CHAPTER 14

# ANALYSING ENVIRONMENTAL DISASTERS

*S. Harris Ali*

Over the last several decades the world has experienced numerous large-scale natural and technological disasters that have had enormous impacts on the lives and livelihoods of people throughout the globe. In fact, the United Nations reports that the number of disasters has risen on an average of 6 per cent each year between 1962 and 1992 (Associated Press 1995, cited in Bankoff 2001: 19) and affected an average of 200 million people annually during the 1990s itself—a fourfold increase from the late 1960s (Walker and Walter 2000). Even in most recent times one can easily recall a long list of large-scale disasters, including, to name just a few examples: the 2005 earthquake in Pakistan, Hurricane Katrina impacting the US Gulf Coast area in 2005, the heat wave in Europe in summer of 2003, the 2004 tsunami in southern Asia, the 1998 ice storm in north-eastern North America and the 1986 Chernobyl nuclear power plant explosion in the Ukraine. Various explanations have been put forth to account for what appears to be an increasing trend in the number of disasters experienced over the last few decades. Some argue that the alleged trend is simply an artefact—the product of better media coverage or merely the reflection of a more densely settled global population (Bankoff 2001). Be that as it may, few would dispute the fact that environmental disasters are having an increasingly greater impact on modern society and that at least some of the factors that account for this enhanced impact are such things as intensified urbanization (that is ever-growing cities) and increasing environmental degradation. Within this context, there has been an increased recognition that as 'natural' phenomena, environmental disasters are inseparably linked to issues related to environmental conservation, resource depletion, migration patterns and land-use patterns in an increasingly globalized world—issues that are inherently social because they are based on human decisions to intervene in nature. In this light, disasters, generally speaking, can be thought of as having both biophysical (that is, 'natural') and social constituents (Murphy 2004).

As we shall see, biophysical and social factors come together to define the nature of a given disaster and its impact. In fact, the coming together of these two sets of factors contribute to the complexity of a disaster as a phenomenon in and of itself. In turn, this *emergent complexity* poses formidable challenges for those wishing to analyse disasters (Homer-Dixon 2001; Perrow 1984). The challenge of analysing such complexity is even more daunting when one considers that disasters are a totalizing phenomenon: '[A] disaster is a collectivity of intersecting processes and events, social, environmental, cultural, political, economic, physical, technological, transpiring over varying lengths of time. Disasters are totalizing events' (Oliver-Smith 1998: 178).

In addition to the inherent complexity and totalitizing nature of disasters, the analysis, and in particular, the management of disasters, are made even more challenging in the light of Hewitt's observations that:

> Disasters are problems that are, by implication and in fact, out of control, in that they break out of the modern mold, or challenge its effectiveness. That is how the tell-tale *un*-words seem so readily to define our concerns—the language of the *un*anticipated or *un*scheduled events; *un*certainty and the results of accident, human error, bad design or underdevelopment (ibid.: 89).

Attempts to analytically grapple with these inherently unpredictable aspects of a disaster are found throughout the history of disaster research. In the following section I will briefly review the historical development of the social scientific research on disasters by selectively focusing on the approaches developed primarily within the disciplines of geography and sociology—the two disciplines which arguably have had some of the most significant influences on the formalized development of disaster research within academia.[1] As we shall see, although the former tended to emphasize the biophysical, while the latter the social, today there is a convergence of approach in disaster research. In essence this analytical convergence represents a response to the need to come to terms with the complexity and totalitizing qualities of disasters which has implications for this study of disaster vulnerability and disaster potential—each of which will be discussed in separate sections of this chapter.

## The Evolution of Academic Research on Disasters

It is widely acknowledged that the first formal sociologically informed study of a disaster was conducted by Samuel Prince who completed a doctoral dissertation on the subject of the 1917 Nova Scotia explosion that resulted from the collision of two ships in Halifax harbour—one of which was carrying large quantities of munitions and explosives (Prince 1920). Subsequent sociological work on disasters receded in the interwar years—a situation that was not mirrored within the discipline of geography. Buoyed by the US Army Corp of Engineers' interest in conducting comprehensive investigations into ways of dealing with the massive devastation from flooding throughout the USA in 1927, geographers quickly became involved with such issues as assessing the human impacts of construction projects associated with altering the course of rivers, the erection of dams and so on (Smith 2001). By the 1930s, geographers were instrumental in developing new environmental planning techniques that focused on the identification and analysis of means to minimize flood damage, ultimately resulting in the 1936 Flood Control Act. In the late 1960s, through the support of programmes funded by the National Science Foundation, the focus gradually broadened from issues related exclusively to flood control to other natural hazards such as: drought, earthquakes, landslides, hurricanes, snow storms and so on. With these developments came the formalization of hazards geography which, in part, focused on issues related to the spatial distribution of hazards as well as on ways to reduce losses from hazards (ibid.).

