

MMC: An Independent Study to Assess the Future Savings from Mitigation Activities

Ronald T. Eguchi

ImageCat, Inc.

Core Research Team

- ATC Project Manager: Tom McLane, ATC
- ATC Project Director: Ronald T. Eguchi, ImageCat
- Track A Leader: Adam Z. Rose, The Pennsylvania State University
- Track A Co-Leader: Keith Porter, Caltech
- Track B Leader: Elliott Mittler, Consultant
- Track B Co-Leader: Craig E. Taylor, Natural Hazards Management, Inc.

Today's Topics

- Community Studies Methodology and Results (Track B)
- Special technical challenges faced by research team
- Study recommendations and implications for future mitigation studies

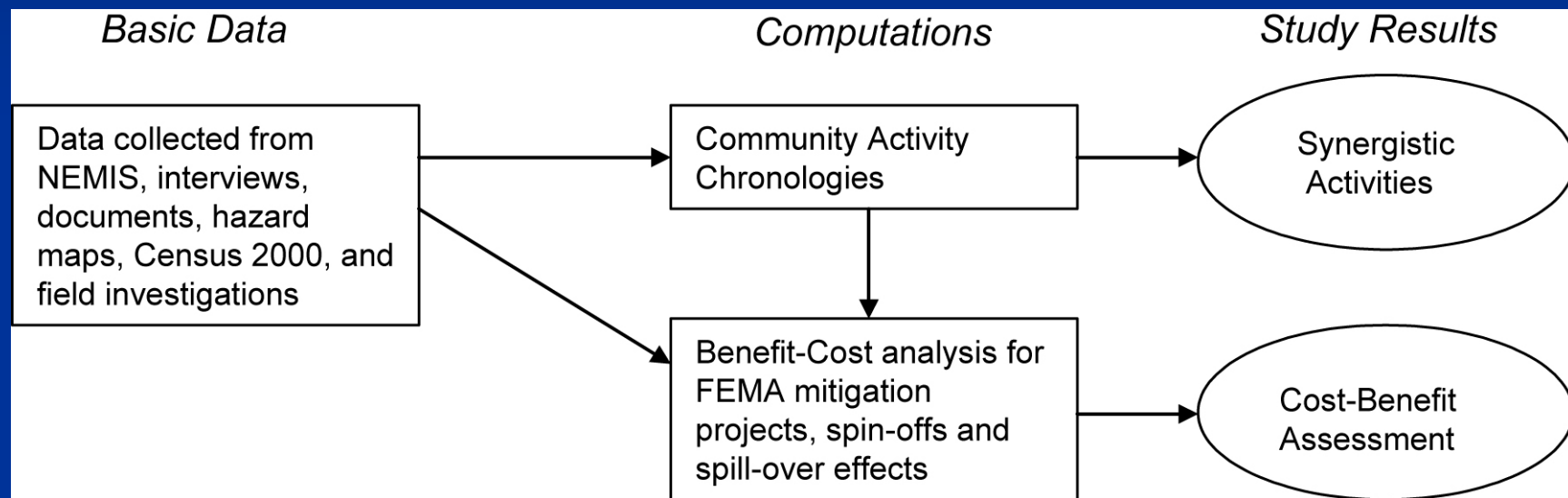
Key Questions in Community Studies

- What is the magnitude of the ratio of the benefits to costs of hazard mitigation activities funded by FEMA when evaluated with a community context?
- What, if any, additional mitigation activities and benefits were stimulated by FEMA HMGP, Project Impact, and Flood Mitigation Assistance Program activities?

Track B: Major Components

- Data collection and processing,
- Computing benefit-cost ratios and determining cost-effectiveness for activities with qualitative characteristics, and
- Developing diagrams called “activity chronologies” to identify synergistic mitigation activities and display their temporal relationship to FEMA hazard mitigation projects.

