Modeling Policy Solutions to coastal climate change in Florida

By

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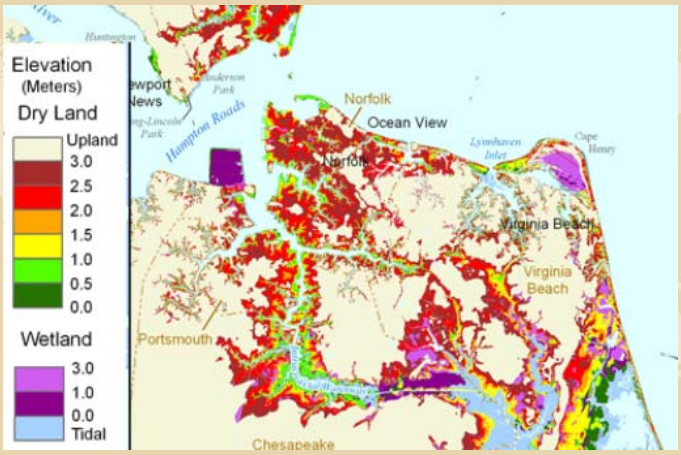
The Problem

Sea Level Rise

Effects in U.S.



Sea Level Rise

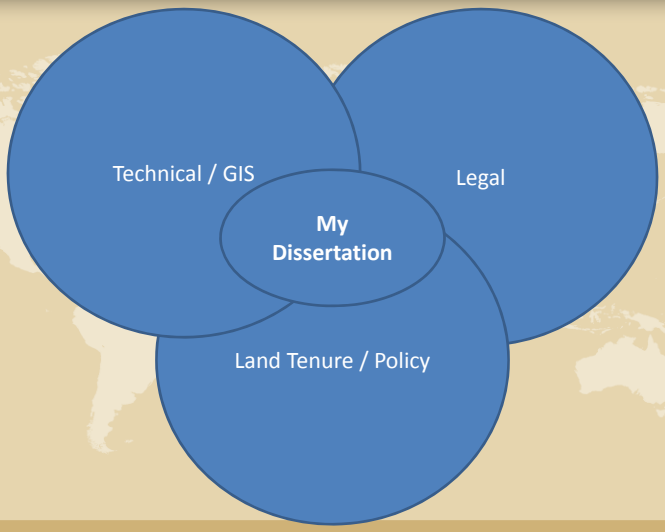
Effects in Florida

- 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



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

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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, in-migration land use conflicts, 'takings', existing incentives for coastal development, tourism and tax base impacts, short term vs. long term costs

Volk, 2008 CN | www.CNettleman.net

Climate change solutions

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Should be used as part of a larger plan for managed retreat- otherwise it will create similar financial and ecological costs as occur with protection

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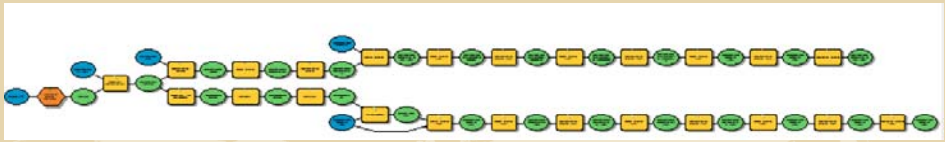
GIS methodology

- 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

```
def getvalue(PERC_D_%n%, CurVal_%n%):
 if PERC_D_%n% == 0:
  return CurVal_%n%
 elif PERC_D_%n% < 0.1:
  return  CurVal_%n% - (PERC_D_%n%* CurVal_%n%)
 else:
  return 0
```