On the other hand, the systematic study of disasters from the sociological perspective really only took off after the Second World War with the establishment of the Disaster Research Centre at Ohio State University in 1963 (later moving to Delaware in 1985). The Centre was noted for carrying out hundreds of field studies that focused on how people, organizations and society react and respond to disasters (Nigg and Mileti 2002). The adoption of such a research emphasis could be traced to the fact that much of this early sociological research on disasters was supported by US military organizations who had practical concerns about potential wartime situations that could arise during the Cold War era (such as nuclear bomb attacks). The rationale for their interest was based on the view that the study of peacetime disasters could lead to knowledge that would be relevant to the types of events and conditions that could result during a wartime emergency (Kreps 1984). In particular, the military was interested in how civilians would respond to natural and industrial disasters so that managerial instruments of social control could be developed.[2]

As alluded to earlier, a disaster will necessarily involve biophysical factors; after all a disaster must occur in some material context, and this physical setting cannot be ignored if any analysis of a disaster is to be complete. It is the incorporation of the biophysical that has been a stumbling block for much of earlier sociological research on disasters (but not so with geography which as a discipline has always had the strong research tradition of physical geography). Traditionally, sociological thinkers have been reluctant to incorporate biological and physical considerations into sociological analysis for a variety of reasons, including: the historically specific need to justify the existence of an autonomous discipline separate from other disciplines such as biology, geography, and psychology, as well as concerns related to the possible misuse of biological explanations in sociological argumentation—as was the case, for example, with Social Darwinism and other variants of racist and sexist based forms of social engineering (Buttel 1996; Freudenburg and Gramling 1989). The fledgling sub-discipline of environmental sociology had to deal with such issues in establishing legitimacy within the discipline and debates are still ongoing on how to reconcile biological and sociological factors (Buttel 2002; Freudenburg et al. 1995; Murphy 2002).[3] For the present purposes, we can at the very least adopt as a starting point the view of the environmental sociologist John Hannigan (1995) that environmental problems (including disasters), unlike other social problems, have a much more imposing physical basis that needs to be taken into account if a more complete understanding of disasters is the goal.

## Technological Disasters Versus Natural Disasters

For some time, disaster researchers have debated the question of whether natural and technological disasters are qualitatively different phenomena that should be analytically separated (Quarantelli 1998). There are various ways to approach this debate. One perspective is to examine the nature of each type of disaster threat in terms of: the type of cause (that is human versus natural, or both), controllability (that is the degree to which the disa... threat or its effects can be prevented and/or controlled) and consequences (that is the nature and types of consequences—short term versus long term, physical versus psychological, damage to property and livelihood versus harm to health, direct versus indirect effects and so on) (Hewitt 1997). Let us consider how these aspects of a disaster inform the debate.

It has been argued that differences between technological and natural disasters may be made on the basis of referring to the nature of the disaster agent (that is the cause) as well as issues related to the relative degree of control humans have over the disaster agent and its consequences. Thus, Kai Erikson (1991) notes that technological disasters are different from natural disasters because they are a product of human hands (not 'Acts of God'), while natural disasters 'visit' us, as if from afar (then leave). The implications of this with reference to control is that technological disasters are human-caused disasters that by definition imply a *loss* of control over systems we have created ourselves, while natural disasters imply a *lack* of control over systems in which we played no role in creating. It is argued therefore, that technological disasters are in principle at least, preventable. Notably, this recognition has many implications for understanding and contextualizing the political aftermath that often arises in response to these types of disasters. Researchers (see, for example, Ali 2002a; Edelstein 2004; Fowlkes and Miller 1987; Freudenburg 1997) have found that shortly after the emergency response to a technological disaster, a flurry of activities occurs as individuals search for those who should be held responsible for the disaster and the compensation that is required thereof. The type of social context in which these interactions occur has been referred to as a 'corrosive community' (Freudenburg 1997). In a corrosive community there is a great deal of public anger and distrust expressed towards the precipitating human agents of the disaster—usually associated with corporate greed and/or government corruption (including ineptitude and bureaucratic bungling by officials).