Overview of Community Studies Methodology



Community Selection Criteria

1. Received awards from FEMA where the objective was to mitigate damage from earthquakes, flood, or wind (coastal storm, hurricane, severe storm, tornado, typhoon);
2. Be at high or medium risk of earthquakes, floods, or wind hazards;
3. Be a single jurisdiction identified with a legal title as a city, town, borough, village, or county within one of the 50 states;
4. Received grants for both project and process mitigation activities (including Project Impact);
5. Received grants that total greater than or equal to \$500,000;
6. Received a total of no more than 15 grants; and
7. Completed at least one mitigation grant before this study was initiated.

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Communities Selected for Analysis

| Community Hazard | Small Communities (Population 10,000-49,999) | Medium Communities (Population 50,000-499,999) | Large Communities (Population > 500,000) |
|-----------------------------|---|---|---|
| Earthquake only | | Hayward, California (in FEMA Region IX) Orange, California (in FEMA Region IX) | |
| Flood only | Jamestown, North Dakota (in Region VIII) | | Multnomah County, Oregon (in FEMA Region X) |
| Flood and wind | Freeport, New York (in FEMA Region II) | Tuscola County, Michigan (in FEMA Region V) | Jefferson County, Alabama (in FEMA Region IV) |
| Flood, earthquake, and wind | | Horry County, South Carolina (in FEMA Region IV) | |

