Hurricane Science and Engineering: The Hurricane Forecast Socio-Economic Working Group's Efforts and Recovery and Mitigation Research Needs*

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The Hurricane Forecast Socio-Economic Working Group

- Many at NOAA
  - have come to recognize the importance of social science research and the need to incorporate research from these fields to enhance their mission capabilities.
- NOAA and the National Center for Atmospheric Research's (NCAR) Societal Impacts Program formed the *Hurricane Forecast Socio-Economic Working Group (HFSEWG).*
- Goals:
  - Identify social science research capabilities, needs, and priorities for the **hurricane forecast and warning system**
  - Recommend research initiatives and projects that can be supported through interagency cooperative funding for public- and private sector academic and commercial enterprises.
- Initial planning and organization late 2003/early 2004
- 1st formal meeting at 2004 Natural Hazards Workshop in Boulder, Colorado.

HFSEWG's activities…

- Fall 2004 and early 2005: 5 white papers drafted by 13 coauthors focusing on the state of social science research related to the hurricane forecast and warning system and future needs.
  - Social Science Research Needs: A focus on Vulnerable Populations (Phillips and Morrow)
  - Hurricane Forecasting: the State of the Art (Willoughby, Rappaport, and Marks)
  - Evacuation Decision Making and Behavioral Response (Dash and Gladwin)
  - The Economic Value of Hurricane Forecasts: An Overview and Research Needs (Letson, Sutter, and Lazo)
  - Organizational Communication and Decision Making in Hurricane Emergencies (Lindell, Prater, and Peacock)
- February, 2005: Pomona Workshop. Thirty participants included social scientists, forecasters, meteorologists, policy makers, etc.
  - Workshop report prepared and circulated spring of 2005.
- July 2005, two sessions at Natural Hazard Workshop in Boulder were held to discuss and review research priorities
  - John Sorenson of Oak Ridge National Laboratory provided a perspective on the effort and made additional suggestions.

HFSEWG's activities…

- Fall 2005 draft summary paper prepared and circulated
  - Social Science Research Needs for the Hurricane Forecast and Warning system
- Feb 1, 2006 white papers and summary paper presented at AMS.
  - Available at www.sip.ucar.edu
- General Research Areas Identified:
  - Warning Processes
  - Decision Making
  - Behavioral Response
  - Social Impacts and Valuation

Social Science Issues Identified…

- Warning Processes
  - Nonlinear process involving multiple messages, sources and end users
  - Messages (structure, format, timing, etc.)
    - Examples: precise low probability versus less precise higher probability forecasts; watch/warning terminology; lead time analysis; graphics and visualization issues; responding to local needs; etc.
  - Source of messages (rapid expansion of sources and repackaging of NWS forecasts)
    - Examples: content and flow issues; utilization of sources by various decision makers; authority, trust, and knowledge perceptions; source prevalence and utilization; media consolidation for local area information, etc.
  - Users (increased diversity of population, consumer needs and interests)
    - Examples: cultural diversity issues; variations in interpretation vulnerable and special needs populations; public education; etc.

Social Science Issues Identified…

- Decision Making
  - Multilayered, complex, individuals, groups, organizations
  - Emergency management decisions making
  - Decision support systems
  - Integrating temporal dimensions into research
  - Decision making by businesses and non-EM governmental organizations at all levels
  - Risk Perception and role of forecast/warning
  - Formal and informal warning networks
  - Warning perception rate estimates
  - Decision constraints

Social Science Issues Identified…

- Behavioral Response
  - Evacuation, preparation, mitigation, etc.
  - Traffic modeling (development, validation, efficiency)
  - Evacuation time estimation
  - **Spatial evacuation modeling**
  - **Development of Common protocols and data depository**
  - **Modeling preparation and other behavioral responses**

Social Science Issues Identified…

- **Social Impacts and Valuation**
  - Broaden "valuation"
    - "Hidden" and broader social costs
    - Distributional aspects of costs and impacts
    - Proportional losses
  - Refine and expand economic evaluation
    - Different aspects and attributes of forecasts
      - Wind fields, forward speed, intensity, lead times, etc.
    - Different valuation methods
      - Stated and revealed preference, Bayesian, cost-loss, cost minimization
    - Different temporal and spatial scales
      - City, regional; hourly, weekly, decadal, etc.
    - Range of stakeholders
      - EM, industrial, public, vulnerable populations, etc.
  - Interdisciplinary approaches
    - Among social sciences
    - Between Social sciences and with other scientific disciplines

