SILVER JACKETS Quarterly Newsletter
Many Agencies, One Solution, Managing Risk
March 2010

The purpose of this newsletter is to share recent Silver Jackets news and to provide a forum for team support, sharing successes, lessons learned, and resources.

Inside This Issue

What or Who are "Silver Jackets"?

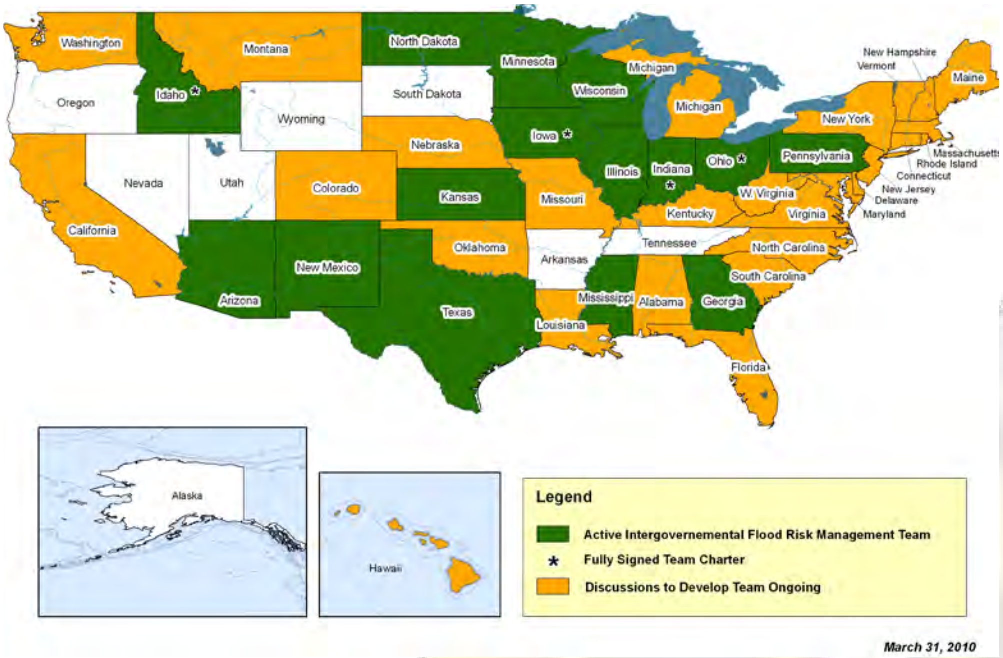
As a Silver Jackets lead, this is a question you may have to answer a few times. While the name of the program is certainly not self-explanatory, it is a great conversation starter and is representative of a number of program qualities. First, the name is not "government-ese" or a government acronym. The intent of the Silver Jackets program is to implement an alternate approach: collaborative Federal teaming to support states. Funds provided through the Silver Jackets program are intended to facilitate a continuous intergovernmental forum through which participants can access the many available programs and cohesively apply them to a state's hazard priorities.

Second, the name refers to the public's view of Federal emergency response: the U.S. Army Corps of Engineers (USACE) in red jackets and Federal Emergency Management Agency (FEMA) in blue jackets. Instead of operating individually, the intent of Silver Jackets is to facilitate collaboration among many state and Federal agencies, and provide one coherent forum for a state to address their priorities. When referring to this analogy, it is important to note that the jackets are symbolic…as a neutral color, silver is meant symbolize unified Federal action. The scope of the program, however, is much broader than emergency response. The intent of the Silver Jackets program is to bring agencies together to manage a state's flood risk, throughout the life-cycle. All aspects, mitigation, preparation/training, response and recovery, are within the scope of the team…the team's focus will be determined by the state's priorities, and participation may vary accordingly.

From an organizational viewpoint, Silver Jackets is the state-level implementation tool for the Flood Risk Management Program (FRMP). Created in 2006, the goals of the FRMP can be viewed at www.iwr.usace.army.mil/nfrmp. The Silver Jackets program contributes to all of these goals, but most commonly integrates flood damage and flood hazard reduction programs across local, state and Federal agencies, improves public awareness and comprehension of flood hazards and risk, and provides current and accurate floodplain information to the public and decision makers. While the FRMP is managed by the Director, Pete Rabbon, and the Deputy Director, Jeffrey Jensen, the Silver Jackets program is managed by Jennifer Dunn (Jennifer.K.Dunn@usace.army.mil). Both programs are currently managed through the Institute for Water Resources in Alexandria, Virginia.

Jennifer Dunn has served as the Silver Jackets Program Manager since October 2008. She has 15 years experience with USACE, as a liaison to DHS, a planner with the South Pacific Division, a planner and program manager at the San Francisco District and as an environmental engineer at Sacramento District. She received her master's degree from UC Davis and is a Certified Floodplain Manager.

The adjacent map shows the current status of Silver Jackets efforts across the country. The ultimate goal is to offer support for an intergovernmental team to every interested state. In many states, a new team will be created. Sometimes USACE and other Federal agencies participate in existing state teams; this is the case in Kansas, Wisconsin and North Carolina. Sometimes existing state teams will be formally associated with the Silver Jackets team, as was done in Illinois. And sometimes, a state will choose an alternate name, such as the Iowa Flood Risk Management Team. Occasionally a state may choose to establish a team to actively and collaboratively address their risk, but will not desire a formal charter. Because



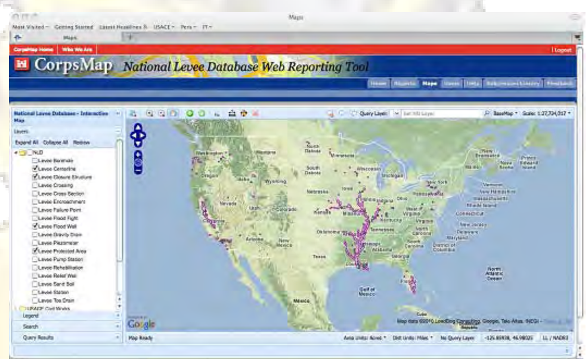
each of these teams creates or supplements a continuous mechanism to collaboratively solve state-prioritized issues and implement or recommend those solutions, these are all Silver Jackets in the eyes of USACE.

Congratulations to the Iowa Team

who became the fourth chartered state when all core agencies signed their charter on March 22, 2010.

Silver Jackets Teams Invited to Participate in National Levee Database Rollout

Within the authority of Title IX of the Levee Safety Act of 2007, the US Army Corps of Engineers National Levee Database (NLD) team is working with the National Committee on Levee Safety Committee (NCLS) to develop a roll-out plan for public dissemination of the NLD. The development of the path forward will be a collaborative effort with federal and non-federal levee owners. This will include the transfer of NLD technologies, transfer of non-Corps data to the NLD, and provide access and awareness of the NLD to the nation. The levee owners and/or regulatory groups comprise 12 federal agencies, 50 states, 3 territories and thousands of locals. Silver Jackets has been identified as one of several collaborating and coordinating organizations capable of assisting the NLD team in jointly developing the path forward and being points of contact with states, local governments, and the public.



A 2-hour informational session will be presented on June 24 at the USACE Flood Risk Management and Silver Jackets Workshop, and a more in-depth full-day training session will be presented at the Association of State Dam Safety Officials conference in September. Further information is provided in "Upcoming Conferences and Training Opportunities" at the end of this newsletter.

Spotlight on: INDIANA Silver Jackets

Indiana was one of the initial pilot teams of the Silver Jackets program, established in 2005. They have found success over a broad range of issues and recently attracted the attention of the United Nations International Visitor Leadership Program. During and following the floods of June 2008, the Silver Jackets team was tested. The state of Indiana found that response and recovery were more effective as a result of the interagency team. Because relationships were strong and members were already very familiar with each agency's roles and responsibilities, the Silver Jackets team was able to assist the Joint Field Office and quickly respond to multiple requests. A member of Indiana Silver Jackets, Chris Ritz of the US Department of Agriculture spread the word, and the State Department arranged a visit to share Silver Jackets experiences with Ms. Laura Jane Tiberi of the Emergency Operations and Rehabilitation Division of the United Nations Food and Agriculture Organization (see attached). The primary message of the meeting was that one organization can not do it all—many agencies have to come together to address the full range of issues holistically. The Indiana Silver Jackets were able to handle many needs, including dams and levees, because sister agencies were all sitting at the table and getting regular reports. Agency representatives were already aware of the challenges and focal areas. The Silver Jackets agencies were given access to the WebEOC (electronic EOC relational/communication database), as well as passes to the operations center. The USGS ran models within the state EOC during this event; previously, the USGS had not been active in the EOC. As a result, efficient and effective response and recovery were achieved. Success travels far; similar communities both here in the US and abroad are among those learning from this particular success.

How did the Indiana team develop the relationships needed to achieve this cooperation?

Manuela Johnson of the Indiana Department of Homeland Security (IDHS) reports that the best thing the team did was to take time to get to know each other. They frequently go to lunch following the regular meeting, providing another venue to discuss issues. Often as much work can be accomplished at lunch as in the formal meeting!

What are some other successes the Indiana team has achieved?

Often resolution of seemingly small issues can lead to greater things. For example, in one Silver Jackets meeting, a comment was made that USACE and Indiana Department of Natural Resources (IDNR) data did not match; differing boundaries used in the models produced elevation differences of up to two feet. The team facilitated resolution, and within a short time the data were aligned. Without Silver Jackets, neither agency would have pursued resolution, leaving the communities to deal with the disparity. While this resolution was a success in itself, the discussion opened the door to further solutions of data discrepancies. The state sees this as a valuable service; when all agencies can agree on a single, 'correct' set of data, the state mitigation program, as well as USACE and IDNR efforts, benefit.

These small successes led to an even more open conversation. Participants started discussing what they really needed in their jobs and how insufficient some current practices were. They wanted a real-time data mixer—they needed the ability to know the current location of the water, where it will be, and how much damage it will create. If this could be put together, it would assist both mitigation and response. From this conversation, the inundation study was born. Now the National Weather Service (NWS) projections and hydrology from the Advanced Hydrologic Prediction Service are combined with real-time gauge data from the US Geological Survey (USGS). Models create real-time view of the location and depth of the water. When overlaid with the tax roll, an accurate prediction of potential damage can be calculated, employing the USACE depth damage curve and HAZUS modeling (see attached for a more detailed description). Another area of success and ongoing effort for the Indiana team is outreach to children. The team drafted a coloring and activity book, and distributed within their agencies for proof-reading. The adults enjoyed the fun, but also noticed that the dangers of low-head dams were not incorporated. Since these are common in the state and not often addressed in safety literature, Silver Jackets embraced the opportunity. NWS and Dam Safety contributed content, and all agencies will distribute hard copies as well as electronically.

