SEDIMENT SUPPLY IN A REGIME OF ACCELERATED COASTAL EROSION (SEDS-RACE): PALEO-PERSPECTIVES, ANTHROPOGENIC INFLUENCES, AND FUTURE CHALLENGES





RESEARCH TEAM

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1. Conceptual Framework

COUPLED NATURE-HUMAN (CNH) DYNAMICS CONCERNING COASTAL SEDIMENT SUPPLY





OBJ. 3: CAUSES OF MODERN EROSION







Houses built in Newburyport, PI



Growth of Coastal Housing on Humarock Beach, Scituate, MA (1880-2016)



- 1898 Portland Gale breaches Shingle Dyke between the Third and Fourth Cliffs
- Humarock seawalls constructed beginning in 1923
- Scituate has ~150 NFIP "repetitive loss properties" (40% of Massachusetts)

Models of Coastal Housing Markets

- Hedonic price method (HPM)
- *Price* = *f*(*S*,*N*,*E*,ε)
- *E* comprises environmental amenities and dis-amenities
- Isolates effects of individual covariates while controlling for others (like waterfront location)
- Used to estimate **implicit price** of:
 - Waterfront
 - Waterviews
 - Beach width
 - Beach quality
 - Distance to beach
 - Elevation
 - Risk of erosion or inundation
 - Hard or soft structural protection
 - Building or zoning restrictions





Fallon (2015)

2. EXAMPLES OF APPLICATIONS OF HPM TO REAL-WORLD DECISIONS*

Policy Focus	Finding	Source
Location near a beach	Increases coastal property values due to recreational amenities	Edwards (1989)
Location in erosion-prone area	Lowers coastal property values	Kriesel et al. (2000)
Location in a flood zone	Lowers coastal property values [§]	Kriesel et al. (2000)
Beach nourishment	Increases both waterfront and non-waterfront coastal property values	Kriesel & Friedman (2002)
Beach nourishment	Nourishment is justified by potential losses in recreational value capitalized into coastal properties	Edwards & Gable (1991)
Dune reconstruction	Increases coastal property values	Eberbach & Hoagland (2007)
Hard structural protection	Benefits waterfront properties; losses in value to non- waterfront properties (due to restricted access)	Kriesel & Friedman (2003)
Seawalls	Increases coastal property values [MA]	Jin <i>et al</i> . (2015)
Public groins and jetties Private revetments and jute bags	Shoreline protection can add value to coastal properties [MA]; public structures >> private structures	Fallon et al. (unpub.)
Building restrictions	Elevation on pilings adds value to coastal properties	Fallon et al. (unpub.)
Seawalls	Decreases the value of coastal properties in downdrift locations by causing accelerated erosion	Granquist (2010)
Land-use restrictions	Vacant land on coastal barriers decreases in value	Dehring (2006)
Value-capture tax	Fair and efficient mechanism for funding beach nourishment projects	Parsons & Noailly (2004)

*Full extent of management "uptake" is unknown.

VALUE-CAPTURE TAX

- Parsons & Noailly (2004)
- One-time tax (typically)
- Mechanism to finance beach nourishment
- <u>Fair</u>: Distributes the tax burden according to the benefit associated with proximity of a property to a beach
- <u>Efficient</u>: Property owners face the real costs of nourishing beaches that maintain or improve their own property values



Fig. 1. Tax index.

3. LIKELIHOOD OF [CONSTRAINTS TO?] APPLYING THE RESEARCH

Some *<u>null hypotheses</u>*: Research is more likely to be applied if:

- Matching temporal or spatial scales
- Data is available and of good quality
- Scientific research focus aligns closely with emergency response or immediate management focuses
- Active environmental consulting industry exists to transfer results
- Decision-makers are capable of learning and interested in applying results (esp. the rules permit it)
- Funding agency calls for researchers to have "broader impacts"
- Low costs of undertaking decisionsupport, including travel, administrative costs
- Individual incentives are consistent