Calculates new parcel value based on percent of inundation

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

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

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

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

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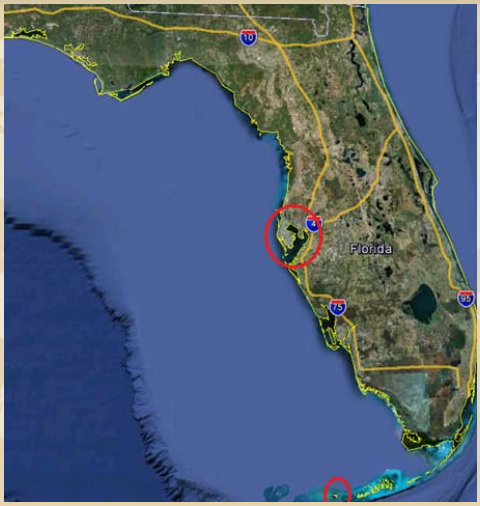
Study areas



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Study areas

Key West, FL

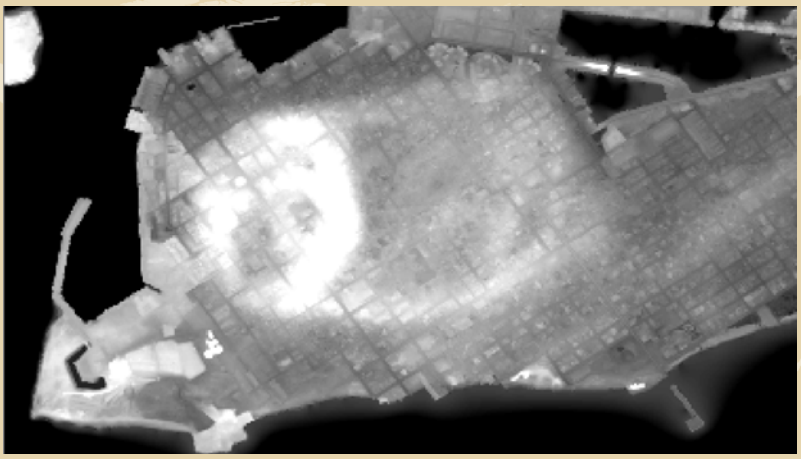
Study areas

Pinellas, FL

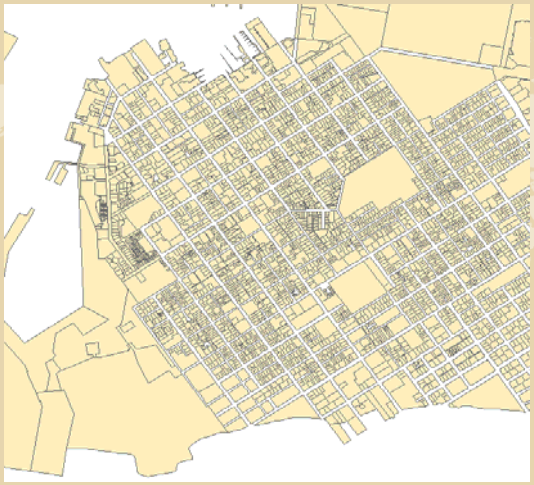
DATA

LiDAR

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



Parcel database



Shape_Area	ID	RECHAR	Shape *
8780.087808	141131.0537	00141131-053700	Polygon
6000.0225	140670	00140670-000000	Polygon
5999.953688	140620	00140620-000000	Polygon
6000.110143	140530	00140530-000000	Polygon
9563.669185	140830	00140830-000000	Polygon
14275.871217	140360	00140360-000000	Polygon
8245.443969	140130	00140130-000000	Polygon
7992.300005	140110	00140110-000000	Polygon
1002891.638433	141131.0331	00141131-033100	Polygon
6617.331913	140640	00140640-000000	Polygon
5999.953689	140580	00140580-000000	Polygon
6000.070227	140500	00140500-000000	Polygon
5999.972519	140790	00140790-000000	Polygon
6000.022501	140480	00140480-000000	Polygon

