

Economic Impacts of Sea Level Rise and Coastal Storms in Dania Beach, Florida

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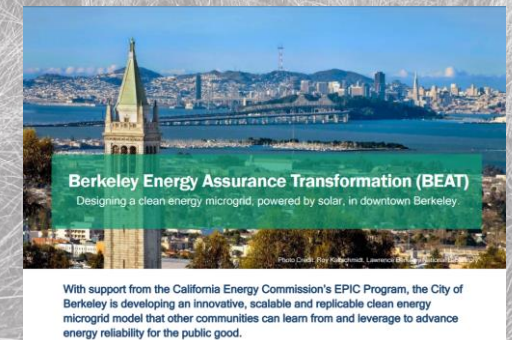
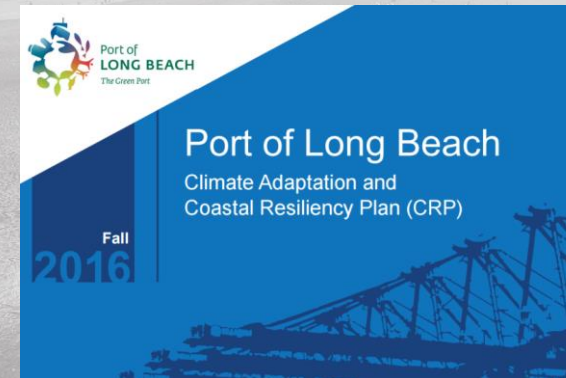
Agenda

- 01 Context
- 02 Dania Beach Project Background
- 03 Analysis Part I: Before REMI
- 04 Analysis Part II: REMI
- 05 Moving Forward

AECOM

Sustainable Economics

- Headquartered in San Francisco
- Economic consulting related to climate adaptation strategy
- Public, private, and non-profit clients
- Specialties include:
 - Environmental and resource economics
 - Urban and real estate economics
 - Public funding and financing

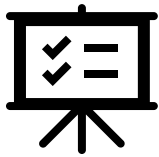


Dania Beach Project Background

A group of seagulls is gathered on a sandy beach. In the background, waves are breaking onto the shore under a clear blue sky. The scene is bright and sunny.

Study Purpose

How can Broward County support adaptation actions and redevelopment investments that **promote economic resilience** in the context of coastal hazards?



What are the vulnerabilities of the Dania Beach business community today?



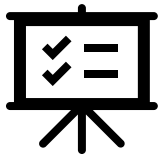
What are the costs and benefits of different response actions over time?



What actions can be taken today to promote resilience?

Study Components

How can Broward County support adaptation actions and redevelopment investments that **promote economic resilience** in the context of coastal hazards?



Survey



Direct Damages Model
REMI PI+



Memo

Key Concepts & Assumptions

Risk assessment modeling

Deterministic vs. probabilistic

Impact types

Temporary vs. permanent impacts

One-time vs. recurring impacts

Results reporting

Single-event vs. cumulative

Static built environment

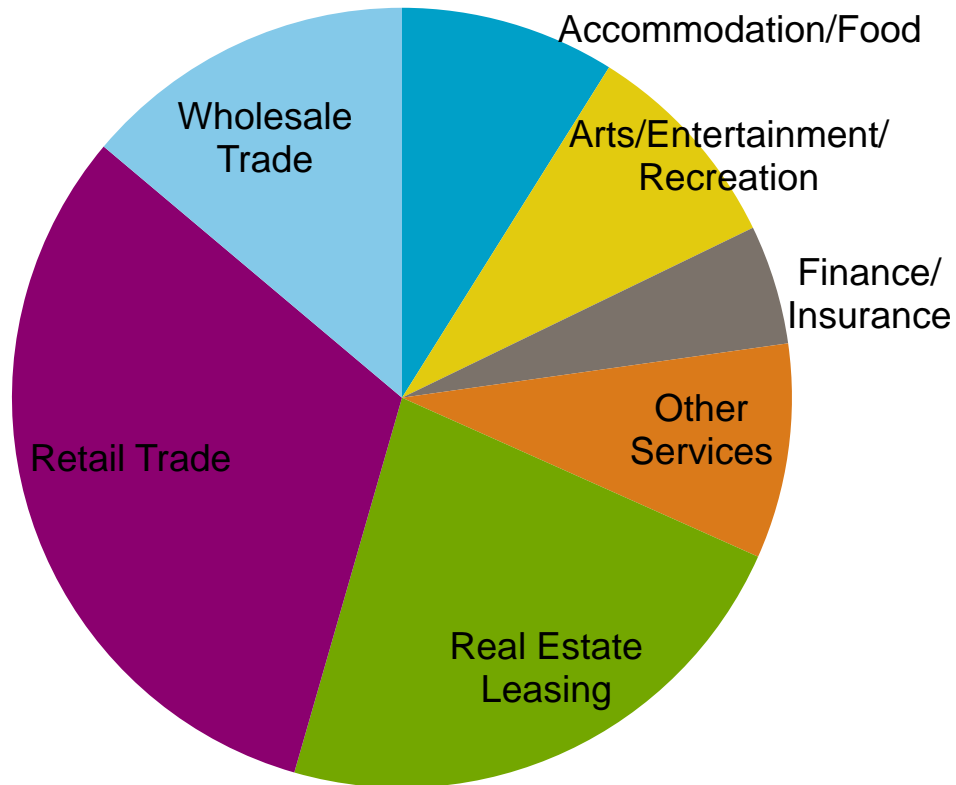
Does not account for future development

Results reporting

Economic damage, Economic impact, Fiscal impact,
Economic value*

Survey Findings

What services or products do you offer?