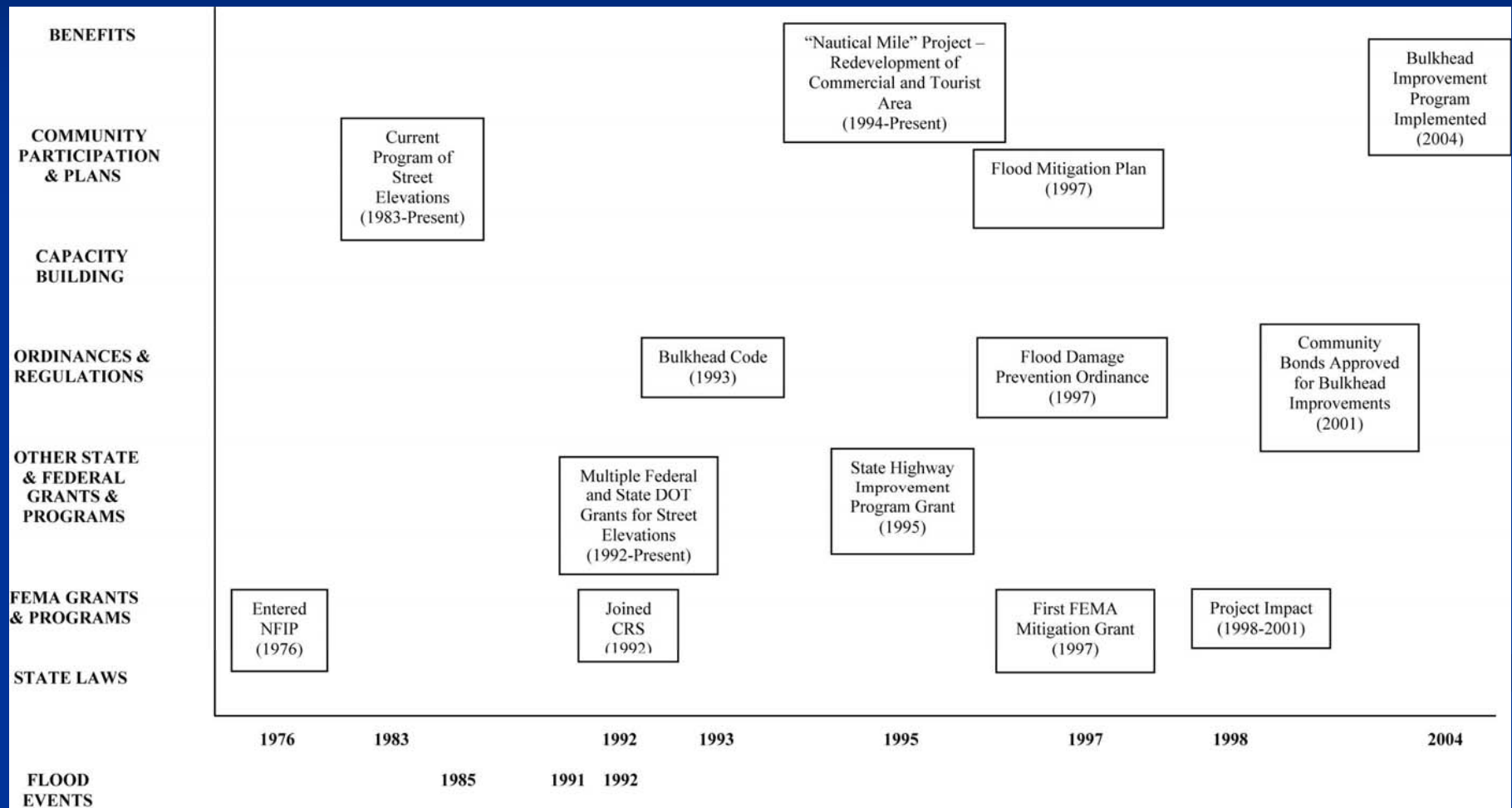
Goals of Field Visits

- Collect relevant reports on past, ongoing and future mitigation activities,
- Identify knowledgeable people for telephone and face-to-face interviews,
- Conduct both formal and informal interviews with knowledgeable people,
- Perform follow-up inquiries to fill in missing information or data, and
- Perform site visits of key mitigation projects.

Analytical Models

- Benefit-Cost methodologies similar to Track A
- In certain cases, new models were developed to address unique mitigation measures, e.g., tornado saferooms, casualty estimation
- Detailed interview guides and instruments developed for capturing information on each community

Activity Chronology for Freeport, NY



Summary of costs, benefits, benefit-cost ratios and ranges by HMG project grant activities and by community

| Community | Brief Description of Mitigation Activity | Total Costs (2002 \$M) | FEMA Costs (2002 \$M) | Best Estimate | | |
|---------------------|--|------------------------------|-----------------------------|------------------------|-----------------------|--------------------|
| | | | | Benefits (2002 \$M) | Benefit-Cost Ratio | BCR Range |
| Freeport | Street grading / elevations | 2.76 | 2.07 | 6.52 | 2.4 | 0.19 – 9.6 |
| | Building elevations | 2.36 | 1.77 | 13.5 | 5.7 | 0.18 – 16.3 |
| | <i>Freeport Totals</i> | <i>5.11</i> | <i>3.83</i> | <i>20.0</i> | <i>3.9</i> | <i>0.19 – 12.7</i> |
| Hayward | Fire stations | 5.11 | 2.60 | 38.1 | 7.5 | 1.65 – 15.0 |
| | Wastewater facility | 1.84 | 0.50 | 12.8 | 7.0 | 2.84 – 17.2 |
| | <i>Hayward Totals</i> | <i>6.95</i> | <i>3.1</i> | <i>50.9</i> | <i>7.3</i> | <i>1.96 – 15.6</i> |
| Horry County | Hazard mitigation plan | 0.16 | 0.08 | 0.21 | 1.25 | – |
| | Purchase emergency generators | 0.05 | 0.02 | 0.05 | 1 | – |
| | Shutter retrofits | 0.26 | 0.20 | 2.27 | 8.6 | 1.9 – 17.2 |
| | Other wind retrofits | 0.45 | 0.33 | 0.45 | 1 | – |
| | Buyouts and elevations | 6.53 | 4.90 | 13.19 | 2.02 | 0.44 – 4.04 |
| | <i>Horry County Totals</i> | <i>7.45</i> | <i>5.54</i> | <i>16.16</i> | <i>2.17</i> | <i>0.55 – 4.2</i> |
| Jamestown | Lift station | 0.05 | 0.04 | 0.63 | 11.8 | 0.8 – 43.2 |
| | Oxbow dike | 0.60 | 0.45 | 0.39 | 0.66 | 0.05 – 6.9 |
| | <i>Jamestown Totals</i> | <i>0.65</i> | <i>0.49</i> | <i>1.02</i> | <i>1.57</i> | <i>0.11 – 9.7</i> |
| Jefferson County | Acquisition grants | 3.17 | 2.38 | 5.71 | 1.8 | 0.4 – 3.6 |
| Multnomah County | Acquisition grants | 0.91 | 0.68 | 1.06 | 1.17 | 0.13 – 11.7 |
| City of Orange | Garage retrofit | 0.27 | 0.2 | 1.28 | 4.7 | 1.03 – 9.4 |
| | Yard retrofit | 0.27 | 0.2 | 0.31 | 1.16 | 0.13 – 4.6 |
| | Pump station retrofit | 0.32 | 0.24 | 0.15 | 0.46 | 0.1 – 1.6 |
| | <i>City of Orange Totals</i> | <i>0.86</i> | <i>0.65</i> | <i>1.73</i> | <i>2.0</i> | <i>0.4 – 5.0</i> |
| Tuscola County | Acquisitions | 0.12 | 0.04 | 0.18 | 1.72 | 0.76 – 3.4 |
| | Moore Drain structural mitigation | 2.40 | 1.8 | 31.30 | 13 | 2.9 – 26.0 |
| | <i>Tuscola County Totals</i> | <i>2.52</i> | <i>1.84</i> | <i>31.48</i> | <i>12.5</i> | <i>2.8 – 24.9</i> |

