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DISASTERS BY DESIGN

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ABSTRACT

It has become clear that natural and related technological hazards and disasters are not a problem that can be solved in isolation. Rather, the occurrence of a disaster is a symptom of broader and more basic problems. Since 1994 a team of over 100 expert academics and practitioners, including members of the private sector, have assessed, evaluated, and summarised knowledge about natural and technological hazards in the USA from the perspectives of physical, natural, social and behavioural, and engineering sciences. The major thesis of the findings is that hazard losses, and the fact that there seems to be an inability to reduce such losses, are the consequences of narrow and short-sighted development patterns, cultural premises, and attitudes toward the natural environment, science, and technology. A way for people and the nation to take responsibility for disaster losses, to design future hazard losses, and to link hazard mitigation to sustainable development is proposed. This paper offers a USA perspective. However, it is hoped the paper will provide private and public decision-makers globally with insights upon which to evaluate the effectiveness of their respective nation's hazard mitigation frameworks.

INTRODUCTION

A quarter-century ago geographer Gilbert F. White and sociologist J. Eugene Haas published a pioneering report on the USA's ability to withstand and respond to natural disasters (White and Haas, 1975). At that time, research on disasters was dominated by physical scientists and engineers. As White and Haas (1975) pointed out in their *Assessment of Research on Natural Hazards*, little attempt had been made to tap into social sciences to better understand the economic, social, and political dimensions of extreme natural events. White and Haas attempted to fill this void. They also advanced the critical notion that rather than simply picking up the pieces after disasters, the nation could employ better planning, land use controls, and other preventive and mitigatory measures to reduce the toll in the first place. Today, at long last, both public and private, programs and policies have begun to adopt mitigation as the cornerstone of the USA's approach to addressing natural and technological hazards.

The White and Haas (1975) report also had a profound impact by paving the way for an interdisciplinary approach to research and management, giving birth to a 'hazards community'. This community brought together

people from many fields and agencies who addressed the myriad aspects of natural disasters. Hazards research now encompasses disciplines such as climatology, economics, engineering, geography, geology, law, meteorology, planning, seismology, and sociology. Professionals, in those and other fields, have continued to investigate how engineering projects, warnings, land use management, planning for response and recovery, insurance, and building codes can help individuals and groups adapt to natural hazards, as well as reduce the resulting deaths, injuries, costs, and social, environmental, and economic disruption. These professionals have improved our understanding during and after disasters. Yet, troubling questions remain about why more progress has not been made in reducing monetary losses.

One central problem is that many of the accepted methods for coping with hazards have been based on the idea that people can use technology to control nature so as to ensure their safety. Moreover, most strategies for managing hazards have followed a traditional planning model: Study the problem, implement one solution, and move on to the next problem. This approach casts hazards as static and mitigation as an upward, positive, linear trend. The reality is, events during the past quarter-century have shown natural disasters and the technological hazards that may accompany them are not linear problems that can be solved in isolation. Rather, they are symptoms of broader and more basic problems. Losses from hazards, and the fact that nations, like the USA, cannot seem to reduce them, result from short-sighted and narrow conceptions of the human relationship to the natural environment.

To redress those shortcomings a shift is needed to a policy of ‘sustainable hazard mitigation’. This concept links wise management of natural resources with local economic and social resiliency, viewing hazard mitigation as an integral part of a much larger context. Many aspects of this strategy were implicit in the recommendations formulated by White and Haas 25 years ago. To head off the continued rise in tolls from disasters, however, those principles must become more explicit.

This paper, and the report on which it is based (Mileti, 1999), reflect the efforts of over 100 experts who have worked and debated, since 1994, to take stock of the USA's relationship to hazards past, present, and most importantly, future. Those contributions have been used to outline a comprehensive approach to enhancing societal abilities to reduce the costs of disaster. All statistical information cited in this paper is fully referenced in *Disasters by Design* (Mileti, 1999).