What's next for this accomplished group?

Upper management at the Indiana DHS was so pleased with the performance of the Silver Jackets that the team has been challenged to develop a statewide riverine strategy. This of course will involve even more agencies and partners as it will have far-reaching impact. While this is a team long-term goal, they are determined not to have a single focus, but to manage risk through a variety of approaches. One current effort is **fluvial erosion**. In June 2008, homes were potentially eroding away, but there is a gap in programs: no state or Federal program covers a home that has not yet flooded, but from under which the ground is eroding. The USGS has documented damage from the bank sliding away from under foundations and the IN team is now trying to put together a fluvial erosion hazards program with thanks to the state of Vermont for sharing information regarding their experience.

The Indiana **State Hazard Mitigation Plan (HMP) update** is also a team focal area. All Silver Jackets members participated as contributing authors and editors on the most recent state HMP, which was finalized in April 2008, just before the significant floods of June and September of 2008. Input to the update, due April 2011, is now being solicited; there is a great quantity of new material since the recent floods. The formatting is also being updated; parts will be made digital to allow greater interaction.

A significant portion of the HMP is the **Hazard Identification Risk Assessment**. This interactive, web-based tool is under development. It will help identify challenges, areas to be explored through Silver Jackets. When the group identifies high risk areas, resources can be focused and good information that wouldn't otherwise have been shared can be put to wider use. For example, in the process of writing a report on a Northern Indiana area, IDHS and IDNR needed to gather a list of resources for mitigation activities. Through Silver Jackets, they found that a partner had done a study on resources for a similar community that could be used for the Northern Indiana report. The Northern Indiana community benefitted from the thorough work done by the Silver Jackets partner, and the taxpayer funds used for the partner's study were put to greater use. Because IDHS and IDNR were willing to share a draft product and ask for input from other agencies, their service to the community was improved. There are many uses for the products already created by the many agencies that serve the public. Similar to the well-known "reduce, reuse, recycle" model, resources are optimized when data that has already been collected and paid for can be used again. The need for new data and new funding is reduced when access to pertinent existing data is increased and existing data can be reused and recycled, allowing the next follow-on product to develop more efficiently.

In the spirit of employing a patchwork quilt approach to local issues, Indiana Silver Jackets team members from other federal agencies and state agencies are always looking for creative ways to cooperate with each other and leverage resources. This week the Louisville District (lead District for Indiana Silver Jackets) participated in a media event hosted by Congressman Hill to celebrate the installation of stream gages in **Orange County** and an FY10 **Planning Assistance to States (PAS) Study**. The PAS Study will develop database layers to be used in development of a hydraulic and hydrologic (H&H) model of the karst flood system in Orange County. This model will then be used by USACE, other federal agencies, the State of Indiana, and local communities to analyze flood risks in Orange County. The Indiana Department of Transportation (INDOT), and local governments are providing funding for installation and operation of six U.S. Geological Survey (USGS) stream gages. The USGS is contributing stream gage equipment purchased with American Recovery and Recovery Act funds and is providing matching funds through its Water Cooperative Program to INDOT and the local communities for installation and operation of the gages. In accordance with USACE Office of Counsel and the USGS, all of these funds and services will serve as the in-kind match for $75,000 in PAS funds to develop the database and GIS layers for the H&H model. In short, the partnership leverages $44,800 in local funding to obtain $142,000 in Federal funds to develop a stream gage network and flood response tool to help Orange County manage flood risk. It's a success story for all participants involved!

The Indiana Silver Jackets Team meets monthly, usually in Indianapolis since that is where most of the agencies offices are located. Each agency has an equal voice, and shares information allowing agency representatives to become aware of the challenges and focal areas within the state. USACE leads for the Indiana Silver Jackets team are Brandon Brummett and Roger Setters.

Silver Jackets in the News

Cartoon by Rob Pudim/Natural Hazards Observer

Your work developing Silver Jackets teams is being noticed. The Silver Jackets program recently has been highlighted in a number of venues. In November, the Natural Hazards Observer ran "Preventing Human Caused Disasters", with a highlight on Silver Jackets as an example of leadership at the state level (http://www.colorado.edu/hazards/o/archives/2009/nov_observerweb.pdf), and the Association of State Floodplain Managers highlighted the program and the new website in their January newsletter. We've also received inquiries specifically about the program from Congress, Sandra Knight, FEMA's new Deputy Assistant Administrator for Mitigation, and Gerry Galloway. Your monthly updates provide the basis of all responses, so thank you for taking the time to send them in.

Don't Let Lack of a Charter Stop You: MINNESOTA Silver Jackets

Many Silver Jackets teams are actively managing their state's risk, but have not fully signed a charter. While a charter can help a team focus and build team identity, it is not absolutely necessary to achieve the goals of Silver Jackets; absence of a formal charter should not delay team activities. The Minnesota Silver Jackets have been quite active, holding regular meetings. The core members met in January at the St. Paul District office to participate in a demonstration of a CorpsMap server-based GIS product called MVP Oracle Digital Assets, or MODA. There were twelve team members present from USACE, USGS, NOAA, NRCS, the Minnesota Department of Natural Resources, and the Minnesota office of Homeland Security and Emergency Management. The purpose of the meeting was to demonstrate a new product developed by the MVP Economics and GIS sections. The product uses a GIS interface to access MVP data on existing Rehabilitation and Inspection Program (RIP) levees. The data available includes levee locations, structure inventories of buildings in the 1% flood outline with addresses, structure type, elevation and location attributes. The flood outline is visible, along with various types of base maps (USGS quadrangles, digital orthoquads, or planimetric only). Other attributes include population at risk and many other GIS layers. The tool can be used on the fly as a quick reference before, during, or after flood events to provide information to forecasters and responders. PDF versions of existing FEMA flood insurance study booklets are also included. Planned enhancements include the addition of all MVP flood risk reduction projects, past after action reports, historic high water mark data, the CRREL ice jam database, real time weather radar links, properties bought out from previous floods, National Weather Service river stage forecast and USGS gage data links. Use is anticipated during spring flooding when access, security, and privacy issues are resolved. The non-USACE agencies readily agreed to provide their data to make the product a complete and seamless emergency response tool.

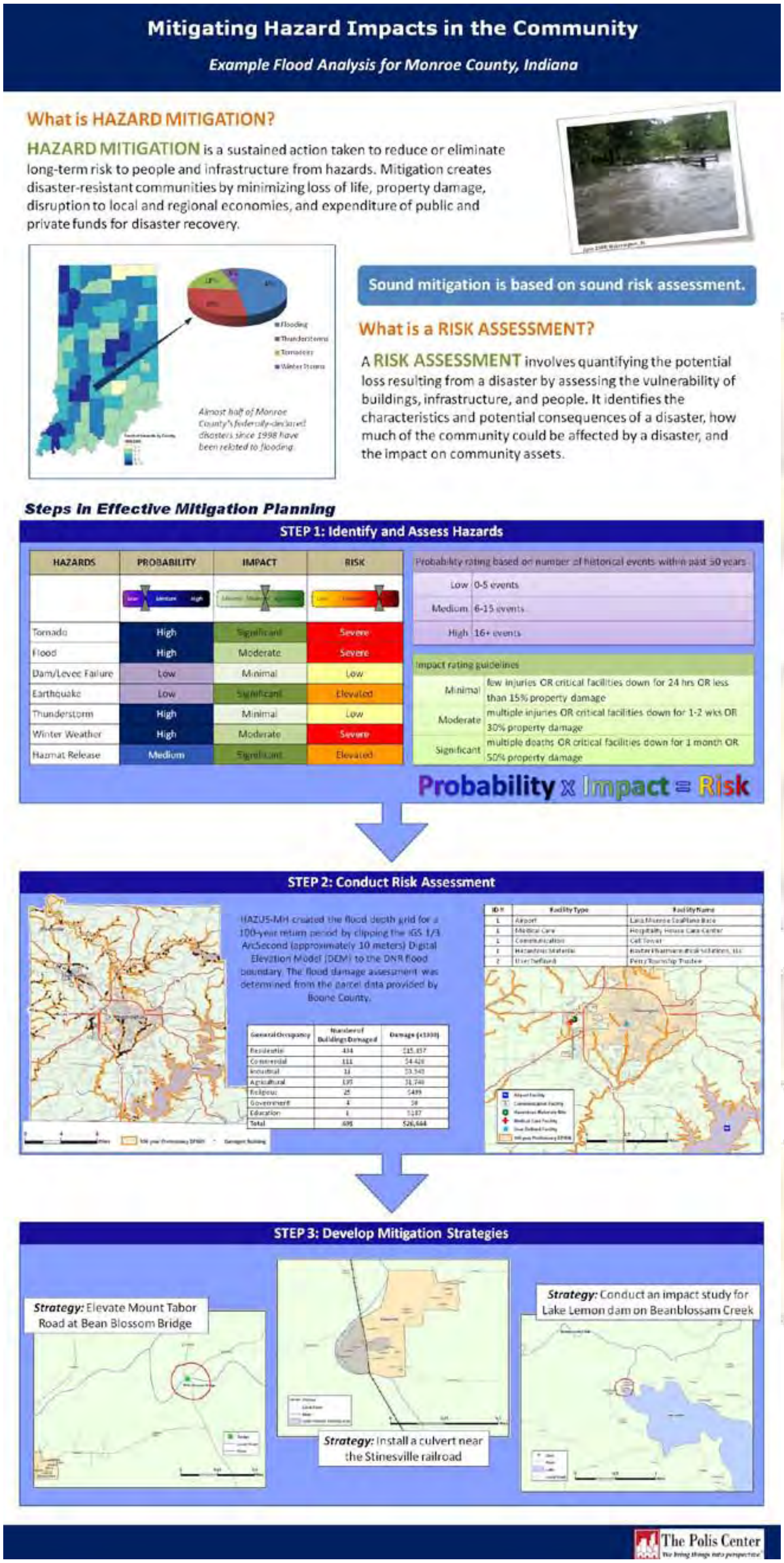
For more information, contact Terry R. Zien, St. Paul District

Website is Live and Ready for Your Contributions

The national USACE Silver Jackets website, www.iwr.usace.army.mil/nfrmp/state, is now live and ready for your use and input. Each state has the flexibility to use their page as they see fit. Send in your comments and content today.

