Modeling Policy Solutions to coastal climate change in Florida

By

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The Problem
Sea Level Rise
Effects in U.S.

Sea Level Rise
Effects in Florida

• Florida is particularly vulnerable to sea level rise due to dense coastal populations and large amounts of land at or near sea level
  – 4,500 sq. mi. of land below 4.5 ft. of sea level
  – One foot rise equal up to 200 ft. of erosion
  – Saltwater intrusion and with salt water “flushing”
  – Mangroves, brackish water and a portion of the Everglades are at risk
Filling The Knowledge Gap

• Comprehensively Analyze Existing Policy Solutions

• Assess How Florida Counties May Have Already Implemented Policies

• Use A GIS Model To Predict How Each Policy Would Impact Two Study Areas In Florida

Field Of Research

Technical / GIS

Legal

My Dissertation

Land Tenure / Policy

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Interested Parties

• Local Gov’t: Counties lack understanding of different policy options, need to understand consequences of not acting now

• Property Owners: Do not understand the CC threat or its effects to their property

• Academia: Coastal GIS research has not yet moved beyond “do nothing” models

Climate change solutions

• **Protection:** hardening techniques like seawalls, jetties and beach nourishment to create static coastline

• **Managed Retreat:** Moving development out of harm’s way in a planned and controlled manner using techniques such as abandonment, relocation, avoidance

• **Accommodation:** Strategies that allow for the use of vulnerable lands to continue, but that do not attempt to prevent flooding or inundation with shoreline protection.

Financially Unsustainable: inequitable use of public funds, property damage costs, maintenance and construction costs, damage to recreational values.

Ecologically Unsustainable: Damages coastal ecosystems and processes, prohibits ecosystem retreat.

Volk, 2008
Climate change solutions

• **Protection:** hardening techniques like seawalls, jetties and beach nourishment to create static coastline

• **Managed Retreat:** Moving development out of harm’s way in a planned and controlled manner using techniques such as abandonment, relocation, avoidance

• **Accommodation:** Strategies that allow for the use of vulnerable lands to continue, but that do not attempt to prevent flooding or inundation with shoreline protection.

Ecologically sustainable by allowing ecosystem processes and retreat.

Financially sustainable by avoiding costs associated with protection, particularly if long range planning occurs.

Issues include Property loss, immigration land use conflicts, ‘takings’, existing incentives for coastal development, tourism and tax base impacts, short term vs. long term costs

Volk, 2008
GIS methodology

• Overlay Datasets

• Create SLR Masks (0.15m steps from 0.15m to 5.0m)

• Simulate Policies
  – Hard protection
  – Rolling Easement
  – Armoring Prohibition

• Analyze Affected Areas
  – Land Area and Value Lost
  – Population Displaced

loops

If You Can Read This, You Should Be a Jet Fighter Pilot
The PYTHON CODE

```python
def getvalue(PERC_D_%n%, CurVal_%n%):
    if PERC_D_%n% == 0:
        return CurVal_%n%
    else:
        return CurVal_%n% - (PERC_D_%n%* CurVal_%n%)

def getvalue(PERC_D_%n%, CurVal_%n%, ID_Dup_%n%):
    if ID_Dup_%n%:
        return (17%)* CurVal_%n%* .1]
    else:
        return 0

def getvalue(ID_Dup_%n%, NewVal_%n%):
    if ID_Dup_%n% > 1:
        return NewVal_%n% + 14000
    else:
        return 0
```

Calculates new parcel value based on percent of inundation

Calculates easement payment based on when (n) the parcel is inundated

Adds “waterfront” premium to parcel due to SLR in a given scenario

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Study areas

[Map showing study areas in Florida]
Study areas

Key West, FL

Study areas

Pinellas, FL
DATA

LiDAR

Key West, FL: White Area is Above 3 feet
H: <10m    V: <1m
Parcel database

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Population

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shoreline

inundation scenarios
Slosh storm surge

Key west results
Armoring prohibition
Key west results
rolling easement

Pinellas results
Armoring prohibition

Land Value

CN | www.CNettleman.net
Pinellas results
rolling easement

Waterfront Values

conclusions
Future work

- Integrate Highly Accurate, Localized Storm Surge Data
- Integrate Water Drainage Issues (Storm and Sewer)
- Integrate Local Beach Studies: Better Understanding of Armoring Strategy
- Outreach: County Policy Makers