THE ROOTS OF THE PROBLEM

Many disaster losses, rather than stemming from unexpected events, are the predictable results of interactions among three major systems: The physical environment (including hazardous events), the social and demographic characteristics of the communities that experience them, and the buildings, roads, bridges, and other components of the constructed environment. Growing natural hazard losses in the USA result partly from the fact that the nation's capital stock is expanding. However, they also stem from the fact that all these systems, and their interactions, are becoming more complex with every passing year.

Three main influences are at work. First, the earth's physical systems are constantly changing. Perhaps the most obvious is the current warming of the global climate. Scientists expect a warming climate to produce more dramatic meteorological events such as storms, floods, drought, and extreme temperatures. A second major influence is the recent and projected changes in the demographic composition and distribution of the USA population. This means a greater exposure to many hazards. For example, the number of people residing in earthquake-prone regions and coastal counties subject to hurricanes is growing rapidly. Worsening inequality of wealth also makes many people more vulnerable to hazards while at the same time comprising less ability to recover from them. A third influence is the built environment comprising public utilities, transportation systems, communications, homes, and office buildings. All these systems and structures are growing in density, making the potential losses from natural forces larger.

Settlement of hazardous areas has also destroyed local ecosystems that could have provided protection from natural hazards. For example, the draining of swamps in Florida and the bulldozing of steep hillsides for homes in California have disrupted natural runoff patterns and magnified flood hazards. Moreover, many mitigation efforts themselves degrade the environment and, thus, contribute to the next disaster. For example, levees built to provide flood protection can destroy riparian habitat and heighten downstream floods.

Another major problem has become clear over the past 20 years: Some efforts to head off damages from natural hazards only postpone them. For example, communities below dams or behind levees may avoid losses from floods whose structures were designed preventatively. However, such communities often have more property to lose when those structures fail because additional development has occurred as a direct result of those structures being present, wherein planners, owners, and occupiers have counted on protection being provided. Such a situation contributed to catastrophic damage from the 1993 floods in the Mississippi basin. Presently, many of the USA's dams, bridges, and other structures are

approaching the end of their designed life, revealing how little thought their backers and builders gave to events 50 years hence. Similarly, by providing advance warnings of severe storms, the USA may well have encouraged more people to build in fragile coastal areas. In turn, such development makes the areas more vulnerable by destroying dunes and other protective natural features.

Who is at Risk

Research has shown people are typically unaware of all the risks and choices they face. They plan only for the immediate future, overestimate their ability to cope when disaster strikes, and rely heavily on emergency relief when disasters occur.

Hazard researchers now recognise that demographic differences play a large role in determining the risks people encounter, whether and how they prepare for disasters, and how they fare when disasters occur. For example, non-minorities and households with higher socio-economic status fare better, while low-income households are at a greater risk, mainly because they live in lower quality housing, and disasters exacerbate poverty.

The need for mitigation and response efforts that acknowledge the demographic differences among citizens will become even more critical as the population becomes more diverse. Research is also needed to shed further light on how mitigation programs, ranging from public education to disaster relief, can be rendered equitably.

Disaster Losses are Growing in the USA

From 1975 to 1994, natural hazards killed over 24 000 people and injured some 100 000 in the USA and its territories. About one-quarter of the deaths and half the injuries resulted from events that society would label as disasters. The rest resulted from less dramatic, but more frequent, events such as lightning strikes, car crashes owing to fog, and localised landslides. The USA has succeeded in saving lives and reducing injuries from some natural hazards, such as hurricanes, over the last two decades. However, casualties from floods, the nation's most frequent and injurious natural hazard, have failed to decline substantially. Moreover, deaths from lightning and tornadoes have remained constant, while injuries and deaths from dust storms, extreme cold, wildfire, and tropical storms have grown.

The monetary losses associated with most types of natural hazards in the USA are also rising. A conservative estimate of total dollar losses during the past two decades is $US500 billion (in 1994 dollars). More than 80% of these costs stemmed from climatological events, while around 10% resulted from earthquakes and volcanoes. Only 17% were insured. Determining losses with a higher degree of accuracy is impossible because

the USA has not established a systematic reporting method or a single repository for the data. Further, these numbers do not include indirect costs such as downtime for businesses, lost employment, environmental damage, or emotional effects on victims. Most of these losses result from events too small to qualify for federal assistance and most are not insured, so victims must bear the costs.