Freeport, NY - HMGP

| Community | Brief Description of Mitigation Activity | Total Costs (2002 \$M) | FEMA Costs (2002 \$M) | Best Estimate | | |
|-----------|--|------------------------|-----------------------|---------------------|--------------------|--------------------|
| | | | | Benefits (2002 \$M) | Benefit-Cost Ratio | BCR Range |
| Freeport | Street grading / elevations | 2.76 | 2.07 | 6.52 | 2.4 | 0.19 – 9.6 |
| | Building elevations | 2.36 | 1.77 | 13.5 | 5.7 | 0.18 – 16.3 |
| | <i>Freeport Totals</i> | <i>5.11</i> | <i>3.83</i> | <i>20.0</i> | <i>3.9</i> | <i>0.19 – 12.7</i> |

Summary of costs, benefits, benefit-cost ratios and ranges by Project Impact activity and community

| Community | Brief Description of Mitigation Activity | Total Costs including Annual Maintenance (2002 \$M) | FEMA Costs (2002 \$M) | Best Estimate | | |
|------------------|---|--|-----------------------|---------------------|--------------------|-----------------------|
| | | | | Benefits (2002 \$M) | Benefit-Cost Ratio | BCR Range |
| Freeport | Community early warning system | 0.44 | 0.02 | 7.86 | 17.9 | 1.8 – 71 |
| | Education | 0.13 | 0.10 | Not calculated | Not calculated | Not calculated |
| | Hurricane shutters | 0.03 | 0.02 | 0.01 | 0.3 | 0.15 – 0.6 |
| | Tree removal | 0.02 | 0.02 | Not calculated | Not calculated | Not calculated |
| | <i>Freeport Totals</i> | <i>0.63</i> | <i>0.16</i> | <i>7.87</i> | <i>12.6</i> | <i>1.3 – 50</i> |
| Horry County | Warning systems | ≤0.13 | 0.04 | 0.16 | 1.20 | 1.20 |
| | Fire hydrant reflectors | ≤0.04 | 0.02 | 0.05 | 1.20 | 1.20 |
| | Education activities | ≤0.04 | 0.03 | Not calculated | Not calculated | Not calculated |
| | <i>Horry County Totals</i> | <i>0.16</i> <i>(limits of governmental funds)</i> | <i>0.12</i> | <i>0.21</i> | <i>1.28</i> | <i>Not calculated</i> |
| Jamestown | Civic center as safe room, warning for safe rooms | 0.12 | .10 | 0.24 | 1.96 | 0.2 – 6.07 |
| | Other activities | 0.19 | 1.44 | 0.18 | 0.93 | 0.28 – 0.93 |
| | <i>Jamestown Totals</i> | <i>0.31</i> | <i>0.24</i> | <i>0.42</i> | <i>1.33</i> | <i>0.28 – 2.92</i> |
| Jefferson County | Community early warning and emergency information systems | 0.12 | 0.09 | 0.40 | 3.45 | 0.85 – 10.5 |
| | Other activities including Edgewater Oaks safe rooms | 0.19 | 0.14 | 0.42 | 2.2 | 0.55 – 6.8 |
| | <i>Jefferson County Totals</i> | <i>0.31</i> | <i>0.24</i> | <i>0.82</i> | <i>2.6</i> | <i>0.67 – 8.3</i> |
| Multnomah County | Emergency kits and model home | 0.15 | 0.11 | 0.08 | 0.53 | 0.2 – 0.6 |

