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THE SOCIAL IMPACTS OF PHYSICAL PROCESSES: HOW DO WE MANAGE WHAT WE CAN'T CONTROL?

Joanne M. Nigg

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Joanne M. Nigg
Disaster Research Center
University of Delaware
Newark, Delaware

Good afternoon. It is indeed a pleasure to be with you this afternoon to discuss a topic that has absorbed a great deal of my attention over the years--namely, how do we make our communities less vulnerable to natural disasters. My presentation today suggests a slightly new direction for these efforts, one that I believe is absolutely crucial if we truly want to provide a policy climate that is actually conducive to taking the steps necessary to achieve this objective. First, however, I would like to begin with a discussion of the definition of disaster and with an outline of the national strategies that have been used to date to encourage state and local governments to reduce threats from natural hazards.

The definition of a "natural disaster" that I am going to use today does not refer to physical dynamics or properties of a natural hazard agent. Rather, from the perspective I use as a sociologist, a natural disaster occurs **only** when social systems and their technological products have been negatively affected by extreme physical events, a point I will return to in a moment. But first, let me address the important role that physical science knowledge plays as the first step in the development of disaster reduction approaches.

THE IMPORTANCE OF PHYSICAL SCIENCE

Within the physical science research communities of seismology, geology, hydrology, and atmospheric sciences, considerable effort has been expended on monitoring, characterizing, and analyzing physical hazards and on predicting, projecting, or forecasting the likelihood of large-scale, extreme occurrences related to those hazards. This activity rests on the notion that good science is needed in order to develop appropriate disaster reduction techniques. To date, much of the national investment in reducing disaster consequences has concentrated on these types of physical science activities. Certainly in the United States, we have a much better understanding of earthquake, flood and hurricane events because of this focus on the physical dynamics of natural hazards. The production of national flood and earthquake hazard maps are good examples of products that have been developed as a first step to the identification of disaster reduction policies. Similarly, the development of hurricane monitoring and land-fall projections, in conjunction with evacuation planning, have been extremely important in reducing deaths related to this type of disaster.

A DEFINITION OF DISASTER

While the production of knowledge concerning the physical characteristics of natural hazard agents is an important first step in the disaster reduction process, society's concern with these disaster agents is related to a broader interest in the social effects of disaster events--that is, with the negative or disruptive effects these agents have on the functioning of a society or community. It is in regard to this emphasis that social scientists and physical scientists may differ in what constitutes a "disaster."

For social scientists, natural disaster events--even those that could be considered extreme or catastrophic events, like a "great" earthquake of magnitude 8.0 or more, or a 500 year flood, or a category 5 hurricane--are not particularly significant events that should be referred to as a disaster unless that seismic activity, flooding, or wind substantially disrupts the built or social environments.

Also, from a social science perspective, it is not always true that disaster consequences are related to the magnitude or intensity of the disaster agent itself. Even when disaster events have similar physical characteristics they may not have similar social consequences. Take, for example, two relatively recent earthquakes--the 1988 earthquake in Armenia and the 1989 Loma Prieta earthquake in California. The earthquake in Armenia, which was a 6.9 magnitude event, killed approximately 25,000 people, injured more than 31,000, and left 514,000 homeless. By contrast, the slightly larger (7.1) magnitude Loma Prieta earthquake in the San Francisco Bay area killed only 62 people, injured 3,800, and left approximately 12,000 homeless. The relationship between the physical event and "social damage" it produces is often quite tenuous (Dynes 1992). The consequences in these instances differed substantially because of the social and cultural contexts in which these two disaster events took place.

For this reason, social scientists define hazards and disasters not on their physical characteristics but on the basis of social disruption. A **hazard** can be defined as: "some aspect of the physical environment that threatens the well-being of individuals and their society." These threats to well-being include harmful or disruptive effects to social, economic, and political systems, or to the built environment (buildings, dams, power and water systems, bridges and roads) that interfere with normal, daily life of a community.

A hazard, then, exists because it is capable of creating a **disaster.** A disaster can be defined as occurring only "when the built and social environments are so disrupted that the resources of the social system are overwhelmed and the system is unable to meet the demands placed on it for goods and services that are routinely expected by its citizens."[1]

A FOCUS ON LIMITING IMPACTS

Since these extreme instances of physical phenomena or hazards cannot be "controlled" in any real sense--that is, we can't stop excessive, sustained rainfall; or the build-up of crustal strain that results in dramatic seismic activity; or the development of atmospheric conditions that lead to the generation of hurricane force winds--we need to focus on how to reduce the consequences--the impacts--of these disaster events on social systems and their technological products.