Seven of the ten most costly disasters, based on monetary losses in USA history, occurred between 1989 and 1994. In fact, since 1989 the nation has frequently entered periods in which losses from catastrophic natural disasters averaged about $US1 billion per week. This dramatic increase in disaster losses is expected to continue.

Many of the harshest recent disasters could have been far worse. Had Hurricane Andrew been slower and wetter or torn through downtown Miami, for example, it would have wreaked devastation even more profoundly than the damage it did inflict. In this respect, it is worth acknowledging that the most likely catastrophic events, including a great earthquake in the Los Angeles area, have not yet occurred. Such a disaster could cause up to 5000 deaths, 15 000 serious injuries, and $US250 billion in direct economic losses.

A NEW APPROACH TO HAZARDS

On the basis of statistics, such as the above, researchers and practitioners in the hazards community, as well as the nation’s policy and law-makers, need to shift their strategy to cope with the complex factors that contribute to disasters in today's and especially tomorrow's world. Following are the main guidelines for improving our ability to mitigate hazards.

Adopt a Global Systems Perspective

Rather than resulting from surprise environmental events, disasters arise from the interactions among the earth's physical systems, its human systems, and its built infrastructure. A broad view that encompasses all three of these dynamic systems and interactions among them can enable us to find better solutions.

Accept Responsibility for Hazards and Disasters

Human beings, not nature, are the cause of disaster losses that stem from choices about where and how human development will proceed. Nor is there a final solution to natural hazards, since technology cannot make the world safe from forces of nature.

Anticipate Ambiguity and Change

The view that hazards are relatively static has led to the false conclusion that any mitigation effort is desirable and will, in some vague way, reduce the grand total of future losses. In reality, change can occur quickly and non-linearly. Human adaptation to hazards must become as dynamic as the problems presented by hazards themselves.

Reject Short-Term Thinking

Mitigation, as frequently conceived, is too short-sighted. In general, people have a cultural and economic predisposition to think primarily in the short-term. Sustainable mitigation will require a longer-term view that takes into account the overall effect of mitigation efforts on this and future generations.

Account for Social Forces

Societal factors, such as how people view both hazards and mitigation efforts or how the free market operates, play a critical role in determining which steps are actually taken, which are overlooked and, thus, the extent of future disaster losses. As such, social forces are now known to be much more powerful than disaster specialists previously thought and, hence, a growing understanding of physical systems and improved technology is not sufficient. To effectively address natural hazards, mitigation must become a basic social value.

Embrace Sustainable Development Principles

Disasters are more likely where unsustainable development occurs, and the converse is also true, disasters hinder movement toward sustainability. For example, they degrade the environment and undercut the quality of life. Sustainable mitigation activities should strengthen a community's social, economic, and environmental resiliency and vice versa.

FOSTERING LOCAL SUSTAINABILITY

Sustainability means that a locality can tolerate and overcome damage, diminished productivity, and reduced quality of life from an extreme event without significant outside assistance. To achieve sustainability, communities must take responsibility for choosing where and how development proceeds. Toward that end, each locality evaluates its environmental resources and hazards, chooses future losses that it is willing to bear, and ensures that development and other community actions and policies adhere to those goals.

Six objectives must simultaneously be reached to mitigate hazards in a sustainable way and stop the trend toward increasing catastrophic losses from natural disasters.

Maintain and Enhance Environmental Quality

Human activities to mitigate hazards should not reduce the carrying capacity of the ecosystem, for doing so increases losses from hazards in the longer-term.

Maintain and Enhance People's Quality of Life

A population's quality of life includes, among other factors, access to income, education, healthcare, housing, and employment, as well as protection from disaster. To become sustainable, local communities must consciously define the quality of life they want and select only those mitigation strategies that do not detract from any aspect of that vision.

