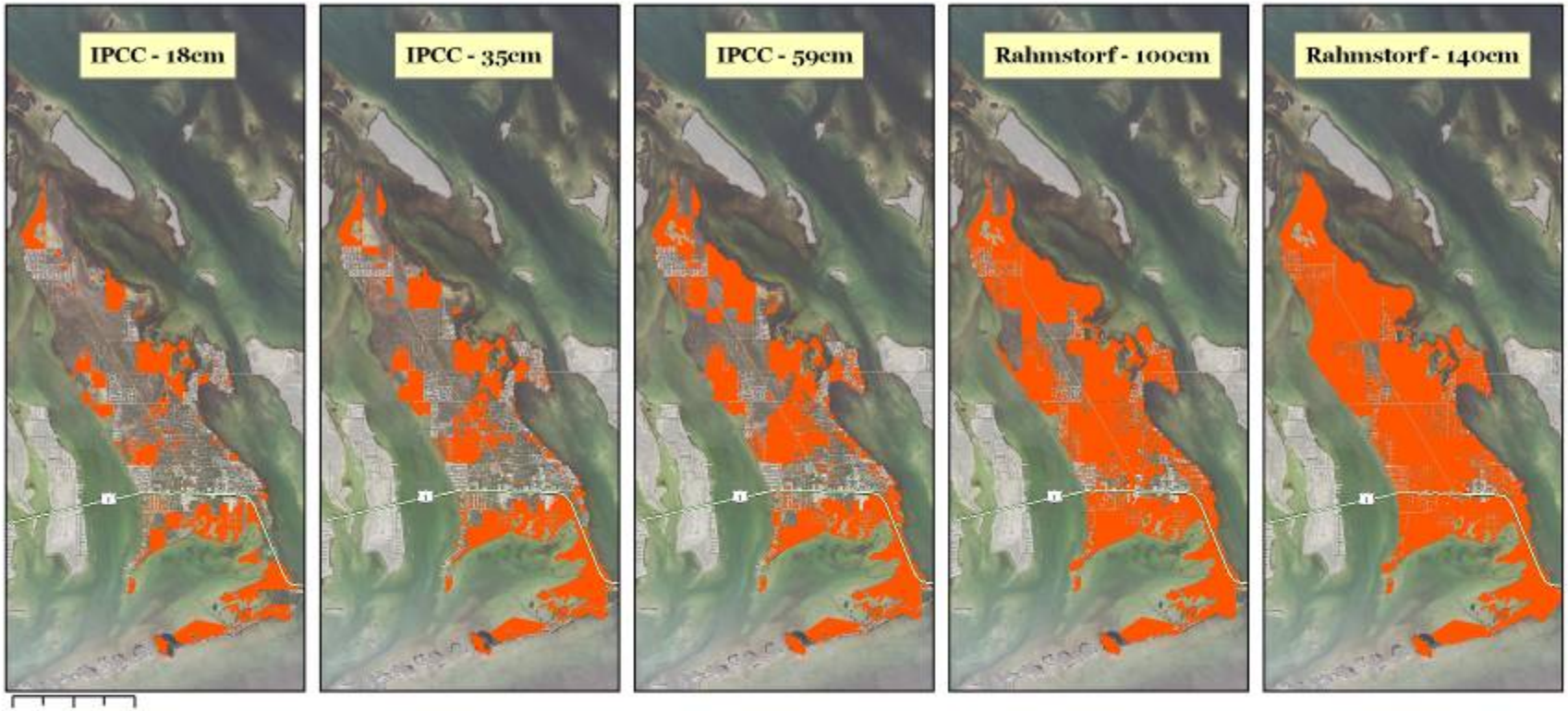
nature.org

- Sea level rise modeling focused on Big Pine Key using fine scale elevation data
  - Potential future shorelines
  - Changes in terrestrial habitat distribution
  - Property value loss estimates
- Sea level rise modeling on the entire Keys using coarse scale elevation data
- Resilience and adaption responses



