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This dissertation primarily uses observations made during the 2005 Kashmir earthquake relief effort and available disaster literature to address problems that impede effective and efficient disaster preparedness and response. Three manuscripts form the body of the dissertation. The manuscripts are thematically linked through the Emergency Management Cycle. Each manuscript examines actual problems and provides recommended solutions to these problems along with a strategy to implement them. The first manuscript proposes a practical method whereby emergency managers can assess risk in their community and examines the use of schools as the basis of a community-wide relief center plan. The second manuscript draws on observations from the 2005 Kashmir earthquake and available literature to examine impediments to operational geo-information utilization during that relief effort. The manuscript concludes with recommendations on how to increase the accessibility of geo-information to a diverse group of users and better manage geo-information during future disaster response efforts. The last manuscript supplements the study of civil-military relief efforts with contemporary anecdotal experience. The research examines the interaction between US military forces and other disaster relief actors during the 2005 Kashmir earthquake relief effort. The manuscript puts forth the Kashmir Model of integration, coordination, and transparency of intent as a framework in which future humanitarian assistance operations can be successfully executed.

Practitioner's Hands and Academic Eyes: A Practical Approach to Improving Disaster Preparedness and Response

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Wiley C. Thompson

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Wiley C. Thompson, Author

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CHAPTER 1 - INTRODUCTION

The impetus for this dissertation came from personal experience leading the initial United States disaster relief effort and later the United States military aviation relief effort following the October 2005 Kashmir earthquake. On Saturday morning, 8 October 2005, I was in Bagram, Afghanistan, 250 miles from the epicenter of an earthquake that would claim the lives of 79,000 people. Two days later I was in Islamabad in the midst of a seemingly chaotic effort in which responders worked tirelessly to provide relief while still struggling to fully appreciate the extent of the earthquake's destruction. By the end of my time in Pakistan I would find myself with a greatly altered perspective of the world and a compelling obligation to share my observations and experiences. However, writing this dissertation is more than an opportunity to document an incredible event – it is an opportunity to critically examine field observations in an academic framework in order to address the impediments to disaster response I encountered while conducting humanitarian assistance operations in Kashmir.

Field observations taken from 10 October 2005 through 8 November 2005 in Pakistan form the core of this research. I made these observations while conducting disaster response, coordinating relief missions, and attempting to solve problems, which if left unaddressed would have brought a large portion of the aviation effort to a standstill. My duty position and responsibilities in Pakistan allowed me to participate in and witness firsthand the negotiation and coordination of relief that occurs at the individual, organizational, and international levels. I was also fortunate enough to escape the politically sensitive world of aid planning and negotiation by flying missions into the affected area. On days that I did not fly, I would jump on an aircraft and perform the crewmember duties of off-loading aid and loading and transporting the sick and wounded. Each flight was an opportunity for me to put my "boots on the ground" and personally assess how military resources, as components of a greater response effort, were doing.

In general, those conducting rescue and relief activities were well intended and committed to doing everything within their capabilities to assist the Pakistani and Kashmiri people during their time of need. Search and rescue teams saved a great

many people and helicopter crews evacuated thousands of injured to medical facilities for wound treatment. However, despite heroic individual and team efforts, key failings at organizational levels led to a less efficient and effective disaster response. Failings by responding organizations delayed rescue, relief supply, and worker deployment. Duplicated efforts failed to use available assets to their fullest potential and missed opportunities to set favorable conditions for a speedy recovery and reconstruction effort.

The failings identified in Pakistan were not unique to that disaster nor would they be unfamiliar to anyone who works in a very large, diverse organization. Many years experience by the author in large organizations and a great deal of research have led to the conclusion that there were five major reasons for failings in the Kashmir earthquake relief effort:

1) There is a continued failure to coordinate the actions of humanitarian organizations. In Pakistan, this was the single greatest impediment to effective disaster response.
2) There is a lack of critical post-relief assessment and lessons learned literature regarding disaster relief.
3) The academic and professional communities, while proficient at identifying failings, fall short in their efforts to recommend solutions to the deficiencies they have identified.
4) There is no overarching organization that will readily take responsibility for implementing suggestions when they are made.
5) The politicized world of humanitarian action does not create an environment in which the organizations conducting relief are willing to "lose their individualism" and implement collaborative recommendations for improvement.

Until scholars and practitioners aggressively address these failings and develop solutions for the issues mentioned above, disaster responders will repeat the same mistakes made in Pakistan, with the costs of failure being paid in human capital.

This dissertation consists of six chapters. Chapter 1 is the Introduction and Chapter 2 discusses seismology and disaster preparedness in South Asia. Chapters 3, 4, and 5 form the body of the dissertation, which consists of three thematically linked manuscripts. Chapter 6 is the Conclusion. Chapter 1 begins with a short discussion describing the significance of the research in this document. Next, the reader will find

a section that examines the field of disaster studies. This section contains a discussion regarding the difference between disasters and hazards and examines thematic topics in the literature. It will also familiarize the reader with the disaster terminology, establishing a rudimentary understanding of the vernacular used in the three manuscripts. This section would traditionally serve as a literature review. As such, an overview of literature and trends and gaps in the literature is discussed in this chapter; however, trends and gaps are critical to much of the writing in this manuscript and therefore are examined throughout the body of the document. The next section is entitled "Threads and Ideas". This section introduces the reader to a model, which unites each manuscript thematically. This work examines common threads and ideas that are very important to this research and serve as a continuation of the review of literature. Chapter 1 concludes with a discussion of the methods employed during this research.

Chapter 2, Seismology, Seismic Risk, and Preparedness in Pakistan, provides the reader with a fundamental understanding of the seismic hazards that threaten Pakistan. This chapter examines the history of earthquakes in the region and the difficulties scientists face both in reconstructing a historical seismic record and in predicting future events. Chapter 2 concludes with an examination of the challenges to seismic preparedness faced by the Government of Pakistan and makes recommendations to improve this area. The main body of this dissertation consists of three manuscripts, each of which is intended for publication in a scholarly journal. *Journal of Emergency Management, Transactions in GIS*, and *Disasters: The Journal of Disaster Studies, Policy and Management* are planned outlets for the manuscripts in this dissertation.

Chapter 3, School-Based Relief Centers: A Community Level Assessment and Discussion, examines local preparedness in Corvallis, Oregon. This chapter discusses community risk assessment and presents a methodology that emergency managers can use to develop a community-wide relief center plan. This chapter contains the only manuscript that focuses specifically on pre-hazard activities and as such, is a departure from the theme of disaster response in the developing world. This was a deliberate

shift intended to provide local-community outreach, in the hope of avoiding the problems of post-hazard sheltering which were observed first-hand in Pakistan.

Chapter 4, Geo-Information Utilization During the 2005 Kashmir Earthquake Response, focuses on the topic of leveraging geographic information (geo-information) in a distributive environment as a means to enable better coordination between all participants during a disaster response. The author examines impediments to operational geo-information utilization during the 2005 Kashmir earthquake response effort and recommends the implementation of a model to increase geo-information availability and utilization in future efforts. Chapter 5, Success in Kashmir: A Positive Trend in Civil-Military Integration During Humanitarian Assistance Operations, examines the interaction between US military forces and other disaster relief actors during the 2005 Kashmir earthquake relief effort. The research uses direct observations made while working in Pakistan to contrast the relationships and activities in that effort with other accounts in prevailing scholarly disaster literature and military doctrine. Finally, the dissertation will conclude with Chapter 6, in which the author provides conclusions and makes suggestions for future research.

SIGNIFICANCE OF PROPOSED RESEARCH

This research was undertaken to address the failings observed in Pakistan and recommend solutions so that those responding to the next large-scale disaster can benefit from the mistakes of the past. It is the hope that in doing so, the work in this dissertation can be viewed as a real contribution to the field of disaster studies. The three publishable manuscripts that make up the core of this document demonstrate original, independent research with a focus on improving disaster preparedness and response by examining real-world problems and providing recommended solutions and implementation strategies.

The other significant contribution from this work resides in the area of lessons learned or post-event critique. Examination of disaster literature while conducting research for this dissertation resulted in great frustration during searches for publications that codify lessons learned. Many of the lessons learned from past relief efforts have not been well documented; therefore, the work in this research seeks to

codify lessons learned in Pakistan for the benefit of future efforts. The intent of this critique is not to belittle or disrespect the efforts of others, but to critically examine past actions and develop recommendations to improve future disaster relief efforts. The recommendations presented in this dissertation come from hands-on disaster relief experience, over two decades of organization leadership study, and the opportunity to examine the actions of the past within an academic framework using scholarly literature. While not an inimitable perspective or an infallible combination of experience and qualifications, it does present a unique opportunity to make a positive contribution to the field of disaster studies.

As this dissertation is largely qualitative in its approach, the early chapters provide the readers with a contextual framework. A contextual framework allows "readers to better understand how analysis arises and supports the researcher's theoretical explanation" (Phillips 2002, 199). The following section provides an examination of the field of disaster studies and the literature that frames the three main works within this dissertation.

LITERATURE, IDEAS, AND METHODOLOGY

Disaster Studies

Before examining the thematic links between the three manuscripts in this dissertation, it is necessary to provide the readers with a brief discussion of the field of disaster studies and familiarize them with some of the vernacular of that discipline. Prior to reading this dissertation, studying disaster relief, or participating in a large-scale relief operation, one should have an elementary understanding of how scholars and practitioners define disasters and hazards. One should also be familiar with the models that disaster scholars employ to track and categorize the activities people undertake between hazard events.

Two closely related fields that examine agents which can adversely affect people and their interaction with and response to these agents are the fields of disasters and hazards. The following section will address each term separately to provide the reader with a better understanding of how scholars currently define them and thus delineate their fields of study and research foci. However, the reader should not view

disasters and hazards as mutually exclusive fields of study. Even though scholars in each field have very distinct research agendas, their findings often combine in a symbiotic fashion – producing solutions to some of humanity's greatest problems.

Gilbert White wrote in his dissertation that "Floods are acts of God, but flood losses are largely acts of man" (White 1945, 2). This statement has become an immortal phrase in disaster studies and eloquently frames the hazard-society-disaster relationship. Although it took many years, the concept proposed by White has gradually shaped the modern disaster research agenda whereby disasters are no longer exclusively "equated with features of physical agents" (Quarantelli 2000, 682). Hazards are conditions, events, and forcing agents, of natural or of human origin, which are capable of creating insult or harm to living things or property. Harm can range from emotional distress to death. Hazards, when allowed to disrupt social and economic systems, can cause humans to modify their way of life drastically.

Alexander (1999, 4) sees a hazard as an event that "makes an impact on human beings and their environment." He later breaks hazards down into three categories: natural, technological, and social. He describes natural hazards as "extreme events that originate in the biosphere, lithosphere, hydrosphere or atmosphere" (Alexander 2000, 9). Technological hazards include "explosions, releases of toxic materials, episodes of severe contamination, structural collapse, and transportation, construction and manufacturing accidents" (Alexander 2000, 9). Lastly, he describes social hazards as events "such as crowd crushes, riots and terrorists incidents" (Alexander 2000, 9). The National Research Council also calls this last category "willful" hazards (NRC 2006). Other broad categories of hazards include biological hazards (disease, fire, pests) and complex hazards (desertification and hunger) (White *et al.* 2001).

A hazard that does not intersect with or influence the sphere of human systems can be categorized as an interesting event worthy of study, but not a disaster (Figure 1.1). Disasters involve the effects of a hazard on society and the subsequent societal response. The American Heritage Dictionary defines a disaster as "an occurrence causing widespread destruction and distress" (1982, 401). However, the term is much more complex, mainly because it involves society and societal responses to hazards. Social scientists have led the way in disaster research and in codifying exactly what

constitutes a disaster. Wisner, a well-known disaster scholar, wrote that "disasters are a complex mix of natural hazards and human action" (2006, 5). Some might expand that definition to include "human inaction" as well. One of the most prominent social disaster scholars defined a disaster as being a "social disruption" which requires a corresponding "social response" (Quarantelli 1978, 3). When societal responses to hazards fail, a disaster often ensues. In fact, "ineffective" measures taken to protect society from hazards can actually "become a source of added vulnerability when extreme events occur" (Tierney et al. 2001, 5). Therefore, researchers can look at disasters as situations that occur when society is unprepared for a hazard event and/or when society's subsequent response to that event is inadequate.

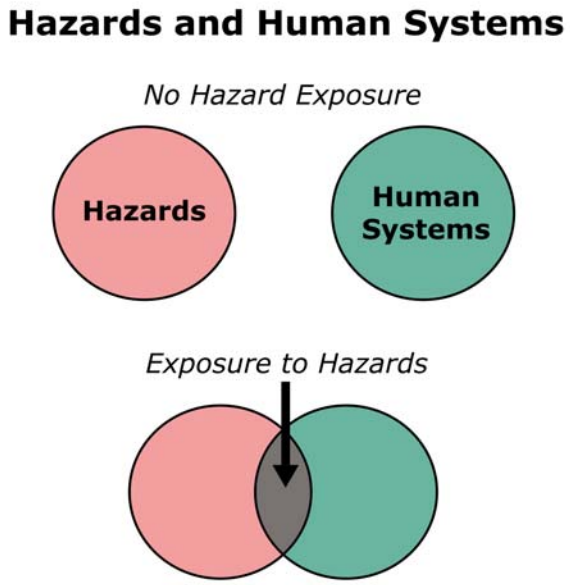

Figure 1.1. Hazards and Human Systems. Hazards do not present a danger to humans unless they intersect with the sphere of human systems. The boundaries of this sphere encapsulate not only where people live, but the infrastructure and natural systems they rely on for their existence. When the spheres overlap, part of the human system faces exposure to a hazard. A social disruption from exposure to a hazard or as a result of society's failure to prepare for or respond to that potential disruption may result in a disaster.

Two key concepts linking hazards and society are risk and vulnerability. Disaster scholars define risk as the "probability that a particular level of loss will be

sustained by a given series of elements as a result of a given level of hazard impact" (Alexander 2000, 10). Risk results from the intersection of a hazard and human systems. The proportion of population, infrastructure, or economic assets that are at risk relates directly to the level of exposure to a hazard. Populations or components of human systems exposed to a hazard may have differing abilities to cope with their exposure. Scientists refer to this concept as vulnerability, or "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner 2006, 11).

As with any discipline, the field of disaster studies has its share of well-known contributors. Those familiar with disaster studies will quickly recognize names established social scientists such as Alexander, Drabek, Dynes, Fritz, Killian, Perry, Quarantelli, Scanlon, Stallings, and Tierney. They currently dominate the field of disaster studies – a trend in which lead roles by geographers in the study of disasters academia have been replaced by sociologists (Montz *et al*. 2005). However, three scholars led the way for others to follow. These pioneers framed the study of disasters as a function of examining societal response to forcing agents. Samuel Prince (1920) wrote *Catastrophe and Social Change* after conducting a sociological study of social change following a ship explosion in Halifax, Canada. Pitirim Sorokin (1942) wrote *Man and Society in Calamity* after researching the effects of "war, revolution, famine, and pestilence" on "mental processes and behaviors" as well as "social organizations and cultural aspects of impacted populations" (Quarantelli 2000, 681). The last of the great progenitors is Gilbert White, a geographer, whose dissertation *Human Adjustment to Floods: A Geographical Approach to the Flood Problem in the United States* (1945), also helped frame early research regarding society's response to a hazard as the precipitating factor most influencing whether a disaster follows or not.

The diversity of subject matter in the field of disaster studies is, in part, due to the influence of many contributing disciplines. As noted by Alexander (2000, 30), the main schools of thought contributing to the study of disasters are "geography, anthropology, sociology, development studies, medicine and epidemiology, and the scientific and technical disciplines such as volcanology, seismology and engineering." These fields have all contributed to a better understanding of hazards, their effects on

humanity, and the methods through which an enhanced state of preparation can be attained. However, Alexander (2000, 30) was quick to note that disciplinary boundaries have also "impeded progress towards a better understanding of emergencies and how to manage them." Alexander alluded to these barriers in an early work where he noted that "academic overspecialization" has resulted in negative consequences and "'disasterology' has become fashionable and many academics have leapt aboard the bandwagon" (Alexander 1997, 298). Specifically he noted that these "disasterologists" claim to be "experts only to find that their training and experience are inadequate." As such, it may be much easier to have been involved in a large disaster relief effort and then develop and formalize that experience with studies in an academic environment. A person can relate findings in the literature to experiences one has had and create meaningful connections and develop a research agenda. This is the approach taken in the development of this dissertation. If this research had been attempted without having an experiential framework through which to examine disaster literature, the work would have lacked an appropriate context and may not have resulted in significant scholarly contributions. However, occasionally during the course of this research, the author too, like the "disasterologists", has felt like a "fish out of water, gasping for the oxygen of their familiar discipline" (Alexander 1997, 208).

The work of physical geographers has historically dominated the Association of American Geographers' Hazards Specialty Group. Currently, there is no disaster specialty group. Physical geographers have focused on the forcing agents, which can create the conditions in which a disaster will develop. These geographers have contributed greatly to the understanding of forcing agents by addressing "real-world problems requiring practical solutions" even while they "continue working to develop conceptual frameworks" (Montz *et al.* 2005, 486). Much like the field of disaster studies, the specialty group has also evolved. Emphasis on hazard modelling, geographic information systems (GIS) applications to hazards, and mapping have gradually replaced research by geographers with a focus on human and physical systems (Montz *et al*. 2005).

Interest in the United Nations' declaration of the 1990s as the International Decade for Natural Disaster Reduction inspired many writings in the 1990s and the early years of this century on the relationship between hazards, human systems and societal response to disasters. Other authors have been motivated by the apparent ever-increasing toll of death and damage caused by natural disasters each year (Alexander 1999). Whatever the motivation, a sizeable body of literature is available for scholars choosing to conduct research in the subject area of disasters. There is also a rich agenda for disaster scholars to pursue. Future researchers will find great opportunity in estimating "hazard mitigation costs", "validating theoretical relationships", documenting and testing issues relating to "multiorganizational systems", and "analyses of cross-hazard databases" (Drabek 2002, 148-152).

A significant observation made while reviewing the literature on disaster studies and regarding particular disasters was that there was a lack of critiques, lessons learned, or after action reviews of disaster relief efforts. This is not to say that there is a lack of critical literature. Critical literature differs from literature that provides a critique of disaster response actions. Critical literature or constructive critique allows organizations to continue to grow professionally and evolve along with their field – it allows organizations to remain both effective and relevant. Many professional organizations conduct internal critiques and reviews of their past actions in order to improve future performance. If made available, these works would aid greatly in improving the collective knowledge of and ability to perform disaster relief. Also noted while reviewing literature about disaster studies and disaster philosophy, was that some of the problems encountered while conducting relief in Kashmir were absent or at least under-addressed in the literature. These deficiencies are "gaps" in the literature. When disaster practitioners and scholars identify mistakes or shortcomings during disaster response efforts and do not adequately address them in the literature and propose remedies, those responding to future disasters are very likely to repeat those same mistakes.

Threads and Ideas

The model that links these three manuscripts thematically is the Emergency Management Cycle (Thomas et al. 2002). This has elsewhere been called the Emergency Response Cycle (Cutter 2003), and simply The Disaster Cycle (Alexander 2000). [1] Going forward, this dissertation will refer to this model as the Emergency Management Cycle (Figure 1.2). This model depicts the full cycle of activities from the hazard event through response and mitigation back to an enhanced state of rebuilt structures and systems that are better prepared to resist a future events. In sequential order, the phases of this model are Hazard Event, Rescue, Relief, Recovery, Reconstruction, and Preparedness.

Figure 1.2. Emergency Management Cycle. Modified from Thomas (2002) with image by author. Used with permission, 2008.

Current disaster management models draw on an earlier work. When Powell and Rayner (1952) proposed their model fifty-six years ago, it consisted of seven phases. These phases were Warning, Threat, Impact, Inventory, Rescue, Remedy, and

[1] Other, non-scholarly materials have referred to this model as the Disaster Risk Management Cycle or Disaster Response Cycle. Variations of this model differ mostly in precise terminology, but not in the actions taken by those involved.

Recovery. Modern models of the emergency management cycle reduce the first three phases of Powell and Rayner's model to one event, the onset of the hazard. Modern models also incorporate phases that focus on hazard mitigation (reconstruction and preparedness). This trend parallels the evolution of disaster theory as it has decoupled from a hazard-focused emphasis to a research agenda that increasingly focuses upon societal preparedness and response.

Although the Emergency Management Model seems to specify a set of discrete, non-overlapping events, nothing could be further from the truth. While Preparedness appears to be an activity that follows Reconstruction and terminates when the hazard event occurs, Preparedness is actually a continuous activity. During the distribution of relief aid, other organizations may focus their resources on future preparedness as they distribute emergency radios and discuss plans for rebuilding in a more hazard-resistant fashion. Likewise, Recovery and Reconstruction activities should start immediately following the hazard event. This happened in Pakistan as helicopters flying relief aid to the disaster area also carried lumber and corrugated tin roofing to begin rebuilding homes. As engineers and relief workers conducted initial damage assessments, they created an inventory of future rebuilding requirements. Not only did this information assist planners in targeting aid, but it also enabled those responsible for putting the damaged areas back together with developing priorities of work and estimating the resources they would need to accomplish the task.

U.S. military forces will most often find themselves involved in the Rescue, Relief and to a lesser extent, the Recovery phase of this cycle. These phases reside in the Response portion of the Emergency Management Cycle. Scholarly disaster literature describes response as "the provision of emergency relief and assistance when it is needed" and as the "evacuation, the distribution of primary necessities and the mobilization of emergency services" (Alexander 1999, 407). US Department of Defense (USDOD) Joint Publication 3-07.6, *Joint Tactics, Techniques and Procedures for Foreign Humanitarian Assistance,* defines foreign humanitarian assistance (FHA), a military term synonymous with disaster response, as operations that are intended to "relieve or reduce the results of natural or man-made disasters or other endemic conditions such as human suffering, disease, or privation that might present a serious

threat to life or that can result in great damage to or loss of property" (USDOD 2001, I-1). Therefore, in accordance with the terminology used in the Emergency Management Cycle, when military forces deploy to conduct disaster response /humanitarian assistance, they should exit as early as possible into the Recovery phase. Unless given a mandate to do so, remaining beyond late in the Relief phase or very early in the Recovery phase would be outside the scope of their mission. Additionally, this would hamper a return to local self-sufficiency (this issue will be addressed in detail in Chapter Five).