The response to a disaster that was not caused by human intervention per se, it is said, leads not to the provocation of anger, but a response based on acceptance or resignation because there can be no human party that can be directly held responsible. The ideal type of the 'corrosive community' that develops after a technological disaster is therefore contrasted to the ideal type of 'therapeutic community' that has been observed to develop after many natural disasters (ibid.). Instead of a fragmented community defined by divisiveness, a therapeutic community is one based on the formation and consolidation of social bonds as volunteers come together, in an altruistic and cooperative way, to focus on rebuilding the community after the natural disaster.

Erikson (1991) also points out that differences in natural and technological disasters may be discerned in terms of the social consequences incurred from each type of disaster. In particular, the mental health impacts and psychological responses to technological disasters may be quite different from those associated with natural disasters in many instances. These effects are a function of the fact that technological disasters, unlike natural disasters, involve more directly the toxic contamination of people and surroundings. That is, they involve not just overtly physical damage, such as the breaking of a limb due to fallen debris from a natural disaster, but the penetration of toxins into the body. Consequently, the threats from a contamination event are more insidious because they work themselves from inside the body outwards—such as the development of cancer due to toxic chemical exposure—as opposed to the more directly observable physical injury experienced, for example, by fallen debris. Consequently, the effects from a technological disaster may be ambiguous and uncertain in terms of potentially harmful effects: 'Toxic risks also have an unbounded quality, wreaking not direct but chronic, long-lasting damage on people who in a sense do not become victims until well after the noxious offense' (ibid.: 20).

The 'unbounded quality' of technological disasters poses particular problems, as victims are forced to deal with significant health issues that may not have developed yet, thus leading to a lingering sense of anxiety that may last much longer than the disaster event itself. Again, quoting Erickson in this regard: 'Chemical disasters involve toxic poisons, that is, they contaminate rather than merely damage, they pollute, befoul, taint, rather than just create wreckage, they penetrate human tissue indirectly rather than assaults of a more straightforward kind' (ibid.: 15).

It is under these very circumstances that Michael Edelstien (2004) documents a whole set of psychological impacts that emanate from technological disasters, many of which can be traced to disruptions in what he calls the personal 'lifescape'—the normal and usually unquestioned, taken-for-granted understandings about what individuals expect from the world around them. In a similar fashion, Anthony Giddens (1991) describes this a threat to the individual's sense of 'ontological security', that is the disruption of the default condition that the world surrounding the individual is non-threatening. Toxic exposure victims experience this disruption in various ways including how, in the post-technological disaster setting, they view their health, their home, their environment, their personal control of the future and their ability to trust others (Edelstein 2004).

From the brief discussion above, it may be concluded that many of the differences between technological and natural disasters are related to differential responses to each phenomenon within the context of the *post*-disaster setting. However, we have already seen that the impacts of disasters—whether they are of technological or natural origin—may have more to do with societal arrangements. In particular, the vulnerability of various groups within society to both technological and natural disasters will be a function of social factors rather than solely due to the causative agent of the disaster itself—thus, leveling the need to analytically separate the two types in this regards. As we will now discuss, further commonalities between the two types of disaster can be identified if we consider the *pre*-disaster context.



## Disaster Vulnerability

As different lines of disaster research have developed over the years, there now appear to be important points of convergence in focus. One example of this relates to investigation and analysis of the location of potential threats to human health and the environment. Hazards geographers have broadened the scope of their investigations in this regard to consider the more general issue of the *vulnerability* of people and property to hazards (Bean and Shelley 2004; Hewitt 1997). Indeed, the geographer Susan Cutter (1996) has even called for the establishment of an interdisciplinary field of vulnerability analysis to analyse those circumstances that put people and places at risk and would provide information on the sectors at risk, including: (*a*) the physical dimension: buildings, infrastructure, critical facilities; (*b*) the social dimension: vulnerable groups, livelihoods, local institutions, poverty; and (*c*) the economic dimension: related to direct and indirect financial losses. The social dimension, as would be expected, is of central concern to sociologists, and over the last decade within the sub-discipline of environmental sociology there has been a proliferation of studies that deal with the issue of vulnerable communities as defined through the lens of environmental justice (Hurley 1994; Krieg 1995). Generally speaking, the notion of environmental justice (Capek 1993) brings attention to issues related to the unequal distribution of risk within a society at both the local and international levels—for example, the siting of toxic landfills near African-American neighbourhoods (Bullard 1990; Bunyon and Mohai 1992) or the global international trade of toxic waste involving the 'dumping' of industrial waste produced by Northern countries onto nations of the Global South (Redclift 1996; Yearley 1996). In investigating the issue of disaster vulnerability, key questions revolve around the questions of how and why certain, almost always marginalized, groups within a community are more susceptible than others to natural and technological disasters. In examining how such questions are addressed by social scientists let us begin by considering a few case studies of environmental disasters.

