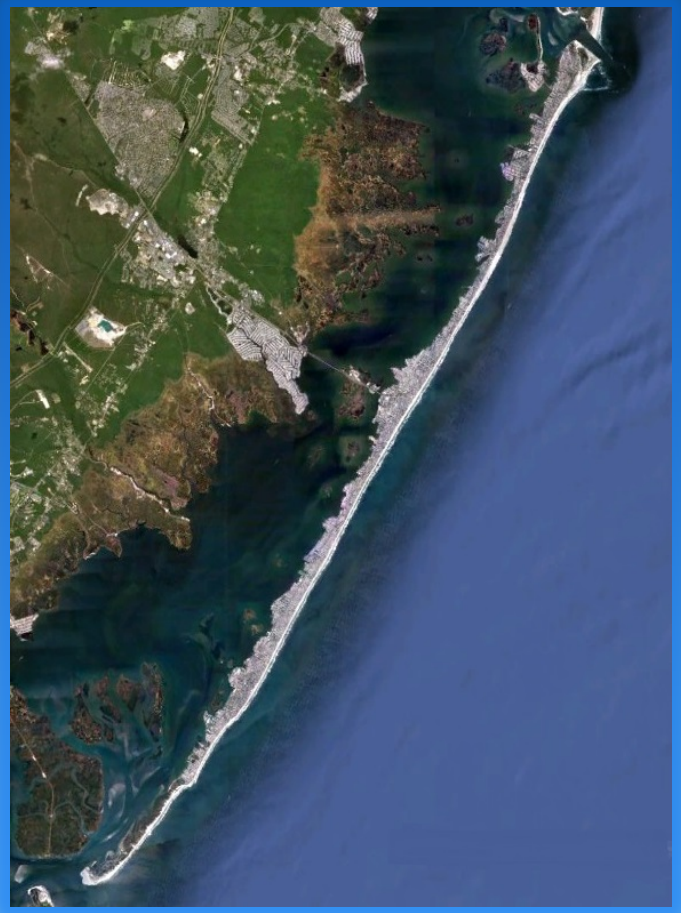


Housing Market Response to Storm Protection on Barrier Islands

NC STATE UNIVERSITY

Steven J. Dundas

Camp Resources XX

Introduction

* Barrier islands vulnerable to erosion
  * Sea level rise
  * Increased storm frequency/intensity
* When dunes are constructed, the amenities/disamenities are capitalized into local home values according to hedonic theory
  * Ocean views
  * Public access
  * Reduction in flood/storm surge risk, aka “Storm protection”
* Dune construction is a major policy instrument to provide storm protection in these vulnerable areas

Purpose of this Study

* Use hedonic price function to estimate an implicit value for storm protection created by dune construction
* Difference-in-Differences model combined with fine scale spatial data can separate this effect from the confounds of other spatial amenities
* Estimates to provide evidence for or against the economic viability of dune construction to combat the potential future impacts of climate change