Foster Local Resiliency and Responsibility

Resiliency to disasters means a locality can withstand an extreme natural event with a tolerable level of losses. It takes mitigation actions consistent with achieving that level of protection.

Recognise that Vibrant Local Economies are Essential

Communities should take mitigation actions that foster a strong local economy rather than detract from them.

Ensure Inter-Generational and Intra-Generational Equity

A sustainable community selects mitigation activities that reduce hazards across all ethnic, racial, and income groups, and between genders equally now and in the future. The costs of today’s advances are not shifted onto later generations or less powerful groups.

Adopt Local Consensus Building

A sustainable community selects mitigation strategies that evolve from full participation among all public and private stakeholders. The participatory process itself may be as important as the outcome.

A long-term, comprehensive plan for averting disaster losses and encouraging sustainability offers a locality the opportunity to coordinate its goals and policies. A community can best forge such a plan by tapping into businesses and residents, as well as experts and government officials. While actual planning and follow through must occur at a local level, a great deal

of impetus must come from above. Nothing short of strong leadership from central government will ensure that planning for sustainable hazard mitigation and development occurs.

MITIGATION TOOLS

Over the past few decades an array of techniques and practices has evolved to reduce and cope with losses from hazards and disasters. These and other tools will be vital in pursuing sustainable hazard mitigation.

Land Use

Wise land use planning that limits expansion into sensitive areas is essential to sustainable hazard mitigation. Indeed, land use planning, hazard mitigation, and sustainable communities are concepts with a shared vision in which people and property are kept away from hazards, the mitigative qualities of the natural environment are maintained, and development is resilient in the face of natural forces.

Unfortunately, no over-arching guidance informs development in hazard-prone areas of the USA, unlike nations such as New Zealand through its Resource Management Act (1991) and the Emergency Management Bill (currently under consideration). Instead, a patchwork of innumerable federal, state, and local regulations creates a confusing picture and often reduces short-term losses that allow the potential for catastrophic losses to grow. This scattershot approach, as well as the USA federal and state trend to cut risk and assume liability, have undermined the responsibility of local governments for using land use management techniques to reduce exposure to hazards.

Warnings

Since the first assessment was completed in 1975, significant improvements in short-term forecasting and warnings (hours to days ahead of a hazardous event) have dramatically reduced loss of life and injury. Yet, many specific communities lag in their ability to provide citizens with effective warning messages. In this respect, the USA needs to make local warning systems more uniform, develop a comprehensive model for how they work and provide this information to local communities along with technical assistance. Better decision-making and local management is now more critical than most future advances in technology.

It is also important to remember, short-term warning systems do not significantly limit damage to the built environment, nor do they mitigate economic disruption from disasters. Long-range forecasts that help define the risks to local communities, years to decades ahead of potential hazards, could assist local decision-makers in designing communities to endure them.

Engineering and Building Codes

The ability of the built environment to withstand the impacts of natural forces plays a direct role in determining the casualties and monetary costs of disasters. Disaster resistant construction of buildings and infrastructure is an essential component of local resiliency. Engineering codes, standards, and practices have been promulgated for natural hazards. Traditionally, local governments have enacted building codes. However, investigations after disasters have revealed shortcomings in construction techniques, code enforcement, and the behaviour of structures under stress. Codes, standards, and practices for all hazards must be re-evaluated in light of the goal for sustainable mitigation. At the same time, communities must improve adherence to them.

Insurance

The public increasingly looks to insurance to compensate for losses from many types of risk-taking behaviour. However, in the USA most property owners do not buy coverage against special hazards, notably earthquakes, hurricanes, and floods. For example, nationwide only about 20% of the homes exposed to floods are insured for them. Many people assume that federal disaster assistance will function as a kind of hazard insurance, even though this type of aid is almost always limited. Even when larger amounts are available, they are usually offered in the form of loans, not outright grants.