- Businesses are already impacted by severe weather events
- Many businesses are dependent on goods, services, employees, and clientele from outside Dania Beach
- Low staff wages and profit margins limit employee and operational resilience
- Businesses have limited capacity to pay for special assessments or utility fees that could fund infrastructure improvements

Physical Scenarios Evaluated

Sea Level Rise Source: NOAA

Storm and Sea Level Rise Source: USACE



A photograph of a beach with several seagulls on the sand and waves crashing in the background. The image is slightly faded to allow text to be overlaid.

Analysis Part I: Before REMI

Direct Damages to Dania Beach Businesses

Physical (Direct) Damages to Dania Beach



1

What are the physical impacts of SLR and coastal storms to business properties in Dania Beach?

– **Inputs**

- Property characteristics
- Business information
- Vulnerability

– **Outputs**

- Temporary damages to Dania Beach businesses
- Permanent damages to Dania Beach businesses

– **Tools**

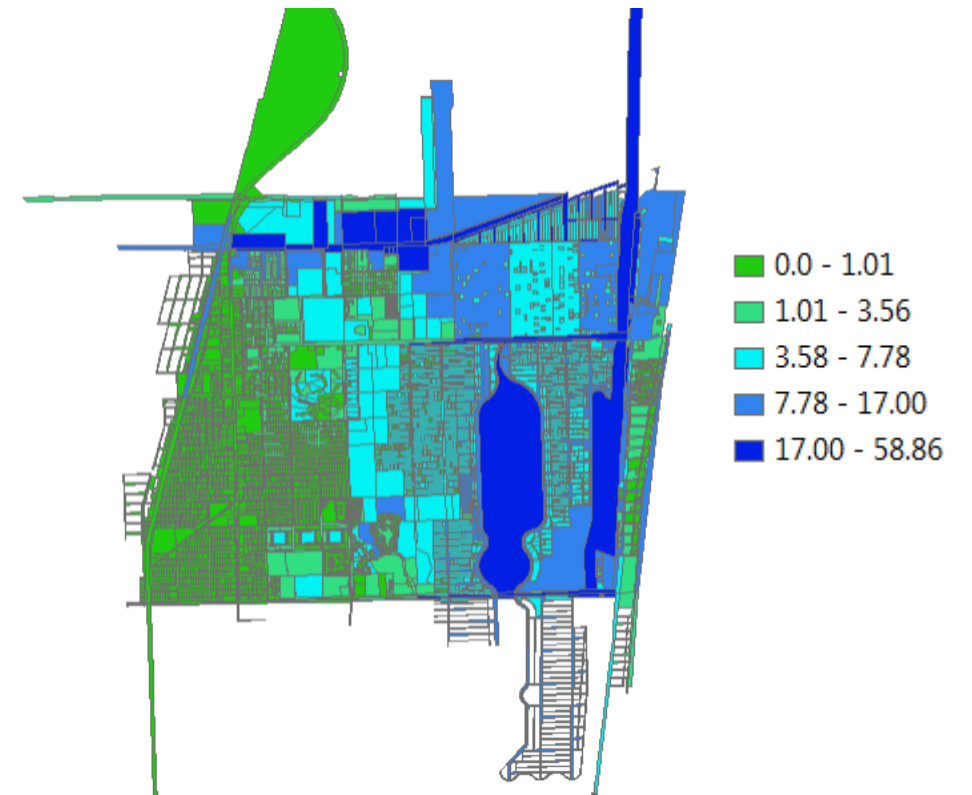
- Custom economic models built off of industry standards and tailored to local conditions