## The Chicago Heat Wave

During the first weeks of July 1995, a humid air mass from the Gulf of Mexico region moved into the Chicago area (metropolitan population: 2.8 million). Normally, the humid air travelling northwards across the continent becomes diluted with the drier air found at the higher altitudes. During the heat wave this did not happen. Instead, a temperature inversion developed over Chicago whereby the humid air mass was trapped close to the surface of the city by a cooler layer of air above, resulting in excruciatingly hot and human conditions for those residing in the city. By the week of July 14–20, 739 fatalities were attributed to this heat wave as temperatures reached 106 degrees fahrenheit.

At first glance, it would seem that as a 'naturally' occurring phenomenon, the heat wave would affect all people equally, because ostensibly, everyone residing in the shared area would be experiencing the same climatic conditions. If this were indeed the case, then it would have been predicted that the mortality rate could be the same throughout the various neighbourhoods in Chicago. On mapping the deaths in the city, Klinenberg (1999) found that this was not the case at all. Rather, there were discernable spatial patterns in the mortality rates that clearly reflected the inequalities of the city's built environment. For example, in comparing two adjoining low-income Chicago neighbourhoods, Little Village and North Lawndale, that were statistically identical, both having heavy concentrations of poor, elderly people who were living alone, it was found that North Lawndale had *ten times* the fatality rate of Little Village. The question then is why? The answer involves the vulnerability of particular groups to the effects of the natural disaster.

According to the Major's Commission of Enquiry into the heatwave, the poor and isolated seniors in North Lawndale did not heed instructions to leave their apartments and find an air conditioned setting, or at least to open their windows and doors for ventilation. The Commission thus concluded that those who were most at risk did not want to, or were the least likely to, accept help from government. Klinenberg (ibid.) argues that this conclusion of the city officials essentially 'naturalized' the disaster, thereby absolving the local government of culpability in regard to the fatalities. Moreover, it was a false conclusion because those in certain parts of the city were more vulnerable than others to the effects of the heat wave for various socio-political reasons that were not acknowledged by the local government. North Lawndale was a sprawling, underpopulated, drug-infested neighbourhood in which the elderly (many of whom were African-American) would understandably be afraid to venture outside or leave their doors and windows open for reasons of personal safety—even under the intolerable conditions of the heat wave. Further, the residents of this neigbourhood did not have anyone close by to visit them to make sure that they were safe. Klinenberg (ibid.) notes that earlier government programmes to 'check-in' on such individuals were cut in the previous years a part of a process of deregulation and privatization pursued by the neoliberal strategies of the local government. In contrast to North Lawndale, for a number of reasons, the effects of these cuts to social services—services that would be even more critical at times of a natural disaster such as a heat wave—were less critical in the case of Little Village. Specifically, this neighbourhood was a bustling, relatively safe, close-knit Hispanic community where the elderly had family and friends nearby who could look in on them, as well as the existence of streets and stores where residents could go to escape their stifling apartment units. It was clear therefore that the vulnerability to this natural disaster was a function of the built and social environments and, most importantly, the political economic circumstances that negatively impacted the life chances of the elderly and minority members of the city.



## Hurricane Katrina in New Orleans

The vulnerability of particular groups to the natural disaster was also quite evident in the recent hurricane that affected the southern United States. On 30 August 2005, Hurricane Katrina ravaged areas of Mississippi, Alabama and Louisiana. Particularly hard hit was the city of New Orleans, Louisiana (metropolitan population: 1.5 million) located on the Gulf of Mexico on the mouth of the Mississippi River. An official evacuation call for the city declared two days before the disaster onset led to massive traffic jams on the highways leading out of the city as 1.3 million individuals fled in their vehicles. The death toll from the hurricane was estimated to be at least 1,000 while considerable physical damage resulted from the hurling of debris—tree branches, garbage cans, sheets of metal, plywood, billboards and so on–against the city's homes and buildings with the flooding of more than 80 per cent of the city (Bakker 2005). For many weeks after, the many that were stranded in the city—because they could not afford vehicles—were left without fresh drinking water, electricity, food, gasoline and sewage services.