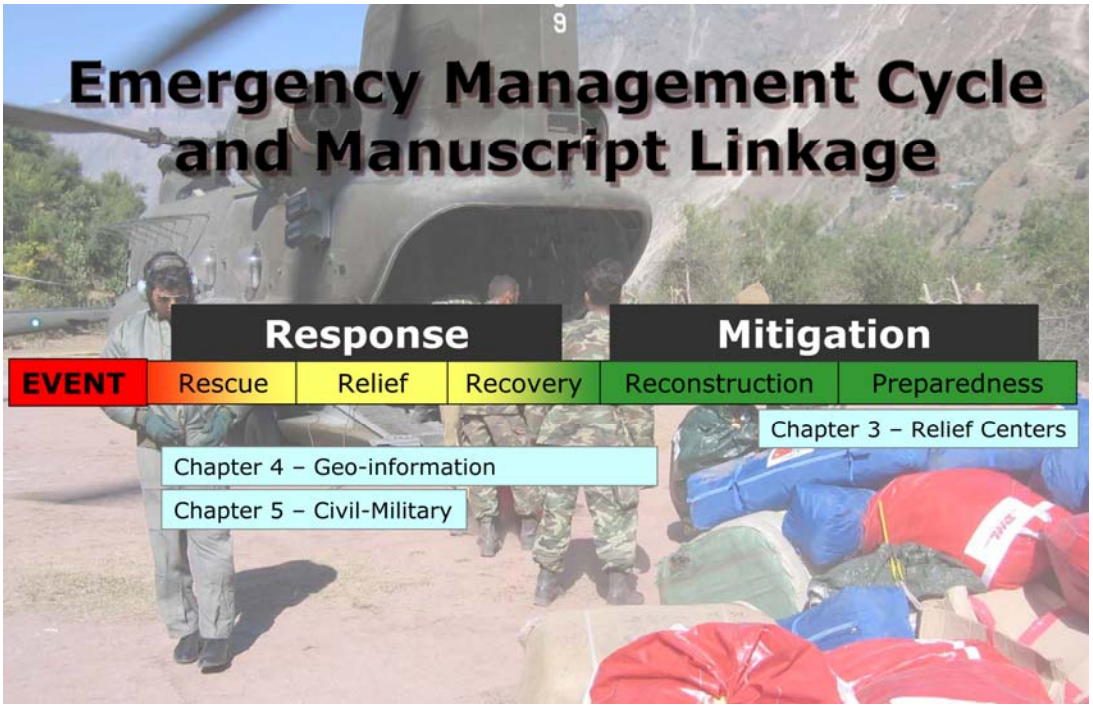

Figure 1.3. Emergency Management Cycle and Manuscript Linkage. This figure depicts the three publishable articles in this dissertation and shows how they correlate with different phases of the Emergency Management Cycle.

Figure 1.3 illustrates how the three publishable manuscripts within this dissertation relate thematically. Each paper contains a unique contribution to disaster literature. The combined scope of the three papers relates in some manner to each phase within the Emergency Management Cycle. Figure 1.3 shows the correlation of each manuscript to its corresponding emergency management phases. However, after examining each paper, the reader will understand that the benefits of incorporating the

recommendations in each manuscript will result in collateral benefits in adjacent phases as well.

Chapter 3 (Relief Centers) focuses primarily on the pre-event phase of Preparedness, but the community will realize the benefits of the methodology prescribed in this chapter in the Relief and Recovery phases as well. Household, neighborhood, and community planning and preparedness are most effective when completed prior to the onset of a hazard (Perry 1985; Drabek 1986; Perry and Lindell 2003). The benefits of planning and preparedness decrease community vulnerability and sets the conditions for a more rapid return to normalcy (Wisner *et al.* 2006). Chapter 4 (Geographic Information) can arguably relate to every phase in the Emergency Management Cycle. However, this paper specifically focuses on the immediate post-hazard phases of Rescue, Relief and Recovery. Previous disaster experience suggests that GIS employment "could have made the [disaster] response more effective and speeded the recovery" Waugh (1995, 429). Chapter 6 (Civil-Military) examines the interaction between military forces that have deployed to conduct humanitarian assistance and the other actors they will encounter in the disaster response environment. Unlike Chapters 3 and 4, recommendations in Chapter 5 should be restricted to phases which correspond to the specific military mission. As long as military forces maintain a presence, disaster victims may continue to rely on them for assistance and resources instead of developing local solutions (Gaydos and Luz 1994). Therefore, military forces should minimize their time in the disaster area as the solution to future disaster risk reduction and preparedness is deeply rooted in generating "local self-sufficiency" (Alexander 2006a, 12).

Humanitarianism

One theme that weaves throughout the entire Emergency Management Cycle is coordination. The coordination that occurs, or should occur between organizations conducting disaster-related activities, is critically important. In early disaster response efforts, limitations in technology that constrained the ability to communicate, share information, track the flow of logistics, or visualize the "disasterspace" may have hampered each actor's ability to coordinate response activities. However,

improvements in travel, computers, mapping technology, imagery, and personal communications have largely eliminated the barriers mentioned above (Alexander 2006b). As the enablers that are capable of improving coordination have matured, the nature of the humanitarianism has changed as well. Therefore, in order to begin to understand why coordination in disaster response is difficult to achieve, one must appreciate how the nature of humanitarianism has changed. One positive note is that while coordination is difficult to achieve, recent research suggests there is a positive trend in donor response and distribution of aid, especially in developing countries (Paul 2006).

The first recorded large-scale disaster response occurred following the Lisbon, Portugal earthquake of 1755 (Dynes 2000; Alexander 2006b; Hough and Bilham 2006). Since then, the world community has increasingly, and in a more complex manner, come to the aid of their fellow citizens during times of disaster. However, the global community of humanitarian actors, while clearly possessing a strong desire to help those in need, especially at the individual level, continues to struggle with an unwillingness to fully integrate, cooperate, and coordinate with all actors during the course of a disaster response effort. The author observed this struggle on many occasions in Pakistan. Readers should not view this dialogue as an indictment of any organization, political belief, or philosophy, but rather a description of the current state of affairs. Scholarly works desiring to contribute to this body of knowledge should not avoid uncomfortable topics for fear of critique or condemnation. Instead, scholars should seize the opportunity to examine and debate controversial topics like the changing nature of humanitarianism. Doing so gives context to their work and provides a framework within which researchers can view the world and develop solutions.

Kent (2004) suggests that the increase in the number of actors involved in humanitarian efforts has resulted in the emergence of a more complex and competitive aid environment. Kent concurs with the previous assertion that most individuals involved in a humanitarian action are well intended. However, those individuals are working in a competitive humanitarian marketplace. Kent (2004) also refers to this marketplace as a *souk*. In the commercial marketplace, competition benefits the

consumer. However, competition between actors in the humanitarian marketplace "skews issues of accountability, dulls advocacy and complicates coherence and cooperation" (Kent 2004, 221).

A review of current literature will find three distinct applications of the term humanitarianism. One will find terms like humanitarianism (in the classic sense), new humanitarianism (Duffield, Macrea and Curtis 2001; Fox 2001) and militant or military humanitarianism (Woodward 2001); all three terms apply to civilian organizations. As such, a single term like humanitarianism cannot adequately describe all organizations found in the complex world of disaster response. Organizations that are humanitarian in the classic sense embody "Henri Durant's concepts of humanity, impartiality, neutrality, and independence" (Stockton 1998, 359). These organizations provide aid and assist disaster victims without regard to aggressor or victim status. Classic humanitarian organizations seek to save lives, relieve human suffering and improve the conditions of those who find themselves marginalized, and aim to do so apolitically and universally (Chandler 2001).

Increasingly, scholars see humanitarianism used to describe engagement in regions of questionable political stability or activities conducted in concert with ongoing military operations. In her paper, *Humanitarian War: A New Consensus*, Woodward (2001) suggests that classic humanitarianism disappeared upon the merging of humanitarianism and politics during the intervention of the North Atlantic Treaty Organization (NATO) into Yugoslavia in 1999. In her words, it was a "war instituted for humanitarian principles" (Woodward 2001, 331). Kent (2004) adds to this assertion by suggesting that humanitarian action has become an acceptable substitute for political action or a means of filling the gap when political solutions are absent. Others have gone so far as to make the claim that "humanitarian action has been politicized to an extent rarely seen" mostly due to a contamination of humanitarian concepts from and an association with military forces in Iraq and Afghanistan (Donini, Minear and Walker 2004, 191-192).

The term "new humanitarianism" is used to describe "Western governments' strategy to transform conflicts, decrease violence and set the stage for liberal development" (Duffield *et al*. 2001, 269). Fox (2001, 275) further asserts that "new

humanitarianism" is political and she "sees apolitical, neutral, humanitarian relief as both naïve and morally questionable". Chandler (2001) goes on to categorize new humanitarianism as a politicized, rights-based movement "which has succeeded in redefining humanitarian policy" (Chandler 2001, 678). Chandler also voices the concern that this new movement challenges "every principle that demarcated the traditional framework of humanitarian action" and that new humanitarians no longer "advocate a principled neutrality, nor defend the most basic level of humanitarian relief as a universal right" (Chandler 2001, 700).

Modern disaster relief staging areas are replete with advertising that rivals a NASCAR or World Cup Soccer event. A visitor to a relief staging area will see logo-emblazoned aid being loaded and scurrying relief workers wearing the hats, vests, and t-shirts bearing the names, logos, and colors of many relief organizations. As far back as 1994, humanitarian operations in Goma were awash in "t-shirts, stickers and flags" or as Stockton called them, the "modern symbols of international aid" (1998, 358). This kind of flag flying is a result of "the higher profile being sought by donor institutions in relief operations" (Walker 1992, 156). However, while identifying attire allows for quick identification of members of a relief organization, similar to a military uniform, the attire may also have an alternate function. Similar to television commercials or billboard ads, logos provide for advertising, brand recognition, and product marketing. In this case, the product is humanitarian aid.

Relief organization leaders will make every attempt to ensure that news cameras capture their logos for broadcast to the global community. Media coverage provides name brand recognition for humanitarian organizations and assists these organizations with gathering the support they require to do their job. The correlation between the media's coverage of a disaster and political and donor activity which often results in action or aid commitments is known as the "CNN effect" (Olson, Carstensen and Hoyen 2003, 110) or "CNN factor" (Roberts 1993, 446; Whitman 1994, 167). When people see an organization's logo in and amongst the suffering, it sticks in their minds. The next time they reach for their wallet to donate to a worthy cause, the logo-emblazoned vision may still be with them.

Military organizations conducting foreign humanitarian assistance are not immune to any of the factors that influence the actions of humanitarian organizations. Responding to a disaster is an opportunity to show a positive aspect of US foreign policy. For example, the US was one of the largest contributors to the disaster response efforts following the 2004 Indian Ocean tsunami and 2005 Kashmir earthquake. Not only did US contributions save many lives, but each effort also supported the strategic information objectives of the current administration's Global War on Terrorism (Bello 2006) by showing the US flag in a positive light in Muslim countries. Foreign humanitarian operations also open the possibilities to engage in productive dialogue with other countries if relations have been less than cordial in the past.

Understanding the different motivations behind the variety of humanitarian organizations is critical to solving problems such as improving coordination during disaster response. While the classic humanitarian organization may not be as ubiquitous as it may have been in the past, the individuals who have deployed to a foreign country to relieve suffering will still demonstrate the tenets of classic humanitarianism even under the most difficult conditions. The author observed this divergence of individual motivations from organizational motivations during many personal interactions in Pakistan. Equipped with a better understanding of disaster studies and terminology, as well as an appreciation for the changing nature of humanitarianism, the reader can now be introduced to the approach used in this study and the methods employed in this research.

Research Focus Areas

Many factors influence how people fare in disasters and how society responds to a disaster victim's needs. Similarly, a researcher can focus in any number of subject areas when trying to define the research question and develop solutions. A research focus area is synonymous with a research approach. The solutions that result from research may incorporate contributions from the analysis one or many areas. A multi-focus solution, which incorporates a number of strategies to problem-solving may provide a more inclusive or holistic remedy to address the root causes of a

disaster. The focus areas in Figure 1.4 are germane to the study of impediments to disaster response in Pakistan, providing a number of possible research approaches. However, three areas dominate the research and recommendations made in this dissertation: Organizational Dynamics, Technology, and Civil-Military. The research did not use each area in isolation, but instead drew on complementary contributions of adjacent areas when possible.

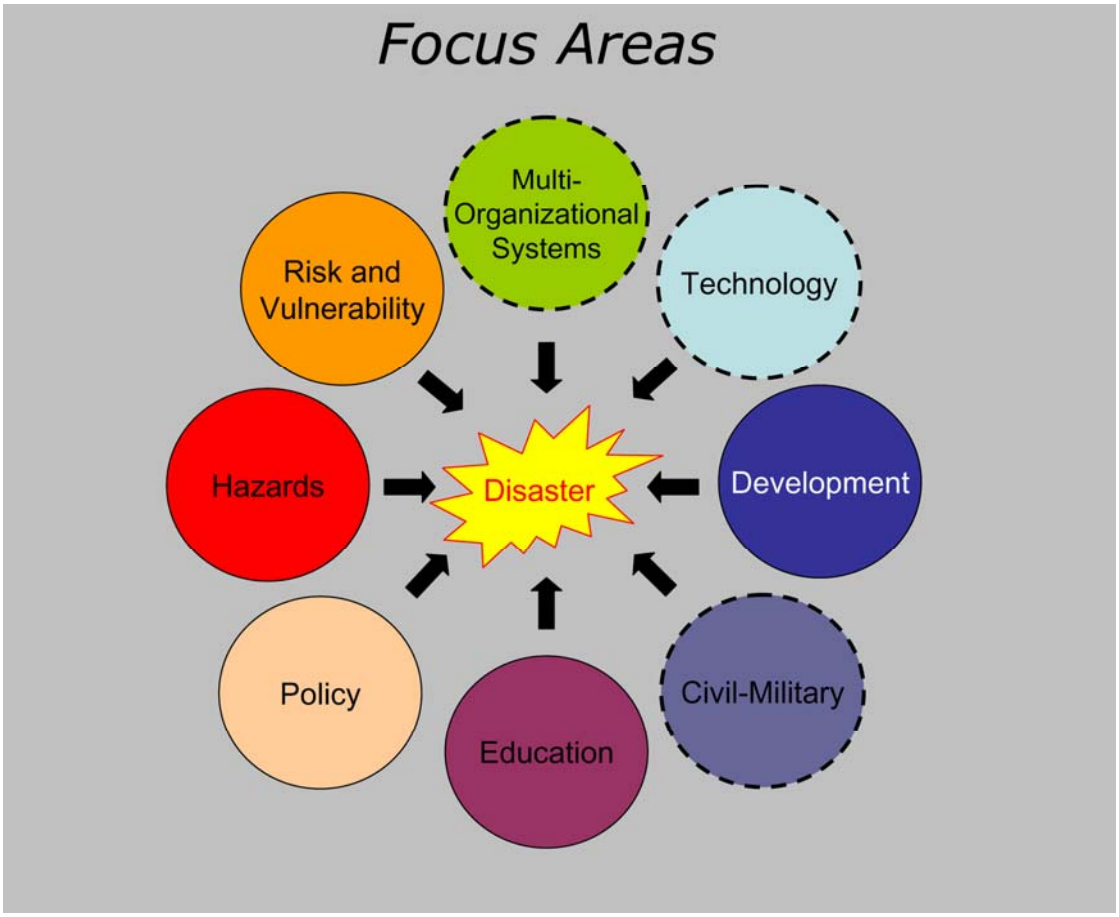

Figure 1.4. Research Focus Areas. The chart above shows a sampling of the topics which researchers could pursue to develop solutions to problems impeding disaster preparedness and response. Many had direct bearing on the disaster response efforts in Pakistan.

Disaster scholars have studied how organizations adapt to disasters (Kreps *et al.* 2007), the theory of organizational response to disasters (Quarantelli 2000), and organizational behavior in emergency management (Rotanz 2007). Coordination within and between organizations is critical in disaster response (Auf Der Heide 1989;

Moore *et al.* 2003; Militello 2007). Observations made in Pakistan imply that improving coordination amongst many actors was a critical focus area for this research. Some have even suggested that an overall lack of coordination was the single greatest impediment to disaster relief in Pakistan (Hicks and Pappas 2006). This dissertation addresses at length improving coordination between disaster response actors by examining their actions through an organizational framework at length.

There is little evidence that increasing technology utilization in disaster response has resulted in any improvements (Quarantelli 2000). This implies that researchers can best view technology as an enabler and not an ends in itself. Disaster researchers must research subject areas, such as technology, to improve disaster response efficiency or effectiveness (Taylor 1986). Scholars have noted that certain technologies, especially GIS, are particularly useful as decision-support tools (Cooke 1992; Cova 1999; Herold *et al*. 2005). Others have written at-large on the applications of GIS in disasters (Alexander 1995; Coppock 1995; Waugh 1995; Amdahl 2001; Thomas *et al.* 2002; Cutter 2003; Galloway 2003; Laefer *et al*. 2006; NRC 2007). However, the contributions of technology in disasters are not limited to GIS. Collecting, processing, and sharing data of all types is critical as well. Personal computer tablets, cellular phone and personal digital assistants with embedded global positioning systems and imaging capabilities can be leveraged to collect and share data. Although technology exists, which can enable collecting and sharing of vast quantities of data, some organizations in Pakistan did not have access to the information they needed to make rescue and relief decisions (Currion 2005), nor were they able to contribute information regarding their relief actions. This adversely affected coordination during the disaster response on a large-scale.

Military forces from Pakistan and many other nations played key roles in the Kashmir earthquake relief effort. Similarly, other humanitarian efforts have utilized military forces extensively (Walker 1992; Gaydos and Luz 1994; USDOD 2001; Palka 2005). However, military intervention into the primarily civilian realm of humanitarian action is not without controversy (Cuny 1983; Walker 1992; Alexander 1999; Alexander 2000; Palka 2005; Bello 2006; Daniel 2006; Waldo 2006). In Pakistan there were tensions between civilian and military organizations which

detracted from effective and efficient disaster response. Therefore, examining civil-military interaction was an obvious approach to scrutinize relief impediments for this dissertation. Focusing on civil-military interactions also created the best opportunity for this author to make meaningful contributions to disaster studies.

Methods

The research in this dissertation breaks with traditional disaster experimental focus and design out of necessity in order to take advantage of a unique research opportunity. Whereas many disaster scholars traditionally focus on the victims of disasters and the social context in which disasters occur, this research focuses on those who respond to disasters. A standard approach to disaster research would include designating a study area (locus), formulating a hypothesis, designing an experiment, and collecting data (usually through victim survey). As a rule, disaster researchers complete their work "post hoc" with the "locus" not selected by the researcher, but by the emergence of a hazard (Killian 2002, 52-53). In the case of this research, the author was already in a disaster area and made observations without the benefit of theoretical frameworks or an existing hypothesis. Although non-traditional, this afforded him the distinct advantage of being able to observe the disaster in its infancy and follow it as it unfolded. It provided a unique opportunity to gather observations as an insider, who was intimately involved in the response to a disaster and not be influenced by study bias.

However, when a researcher uses his or her own observations as a data source, he or she may create some concern if not outright conflict with established scientific methodology. As such, the methodology employed in this research must address concerns that the observations made during this study in Pakistan could be biased and self-serving as they represent an "n" of one and were made prior to formulating a hypothesis. This, however, does not render the observations made in Pakistan invalid nor diminish their contributions to this study or to the field of disasters. The observations in Pakistan were made by a mature person who was trained to focus on detail, discern fact from fallacy, and who understood the scientific method. Still, the circumstances of this research did require a cross-validation of the study observations

with those of other observers and researchers in both Pakistan and other relief efforts. This was similar to the approach known as comparative research (Peacock 2002), which is an accepted approach to disaster research.

The author began to formulate an initial research agenda for this dissertation toward the end of his participation in the Kashmir relief effort. During the response to the Kashmir earthquake, the author noted that some aspects of the effort went well, while other elements appeared to impede effective and efficient relief. Of the observations he made, the author chose to focus on perceived problems that had a common theme and appeared to be systemic at an organizational level. Figure 1.5 details the methodology employed in this research.

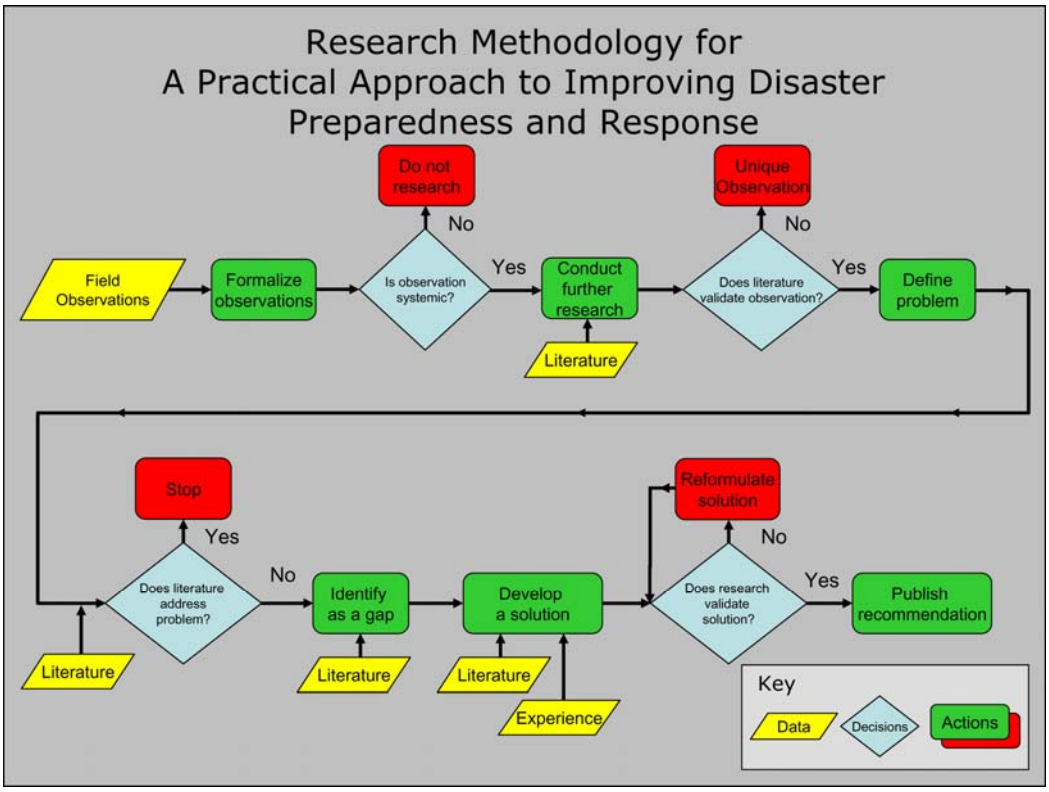

Figure 1.5. Research methodology used in this dissertation.