In The Works: Program Guide

One of the most beneficial exercises a developing team can engage in is a discussion of each agency's mission and programs related to flood risk management. A written description of potentially relevant programs may also facilitate collaboration. A Program Guide is currently being developed, but as you can imagine, such an inclusive document is a daunting task. If you have suggestions for programs or resources that should be included, please send them in. The first edition of the program guide will be available at the upcoming Silver Jackets workshop.



Useful Links:

Mitigation Planning

For an excellent introduction to State and Local Mitigation Planning, please see the FEMA handout attached to this newsletter, and the associated link to the FEMA Mitigation Planning website: www.fema.gov/plan/mitplanning/index

As many of you know, FEMA is initiating Risk Mapping, Assessment, and Planning (Risk MAP) and has developed a multi-year plan spanning Fiscal Years 2010-2014. The plan was approved on March 16, 2009, and is now available at www.fema.gov/plan/ffmm.shtm. Silver Jackets and RiskMAP share a number of complementary goals. The Multi-Year Plan outlines the FEMA plan for enhancing and maintaining the quality flood hazard data and maps, and building on that data to enable the Risk MAP vision: Through collaboration with State, local, and Tribal entities, Risk MAP will deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Risk MAP aims to improve and maintain flood hazard data and maps; efficiently deliver quality products and services to the right audiences at the right time; reduce loss of life and property through continuous improvement of mitigation plans; increase mitigation actions at the local level; and integrate risk identification, assessment, communication, and mitigation.

While it is widely believed that the benefits of mitigation far outweigh the investment, it is sometimes difficult to demonstrate. The article "Estimating the value of foresight: aggregate analysis of natural hazard mitigation benefits and costs" by David Godschalk, et. al., was recently published in the Journal of Environmental Planning and Management, and follows this newsletter.

"Ask an Established Team" Corner

This section will be dedicated to questions from developing teams to established teams. An experience common during initial Silver Jackets team development is hearing from the state representatives that the last thing they need is another meeting to attend. The program is so flexible that it is sometimes difficult to communicate the added value of the effort. While the state of Indiana now highly values their Silver Jackets team, their initial reaction was also that they didn't see a need to attend yet another meeting with the Federal folks. Following is a description of how they came to value Silver Jackets.

Manuela Johnson advises Silver Jackets leads to start with small, achievable goals, and talk about what the team is doing—people like being part of a successful team. Especially in the initial stages, teams need short-term successes. The world's problems can not be solved quickly, so set attainable goals, build on what is working and take doable 'bites' upfront. Establish a common goal of open and frank discussion of how to leverage resources and share information. Ask each agency to bring a list of their current projects; when discussing actions in the same communities and counties, opportunities tend to come together. Once the team has a focus, a key action is to talk about what the developing team is accomplishing. Although a particular division of the state agency was not initially supportive of the active team, they happened to be in the audience when a team member presented some recent work, and were then convinced of the value. Another team member attracted the attention of a local university as he presented the inundation study success. As a result, the team can now easily access the soils mapping research conducted by the university. Like a complex jigsaw puzzle, various parts of the picture come together separately, and often on varying timelines, but the ultimate goal is for them all to come together to form a complete picture of managed risk. Small successes can build larger successes.

Upcoming Conferences and Training Opportunities:

- Flood Warning Systems Preparedness Training Symposium and Workshop
  23rd Conference and Exposition of the ALERT Users Group, Palm Springs, California: May 4–7: http://www.alertsystems.org/aug/2010conf/2010conf_flyer.pdf
- Association of State Floodplain Managers Annual Conference "Building Blocks of Floodplain Management", May 16 – 21, 2010, in Oklahoma City, Oklahoma: www.floods.org
- Planning Community of Practice Conference 2010 "Planning Smart, Building Strong: Developing Sound Water Resources Solutions", June 7-10, Orlando, Florida: http://www.usace.army.mil/CECW/PlanningCOP/Pages/2010_plnconf.aspx
- USACE Flood Risk Management and Silver Jackets Workshop, June 22-24, Minneapolis/St. Paul, Minnesota. Website to be announced.
- Association of State Dam Safety Officials (NLD training session), September 19-23, Seattle, Washington. http://www.damsafety.org/conferences/
- Nonstructural Measures for Flood Risk, March 29-April 2, Omaha, Nebraska (Prospect 345)
- Certified Floodplain Manager (CFM) training and testing is available at the ASFPM Conference.

Have a question for an established team? Have a topic you'd like more information on? Want to highlight a success your team has achieved? Want to share a useful link? Your contributions to the third quarter newsletter are welcome; send them to Jennifer.K.Dunn@usace.army.mil anytime before May 15, 2010.

MITIGATION DIRECTORATE

State and Local Mitigation Planning

Building Stronger and Safer—Disaster Resilient

Hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards. Hazard mitigation planning is the process State, Tribal, and local governments use to identify risks and vulnerabilities associated with natural disasters, and to develop long-term strategies for protecting people and property from future hazard events.

Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended, State, Tribal, and local governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects.

RAISES AWARENESS AND SUPPORT

The planning process promoted by FEMA is as important as the resulting plan because it creates a framework for governments to reduce the negative impacts from future disasters on lives, property, and the economy.

The mitigation plan defines a long-term strategy for reducing disaster losses by breaking the cycle of disaster damage, reconstruction, and repeated damage. Mitigation planning includes the following elements:

Public involvement – Planning creates a way to solicit and consider input from diverse interests. Involving stakeholders is essential to building communitywide support for the plan. In addition to emergency managers, the planning process involves other government agencies (e.g., planning, zoning, floodplain management, public works, conservation, community and economic development), businesses, civic and neighborhood groups, environmental groups, and schools.

Risk assessment – Mitigation plans identify natural hazards and risks based on history, potential frequency and magnitude, and identifies potential losses of life and property. The assessment considers the built environment including the type and numbers of existing and future buildings, infrastructure, and critical facilities relative to identified hazard areas.

Mitigation strategy – Based on the risk assessment, communities develop mitigation goals and objectives, as part of a strategy for mitigating disaster losses. The strategy is a community's approach for implementing mitigation activities that are cost-effective, technically feasible, and environmentally sound as well as allowing strategic investment of limited resources.

BENEFITS OF MITIGATION PLANNING

Increases public awareness and understanding of vulnerabilities as well as support for specific actions to reduce losses from future natural disasters.

Builds partnerships with diverse stakeholders increasing opportunities to leverage data and resources in reducing workloads as well as achieving shared community objectives. For example, managing floodplain development may decrease flood losses but also protect water quality by restoring natural functions.

Expands understanding of potential risk reduction measures to include structural and regulatory tools, where available, such as ordinances and building codes. Through implementation of local floodplain ordinances, it is estimated that $1.1 billion in flood damages are prevented annually.

Informs development, prioritization, and implementation of mitigation projects. Benefits accrue over the life of the project as losses are avoided from each subsequent hazard event.

PLANNING GUIDANCE, TOOLS & TRAINING

Multi-Hazard Mitigation Planning Guidance, or "Blue Books," are designed to increase understanding of the requirements for States, local and Tribal governments when developing new or updated mitigation plans, and help Federal and State reviewers fairly and consistently evaluate mitigation plans from different jurisdictions.

Training available through FEMA's Emergency Management Institute (EMI) or your State Hazard Mitigation Officer (SHMO) include:

- G318 Mitigation Planning Workshop for Local Governments
- E296 HAZUS Multi-Hazard/DMA 2000 Risk Assessment
- E344 Mitigation for Tribal Officials

Series of "How-To" guides are designed to provide information beyond FEMA's basic requirements. The guides focus on initiating and maintaining a planning process that will result in safer communities, and are applicable to jurisdictions of all sizes, resource and capability levels.

CURRENT LIST OF HOW-TO SERIES

- Getting Started: Building Support For Mitigation Planning (FEMA 386-1)
- Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)
- Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3
- Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)
- Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)
- Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning (FEMA 386-6)
- Integrating Manmade Hazards Into Mitigation Planning (FEMA 386-7)
- Multi-Jurisdictional Mitigation Planning (FEMA 386-8)
- Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects (FEMA 386-9)
- Using HAZUS-MH for Risk Assessment (FEMA 433)

HAZARD MITIGATION PLANNING RESULTS

History shows that the physical, financial, and emotional losses caused by disasters can be reduced significantly through hazard mitigation planning. A broad range of activities designed to reduce risk can result from the mitigation planning process, such as:

- Adopting and enforcing regulatory tools, including ordinances, regulations, and building codes to guide and inform land use, development, and construction decisions in areas affected by hazards. Where authorized, consider adopting more stringent criteria to provide greater protection for citizens, as conditions may change over time. For example, consider:
  - Exceeding the National Flood Insurance Program (NFIP) floodplain management regulations by elevating structures above the Base Flood Elevation (BFE) in high-risk areas.
  - Creating a buffer area by protecting natural resources, such as floodplains, wetlands or sensitive habitats. Additional benefits to the community may include improved water quality and recreational opportunities.
- Developing mitigation projects to acquire and demolish flood damaged structures, such as homes or businesses, or to retrofit public buildings, schools, and critical facilities to withstand extreme wind events or ground shaking from earthquakes.

The examples above illustrate a range of possible long-term mitigation actions and are not intended as examples of eligible activities under the FEMA Hazard Mitigation Assistance (HMA) programs.

HAZARD MITIGATION ASSISTANCE (HMA)

FEMA's HMA programs fund eligible mitigation activities that reduce future disaster losses and protect life and property. Funding is available for mitigation plan development and updates as well as mitigation projects. Please note that specific requirements relative to FEMA-approved mitigation plan(s) as a condition of receiving mitigation project grants vary by HMA program.

FOR MORE INFORMATION

Please visit the Mitigation Planning website:
www.fema.gov/plan/mitplanning/index

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Estimating the value of foresight: aggregate analysis of natural hazard mitigation benefits and costs

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Estimating the value of foresight: aggregate analysis of natural hazard mitigation benefits and costs

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Hazard mitigation planners claim that foresighted present actions and investments produce significant future benefits. However, they have difficulty in supporting their claims, since previously their evidence typically was derived from individual case studies. Constituents and decision makers are often sceptical, believing that individual cases are either inapplicable to their situation or non-randomly selected to support a particular view. Planners need objective evidence based on a large body of experience to support the case for mitigation. Such is the unique contribution of a recent U.S. study that found that each dollar spent in three federal natural hazard mitigation grant programs (the Hazard Mitigation Grant Program, Project Impact, and the Flood Mitigation Assistance Program) saves society an average of $4 in future avoided losses. Complementing the aggregate benefit-cost analysis with community-based evaluations, the study yielded insights on how planners can improve long-term community resilience in the face of extreme events. Valuable lessons for mitigation planners and policy makers emerged: the need to consider a wide variety of losses, the importance of mixing qualitative with quantitative analysis, the value of averaging results over a large number of projects, and the need to more explicitly address social issues and data collection in order to reduce vulnerability and enhance resilience to cope with twenty-first century hazards.