0 0.5 1 2 Miles

Big Pine Key - Parcels at Risk

Parcels at Risk from Sea-Level Rise

Outside Study Area

Study Area

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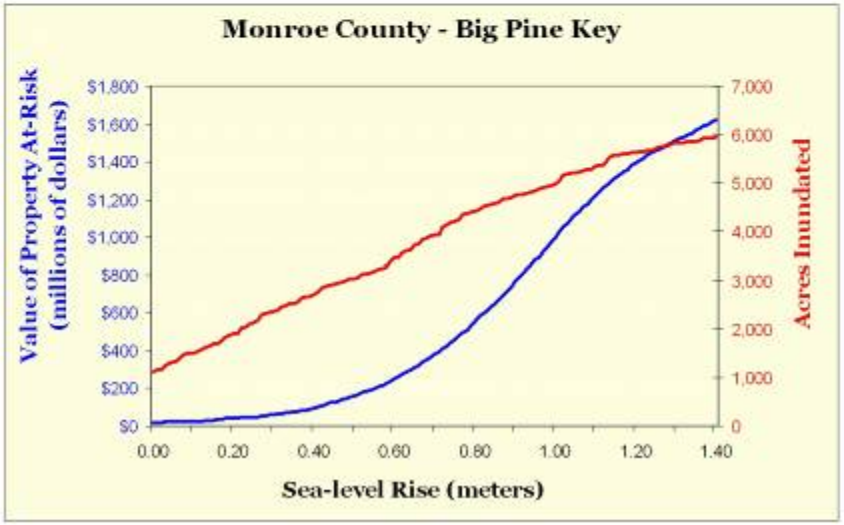
INDUSTRIAL ECONOMICS, INCORPORATED

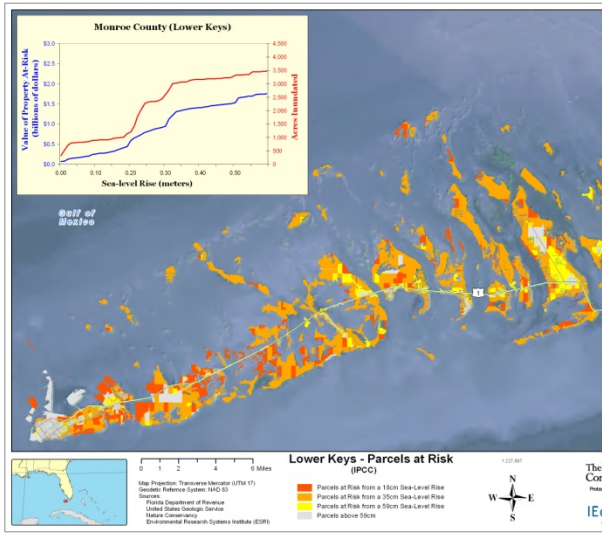
Map Projection: Transverse Mercator (UTM 17)
Geodetic Reference System: NAD 83
Sources:
Florida Department of Revenue
United States Geologic Service
Nature Conservancy
Environmental Research Systems Institute (ESRI)