Selected Inputs

– Property and Business Information

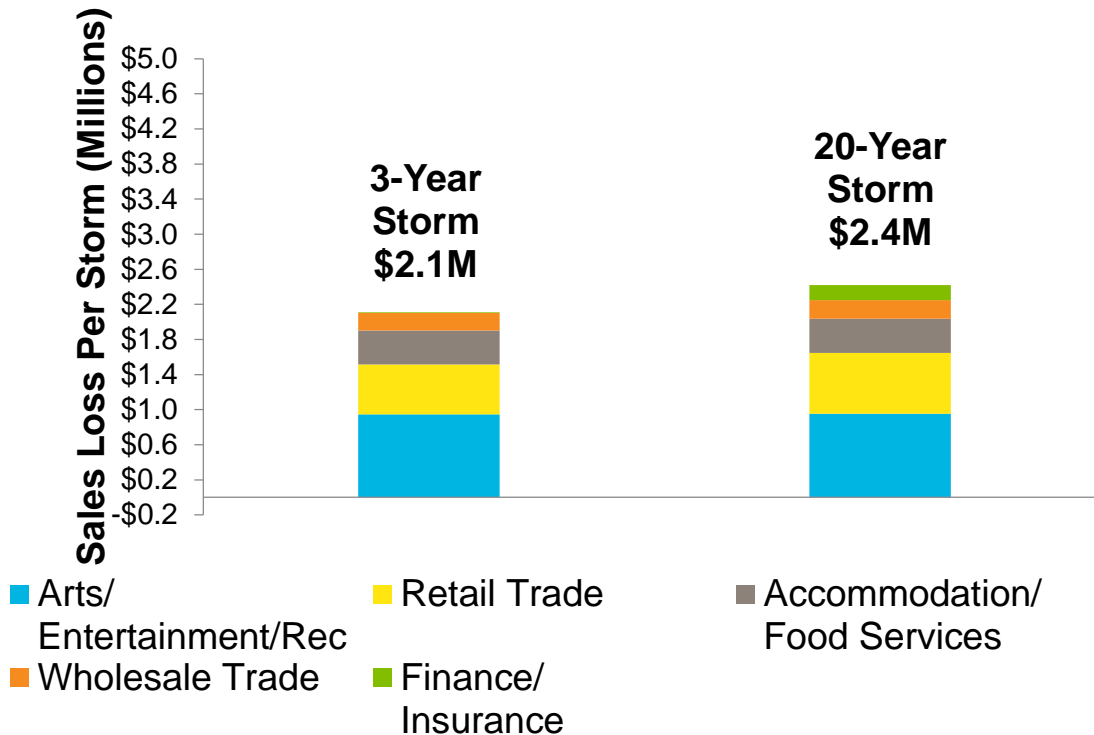
Property	Business
Square footage	Industry
Land use	Annual Sales
Assessed value	Annual Wages/Salaries
Stories	Number of Employees