Freeport, NY – Project Impact

| Community | Brief Description of Mitigation Activity | Total Costs including Annual Maintenance (2002 \$M) | FEMA Costs (2002 \$M) | Best Estimate | | |
|-----------|--|---|-----------------------|---------------------|--------------------|----------------|
| | | | | Benefits (2002 \$M) | Benefit-Cost Ratio | BCR Range |
| Freeport | Community early warning system | 0.44 | 0.02 | 7.86 | 17.9 | 1.8 – 71 |
| | Education | 0.13 | 0.10 | Not calculated | Not calculated | Not calculated |
| | Hurricane shutters | 0.03 | 0.02 | 0.01 | 0.3 | 0.15 – 0.6 |
| | Tree removal | 0.02 | 0.02 | Not calculated | Not calculated | Not calculated |

Net benefits for spin-off activities

| Community | Mitigation Descriptor | Costs Not Borne by or Required by FEMA (2002\$M) | Net Benefit treated as an acceleration (2002\$M) | Net Spin-Off Benefit not treated as an acceleration (2002\$M) |
|----------------|--|--|--|---|
| Hayward | Tilt-ups | 42.9 | 7.6 | 213.6 |
| | URMs | 10.8 | 1.3 | 49.2 |
| | <i>TOTALS</i> | <i>53.7</i> | <i>8.9</i> | <i>262.8</i> |
| Horry County | Code development | 36 | | 3.6 |
| Tuscola County | A few residences elevated more than required | Low | Low | Low |
| | Residential development grading | Low to medium | Low to medium | Low to medium |

Key Findings

- Synergistic activities occur in communities that have institutionalized their hazard mitigation activities
- Federal hazard mitigation grants often led to additional or synergistic activities
- Most interviewees believed that grants permitted their communities to attain mitigation goals that otherwise would not have been achieved

Key Challenges

- FEMA's NEMIS database on hazard mitigation projects – for the most part, was reasonably accurate – however, the details of some projects had to be verified during field visits because of limited information
- The details of some Project Impact studies were fuzzy because final reports were not prepared
- Loss estimation tools that the research team had hoped to use in the study were being Beta tested and therefore were not available for this study (HAZUS-Flood)

Study Recommendations

- Communities that know they are at risk of natural disasters and have at least some elements of an established hazard mitigation program in place are good investments for federally-funded hazard mitigation programs.
- Loss estimation tools are still inadequate; methodologies to estimate indirect losses and benefits must be improved, e.g., casualty estimation
- NEMIS database can be valuable tool for tracking mitigation programs; however, key information such as property geo-locations; values exposed to loss; and various physical, economic, and operational characteristics before and after mitigation should be added.