The rationale behind this approach was to eliminate non-systemic impediments such as individual personality issues or unique circumstantial occurrences. These impediments would not possess the gravity to influence problems that were response-wide in their scope, nor would they be likely to repeat in future disasters. Researching

the root causes of these impediments and recommending solutions would result in nothing more than one-time fixes and the lessons learned would be difficult to extrapolate to future relief efforts.

Having identified large-scale, systemic impediments, the next step was to engage the literature and determine if it addressed these areas in any detail. If prior research had not addressed the problems or if they were under-addressed, the author identified the problems as gaps in the literature. By addressing gaps in the literature, the results of this study can provide a small but unique contribution to the field of disaster studies. The next step was to formulate a remedy or solution that addresses impediments on a systemic level. This step employed both art and science approaches. The art component comes from using personal experience to refine any solutions which were developed. The art is often a qualitative approach and may involve intuition or "gut feelings." The science component is more quantitative and entailed using scholarly literature to validate the solution. Using both approaches would ensure that any recommended solutions would be feasible, acceptable, and suitable (FAS). If a solution did not pass a literature validation or the FAS test, the author reformulated the solution and went through another iteration of validation.

In the end, any recommendations are just that, recommendations. Every new disaster response effort will consist of different geography, hazards, levels of development, levels of preparedness, composition of response personnel, and availability of response resources. Therefore, each recommendation must be able to accommodate differing environments and circumstances. A recommendation that is constrained to the point that it provides a solution in only one disaster scenario will be less valuable to future efforts.

Finally, in another departure from prevailing disaster research, this dissertation primarily focuses on the actions of disaster responders instead of the disaster victims themselves. One scholar echoed the sentiments of others by asserting that the disaster in Pakistan "was actually a social, not a natural disaster" (Ozerdem 2006, 398) which was compounded by pre-existing physical factors and induced by an uncoordinated response from a group of actors. Such statements suggest that one possible path to improving future disaster response resides in focusing on the actions of the

organizations which are supposed to plan and execute rescue, evacuation and aid delivery, instead of focusing on the victims. This is the path this author has chosen to take. The following section will address the objectives, methods, and expected outcomes for each of the three manuscripts.

Chapter Three represents a departure from the theme of disaster relief in developing countries. Although there is a rich research agenda in the developing world, this work done is this chapter takes advantage of opportunities for local community outreach. Chapter Three focuses on risk assessment and relief center selection as a component of disaster preparedness. Preparedness has a link to disaster response, as prepared communities require fewer resources for post-hazard rescue and relief (Perry 1985; Drabek 1986). Additionally, communities with greater preparedness can more readily and efficiently receive and integrate outside resources into their relief effort. The research question for this manuscript asks if there is a practical method whereby emergency managers can assess community risk and employ a set of criteria to select relief centers.

Objectives for this research topic are:

- Demonstrate a effective method that can determine what is at risk in a community
- Demonstrate a effective method that can show community emergency managers which facilities have the least risk
- Demonstrate how facilities with high survivability traits can be integrated into a community-wide relief center plan
- Develop a set of qualitative and quantitative considerations that can be used to evaluate the suitability of relief centers

Methods used in this research are:

- Using the data from Benton County, Oregon:
  - Map known hazards, population, and critical facilities
  - Identify what portion of the population and critical facilities are at risk
  - Identify which critical facilities are not at risk
- Examine relevant literature and determine considerations for developing a community relief center plan

Expected outcomes are:

- A methodology for determining risk populations and critical facilities
- A set of qualitative and quantitative considerations for relief center selection
- A community-wide relief center proposal

The manuscript in Chapter Four examines how the failure to collect and share geo-information affected disaster response coordination in Pakistan. During the Kashmir earthquake response, planners and decision makers did not have a common operational picture of the "disasterspace". A common operational picture allows disaster responders to coordinate their actions, resulting in an efficient and effective effort (Taylor 1986). This paper does not focus on or recommend the use of specific software or technologies. It does, however, suggest a geo-information structure intended to increase the accessibility of geo-information to a diverse group of users and manage geo-information during future disaster relief efforts. The research question for this manuscript asks if research can result in a framework which facilitates geo-information sharing and accessibility for all hazards on a global scale.

Objectives for this research topic are:

- Codify observations regarding the use of geo-information and related technologies in the Kashmir Earthquake of October 2005
- Inventory what researchers have done to address this topic
- Make recommendations for improving future geo-information accessibility

Methods used in this research are:

- Examine impediments to and successful uses of geo-information management and utilization by incorporating:
    - Observations from the 2005 Kashmir earthquake
    - Observations in other disaster response efforts
    - Available literature which addresses the topic of geo-information and disaster response

Expected outcomes are:

- A geo-information structure that will enable the humanitarian community to leverage available geo-information and technologies

- An implementation strategy for the proposed geo-information structure

The last manuscript in this dissertation focuses on the organizational composition of a relief effort and investigates how a military organization can seamlessly integrate into a civilian-controlled relief effort. Involving military forces in humanitarian actions has been and is still a "highly political and emotionally charged subject" (Walker 1992, 152). Civilians are concerned about creating the perception of an alliance with military forces. Military leaders may see involvement in the humanitarian realm as a conflict in priorities and a drain on resources. However, each organization, civilian or military, has valuable skills and experiences that it can bring to bear in an attempt to solve the complex problems encountered in disaster relief operations. Civil-military operations in the Kashmir earthquake response were conducted in a relatively coordinated, cordial manner. The research questions for this manuscript asks if elements which made the Kashmir mission successful can be identified and if so, can they be codified in a model or framework which can be extrapolated to future disaster response efforts.

Objectives for this research topic are:

- Codify organizational-level observations and lessons learned during the Kashmir earthquake relief effort

- Determine how military leaders can assist in creating a more cooperative relief environment

Methods used in this research are:

- Examine observations and lessons learned from the Kashmir earthquake and other civil-military humanitarian efforts

- Review current literature that examines and critiques:
  - The organizational structure of large scale disaster relief operations where military and civilian actors participated
  - The roles of each actor (governmental, NGO, PVO, military) in the ever increasingly complex humanitarian environment
  - Concerns from both the civilian and military perspective regarding the employment of military personnel and resources in the humanitarian realm

Expected outcomes are:

- Clarification of the roles and relationships between other actors and an assisting military organization during a disaster response effort

- Recommendations to improve coordination and capabilities in civil-military disaster relief operations.

- A model whereby responding military forces can effectively integrate their assets into a disaster response effort

CHAPTER 2 - SEISMOLOGY, SEISMIC RISK, AND PREPAREDNESS IN PAKISTAN

SUB-HIMALAYAN TECTONICS

The thrust of this chapter is not a detailed geologic analysis, but an attempt to provide the reader with a basic understanding of tectonics in South Asia, the events of the 2005 Kashmir earthquake, and the challenges facing governments to prepare for these hazards. The large-scale process of continental-to-continental collision between the Indian and Eurasian plates dominates regional tectonics in South Asia. These two plates converge at a rate of approximately 50 mm per year (Khattri 1987). This is a little less than twice the speed at which a fingernail grows. This rate does vary somewhat as convergence between India and Southern Tibet is approximately 20 mm per year. During convergence, the plates collide and "stick" in areas, resulting in the deformation of the Earth's surface and the accumulation of strain. Over time, this deformation gave lift to the Himalayan Mountain Range. If the plates could simply slip past each other along faults, there would be no accumulation of strain and little deformation of the land surface. There would also be no earthquakes.

However, this is not the case. Scientists have noted that while the plates along the Himalayan Front continue to move, there is an absence of movement at the surface. The absence of measured surface movement suggests that somewhere below the surface of the earth, the plates are locked and are accumulating strain (Bilham 2004). When the locked portion of the plates overcomes the strength of the sub-surface materials, the accumulated strain is released resulting in an earthquake. Bilham finds that strain release in South Asia happens infrequently; therefore, when it does occur, the earthquakes are large.

Scientists do not have a complete understanding of seismicity in northern Pakistan and Kashmir, but they do believe that large Himalayan earthquakes greater than magnitude 7.5 will occur in the future. The large-scale tectonics and the long-term forces in the region are well understood, but the short-term processes that control the timing of earthquakes along the Himalayan thrust front are not (Bilham and Hough 2006). In addition to the complex geology of the area, factors such as differing convergence rates and the uncertainty of reoccurrence of large events in the region

make accurate short-term forecasting more difficult (Yeats and Thakur 1998). This creates a challenge for scientists as they can explain to concerned individuals and groups what is happening, but not when or exactly where it will occur.

When earthquakes occur, they may not rupture along the entire extent of a fault. While given segments of a fault may have ruptured in the past, other segments along that same fault may not have ruptured. Seismologists call these non-ruptured segments seismic gaps, and classify them as "a section of a fault that has produced large earthquakes in the past, but has been quiet recently, and has been experiencing strain accumulation" (Gahalaut 2006, 507). This means that there is still the potential for an earthquake in that area. Scientists believe that there are many seismic gaps on the Indian sub-continent, including one in Kashmir (e.g., Khattri 1987). In order to identify seismic gaps, scientists must look for evidence of paleo- and historical earthquakes and measure current surface deformation with geodetic techniques like global positioning systems and advanced technology such as synthetic aperture radar (Quittmeyer and Jacob 1979; Yeats and Thakur 1998; Thakur 2006). These are important steps in predicting the possibility of future seismic events in northern Pakistan and Kashmir.

However, gap theory is difficult to apply to the Kashmir section of the Himalayan boundary (Quittmeyer and Jacob 1979) and no one can be sure as to whether the 2005 Kashmir earthquake completely or partially released the accumulated strain along the Bagh-Balakot fault (Kaneda *et al.* 2006). If the 2005 Kashmir earthquake released some of the accumulated strain in the Kashmir gap, then the people of Azad Jammu and Kashmir may have a bit of a reprieve. However, if this temblor was in fact, outside the Kashmir gap, then a large earthquake, with 450 years of stored strain potential may still exist (Gahalaut 2006). Should this prediction be correct, the Pakistanis now find themselves in a compounded predicament as they continue to recover from the damage of the last earthquake while an even larger temblor may loom in the not so distant future.

HISTORICAL EARTHQUAKES IN PAKISTAN

Evidence of large earthquakes in Pakistan and Kashmir is rare and the time between earthquakes, or reoccurrence intervals, may be rather long, on the order of 600 years (Bilham *et al.* 2001). A lack of written or oral records regarding large earthquakes in an area further complicates attempts by scientists to calculate reoccurrence intervals. If scientists are fortunate, the earthquake will create a surface rupture for them to study (Figure 2.1). However, earthquakes can leave no surface rupture. These are known as *blind-thrust events*. The complicated geology of northern Pakistan and Kashmir can further frustrate scientists as they attempt to develop a more complete understanding of seismicity in this region (Yeats and Lillie 1991).

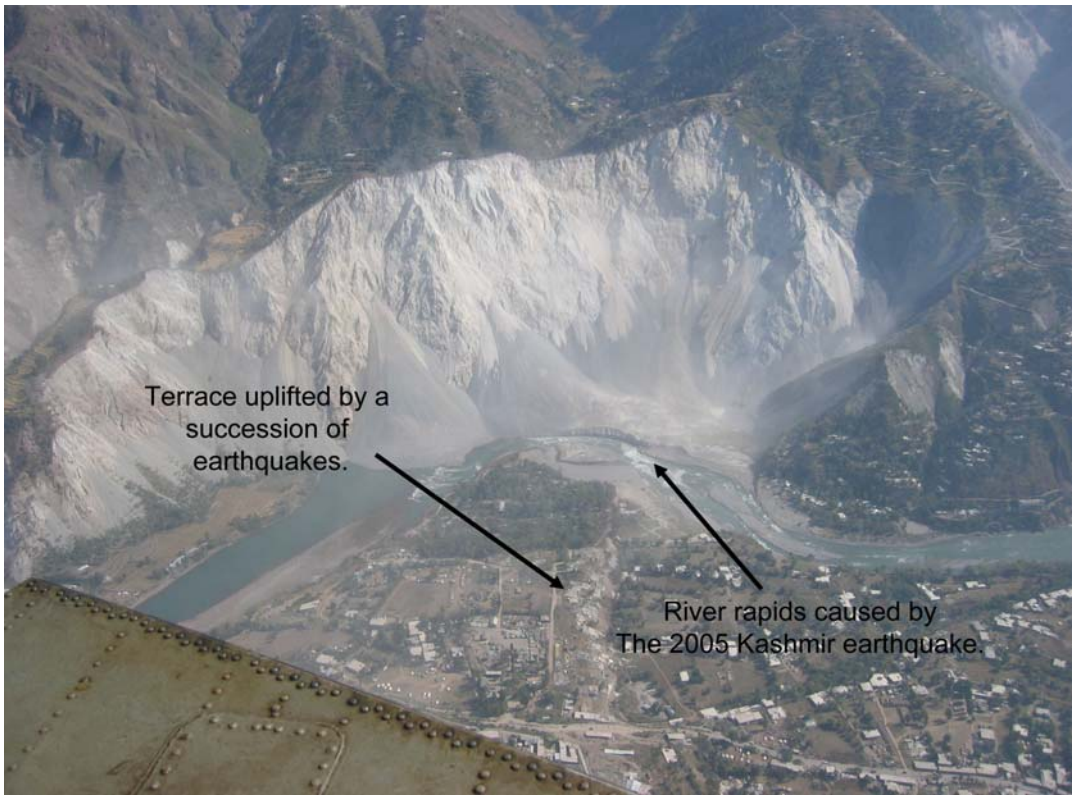

Figure 2.1. Uplifted stream terrace, river rapids and landslide caused by the 2005 Kashmir earthquake. Source: Author.

Despite geological complexities and research barriers, geologists have attempted to reconstruct a historical earthquake record in Pakistan. Quittmeyer and Jacob (1979) broke historical earthquakes into two categories: those events in which

the magnitudes were determined by intensity scales derived from how people "felt" and those events that were recorded by instrumentation. While acknowledging that the historical record of all earthquakes northern Pakistan may be incomplete, scientists believe that local populations were more likely to document larger earthquakes. Quittmeyer and Jacob (1979) interpreted the magnitudes of non-instrumented accounts by using a Modified Mercalli scale of intensity to convert from a Milne, Rossi Forel or descriptive "felt" scales. Their work has contributed greatly to the historical reconstruction of the location and size of many rupture zones, which is a key component in identifying modern seismic gaps. Table 2.1 lists and Figure 2.2 depicts some of Pakistan's large, documented historical earthquakes.

Table 2.1. Historical earthquakes in Pakistan. Sources: Quittmeyer and Jacob (1979) and Ambraseys and Douglas (2004).

Date	Location	Est. Magnitude	Note
1878	Abbottabad	6.7	
1885	Kashmir	6.3	
1892	Chaman	6.7	
1909	Kachhi Plain	7.2	
1931	Sharigh	7.0	
1931	Mach	7.4	
1935	Quetta	7.5	Destroyed the capital and killed 30,000
1945	Makran Coast	8.0	120 km rupture
1974	Pattan	6.2	Killed 5,300
2005	Kashmir	7.6	Killed 73,000

Scientists believe that the largest earthquake in the Kashmir region may have occurred in 1555. This event was so great that scientists believe it caused the Vitasta River (today called the Jhelum River) to reverse its course (Radhakrishna 2006). Although the exact location and magnitude is unknown, research suggests that this earthquake occurred in the Kashmir seismic gap and had an estimated magnitude and slip of 8.6 and 6.2m respectively (Khattri 1999). If the October 8, 2005**,** Kashmir earthquake occurred inside the Kashmir seismic gap, then probable reoccurrence interval can be estimated to be approximately 450 years (Bilham and Hough 2006). However, until scientists are able to complete a more detailed study of the seismicity of the region and the hazards it presents, one cannot be certain of the accuracy of this estimation. What is certain is that the complexity of South Asian seismicity and the

hazard it presents provides a rich, compelling, and urgent research agenda for future study.

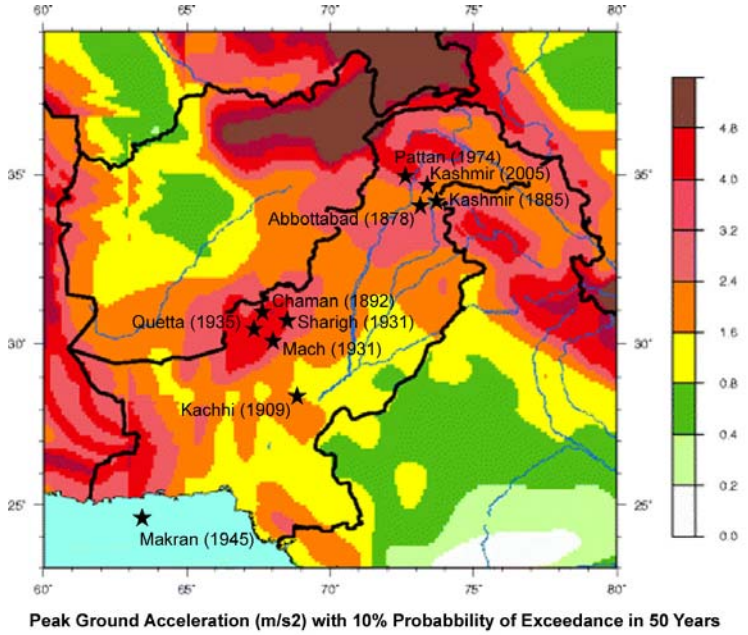

Figure 2.2. Major historical earthquakes in Pakistan demonstrating the correlation between large earthquakes and probability of high peak ground acceleration. Peak ground acceleration base map from USGS (2006). Historical earthquakes data from Quittmeyer and Jacob (1979) and Ambraseys and Douglas (2004).

2005 KASHMIR EARTHQUAKE

On Saturday morning, October 8th, 2005, the Kashmir region in northern Pakistan and India was struck by a magnitude (M_w) 7.6 earthquake. Unlike preceding blind-thrust events, this temblor left a 7-meter surface rupture, 70 kilometers long, following a trace that runs roughly from Bagh to Balakot (Kaneda *et al*. 2008). Hussain and Yeats (2006) interpreted the rupture to be a thrust fault, dipping 20-50 degrees northeast. Although Khattri (1999) had previously suggested the high probability of a large earthquake killing many hundreds of thousands of South Asians and resulting in vast economic devastation, this earthquake took Pakistan by surprise. The surprise may be a result of the fact that there had not been an event of this magnitude in the area for approximately 450-500 years (Bilham and Hough 2006; Thakur 2006). Emulating the 1935 Quetta earthquake, the Kashmir earthquake's

destructive forces heavily damaged Muzaffarabad, the capital of Azad Jammu and Kashmir (AJK), and reduced Bagh and Balakot to rubble.

The earthquake occurred on a school day while classes were in session, killing many educators and scores of students in their classrooms. This earthquake killed an estimated 79,000, injured at least as many more, and left over two million people homeless or displaced. Schools were not the only large public buildings to receive significant damage. The shaking damaged many hospitals, leaving earthquake victims reliant upon makeshift hospitals for treatment. The damage from the earthquake and a lack of local sheltering capacity resulted in a high number of internally displaced persons. On the one-year anniversary of the disaster, approximately 36,000 Kashmiris still remained in refugee camps (Relief Web 2006).

POPULATIONS AT RISK

At-risk populations in Pakistan and Kashmir continue to increase in number, as marginalized people without an alternative move to hazard-prone areas. Similarly, in neighboring India, one third of the population lives in at-risk areas along the edge of the Indo-Gangetic Plain (Radhakrishna 2006). In fact, half of the world's largest cities lie on earthquake-prone plate boundaries (Hough and Bilham 2006). In the developing world, urbanization rates continue to increase. Unlike the developed world where those with the economic means to do so move from the cities to the suburban areas, the developing world sees a reverse migration whereby populations move from the rural areas to the cities in search of jobs. However, as developing world populations increasingly concentrate in cities, they do so without the benefit of seismic resistant construction and materials as well as the social and emergency systems to protect and provide for the population. A sad example of this dichotomy of development is seen in the magnitude 6.7, 1994 Northridge earthquake which killed only 50 people, yet the magnitude 6.6, 2003 Bam earthquake killed 40,000 (Hough and Bilham 2006). A smaller earthquake and nine years to apply lessons from other earthquake disasters did little to stem the loss of life.

SEISMIC PREPAREDNESS IN PAKISTAN

Earthquake preparedness – the actions taken to mitigate the effects of a hazard prior to its onset can 1) result in less destruction and loss of life during the hazard event 2) provide a better foundation from which to launch the rescue effort, and 3) will set the conditions for a quicker transition to and a more rapid recovery and rebuilding phases. Pre-earthquake preparedness deficiencies will hinder the relief effort and impede the follow-on reconstruction programs. Dr. Muhammad Ali Sheikh, a pediatric surgeon from Karachi, assisted in the relief effort in both Mansehra and Abbottabad. He noted that "the main lesson learned was that relief efforts were not coordinated" and a "disaster management plan was lacking" (Sheikh 2005, 747). Others noted a "chronic lack of preparedness," that large modern buildings were "constructed anti-seismically," and first responders consisted of "untrained, unequipped local people" (Alexander 2006a, 1). Prior to the earthquake, the Government of Pakistan (GOP) had formed the Emergency Relief Cell (ERC) to serve as "the focal point during emergencies" and to coordinate the actions of the provincial relief departments (UNS 2005, 4). A few days after the earthquake, the GOP established the Federal Relief Commission (FRC) to coordinate and streamline the relief effort (UNS 2005). While the ERC was functional prior to the Kashmir earthquake, their ability to handle large-scale emergency management tasks was untested and may be the reason that the Pakistani Army General Headquarters was put in charge of relief aid prioritization and distribution as well as search and rescue coordination.

Initial Response Capability

In order to reduce the number of causalities a community will sustain, it is essential that local, first responders have the ability to act quickly, in the hours immediately following a natural disaster. In fact, the rates of rescue "diminish exponentially after 6-8 hours" (Alexander 2006a, 3) and casualty rates are highest in the first 36 hours (Alexander 1999). In high hazard risk areas, local first responders must possess the ability to conduct initial search and rescue, treat and stabilize deep

flesh injuries and broken bones and understand how to receive and load helicopters (Alexander 2006a). After the initial 48 hours, relief workers from around the world will begin to infiltrate the disaster area, bringing reprieve to local rescue teams. In Kashmir, the first large groups of international rescuers showed up 48 to 96 hours after the earthquake. Search and rescue teams from the United Kingdom, Japan, Russia, France and the United States arrived in Islamabad and quickly sought transport to the disaster area. Local first responders may have less training and be more poorly equipped than outside relief providers, but they are available immediately following a hazard event allowing them to act during the critical "golden period" (Alexander 1999). They also possess local knowledge that would enable them to be much more effective in organizing search activities and in providing medical treatment to the injured. Because local rescue and relief personnel are a part of the affected community, it is more likely that they speak the same language as the disaster victims, eliminating the need for translators. Lastly, in Kashmir, as a local responder was likely to be a Muslim, they would have the ability to communicate directly with and treat a Muslim female – a distinct advantage not afforded to an outsider.