Keywords: hazard mitigation; aggregate benefit-cost analysis

1. Claiming the value of foresight

Planners work in the future tense, claiming that foresighted present actions and investments produce significant future benefits. They argue that common sense supports the wisdom of acting today to provide a better tomorrow. The core concept of planning is that actions informed by foresight can provide more benefits and incur fewer costs than after-the-fact responses that involve relatively more expensive retrofit, repair or reconstruction.

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Foresighted action is particularly relevant in the field of natural hazard mitigation, where it is often stated that "an ounce of prevention is worth a pound of cure". But hazard mitigation planners have difficulty pinning down the differences in benefits and costs between prevention and cure. The difficulty springs from analytical challenges and future uncertainties, which have long plagued practitioners of emergency management. Future disaster probabilities are reckoned over many decades, and, in some cases, in hundreds of years. Hazard mitigation projects, such as relocating households from floodplains, often have high up-front price tags and require challenging behaviour changes. Public understanding of the benefits of, and support for, investing in mitigation is limited, as shown in post-Katrina experience in Gulf coast communities that have resisted land use and structural safety recommendations in their haste to rebuild (Roig-Franzia 2006). Appeals for foresighted action based on single case studies (Association of State Floodplain Managers 2000) are questioned as either inapplicable to differing situations or non-randomly selected by advocates to inflate the value of mitigation.

Benefit-cost analysis (BCA) offers a rigorous, widely applied tool for assessing public policy and public investment proposals (Campbell and Brown 2003, National Research Council 2004, Moore and Thorsnes 2007). Basically, benefit cost analysis is concerned with efficiency. Public investments are considered to be efficient if their benefits exceed their costs. Given that these investments are intended to last and need to be maintained for many years, they are efficient if the present discounted value of the estimated future stream of positive impacts (benefits from the investment) is greater than the present discounted value of the estimated future stream of negative impacts (costs of the investment). Thus, a project is deemed efficient if its benefit/cost ratio is greater than one.

Sceptics about BCA note that it attempts to measure everything in dollars, ignoring the qualitative aspects of public policy actions; that its focus on a single numerical ratio overlooks associated impacts; that quantification leads to a false sense of confidence in the estimates; that internal rate of return or other measures better inform financial decision making, and that its focus on efficiency fails to consider the important equity or distributional issues involved in policy decisions (Stokey and Zeckhauser 1978, Boardman *et al.* 2001). Thus, it fails to reckon with the comprehensive nature of planning, which recognises that government actions must be judged both qualitatively and quantitatively.

These are indeed valid criticisms of using traditional benefit-cost analysis as the sole evaluative tool for a prospective project. However, in a random sample of a large number of projects, and using a consistent valuation methodology, individual under-estimates and over-estimates tend to be off-setting, yielding useful information on the average efficiency of the planning activity. In addition, when the benefit-cost analysis is augmented by community-based studies, interpretations and implications of the economic numbers are enhanced by setting them within the more comprehensive context where planners actually operate. The combination of aggregate BCA and community studies effectively incorporates the advantages of the argument by 'anecdotal analogy' – namely, its richness in scope of factors considered – but mitigates the shortcomings of that approach which detract from its credibility – namely, lack of scientific objectivity and failure to systematically draw on a large body of existing experience.

Aggregate BCA has been used to evaluate other public policies. For example, Austin *et al.* (2007) used it to analyse the benefits of restoring the Great Lakes ecosystem. So why had it not been used to evaluate US mitigation policy? The short answer is that it is difficult to do correctly, given a number of methodological challenges.

However, aggregate BCA was successfully employed in the study responding to the 1999 Congressional request that the Federal Emergency Management Agency (FEMA) sponsor an independent study to assess the future savings resulting from hazard mitigation activities (US Senate 1999).[1] To overcome the limitations of traditional project-by-project analysis, an innovative methodology based on aggregate benefit-cost analysis supplemented with community-wide studies was developed to respond to the Congressional request.[2] The resulting study by the Multi-hazard Mitigation Council (MMC), *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, analysed the effectiveness of more than $3.5 billion spent in individual grants under FEMA's Hazard Mitigation Grant Program, Project Impact and Flood Mitigation Assistance Program to mitigate risks from floods, windstorms and earthquakes between 1993 and 2003 (MMC 2005).

This article discusses the importance to planners and policy makers of assessing the aggregate benefits and costs of hazard mitigation and describes the MMC study and its findings. In terms of study methodology, it is demonstrated that aggregate BCA is a valuable way to quantify mitigation impacts and that supplementary community studies are a valuable approach to uncover qualitative mitigation impacts, especially on overall community resilience. In terms of study findings, implications for both local planners and for federal mitigation policy are highlighted.

2. Assessing mitigation benefits and costs

Effective assessment of the benefits and costs of hazard mitigation is important to planners and policy makers, since nearly every US community is subject to risks from natural hazards (FEMA 2004a).[3] Floods are the most prevalent natural hazard; most US counties have experienced at least one Flood Presidential Disaster Declaration and some experienced as many as 12 during the 1965 to 2000 period (FEMA 2004a). Many communities are also subject to one or more of the other six major natural hazards – earthquakes, tsunamis, tornados, coastal storms, landslides and wildfires. Mitigating the risks from these hazards involves projects that affect land use and environmental management, public facilities, building codes, retro-fitting existing structures, relocating threatened households from hazard areas and other aspects of comprehensive planning, development regulation and capital programming.

Paying for flood, earthquake and high wind disasters in the US costs the federal government nearly $5 billion on average each year for disaster relief and recovery (FEMA 2004b). Most of the expenditures to cover these disaster costs come from special appropriations in the wake of disasters, which can be problematic for a Congress burdened by record budget deficits. It is important to select for funding those mitigation projects most likely to reduce the impacts of future disasters.

Early US disaster policy employed a *reactive* approach, treating disasters as acts of God, with the federal government as the lead response and recovery agency when a disaster exceeded states' response capabilities. Over time this reactive stance has been changed to a *proactive* approach. The Disaster Mitigation Act of 2000 (P.L. 106–390) now requires state and local governments to prepare and implement pre-disaster mitigation plans. The Act, which is implemented through the Hazard Mitigation Grant Program, defines natural hazard mitigation as sustained action taken before a disaster strikes in order to reduce future property damage, human casualties and other disaster impacts. Pre-disaster mitigation plans seek to reduce hazard vulnerability and strengthen hazard defenses (Burby 1998, Godschalk *et al.* 1999, Mileti 1999, Waugh and Tierney 2007). Such plans incorporate a slate of hazard reduction techniques (Godschalk 2007, Puszkin-Chevlin *et al.* 2007).

State pre-disaster mitigation plans are evaluated and approved by FEMA and local pre-disaster mitigation plans are evaluated and approved by state emergency management agencies and FEMA. Hazard Mitigation Program grants to implement the plans are evaluated individually and funding is awarded on a competitive basis. However, until now there has been no systematic analysis of the *overall* natural hazard mitigation programme.

Conventional mitigation assessment analyses have relied on case studies of the outcomes of individual communities' mitigation efforts. Not surprisingly, many case studies tend to focus selectively on successful efforts. The literature contains a number of such success stories, which describe best practices and lessons learned.[4] For example, Berkeley, California, is described as a community that has used a combination of federal mitigation grants and local government funding to develop and implement a co-ordinated array of earthquake mitigation projects guided by mitigation policies adopted in their comprehensive plan (Chakos *et al.* 2002, Berkeley 2002). While success stories can be useful motivation devices and exemplars of best practices, they do not provide reliable estimates of overall mitigation programme benefits and costs.

The literature also contains examples of failure stories. Among the recent ones are accounts of what went wrong during Hurricane Katrina in 2005. The most costly US natural disaster, in terms of death and injury, property damage and community destruction, Katrina showed the world that despite ample warnings the Gulf Coast region failed to implement adequate mitigation measures to cope with a major hurricane strike (Cutter 2005, Birch and Wachter 2006, Hartman and Squires 2006, US House of Representatives 2006, Nolon and Rodriguez 2007, Laska and Morrow 2007). Katrina and other recent disasters also vividly demonstrated that individual mitigation measures might be immaterial if comprehensive mitigation planning and programmes are absent. It does little good to strengthen roofing requirements in building codes or to provide emergency generators in hospitals if the buildings and emergency equipment are likely to be destroyed by flooding due to levee failure. Land use, flood and fire protection, transportation, environment, building construction and community and economic development all affect disaster resilience and catastrophe potential.

Despite the availability of individual case studies of success and failure, prior to the MMC study, the current study lacked a broad systematic assessment of natural hazard mitigation benefits and costs. Thus, the nation had no evidence-based analysis of the future savings from hazard mitigation activities.

3. Aggregate benefit-cost methodology and findings

Seeking objective evidence about the benefits and costs of natural hazard mitigation, Congress directed the FEMA to sponsor an independent study to assess the future savings resulting from hazard mitigation activities (US Senate 1999).[5] The resulting study found a wide array of mitigation benefits, concluding that these expenditures generated savings to society at a rate of $4 on average for every $1 spent (Ganderton *et al.* 2006, Rose *et al.* 2007).[6] Both the study methodology and its findings have begun to affect public policy. The Congressional Budget Office built on the MMC approach in its subsequent study of potential cost savings from the pre-disaster mitigation programme (CBO 2007).[7] The Administration's 2006 Budget based a $100 million budget increase for FEMA pre-disaster mitigation grants on them (DHS 2006). The Oregon Legislative Assembly cited them in a 2007 Bill directing governments in the state to develop plans for mitigating and recovering from catastrophic disasters (Senate Bill 1038).[8]

A Congressionally-mandated policy study must stand up to hard critical analysis. Individual case studies have documented substantial savings from mitigation, but they cannot be generalised to overall federal programme outcomes and they are subject to the charge of 'cherry picking' – the practice of looking only at the most successful mitigation cases. To deal with these issues, the study developed an aggregate methodology that analysed and aggregated a systematically sampled group of hazard mitigation grant drawn randomly from FEMA's National Emergency Management Information System (NEMIS).[9]

Benefit-cost analysis was selected to provide credible results to the Congressional Budget Office, the Government Accountability Office and other fiscal experts (see Rose 2004a, Ganderton *et al.* 2006, Rose *et al.* 2007). Every FEMA-funded mitigation project application must present an argument that its benefit-cost ratio is greater than 1.0 (FEMA 1995). However, given competing demands for taxpayer dollars, it matters whether the ratio is 1.1, 3.8 or 15.1.[10] Since BCA has not in the past been applied systematically to an *aggregate* set of mitigation activities, we do not know the scale of effectiveness of overall FEMA mitigation activities in terms of use of society's resources.