– Vulnerability: Flood Depth & SLR Data

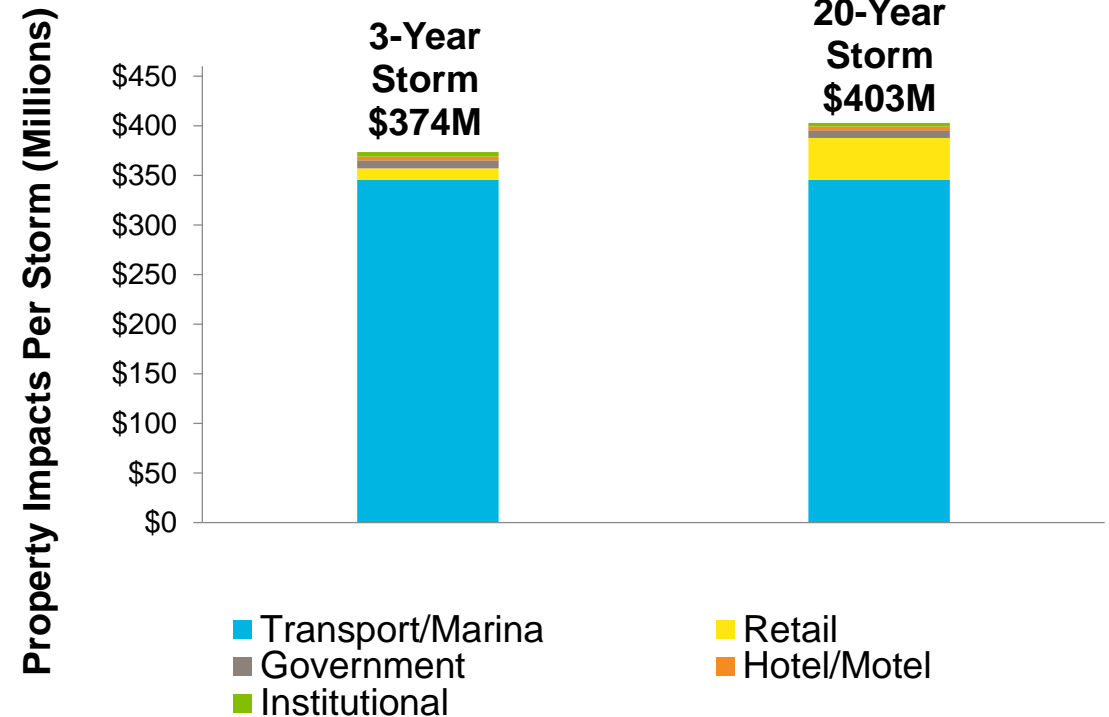


Selected Outputs: Damages per Storm

Business Sales Impacts from a 3-Year and 20-Year Storm*



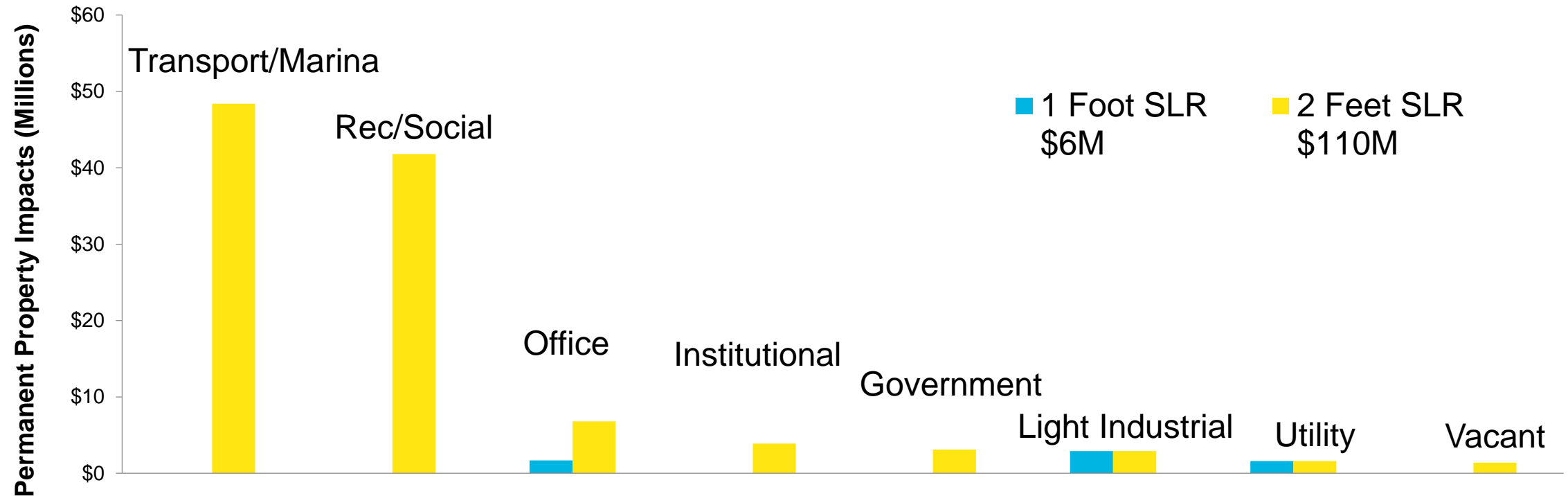
Direct Property Impacts from a 3-Year and 20-Year Storm*



*Five most impacted industries shown; storm conditions under 2 feet of sea level rise; no discounting; excludes properties permanently impacted by sea level rise

*Five most impacted land uses shown; storm conditions under 2 feet of sea level rise; no discounting; excludes properties permanently impacted by sea level rise

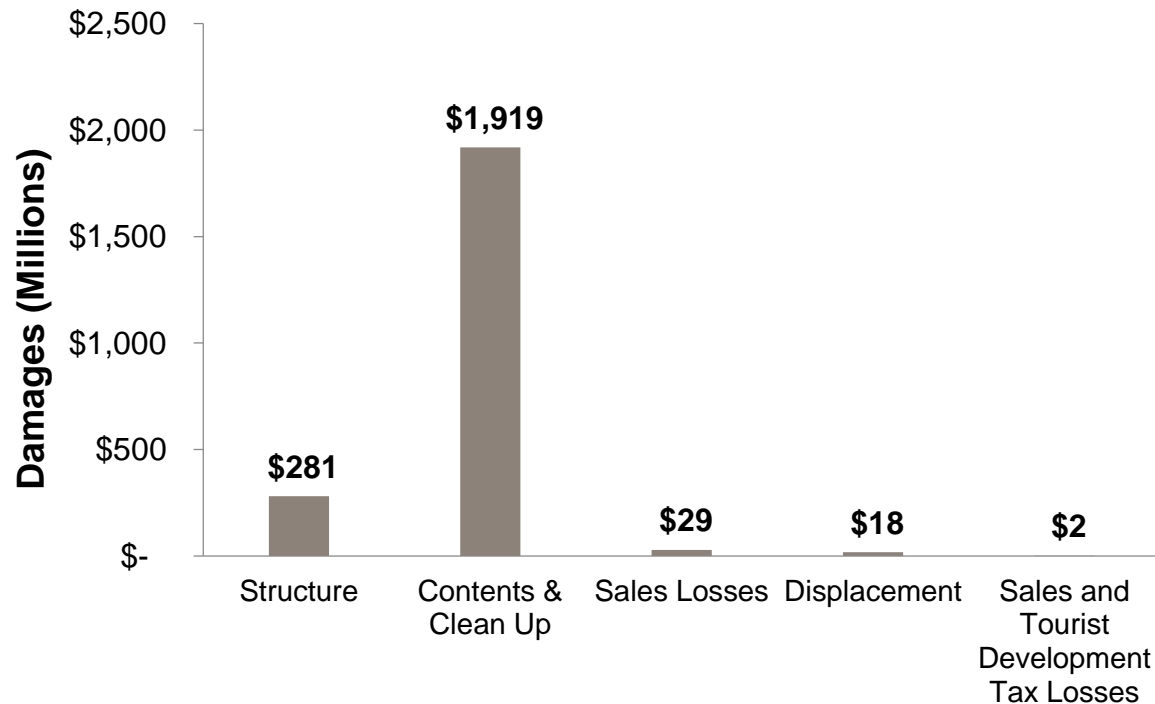
Selected Outputs: Property value permanently impacted by sea level rise