Earthquake-Resistant Construction

Preparedness starts well before an earthquake occurs, particularly in terms of building construction. In Kashmir, collapsed residential dwellings resulted in numerous casualties, many of which might have been prevented. Accepted construction techniques include open first floor or "soft story" construction. The soft story provides space for a shop or large gathering area at street level. Unlike upper floors of a building, the first floor of a soft story structure will have few supporting walls. When the building shakes intensely, the few bottom walls are not properly tied into the floor above and cannot support the shaking and weight above them, so they collapse. This results in the first floor "pancaking", which will typically crush its occupants (Figure 2.3). Pancaking walls resulting from soft story construction contribute to the disproportionately large numbers of dead and injured during earthquakes in developing areas and is specifically noted to have been the case in the 2005 Kashmir earthquake (Peiris et al. 2006).

Figure 2.3. Example of a collapsed home in Balakot. Notice the walls have failed and the roof has "pancaked", crushing the contents of the home. Source: Author.

A significant proportion of residential buildings were damaged in Kashmir and as such, homeowners will most likely be involved in the reconstruction of their homes. Therefore, successful rebuilding programs must emphasize seismic resistant construction practices using local labor and locally available materials, whenever possible. In fact, traditional wood frame and masonry infill construction techniques, especially those involving single-family homes, have withstood recent earthquakes (Hough and Bilham 2006). Involving local craftsmen during the reconstruction process can also lead to the training in seismic resistant construction techniques to other craftsmen in the area (Ozerdem 2006).

The Role of Government in Seismic Preparedness

Governments at all levels must take the lead to ensure the safety of their citizens in at-risk areas where improperly erected modern public concrete structures such as hospitals, schools, apartment buildings, businesses exist. In economically challenged areas, a total rebuild or retrofit of structures, as well as enforcement (in some cases adoption) of seismic codes may be beyond expectations. However, in critical, large occupancy facilities, such as schools, hospitals, and community centers

seismically resistant construction techniques and building codes should receive the greatest emphasis. Not only do these facilities house large populations at any given time, but they also play critical roles in a post-seismic disaster response effort (Radhakrishna 2006).

Sadly, as compelling as implementing seismically resistant construction codes may seem, the failure to do so in countries such as Pakistan and India is largely understandable. The populations of these countries face enormous poverty and the governments are challenged to provide even basic services to their citizens. When viewed in this context, costs associated with making buildings earthquake-safe, as desirable as they may be, are unlikely to get serious attention for a number of reasons. Factors such as time, distance and cultural preference may also play a role in the struggle to implement seismically resistant building codes in Pakistan. Recall that large magnitude earthquakes are infrequent and the reoccurrence intervals between them are usually very long. As noted by Bilham and Hough (2006), successive generations quickly forget such devastating events. Pakistan's previously most devastating earthquake, which killed 30,000 people in 1935 in Quetta, was in a location far removed from today's modern capital. Additionally, most of the regions of Pakistan with the greatest seismic threat are in areas populated by people who are ethnically very different from the Punjabi national leadership.

THE WAY AHEAD

The Kashmir earthquake of October 2005 caused the greatest recorded loss of human life from an earthquake along the frontal Himalaya. This event should serve as a wake-up call for the governments and citizens of countries in this region to push for and create less vulnerable communities. The Government of Pakistan has committed to a newfound willingness to invest in seismic resistant construction and earthquake monitoring and preparedness. It remains to be seen whether this "honeymoon effect" or teachable moment will last until solutions can be implemented.

A country struggling with domestic economic issues, dealing with unrest in tribal areas, or even facing the prospect of civil war may not see the feasibility or even the utility of significant investment in systems to mitigate events that events which are

rare in occurrence. However, by focusing on government preparedness at the national, regional and local levels, countries can ensure that the systems, which allow for first response in a disaster and enable the integration of follow-on capabilities into a disaster response plan, are in place ahead of time. Proper seismically constructed buildings, especially in schools, hospitals and multi-family dwellings will greatly decrease loss of life and allow for post-disaster treatment of the injured and sheltering of displaced persons. Lastly, governments should make every effort to ensure families are educated on what to do in the event of an earthquake. Many of the above recommendations were not in place prior to the Kashmir earthquake. If they had been, it is quite possible that a significant number of the 73,000 Kashmiris who perished would be alive today.

Finally, continued work toward understanding and predicting these catastrophic events will over time, allow governments to better prepare for such disasters. As seismologists are better able to identify seismic gaps and tell officials which areas are more hazard-prone, governments can focus their scarce resources in those areas. Such revelations may result in better-prepared communities that are more capable of withstanding the next event, without incurring in the number of casualties and destruction seen in Kashmir. The earth is giving up its secrets through the seismological and geomorphological manifestation of tectonic forces and the evidence left by earthquakes of the past. It is up to the tenants of this magnificent, powerful sphere to learn how to interpret these signs and coexist in such an environment.

CHAPTER 3

SCHOOL-BASED RELIEF CENTERS: A COMMUNITY LEVEL ASSESSMENT AND DISCUSSION

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ABSTRACT

An effective community relief center plan provides emergency managers with the ability to provide shelter and services to a population following the onset of a hazard and is a key component of emergency preparedness and disaster recovery. This paper presents a practical method whereby an assessment of schools as the basis of a community-wide relief center plan is made. The paper suggests desired characteristics of a relief center, details a selection methodology, and provides recommendations for implementation of a community relief center plan. Alternative considerations and the role of GIS are also discussed.

KEYWORDS: schools, disaster preparedness, emergency preparedness, emergency shelters, relief shelters, GIS

INTRODUCTION

Where does one go in their community to get help during a disaster? Following an earthquake, hurricane, or flood, should homes be rendered unsafe to occupy? Where does a single mother and her children or an elderly couple go for shelter and support? If the power was out, and radio, television, landline and cellular phones were inoperative, how would a community stay informed? In the event of a hazardous material spill or terrorist attack, what preparations have been made to protect a community and provide for the overflow of patients in a mass casualty situation? These are questions that emergency managers, especially at the city and county levels, must find solutions to. Certainly the time to make this assessment and develop a plan of action is not after the onset of a natural hazard (e.g. earthquake, flood, wildfire or storm), technological or man-made hazard (e.g. hazardous material spill, explosion or urban fire), or terrorist attack, but well before the hazard occurs.

The research question in this paper focuses on whether the characteristics and spatial distribution of schools in Corvallis make them a viable option for utilization as relief centers. This paper is based on previous work (Thompson 2007) that employed an integrated hazard and capacity/vulnerability analysis approach to risk assessment similar to suggestions by Wisner et al. (2006). The methodology used in this research - assessing threats to a community and then developing a shelter plan which is based not only on available resources, but also the needs and actions of survivors – conforms well to Perry and Lindell's (2003, 340) recommendation that preparedness planning be "based upon accurate knowledge of the threat and of likely human responses". The paper begins with an examination of hazards facing the City of Corvallis, located in Benton County, Oregon. It then discusses desired aspects of a relief center, explores a methodology for the selection of relief center locations, and makes recommendations for a proposed course of action intended to meet community relief center requirements. The use of schools as relief centers in other communities, study error, and alternative considerations are also discussed.

Throughout this paper, the term "relief center" shall be used. Other terms synonymous with relief centers which are found in emergency management literature include relief shelters, emergency shelters, community shelters, fallout shelters, and

congregate care facilities. The rationale behind the decision to use the term “center” is that the facility and persons staffing it will provide many functions other than sheltering and care. Relief centers should provide shelter, medical support, distribution of goods and materiel, and a place to maintain the social networks of neighborhood or community. In a large scale disaster resulting in numerous casualties, a relief center would provide medical triage, immediate evacuation, and collection for onward movement of casualties to safer areas.

Communities may find themselves with the requirement to shelter a population from outside their immediate area. This may occur when a neighboring community has experienced some type of hazard which has rendered their community unfit to live in or when community resources have exceeded their capacity to respond to disaster requirements. Large relocations of community members have occurred recently following many small disasters and especially so in larger events such as the 2004 Indian Ocean earthquake and tsunami, Hurricane Katrina (2005), and the South Asia earthquake (2005).

Relief centers also play a key role in information management during a disaster, especially when traditional forms of communications have been disrupted. Two-way information exchange is critical to the successful emergency management (Guha-Sapir and Lechat 1986; Quarantelli 1997; Alexander 1999; Militello 2007) and may take the form of posting public information flyers or having relief personnel staff information stations. At relief centers, citizens could not only access information in times when radio, television and phones are disrupted, but they could also submit individual or neighborhood needs and requests. Citizen requirements would be consolidated at relief centers and forwarded to city or county emergency operations centers for action.

The Red Cross has responsibility for implementing a shelter management plan in Corvallis following a disaster (Leeper 2007; Peirson 2007). The Red Cross will open, manage and staff shelter facilities upon the request of Benton County Emergency Management personnel. The current shelter plan calls for the locations of the shelters to be made available to the public after the hazard event. This will normally be done by means of public service announcement through the joint

information center. However, emergency planners should note that research suggests that disaster victims have reported that warning message rarely "the source of information about the availability of the place to which they evacuated" (Perry 1985, 149). This may lend itself to the establishment of pre-designated evacuation centers.

METHODS

Research was conducted in order to assess the number of households and critical facilities in Corvallis and the smaller surrounding communities that would be affected by hazards selected from the Benton County hazard ranking (Thompson 2007). Critical facilities examined during the analysis included hospitals, police stations, fire stations and schools. The facilities selected in this study are in line with FEMA guidance (FEMA 2007). However, FEMA encourages each jurisdiction to determine which facilities are critical to their community. The vulnerability analysis used a geographic information system (GIS) to find the coincidence of hazards (polygons) and residential addresses (point data) or critical facilities (point data). GIS allows the analysis of spatial data, such as hazard and population information to produce precise, verifiable solutions in the form of a table or a map. GIS allows the user to ask the map a question.

The methodology used in the risk assessment consisted of defining the existing or predicted hazards which could affect Corvallis and then mapping the coincidence of the community population and critical facilities with these hazards. This creates a risk map (Figure 3.1). The risk map shows who and what is at risk. For other methods and comparisons of determining populations at risk, see Morrow (1999), Dobson (2003), Wood and Good (2004), and Garb et al. (2007).

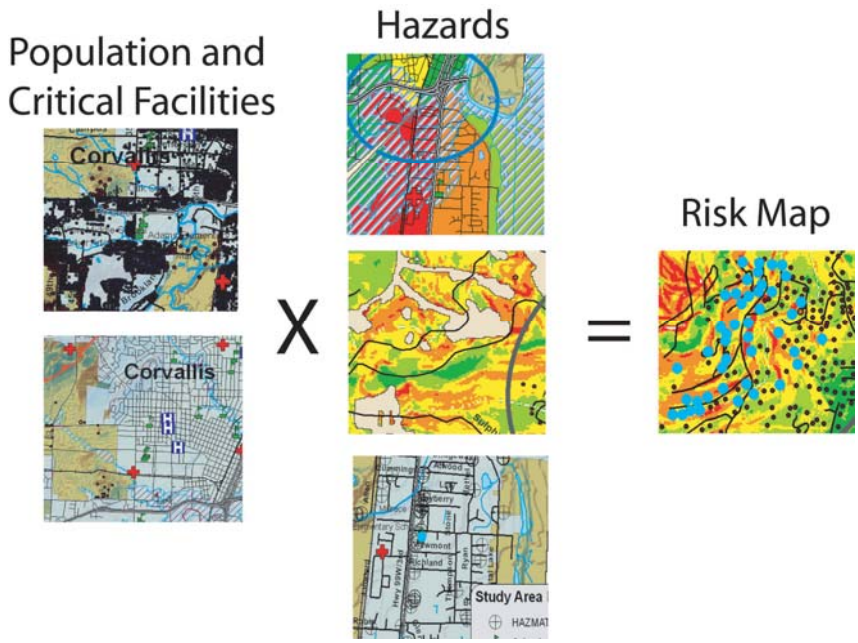

Figure 3.1. GIS Risk Map Methodology.

RELIEF CENTER SELECTION CONSIDERATIONS

Selecting the locations of potential relief centers is both an art and a science (Table 3.1). The art of selection involves qualitative assessments of community needs and the ability to project oneself into the mental state and thought processes of those who have survived a disaster and are seeking assistance; it requires one to see through the eyes of affected persons and predict their needs and actions. The science of selection involves obtaining and analyzing data to assess needs and enhance decision making. Location and desired attributes of relief centers also take into account the requirements of those who are organizing relief and providing assistance.

Some desired characteristics of relief centers can be easily measured in a quantitative manner, thus giving emergency management planners the ability to set minimum desirable criteria. One such criterion is location. Ideally the location of proposed centers would not coincide with known or probable hazards (e.g., occupancy of flood plains or being situated on steep slopes). Relief center structures should be hazard resistant or have undergone retrofitting to increase their survivability. In the case of a seismic hazard, structural improvements would increase a facility's resistance to an earthquake. Relief centers should be well distributed throughout a

community, with minimal underlap. This allows greater access and ensures a more uniform community-wide coverage. Another consideration is the size of the facility. The size of a facility relates directly to the facility's ability to accept, process, shelter, and sustain large groups of people, receive delivery of bulk relief and disperse that relief to those in need. Finally, if intended to be used in a mass casualty situation, relief centers should have enough open space to allow for landing aeromedical evacuation helicopters. A UH-60 Blackhawk, for example, requires a landing zone with a radius of 30m. A GIS can be utilized for this analysis as well.

Other considerations include social factors (for a more complete discussion of social considerations see Bolin and Stanford 1991). These are more qualitatively measured, but are very important nonetheless. To ensure maximum utilization during a disaster, the relief center should be a place in which community members feel welcome, even if they have little affiliation with the function of that facility. For example, a Muslim family who lives very near a synagogue or a Baptist church may feel hesitant to enter that facility in search of assistance, even in a time of crisis. For this reason, churches, synagogues, temples, and mosques would not be the best choices as relief centers. This, however, should not discourage the engagement of members of religious organizations to work as volunteers and provide support during a disaster. Relief centers, ideally, should be iconic to the community. There are certain places in a community that "everyone knows about." These are places the community members drive by, see on their daily walks or interact with on a continual basis. They read about them in the paper, but more importantly they know where the closest one is.

Table 3.1. Qualitative and quantitative relief center selection considerations.

Quantitative Considerations	Qualitative Considerations
Minimal coincidence with hazards	Welcoming environment
Hazard resistant or retrofitted	Iconic to community
Location - cover entire community	
Size and equipping - able to accept, process, shelter and sustain evacuees	
Area to receive and distribute bulk relief aid	
Open space for helicopter landing zones	

In a method similar to the one used to determine the proximity of residential addresses to hazards (Thompson 2007), these same residential addresses were analyzed in a GIS as to their proximity to schools. Twenty-two Corvallis schools or public school properties, to include the Linn Benton Community College and Oregon State University campuses, were used in this analysis. A simple "selection by location" operation was performed to determine which homes were within a one-half mile buffered geographic extent of school locations in the community (Figure 3.2).

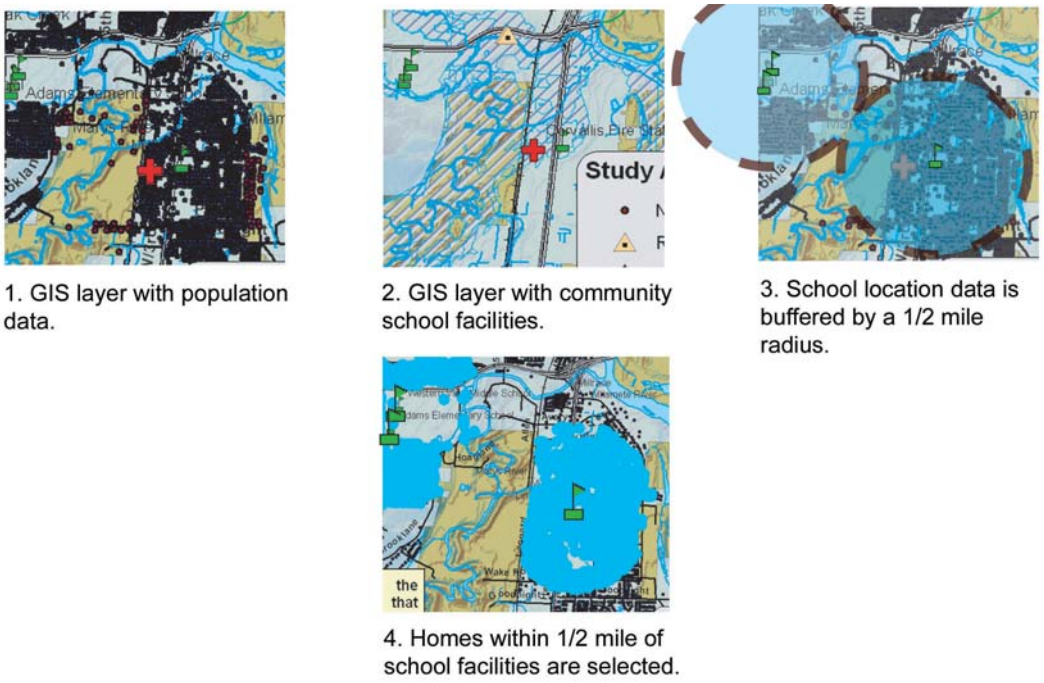

Figure 3.2. GIS methodology for determining number of households within one-half mile of a school facility.

In the absence of any recommended maximum or minimum evacuation distance in the literature, a radius of one-half mile was chosen for this analysis. For the purposes of this study, it was deemed reasonable that this distance would represent homes within a space through which the elderly, very small children and others with limited mobility could move if required following a hazard event. As noted by Bolton (2007), walking is a viable alternative evacuation strategy in a larger scale disaster and may offer the most direct means of getting to a safe area when sheltering in place is not possible; however, distances must be minimized to decrease exposure to ongoing hazards or their effects. Furthermore, evacuation on foot is an often under-addressed

component of a multi-modal mass evacuation despite many communities having significant "car-less" populations (Hess and Gotham 2007). In this assessment, walking distances were used to constrain the coverage a school would provide to the neighboring population. One should note that the distance of one-half mile is much less important than the selection methodology. It is recommended that emergency management planners vary this distance to meet unique community requirements. They may also want to vary the number of schools used to assess the impact on the coverage of the population by different relief center solutions.

RESULTS

Corvallis Community Hazards

Benton County, Oregon and the community of Corvallis face potential exposure to a wide variety of hazards. The Benton County Emergency Operations Plan (EOP) contains an assessment of the hazards that pose a risk to the population of Benton County (Benton County 2006). The assessment, conducted by the county emergency management section (in the office of the county sheriff), employed a variation of the Federal Emergency Management Agency (FEMA) model, which examines hazards in the context of History, Vulnerability, Maximum Threat, and Probability (OEM 2005). Using this methodology, county emergency managers determined that the top threats facing Benton County were (greatest to least): earthquake, flood, snow/ice storm, wind storm, utility failure, wildland fire, hazardous material release and enemy attack.

Table 3.2. Sample results of Benton County household proximity to hazard analysis.

Hazard	Vulnerable Households	% of Total	# of Population Vulnerable
Flooding	4075/32338	12.6%	9780
Wildfire 1/2 mile	4684/32338	14.5%	11242
Wildfire 1/4 mile	1552/32338	4.8%	3725
Landslides (Rapid)	332/10143	3.3%	797

The results of this research suggest that although Benton County faces exposure to many hazards, only a relatively small portion of the population faces direct exposure to the majority of these threats (Table 3.2). This appears to reinforce

the findings of a previous study on hazards and populations at risk in Benton County (Goettel 2006). The one exception to this low percentage impact, which was reported in both studies, is vulnerability to earthquakes. The Geottel study estimated that following a magnitude 7.5 Cascadia Subduction Zone intraplate earthquake, 11,118 people in Benton County would be displaced. Of these displaced persons, approximately one-third or 3,706 would be in need of emergency shelter as others would have alternate arrangements available. The entire Corvallis community should expect to be impacted to some extent during an earthquake. Residents occupying steep terrain, living on soils prone to liquefaction, or occupying inadequately built or reinforced structures should expect to experience the worst effects. Those not directly affected by the destruction of their homes may see utilities, services or the lifelines they depend upon disrupted.

With such small percentages of the community being at risk, are relief centers a necessary element of a community preparedness plan? Past research has shown that an effective community relief center system, providing shelter and services to a population following the onset of a hazard, is a key component of preparedness and recovery (Bolin and Stanford 1991). However, research also suggests that the relief center facilities are underutilized (Perry 1985, Drabek 1986, Tierney et al. 2001) and seen as a last resort. Instead, displaced individuals will often choose to stay with friends or family outside of the affected area if that option is available (Perry and Lindell 2003). Shelters are most often used when evacuees are "less integrated in the community", "have lower incomes", or "rely on public transportation" (Tierney et al. 2001, 97). Additional circumstances which may encourage shelter use are when hazards are "rapid in their onset", provide "little forewarning", or create "large levels of destruction" (Tierney et al. 2001, 98).

Other factors encouraging use of local relief centers, if sheltering in place is not possible, might include the onset of a hazard during the night or during inclement weather. Findings from Perry (1985) and Drabek (1986) and suggest that communities with a high level of preparedness had greater use of relief centers. Drabek also noted that while people tend to avoid public relief centers if an alternative is readily available, they will often go to a relief center for initial support. When only

initial support is sought, relief centers should provide the flexibility of allowing evacuees to register information regarding their alternative accommodations prior to departure (Tierney et al. 2001). Perry (1985, 148) called this a "shelter checkpoint". This information can aid recovery and reconstruction personnel by giving relief workers a means to contact community members if necessary.