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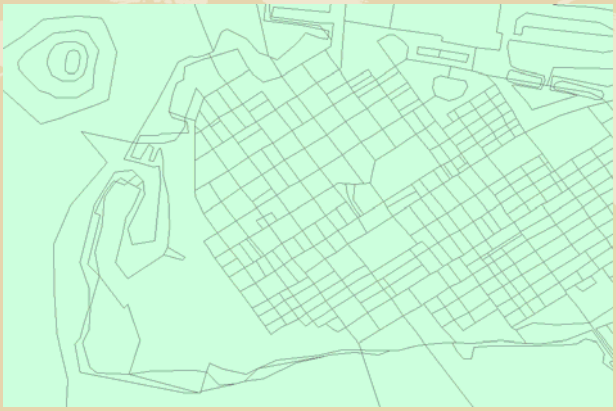
Population



1	12087	970100	1000
2	12087	970100	1001
3	12087	970100	1002
4	12087	970100	1003
5	12087	970100	1004
6	12087	970100	1005
7	12087	970100	1006
8	12087	970100	1007
9	12087	970100	1008
10	12087	970100	1009
11	12087	970100	1010
12	12087	970100	1011
13	12087	970100	1012

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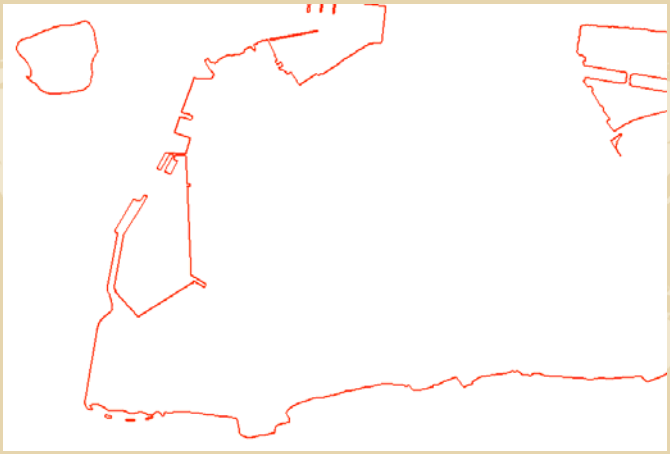
shoreline



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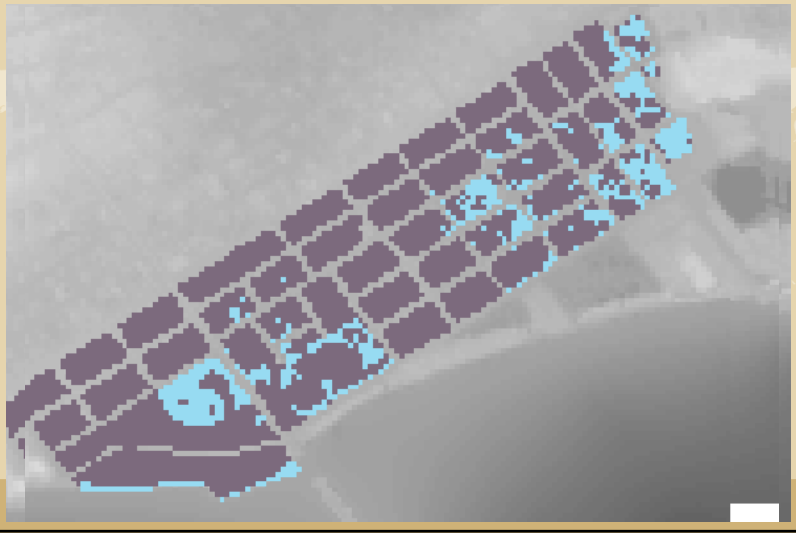
inundation scenarios



