Community Resilience: Building an Evidence Based Approach
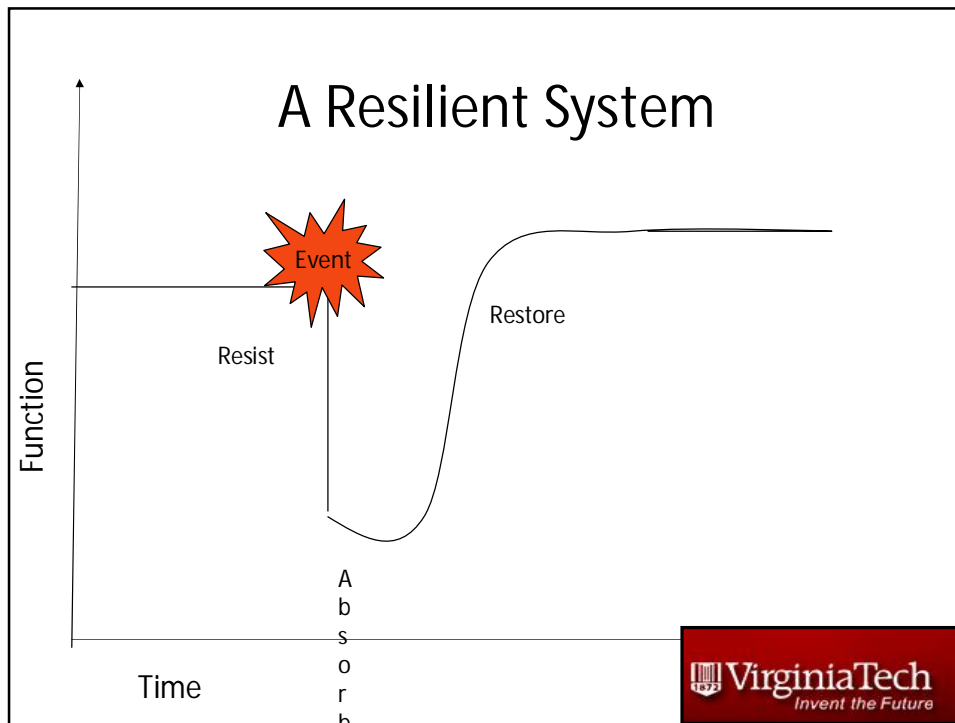
John Harrald, Ph.D.
Director, Center for Community Security and Resilience
Virginia Polytechnic and State University
NUCREN May 2011

VirginiaTech
Invent the Future

What is Resilience?

- Concept used in medical, ecological, and systems engineering
- "Borrowed" to describe behavior of physical and social systems to absorb, reflect and resist disaster impacts and to recover after being impacted.
- Homeland Security Institute: Attributes of resilience are resistance, absorption and restoration.
- National Academies: Resilience is the ability to prepare/plan for, absorb, recover from or more successfully adapt to potential adverse events.

VirginiaTech
Invent the Future

A Resilient System

Function

Event

Resist

Restore

Absorb

Time

Measuring Resilience

If resilience is to become a meaningful organizing concept, we must be able to measure resilience, predict impacts and value of interventions.

Basis for empirical study is work done social, economic, physical, and human vulnerability
- Susan Cutter—social vulnerability index
- Community and Regional Resilience Institute Resilience Framework
- NOAA coastal vulnerability project (Walter Peacock)
- National Academies Study "Increasing National Resilience to Hazards and Disasters"