Suitability of Corvallis Community Schools as Relief Centers

GIS was used to assess the suitability of school facilities both in terms of their proximity to hazards and the coverage they provide to the population of Corvallis. The first step was to assess the coincidence of schools and other critical facilities with local hazards. GIS analysis showed that all schools are located outside of mapped FEMA designated floodplains and are not located in areas which have questionable slope stability (Goettel 2006; Thompson 2007). As previously mentioned, Corvallis and surrounding communities should expect to be impacted to some extent by an earthquake. This may be especially true for Crescent Valley High School, which is directly crossed by the Corvallis fault. Corvallis schools which were not built to meet seismic resistant standards have been demolished, are no longer used as a school facility, or have undergone some level of structural retrofitting to enhance their resistance to damage by a seismic event (Benton County 2001). From a survivability aspect, schools are a desirable choice for relief centers. While other critical facilities in Corvallis, such as fire stations and hospitals, have similar survivability traits, using them as relief centers may be undesirable as the arrival of displaced persons may overwhelm facilities and staff as well as impede their ability to perform emergency functions.

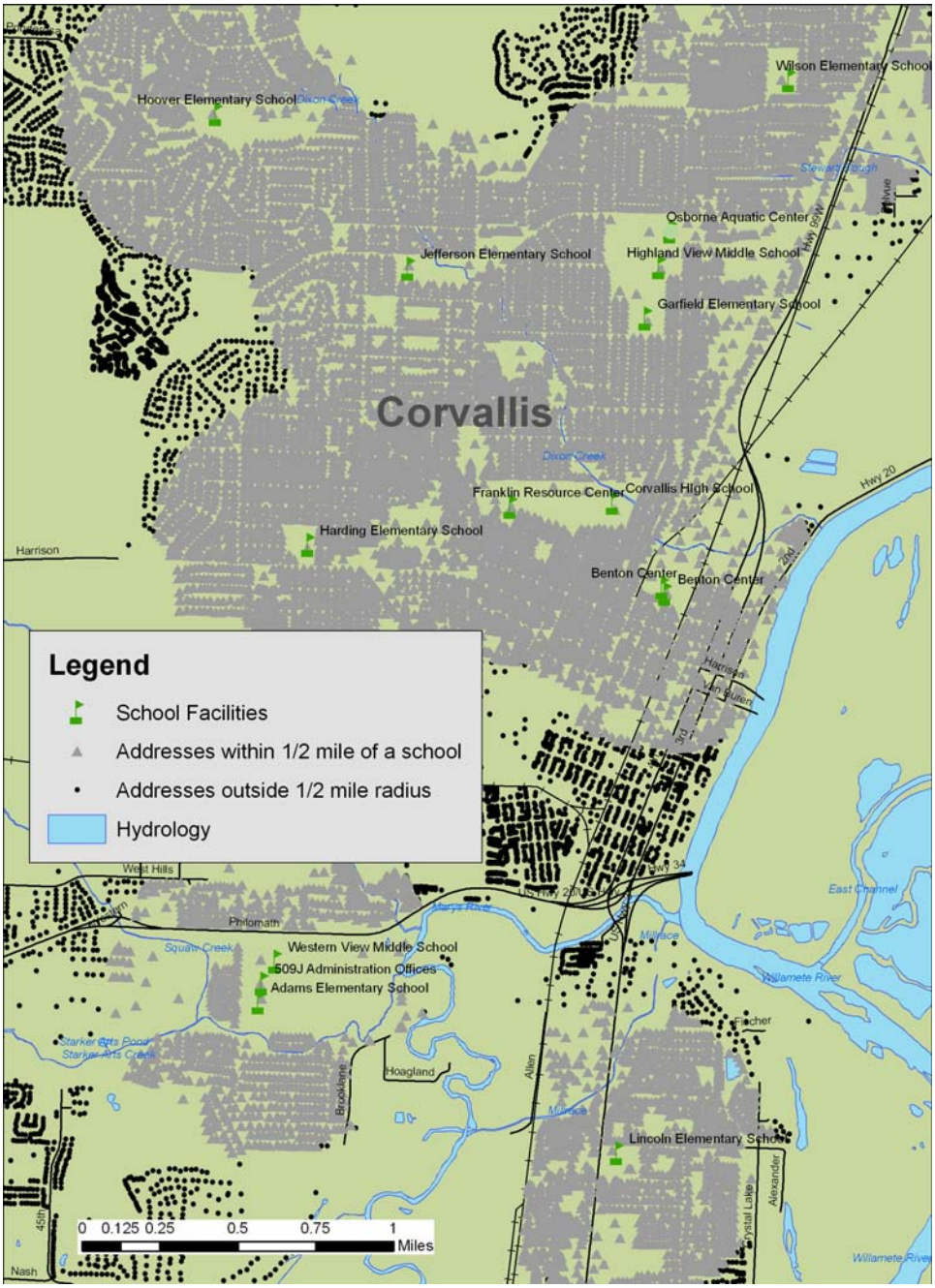

Figure 3.3. Map depicting residential addresses within one-half mile of a school facility.

The results of the GIS analysis showed that 14,367 or 64.7% of residential addresses out of 22,195 sampled were within one-half mile of a school (Figure 3.3). Using the same methodology, the buffer was decreased to one-quarter mile, resulting in a finding of 5,440 or 24.5% of residential addresses out of 22,195 were within the

specified distance of the nearest school. As noted previously, the distance used in the analysis can be varied to meet specific community and resource requirements.

DISCUSSION

The Role of Schools in Disaster Preparedness and Response

Many may view the public (and private) school system as an organization without a disaster-relevant mission; however nothing could be farther from the truth. Emergency managers should view schools as partners in community preparedness. One preparedness functions schools can continuously participate in is hazard education (King 2000; Ronan and Johnston 2005). Ronan and Johnston (2005) write on this subject in detail and its relationship to promoting community resilience. A significant number of households in any given community have children enrolled in local schools. These students represent an effective conduit through which preparedness information can be introduced into the home and can positively impact the long-term preparedness of a community.

Schools also play a critical role in protecting student populations during the onset of and immediately following a hazard. Schools have been used as relief centers very effectively in the past. Research by Provenzo and Fradd (1995) in the aftermath of Hurricane Andrew suggested that schools played an important role during and following the onset of that disaster. In this situation schools serviced their community by sheltering disaster victims and contributed staff members to function as shelter leadership during the response and recovery phases following the disaster. The public, and to an extent the private school systems, are invested in the community they serve. School employees from bus drivers to principals are part of the social fabric of a community. They interact daily with and care greatly for some of the most precious citizens and have established their roles as authority figures. These personnel, when included in disaster planning and preparedness exercises, will be a valuable asset during a crisis.

In 1995, following the magnitude 7.2 Kobe earthquake in which 6,729 people were killed and 310,000 people were left homeless, local schools played a critical role in providing a relief center and shelter for displaced citizens (Wisner 2006). During

the Kobe earthquake recovery, people who remained at schools for lack of alternate accommodations or due to limited mobility, assisted in operating relief centers as well as supporting the teachers and working in classrooms. School facilities simultaneously provided relief and school functions, demonstrating the versatility of the facility, its staff, and its community members. Allowing children to return to school as soon as possible is also an essential component of promoting the healing and recovery of a community after a disaster (Ronan and Johnston 2005). Schools provide a familiar setting in which children and families can congregate and begin recovery. This may be viewed as the beginning of the healing of the social fabric of a community. While students' routines at home may be temporarily disrupted by a disaster, schools can "provide appropriate settings to assist with recovery as they provide a natural grouping of young people who share life experiences" (Ronan and Johnston 2005, 116).

Recommendations for Implementation

A plan to use schools or other facilities as relief centers must be in place well before the onset of a hazard. This plan starts with preparedness in the home. The deliberate decision to move to a relief center, if not notified to do so by some type of warning, can result from the identification of the closest relief center in a family disaster plan (Perry 1985). The next level of preparedness is found in the neighborhood in which people live. Corvallis has an active Neighborhood Emergency Training Program (Peirson 2007). Information regarding emergency evacuation can be reinforced during neighborhood meetings. This includes describing how disaster notifications will be given, handing out maps to the nearest relief center, and distributing packing lists of what to bring. Neighbors with limited mobility or those that live alone or who are elderly can be identified and the individuals who will check on them and ensure they can safely move to a relief center can be designated.

At the community level, creating a sense of awareness can be an effective means of encouraging preparedness prior to a hazard event. This awareness focus should include not only the hazards present in the community, but what to do and where to go when they occur. This is best accomplished through a public awareness campaign, which includes media announcements and distribution of materials in

schools. Another recommendation to increase awareness would be to place signs on disaster relief centers, similar to the Civil Defense Fallout Shelter signs, so effectively employed during the Cold War period. One only has to look to similar signage campaigns such as tsunami zone designations in coastal communities to know that they can be an effective tool to create awareness.

Once a school facility has been designated a relief center, it should be equipped appropriately as funding allows. Installing or upgrading existing communications systems would greatly enhance the ability to gather information requirements and maintain situational awareness by emergency managers during a crisis. If power to the community is disrupted, the functions that relief center personnel can perform would be greatly increased by the addition of generators and emergency fuel sources. Tanks to store potable water could be emplaced if the intent is to use the center to shelter evacuees. In order to be effective, any backup or supplemental component should be integrated into the existing utility system, and be tested regularly. School personnel should also be trained to use the additional equipment.

Past experience has shown that conflict can arise over the use and control of school facilities during a disaster (Provenzo and Fradd 1995). School authority figures, such as principals, should remain in charge of the school buildings during a crisis. The Red Cross or military organizations may use the facilities in the conduct of their duties, but should do so in a partnership with existing school leadership. Not involving school leadership in the past has resulted in school property being destroyed or thrown away by unaware relief workers (Provenzo and Fradd 1995). School principals can provide keys and access to all school facilities and monitor property use and clean-up. By allowing the principal to remain in charge of the facility and oversee its functions, continuity is maintained, and once the crisis has concluded, a transition to normal school operations can be more easily accomplished. Successful implementation of such a plan must have agreements and relationships formalized in writing. Written documents should detail the relief center management plan and codify the authority, roles, and responsibilities of each organization and their key personnel.

When planning for relief centers in a community there are special circumstances that emergency managers must address. One of these circumstances entails designating and equipping centers for people with special health needs (see Gurlitz 1990). Evacuation of a senior care facility into a relief center may bring with it an increased need for specialized care and equipment. While this population may be a relatively small percentage of the total evacuated population, their needs may require a disproportionately large proportion of personnel or equipment. Another group which will need to be addressed in community planning is the population of persons with disabilities and their families. Additional planning may be required to adequately address the notification, evacuation, sheltering and health concerns of this population (Kearns and Lowe 2007). Pets and domestic animals create unique evacuation and shelter requirements. Animals are valuable to a community and its members from either an emotional connectedness or economic value point of view. Some pet owners may be unwilling to leave their homes without their pets. However, mixing pets with people in a relief center has potential negative health impacts, including disease and injury. These concerns have been addressed through both research and legislation. Dorsey (2006) addressed these concerns in a study in which examined the local needs and planning of a community humane society during a disaster. As a result of problems in dealing with pets during Hurricane Katrina, the federal government enacted legislation to address pet planning requirements. The *Pets Evacuation and Transportation Standards Act of 2006*, requires that state and local emergency preparedness plans address the needs of individuals with household pets and service animals following a major disaster or emergency (U.S. Government 2006). Not only does this place emphasis on an easily overlooked component of a disaster plan, but it also ties federal grants to planning.

Finally, emergency managers must avoid the "Paper Plan Syndrome" (Auf Der Heide 1989, 34), which is the tendency to believe that if a written plan exists, then a community is in an enhanced state of disaster preparedness. However, to be effective the plan must be rehearsed. Rehearsals should focus on testing the plan, procedures, training, communications, and backup systems as they would be exercised in an actual event (WHO 1991) and should involve all potential response participants (Perry and

Lindell 2003). School administrators and staff should be included not only in the development of a community response plan, but also in exercises and rehearsals.

While it may not be advisable or even feasible to conduct such an exercise with a large population, key personnel and proxy members representing each community sub-group or neighborhood could participate. Plan rehearsal is not confined to large scale efforts, which can be expensive to run and disruptive to normal community activities. Table top, terrain model or map exercises allow agencies to conduct pre-operational or refresher exercises (Blanco and Mathur 2005). In this manner, the systems (i.e. plans, information management, communications, utilities, and facilities) can be tested, deficiencies can be noted, and solutions developed.

Assessment Error

The method used in determining the proportion of households that fall within a buffered distance of a school provides only an estimate. Each point in the household data layer represents a residential address. The number of persons per household was determined by dividing the community population by the number of point residences. Few hazards (natural or technological) are time-sensitive, making it difficult to predict the most likely time of occurrence. As such, these findings would be most valid if the population from which the estimate was drawn was at home when a disaster occurred.

While the estimates in this assessment may adequately represent the whole of the population, it falsely assumes a uniform distribution and fails to account for high density housing or areas with unusually low density of persons per household. Additionally, Benton County gains approximately 1,400 workers during the workday (US Census 2000). A portion of those workers would come to Corvallis. While for 40 hours (24% of the time) a week, a portion of the city population may move away from the residential areas, a reasonable assumption can be made that for the other 128 hours (76% of the time) in a week many residents will be at or around their homes and thus nearer their closest school facility. Should a hazard occur on weekends, during holidays or outside of work hours, the method employed in this paper provides emergency managers with a reasonable expectation of relief requirements.

If a disaster occurs during the workday, commuters may be forced to shelter in place or backtrack through parts of the city or from other communities to reach their designated relief center. Depending on the type of disaster, transportation networks may be severely disrupted and commuters may be unable to move or use public transportation for a period of hours to days. However, once the ability to travel is restored, commuters would know where family and neighbors can be found.

Another population, which must be factored into a planning scenario, is the non-resident population of tourists, visitors and the homeless. These populations are not accounted for by address locations. During festivals or on a home football game Saturday, the community population and as such, the overall number of people at risk may increase significantly. In the event of a terrorist attack or technological hazard event, relief centers may find themselves filled to capacity in response to a mass casualty situation. These hazards are likely to create the conditions which Tierney *et al.* (2001) described as favorable for using a relief center. While this study suggests that only a small portion of Corvallis is at risk on a daily basis, emergency managers may find that under certain conditions or based on its proximity to a hazard event, a relief center may be filled to capacity.

Alternative Considerations

More is not always better. Just as the benefit of not requiring emergency workers to visit every home in Corvallis is plainly evident, a decrease in the number of schools functioning as relief centers reduces the number of nodes that must be staffed, controlled, linked, and serviced. For example, the facilities and space of the Oregon State University property would be able to accommodate people from peripheral neighborhoods, whom might otherwise go to their nearest elementary school. Additionally, a university will often have its own emergency response or disaster plan and more extensive resources making it a valuable component of a community preparedness plan. The question then becomes how many relief centers are enough and are some locations better than others? Each inquiry alone gives possibility to an extended analysis of the problem and would require further study. However, lacking further or more detailed analysis by emergency managers, an enhanced state of

community preparedness and resilience could be obtained by taking the initial steps and starting the process of designating relief centers and increasing public awareness.

Are schools the best choice for relief centers in every community? Depending on the needs, spatial characteristics, and availability of other facilities in the community, they may not be. Activating a school as a relief center should be done only after carefully weighing the potential disruption of its daily function when compared to the urgency of the situation. One negative aspect to using schools involves the disruption of normal school activities. If a community has not been affected by a hazard event, but is providing shelter and services for evacuees from a neighboring area, the potential to disrupt an otherwise normal school routine must considered when developing potential courses of action. In some cases, areas of the community may not have a school nearby or may be better served by a non-school facility. The populations of the Grand Oaks development, the Oak Creek Road community, and those living on central 53rd Street in Corvallis are well outside any of the one-half mile buffers. They would be better served by using the Benton County Fair Grounds for their relief center. In other areas, National Guard armories, recreation centers, and community centers may possess an even greater level of functionality without any existing improvements or modifications.

CONCLUSION

This paper has demonstrated that school facilities throughout the Corvallis community represent an attractive, viable option for use as relief centers in the event of a disaster. School have well-equipped facilities, existing leadership, traditional neighborhood-centric layout, and community-wide dispersion, all of which make them a potentially valuable resource to emergency managers. The methodology presented in this paper can be easily adapted by emergency management planners to examine unique requirements in their communities. Whether emergency managers choose to use schools as relief centers is really not important. What is important is that studies like this one encourage emergency managers to examine their own plan and focus on potential evacuee problems as well as provide the resources to service the needs of displaced persons in time of crisis.

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CHAPTER 4

ON FIRE, UP A CREEK AND BLOWN AWAY: AN ASSESSMENT OF GEO-INFORMATION UTILIZATION DURING THE 2005 KASHMIR EARTHQUAKE RESPONSE AND RECOMMENDATIONS TO IMPROVE FUTURE USE

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ABSTRACT:

The destructive effects of disasters on vulnerable populations will continue to increase as global inhabitants grow in numbers and occupy marginal, often hazard-prone areas. Recent experience has shown that there is a gap between available GIS technologies and geo-information management tools and their employment during disaster response operations. The goal of this paper is to examine and critique the use of geo-information and related technologies in the Kashmir earthquake of October 2005, discuss what researchers have done to address this topic, and make recommendations for improving future geo-information accessibility. This paper draws on observations from the 2005 Kashmir earthquake and available literature to examine impediments to operational geo-information management and utilization during that relief effort. The paper concludes with recommendations on how to increase the accessibility of geo-information to a diverse group of users and better manage geo-information during future disaster response efforts.

KEYWORDS: disaster response, disaster management, hazards, geo-information, GIS, information management

INTRODUCTION

The Kashmir earthquake of 8 October 2005 killed an estimated 79,000 people, injured twice that number and displaced up to 2.8 million in habitants. This large earthquake – high death scenario is likely to repeat along the Sub-Himalaya of South Asia in the near future. While the reported numbers of dead, injured and displaced people may vary by source, they still suggest that this was a notable disaster, with the high costs paid in human capital. This work is based on the observations of a relief planner, who was on the ground by the morning of 10 October and spent the next 30-plus days planning, coordinating, and executing relief support at all levels from Islamabad to the farthest extent of the affected areas. The goals of this paper are to: 1) Examine and critique the use of geo-information and related technologies in the Kashmir Earthquake of October 2005, 2) Discuss what researchers have done to address this topic, and 3) Make recommendations for improving future geo-information accessibility. Implementing the recommendations in this paper will enable the humanitarian community to leverage available geo-information and technologies so that responders can conduct future relief efforts in a more efficient, effective manner.

Response in a disaster includes rescue, relief and the initial activities involved in recovery (Thomas *et al.* 2002; Cutter 2003). For a variety of reasons provided below, many have criticized domestic and international responses to the Kashmir earthquake. Among the criticisms cited were that relief was slow to get to the mountainous areas (McGirk *et al*. 2005), that the initial response from the United Nations "was confused and inadequate" (Kronenenfeld and Margesson 2006, CRS-30), and that a "disaster management plan was lacking" (Sheikh 2005, 747). Hicks and Pappas (2006) noted that there was an overall lack of coordination. Sheikh agreed, writing that the "relief efforts were not coordinated" (2005, 747).

Invoking current philosophy regarding the origin of disasters, one scholar expressed concern that the "Kashmir earthquake was actually a social, not a natural disaster" (Ozerdem 2006, 398) which was compounded by pre-existing physical factors and induced by an inept response from a host of actors. Other criticisms include donor fatigue on the heels of the 2004 Indian Ocean tsunami and the

xenophobic tendencies of the Government of Pakistan, both of which served as impediments to the relief effort. A collective failure by all actors to fully assess the impact of the earthquake and the widespread devastation that resulted may have also contributed to the slow start. As most of the damage was in Kashmir, an area with a limited, military-controlled communications infrastructure, delayed, sporadic, and at times, inaccurate reporting resulted. Each critique has merit, depending upon the information or framework used to make the assessment. Hicks and Pappas (2006) along with Sheikh (2005) may have come closest to assessing what the planner in this study observed to be the principal impediment to a coordinated response in Kashmir − a multi-level failure to coordinate, track, share, and monitor information regarding rescue and relief actions. Failures in coordination during a disaster response result in costs that are paid by those who died from lack of aid or rescue, watched their injuries worsen while waiting for help, or will endure unnecessary hardships long after the relief effort is over.

The United Nations noted that relief efforts require among other things "the development of coordination mechanisms at different levels" (UNS 2005, 4). Coordinated efforts disaster response should result in both efficiency and effectiveness of action among contributing actors (Taylor 1986). Efficiency is "the avoidance of material waste, [and] duplication of effort," all of which should be achieved with minimal application of resources (Taylor 1986, 70). Effectiveness implies that aid gets to those "of greatest need" (Taylor 1986, 70), that the aid matches the need, and that there is an impartial and complete coverage of aid distribution. In Pakistan, disaster responders failed to employ geo-information and available technologies effectively to coordinate humanitarian action. This resulted in ineffective, inefficient relief and delayed universal coverage of relief aid.

In order to improve the effectiveness and efficiency of future relief efforts, researchers must examine the problem of how disaster responders can share information in a manner that allows tracking and total visibility of all relief actions in a proven system. The action of a relief actor has consequences. Relief actions have first, as well as second and third order effects on disaster victims and other actors. If actors are not aware of the actions of others, their activities may result in duplication

of effort, omission of effort, and even unintended negative consequences. The disaster area, place limits on an actors ability to see or know what is occurring within the "disasterspace". Mountains or forests can limit an actors visual sense and immediate geographic understanding. If an actor is not aware of the actions of other actors in the vicinity, it can become very difficult to plan future disaster response activities.

To coordinate the activities of so many participants in a large operation, such as the relief effort in Kashmir, one must use a map. In fact, maps are so important to disaster response that the National Research Council (2007) published a recent report *Successful Response Starts With A Map*. Fortunately, a map, or better yet a geographic information system (GIS), allows people to see beyond the limits of their physical senses and immediate geographic understanding. Similar to descriptions by Friedman (2005) of a "flat world", a GIS can "flatten" the disasterspace, eliminating the curvature of the geo-information horizon beyond which they can sense. Distributive technology, such as the Internet, enhances flattening. Once the disaster area is flattened, response planners and decision makers can portray the actions of others by depicting what has happened and where it has occurred. Armed with a more holistic understanding of the problem at hand, planners and decision makers can see opportunities where effort is lacking and can avoid locations where action would duplicate the previous effort of others.

Collaborative mapping activities in a hazard space is an essential step in coordinating the activities of disaster responders. While responding to a disaster, actors may find themselves differing greatly from others in their perceptions of "space and place" (Alexander 2004). Differing perceptions of activities and space can create a fusillade of conflicting or duplicate management decisions (Goodchild *et al*. 2007). Maps and the geographic information (hereafter referred to as geo-information) they display are essential to coordinating large or complex operations. Geo-information unites "location in space-time" with a "set of properties" (Goodchild *et al*. 2007, 251). Geo-information tells a user what it is, where it is, and when it happened. Geo-information and the technologies used analyze, manipulate, and share these types of data, can reduce conflict and have proven to be "critical inputs to incident management and tactical decision making" (National Research Council 2007, 53).