Slosh storm surge

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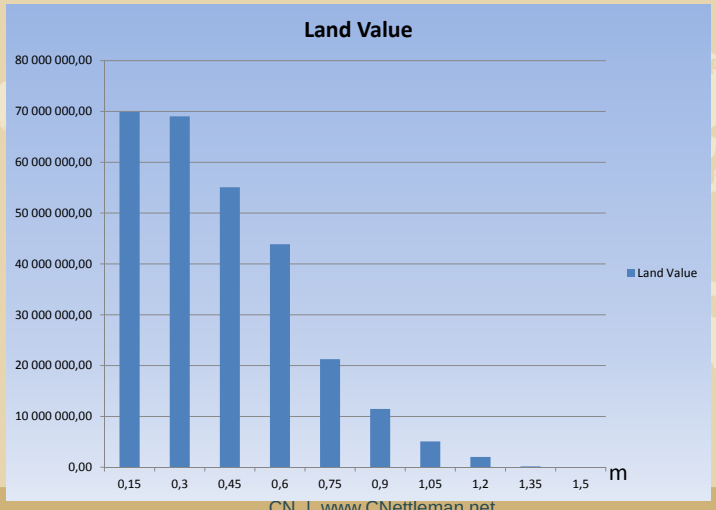
Key west results

Armoring prohibition



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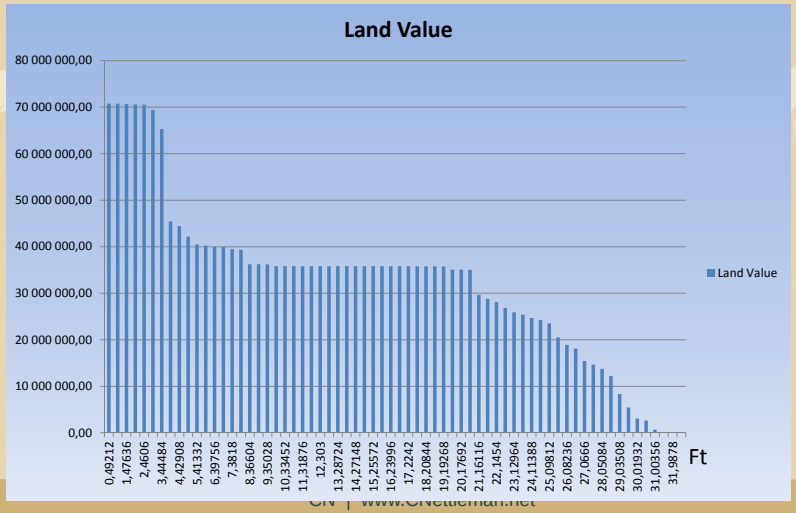
Key west results

rolling easement

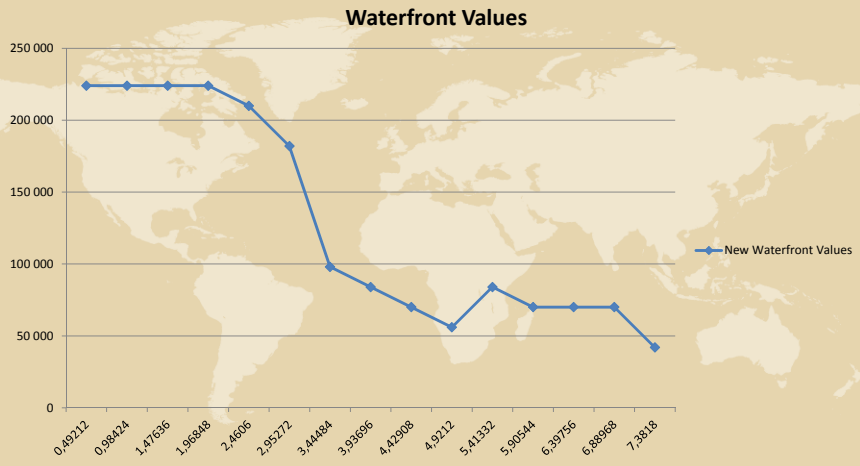
Pinellas results

Armoring prohibition



Pinellas results

rolling easement



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conclusions

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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**