*No discounting

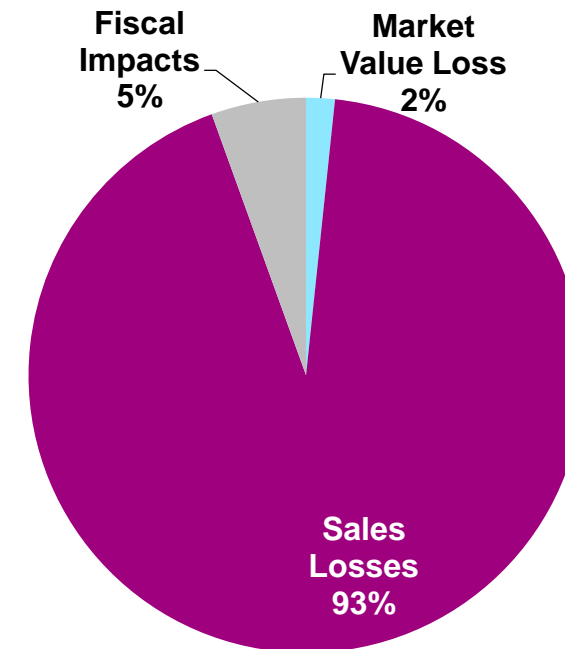
Selected Outputs: Cumulative Damages

Coastal Storm Events: Cumulative Damages*
2030-2070: \$2.2B



*Using assumed event occurrence; no discounting or escalation incorporated; excludes permanently impacted properties

Sea Level Rise: Cumulative Damages**
2030-2070: \$6.6B



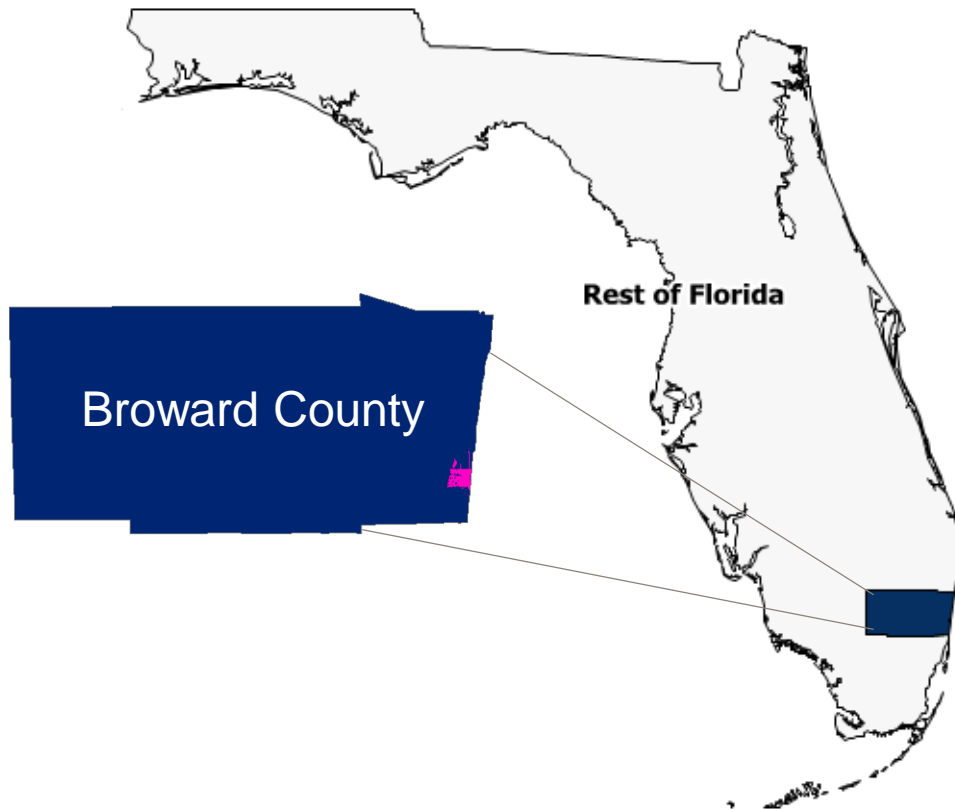
**Using assumed event occurrence; no discounting or escalation incorporated

A photograph of a beach with waves crashing onto the shore. Several seagulls are on the sand. The image is overlaid with a semi-transparent white box containing text.

Analysis Part II: REMI

Impacts to Broward County and the Rest of Florida

Impacts to Broward & the Rest of Florida



2

How will different response actions, or no action, affect the Broward County economy? How will they affect the rest of Florida?