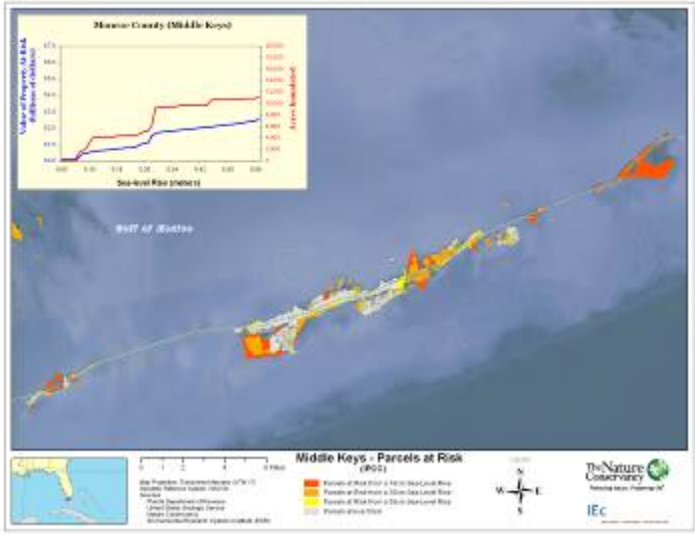


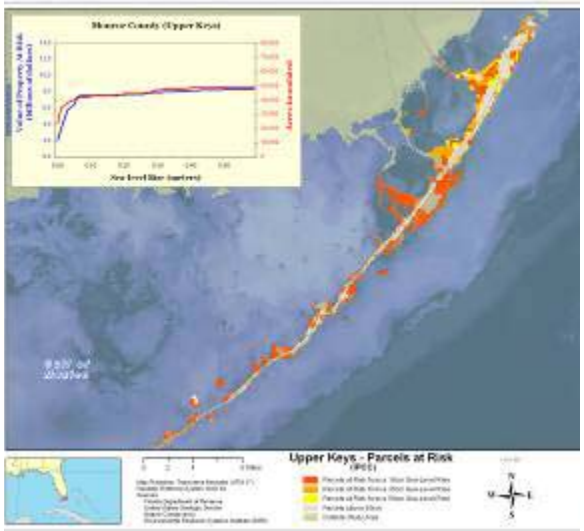
PROPERTY VALUE AND ACREAGE AT RISK UNDER VARIOUS SLR SCENARIOS (MONROE COUNTY; 30M NED)