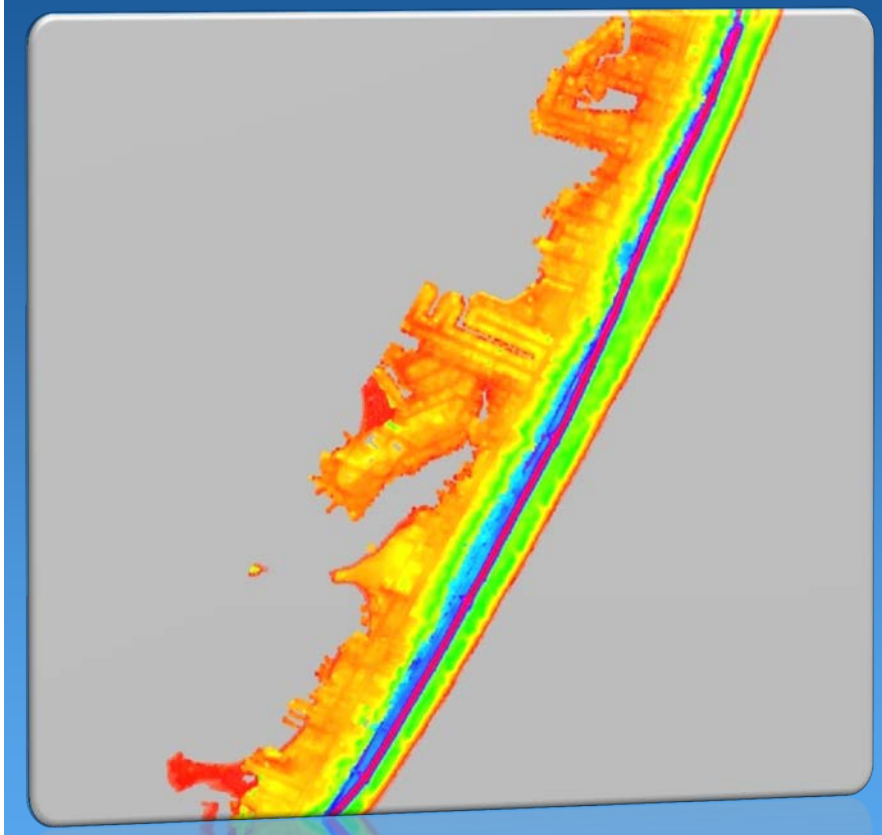
Study Area: Long Beach Island, NJ

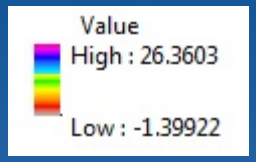
* 18 mile long barrier island
* ½ mile at its widest point; 1000 feet wide at narrowest
* 6 municipalities: Long Beach Twp., Beach Haven, Ship Bottom, Surf City, Harvey Cedars, & Barnegat Light
* Significant erosion in 1990s motivated the USACE to move forward with a dune construction projects for the entire island
  * 22' dune system with 125-foot berm
* Property rights issues holding up the project in a number of municipalities

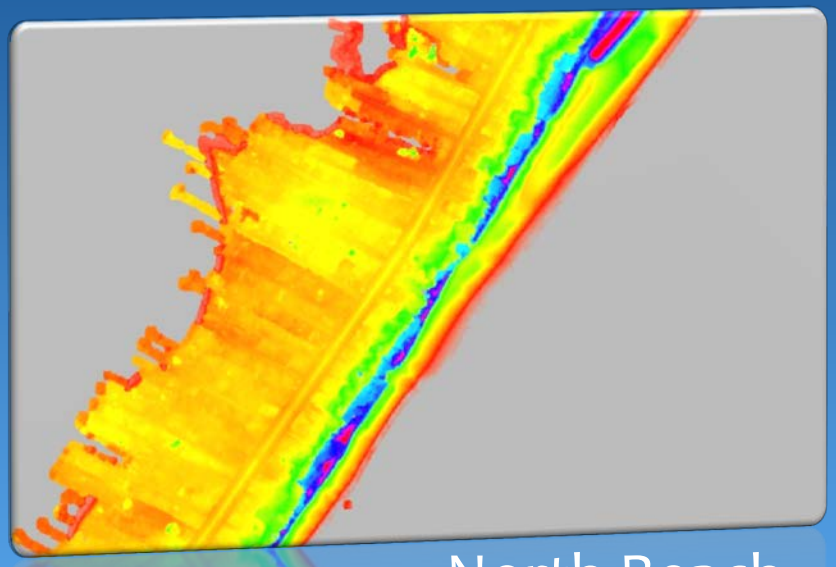
Identification Strategy

- Prior to PTC Sandy, only 3 sections of the island had USACE constructed dunes
- Houses in municipalities with a dune after construction = Treatment group
- Houses in municipalities without a dune = Control Group
- P(house)=f[V(D), A(D), S(D)]
  - $\frac{dP}{dD} = \frac{df}{dV}\frac{dV}{dD} + \frac{df}{dA}\frac{dA}{dD} + \frac{df}{dS}\frac{dS}{dD}$

Harvey Cedars







North Beach

LiDAR Comparison

Harvey Cedars

Beach Haven

Data Sources

* **Deed Records and Property Characteristics**
  * Ocean County (NJ) Clerk's Office & Tax Assessor
  * Harvey Cedars & Barnegat Light Tax Assessor

* **Spatial (GIS), LiDAR, and other Relevant Data**
  * NOAA Digital Coast Data Registry
  * US Army Corps of Engineers
  * NJ Department of Environmental Protection
  * Ocean County (NJ) GIS Program/Planning Board
  * USGS Coastal and Marine Geology Program
  * Richard Stockton College of New Jersey Coastal Research Center
  * NJ Geographic Information Network
  * US Census Bureau