Two types of FEMA mitigation grants were analysed: *project* grants and *process* grants. Project grants invest in physical capital (drainage enhancement, acquisition and relocation of at-risk structures, structural improvements, non-structural improvements, lifeline improvements and land-improvement projects). They generate tangible physical change to the built or natural environment and can be quantitatively assessed. Process grants invest in human, social or institutional capital (e.g. vulnerability assessments, community priorities, action plans, education campaigns, and the development of codes and regulations). They support actions that reduce risk and increase community resilience, but their outcomes are more difficult to quantify.

The study finding of an average benefit-cost ratio of 4 to 1 means that each dollar spent on mitigation grants saves society an average of $4 in real resource costs. As expected, benefit-cost ratios varied across hazards, reflecting individual hazard characteristics and local mitigation priorities. Rapid onset hazards (earthquakes and wind) pose more risks to people; slower onset hazards (floods) primarily damage property. Thus, seismic mitigation grants to rehabilitate school buildings to protect school children reduced risks to people, but did not generate large monetary savings. However, flood mitigation grants for buyout and relocation of houses from flood zones generated large monetary benefits from avoided property losses.

Table 1 summarises the outcomes. Note that project grants are by far the largest category, accounting for 95% of grant costs, and that flood mitigation grants are the dominant project category. Hazard specific benefit-cost ratios range from a low of 1.4 for earthquakes through to 4.7 for wind to a high of 5.1 for floods. In all categories except earthquakes, project grants had higher benefit-cost ratios than process grants.[11] The lower benefit-cost ratios for process grants may be due to less developed techniques for estimating process benefits, rather than actual benefits.[12]

It is important to understand definitions and procedures used in the methodology.[13] Costs were acquired from the FEMA database; benefits were estimated as expected losses that could be avoided by the mitigation activity, considering the various intensity events that could occur to the mitigated facilities in the future, and the probabilistic likelihood of each level of intensity. (It must be emphasised that these intensities are *predictive*, meaning that theoretical hazard models are used to estimate the effects of future floods, hurricanes, etc., not past events. Of course, the theoretical hazard models are developed from knowledge of past events.) These expected savings typically accrue over a 50–100 year period, depending on the nature of the mitigated structure involved. Savings are systematically estimated using the original version and various refinements of HAZUS-MH, FEMA's loss estimation software,[14] and basic input data from each grant application. Benefits include expected: (1) reduced direct property damage; (2) reduced direct business interruption loss (e.g. damaged factory shutdown); (3) reduced indirect business interruption (e.g. factory A is shut down so B cannot operate and it must shut down); (4) reduced casualty losses; (5) reduced emergency response; and (6) reduced non-market damage (e.g. reduced environmental damage and reduced damage to historical sites).[15]

For each grant in the sample, benefits were compared with costs to yield a grant-specific benefit-cost ratio. Since grants were selected with probability in proportion to their cost, using strata of equal cumulative cost, the expected value of the population benefit is calculated as $C * \sum_{i=1}^{N} \beta_i / N$ where β_i denotes benefit-cost ratio of grant i of N in a group (e.g. wind) and C is total population cost in the group (e.g. the total cost of all project grants aimed at flood mitigation; determined from NEMIS records).[16]

Table 1. Estimated FEMA Hazard Mitigation Grant benefit-cost ratios. (All $ figures in 2004 constant dollars).

	Project grants			Process grants			
	Quake	Wind	Flood	Quake	Wind	Flood	Total
Total grant cost ($M)	$867	$280	$2,204	$80	$94	$13	$3,538
Total grant benefit ($M)	$1194	$1307	$11,172	$198	$161	$17	$14,049
Total benefit-cost ratio (BCR)*	1.4	4.7	5.1	2.5	1.7	1.3	4.0
Standard deviation of BCR	1.3	7.0	1.1	n.a.	n.a.	n.a.	n.a.

Note: *Row 2 (benefit) divided by row 1 (cost) equals row 3 (benefit-cost ratio).
n.a. = not applicable because of estimation method used.
Source: MMC (2005).

The study developed a number of innovations and refinements to overcome the challenges of aggregate BCA for natural hazard mitigation (MMC 2005, ch. 4 and appendices for details of methodology). In addition to the use of community studies, innovations included use of a consistent methodology,[17] a solid sampling strategy, collection of primary data,[18] an appropriate aggregation measure, sensitivity analysis, consideration of indirect benefits,[19] and use of reproducible methods.[20]

Equity was not addressed head-on in the MMC study because of lack of data on socio-economic, race/ethnicity or other relevant status of the affected population. However, several inferences can be made. On the cost side, payment for FEMA grants came from tax dollars based on 'progressive' principles, where the well-to-do pay relatively more than the poor. On the benefit side, most of the grants were applied to public facilities or semi-public private facilities (hospital and utilities) that provide services to the public in an even manner. Since the poor, racial/ethnic minorities, children, the aged and the infirm are more vulnerable to hazards, reducing the threat is an improved benefit. Lower-income groups typically reside in areas with lower property values, such as flood plains (Bankoff *et al.* 2004, Cutter 2005), so they are likely to benefit disproportionately by FEMA buyouts. At the same time, mitigation projects can have negative impacts on the poor by raising their property taxes and encouraging redevelopment that may displace them.

4. Community case studies methodology and findings

The MMC study paired aggregate BCA with in-depth community case studies to provide a more complete picture of the benefits and costs of mitigation projects and to supplement quantitative findings (MMC 2005). The community studies explored community perceptions of mitigation and looked for synergistic effects of mitigation grants on other community mitigation efforts and overall community resilience. Community study methodology involved four phases: pre-interview data collection; formal telephone interviews; site visits and face-to-face interviews; and data and information processing. In each community, data were collected about all mitigation grants received from FEMA, other federal agencies and state agencies, investments made by the community to mitigate disasters (both required local shares of government grants and projects fully funded by the communities). Data were also collected about state mitigation laws and local ordinances as well as public-private partnerships that led to mitigation actions (i.e. the adoption of local building codes beyond state requirements and the concomitant adoption of related building practices by developers). Unlike the aggregated BCA analysis, which evaluated single mitigation grants in isolation, the community studies were able to evaluate all community mitigation activities in total, identify community mitigation capacity, and, using time lines, plot the longitudinal development of comprehensive community mitigation programmes. Following interviews with community officials and the collection of relevant documents and data, benefit-cost ratios were computed for mitigation projects and cost effectiveness was determined for activities with qualitative characteristics (MMC 2005, ch. 5. pp. 59–121).

The MMC study used purposive sampling techniques to select eight cities and counties that represented the characteristics of communities that had received grants from FEMA for mitigation activities.[21] These eight communities were selected from a group of 113 (single jurisdictions identified with a legal title as a city, town, borough, village or county within one of the 50 states) using multiple criteria, including having received over $500,000 in mitigation grants and being at high risk from at least one of three major natural disasters (wind, flood, earthquake). The selected communities were: Freeport, New York; Hayward, California; Horry County, South Carolina; Jamestown, North Dakota; Jefferson County, Alabama; Multnomah County, Oregon; City of Orange, California; and Tuscola County, Michigan.

A BCA was performed on all FEMA-funded activities identified in the community studies analysis, together with a review of background information. The analysis benefited from the vast amounts of background engineering and science investigations and analyses, not available in NEMIS and therefore not used in the aggregated BCA analysis, which assisted in the development of benefit-cost evaluations. Not only did FEMA regional offices and local communities help in gathering such background information, they also provided materials for additional analyses, such as the identification of synergistic community activities (i.e. spin-offs and spillover effects) related to activities funded by FEMA.

One question addressed by the community studies concerned the contributions to resilience of FEMA mitigation grants. Mitigation impacts may be analysed from several viewpoints, including the disaster performance of physical structures (e.g. levees, dams, buildings and other built environment elements), deaths and injuries to occupants or protected populations, and direct and indirect losses due to business interruption resulting from physical damage. A more comprehensive approach focuses on the ability of mitigation actions to increase the physical, social, environmental and economic *resilience* of communities under stress. The goal is to assist communities in withstanding an extreme event without suffering devastating losses and without requiring a great deal of outside assistance (Mileti 1999, Godschalk 2003, 2007). The impacted communities survive and continue to function; they might bend from disaster stresses, but they do not break. Instead of repeated damage and continual demands for federal disaster assistance, resilient communities proactively protect themselves against hazards, build self-sufficiency and become more sustainable. Resilience is the capacity to absorb severe shock and return to a desired state following a disaster. It involves technical, organisational, social and economic dimensions (SDR 2005, Buckle 2006, Rose, 2007, Tierney and Bruneau 2007).[22] It is fostered not only by government, but also by individual, organisation and business actions.

In each community, the study determined the impact on community resilience of the individual FEMA mitigation grants as well as the impact of all related mitigation programmes. Individual grants tended to have a positive benefit irrespective of community context, but resilience was dependent on the type and robustness of the overall community mitigation programmes, which varied considerably.

The selection process produced three types of communities: (1) two communities with no existing mitigation programme and no previous mitigation activities prior to receiving their FEMA grants; (2) five communities with no existing mitigation programme, but that had completed or were involved in isolated mitigation activities; and (3) one community that had carried out a successful, robust mitigation programme for over 20 years.

More effective community mitigation programmes exhibited seven attributes (Mittler *et al.* 2008):

(1) Presence of a mitigation champion.
(2) Constant support of elected officials and agency heads.

(3) Institutionalised mitigation programmes, engrained in local government budgets.
(4) Earmarked funding sources to support mitigation.
(5) Community involvement and support, including use of local consultants to supplement city or county agency staff.
(6) Opportunistic strategies seeking grants from various private, state, and federal sources.
(7) Requests from other communities for mitigation champions to train their officials and staff.