– **Inputs**

- Response actions
 - Purpose, Beneficiaries and Physical Impacts, Costs and Sources of Funds, Involved Industries, Timeframe

– **Outputs**

- Impacts to Broward County
- Impacts to the Rest of Florida

– **Tools**

- REMI PI+

Selected Inputs: Response Actions

Response Actions	Description	Application to Physical Scenarios
No Preemptive Action	Nothing is done to mitigate future SLR and coastal storm conditions, but structures subject to storm damage are rebuilt post-event	Temporary & Permanent
Relocate	Low-lying businesses subject to tidal inundation from SLR relocate to higher ground in Dania Beach or outside of the City boundaries	Permanent
Fortify	Construct a seawall to prevent low-lying business from being subject to tidal inundation from SLR	Permanent
Accommodate	Elevate structures so their first floor elevation is higher than the base flood elevations of modeled coastal storms	Temporary

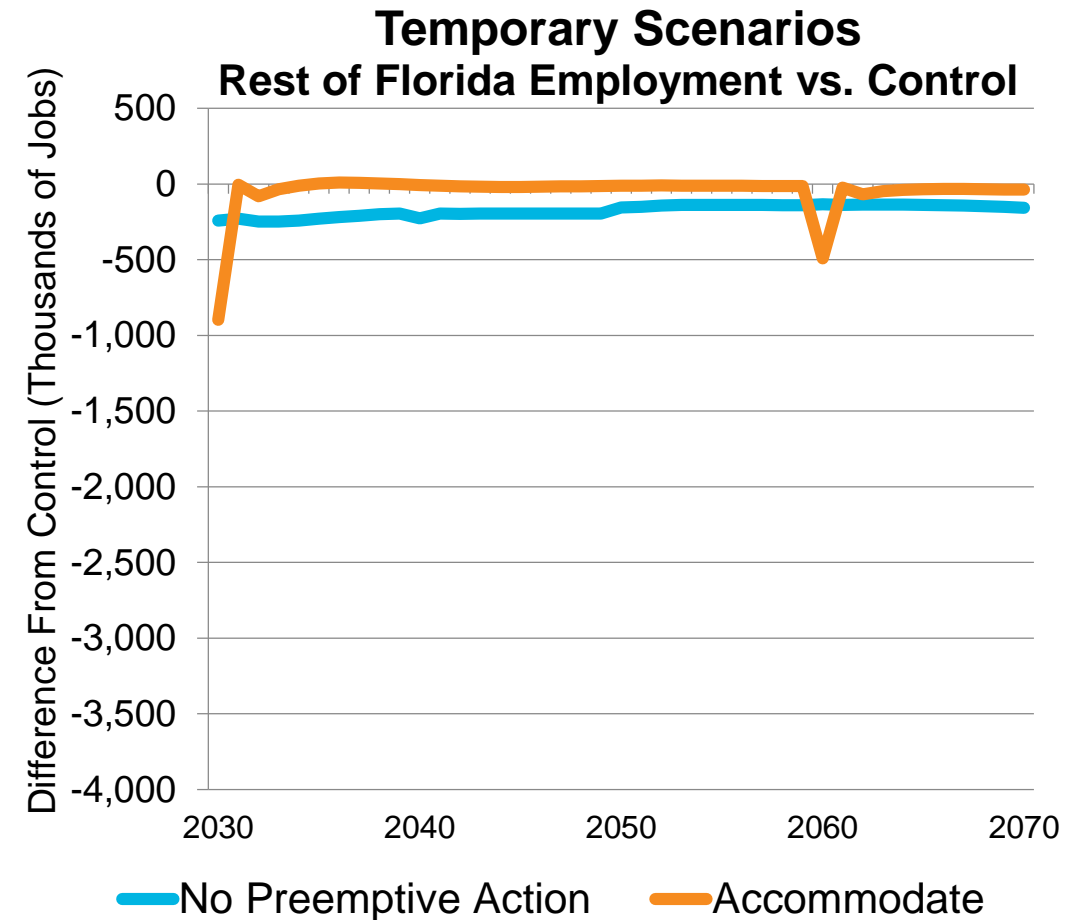
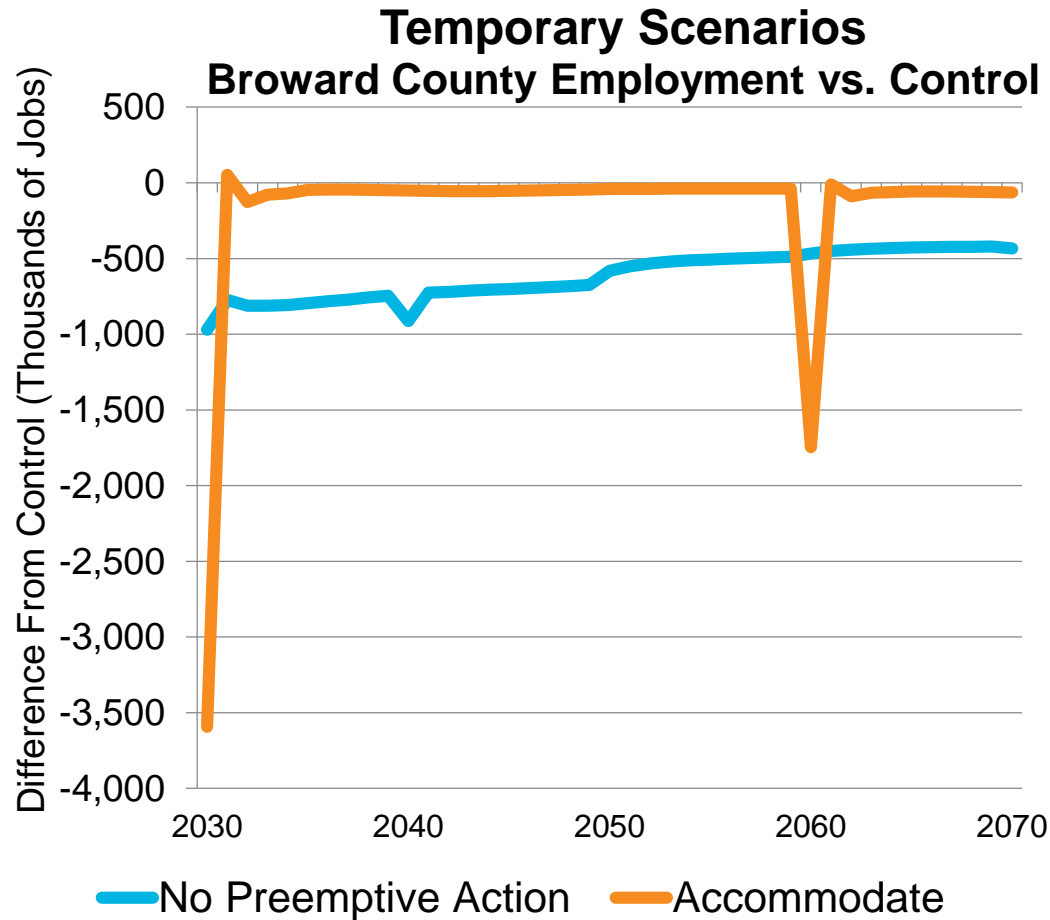
REMI Model Analysis Elements