What is perhaps most alarming in regard to this disaster, is that experts had known for some time that the city of New Orleans was particularly susceptible to the effects of flooding the result from hurricanes but little was done to address this (Rydin 2006). New Orleans is essentially a bowl-shaped city situated on swamp land and is located about 3m below sea level. Water is kept from entering into the city through a systems of canals, levees (that is soil embankments) and pumping stations built in the 19th century. During the hurricane, three of the main levees collapsed, resulting in flooding of up to 6m in depth across most of the city. The physical vulnerability of New Orleans to flooding was exacerbated prior to Hurricane Katrina due to several social causes. First, the pressure for industrial development in the areas led to the gradual disappearance of the wetlands on the Gulf Coast, but these wetlands served a protective purpose, in that they served as a natural buffer between the city and storms coming in from the water. Second, off-shore oil drilling led to the reshaping of channels, thus increasing the access of ocean water onto the land (Reed and Wilson 2004). Third, the US Administration's recent budget cuts affected the effectiveness of Louisiana's hurricane preparedness plans, as the funding was reallocated towards the US Homeland Security Department in the wake of the terrorist attacks of 11 September (Bakker 2005).

In assessing the differential impacts of Hurricane Katrina on particular groups in New Orleans, it is useful to first consider some of the demographic characteristics of the city. According to the US 2000 Census, the percentage of households in the city that fell within the low income category (below $18,000) was quite high at 36.1 per cent; the percentage of the population that was non-White or Hispanic was 73.4 per cent with African Americans constituting about 68 per cent of the population of New Orleans. In this connection, it is also interesting to note that the percentage change in the White population from 1990 to 2000 was 21.7 per cent, thus indicating the phenomenon of 'White flight' historically found in many American cities was a more recent phenomenon in New Orleans. With this demographic profile in mind, it is not surprising to discover that those who were unable to afford a vehicle to flee the city or have the funds to stay in a hotel outside of the city, were those of an African American and lower economic class background (35 per cent of the African American households did not have a car compared to just 15 per cent amongst Whites). In fact, it was estimated that of those survivors stranded on rooftops, or evacuated to inner city shelters (such as the Superdome football stadium), 80 per cent were those of an African-American and lower economic background (Seager 2006).

The vulnerability of low-income African Americans to the ravages of the flood was even further intensified by industrial and residential trajectory of the city. Located along the Mississippi River, New Orleans is host to a very heavy concentration of chemical refineries. The chemicals originating from these local sources then mix with those accumulated chemical toxins originating from many upstream industries located on the Mississippi River throughout the American heartland. The areas where the highest concentration of toxic chemicals are found (that is economically devalued lands), are also those areas in which a high proportion of African Americans reside because they cannot afford to live anywhere else in the city (Rydin 2006). In fact, as the cancer rate for those residing in this area is known to be one of the highest in the nation, this area is referred to as Cancer Alley. With the flooding from Hurricane Katrina, these particular residents were further endangered because flooding would expose them even more directly to a toxic slew of sewage, seawater and industrial pollutants. Second, Smith (2005) found that the hurricane vividly revealed the fact that those neighbourhoods located on higher ground—and therefore less vulnerable to the impacts of flooding—were those areas inhabited predominantly by White residents.



Vulnerable groups during Hurricane Katrina may also be discerned along gender lines as the majority of victims trapped in New Orleans were African American women with children. Seager (2006) argues that the disproportionate number of women affected by the hurricane may be due to cultural influences of gender roles that may have resulted in differences in location between men and women during the disaster onset. Specifically, women who may have been tending their homes and families would literally be in harm's way vis-à-vis the floodwaters, while, the men may have been at their jobs in places that required them to be away from the coastal waters.

## Toxic Gas Leak in Bhopal, India

On the night of 2–3 December 1984, a leak of the deadly dimethyl isocyanate gas from the Union Carbide pesticide factory in Bhopal, India eventually resulted in the deaths of 20,000 people and 120,000 chronically ill survivors, many of whom later developed cancers, or gave birth to children with serious birth defects (Dinham and Sarangi 2002). All of the environment in the vicinity of the site became chemically contaminated and resulted in the poisoning of the soil, water and mother's milk. The potential for disaster was completely unknown to residents, local political and medical authorities, as well as many of the Union Carbide workers themselves. The people of Bhopal were not aware of the extreme toxicity of dimethyl isocyanate gas in their midst, and particularly troubling was that there were no emergency plans in place to deal with the possibility of accidental release of the dangerous chemical (Shrivastava 1991). In fact, no guidance or direction was provided by either the company or local authorities during the emergency response and immediate aftermath of the disaster. This was particularly troubling in light of the fact that the vast majority of those poisoned were uneducated people from the surrounding rural areas who had come to Bhopal to work in the Union Carbide factory. Many of these workers stayed in makeshift shelters constructed from corrugated metal and other detritus found within the city. Notably, the collections of these shelters essentially formed 'slum areas' situated close to the factory (Shrivastava 1992). Such shelters provided little resistance to the flow of the deadly gas and most likely increased the degree of exposure than would normally have been the case if the workers were housed in proper residential dwellings—thus increasing the disaster vulnerability of this already marginalized group even further.