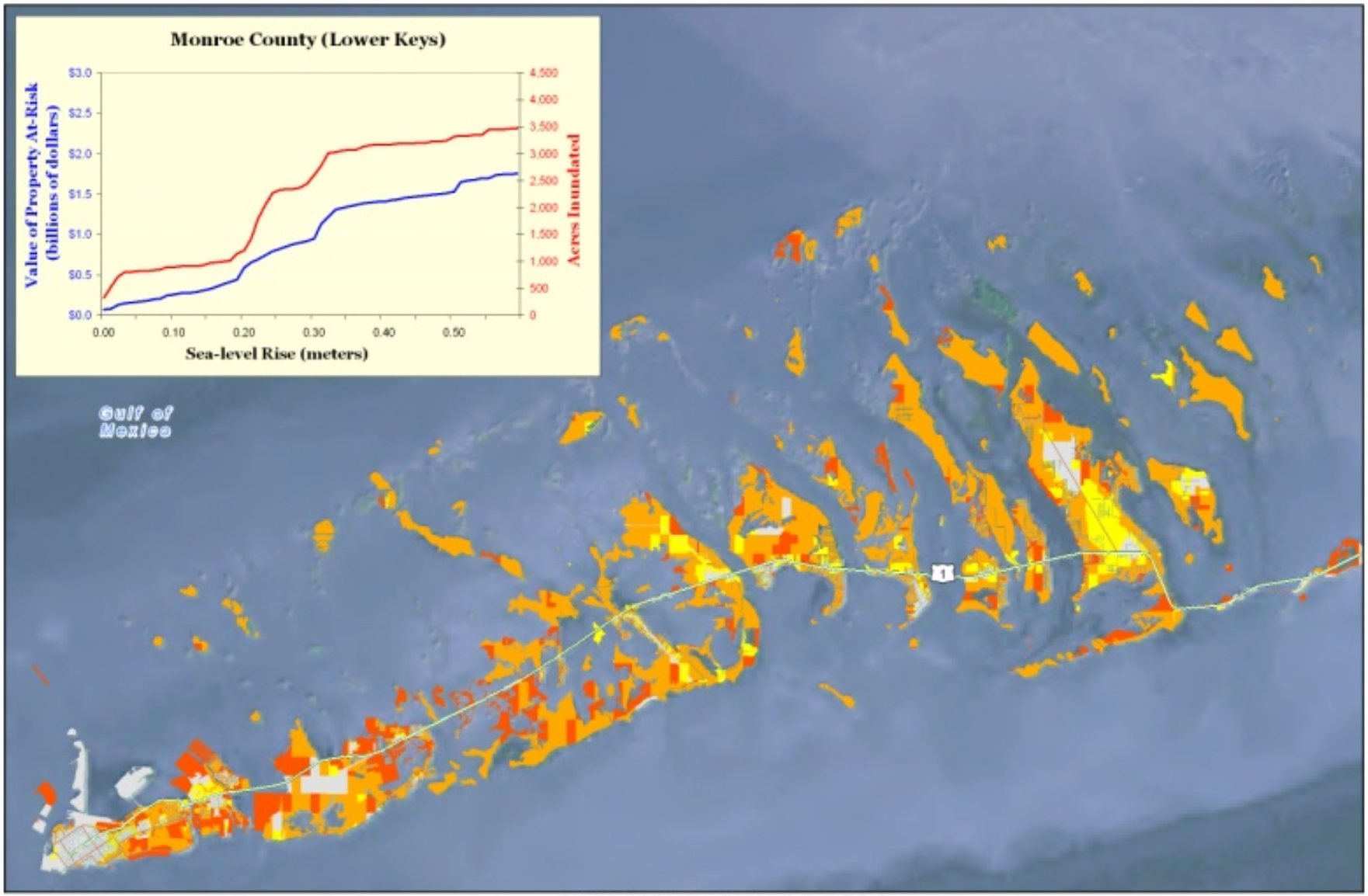
SLR Scenario	LOWER KEYS		MIDDLE KEYS		UPPER KEYS		FLORIDA KEYS	
	PROPERTY VALUE AT RISK	ACRES	PROPERTY VALUE AT RISK	ACRES	PROPERTY VALUE AT RISK	ACRES	PROPERTY VALUE AT RISK	ACRES
IPCC 18cm	$2,610,000,000	11,000	$753,000,000	4,430	$7,670,000,000	43,300	$11,000,000,000	58,800
IPCC 35cm	$8,790,000,000	49,400	$1,850,000,000	9,500	$8,040,000,000	47,500	$18,700,000,000	106,000
IPCC 59cm	$11,000,000,000	54,400	$2,610,000,000	11,200	$8,330,000,000	49,600	$21,900,000,000	115,000
Rahmstorf 100cm	$13,000,000,000	56,300	$3,530,000,000	12,600	$10,100,000,000	55,600	$26,700,000,000	124,000
Rahmstorf 140cm	$15,800,000,000	58,000	$6,040,000,000	17,300	$13,200,000,000	67,100	$35.1 B	142,000

Note: Figures are rounded to 3 significant digits. Entries may not sum to totals due to rounding.









0 1 2 4 6 Miles

Map Projection: Transverse Mercator (UTM 17)
Geodetic Refernce System: NAD 83
Sources:
Florida Department of Revenue
United States Geologic Service
Nature Conservancy
Environmental Research Systems Institute (ESRI)

Lower Keys - Parcels at Risk
(IPCC)

- Parcels at Risk from a 18cm Sea-Level Rise
- Parcels at Risk from a 35cm Sea-Level Rise
- Parcels at Risk from a 59cm Sea-Level Rise
- Parcels above 59cm

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We have time to minimize the consequences of sea level rise.

- By mitigating the root causes of global climate change at international through local scales
  - Atmospheric pollution from greenhouse gases
  - Deforestation and forest degradation
- By preparing our local natural areas, native species populations and the built environment
  - Enhancing their resilience to undesirable change
  - Enabling them to adapt to unavoidable change