The role of FEMA hazard mitigation grants depended on the type of community. For communities with no or limited mitigation experience, the grants provided funds to either resolve a contained problem or to be a catalyst for the development of a long-term community programme. Experience with mitigation laid the foundation for these communities to expand their mitigation efforts (spin off activities) or promote economic development in those areas that benefited from mitigation activities (spillover effects). For communities with an established mitigation programme, the grants either accelerated planned mitigation projects or permitted the community to divert funds to other pressing problems, thereby broadening their mitigation efforts. These grants were seamlessly integrated into existing mitigation programmes.

In all eight communities, federal hazard mitigation grants played a significant role in the community's mitigation history, often leading to additional activities. These grants acted as *catalysts*, demonstrating the benefits of mitigation to community decision makers. Interviewees reported that FEMA grants were important in reducing community risks, preventing future damage, and increasing mitigation capacity. They believed that the benefits of mitigation projects and processes went beyond what could be measured quantitatively to include increased awareness, *esprit de corps*, and peace of mind.

The community case study interviews did not assess economic resilience from the private sector viewpoint (although the project analysis did include economic resilience). Typically neglected in assessing hazard losses and mitigation, economic resilience refers to the ability of an organisation or system to retain its function and continue producing, as well as to increase its speed of recovery (Rose 2004b, 2007). Strategies include conservation of scarce inputs, input and import substitution, relocation of facilities, recapturing lost business by rescheduling production at a later date, and provision for repair and reconstruction of capital stock. Resilience was accounted for in the MMC study primarily through the inclusion of the potential of businesses to reschedule lost production after recovery has begun.[23]

Economic resilience strategies can reduce both direct and indirect business interruption losses. Direct business interruption, even in major disasters such as the Northridge earthquake, affects a limited number of firms. A larger, but still limited, number of businesses are affected by the loss of utility lifeline services, although this is often for a relatively short period (following the Northridge earthquake, 99% of the power was restored within 36 hours). However, every business in the region is likely to be affected more lastingly by indirect, or multiplier, effects stemming from curtailment of critical inputs from suppliers or cancellation of orders by customers. Even businesses that are physically unscathed may be forced to shut down because of these ripple effects.[24]

This situation is illustrated by the high benefit-cost ratios of FEMA mitigation grants to protect power supplies. Grants for underground placement of electricity transmission lines to protect against wind damage had the highest benefit-cost ratios in the MMC study sample, with some exceeding 50. This is not surprising given the relatively small investment (often less than a few million dollars) capable of preventing a power outage that shuts down a major city. These grants explain why business interruption benefits are the dominant category for wind hazards.

Economic resilience may be inherent – built into the ordinary workings of the system (e.g. ability to substitute bottled or trucked water for water utility services); or adaptive – dependent on coping ability or ingenuity in a disaster situation (Rose 2004b, 2007). Both forms of resilience can be enhanced prior to disasters. For example, distributed electricity generation (e.g. a firm's own co-generation facility or a smaller, diesel-powered back-up generator) can reduce the risks of centralised power station interruption. Prior contracting with business continuity consultants (who provide help in duplicating the databases in communication services off site, facilitating relocation and post-disaster clean up) can enhance a business's ability to recover. Given the interdependencies between businesses, a single business needs to be concerned not only with its own resilience but also that of its suppliers and customers. Prior planning, including large-scale aspects of city design (e.g. land use and public facility systems), together with integrating business emergency response plans into more general multi-hazard community-wide mitigation plans, can promote economic resilience.

In summary, the community studies highlighted the importance of FEMA mitigation grants as catalysts for local mitigation efforts, as well as key elements of long-term community resilience.

5. Planning and policy implications – coping with future disasters

What do the findings of the MMC study imply for planning and public policy? As a national study averaging over a large number of local geographic areas and grants, it is tempting to overstate the study's significance for national policy makers and to offer unjustifiably definitive conclusions. Conversely, one might underestimate its significance for local policy makers because the robustness of its conclusions rests to some extent on the law of large numbers, i.e. the tendency of the sum of uncorrelated random samples to become highly certain as the number of samples increases. In fact, the study provides lessons and raises challenges for both sets of policy makers, and also warns both against simplistic conclusions.

5.1. Federal mitigation issues and recommendations

Certainly the economic bottom line of the MMC aggregate BC ratios affirms that FEMA funds have been well spent. Indeed, with an average BCR of 4.0, the suggestion is that more similar funding would be appropriate or even that major funding increases would be warranted. However, conclusions are not so easily drawn if we raise the policy bar from 'well spent economically' to 'optimally spent in a broad economic and social context'. National policy has yet to define the latter with a clear federal mitigation objective.

Policy makers need to ask further questions. Should the public goal be to achieve the highest average return, to protect against catastrophic economic collapse of a region, to protect those most in need or some combination of these objectives? Highest average return implies funding projects with the highest benefit-cost ratios. Protecting against economic catastrophes implies funding mitigation efforts for lifelines and systems that protect society and local economies as a whole. For example, preventing the Katrina catastrophe would have required \$3 to \$6 billion levee improvements (USACE 2006), i.e. a single effort costing approximately the same as all the FEMA-funded natural-hazard mitigation grants between 1993 and 2003 (and notably preventing some \$20 billion in property losses alone, approximately the same as all the 1993–2003 FEMA-funded grants are estimated to save).

Should future mitigation grant programmes consider individual ability to pay, rather than treating all economic savings equally, as in BCA? For example, should well-to-do people who can afford to live on the coast of Florida or in the plush wooded hills of California be treated the same as disadvantaged inner-city residents of Louisiana or Iowa? Under current policy, preventing loss to a fully insured million dollar home is considered a benefit on a par with preventing loss to 50 uninsured or only partially insured \$20,000 homes. Equitable mitigation policy should recognise social and economic issues. HAZUS-MH contains economic impact data, but more extensive private sector impacts and social impact data should be added. In particular, the risks faced by poor and disadvantaged populations, who often live in high risk areas in communities and have the least capacity to cope with hazards, should be calculated. Methodologies are being developed to refine the necessary data and to simulate the distributional impacts of hazards and their mitigation (Oladosu and Rose 2007). These tools generate disaggregated benefit-cost analysis results according to various socio-economic groups in a manner that can facilitate public participation in the decision process (Rose *et al.* 1988).

Even without fully answering these difficult mitigation objective questions, the study supports previous calls for expansions of federal mitigation funding criteria. The community case studies demonstrated the value of a comprehensive approach to hazard mitigation. Present federal mitigation efforts fall short of achieving the necessary comprehensive framework (Godschalk *et al.* 1999, Waugh 2006, GAO 2007). The mitigation grant process lacks a requirement for comprehensive strategies to build community resilience.[25] Mitigation of natural hazards,[26] as well as man-made hazards,[27] is not co-ordinated under one umbrella in an all hazards approach administered through a comprehensive emergency management organisation. Such a comprehensive approach will require vigorous efforts to overcome the stove-piped nature of current disaster and homeland security preparedness efforts (Tierney 2007).

5.2. Local mitigation issues and recommendations

For local planners, the 4.0 national BCR can be an effective sound-bite to draw people to the mitigation discussion table.[28] However, they are not likely to be able to do a similar aggregate BC analysis (although some state level agencies will have the necessary capacity). Local planners in specific places at specific times are not evaluating a large random sample of mitigation projects; they are concerned with evaluating a few plausible alternatives. Nonetheless, the MMC analysis provides lessons and raises challenges for local planners that go beyond the sound bite. Direct lessons relate to the framework of potential losses avoided by mitigation and the importance of mixing qualitative with quantitative analysis.

In the MMC study, all major categories of losses potentially avoided by mitigation – disaster response costs, human injury and loss of life, property damage and business interruption – entered significantly in determining aggregate benefit-cost ratios, but varied substantially in importance for individual projects or classes of projects. The results highlight the importance of starting with a framework that considers potential losses very broadly, but simultaneously not expecting all cells of such a framework to emerge with significant entries in any particular application.

The limitations of the MMC study and the augmentation of the aggregate BC analysis with community studies emphasise the importance of mixing qualitative with quantitative analysis. The MMC study focused on integrating current best practices across multiple areas, not advancing understanding in a particular area. Reflecting the limitations of current science, valuing items such as avoiding mental anguish and family stress or preventing destruction of non-replaceable historical treasures are not covered well in the study. The inability to confidently quantify items such as these does not mean they should be ignored in plan analysis. Similarly, the study found process grants less amenable to analysis by current BC techniques than project grants and this calls for augmenting BC analysis with qualitative observations on potential impact.

While the small number of community studies limits conclusions that can be drawn from them, they do point to the need to consider individual initiatives in a broader, long-term context. Lining up individual projects by individually calculated BCR and starting implementation from the top might not be optimal if a project or process lower on the list might contribute more to developing a community dynamic that raises the return to future mitigation endeavors.

From two perspectives, the MMC study raises challenges for the local planner. First, while the national 4.0 BCR can be an effective call for local action, there is the danger of it becoming an unintended benchmark. For a local project with a BCR greater than 4.0, the existence of such a benchmark is a plus by providing ready appeal to 'being above national average'. The problem is if local constituents and/or funding agencies become sceptical of a particular mitigation project with a BCR of 'only' 2.5.[29]

The lesson of the study is to return to the fundamentals that gave the 4.0 validity – it was an average over a large number of projects, not the result of potentially "cherry-picked" anecdotal evidence. Planners in particular places at particular points in time cannot similarly average over a large number of projects – they are usually contemplating a few alternatives. Nonetheless, robustness can be introduced by increased sensitivity testing of the BCR analysis, asking whether the BCR greater than one holds over a range of reasonable variation in study parameters, i.e. by demonstrating that BC analysis parameters were not 'cherry picked'.

Second, it is important to recognise that averaging across areas eliminated the need for certain types of sensitivity testing in the MMC study that most definitely is not eliminated for the local planner focused on one region. 'Benefits' in the study are very different in nature from 'costs'. The latter are typically current certain items – cash paid now for programme implementation – but benefits are statistically expected avoided losses from natural disasters in the future. 'Statistically expected' and 'in the future' introduce questions of what statistical distribution of potential hazard intensity is embedded in the analysis and how to discount future loss savings to make them comparable with costs paid now.