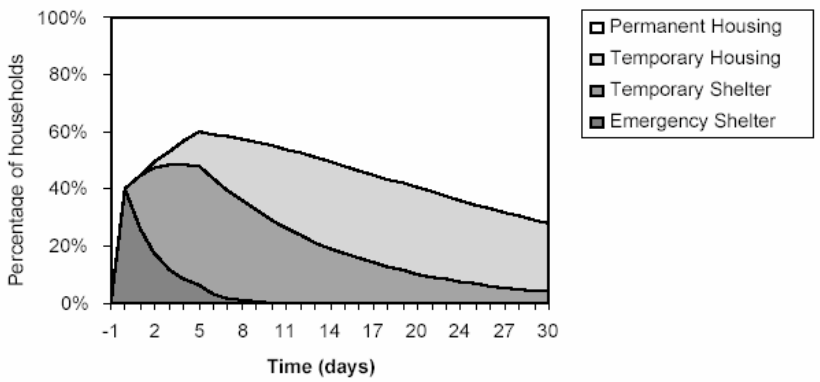
Recovery and Restoration Research

- Current State of the field
  - Units of Analysis
    - Individual, household/family, Businesses and other organizations, community
  - Limited, at best
    - Few in number and limited in scope
    - Majority focused on Earthquakes
  - Methodological problems and compromises
    - Sample selection bias
      - survivors or those that stay, homeowners,
    - Measurement issues
    - Limited design options
    - Often dependent on secondary data
      - Units of observation compromises
      - Temporal compromises
  - Limited cumulative knowledge
    - Results are often inconsistent and problematic
    - Require too many assumptions to combine and generalize

Recovery / Restoration Research Needs…

- Impact / loss
  - Heterogeneity not explained by the physical event
  - Need to develop systematic and consistent approaches
- Population Displacement / Dislocation
  - Prevalence and duration
  - Determinants
  - Consequences for housing needs and recovery
- Shelter and housing