The second major step in the development of disaster reduction strategies, then, focuses on identifying policies and programs designed to reduce the **impacts** of natural disaster agents. This activity requires an understanding of what those impacts are likely to be and how they will affect certain categories and types of structures in the built environment and the functions those structures perform for society. This is

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[1] This definition is adapted from the classic definition developed by Charles Fritz (1961: 655).

true whether the policies in question focus on the direct damage and losses resulting from the disaster itself--such as structural damages, lifeline failures, and injuries and deaths--or on indirect impacts--such as losses due to the disruption of economic and social systems.

From this perspective we need to know how different hazard impact potentials could affect different types of structures and physical systems, as well as the functions they house and serve. For example, we are well aware that buildings and lifeline systems in coastal communities along the Eastern seaboard and the Gulf Coast should be built to sustain certain wind velocities associated with hurricanes. Engineers have been conducting research on wind loads on physical systems in an effort to determine how to design and construct buildings and lifeline systems that can withstand both wind speeds and storm surges associated with various types of hurricane events, from those just stronger than tropical storms to those like Hurricane Hugo.

Similarly, the emergency management community also uses both physical science information on hazards and engineering knowledge about weaknesses in building stock to develop both disaster response plans and early recovery programs that anticipate the types of problems they will have to deal with following disaster events of different sizes. For example, local emergency management organizations were able to competently respond to the problems created by the 1994 Northridge earthquake--despite widespread damage throughout the Los Angeles area. Fire suppression, search and rescue, emergency medical services, mass feeding and sheltering, and lifeline restoration were all adequately dealt with by local organizations and governments, which had planned for and exercised these functions both independently as well as on a regional basis. Much of this planning activity was based on disaster scenarios that were developed by the State of California using both physical science information about earthquake hazards and engineering knowledge that identified potentially problematic types of structures.

From an emergency management and disaster response perspective, the Northridge earthquake was **NOT** a major disaster--it did not overwhelm local capacity to respond quickly to emergencies, to reduce further life loss, and to limit additional, post-impact property losses. But any event that causes $20-$30 billion or more of losses, like those being tallied from the Northridge event, would certainly consider this a disaster. And it was--freeways collapsed, interfering with commuting and commercial traffic for weeks or months; tens of thousands of residences were uninhabitable for days to months, causing people to be temporarily relocated and children's schooling interrupted; businesses were disrupted, some for only hours due to power or phone service interruptions, but others for months due to structural or equipment damage or inventory losses; the provision of regular community services--like sanitation and trash removal, or construction permitting and inspection--were strained for months because of the additional burden of earthquake-aftermath conditions.

The experiences we have had in the United States with respect to the last several large-scale disasters points out a very important lesson: we are getting better at limiting life loss due to our warning systems (such as the in Hurricane Andrew and the Midwest floods) and in post-disaster emergency response (like in the Northridge earthquake), but we are still not doing well in reducing disaster losses to the physical built environment or to our social systems.

The questions remains: why not?

THE IMPORTANCE OF VULNERABILITY ASSESSMENTS

The emphasis we have placed on disaster impacts and disaster reduction focuses our attention--incorrectly I believe--on the disaster event--that is, on the nexus between the physical hazard and the built environment--and on dealing with the problems that result from such an event. I would like to suggest that this approach has not necessarily resulted in safer communities that can actually resist disasters. While we are getting better at dealing with these problems **after** a disaster, we are still failing to develop and implement policies and strategies where the physical natural hazard agent can not create a disaster situation.

I believe that it is time to move to the third step in this process--to focus on vulnerability reduction of our communities; that is, to make them less prone to becoming disaster events. If we actually can reduce the vulnerability of communities and regions, we will, in fact, reduce both the number of events that could be considered a "disaster" as well as reduce the scope (or the magnitude of losses) of disaster events.

But, you might be thinking, we know how to make cities safer places to live--because of engineering research, we know how to build houses and structures that can withstand certain seismic and wind loads and we are learning more all the time about how to retrofit existing structures to make them safer; through the characterization of physical hazards, we know where it is unsafe to build new structures--in floodplains, in areas prone to liquefaction or on unstable soils, in areas that can be inundated by storm surge. All of these observations are true. But if we "know" these things, why is the cost of disaster events continuing to increase, not just in the United States but internationally?

I would like to suggest that we have not been successful linking the knowledge developed in the first two steps of our disaster reduction process to local community or regional conditions. We have not focused on what actually makes communities vulnerable to natural hazards. And because we have not focused our attention on the social issues and political processes associated with vulnerability, we are unable to provide compelling rationales for communities to undertake mitigation actions that are the basis of effective disaster reduction programs.

I would argue that we need to take the knowledge that has heretofore been generated by the physical science and engineering communities and use it as a background against which community vulnerability assessments are conducted. Such assessments would identify the specific types of hazards--both natural hazard agents, as well as endangered, weak, or underdesigned structures--and overlay social vulnerability on top of it.