A Framework for Resiliency Metrics
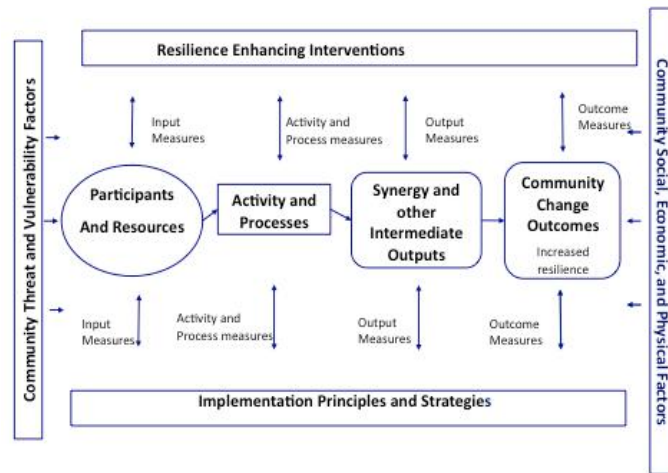
Source: Adapted from NRC *Building Community Resilience Through Private-Public Collaboration*, 2011

A Comparative Study of Community Resilience to a Common Threat: Hurricane and Coastal Flooding

- Rural coastal—Bay Hundred region of Talbot County, Maryland
- Wealthy coastal—Fisher Island, Dade County Florida
- Urban coastal—Hampton Roads, VA

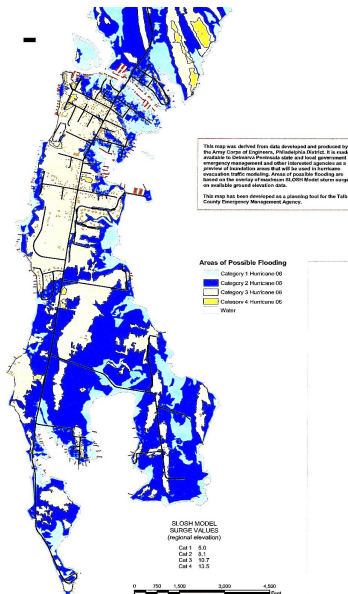# Bay Hundred Maryland
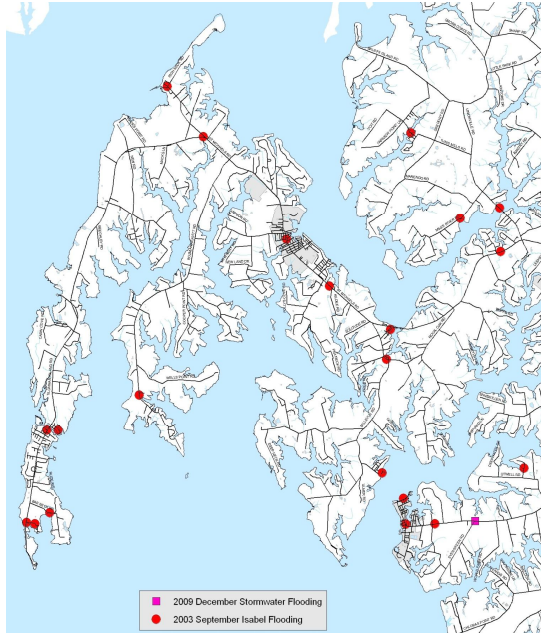
Rural low lying environment, 8,000 residents

One road out, road floods before homes

Limited medical and emergency resources on peninsula

Struck by hurricanes in 1935, 1974, 1992, 1996, 2003

■ 2009 December Stormwater Flooding
● 2003 September Isabel Flooding

VirginiaTech
Invent the Future

Inundation Map of Tilghman's Island

Historic center of Maryland oyster and crab watermen

Evacuation routes would flood first

Most or area would be submerged by a Category 2 Hurricane (Blue)

Category 4 Hurricane would inundate entire island

Areas of Possible Flooding
Category 1 Hurricane 06
Category 2 Hurricane 06
Category 3 Hurricane 06
Category 4 Hurricane 06
Water

SLOSH MODEL
SURGE VALUES
(regional elevation)

Cat 1   5.0
Cat 2   8.1
Cat 3   10.7
Cat 4   13.5

VirginiaTech
Invent the Future

Bay Hundred Resilience Strategy

- Strengthen ability of local communities through inclusion in training and planning, information, and support of existing networks.
- Raise awareness of risk, threat, vulnerability
- Provision of emergency power to community facilities to facilitate shelter in place and short term recovery.
- Identify special needs populations and stockpile medicines