There is no definitive consensus on either issue, rendering both important candidates for BC parameter sensitivity analysis. In fact, the statistical distribution of hazard intensity at any given location changes both as our understanding of earth science and meteorology advance. Witness the recent development of next-generation seismic attenuation relationships summarised by Power *et al.* (2008), and as the natural processes themselves change over time as a result of climate change, urbanisation impacts on hydrology, crustal stress redistribution after earthquakes, etc.

The MMC study tested the sensitivity of the benefit estimates to important hazard uncertainties (e.g. site soil classification, terrain roughness, and flood depth), as well as uncertainties in values exposed to loss, vulnerability of assets and socio-economic parameters such as discount rate. Although the study did not test *all* uncertainties in hazard and other distributions, it did test the ones considered likely to most strongly affect the results, with the goal of estimating benefits given best-estimate, upper-bound, and lower-bound values of each uncertain input parameter (as opposed to selecting values that estimate benefits as highly as possible, which was explicitly not the goal of the study). The robustness of the MMC study's benefits estimates depend to some extent on the large variety of places in the analysis (which makes the grant benefits have low correlation) and from the size of the sample.[30]

The planner concerned with one particular geographic region and a smaller number of mitigation efforts might not benefit as much from the law of large numbers, and the uncertainty in benefits is likely to be greater from a smaller, more concentrated portfolio of efforts. In the latter case, it is critical to examine and question the statistical hazard intensity distribution, especially in regions potentially subject to very low probability, but highly devastating earthquake or wind events. Just how low the 'very low probability' is can be the statistical tail that wags the benefit dog.

5.3. The bottom line for federal and local planners and policy makers

On an economic benefit-cost basis, mitigation pays, and, on that basis alone, more needs to be spent to ensure a safe future. By spending \$3.5 billion on hazard mitigation between 1993 and 2003, the federal government saved society \$14 billion in estimated losses. Simultaneously, however, there is a need to explicitly address more difficult issues of social factors in mitigation objectives and community issues in mitigation planning and to continually 'raise the bar' at all levels of analysis in this critical endeavour. This will entail improving FEMA data collection and carrying out research on the effectiveness of both project and process mitigation in the context of reducing vulnerability and building the resilience necessary to cope with twenty-first century hazards. Only then will 'well spent' money become 'optimally spent' money.

Notes

1. FEMA charged the Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences with conducting the study. This is a non-profit, non-governmental organisation chartered by the federal government in 1974 to bring together representatives of government, the professions, industry, labour and consumer interests to develop findings on technical building-related matters. MMC specified the study parameters, set up a project management committee, and contracted with Applied

Technology Council (ATC) to convene a research team to perform the analysis. Godschalk and West served on the MMC project management committee. Mittler led the ATC community studies team. Rose led and Porter co-led the ATC benefit-cost analysis team.

2. FEMA does require a rudimentary benefit-cost analysis for each proposed hazard mitigation project. However, applicants typically do not carry out the specialized sophisticated computer simulation techniques used in the MMC study. BCA information listed on the FEMA applications was not used in the MMC study.
3. Important research also has been conducted on management of natural hazards in Europe (e.g. Greiving *et al*. 2006a, 2006b).
4. For examples of reports on successful mitigation efforts, see North Carolina Division of Emergency Management Success Stories. Available from http://www.dem.dcc.state.nc.us/Mitigation/Library/Success_Stories/Perf%20Assessment%20NC%20Print.pdf [Accessed 21 May 2007]. See also Association of State Floodplain Managers 2000.
5. The study was directed at FEMA's three major natural hazard mitigation grant programmes: the Hazard Mitigation Grant Program, Project Impact and the Flood Mitigation Assistance Program. It did not cover other federal hazard mitigation efforts, such as those of the US Army Corps of Engineers.
6. This aggregate benefit-cost finding does not imply that every local mitigation programme will achieve the same benefit-cost ratio. Local circumstances may result in either higher or lower benefit-cost ratios.
7. The CBO study, completed after the MMC study, was required by the Predisaster Mitigation Program (PDM) Reauthorization Act of 2005 to estimate the reduction in Federal disaster assistance attributable to the PDM programme. It built on the MMC study findings, although it analyses only PDM grants awarded since 2004, uses a different discount rate (7%), discounts the value of reduced injuries and deaths, and has some other differences. The CBO study estimated an overall benefit-cost ratio of three to one (CBO 2007, p. 2). It noted that when the MMC estimated ratios are converted to a 7% discount rate, the flood and wind benefit-cost ratios are within about 15% of each other, although it found a higher BC ratio for earthquake mitigation, speculating that the 25 MMC projects might have been an unrepresentative sample.
8. The Oregon Bill required state agencies to develop plans for mitigating effects of natural disasters and for recovery and reconstruction efforts after a natural disaster has occurred.
9. The database of the population of grants for the study time period (June 1993–July 2003) was the National Emergency Management Information System (NEMIS) used by FEMA to monitor the status of hazard mitigation grants. A stratified random sample of grants was drawn to assure representation by hazard type (flood, earthquake, wind), mitigation type (project or process), and grant monetary size. The final sample consisted of 136 grants out of a total population of 5479, although for purposes of reducing uncertainty the grants were selected to represent a much larger fraction of the total mitigation expenditures. For each grant in the sample, a total cost was calculated that included state, local and private resources, as well as FEMA resources used to carry out the project.
10. California's Office of Emergency Services does give project applications with a higher benefit/cost ratio a higher ranking factor (*State of California Multi-Hazard Mitigation Plan*, 2007). Available from: http://www.oes.ca.gov [Accessed 25 July 2008].
11. Earthquake findings are skewed because of the preponderance of school ceiling projects that appeared in the sample.
12. Standard methodologies like HAZUS do not lend themselves to the estimation of the benefits from process grants. Moreover, there is only a very thin literature on their actual measurement, such that a standard alternative – benefits transfer (adapting the results of a benefit estimation for an activity in one place and time to another context) – could not be used. Therefore, the research team was forced to adapt results from more general analogs to the process grants in the sample (e.g. using information dissemination campaigns aimed at risks in general, rather than those just pointed at natural hazards).
13. See the Multihazard Mitigation Council (2005) and Rose *et al*. (2007) for specifics of the research methodology.

14. For information on HAZUS-MH, see the FEMA website, available from: http://www.fema.gov/plan/prevent/hazus [Accessed 8 June 2007].
15. Short-term economic stimulation from post-disaster reconstruction was not netted from benefits since it essentially represents a transfer in time/place expenditures (e.g. from individual future to current expenditures, from insurance company profits to the region, from general taxpayers to disaster aid recipients). Benefits, except prevented casualties, were discounted at a rate of 2% and all benefits and costs were expressed in constant 2004 dollars. Following the common tenet that a future life is not less valuable than a current one, casualties were not discounted.
16. Alternative methods of sampling and scaling were considered and tested using NEMIS-reported BCR, with the method selected based on a balance between low bias and low uncertainty (see MMC 2005, Appendix N).
17. To ensure consistency, project grants benefits were estimated using HAZUS-MH, which is applicable to earthquakes, hurricanes and floods. Since the flood version of HAZUS was incomplete, it was necessary to extract the flood property damage functions that were available and to apply them to individual projects in a 'reduced form' manner. In a similar fashion, HAZUS equations on wind damage had to be modified for estimating tornado-related property and casualty losses prevented by mitigation grants. In addition, since HAZUS-MH lacks the ability to estimate most of the direct and indirect business interruption impact stemming from damage to utility systems, the study developed a HAZUS Extension, or 'patch', using data on direct customer demand for utility services and input-output multipliers for indirect effects. Another HAZUS Extension was developed to estimate population displacement for tornados and floods.
18. HAZUS is often applied to national averages or generic data. However, a major contribution of this study was the collection of primary data on relevant structures from the associated project grant application.
19. The largest category of indirect benefits refers to business interruption of customers and suppliers of firms, non-profit organisations or government agencies that would otherwise be damaged. These 'multiplier' effects were included through the use of the Indirect Economic Loss Module of HAZUS-MH, as well as through the use of HAZUS Extensions developed for public utility related projects. Other categories often lumped into 'indirect benefits' include societal impacts (displacement and trauma) and environmental benefits, many of which were estimated in their own right, rather than relegated to the secondary status of indirect effects.
20. A standard criticism of BCA is that results cannot be replicated. MMC study data are available from FEMA in sanitized form (in order not to reveal any specific entity). HAZUS-MH reduced form and extended versions are available from the study authors. Process grant estimation methodology is spelled out MMC (2005). The MMC study was evaluated by the Congressional Budget Office in its recent evaluation of FEMA mitigation grant programs (CBO 2007), including detailed questions on its methodology, data, assumptions and results. The CBO study arrived at an overall benefit-cost ratio of 3:1, reasonably close to the MMC study's 4:1 BCR.
21. One pilot city also was studied to test the methodology, but its results were not included in the overall analysis.
22. Tierney and Bruneau (2007) describe a four-part resilience framework based on robustness (ability to withstand disasters without significant degradation or loss of performance), redundancy (extent to which system elements are substitutable), resourcefulness (ability to diagnose and solve problems), and rapidity (capacity to restore functionality in a timely way).
23. Production rescheduling is one of the most effective of all post-disaster resilience actions (Rose and Lim 2002). It was computed by invoking the production 'recapture factor' contained in HAZUS-MH.
24. As evidenced by Hurricane Katrina, households suffer significant losses as well. Property damage to housing stock, loss of income and death and injury are included in loss estimates, but inconvenience or social/psychological damages are difficult to measure and typically not incorporated into major economic indicators. For a review of evaluation of impacts on the general population not stemming from the business sector, see Rose and Oladosu (2008).

25. As the MMC report (2005, Volume 1, p. 6) stated:

> Mitigation is most effective when it is carried out on a comprehensive, community-wide, long-term basis. Single projects can help, but carrying out a slate of coordinated mitigation activities over time is the best way to ensure that communities will by physically, socially, and economically resilient in coping with future hazard impacts.