Figure 1: Impact Area Residents' Changes in Housing Status Over Time

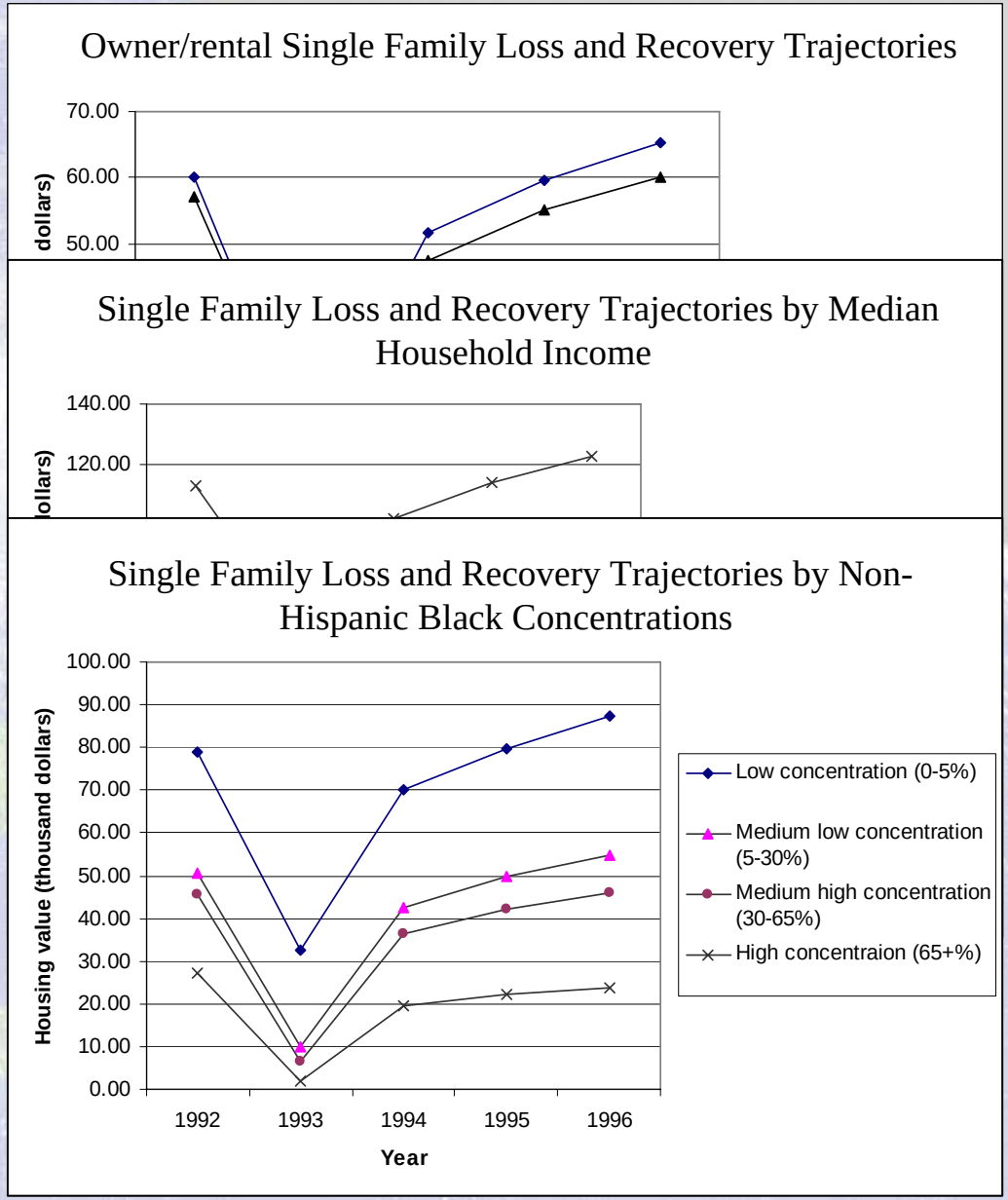


Need systemic research of factors determining its…

-forms
- prevalence of usage
- use patterns and duration
- transitions
- consequences for long term recovery

Recovery / Restoration Research Needs…

- Permanent Housing Recovery
  - Limited planning yet critical for recovery
  - Model development needed
    - Owner/rental
    - Single family, multi-family, condominiums, etc.
- Long term household recovery
- Business recovery
- Systemic analysis and evaluation of recovery programs and policies



Mitigation

- Actions undertaken with the intent of reducing disaster impact and consequences
- Structural versus nonstructural
  - Structural
    - Primary focus on technological fixes to the problem
      - Dams, levees, construction materials and practices, engineered structures etc.
    - Research has been limited relative to earthquake
  - Non-structural
    - Land use planning and other approaches to reducing exposure and risk
    - Adoption, implementation, enforcement of building codes
    - Hazard adjustment by households, businesses, communities, etc
    - Insurance or other mechanisms of spreading risks
    - Research has been very limited to nonexistent

Mitigation Research Needs…

- Analysis at all levels
  - Household, businesses, communities, counties
- Political, legal, and economic constraints to various forms of mitigation
- Dynamics and complexities of choice
  - Complex nested chains of choices
    - Developers, builders, homeowners, renters
  - Political economy of choices
  - Constraints regarding choice
- Evaluate the effectiveness of various forms of nonstructural mitigation
- The temporal and spatial consequences of building code changes for improving built environment

Mitigation Research Needs…

- Research into policies and programs to enhance and encourage adoption and implementation of mitigation technology
- Improvement of models predicting household and business hazard adjustment/adoption
  - Most research has focused on earthquake hazard adjustment
  - Limited to homeowners

Couple of general comments…

- Three cross-cutting issues emerged from the HFSEWG that have equal relevance whether addressing warning, response, recovery and mitigation:
  - Vulnerable populations
    - Special needs, race, socio-economic status, gender…
  - Nonlinear warning/communication systems and decision/choice processes
  - Interdisciplinary research
    - Among Social Sciences
    - Between Social and other sciences

Additional Considerations…

- Encourage funding disciplinary and interdisciplinary workshops for developing specific hurricane research agendas
  - Diverse social science community is primed to develop a multidisciplinary advances…
- Lets not be quick to follow the Earthquake Center model
  - Some strengths and many weaknesses
  - Multi-university center model
  - Interdisciplinary agenda setting teams