The Bhopal tragedy is a clear illustration of an environmental corporate crime on several fronts and it brings to the fore the issue of how political and economic factors raise the disaster potential for certain groups within society. As alluded to above, the types of occupational health and safety standards found in comparable facilities in the developed world were not found in the Bhopal Union Carbide plant. For example, plant workers were not informed of the potential dangers lurking within their work facility—a situation that would be illegal under the 'right-to-know' occupational legislation of most developed nations. Moreover, the fatalities from the disaster would have been much lower if land zoning policies and factory inspection procedures had been developed by the various government agencies in Bhopal (Shrivastava 1991). In addition, a Union Carbide plant in Beziers, France that manufactured the same pesticides as those in Bhopal, had adopted a safer production process in the 1970s based on producing the amount of dimethyl isocyanate gas required for immediate processing, thus ridding the requirement for the on-site storage of this gas altogether (Dinaham and Sarangi 2002). The question then arises: Why was this safer production practice not adopted in the Bhopal facility? Second, efforts were made by the US-based Union Carbide Corporation to displace the legal and moral responsibility for the accident solely on the Indian subsidiary. This was despite the fact that the decision to close the refrigeration unit to store the gas in the Bhopal plant was in compliance to a cost-cutting directive from the US headquarters—an action that precipitated the disaster (ibid.). The US corporation also argued that the Bhopal plant was designed, engineered, built, operated, managed and maintained with local Indian labour, materials, equipment and staff; consequently the parent company, Union Carbide Corporation, was not responsible for the damages. In reality, however, the technology was not only supplied by the US corporation, but the Indian subsidiary actually had to pay royalty and technical service fees for its use (Shrivastava 1991). Third, the Union Carbide Corporation fought for the legal case to be heard in India, where any possible compensation settlements would be lower than those awarded in the US system (Das 2000; Dinham and Sarangi 2002).

The technological disasters arising from environmental corporate crimes are, unfortunately, not unusual for 'company towns' having a narrow economic base, wherein many in the locality are dependent upon a particular industry for livelihood. Under such circumstances, local industry is not averse to taking advantage of this dependency by adopting unsafe occupational health and safety practices coupled with the threat of relocation or plant closure (Ali 2002b)—as is seen in many resource-dependent communities, such as mining towns (Tucker 1995).

In sum, the cases of the heat wave in Chicago and Hurricane Katrina in New Orleans and the toxic chemical leak in Bhopal, all illustrate how vulnerability to both natural disasters and technological disasters is in fact socially constructed on the basis of the intersection of various variables, including social class, race/ethnicity and gender, which together reflect the structural inequalities of the locale. That is, those who are most susceptible to these types of disasters tend also to be the most marginalized in terms of power and resources (including, money, education, expertise, political voice and time) and are therefore placed in a position in which they unfairly face the consequences of the uneven social distribution of environmental and health risks.

## The Incubation of a Disaster

Part of what makes particular sub-populations within a given community vulnerable to disaster involves the existence of inadequate regulatory systems of various types—industrial, occupational, land use and environmental—as well as a serious lack of *enforcement* of any of the weak existing regulations that there may be. We have already seen various instances of this in the disaster cases reviewed above. For example, in the case of the Chicago heat wave, an increased fatality rate in particular areas of the city could be traced to the privatization and deregulation of certain public health and social service programmes; in the case of Hurricane Katrina, a lack of adequate land use regulations and industrial zoning ordinances increased the exposure to dangerous chemicals for those residing in predominantly African American neighbourhoods during the flooding; while in the case of the Bhopal tragedy, a weak system of land use regulations allowed unsafe housing to be built near a dangerous industrial facility—a facility in which the potential for disaster was high because of a serious absence of occupational health and safety regulations. Disaster vulnerability may therefore, at least in part, be thought of as a function of the regulatory environment. To study the role of regulations in increasing the potential for disaster, I would suggest a focus on process of what is known as 'disaster incubation'; a process that involves the organizational culture of a particular locale, institution, factory, or community setting (including the broader political economic context).

