The Role of Coastal Habitats in Reducing Risk: An Emerging Approach to Comprehensive Risk Assessments

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Overview

• TNC - Hazard Mitigation and Adaptation
• Science - Coastal Habitats & Risk Reduction
• Accounting for Natural Defenses
• Finding the Fit
The Nature Conservancy

50+ years

3,500 staff – 50 states & 34 Countries

1 million members

Science-based & solution driven
Some Key Areas of TNC’s Work in Hazard Mitigation and Adaptation

✓ **Science and Practicable Translation**
  Function and Cost-Effectiveness of Natural Solutions
  Assessing Risk and Vulnerability

✓ **Decision Support Systems- Engagement Tools**
  Coastal Resilience & Climate Wizard

✓ **Policy**
  US – Federal (FEMA); State (Legislation)

✓ **Action – Demonstration Projects**
  Hazard & Mitigation Planning- CT, NY, FL
  Restoration – oysters, mangroves, marshes, corals
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Coastal Habitats Attenuate Waves and Decrease Erosion

Salt Marsh – Mangroves – Oyster Reefs – Coral Reefs
Global review:
Salt marshes and coastal protection

Meta-analysis:
✓ Wave Attenuation
✓ Shoreline Stabilization
Mangroves and Coastal Protection

- Reduction of wind and swell waves by mangroves
- Reduction of storm surges by mangroves

Reports available at www.coastalresilience.org
Click on Science
Conclusions of Mangrove work so far…

**Key Findings:**

- Mangroves attenuate wind waves over relatively short distances (less than 500m)
- Storm surge height can be reduced over very large areas of forest
- Coastal forests can help reduce tsunami damage and more routine coastal erosion
Oyster reefs - ongoing field work

Albemarle-Pamlico region of North Carolina and multiple sites in the Gulf of Mexico
Living Shoreline Work
Nearshore oyster reefs in North Carolina
Coral reefs are effective for coastal hazard risk reduction
197 million people live in at-risk coastal areas (below 10m elevation) and within 50km of coral reefs.
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Where do habitats fit in to risk assessment?
World Risk Report: Coastal Habitats and Hazards

Dr. Michael W. Beck & Dr. Christine C. Shepard

The Nature Conservancy & UC-Santa Cruz
Concept of the WorldRiskIndex

Natural hazard sphere

Exposure
Exposure to natural hazards

Vulnerability - Societal sphere

Susceptibility
Likelihood of suffering harm

Coping
Capacities to reduce negative consequences

Adaptation
Capacities for long-term strategies for societal change

WorldRiskIndex
Components and indicators of the WorldRiskIndex

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<tr>
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<tr>
<td><strong>Public infrastructure</strong></td>
<td><strong>Government and authorities</strong></td>
<td><strong>Disaster preparedness and early warning</strong></td>
<td><strong>Education and research</strong></td>
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<tr>
<td>A Earthquakes</td>
<td>A Corruption Perceptions Index</td>
<td>National disaster risk management policy according to report to the United Nations</td>
<td>A Adult literacy rate</td>
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<td>B Storms</td>
<td>B Good governance (Failed States Index)</td>
<td>Medical services</td>
<td>B Combined gross school enrolment</td>
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<td>C Floods</td>
<td>C Number of physicians per 10,000 inhabitants</td>
<td>Social networks</td>
<td>C Gender parity in education</td>
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<td>D Droughts</td>
<td>D Number of hospital beds per 10,000 inhabitants</td>
<td>Material coverage</td>
<td>D Share of female representatives in the National Parliament</td>
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<td>E Sea level rise</td>
<td>E Insurances (life insurances excluded)</td>
<td><strong>Environmental status / Ecosystem protection</strong></td>
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<tr>
<td><strong>Poverty and dependencies</strong></td>
<td><strong>Economic capacity and income distribution</strong></td>
<td><strong>Environmental status / Ecosystem protection</strong></td>
<td>Projects and strategies to adapt to natural hazards and climate change</td>
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<td>A Dependency ratio (share of under 15- and over 65-year-olds in relation to the working population)</td>
<td>F Gross domestic product per capita (purchasing power parity)</td>
<td><strong>E Water resources</strong></td>
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<td>B Extreme poverty population living with USD 1.25 per day or less (purchasing power parity)</td>
<td>G Gini index</td>
<td>F Biodiversity and habitat protection</td>
<td>I Public health expenditure</td>
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<td><strong>Education and research</strong></td>
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<td>G Forest management</td>
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<td><strong>Gender equity</strong></td>
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$19 billion in building replacement costs
321,000 people
1,700 miles of roads
138 critical facilities

Susceptibility/Exposure reduction from existing marsh...
Risk Reduction Involves Multiple Solutions

Total Risk

Natural Defenses

Risk Transfer

Development choices
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How do we identify where ‘green’ solutions make sense?

Dependent upon:

- Risk reduction
- Cost/benefit
- Feasibility
Ongoing and Future Work

- Test cases incorporating environment into Risk Assessment – WRI, etc...
- Develop solutions framework to be applied across Gulf of Mexico
- Continued field projects to test and measure responses
Where do specific habitats play a role in risk reduction across the Gulf?

With oyster reefs and marshes

Without oyster reefs and marshes
Risk Explorer- interactive web based risk assessment
Visualizing coastal impacts, planning wisely for the future, and making smart choices today

www.coastalresilience.org

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Geographies

Decision Support

Solutions
Natural Infrastructure and Risk Reduction Study

- Study Area: New York City (5000 buildings)
- Structures similar distance and elevation from shore
- Logistic regression

Areas without marsh have a 12% increase in probability of flooding compared to areas with marsh.