

An Integrated Index of Social-Ecological Resilience



Margaret Reams, Ph.D.

Nina Lam, Ph.D.

Department of Environmental Sciences
Louisiana State University

Research Funded by the MMS



Two-year study to examine resilience of Louisiana coastal communities facing:

- Hurricanes
- Coastal Land Loss

Research Objectives



Address Outer Continental Shelf (OCS) management questions:

- How resilient are OCS and other communities to threats posed by coastal land loss and hurricanes?
- How can community resilience best be measured?
- Are OCS communities more resilient to these natural threats than coastal communities less involved in OCS activities?

Earlier Efforts to Assess Socioeconomic Impacts of OCS



Limitations of Social Impact Assessment Models

- No areas “unaffected” by OCS activities.
- “Affected” areas are broad.
- Complex linkages exist between the wide range of OCS-related enterprises.
- Local impacts are difficult to quantify.
- Cumulative, long-term effects are hard to identify.

See: McKay and Nides, 2005; Luton and Cluck, 2005.

Our Research Design



- Develop quantitative indicators of community resilience to coastal land loss and to hurricanes by incorporating both socioeconomic and natural/environmental variables;
- Compile these indicators into a “resilience index”;
- Apply the index to parishes and communities to evaluate changes in resilience through time;

Research Design



- Create GIS-supported maps depicting vulnerability and resilience based on these indicators, and;
- Make statistical comparisons among communities of coastal Louisiana more and less involved with OCS activities.

Assumption is that socioeconomic contributions & impacts of OCS will be captured in index.

Utility of Social-Ecological Resilience Approach



Social-Ecological Resilience provides a theory base and evaluative framework for:

- Sustainable development
- Wiser use of natural resources
- Recovery from disruptive events

Social-Ecological Resilience



Stability: Tendency of a system to return to equilibrium when disturbed

Fundamental Elements

- Recognition of linkages between natural and social systems;
- Self-organization of systems;
- Adaptation to avoid or respond to disruptions.

Social-Ecological Resilience



The Raft – A Metaphor of Stability and Resilience

Ludwig's model is useful.

The raft's system? *Raft + Weight + Occupants*

Disruptions? *Either rapid or slow increase weight.*

Key Variables? *Include Adaptive Behavior of
Occupants*

Social-Ecological Resilience



The Raft – A Metaphor of Stability and Resilience

Ludwig's model is useful.

The raft's system? *Raft + Weight + Occupants*

Disruptions? *Either rapid or slow increase weight.*

Key Variables? *Include Adaptive Behavior of
Occupants*

Raft's fate is related to 3 types of contextual factors



- Its own physical characteristics
- The environment into which it's deployed
- Social, economic and political resources of inhabitants

What Factors may Influence Community Resilience?



Social and Economic Capital Indicators Include:

- Income
- Education
- Property Insurance
- Local tax base

Using variables from Cutter et al., 2003; Cutter and Emrich, 2006

Next, add community attributes



- Inclusion of stakeholders in public policy decisions
- Opportunities for self-organization

Thus, **voter turnout rates** by parish will be included.

Then, add measures of environmental vulnerability



- Percent land loss in each in coastal area
- Potential for land loss – measured by distance from coast
- Elevation to determine flood potential
- Pollution: Toxic Release Inventory (TRI) discharge

Integrated Resilience Index



- Resilience will be a function of:

$$R = f(S_1, S_2, \dots, S_m, E_1, E_2, \dots, E_n, V, W)$$

Where:

R = resilience index

S_m = m number of socioeconomic variables

E_n = n number of environmental variables

V = voter turnout rate

W = neighborhood effect

How is Resilience Related to Post-Katrina Recovery Rates?

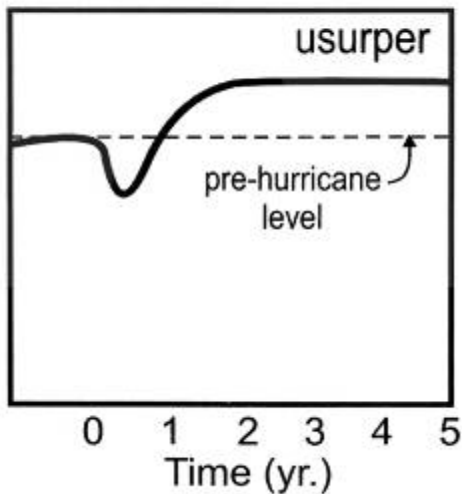
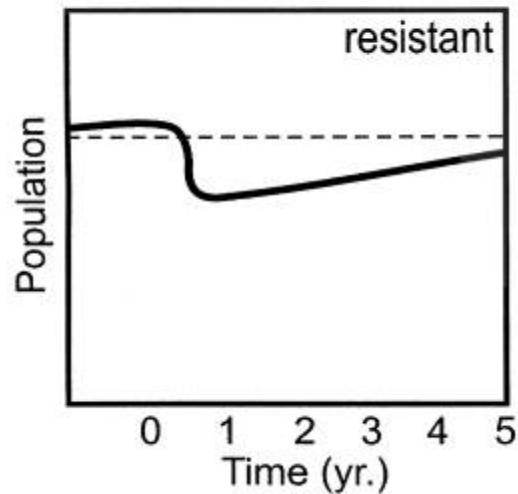
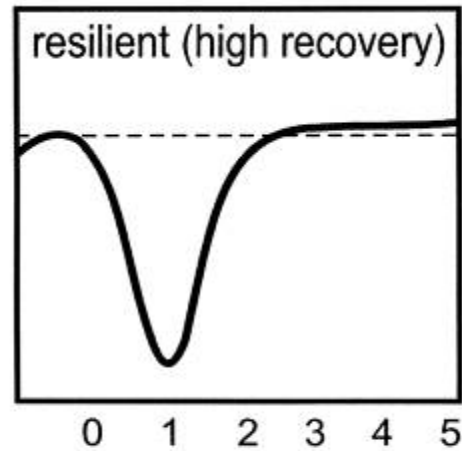
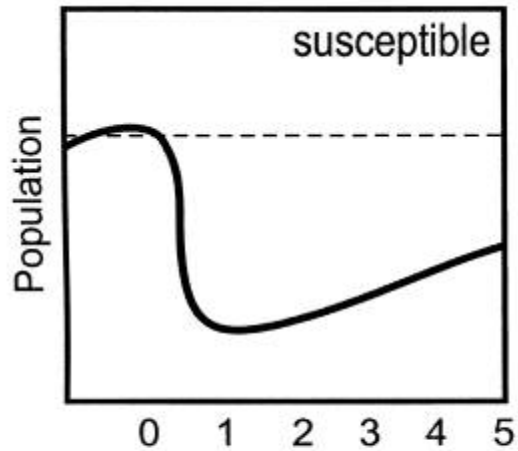


One indicator of recovery is:

- **Returning population**

Measured by change in number of households receiving mail before the storm and those receiving mail at various points after the storm

Four States of Vulnerability & Resilience



(modified from
Liu et al. 2006)

Is Resilience Related to Post-Katrina Recovery Rates?



Statistical associations can be determined between:

- Resilience index scores &
- Return rate of residents (one indicator of recovery)

Summary



- Social-ecological resilience provides a theoretical framework to consider the conditions under which recovery and long-term community survival may be more likely.
- The Integrated Social-Ecological Index serves to operationalize these concepts.
- It is a useful, quantitative tool that facilitates comparative analyses among coastal communities.



- *Thank you all very much*

- **Questions?**