Using a GIS to display and analyze geo-information is especially useful as a decision-support tool during all phases of a disaster (Cova 1999; Thomas *et al*. 2002); however, planners will find this capability most useful during the early stages of a relief effort. Early access to such information assists planners as they analyze and assess past actions, predict future movements, increase the efficiency of relief operations, and ensure universal coverage of aid.

The ability to access geo-information during a crisis is empowering. In a distributive and collaborative environment, small actors can "see" what large actors "see." Equal access to geo-information also allows each actor to visualize what others are doing and provides each participant with a common sense of the disaster space. Aside from the expected problems associated with a large-scale relief effort start-up, it is likely that one of the greatest factors impeding the initial push in the Kashmir earthquake relief effort was that organizations participating in the effort could not coordinate their actions with those of others because they did not have a "common operational picture" (Figure 4.1). Military doctrine describes the phrase, common operational picture, as "a single identical display of relevant information shared by more than one command" which "facilitates collaborative planning and assists all echelons to achieve situational awareness" (Joint Publication 3-0, GL-11). In order to build a common operational picture one must have geo-information and the tools to collect, process, display, distribute, and archive data.

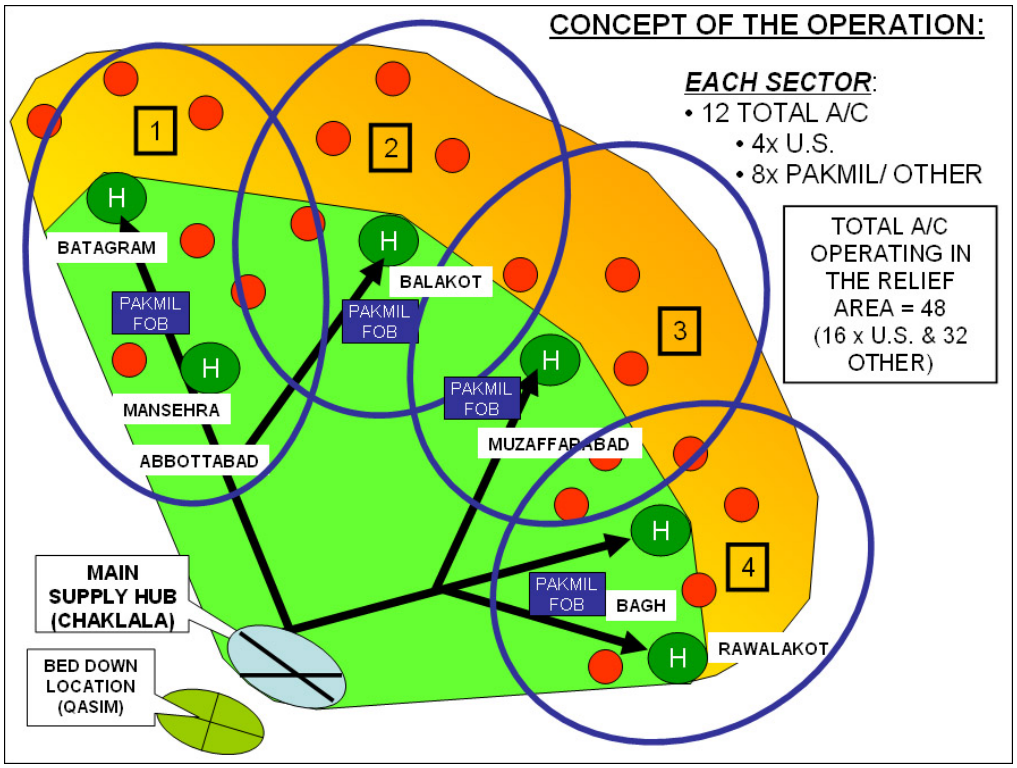

Figure 4.1. A concept map developed by a US aviation planner (S. Halter) in Pakistan. Even without terrain data or high-resolution imagery, maps that depict the actions of others provide users with a basis for a common concept of space in a large operation, give relational attributes to mapped data, and eliminate conflicts of space and activities resulting in safer, more efficient operations. Such products are often the basis on which a common operational picture is further developed for a complex operation.

THE ROLE OF GEO-INFORMATION IN DISASTERS

Geo-information scientists have written a great deal on the subjects of GIS in disasters and emergencies (Alexander 1995; Coppock 1995; Waugh 1995; Wood 2000; Greene 2002; Thomas *et al.* 2002; Cutter 2003; Laefer *et al*. 2006; NRC 2007) and spatial decision support systems (SDSS) (Cooke 1992; Herold *et al*. 2005). They have contributed to the very technical subjects of interoperability, accessibility, ontology of geo-information, and information sharing (Mansouran *et al.* 2005; Abdalla *et al.* 2007; Bakillah 2007; Xu and Zlatanova 2007), as well as the challenges of using GIS for disaster response (Zerger and Smith 2003; Abdalla *et al.*, 2007). Even newer subjects such as the employment of open-source, grassroots, or alternative solutions to disaster management (Singel 2005; Cai *et al*. 2006; Careem *et al*. 2006; Chang and Li

2007; Goodchild *et al*. 2007; Palen *et al.* 2007; Pezanowski 2007) are well documented. Geoscientists have and continue to make meaningful contributions to the application of GIScience in emergency and disaster management. The humanitarian community must now take available technology and create an Internet-based geo-information system, which provides one-source, all-hazard, continuous, global disaster coverage. If done, this will enable greater coordination in future humanitarian efforts.

Information that captures the space, time, and attribute data of a disaster is most useful when it is shared amongst a large field of users while simultaneously retaining the ability to collect more information. The Internet is a sharing tool. The Internet provides the ability to collect, publish, and make available geo-information to a broad array of users by means of an online-GIS, which is especially useful during a crisis (Mansourian et al. 2005; Boulos and Honda 2006).

The first step to making geo-information available to those responding to a disaster is to collect, consolidate, and organize geographic data in a data clearinghouse (Mills *et al.* 2008). Following Hurricanes Katrina and Rita, a group from Louisiana State University (LSU) cooperated with the Federal Emergency Management Agency to do just that. They developed the LSU Geographic Information Systems GIS Clearinghouse Cooperative (LGCC). This cooperative effort created a data clearinghouse, which provided a repository of geospatial data immediately following the hurricanes. This database is still available today as an archive of data from the two disasters. Models such as the LGCC are a valuable source of data and a key component of the proposal in this paper.

An example of a current web-based initiative that facilitates geographic and non-geographic information exchange is Sahana (http://www.sahana.lk/). Sahana provides registries and management tools to assist both victims and disaster relief planners. However, this application would be much more useful if it included an online GIS and allowed relief planners to retrieve or submit spatial data collectively. GeoWorlds (Neches 2002) was an initiative that sought to integrate GIS capabilities, spatial and document libraries, and 3-dimensional visualization in an Internet-based application framework. While GeoWorlds did not address a broad-spectrum of user needs, nor examine implementation at a global scale, it did validate the viability of

online geo-information systems. A system, which allows broad-spectrum users to access geo-information in as many formats as possible, has greater functionality. Herold *et al*. (2005) proposed a system that integrated GIS and spatial databases in an Internet-based environment. Their self-described Internet-GIS incorporates Open Geospatial Consortium (OGC) interface specifications and allows for user input in the form of the creation of points, lines and polygons on a map. Calling for standardized interfaces and data formats is critical to successful implementation of a large-scale geo-information system. Furthermore, allowing users to contribute data is valuable because it addresses the needs of users without robust GIS capabilities but who have a need for more than static maps.

Relief planners have employed GIS and leveraged geo-information in previous large-scale relief efforts. GIS played a central role in the response to the New York City World Trade Center destruction in 2001 (Galloway 2003). During the 2004 Indian Ocean tsunami relief effort, shared geo-information made for a more efficient and effective effort (Boulos and Honda 2006). During that disaster, the Pacific Data Center provided the service of collecting, analyzing and distributing spatial data and data products (PDC 2006). Global Connection (2008) was a key player in the drive to make high-resolution imagery available during Hurricane Katrina in 2005 and the 2006 Bantul Indonesian earthquake. In each crisis, geo-information provided valuable data to relief planners and decision makers. However, while of great value for each particular crisis, the initiatives were event specific and did not provide the variety of geo-information products and functionality that would accommodate a diverse set of user needs.

Although some may not see Digital Earth applications as a true GIS, it would be an oversight to write about geo-information in disasters and not address them. A commonly known Digital Earth application is Google Earth. Some (mainly GIS and Society scholars), will argue very strongly that Google Earth and other Digital Earth applications are not GIS. While Digital Earth applications do not possess the powerful analytical capability of a true GIS, they require less funding to purchase software and minimal operator training, making them an attractive tool for disaster management. As suggested by some, Digital Earth applications such as Google Earth or GIS/2

applications like Google Maps are viable, alternative disaster relief and crisis management tools (Miller 2006; Pezanowski, *et al.* 2007). Other non-GIS specific alternatives for collecting and making available geo-information reside in the public participation wiki realm. A wiki allows individuals to contribute to collaborative projects such as online encyclopedias, dictionaries, and maps. Public participation wiki projects during Hurricane Katrina (Singel 2005; Palen *et al*. 2007), the 2007 California wildfires, and even an Avian Flu forum (Palen *et al*. 2007) have demonstrated the ability to collect and share a wealth of information from a very diverse group of participants by using the Internet.

GEO-INFORMATION IN PAKISTAN

As noted by an NGO staff member during the 2005 Kashmir earthquake relief effort, "If we had good maps, we would be on top of things" (Currion 2005, 17). This correlates with observations made during the research for this study. The staff member's remark suggests a lack of situational awareness and a failure to develop a disaster-wide common operational picture. However, the statement also indicates that there was awareness among those conducting relief operations that the ability to display time-space-attribute information in some format, either hardcopy or digital, would have been of great value, if not a necessity.

Kashmir earthquake responders employed geo-information and associated technologies to a limited extent in that relief effort. The United Nation's Humanitarian Information Centre (HIC) made their *Who is doing what where?* maps and other products available via Relief Web (www.reliefweb.org). MapAction (www.mapaction.org) deployed to Pakistan in support of the United Nations Disaster Assistance Centre. They produced numerous map products during the initial earthquake relief effort. Global Connection Project (2008) worked with Google Earth to make higher resolution imagery of the earthquake area available via a "dynamic overlay process" (Nature 2006). Developers also deployed Sahana to Pakistan to support the relief effort and continue product testing. Maps and products available to planners following the Kashmir earthquake were useful at a very coarse scale, but lacked the fine granularity required to be most beneficial to disaster response planners

and decision makers on the ground. Additionally, the inability to input response actions from actors, the lack of interactivity, and limited functionality of these products further handicapped their utility to relief planners. Information available on each of these products would have been much more useful if planners and decision makers had combined it with geo-information detailing relief actions of each organization as well as existing aid requirements.

The United States (US) Army's 12th Aviation Brigade (TF Griffin) was the largest operational foreign military aviation contributor during the relief effort (Thompson 2006). The 12th Brigade had the responsibility to provide rotary airlift capability to the Government of Pakistan (GOP) and advise the US Joint Task Force Headquarters on the matter of aviation capabilities and utilization. Although not ordered to do so in writing, 12th Brigade also took on the responsibility for receiving and integrating foreign military aviation units as they arrived in Islamabad.

The Pakistani Army General Headquarters (GHQ) was the mission approval authority for aviation resources during the relief mission in Kashmir. Representatives from the GHQ coordinated all activities at the disaster relief-loading zone on Chaklala Airbase in Islamabad. GHQ planners collected relief requirements and then sought to source them with rotary wing assets if appropriate. Appropriateness meant that there was either an immediacy of need which a slower method of delivery could not satisfy or that ground assets could not reach the affected area. Many civilian relief agencies and all of the foreign military aviation units participating in the relief effort operated primarily out of Chaklala. Two key actors, which did not appear to take aviation support requests from or coordinate directly with the GHQ at Chaklala Airbase, were the United Nations Helicopter Air Service and the International Committee of the Red Cross (ICRC). However, the author notes that the ICRC did initially attend the GHQ nightly aviation coordination meetings.

Although one author levelled criticisms at the United States aviation relief effort (Ozerdem 2006), rotary wing resources were the key to the success of the initial rush to provide relief (Thompson 2006). In fact, civilian and military aviation operations were a major component of the overall earthquake response in Pakistan. As such, aviation asset employment during the earthquake response reflected the

failure to use geo-information to plan and coordinate affected relief activities. Helicopters are a terrain-independent mode of transportation, and as such, aircrews were the first formal response components to reach some affected areas. Aircrews were able to cover more ground and observe more damage each day than ground-based relief actors. The question must be asked now (and should have been asked back then) why weren't geo-information and technologies used to plan the helicopter utilization? As aircraft and aircrews are low-density, high-payoff resources, planners must use them in the most efficient manner possible. Efficient use includes going after hard to reach targets and minimizing ground time in order to achieve maximum work per blade hour. Beginning on 10 October, U.S. military aircrews flew in excess of 1,500 hours in their first 30 days in country (Thompson 2006). Despite this high tally of blade hours, US military aviation planners and aircrews maintained a concern that planners and decision makers were not employing aviation assets in the most efficient manner.

Inefficient use of helicopters occurred often. An example of this type of ill-coordinated use occurred when two large aircraft, capable of carrying many tons of aid and evacuating upwards of 40 casualties each, arrived at a destination only to find an aircraft with the capacity to evacuate only four injured people shut down on the landing zone. The two large helicopters would then have to remain in a holding pattern for upwards of 30 minutes. This was a waste of time and fuel, but more importantly, it decreased the probability that the large helicopters could make an additional sortie to the relief area at the end of the day. If relief planners had used geo-information to build a common operational picture, they could have been able de-conflict destinations by time and space. Doing so would have avoided the inefficient use of limited aviation resources.

Aircrews also used valuable flight hours on missions to deliver aid to destinations that were either already well stocked with the same aid that was onboard the helicopters (Figure 4.2) or were in need of different items. There were also occasions, within the first week of the relief effort, in which aircrews sat idle because relief planners did not have the situational awareness to assign aircrews a load or a destination. Worse yet, however, is the thought that as pilots sat idle waiting to be

assigned a destination, there were villages, as long as a week after the earthquake, that had not received any aid or medical evacuation.

Figure 4.2. A picture taken by a US Army helicopter pilot to prove to relief planners that Balakot had sufficient tentage on-hand. After viewing this image, aviation planners wasted no additional sorties by sending tentage to Balakot (Source: Author).

While aware of the benefits of capturing and sharing geo-information, military leadership and planners did not force the establishment of a collaborative geo-information collection system. In hindsight, they should have. Military pilots brought back important data such as road closures, damage reports, reports of aid requirements, and assessments of aid saturation. Aviation liaisons captured the details of each mission flown by military aircrews and posted the information on a map in the aviation operations center on Chaklala. This map was available for any interested party. However, the map contained observations from only one organization and was not accessible by all relief planners. Therefore, it was limited in its utility. If relief coordinators had had a system that allowed them to share information, observations, and relief actions in a collaborative, Internet-based geo-information structure, all actors would have had a common operational picture. This would have allowed each organization to achieve greater efficiencies and effectiveness in targeting aid from the first day.

RECOMMENDATIONS

Recommendations for improving situational awareness and coordination during disaster relief should focus in areas of geo-information collection, sharing, and product development. Successful efforts in these areas must be both bottom driven and top supported. This means a single coordinating organization must take responsibility for implementing such an initiative, but the success of the project and usefulness of the products depends on data contributions by each actor. Those conducting relief activities must capture and input data into a collaborative system. Input format and the means to do so should be the same from disaster to disaster. In this manner, the data collection requirements and formats will not change with each humanitarian effort. Additionally, the system must be web-based, as this would enable simultaneous input by actors with Internet connectivity from virtually any location.

Figure 4.3 shows a proposed geo-information structure for disaster relief and other humanitarian operations. The pyramid in the center of the figure represents a series of differing levels of functionality of web-based geo-information. At the top level (top of the pyramid), users can access GIS data files, allowing their internal, GIS-trained staff to incorporate those data into their organizational planning requirements. The lowest level (bottom of the pyramid) represents an environment where static, digital maps and documents are available. In between these two levels are environments where an online GIS is available and Digital Earth applications such as Google Earth are available. Each level will give the user similar information, and thus a common operational picture. The only variation is the product format and method of interactivity offered.

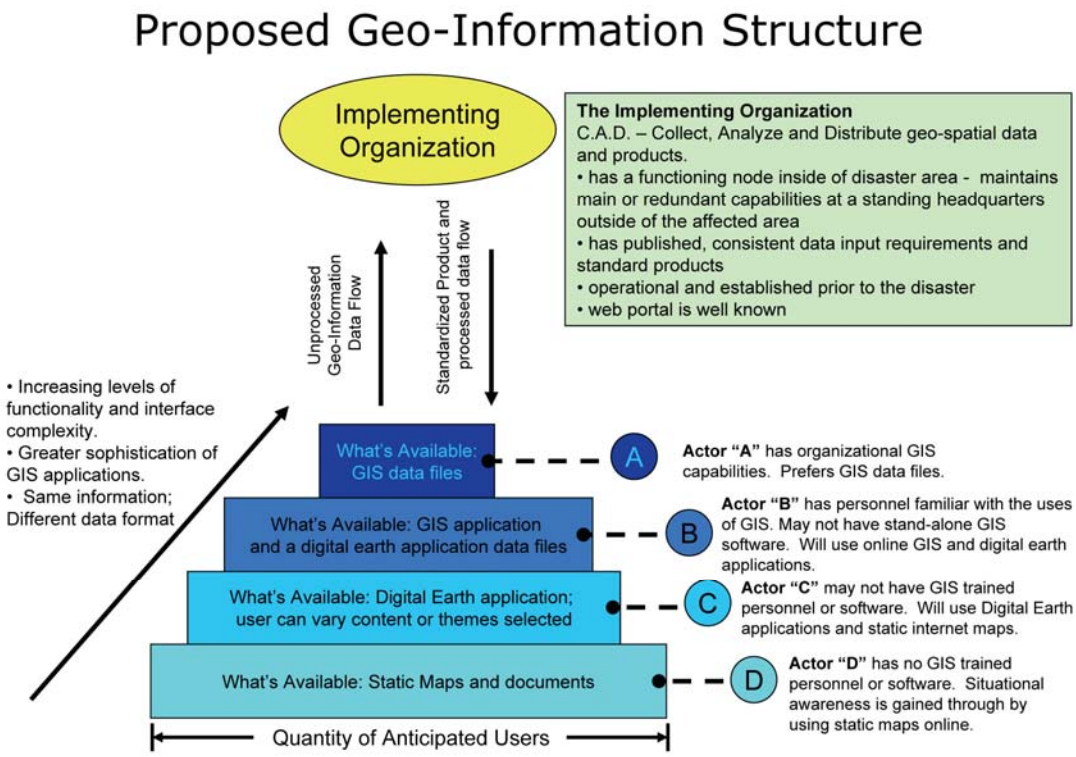

Figure 4.3. Author's Proposed Geo-Information Structure. This system will provide near real-time, one-source, all-hazard, all-access, global-coverage of ongoing humanitarian response efforts and crises. Maintenance outside of affected areas and support by an in-country staff will ensure reliability and better collection and distribution of data, information and products. The multi-level functionality and complexity will support a more diverse community of geo-information user requirements.

The width of each level represents anticipated user traffic. While not completed as a component of this research, the suggestion here is that more organizations would be likely to download pre-made maps to satisfy their information requirements and that fewer organizations would require GIS data files for use by their own GIS-capable staffs. One must consider that copyrighted GIS software is expensive to purchase and requires trained operators; each contributes to the cost of maintaining a GIS capability. If GIS use were episodic, many organizations would have difficulty justifying, let alone funding, such a cost-to-use ratio. The assumptions made here are that more organizations would be likely to require that static maps be available on the Internet to satisfy their information requirements and that fewer organizations would require GIS data files for use by their own internal GIS-trained

operators. The needs and capabilities of other organizations would likely fall somewhere in between.

In order to ensure the success of the proposal in this paper, a single lead organization must take ownership for these responsibilities of implementing and maintaining the geo-information structure. The implementing organization for this project must provide the same level of commitment that the United Nations provides for ReliefWeb. Only in this manner can the humanitarian community ensure continuous, global, disaster coverage. The implementing organization would collect, analyze and distribute geo-information. They would be the "map steward". To coordinate the collection of geo-information, the implementing organization must have a staff both outside of and inside the disaster area. The staff outside the disaster area would maintain the server on which the system resides, while the in-country staff would collect and forward data from walk-in sources, disseminate products, and respond to requests for information. Contributing governments and the humanitarian community must appropriately fund the implementing entity so that the costs associated with staff, training, technology and software do not drive the level of functionality or reliability of service. Likewise, the implementing entity should be a stakeholder in the success of humanitarian efforts. In this manner, as disaster requirements ebb and flow, the organization will not "follow the money" to satisfy profit-focused investors.

Individuals and organizations should not have to ask who is going to provide geo-information support each time they deploy on a new humanitarian mission. The intent for the geo-information structure proposed in this paper is for long-standing use, not a transitory, per-disaster effort. In order to ensure continuous global disaster coverage, the portal from which actors access geo-information must be in place prior to the declaration of a disaster. Waugh (1995, 429) noted that experience during Hurricane Andrew demonstrated that GIS deployment "could have made the response more effective and speeded the recovery", but that GIS "databases need to be created beforehand, rather than pieced together in the chaos of a disaster operation." It is difficult to advertise the existence of the geo-information website after relief organizations and workers have already deployed to a disaster stricken area. The

humanitarian community should be as familiar with the website for the proposed system as Internet users are with websites like YouTube.com, Yahoo.com, Google.com, or Amazon.com. Whether a relief worker is a seasoned veteran or a relative newcomer, he or she should know where to go to get data or contribute geo-information of their own. As previously noted by Mills *et al.* (2008), a pre-existing website would allow users to get an historical download of response activity prior to their deployment or commitment of resources.

Just as the system proposed in this paper offers a diversity of products, there should be multiple methods with which to search for information about an on-going disaster. Users must be able to go to the web portal and access information on an in-progress disaster or crisis by entering a GLIDE (GLobal unique disaster IDEntifier), by selecting from a country or hazard list, or by locating the disaster geographically on a clickable map. Actors will soon gain familiarity with the formats, methods, and functionality of the geo-information website. The ensured "sameness" in future events will provide continuity while reducing initial pre-deployment information collecting difficulties. Finally, the website must have data available in multiple formats and methods of access including downloadable shapefiles, keyhole markup language (KML or KMZ) files for easy opening in Google Earth, an online, collaborative GIS, and static digital maps and documents. In this manner, every organization, regardless of geo-information processing capability, will have the same common operational picture and a greatly enhanced state of situational awareness.