Social vulnerability arises from at least three sources. First, we know that certain segments of our society are especially vulnerable because of their social location. That is, the poor and the elderly are already often functioning on a marginal basis during normal times. The economic resources available to them to engage in lessening their own exposure to hazards--by improving the structural stability of their residences (either by strengthening them or moving to better buildings)--is minimal at best. On a societal basis, the relative number people being put at risk is expanding each year due to (1) an increase in the number of working poor, (2) the continuing isolation of the urban underclass, (3) the large percent of the elderly who live on small, fixed incomes, and (4) an exploding immigrant population, where available jobs pay very minimal wages.

A second type of social vulnerability arises due to geographic location. Obviously, people who live in more dangerous physical locations--in floodplains, on beachfronts in hurricane-prone areas, on liquefiable soils or unstable hillsides in seismic areas--will be more vulnerable, as will those who live in structures that can not withstand the dynamic forces of natural hazard agents.

A third form of social vulnerability results from the density of development and population, illustrated by many of the large cities around the world. We know that the megacity trend is putting ever greater numbers of people at risk.

In other words, we need to begin to address the issues of contextualized vulnerability, or vulnerabilities that arise from local conditions and the history of the local area. It is not uncommon to discover that large areas of major metropolitan areas are characterized by all three types of social vulnerability. However, by knowing which areas of a community are more socially vulnerable, communities can begin to prioritize where and how they want to begin to reduce potential disaster impacts.

We need to address a series of questions about these localized vulnerabilities in order to begin to assess what types of vulnerability reduction policies are important. Let me suggest what a few of these questions might be. For example, What types of housing stock are likely to fail, leaving people temporarily or permanently homeless after a disaster; who are these people, and what policies over time have led to this situation? When are power, water, and communication systems likely to become non-functional; and what effects will this have on the community's ability not only to respond to post-disaster emergency situations but to provide these resources for the continuing social and economic functioning of the community? Why are some economic sectors more disrupted than others; what relationship exists between this disruption and the location or structure that houses these businesses; and what consequences will occur for their employees? Are there some areas of the city in which minority-owned businesses--which generally employ minority workers--are located; the disruption of which may have far reaching social consequences? Under what conditions are local governments unable to provide normal services to their residents after a disaster; and what consequences does this have, especially for the elderly, the infirm, or children in the community?

These questions of vulnerability will differ not just across national boundaries, but will vary across regions in the United States, and even among cities in the same region. We must not forget that communities have unique histories; and that those histories have resulted in different policy environments with respect to hazard vulnerability reduction. A "policy environment" can be defined by the many factors that affect a community's receptivity to a policy concern or initiative. In this instance, such factors include: local social, political, and economic forces; cultural and historical ways of dealing with hazard- and disaster-related concerns; perceptions of the local risk from natural hazards, and the relative importance of other current issues in the community.

Similarly, we must remember that communities are neither homogeneous in composition nor non-conflictual arenas for decisionmaking. Rather, they are composed of different types of ethnic and racial groups, of special interest organizations with differing histories of tensions or cooperation. Some cities have very elderly populations, while in others younger families make up the majority of households. Some cities are "old" in terms of their lifecycle, with crumbling inner cities, a disappearing manufacturing base, and a dwindling supply of blue collar jobs; while others are relatively new and growing, with vibrant, high-tech economies and an expanding job market. Depending on the composition and the political strength of some of these groups in a city, certain issues will be seen as more important than others.

Vulnerability reduction policies, then, are part of this larger, social context within which a variety of organizational, institutional, and governmental processes are taking place. Thus, there is no standard policy environment; the dynamics within one community (or country) will be different from those in another.

It is specifically because of this variation across communities, decisionmakers must have vulnerability reduction choices available to them that address particular types of vulnerabilities and for which specific constituencies can be identified as benefitting by becoming less endangered. Since we know that it is often hard to "sell" safety to communities--and this **is** one of the major reasons why our disaster reduction messages have not been particularly successful--this information allows communities to link vulnerability reduction actions to other key community issues and processes, thereby, meeting different or broader goals that the community might have.

This type of focus on vulnerability reduction also has another major consequence: it moves concerns about natural hazards out of the exclusive domain of emergency management agencies--which we know are often relegated to low status, small staff operations in many cities and counties--into departments that have as a mission the future development of the community--planning and zoning, economic development, risk management--as well as into the office of the jurisdiction's chief executive officer, often the city or county manager. This strategy elevates hazard concerns within the city, provides mechanisms for identifying the most "at risk" populations, and identifies constituencies that could be mobilized to politically support such efforts--factors that have not been part of the policy environment to date in most of our communities across the country.

I believe it is time for us to rethink and redirect our national disaster reduction strategies to focus on vulnerability reduction efforts, that provide not just the tools to identify problems and the global solutions for those problems, but the mechanisms to begin to solve those contextualized problems locally.