In approaching the issue of how technological disasters develop, Barry Turner (1976) proposed the notion of 'disaster incubation'—the pre-disaster period in which factors and processes that contribute to a disaster *accumulate and interact in an unnoticed manner* until their convergence leads to the actual disaster onset. Turner (ibid.) identifies various organizational tendencies that facilitate the disaster incubation process, including: rigidities in institutional beliefs; the presence of distracting decoy phenomena; the neglect of outside complaints; multiple information-handling difficulties; the exacerbation of the hazards by strangers; the failure to comply with regulations; and the psychological tendency to minimize emergent danger. The processes of the 'normalization of deviance' (Vaughan 1996) and 'agency capture' (Freudenburg and Gramling 1994) could also be added to this list of the organizational antecedents that contribute to the incubation of disaster. For example, in her study of the Space Shuttle Challenger disaster, Vaughan (1996) proposes the notion of the 'normalization of deviance' to describe how certain rule violations in technical decisions that were at first recognized by those involved as deviant, came to be accepted and taken-for-granted as part of the normal routine after a period of time. That is, that which originally was considered a deviant activity, through repeated reinterpretation over a period of time, becomes an acceptable (that is non-deviant) practice (for another example, see Beamish's (2002) study of how a gradual leak of petroleum was 'normalized' over a 38-year period, and ultimately resulted in the largest petroleum spill in US history). Similarly, the notion of 'agency capture' considers how the relationship between regulatory agency and the industry or other party that is to be regulated, changes over time such that regulatory agency comes to share the perspective of the regulated, thus ultimately resulting in the neglect of regulatory enforcement procedures (Freudenburg and Gramling 1994).

By focusing on the organizational practices involved in the disaster incubation process, Turner (1976) limits his attention to the social dimensions of a disaster. However, to capture the totalitizing character and complex nature of a disaster as an emergent phenomenon, will require a consideration of not only the social dimensions but the ecological dimensions involved in disaster incubation as well. By developing an analytical approach that considers both the social and ecological processes (and the latent interactions of these two types of processes therein) it is hoped that a merger of sociological and geographical perspectives will be facilitated. Notably, the consideration of both the 'social' and the 'natural' factors involved in disaster incubation will allow us to extend our analysis to include natural disasters as well as 'technological' ones (Turner focused only on the latter).



**Table 14.1: The Socio-Ecological Disaster Matrix**

| | *Micro Level* | *Meso Level* | *Macro Level* |
|---|---|---|---|
| Ecological Dimension | 1 | 2 | 3 |
| Social Dimension | 4 | 5 | 6 |

A concerted effort to bridge the social and natural processes involved in disaster incubation is given in the socio-ecological disaster matrix approach (see Table 14.1).

This approach is based on identifying disaster incubation factors that belong to each of the cells in the matrix. After all the cells are filled with the relevant factors, the matrix will serve as a template for discussion on how to develop targeted disaster prevention and/or management strategies by helping to identify those issues and matters that need more careful attention—for example, the protection of vulnerable sub-populations. In attempting to develop a more complete and comprehensive account of a disaster, the socio-ecological disaster matrix approach attempts to go beyond the immediate and localized ecological and social circumstances associated only with the onset stage of the disaster (Ali 2004). This is necessary because the roots of a disaster may be quite deep, extending far beyond the local spatial and temporal circumstances associated with the place where the disaster onset actually unfolded, including factors related to global environmental changes on the macro ecological level (Cell 3)—such as global climate change, for example—and the forces of global political economy at the marco social level (Cell 6)—such as neoliberal policy trends at the international level. Elements in the meso ecological level (Cell 2) refer to those disaster incubation factors related to the regional geography—for example, a humid air mass over the Gulf of Mexico region in the case of the Chicago heat wave—while, the meso social level (Cell 5) refers to many of the organizational elements discussed above. The micro level of analysis focuses on the more localized ecological and social factors involved in disaster incubation. In general, these factors tend to be factors involved in the triggering of a disaster, such as operator failure in the case of a technological disaster (Cell 4) or the physical circumstances present in a particular locale—for instance, flood-prone areas arising from alterations to the natural environment due to industrial interventions such as the reshaping of natural channels, as was the case in making New Orleans even more vulnerable to the effects of Hurricane Katrina (Cell 1).

For the purposes of making possible a comprehensive and holistic analysis of disasters manageable through the use of a generic template, the matrix somewhat artificially separates out elements that are actually interrelated in a dynamic way. To address this limitation, efforts should be taken to ensure that proper consideration is given to examining the possible interrelationships between the various matrix cells in developing the disaster incubation analysis. Spatial constraints prohibits me from giving a more fuller account of this approach here but for more details on this approach I direct the reader to Ali (2004), in which the method is applied to the case of a waterborne disease outbreak in Canada.