Insurance does help minimise some disruption by ensuring that people with coverage receive compensation for their losses as they begin to recover. The insurance industry could facilitate mitigation by providing information and education, helping to create model codes, offering financial incentives that encourage mitigation, and limiting the availability of insurance in high hazard areas. To achieve these results, the insurance industry needs to develop better loss modelling techniques, and consolidate its links with the science, technology, and research communities.

The industry already has problems providing insurance in areas subject to catastrophic losses because many insurers do not have the resources to pay for a worst case disaster. Furthermore, the current regulatory system makes it difficult for an insurance company to aggregate adequate capital to cover low frequency but high consequence events.

New Technology

Computer-mediated communication systems, geographic information systems (GIS), remote sensing, electronic decision-support systems, and risk analysis techniques have developed substantially during the last two decades and show great promise for supporting sustainable hazard

mitigation. For example, GIS models enable managers to consolidate information from a range of disciplines, including the natural and social sciences, engineering, and the ability to formulate plans accordingly. Remote sensing can be used to make land use maps, show changes over time, feed information to GIS models, and gather information in the wake of disasters. Finally, decision-support systems can fill a gap in hazards management by analysing information from core databases, including data on building inventories, infrastructure, demographics, and risk. The systems can then be used to ask ‘what if’ questions about future losses to inform today's decision-makers. Such systems are now constrained by the lack of comprehensive local data, but they will become more important as the process of evaluating and managing risk grows in complexity.

In the context of new technology, it is worth repeating a point made earlier: In many cases, better management and decision-making is more critical than relying solely on technology to provide solutions.

Emergency Preparedness and Recovery

Even if encouraged by more holistic state and federal policies, sustainable hazard mitigation will never eliminate the need for plans to address the destruction and human suffering imposed by disasters. In fact, one way to progress toward sustainable hazard mitigation is to create policies for disaster preparedness, response, and recovery that support this goal. A great deal of research has focused on pre-disaster planning and response since the White and Haas 1975 assessment. Studies have found that pre-disaster planning can save lives and injuries, limit property damage, and minimise disruptions, enabling communities to recover more quickly.

Recovery was once viewed as a linear phenomenon, with discrete stages and end products. Today, it is seen as a process that entails decision-making and interaction among all stakeholders: Households, businesses, and the community at large. Research has also shown that recovery is most effective when community-based organisations assume principal responsibility, supplemented by outside technical and financial assistance. An even further shift away from an exclusive focus on restoring damaged structures toward effective decision-making at all levels may be needed. Outside technical assistance can help strengthen local organisational and decision-making capacity.

Local leaders also often fail to take advantage of the recovery period to reshape their devastated communities to withstand future events. Most local disaster plans need to be extended, not only to explicitly address recovery and reconstruction, but to identify opportunities for rebuilding in safer ways and in safer places.

Fortunately, in the USA, revisions to disaster legislation in the last several years have allowed a greater percentage of federal relief monies to fund mitigation programs. Pre-disaster planning for post-disaster recovery is vital to communities' abilities to become disaster resilient.

ESSENTIAL STEPS

The shift to a sustainable approach to hazard mitigation will require extraordinary actions. Following are several essential steps, of which many initial efforts are under way in the USA.

Building Local Networks, Capability, and Consensus

Today, hazard specialists, emergency planners, resource managers, community planners, and other local stakeholders seek to solve problems on their own. An approach is needed to forge local consensus on disaster resiliency and nurture it through the complex challenges of planning and implementation.

One potential approach is a ‘sustainable hazard mitigation network’ in each of the nation's communities that would engage in collaborative problem solving. Each network would produce an integrated, comprehensive plan linking land use, environmental, social, and economic goals. An effective plan would also identify hazards, estimate potential losses, and assess the region's environmental carrying capacity. The stakeholder network especially needs to determine the amount and kind of damage that those who experience disasters can bear. These plans would enable policy makers, businesses, and residents to understand the limitations of their region and work together to address them. Full consensus may never be reached, but the process is a key element because it can generate ideas and foster the sense of ‘community’ required to mitigate hazards.