Disaster responders are more likely to use a familiar application or website that provides greater functionality, utility, and diversity of coverage. As such, one final recommendation is that this initiative serves the humanitarian community at large. Hazard events are transitory, so to avoid designing an application for the "disaster *de jour*," application developers must account for a wide range of potential contingencies. The proposed website should cover a variety of threats to humanity, such as droughts, land mines, reproductive rights, food security as well as earthquakes. A system that services a greater diversity of needs will continue to be used, improved, and most importantly, funded. Lastly, as a collateral benefit, this proposed geo-information structure would also function as a data repository for each disaster or crisis (Mills *et*

al. 2008). Disaster researchers would find great value in such a collection of data as it would enhance their ability to study past disasters and improve future relief efforts.

As mentioned previously, the geo-information structure proposed in this paper contains similar features found in other proposed designs (Table 4.1). As such, this proposal is not a new idea, but instead a more complete approach to facilitate the collection and sharing of geo-information. In terms of user interface, what really distinguishes the geo-information structure in this proposal from others is the greater diversity of functionality and the broad spectrum of geo-information available. Both of these features are necessary to address a wide array of user needs and levels of GIS sophistication. Additionally, unlike other proposals, the requirements for full-time implementation, global coverage, and ownership by a humanitarian-focused organization will ensure long-term utilization. Providing global coverage is also important because hazards do not adhere to political boundaries, so neither should the systems that people use to respond to disasters.

Table 4.1. Comparison of proposed and existing system specifications/capabilities.

	Proposed	Herold et al. 2005	Sahana	Neches et al. 2002 (GeoWorlds)	ReliefWeb	LGCC
Internet-based	X	X	X	X	X	X
Global Coverage	X	X	X	X	X	
All Hazard	X	X	X	X	X	
Static Map Availability	X	X	X	X	X	X
Online GIS	X	X		X		
User Activity Input	X	X	X			
Document Repository	X		X	X	X	X
Humanitarian Ownership	X				X	
Creation of Attribute Data		X	X			
GIS Data Files Available	X		X			X
Digital Earth Application	X					

CONSIDERATIONS REGARDING IMPLEMENTATION

Researchers have addressed many considerations regarding the implementation of web-based systems at length in the literature; however, it is necessary to highlight a few considerations that are most applicable to this specific proposal. Data from the field is vital to the success of the system proposed in this paper. Without geo-information, mapping products are meaningless and lack the appropriate context in

which decision makers can view their proposed actions. Actors must record their actions and observations and put these data back into the system. They must ensure their data are "comprehensive, accurate, timely and accessible" (Leafer et al. 2006, 115).

A potential drawback of a web-based system is that in some locations, relief workers may find it difficult, if not impossible, to access the Internet for a given period. This is where the in-country staff could facilitate data collection by gathering information for later input. In other areas, organizations can collect and record data on paper or in digital format and deliver the data to a location with web connectivity for delayed input. Acknowledging that this type of approach does not lend itself to real-time reporting, the fact is that even older data, once entered into a collaborative geo-information environment, allows planners to create a more complete picture of past actions and future relief requirements. Whether relief field workers handwrite geo-information on paper for later input or capture it in real-time on a GPS-enabled personal digital assistant (PDA), each bit of data is a valuable piece of a bigger picture.

Those contemplating the viability of the system proposed in this paper may be concerned about existing spatial data availability. In Kashmir, Pakistani Government concern regarding national security resulted in an initial lack of publically available maps, high-resolution imagery, and digital geographic datasets. Future disaster-stricken regions may lack geographic data as costs of acquisition, levels of technological development, or competing demands have prevented the collection and creation of datasets or at least relegated these activities to a lower level of government priority. Spatial data availability should not be viewed as a barrier to developing products which will assist in coordinating efforts and creating greater situational awareness through mapping. Peduzzi *et al.* (2005) demonstrated that global datasets available during their research allowed them to map 82% of hazard events and 88% of disaster victims.

While it would be ideal to have one-meter color, geo-referenced imagery of every disaster area and a geodatabase containing complete population, infrastructure, and terrain data, the fact remains that this is not a realistic expectation yet. However,

what is reality is that as humanitarian organizations begin to input their observations and activities into the proposed geo-information structure, a blank map will quickly become a useful tool as information begins to paint the common operational picture. Filling in the map "flattens" the disasterspace beyond which relief workers can "see". It allows them to visualize the entire disaster area from anywhere. Organizations can then begin to picture their operations within the context of the locations and actions of others, allowing them to plan and coordinate what their next action must be.

Geo-information system designers are very concerned with data format and software compatibility. Initiatives to create a spatial data standard already exist. Hard work by GIScientists has had varying levels of success. Gaining consensus, implementation, and compliance in the area of a single data standard is a difficult task. In the context of the proposal in this paper, the implementing agency can eliminate data compatibility issues by adopting a standard − whatever it may be − and adhering to it. Once they adopt a data standard, those wishing to make the most of their efforts in a humanitarian crisis will comply. Finally, because the proposed system is web-based, the issue of software compatibility largely becomes a moot point for the lower three levels of the geo-information structure. As long as users have a compatible web browser, they should be able to access applications and data on the website.

CONCLUSION

Humanitarian organizations, scientists, and researchers, have developed web-based disaster information support systems and initiatives in the past and continue to deploy new applications. Still there has yet to be a one-source, all-hazard initiative that supports the diverse, global geo-information needs of the humanitarian and disaster communities. Rapid advances in technology and scientific gains in geo-information science make the rationale behind the lack of a geo-information structure unacceptable. Until the humanitarian community employs a system that provides a common operational picture for all disaster responders, it will continue to fail at attempts to fully coordinate large-scale relief efforts and achieve maximum efficiency and effectiveness. Unfortunately, the victims of disasters will increasingly continue to

pay the costs associated with these failures. Therefore, it is time that leaders in the humanitarian realm take the initiative and flatten the disasterspace.

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CHAPTER 5

SUCCESS IN KASHMIR: A POSITIVE TREND IN CIVIL-MILITARY INTEGRATION DURING HUMANITARIAN ASSISTANCE OPERATIONS

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ABSTRACT

The modern cast of disaster relief actors includes host nations, non-governmental organizations, private-volunteer organisations, and military organizations. Each group, civilian or military, has valuable skills and experiences that it can bring to bear in an attempt to solve the problems encountered in today's ever-increasingly complex humanitarian environment. The goal of this paper is to supplement the study of civil-military relief efforts with contemporary anecdotal experience. This paper will examine the interaction between US military forces and other disaster relief actors during the 2005 Kashmir earthquake relief effort. The author uses direct observations made while working in Pakistan to contrast the relationships and activities from that effort with other accounts in prevailing scholarly disaster literature and military doctrine. Finally, this paper will suggest that the Kashmir Model of integration, coordination, and transparency of intent creates a framework in which future humanitarian assistance operations can be successfully executed. Recommendations to improve civil-military interaction in future relief efforts will also be addressed.

KEYWORDS: disaster relief, humanitarian assistance, military, NGO, Kashmir, earthquake.

BACKGROUND

On 8 October 2005, a Mw 7.6 earthquake rocked the Kashmir region in northern Pakistan and India (Figure 5.1). While neighboring countries have experienced recent, devastating earthquakes, this was the largest modern earthquake in Pakistan since the 1935 Quetta earthquake, which killed 35,000 people. The earthquake coincided with the morning attendance of school, resulting in the deaths of many educators and thousands of students. This earthquake killed an estimated 79,000, injured at least as many more, and left over two million people homeless or displaced.

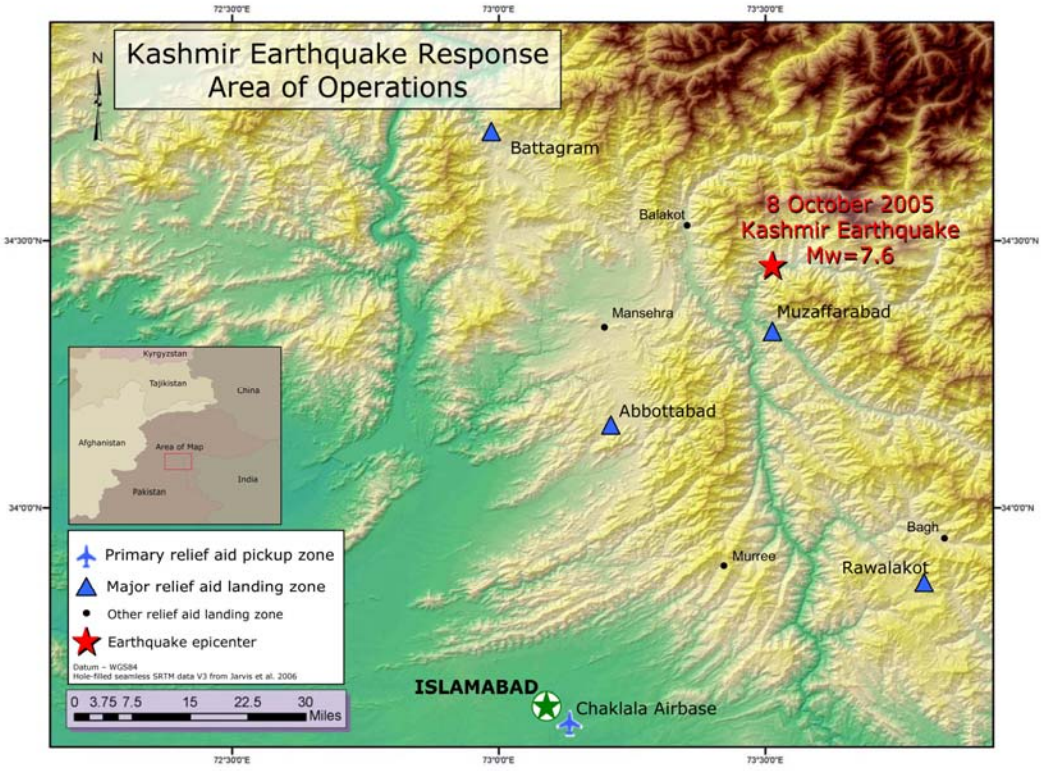

Figure 5.1. October 2005 Kashmir Earthquake Area of Operations

At Bagram Airbase, Afghanistan, 270 miles from the center of the disaster area, Task Force Griffin (TF Griffin), headquartered by the United States (US) Army's 12th Aviation Brigade, was seven months into a year-long deployment in support of Operation Enduring Freedom. On Sunday morning, 9 October 2005, Combined Joint Task Force – 76 (CJTF-76) ordered TF Griffin to prepare to deploy to Pakistan and provide humanitarian assistance. The following morning, 10 October 2005, three UH-

60 and five CH-47 helicopters departed from Afghanistan for Qasim Airbase, in Rawalapindi, Pakistan. Accompanying the aircrews were the operations, logistics and maintenance personnel required to support the task force during their 30-plus day humanitarian assistance mission.

This paper, while focused on anecdotal actions of US military forces in Pakistan, examines reoccurring themes regarding the intervention of military forces into the primarily civilian realm of disaster relief. The author analyzes the mission in Kashmir from the perspective of an individual who interacted daily with host nation personnel, non-governmental organizations (NGOs), other foreign militaries, and the disaster victims themselves. Examining these relationships is essential to the study of improving disaster relief and will form the core of this work.

The goal of this paper is to supplement the study of civil-military relief efforts with contemporary anecdotal experience and to bridge the gaps that exist between military and civilian literature. This paper addresses the concerns of both military and civilian organizational leadership; however, the author will not examine political motivations of relief actors, which do play a large role in today's disaster relief efforts. Finally, this paper will discuss the manner in which US military forces interacted with other relief actors in Pakistan and will suggest that the Kashmir Model of integration, coordination, and transparency of intent is a viable framework in which future human assistance operations can be successfully undertaken.

A subject the paper will not address at length is cultural awareness. While acknowledging that there is still room for improvement, US military forces study the cultural customs and courtesies of the people in the deployment location prior to any movement. The US military provides cultural awareness training for deployments in support of the full spectrum of potential operations from combat to humanitarian assistance. Cultural sensitivity and awareness displayed by aircrews and support personnel unquestionably enhanced the ability of TF Griffin to develop a much better working relationship with their Pakistani counterparts, fellow relief workers, and earthquake victims. This was particularly important because the assistance mission in Pakistan occurred during Ramadan.

THE MILITARY AS A HUMANITARIAN RESOURCE

US military forces, like those of other countries, have a long history of participating in both domestic and international humanitarian efforts (Walker 1992; Gaydos and Luz 1994; USDOD 2001; Palka 2005). However there are differences in military and civilian terminology and sensitive issues regarding the employment of military forces, which this section will address in order to create an appropriate framework for examining the model put forth in this paper. Military humanitarian actions range in scope from simply providing transportation for relief goods or workers to or within a disaster area, to actively participating in complex, large-scale disaster relief efforts. US Department of Defense (USDOD) Joint Publication 3-07.6, *Joint Tactics, Techniques and Procedures for Foreign Humanitarian Assistance,* defines foreign humanitarian assistance (FHA), a military term synonymous with disaster relief, as operations that are intended to "relieve or reduce the results of natural or man-made disasters or other endemic conditions such as human suffering, disease, or privation that might present a serious threat to life or that can result in great damage to or loss of property" (USDOD 2001, I-1). The joint publication further directs that FHA operations are supposed to be "limited in scope and duration" and should "supplement or complement the efforts of the host nation (HN) civil authorities or agencies that have the primary responsibility for providing FHA" (USDOD 2001, I-1). Joint Publication 3-07, *Joint Doctrine for Military Operations Other Than War,* goes on to describe the three types of FHA operations as "those coordinated by the UN, those where the United States acts in concert with other multinational forces, or those where the United States responds unilaterally" (USDOD 1995, III-5).

Another type of humanitarian assistance operation addressed in both civilian academic and military literature is the complex humanitarian emergency or as named in military publications, "complex contingency operations" (USDOD 2001, I-7). These are internal, socially derived disasters which may be incited by "some kind of violent political/military event" (Albala-Bertrand 2000, 189) and "tend to have multiple causes including political breakdown or exploitation, and military offensive, which interact with and increase existing vulnerability to natural disasters" (Alexander

1997, 289). The resolution of a complex humanitarian emergency may go far beyond delivering aid and planning recovery and reconstruction. In a complex emergency, military forces will often focus on providing security in addition to relief aid distribution. Recent examples of complex humanitarian emergencies include crises in Sudan, Somalia, Bosnia, Ethiopia, Liberia and Sierra Leone (Anderson 2005).

When responding to a request for assistance in a disaster scenario, military organizations will find that the relief tasks they perform may be tasks with which they are well acquainted, but the operational environment and the potential partners with whom they are coordinating may be entirely unfamiliar (Daniel 2006). Military forces possess strategic force projection capabilities, they are experts at logistical planning, and they have ready-at-hand medical, transportation, supplies, communications, engineering, and security capabilities (Cuny 1983; Walker 1992; Alexander 1999; Anderson 2005; Gaydos and Luz 2006; Telford and Cosgrave 2007). Military forces are also capable of bringing their own life support systems (*e.g.,* food, water, medical, shelter), which decreases their dependence on limited host nation resources. From a civilian perspective, it appears that the greatest argument for the involvement of military forces in disaster relief is largely one of the military's availability and the resources they bring.

Involving military organizations in the humanitarian realm is not without controversy, either from the perspective of the civilian community or military leadership. Some relief actors may fear that when a military force shows up, it will try to assume full control of the relief operation (Cuny 1983; Waldo 2006), possibly in the pursuit of other, not-so-humanitarian goals. Civilians may also believe that military relief forces will "adopt too authoritarian an attitude to the problems of survivors" (Alexander 1999, 411). Furthermore, those needing relief or serving in relief organizations may come from a country in which past interactions with military forces may have been fearful or intimidating (Cuny 1983). These past experiences would certainly cause individuals to be wary of working with or relying on uniformed personnel for assistance. If the disaster area has a history of military or political tension, the use of military forces may hinder relief operation (Alexander 2000).

Therefore, prior to deployment, military leaders should take the time to study the past history of the host nation military and its relationship to the citizens of that country.

Military leaders will be concerned about committing training resources, personnel, and materiel to the preparation and execution of humanitarian assistance instead of focusing on their primary mission of preparation for combat. In fact, they may perceive that maintaining combat readiness while conducting humanitarian assistance missions is unachievable (Gaydos and Luz 1994; Palka 1995), or that an extended engagement in humanitarian assistance missions will produce "little training value in the repetition of routine" (Walker 1992, 158). Still others suggest the potential for a protracted engagement can "lead their organizations down the dark road to mission creep and quagmire" (Daniel 2006, 53). Doctrinal reinforcement of these assertions can be found in Joint Publication 3-07, *Joint Tactics, Techniques and Procedures for Peace Operations*, which cautions that "US military forces are not the primary US Government (USG) means of providing FHA" (USDOD 1999, I-1).

Despite these concerns, past and recent experience has demonstrated that service members who have participated in humanitarian assistance operations have gained tremendous fulfilment (Thompson and Halter 2006) and have found the experience to be both "personally and professionally rewarding" (Palka 1995, 206). From a public perspective, US taxpayers may be "more willing to maintain a larger military force if they see meaningful work, other than training for war, being conducted by the military" (Gaydos and Luz 1994, 53). The debate regarding the appropriate use of military forces in humanitarian assistance operations will persist into the future. However, the fact remains that disasters will continue to occur and as circumstances force marginalized populations to occupy hazard-prone areas, placing themselves at greater risk, the military will continue to provide post-disaster assistance.

MILITARY – HOST NATION RELATIONSHIPS

Joint Publication 3-07 directs that FHA is "intended to *supplement* or *complement* efforts of host nation (HN) civil authorities or agencies with the primary responsibility for providing assistance [italics authors]" (USDOD 1995, III-5). If a

military organization has the mission to provide assistance to the host nation during a disaster, the operation cannot be successful without fully integrating and coordinating military actions and resources with those of the other relief actors involved. This is especially true in terms of the degree to which the US military integrates or "vertically nests" its effort with that of the host nation relief effort. Foreign militaries must avoid setting up a separate and parallel relief system even if logistical advantages or security concerns may favor doing so. Military leaders should balance the potential gains in security and logistics with the fact that civilians may call their intentions into question. Additionally, if not fully integrated into the mainstream disaster response, military relief forces may not be able to attain full efficiency and unity of effort with other relief actors.

The terms supplement and complement, as used above, imply that US military forces should see themselves in an assistance role and as integrated enablers, not as the ones who are in charge of the relief operation. While the temptation may be very strong to step in and take over, especially if relief operations are stymied, military forces must resist doing so. It would certainly be appropriate to make recommendations for improvement to relief decision makers; however, military personnel must do so with discretion so as not to be seen as a critique of the host nation's or lead agency's management of the relief effort. The lead relief coordinator should present any accepted suggestions. This empowers the host nation or lead agency in the eyes of other actors and gives them ownership of the idea as well as the responsibility for implementing the plan. Military forces must remember that their time in the disaster area is transitory and therefore by empowering the host nation, they can ensure that their good ideas and contributions do not leave with them when they redeploy.

Joint Publication 3-07.3 states that "in some cases, joint forces will provide direct support to a recovering host nation (HN) or population" (USDOD 1999, I-8). In the case of the Kashmir earthquake, TF Griffin initially had no higher headquarters on the ground in Pakistan. While they continued to report to and receive support from their higher headquarters in Bagram, Afghanistan, TF Griffin went right to work, accepting missions from the Pakistani Army General Headquarters. Task force

personnel coordinated directly with the General Headquarters representative for mission requirements. This direct support relationship worked out very well for both task force mission planners and the Pakistanis. Each evening liaison officers would ask the Pakistan Air Mission Coordinator (Pakistani AMC) for a list of missions for the following day. Overnight, planners developed the mission packets which operations personnel would brief to aircrews the following morning. During the day, liaison officers continually sought updates or new mission requirements. This was not only the most efficient approach, but it also kept aircrews fully utilized during the early stages of the effort, forced the host nation planners to prioritize tasked missions, and demonstrated that TF Griffin leadership was determined to integrate their support with the efforts of other actors to the greatest extent possible.

MILITARY – MILITARY RELATIONSHIPS

US military forces participating in a disaster-focused FHA will quickly see many benefits in working with both host nation and other foreign militaries. US military forces may find that they are reporting to a non-US military headquarters, such as the UN. They may even find themselves under the operational control (OPCON) of a non-US commander, as many countries use their military as the primary organization responsible for civil defense or large-scale emergency response (Cuny 1983). However, the chain-of-command from the senior US military commander on the ground to the US National Command Authority will remain fully intact (USDOD 1999). A benefit of working with other military organizations is that regardless of national origin they seem to understand each other. In military parlance, they "get it". Chain-of-command, planning, mission orders, security, communications, and coordination are all concepts which are components of professional military organizations. Military relief providers can use this common ground as a basis upon which they can quickly form a cooperative working relationship.

MILITARY – NGO RELATIONSHIPS

It is in the best interest of a military organization to also form a cooperative working relationship with civilian relief agencies. While military forces may have resources and manpower, which are very valuable in a disaster, it is the civilians that are the relief experts. Many NGOs have participated in numerous relief efforts and are either locals themselves or have worked with the local population for an extended period of time. NGOs can be of great assistance in letting military leaders and planners know how to best utilize their assets to assist in the relief effort. A good working relationship with NGOs can be a force-multiplier for military organizations. Following an FHA operation in Bangladesh in 1991, a US military officer codified the benefits of establishing a working relationship with NGOs:

> U.S. military personnel must learn to draw on these organizations as assets; we should not be too proud to request their advice and assistance. In Bangladesh, a synergistic relationship developed in which both the military forces and the NGOs provided the talents they were each best suited to bring to the table. The NGOs had the advantage of a sound day-to-day knowledge of the area of operations, the trust of the locals at the village level, and years of experience in disaster relief operations; all of this can be invaluable in the initial assessment process as well as in actual operations (Seiple 1996, 17).

NGOs will be very concerned about construed associations or relationships arising from their involvement military forces and the potential implications upon their status as a neutral entity (Pugh 1998; 2001; Donini, Minear and Walker 2004; Weissman 2004). Even in a relief effort, a perceived blemish on their neutrality could potentially place NGOs at risk or make them "targets of insurgents" (Bello 2006, 293). Walker (1992, 156) examined this issue and proposed a series of questions regarding the initiation, control, monitoring, and funding of the responding military that NGOs need to ask in order to determine if they can maintain their "independence and integrity of purpose" when working with military forces.