## Conclusion

The inherent complexity of all disasters pose very difficult challenges for analyses. It is not surprising therefore that there still exists a critical need for more powerful descriptions and explanations of disasters as sociological phenomena (Kreps 1998). This is true not only in terms of understanding what the effects of a disaster are, but also of how disasters can happen. To address these questions, it is important to begin the analysis of disasters with the recognition that environmental disasters are not simply isolated events or anomalous occurrences that happen in a vacuum. Rather, disasters are processual; they are in essence an emergent phenomena that arise from a complex interplay of a myriad biophysical and social factors or circumstances. For this reason, an effective and comprehensive account of a disaster must ensure that the *context* in which the disaster process unfolds is given due consideration in the analysis. By considering the social and biophysical context, we can move towards a more penetrating investigation into how humans have created situations that endanger the community, and how human action can lessen the potentially disruptive effects of a disaster through appropriate and suitable means. Moreover, the context of a disaster must be considered if one hopes to gain an understanding of how particular groups within a given society are especially vulnerable to a disaster and its effects.

In ensuring that the contextual and processual nature of a disaster is front and centre to disaster analysis, the researcher is less likely to lose sight of the important fact that all disasters are founded upon a collection of situations and circumstances that, under certain conditions, can result in a catastrophic outcomes. In this light, it becomes clear that the *pre*-disaster context requires special attention because many social and biophysical processes that contribute to the onset of a disaster remain latent until it is too late. That is, the factors involved in the incubation of a disaster often go unnoticed. Research investigations into the factors that contribute to disaster incubation are not only relevant to post hoc analysis (where disaster incubation analysis will



allow for preparation in the case of future disasters), but they can also be used prospectively to help identify possible disasters 'waiting to happen'. To help address the issue of how to identify those factors that are relevant to disaster incubation in a given locale/context, it will be useful to compare the disaster incubation of as many disasters as possible through the template of the Socio-ecological Matrix and then discern what may be the most relevant to the circumstances at hand. By adopting such an (admittedly labour-intensive) approach, it is hoped that a broader pattern of consistent patterns will be revealed—particularly with reference to unnoticed regulatory lapses and developing but latent environmental problems at all scales. Such an orientation will help to identify those areas that are 'hotspots', that is those collections or configurations of circumstances that will raise the potential for a disaster to occur. In so doing, the adoption of such an orientation may also help to address the significant problem identified by Gramling and Krogman (1997: 44), namely that: Activities that have not yet resulted in disasters may be subject to little policy, planning or oversight, even though they may have greater potential for damage than some activities that are highly regulated' (ibid.).

A research focus based on disaster incubation in conjunction with the socio-ecological matrix will also help address issues related to disaster vulnerability because the danger signals that are most often overlooked during the pre-disaster phase often go unnoticed precisely because they occur in settings that are not normally under public scrutiny—that is, those contexts associated with marginalized groups such as factory settings or the poorer residential areas of urban centres.

Finally, by considering the biophysical contributions to disaster incubation in parallel to the social contributions, the disasters that may ensue from 'creeping' environmental problems—especially those related to societal interventions that change the environment, such as increased chemical loadings, climate change, the loss of biodiversity; desertification and loss of topsoil and the proliferation of new genetically engineered organisms and so on—can also be identified and addressed before these types of potential hazards become transformed into actual disasters.

## Notes

1. Having said this, it should be kept in mind that, as an interdisciplinary field of inquiry, disaster research has of course also been influenced to varying degrees by many other social science disciplines, including, for example: anthropology, policy studies, psychology and so on, and it is not my intention to minimize the contributions from these other social sciences.

2. It is also interesting to note that the governmental (and military) concern with handling 'emergencies' of all kinds was reinforced by the civil disturbances of the late 1960s and this led some to social scientific research on disasters for answers. In a similar fashion, it could be said that more recently, in the West, interest in disaster research, both within academia and in government, has to some extent intensified with the increased concern over 'Homeland Security' and emergency preparedness in the aftermath of the terrorist attacks of 11 September 2001, and social scientists who study disaster have been called to sit on various government boards and be involved in the drafting of disaster management legislation (Herring 2005).
3. These debates have taken various forms, the most prominent being the realist versus constructionist debate (also addressed within the sociology of science), but the details of this debate are far beyond the present scope of discussion—for details on this debate, see, for example, Burningham and Cooper 1999; Lupton 1999; Murphy 2002, 2004.

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