Data: Summary Statistics

Variable (5036 observations)	Mean	Std. Dev.	Min	Max
Sales Price	$823,521	$610,304	$35,000	$7,745,000
Oceanfront	0.060	0.238	0	1
Bay front	0.056	0.229	0	1
Dune	0.084	0.277	0	1
Bedrooms	3.795	1.178	1	10
Bathrooms	2.709	1.083	0.5	11
Square Footage	1723	794	195	18,000
Lot Size (feet^2)	5733	4873	0	86,249
Age	35.62	23.01	0	137
Condo	0.056	0.231	0	1
Garage	0.425	0.494	0	1
Hot Tub	0.093	0.291	0	1
Fireplace	0.42	0.494	0	1
Basement Area (feet^2)	326.7	530	0	2937
Attic Area (feet^2)	38.25	168.5	0	1600
Distance to Ocean	1210	881	0	6488
Distance to Bay	795	590	0	2928
Distance to Dune Crest	1024	846	0	5957
Distance to Route 72	20,234	14,045	18	49,316
Distance to Public Access	989	813	0	5696

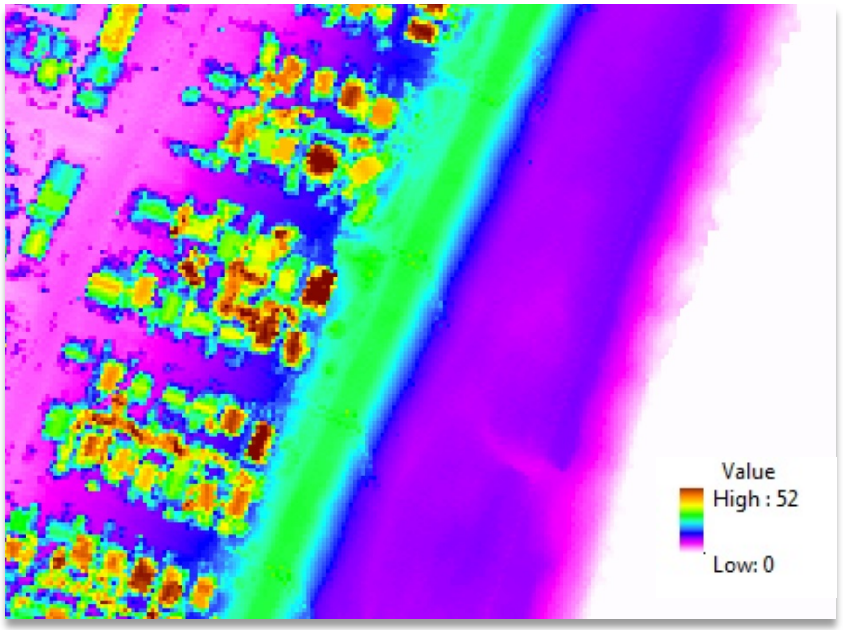
Hedonic DID model

* $lnPrice_{it} = \alpha + \delta_1 OF + \delta_2 BF + \phi_1 DuneOF_{it} + \phi_2 DuneNOF_{it} + \beta_1 Protect_{it} + \beta_2 Protect_{it}\ x\ DuneOF_{it} + \beta_3 Protect_{it}\ x\ DuneNOF_{it} + \theta_1 Access_{it} + \theta_2 Access_{it}\ x\ DuneOF_{it} + \theta_3 Access_{it}\ x\ DuneNOF_{it} + \varphi_1 View_{it} + \varphi_2 View_{it}\ x\ DuneOF_{it} + \varphi_3 View_{it}\ x\ DuneNOF_{it} + \sigma \boldsymbol{X}_{it} + \rho \boldsymbol{L}_{it} + \tau_t + \eta_t + \epsilon_{it}$