This kind of holistic approach will also situate mitigation in the context of other community goals that, historically, have worked against action to reduce hazards. Finally, the process will advance the idea that each locality controls the character of its disasters, forcing stakeholders to take responsibility for natural hazards and resources, and realise that the decisions they make today will determine future losses.

Federal and state agencies could provide leadership in this process by sponsoring, through technical and financial support, a few prototype networks, such as model communities or regional projects.

Establish a Holistic Government Framework

To facilitate sustainable mitigation, all policies and programs related to hazards and sustainability should be integrated and consistent. One possible approach toward this goal is a conference or series of conferences that enable federal, state, county, and city officials to re-examine the statutory and regulatory foundations of hazard mitigation and preparedness, in light of sustainable mitigation principles. Potential changes include limiting the subsidisation of risk, making better use of incentives, setting a federal policy for guiding land use, and fostering collaborations among agencies, non-governmental organisations, and the private sector.

Other efforts to foster a comprehensive government framework in the USA system could include a joint congressional committee hearing, a congressional report, a conference by the American Planning Association to review experiences in sample communities, and a joint meeting of federal, state, and professional research organisations.

Conduct a Nationwide Hazard and Risk Assessment

Not enough is known about the changes in or interactions among the physical, social, and constructed systems that are reshaping the nation's hazardous future. A national risk assessment should meld information from these three systems so hazards can be estimated interactively and comprehensively to support local efforts on sustainable mitigation.

Local planning will require multi-hazard, community risk assessment maps that incorporate information ranging from global physical processes to local resources and buildings. This information is not currently available and will require federal investment in research on risk analysis tools and dissemination to local governments.

Build National Databases

The nation must collect, analyse, and store standardised data on losses from past and current disasters, thereby establishing a baseline for comparison with future losses. This database should include information on the types of losses, their locations, their specific causes, and the actual dollar amounts, taking into account problems of double-counting, comparisons with gross domestic product, and the distinction between regional and national impacts. A second database is needed to collate information on mitigation efforts, what they are, where they occur, and how much they cost, to provide a baseline for local cost-benefit analysis. These archives are fundamental for informed decision-making and should be accessible to the public.

A central repository for hazard related social science data is also lacking. This third central archive would speed development of standards for collecting and analysing information on the social aspects of hazards and disasters.

Provide Comprehensive Education and Training

Today, hazard managers are being called upon to tackle problems they have never before confronted, such as understanding complex physical and social systems, conducting sophisticated cost-benefit analyses, and offering long-term solutions. Education in hazard mitigation and preparedness should, therefore, expand to include interdisciplinary and holistic degree programs. Members of the higher education community will have to invent university-based programs that move away from traditional disciplines toward interdisciplinary education that solves the 'real world' problems entailed in linking hazards and sustainability. This will require not only new tertiary programs, but also changes in the way institutions of higher education reward faculty, who now are encouraged to do theoretical work.

Measure Progress

Baselines for measuring sustainability should be established now so the nation can gauge future progress. Interim goals for mitigation and other aspects of managing hazards should be set, and progress in reaching those goals regularly evaluated. This effort will require determining how to apply criteria, such as disaster resiliency, environmental quality, intra-generational and inter-generational equity, quality of life, and economic vitality, to the plans and programs of local communities.

Also important is evaluating hazard mitigation efforts already in place before taking further steps in the same direction. For example, the National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency (FEMA), which combines insurance incentives, land use and building standards, has existed for 30 years. Yet, NFIP's effectiveness is only now (June 1999) being comprehensively assessed by the FEMA (Natural Hazards Research and Applications Information Centre, 1999).

Each disaster yields new knowledge relevant to hazard mitigation and disaster response and recovery. Yet, no entity collects this information systematically, then synthesises it into a coherent body of knowledge, and evaluates the nation's progress in putting knowledge into practice. Systematic post-disaster audits, called for in the 1975 assessment by White and Haas, are still needed.