26. Foresighted mitigation policy should look beyond past experience to consider risks from more severe storms, climate change, and sea level rise (IPCC 2007). A recent study found that California local governments, together with those in other coastal states, are unprepared to cope with climate change and sea level rise (Moser and Tribia 2007), although the 2007 *State of California Multi-Hazard Mitigation Plan* emphasizes resilience from climate change, levee failure, and tsunamis, as well as earthquake, flood, wildfire and other hazards. Available from: http://www.oes.ca.gov [Accessed 25 July 2008].
27. See FEMA 386-7, *Integrating human-caused hazards into mitigation planning*, Mitigation Planning, How-To Guide #7, September 2002. Available from: http://www.fema.gov/plan/mitigation/howto7.shtm [Accessed 25 July 2008].
28. Engaging the public in hazard mitigation planning can be a challenge. See Brody *et al.* 2003 and Godschalk *et al.* 2003).
29. California has adopted a BCA of 4 as a planning standard for mitigation. Its OES HMGP Review Form gives an application with a BCA of 1–3 zero points, 4–6 one point, and 6 or higher two points. Available from: http://www.oes.ca.gov [Accessed 25 July 2008]. Because BCA is one of many criteria, a low BCA will not kill a project, but it may be important in funding decisions if there is insufficient money to fund all projects.
30. A preliminary statistical test indicated that a sample of at least 25 grants was required in each hazard to assert with high confidence that benefits exceed cost. A statistical test (termed tornado-diagram analysis) performed after estimating benefits indicates that, using the selected sampling scheme and sample size for each hazard, the aggregate uncertainty in benefit for flood-related grants exceeded cost with more than 99% confidence; in the cases of wind and earthquake, the probabilities were 99% and 83%, respectively. Because not all uncertainties are reflected in the sensitivity tests, these figures might be considered upper-bound probabilities, but since the study tested what were considered to be the largest uncertainties, the degree of possible overestimation is probably small.

References

Association of State Floodplain Managers, 2000. *Mitigation success stories in the United States* [online]. Available from: http://floods.org/Publications [Accessed 16 May 2008].

Austin, J.C., Andersen, S., Courant, P.N., and Litan, R.E., 2007. *America's North Coast: a benefit-cost analysis of a program to protect and restore the Great Lakes*. Ann Arbor, MI: Healing our Waters – Great Lakes Coalition.

Bankoff, G., Frerks, G., and Hilhorst, D., 2004. *Mapping vulnerability: disasters, development, and people*. London: Earthscan.

Berkeley, C.A., 2002. Disaster preparedness and safety element. *General Plan* [online]. Available from: http://www.ci.berkeley.ca.us/planning/landuse/plans/generalPlan/pdf/safety.pdf [Accessed 13 November 2007].

Birch, E.L. and Wachter, S.M., eds., 2006. *Rebuilding urban places after disaster: lessons from Hurricane Katrina*. Philadelphia: University of Pennsylvania Press.

Brody, S., Godschalk, D.R., and Burby, R.J., 2003. Mandating citizen participation in plan-making: six strategic planning choices. *Journal of the American Planning Association*, 69 (3), 245–264.

Boardman, A., *et al.*, 2001. *Cost-benefit analysis: concepts and practice*. 2nd ed. Upper Saddle River, NJ: Prentice-Hall.

Buckle, P., 2006. Assessing social resilience. *In*: D. Paton and D. Johnson, eds. *Disaster resilience: an integrated approach*. Springfield, IL: Charles C. Thomas, 88–104.

Burby, R.J., 1998. *Cooperating with nature: confronting natural hazards with land-use planning for sustainable communities*. Washington, DC: Joseph Henry Press.

Campbell, H.F. and Brown, R.P.C., 2003. *Benefit-cost analysis: financial and economic appraisal using spreadsheets*. Cambridge University Press.

CBO (Congressional Budget Office), 2007. *Potential cost savings from the Pre-Disaster Mitigation Program*. Washington, DC: Congress of the United States.

Chakos, A., Schulz, P., and Tobin, L.T., 2002. Making it work in Berkeley: investing in community sustainability. *Natural hazards review*, 3 (2), 55–67.

Cutter, S., 2005. The geography of social vulnerability: race, class, and catastrophe. *Understanding Katrina: perspectives from the social sciences* [online]. Available from: http://www.understandingkatrina.ssrc.org/cutter [Accessed 8 February 2007].

DHS (Department of Homeland Security), 2006. The budget for fiscal year 2007, p. 136.

FEMA (Federal Emergency Management Agency), 1995. *Benefit-cost analysis of hazard mitigation projects*. Washington, DC.

FEMA, 2004a. *Understanding your risks: identifying hazards and estimating losses*. Washington, DC.

FEMA, 2004b. *FEMA expenditures by category: 1994–2003*. Unpublished. Washington, DC.

Ganderton, P.T., *et al*., 2006. Mitigation generates savings of four to one and enhances community resilience: MMC releases independent study on savings from natural hazard mitigation. *Natural hazards observer*, 30 (4), 1–3.

GAO (US Government Accountability Office), 2007. *Various mitigation efforts exist, but federal efforts do not provide a comprehensive strategic framework*. GAO-07-403. Washington, DC.

Godschalk, D.R., 2003. Urban hazard mitigation: creating resilient cities. *Natural hazards review*, 4 (3), 136–143.

Godschalk, D.R., 2007. Mitigation. *In*: W.L. Waugh and K. Tierney, eds. *Emergency management: principles and practice for local government*. Washington, DC: ICMA Press, 89–112.

Godschalk, D.R., Brody, S., and Burby, R.J., 2003. Public participation in natural hazard policy formation: challenges for comprehensive planning. *Journal of environmental planning and management*, 46 (5), 733–754.

Godschalk, D.R., *et al*., 1999. *Natural hazard mitigation: recasting disaster policy and planning*. Washington, DC: Island Press.

Greiving, S., Fleischhauer, M., and Luckenkotter, J., 2006a. A methodology for an integrated risk assessment of spatially relevant hazards. *Journal of environmental planning and management*, 49 (1), 1–19.

Greiving, S., Fleischhauer, M., and Wanczura, S., 2006b. Management of natural hazards in Europe: the role of spatial planning in selected EU member states. *Journal of environmental planning and management*, 49 (5), 739–757.

Hartman, C. and Squires, G.D., eds., 2006. *There is no such thing as a natural disaster: race, class, and Hurricane Katrina*. New York: Routledge.

IPCC (Intergovernmental Panel on Climate Change), 2007. *Climate change 2007*. Fourth Assessment Report.

Laska, S. and Morrow, B.H., 2007. Social vulnerabilities and Hurricane Katrina: an unnatural disaster in New Orleans. *Marine technology society journal*, 40 (4), 16–26.

Mileti, D.S., 1999. *Disasters by design: a reassessment of natural hazards in the United States*. Washington, DC: Joseph Henry Press.

Mittler, E., *et al*., 2008. How communities implement successful mitigation programs: insights from the Multihazard Mitigation Council (MMC) community study. *In*: J. Beavers and W. Hall, eds. *Disaster risk assessment and mitigation*. Council on Disaster Risk Management Monograph 2. Washington, DC: American Society of Civil Engineers, 51–73.

Moser, S. and Tribia, J., 2007. Vulnerability to inundation and climate change impacts in California: coastal managers' attitudes and perceptions. *Marine technology society journal*, 40 (4), 35–44.

MMC (Multihazard Mitigation Council), 2005. *Natural hazard mitigation saves: an independent study to assess the future savings from mitigation activities*. Washington, DC: National Institute of Building Sciences.

Moore, T. and Thorsnes, P., with Appleyard, B., 2007. *The transportation/land use connection*. 2007 ed. Planning Advisory Service Report 546/547. Chicago: American Planning Association.

National Research Council. Ocean Studies Board. Water Science and Technology Board, 2004. *River basins and coastal systems planning within the U.S. Army Corps of Engineers*. Washington, DC: National Academy Press.

International Visitor Leadership Program

http://exchanges.state.gov/education/ivp

Introduction

The U.S. Department of State's Bureau of Educational and Cultural Affairs funds and administers the International Visitor Leadership Program (IVLP), one of its premier professional exchange programs. The IVLP is designed to build mutual understanding between the U.S. and other countries through carefully designed visits that reflect the participants' professional interests and support U.S. foreign policy goals. Participants are established or potential foreign opinion makers in government, public policy, media, education, labor, the arts, and other key fields. Selected by American embassies abroad, International Visitors come to the United States to meet and confer with their professional counterparts and to gain an appreciation of the ethnic, cultural, political, and socio-economic diversity of the U.S. In 2008, approximately 4,000 International Visitors participated in the program.

The IVLP is carried out through close collaboration with eight non-profit program agencies in Washington, D.C. and a network of over 90 community-based organizations across the U.S. whose members arrange professional meetings, cultural activities and home hospitality for the visitors. These organizations are members of the National Council for International Visitors (*http://www.nciv.org/*). Tens of thousands of Americans volunteer their time and expertise to strengthening relations between the United States and other countries through the International Visitor Leadership Program.

IVLP Snapshot

- Over 190,000 International Visitors have participated in the program since its inception in 1940.
- A typical IVLP project is three weeks in length, and includes visits to four U.S. cities. IVLP participants meet with professional counterparts and visit U.S. public and private sector organizations related to the project theme. In addition, IVs are usually hosted by American families and participate in cultural activities.
- As an example, ten Pashtun tribal elders and community leaders from the border regions of Afghanistan and Pakistan met with U.S. government officials and non-governmental entities to explore strategies of cross-border cooperation and the integration of tribal traditions and governance with national development priorities.
- At any given point during the year, approximately 250 IVs are on projects in the United States. In 2008, over 4,000 IVs participated in over 900 projects on themes such as:

- Counter-terrorism
- International Crime and Drug Prevention
- Combating HIV/AIDS
- Civic Education
- NGO Management
- Foreign Policy
- Religious Tolerance
- Democracy and Rule of Law
- Journalism

Alumni

Almost 300 IVLP alumni are current or former Heads of Government or Chiefs of State. Alumni include:

- *President Hamid Karzai of Afghanistan ('87)*
- *President Alvaro Uribe Velez of Colombia ('98)*
- *President Mwai Kibaki of Kenya ('99)*
- *Turkish President Abdullah Gul ('95)*
- *Former Prime Minister Helen Clark of New Zealand ('98)*
- *President Nicolas Sarkozy of France ('85)*
- *Prime Minister Gordon Brown of The United Kingdom ('84/'92)*

Educational and Cultural Programs

The International Visitor Leadership Program exchanges are among more than 30,000 annual exchanges managed by the Department of State's Bureau of Educational and Cultural Affairs. Other academic and professional exchange programs include the Fulbright Program and the Citizen Exchanges Program. For further information, see *www.exchanges.state.gov.*

"The IVL Program offers priceless opportunities to understand the United States and the American people through direct experience, and to make valuable contacts…I am immensely grateful for the insights into the U.S, which this exchange scheme provided. I have drawn on them regularly since then."
— Tony Blair, former British Prime Minister