Elements	Description
Capital Stock	Property damage from coastal storms and SLR
Output	Direct output loss resulting from business closure
Production Cost	Increase in costs to pay for response actions
Investment Spending	For businesses relocating to outside of Broward County, investment into rest of Florida
Government Spending	Funding for rebuilding, relocating businesses, or adaptation strategies
Demand	Demand for certain industries involved in adaptation strategies

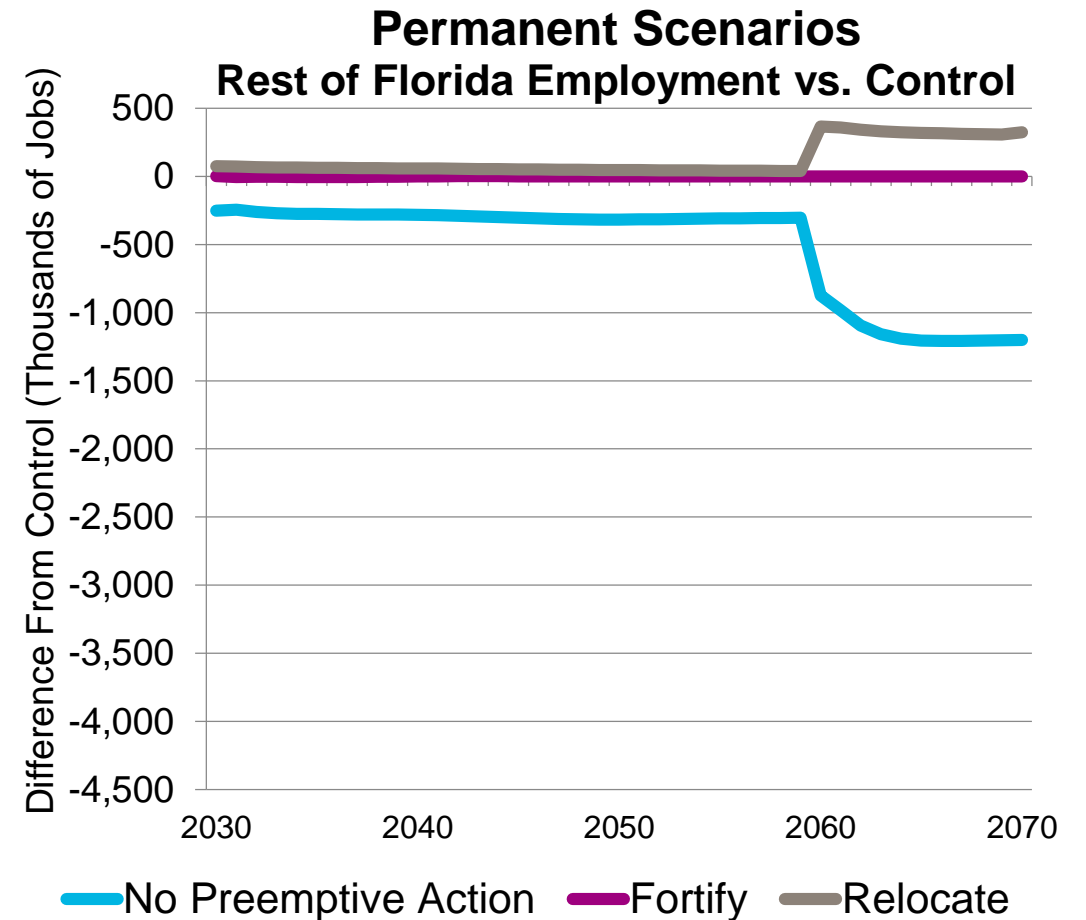
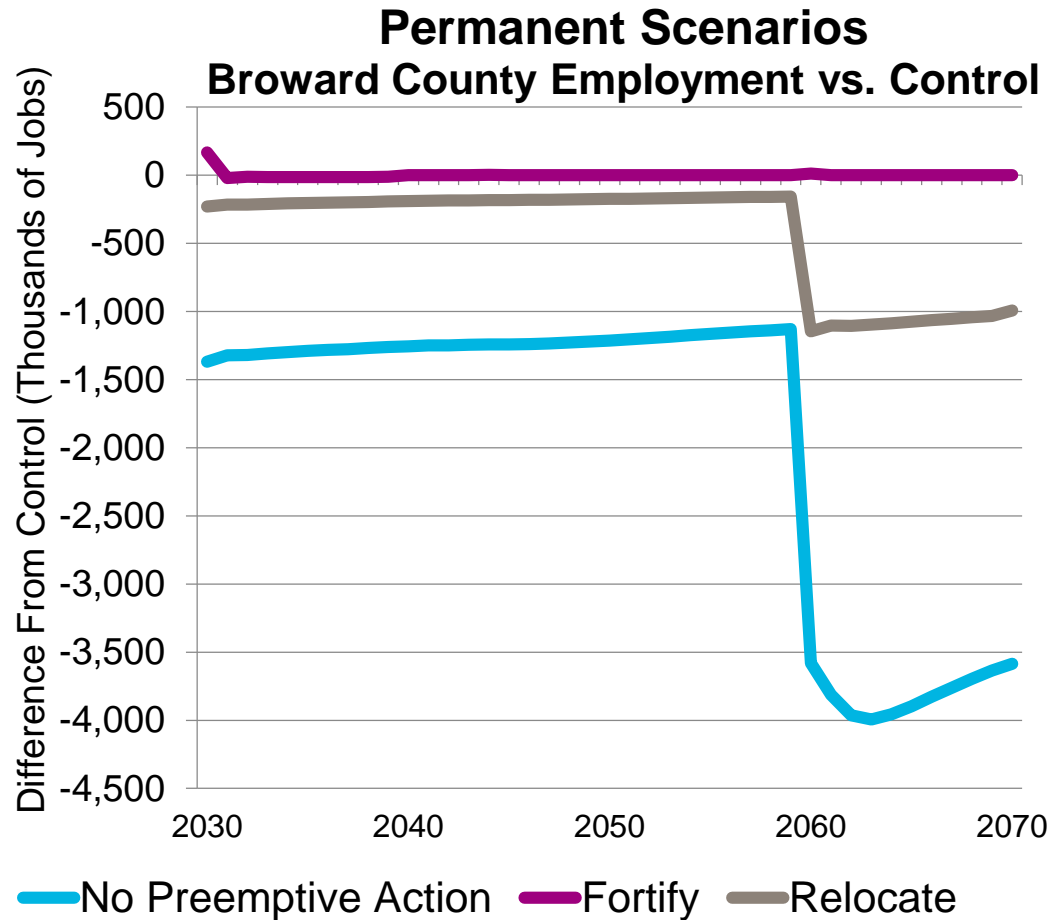
Selected Outputs: Summary Table