In order to increase resource accessibility and better coordinate efforts with NGOs and civilian relief organizations, the military must establish a Civil-Military Operations Center (CMOC). The CMOC "provides a venue for coordination between the military and civilian organizations" (USDOD 1999, II-18) and "serves as the focal

point for requesting support from US forces" (USDOD 1999, III-5). The CMOC allows civilian and military relief workers to meet and capitalize on the strengths of each other's organizations. In past operations, these centers have "facilitated dialog, mutual awareness, exchange of information and requests by civilian fieldworkers for military logistical support" (Pugh 2001, 352). The CMOC also provides the benefit of allowing all civilian organizations to have access to military capabilities and resources, eliminating perceptions of favoritism. This may enable NGOs to better maintain their status as a neutral party.

In the case of TF Griffin, the CMOC consisted of a tent structure at the relief staging area on Chaklala Airbase. TF Griffin did not use, store or discuss any classified materials or information in this facility, which allowed open access to all personnel involved in the relief effort. The pickup zone officer and aviation liaison officer worked out of and lived in this tent, making them available at all times to the Pakistanis or any other relief provider. The CMOC contained a chart with current and future missions as well as a map that catalogued where relief flights had been and displayed an assessment made by the pilots of what type of aid was still lacking in each area. Ease of access and availability of information made the CMOC a valuable asset to all relief actors. The CMOC quickly became a rally point for passenger manifesting, liaison contact, and relief coordinators looking for means to move their people, equipment, and supplies.

Military leaders must understand that the solution to future disaster risk reduction and preparedness is deeply rooted in "local self-sufficiency" (Alexander 2006b, 12). Military forces can best help create conditions which facilitate a return to local capacity by engagement with NGOs early on and throughout the duration of the assistance mission. Relief organizations, and especially military forces, must minimize both their footprint and time spent in the disaster area and encourage local leadership to take responsibility for recovery as soon as possible. A return to self-sufficiency by the affected population indicates that the time may be appropriate to begin the redeployment of foreign military assets.

THE MILITARY, THE MEDIA, AND RELIEF

Some military personnel may have had an adversarial relationship with media workers in the past. Military leadership must understand that media organizations play a critical role in the overall effort of a disaster relief operation. The scenes of destruction and the dead and injured as portrayed by the media helped to ignite a great outpouring of commitments for the people of Kashmir. The correlation between the media's coverage of a disaster and political and donor activity which often results in action or aid commitments is known as the "CNN effect" (Olson, Carstensen and Hoyen 2003, 110) or "CNN factor" (Roberts 1993, 446; Whitman 1994, 167). The Government of Pakistan was well aware of the CNN effect and made efforts to both welcome and accommodate the international media.

Figure 5.2. Military and the Media. A reporter steps off a TF Griffin helicopter to file a report from the disaster area. Source: M. McKearn.

During the initial days of the relief effort, the number of media personnel occupying the relief staging area at Chaklala Airbase at times appeared to equal the number of relief workers. Media personnel fought with tenacity for a seat on an aircraft destined for the disaster area. As a general practice, TF Griffin aviation liaisons reserved at least one seat for a media person on each of the larger relief

helicopters. This provided an average of between 15 and 20 opportunities each day to get media personnel into the affected area (Figure 2.1). TF Griffin liaisons understood that their primary responsibility was getting aid and relief workers to the earthquake victims; however, they went to great lengths to ensure that media personnel had opportunities to report on the damage and destruction to potential donors. Positive media coverage helped ensure that relief aid continued to flow into the staging area.

INTEGRATION AND COORDINATION

In situations where US military forces enter a foreign country by invitation, US Embassy personnel from the Department of State will provide some level of liaison with the host nation. US Embassy personnel met advanced party personnel from TF Griffin at Chaklala Airbase in Islamabad. Coordination through embassy defense attaché personnel proved invaluable during the early stages of the relief effort. Embassy personnel should have greater situational awareness and understanding of politically sensitive issues than newly deployed forces. As such, they must advise newly arrived foreign military leaders regarding political concerns or potential activities which may negatively affect or impede the assistance mission.

The most critical contribution of embassy personnel in Pakistan was their ability to introduce the advanced party personnel from TF Griffin to key Pakistani military decision makers. If a host nation is not running their own disaster relief mission, embassy personnel should introduce advanced party personnel to persons in the head relief agency (*e.g.*, United Nations, Red Cross, or others). From the initial introductions made in Pakistan, US and Pakistani military leaders quickly formed working relationships and made key decisions very early on, which set favorable conditions for a US humanitarian assistance mission that would last another six months. Once steady-state operations were established, embassy personnel provided critical support in the areas of trouble shooting and problem solving beyond the capabilities of the US military relief leadership, allowing military personnel to maintain focus on their humanitarian assistance mission.

TF Griffin was the first operational foreign military organization on the ground in Pakistan. Consequently, they were the first ones to integrate their effort with and

get mission requirements from the Pakistanis. Once TF Griffin leaders had initial mission requirements, their planners developed a concept of support, which included pick-up zone operations, airspace control measures and mission graphics. These concepts were briefed to and accepted by the Pakistani Army General Headquarters and formed the core of the aviation relief support plan.

Relief actors should take the steps necessary to increase the efficiency of their operation and maximize their capabilities. One of the necessary steps in attaining this end is coordinating with other relief actors. As noted by many (Taylor 1986; Moore, Eng and Daniel 2003; UNS 2005; Pappas and Hicks 2006), coordination among relief actors in a disaster is critical to successful disaster response. TF Griffin went to great lengths to reach out to and coordinate with military and civilian aviation relief providers. As follow-on foreign military forces arrived, they were steered to the TF Griffin operations area by the Pakistanis to receive a new aviator briefing (developed in conjunction with Pakistan's 8th Aviation Squadron), aviation maps of the area of operations, communications frequency cards, and global positioning coordinate cards with known checkpoints and landing zones (Figure 5.3). TF Griffin offered these same products and briefings to civilian aviators as well. Sharing these products among all aviation relief providers led to a safer, more coordinated effort.

Figure 5.3. The military as an integrator. Colonel Mark McKearn, the TF Griffin and 12th Aviation Brigade Commander, conducts a briefing for visiting Japanese Defense Force senior leaders. Source: Author.

In taking on this responsibility to coordinate the greater aviation effort, TF Griffin leadership made three very important contributions. First they ensured standardization of aviation operations between as many organizations as possible, preventing a potential aviation disaster. Second, they relieved the Pakistani Army aviation personnel from adding this briefing requirement to their already overworked force. And lastly, by acknowledging in all of their actions that the Pakistanis were in charge of the relief operation and that all mission requirements should originate from the Pakistanis, TF Griffin set an example of full integration, which many other organizations followed as they came on board.

During the relief effort, TF Griffin leaders and relief planners formed good working relationships with the other military and some civilian aviators. These relationships allowed for a dialog to develop in which aviation relief planners shared recommendations to improve operations and gain efficiency of work through a coordinated, collective effort. While this effort to coordinate was not as successful with all aviators, those who did collaborate greatly increased the safety and efficiency of their operations by sharing frequencies, route and zone structure, and landing zone names. As such, military forces must place greater emphasis in the future on coordinating and integrating with civilian counterparts, whatever their specialty may be.

During all of the coordination and product development, TF Griffin liaison personnel ensured that they gained the concurrence of the Pakistani AMC. The Pakistani AMC would then present new products to the relief community representatives at nightly coordination meetings. Figure 5.4 depicts an example of this type of coordination and integration with the greater effort.

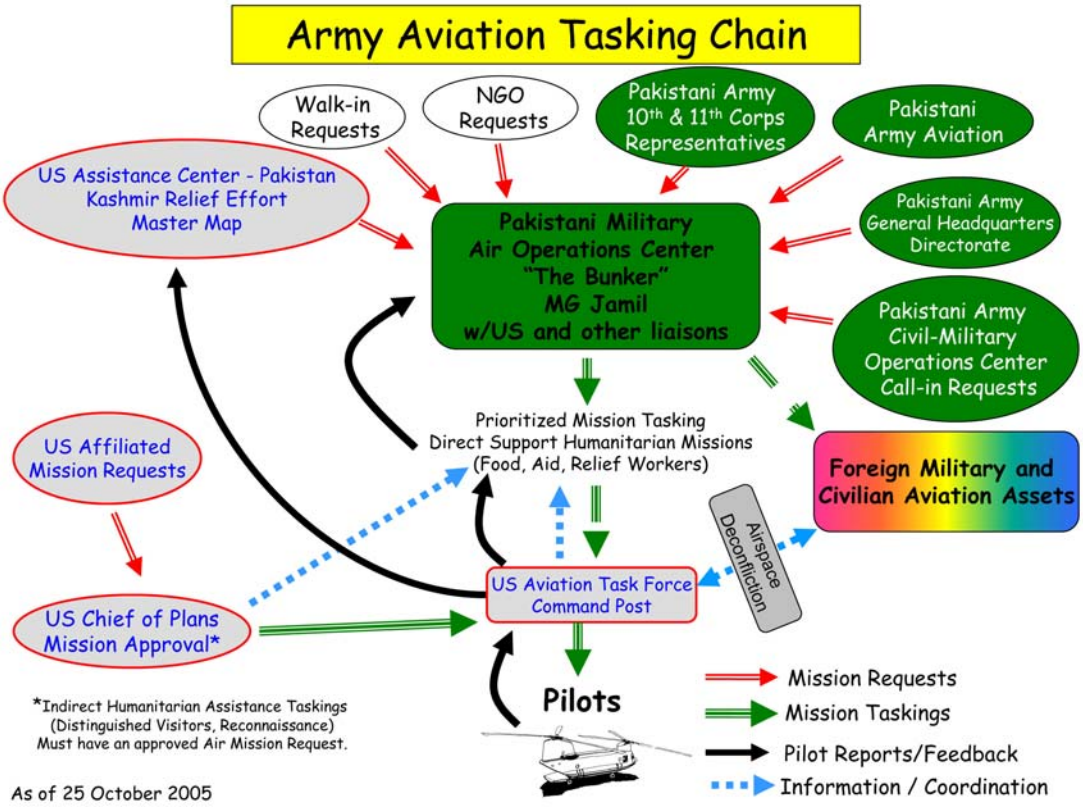

Figure 5.4. Army Aviation Tasking Chain. Source: Author.

In order to allow full access to air support, as well as screen and prioritize air mission requests, a TF Griffin officer submitted the Army Aviation Tasking Chain (Figure 5.4) to the Pakistani AMC as an example of how the mission request process could work more efficiently during relief operations. This diagram depicts an ad hoc, yet understood and executable system which was established to match aviation resources to the needs of all actors, regardless of the size or affiliation of their organization. The host nation personnel accepted the model and implemented it during their nightly coordination meetings. This put a Pakistani face on the idea, which undoubtedly gave it much wider acceptance among the other relief actors. From the outset of the assistance mission, the leadership of TF Griffin presented themselves as an enabling organization that was able to support the needs of the Pakistani and Kashmiri people by lending their unique capabilities to the effort.

BUILDING TRUST THROUGH TRANSPARENCY

When a military force attempts to integrate with humanitarian-focused civilian organizations there may initially be a gap in trust. The sooner military leaders conducting FHA can bridge that gap in trust, the quicker they can begin to truly support the operation and take advantage of the working knowledge possessed by civilian relief workers. TF Griffin personnel made building trust through transparency a top priority right from the very start. Transparency, in this situation, implied that TF Griffin had no hidden agenda while in Pakistan and that their only mission was to support the relief effort. While some relief organizations would carry only certain people or cargo, or fly only to predetermined destinations, TF Griffin pilots and aircrew would take on any cargo or mission the Pakistani AMC gave them (Figure 5.5). They would fly to any destination, as long as the mission could be safely accomplished, thus demonstrating their altruistic intentions.

Figure 5.5. Any cargo, any destination – a TF Griffin CH-47 loaded with blankets from China. Source: Author.

During the Kashmir earthquake relief effort, leaders of a British Royal Air Force (RAF) helicopter squadron (CH-47 equipped) were anxious to accept an offer by the TF Griffin leadership to merge living and working conditions on Qasim Airbase. This was a very sound course of action from a logistical standpoint. TF

Griffin already had a life support area setup, which if used by the RAF crews, would alleviate the RAF leadership from having to find and develop their own sleeping, eating, living and maintenance facilities. Since each organization possessed similar airframes, aircrews could realize efficiency of effort by sharing maintenance facilities and functions, as well as weather briefing resources and operations personnel.

However, United Kingdom Department for International Development (DFID) had paid for the RAF aircraft flight hours. DFID organizers in Pakistan were hesitant to allow the merger to go forward. TF Griffin leaders were informed that DFID personnel were concerned that a close association with the US military could taint their mission in Pakistan and their standing as a humanitarian-focused organization. Building on lessons learned earlier in the FHA operation, TF Griffin leaders invited DFID personnel to ride on their aircraft and scrutinize their operation from the inside. In doing so, they showed DFID that they had no hidden agenda and that their sole mission was to help relieve the human suffering caused by the earthquake. In the end, DFID allowed the merger of facilities, functions, and operations to go forward and each organization benefited greatly from the relationship.

THE WAY AHEAD

The fact that TF Griffin aircraft and aircrews were able to arrive in Pakistan only 48 hours after the earthquake was simply based on the fortunate circumstances of being already engaged in the region. Assembling, loading and transporting large amounts of personnel and equipment takes time – time that disaster survivors may not have. However, the relief providers can improve the timeliness of future responses. Forward-deployed militaries of all nations could form agreements with regional partners so that upon issuance of a formal request for international assistance, those forces, if available, could begin immediate preparation for deployment. Regional partners can have pre-approved paperwork, such as country clearances in place so as to eliminate some of the “red tape” which impedes timely deployment.

While often near impossible to predict, military planners must have a better understanding of anticipated hazard requirements from the disaster community. Awareness of known, regional resource and capability shortcomings would allow

military organizations to better plan for potential assistance requests and become more familiar with key actors in the civilian disaster relief community. Telford and Cosgrave (2007, 11) noted similar "joint planning and training" shortcomings during the 2004 Indian Ocean earthquake and tsunami response. Military and civilian relief planners should address inadequacies like these during planning conferences organized around a regional or hazard-specific theme.

Lastly, the most productive and beneficial effort to improve military support to disaster relief may come about through dialog and contributions to disaster related literature from both the civilian and military communities. Increased discussion regarding concerns, operational procedures, lessons learned, and strengths and weaknesses of both civilian and military relief organizations would contribute greatly to a better working knowledge of each group. When responding to a disaster, civilians and military alike, leave behind the comfort and safety of their home to deploy to an unfamiliar area in an attempt to relieve the suffering of those who have endured a terrible hardship. Possibly one day, military forces and civilians can cease viewing each other with suspicion or contempt and begin to see the other as a welcome partner in the humanitarian realm.

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CHAPTER 6 - CONCLUSION

The Inverse Gambler's Fallacy (Hacking 1987) addresses the belief that once a large event has occurred, the chance of that event reoccurring is very small. This line of thinking bears directly upon the ability of emergency managers to "sell" disaster preparedness to their communities. It also influences their ability to fund developments and improvements in resources and training, as well as in staffing the organizations that focus on disaster response and recovery. Yet there is a way forward. Researchers can make meaningful contributions to disaster preparedness and response. They can develop solutions, which emergency managers can implement as funding becomes available. Similarly, the goal of this research was to examine real problems that impede disaster preparedness and response through original independent research and recommend a practical solution for each problem. Individually, each of the manuscripts makes a unique and valuable contribution to the field of disaster studies. When examined collectively, the three manuscripts address almost every aspect of the Emergency Management Cycle (Thomas *et al.* 2002).

The research in this dissertation examined community preparedness by addressing the issues of risk and post-hazard sheltering and relief. This resulted in a practical methodology whereby local emergency managers were able to assess risk to critical facilities in their communities and designate relief centers by incorporating qualitative and quantitative considerations. The second manuscript focused on the geo-information needs of those who provide disaster response. Practitioners can extend the recommendations suggested in this manuscript to address geo-information needs in disaster recovery and reconstruction as well. The proposed geo-information structure in this manuscript, if implemented, will offer humanitarian actors a continuous, one-source, global suite of geo-information products. With this tool, each contributor can have the same common operational picture, regardless of organization size or level of funding. The proposal also offers a positive-feedback incentive, as the more information that disaster response actors contribute the greater the amount of geo-information that each actor will have to plan and execute humanitarian tasks. Lastly, this dissertation makes a unique and valuable contribution to the field of disaster studies, by examining the contentious realm of civil-military operations –

addressing the concerns of both civilian and military relief actors. This manuscript proposes a framework within which each actor can operate in a more cooperative environment.

The personal observations made while conducting disaster relief following the Kashmir earthquake formed the foundation of this research. The observations not only provided key data for this study, but also motivated the author to address the deficiencies he saw. However, by incorporating personal observations into this research, the author departed from a traditional disaster studies approach (Killian 2002). This was not a frivolous attempt to thwart rigorous, accepted methodology, but a deliberate course of action, employed to take advantage of a unique opportunity in order to make a meaningful contribution to the body of disaster knowledge.

The disaster researcher and the disaster victim can experience significant "emotion and tensions" from their participation in the disaster experience (Killian 2002, 53). This may influence any conclusions that researchers draw from their observations. The researcher must account for this influence and not immediately rely on his or her observations as an unbiased source. Consequently, a researcher should not incorporate conclusions into their work until he or she has validated them through comparison with similar observations in existing literature. That is precisely why the methodology used in this study incorporated an observation-validation approach. While it would be very rare to find a study (methods) or set of observations (data) that perfectly matched one's own experiment, researchers can scrutinize their observations against those of others to substantiate their validity. Alternatively, if the researcher can find no match for his or her observation in the literature that does not necessarily invalidate the data. However, the researcher must be prepared to defend any conclusion he or she makes based on a unique observation.

FUTURE RESEARCH – RECOMMENDATIONS AND CAUTIONS

Much of the work in this dissertation has drawn upon the efforts of sociologists and geographers and the vast body of literature they have produced while examining the response of society to and the actions of victims in a disaster. The progenitors of modern disaster research were Prince (1920), Sorokin (1942), and White (1945). The

groundbreaking work of these scholars defined the society-hazard relationship during the infancy of disaster studies. Subsequently, scholars have focused on improving hazard understanding and awareness. Their innovative and aggressive research has reduced hazard vulnerability in the past and should continue to produce breakthroughs in the future.

Reducing societal losses from hazards can come from better hazards understanding, pre-hazard community preparation, and more efficient and effective post-hazard response. Curiosity can inspire scientists to pursue hazard understanding in an aggressive manner. Self-interest and self-preservation can encourage community preparedness; however, future estimates suggest that this will not be enough. Hazards in the future "will simply have more [people and property] to impact as the result of normal population growth and higher, denser concentrations of inhabitants in risk-prone localities" (Quarantelli 2000, 686). From Quarantelli's suggestion, one can draw the conclusion that despite research by hazard scientists and work by emergency managers in community preparedness, hazards will continue to impact society and do so in an increasingly detrimental manner. Therefore, future research should focus on how society responds to disasters as well. This is not a fatalistic resignation, but simply an acknowledgement that until society is fully prepared to face all hazards without a loss of human life and property, a disaster response requirement still exists.

Disaster response "is the most studied phase of disasters" (Mileti 1999, 220). Yet until coordinated, effective, and efficient disaster response efforts become the norm, a rich research agenda aimed at improving future response activities still exists. As noted in Chapter One (Figure 1.4) there are many areas in which scholars can focus their research when examining the 2005 Kashmir earthquake. Researchers can approach the disaster in Pakistan by examining societal risk and vulnerability, hazard preparedness and education, policies of the Government of Pakistan prior to the earthquake, and pre- and co-seismic geologic understanding of the area. Each approach can yield a unique insight into exactly what happened during the disaster response and create solutions to future disaster-related problems.

However, researchers should proceed with caution as some solutions may incorrectly appear like a quick fix or panacea. For example, employing a new

technology to improve Internet connectivity may appear to give disaster responders a great advantage. However, if the actors continue to fail to coordinate their actions while using their new technology, there will be no better outcome for the disaster victims. In fact, there is little research supporting the assertion "that new technologies – especially computer-related ones – will allow major improvements in disaster planning and management" (Quarantelli 2000, 684). Therefore, research that incorporates new technologies as a component of its solution must do so with specific goals such as improving coordination in response organizations, increasing preparedness education, or improving hazard understanding. In this manner, improvements in one area will result in corresponding improvements in another area – each drawing on the strength of the other.

Two areas in need of very specific, targeted research are improving coordination during disaster response and developing and refining the tools and techniques which allow disaster planners and decision makers to execute their operations with greatest efficiency and effectiveness (NRC 2006). The same deficiencies noted by the NRC were also seen during the Kashmir earthquake relief effort. Issues stemming from poor coordination between actors and failures to employ tools in order to increase the efficiency and effectiveness of disaster response are reoccurring themes in the literature, yet solutions to these problems remain under-addressed.

Finally, future research must employ a collaborative approach, drawing on the contributions from both practitioners and scholars. Practitioners possess valuable experience, institutional knowledge, on-the-ground expertise, and an experiential context that can validate proposed solutions. Scholars understand research methodology, theoretical frameworks, and are current on recent developments in enabling technologies. Literature incorporating the ideas and contributions of both groups is rare. Therefore, disaster-related deficiencies will not be adequately addressed, nor will the solutions developed be as effective until scholars and practitioners begin a meaningful dialogue aimed at developing practical solutions.

This research has attempted to address a number of disaster response impediments at length. While each manuscript contained recommendations intended

to improve some phase within the Emergency Management Cycle, much more work needs to be done. The Kashmir earthquake directly and indirectly affected many people. Those who suffered through the earthquake and its aftermath are counting on government systems, scholars, and practitioners to complete reconstruction and preparedness tasks so that their lives may return to normal. Those who witnessed the devastation in Kashmir and returned to the comfort and safety of their homes are obligated to do their part to reduce the impact of future disasters by analyzing and sharing their observations. Each participant has information that can improve future disaster response efforts. To take no action, is to be complicit in the occurrence of future response failures. I too share this responsibility. This dissertation is my part – a partial payment of what I see as my moral obligation to help others. As such, this dissertation is not a terminal effort, but instead represents the beginning of a long-term professional and personal research agenda aimed at helping communities prepare for hazards and providing disaster responders with the tools they require to help those in need.

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