Share Knowledge Internationally

The USA must share knowledge and technology related to sustainable hazard mitigation with other nations, and be willing to learn from those nations as well. Globally, disaster experts need to collaborate with development experts to address the root causes of vulnerability to hazards, including overgrazing, deforestation, poverty, and unplanned development. Disaster reduction should be an inherent part of everyday development processes. International development projects must consider vulnerability to disaster.

INSURANCE AND SUSTAINABLE HAZARDS MITIGATION

Insurance itself is not a mitigation measure because it redistributes rather than reduces losses. However, a carefully designed insurance program can encourage the adoption of loss reduction measures by putting a price tag on the risk and creating financial incentives through rate discounts, lower deductibles, and higher coverage limits. There are no easy explanations and no easy solutions to the problem of mitigating and insuring against natural hazards. Nevertheless, there is an increasing recognition by those in the insurance sector, the model code organisations, and government that a program must be developed to address these issues. There are four principal means by which the insurance industry can facilitate mitigation.

Education and Information

A major role for the insurance industry is to engage in education programs designed to enlighten individual property owners about the risks they face and the mitigation actions they can take to reduce chance of loss. An informed property owner is more likely to engage in risk reduction and to purchase insurance.

Participate in the Model Code Process

The insurance industry must become an active participant in the code development process in order to make its case for better codes to reduce property losses from natural hazards. The insurance industry has as much at stake in the outcome of these processes as do the homebuilder associations, real estate interests, material suppliers, and local code officials. After model codes are improved, the insurance industry can actively encourage communities to adopt and enforce them.

One of the industry's most significant concerns is that building codes, historically, have been designed for life safety and contain few, if any, provisions for reducing damage to property. This view persists today among

model code groups and local building officials. Ironically, it is these groups that are most involved in writing and enforcing the codes.

Offering Financial Incentives

The most frequently suggested financial incentives are insurance premium reductions, changes in the amount of the deductible, and changes in co-insurance schedules which all reflect the changes in risk resulting from the implementation of a mitigation program. In the case of premium reductions, individuals would compare the reduction in premium offered with the estimated cost of mitigation action and decide whether the mitigation measure is beneficial, based on a perception of the risk. It should be noted, before a premium can be reduced (as an incentive), it must first develop sufficient funds to pay for losses. In addition, in the USA, any premium incentive must be approved by state regulators. Deductibles and co-insurance involve risk sharing and are designed to encourage property owners to protect against small losses. These practices benefit insurance companies by reducing the expense of dealing with small claims.

The high front-end cost of mitigation versus a premium reduction spread over many years may weaken the financial incentive. It could, however, be bolstered with non-insurance incentives that would yield benefits to the property owner who hold a policy in the shorter-term. Examples could be a waiver of property taxes that would be derived from the increase in the property's value as a result of the retrofit, a waiver of sales tax for materials used in the retrofit, or a waiver for building permit fees. Innovative financing programs could help, such as long-term loans tied to mortgages or awarding a mitigation seal of approval to raise the price of a house at resale.

Limiting the Availability of Insurance

Property owners would be most likely to implement mitigation measures if insurance was not available until after the property had been built or retrofitted to an acceptable standard. Given sufficient market penetration, the application of market forces that make the availability of financing and insurance for buildings dependent on their meeting certain high mitigation standards should help motivate builders to build to a higher standard and owners to retrofit existing properties.

CONCLUSION: THE KEY ROLE OF THE HAZARDS COMMUNITY

To support sustainable mitigation, researchers and practitioners need to ask new questions as well as continue to investigate traditional topics. Important efforts will include interdisciplinary research and education, the development of local hazard assessments, computer-generated decision-making aids, and holistic government policies. This requires a closer

collaboration between the hazards community and the nation's policy and law-makers. This in itself, is no small task. Yet, without it, essential developments based on changes in thinking and understanding, will not eventuate.

Future work must focus on techniques for enlisting public and governmental support for making sustainable hazard mitigation a fundamental social value. Members of the hazards community will play a critical role in initiating the urgently needed national and global conversations on attaining that goal.

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