	CONTROL		TEMPORARY		PERMANENT		
	Change 2030-2070	Control	No Preemptive Action	Accommodate	No Preemptive Action	Relocate	Fortify
Broward County	Employment	312,810	-25,210	-7,270	-78,800	-17,330	100
	GDP (Millions)	\$131,150	-\$2,910	-\$740	-\$7,400	-\$2,240	\$10
	Population	584,770	-42,150	-11,150	-88,260	-20,270	140
Rest of Florida	Employment	1,758,020	-7,230	-2,160	-21,330	5,230	-20
	GDP (Millions)	\$918,090	-\$920	-\$250	-\$2,790	\$730	\$0
	Population	3,520,990	-10,320	-2,580	-30,550	5,860	-60

Selected Outputs: Employment in Temporary Scenarios



Selected Outputs: Employment in Permanent Scenarios



Moving Forward

A group of seagulls is gathered on a sandy beach. In the background, gentle waves with white foam are washing onto the shore. The sky is a clear, bright blue. The overall scene is peaceful and natural.

Recommendations by Sector

PUBLIC

- Phased investments that incorporate long-term risk
- Regional strategies
- Accessible data to identify vulnerability
- Expanded assessment of potential damages
- Standards to build back better in the event of disaster
- Tradeoff of evaluation responses

PRIVATE

- Business continuity plans
 - Vulnerability to future conditions both on-site and offsite
 - Review insurance policies
- Intra-industry collaboration to develop preparedness and limit duplicate efforts
- Public sector collaboration for data needs & adaptation prioritization

Other REMI Factors to Consider in Future Studies

- Role of insurance
- Assumed built-in resilience and ability for small businesses to weather impacts
- Ability to stage adaptation responses to minimize impacts
- Changes in property values
- Ability to effectively deploy funds

Other Considerations



Paying for adaptation



Accounting for equity



Disadvantaged populations



Opportunity costs



Reputation risks and associated impacts

Q & A

Thank you for your time!

Feel free to contact me:
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