VirginiaTech
Invent the Future

Fisher Island, Florida
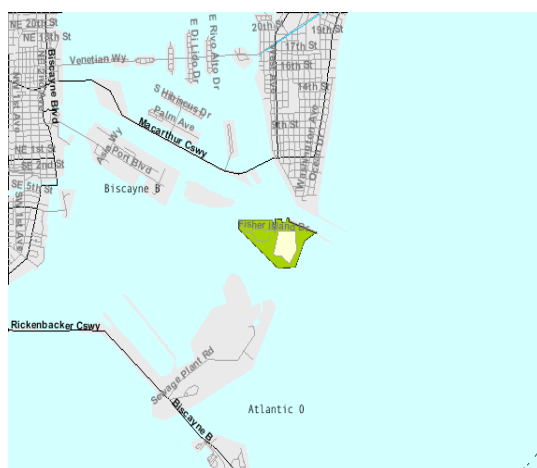
Small (0.34 sq. mile) Coastal Island created from dredge spoils from Miami

Was a Vanderbuilt estate

Exclusive community and resort for the rich
-Population 507
-Per Capita Income $337, 598
-Median House Value $1.5M

6 hurricanes have hit Miami area since 1964

Category IV hurricane would inundate island

VirginiaTech
Invent the Future

Fisher Island Resilience Strategy

- Major issue is ensuring life safety during/after direct hit
- Secondary issue is short term recovery
- Strategy
  - Increase awareness of threats and hazards
  - Improve preparedness and planning for evacuation
  - Ensure safety of hotel guests and special needs population
  - Improve crisis/incident communications and management systems
  - Improve ability to restore critical systems

VirginiaTech
Invent the Future

Hampton Roads, Virginia
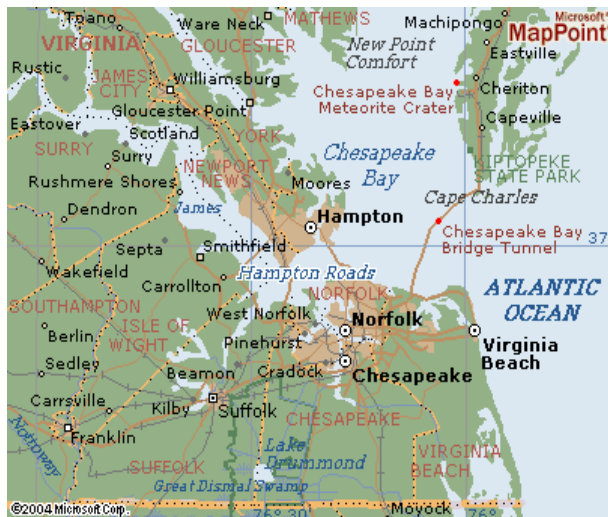
Urban area with 16 political jurisdictions

Major military center

Major tourist area

1.8 million people in 3,000 square miles

Hurricanes have struck area regularly since 1607

Key to resilience is ability to preserve or rapidly restore physical infrastructure

VirginiaTech
Invent the Future

Hampton Roads Resilience Strategy

- Rapid restoration of electric power and communications.
- Ensure fuel source for power generation
- Clear transportation routes (tunnels)
- Ensure collaboration between infrastructure crisis managers
- Determine which critical facilities will be unavailable due to flooding and plan alternatives
- Ensure ability to communicate with public during crisis stage

VirginiaTech
Invent the Future

All three areas lack resilience to threat of coastal flooding.

Differing attributes of vulnerability determine different resilience building strategies

VirginiaTech
Invent the Future

Conclusions

- We need models and measures that will provide the ability to compare areas and to predict effectiveness of interventions by linking activities to outcomes.
- Increasing community resilience to common threat may require very different strategies and investments in different areas due to nature of physical, social, and structural vulnerabilities.
- Qualitative measures are insufficient to compare regional resiliency capacities or to predict impact of interventions

VirginiaTech
Invent the Future