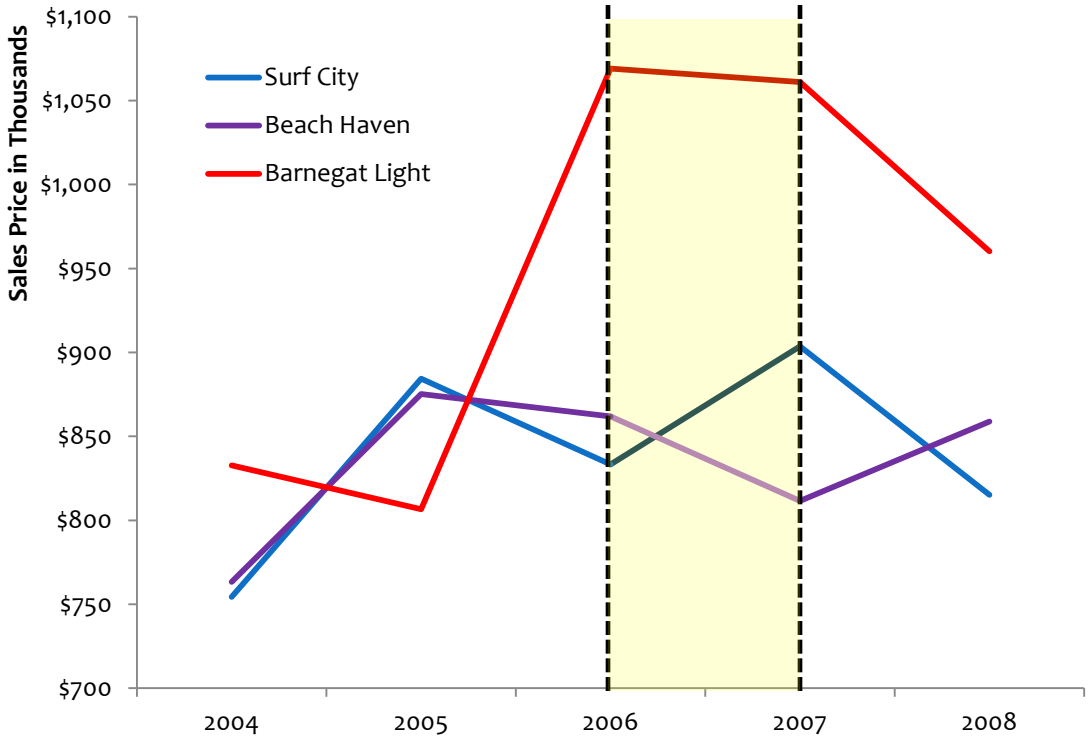
* Key coefficients are β_2 & β_3, θ_2 & θ_3, and φ_2 & φ_3

Construction of Spatial Amenity Variables

* ***Protect***
  * Dune "Sand Reservoir" Area
  * Lateral distance to dune edge
  * Dummy variables for protected, edge, and inside
* ***Access***
  * Distance to nearest public access point
  * Beach Width
* ***View***
  * Digital Elevation Model (DEM with first returns) with building footprints geo-processed to obtain a degree measure for view



Graphical Comparison of Average Sales Price 2006-2007



2006 USACE Dune Built in Surf City

* Surf City (Constructed Dune)
  8.5% increase
* Beach Haven (No Dune)
  5.8% decline
* Barnegat Light (Natural Dune)
  0.75% decline

Preliminary Model Results

Ln_price	Coefficient	T-Stat
OF	0.4573**	24.96
BF	0.4184**	16.97
Dune_OF	0.1512**	3.27
Dune_NOF	0.0338*	1.99
Bedrooms	0.151**	6.87
Bed_sq	-0.016**	-5.93
Bathrooms	0.1344**	9.20
Bath_sq	-0.0088**	-5.11
Condo	-0.3558**	-13.97
Dist_Route72	5.20e-06**	16.50
Dist_PubAccess	-0.0001**	-18.54
Constant	12.726**	243.13

Note: ** $p<0.01$, *$p<0.05$

* R-squared: 0.7975
* Other controls in prelim. model:
  * Square Footage, Lot size, Age, Garage, Fireplace, Hot Tub
  * Yearly and quarterly dummies
* Further controls in the works:
  * Protect, View, Access
  * Spatial fixed effects
  * Natural dune quality in "control group" areas
  * Proximity to other shoreline protection features (i.e. groins, jetties, etc.)

NC STATE UNIVERSITY

Steven J. Dundas

Camp Resources XX

Appendix: Selected Demographics

	Barnegat Light	Beach Haven	Harvey Cedars*	Long Beach Township**	Ship Bottom	Surf City***
Population	586	1322	521	3101	1208	1393
Median Age	58.4	54.9	63.8	60.8	56.1	61.9
Percent White	94.70%	98.50%	99.60%	98.10%	95.60%	95.80%
Total Housing Units	1188	2518	1209	8263	2084	2617
Median Home Value	$803,800	$731,200	$977,300	$855,600	$622,200	$717,500
Median HH Income	$69,432	$72,031	$112,679	$86,912	$64,554	$59,138
Mean HH Income	$99,221	$113,474	$162,814	$142,153	$81,342	$81,936
Per capita income	$47,377	$55,913	$78,784	$67,758	$39,333	$40,940
Mean HH Size	2.11	2.06	2.04	2.1	2.06	1.99
Bachelor's Degree or <	54.60%	49.70%	67.30%	57.40%	35%	43.90%

***- Used eminent domain on 10 remaining holdouts (2009)**
****-Only small portion of township (Brant Beach) received dune in 2012**
*****- First dune construction project on the island (2006)**