Catastrophe management: coping with totally unexpected extreme disasters

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There is no doubt that conventional incidents can be effectively handled by clearly defined emergency procedures under a well acknowledged authority structure, but a major event creates a whole new situation. No longer is the incident clear cut. No longer is the degree of preparation and competence enough.

Now we have the big one. No-one understands why it is out of control. It is not easy to label because it is taking new directions every few minutes. It is coming at you from every angle. Too many people have been affected. The bad news is getting worse. And as you look around you, you see the whole world collapsing.

Campbell, 1999

Catastrophes

There is a rich array of accounts of past calamitous events that have impacted the inhabitated world. Each dysfunctional event has its own unique characteristics, impacts, and legacies. Many examples have appeared in this journal and elsewhere (e.g. Bryant 1991; Blackie et al. 1994; Hobsbawn 1996; Newson 1998; Berz 1999; Halley 1999; Mitchell 1999; Kundzewick and Kaczmarek 2000).

Bringing about safer futures for human communities will benefit from an objective appreciation of the adverse impacts of severe hazards coupled with an examination of the hazard mitigation weaknesses and risk management limitations of current human settlement design and functioning (Brooks 1992; Lintern 1992; Kugler and Lintern 1995; Reed 1996; Rasmussen 1997; Lewis 1999; Mitchell 1999; and Kundzewick and Kaczmarek 2000).

The recent publication, 'Dreadful Visitations: Confronting Natural Catastrophe in the Age of Enlightenment' (Johns 1999) provides a suitable starting point for examining the prime topic of this paper—how best to contend with the impacts upon communities of unexpected extreme hazards. The above study focuses upon the eighteenth century 'where overwhelming natural disasters are seen to be rarely wholly "natural", but are the products of human agency as well'. As Johns goes on to observe:

Indeed, it might well have seemed a particularly calamitous period to the people of the eighteenth century. The Bengal famine of 1770 is estimated to have killed ten million; earthquakes in Portugal, Peru, Calabria and Japan leveled cities, killing tens of thousands of inhabitants, igniting volcanoes, and setting in motion destructive tidal waves that smashed ports and swallowed up entire islands; cyclones in India in 1737 and 1789 claimed hundreds of thousands of lives; avalanches in Switzerland buried whole towns and their populations, among them the faithful of Leukerbad, who gathered for vespers in January 1718 and were crushed under tons of snow; hurricanes made their way through the Caribbean and the Atlantic coast of North America, sweeping away people and property in every decade of the century; and volcanic eruptions killed thousands, witness Vesuvius in Italy, Laki in Iceland-where one-third of the population died in 1783-and Papandayan in Java, where in 1772 three thousand people in mountainside villages were sucked into a lake of lava.

Since the eighteenth century there have been substantial world-wide population increases, the Industrial Revolution, urbanisation and the growth of cities, the arrival of teeming mega-cities, the advent of the Computerised Information Age and, increasingly, Globalisation. Throughout this period the dysfunctional impacts of natural and constructed hazards have intensified (Berz 1999; Blanke and Smith 1999; Leach 1999; Lewis 1999; Mitchell 1999 and Guidette 2000), with the prospects for future natural environmental hazards looking even bleaker (IPCC 1996 and MacDonald 1999). According to MacDonald:

The impacts of global climate change are conventionally discussed in terms of changes in the temperature averaged over the year and over the globe. Much less emphasis has been placed on anticipated changes in weather variability. Of particular interest are extreme events such as windstorms, hurricanes, floods, droughts, hailstorms, tornadoes, etc.

In the last decade, the number of catastrophic weather events has been three times as great, and the cost to the world economies eight times higher, than in the decade of the 1960s. In part, the higher cost in the last decade is due to greater vulnerability of society as a result of increasing urbanisation.

In 1997, a year with exceptionally few natural disasters, some 13,000 deaths could be attributed to weather-related events, and the economic losses were $30 billion, as compared to $60 billion in 1996. The most frequent natural catastrophes in 1997 were windstorms and floods, which accounted for 82% of the economic losses and no less than 97% of the insured losses. 1992 was the worst, 1999 the fifth worst for insurance losses in the USA.

Floods devastated large areas of China in 1996 and 1998, North Korea, 1995, South Korea 1996, Latin America and the United States, particularly in 1993, 1999. As in 1996, Central Europe, experienced the Odra (Oder) and Vistula rivers floods when the heaviest precipitation ever recorded inundated areas in Poland, Germany, the Czech Republic and Austria. And so on to the present, every year has evidenced major natural disasters. Such events are ongoing, and we must learn how best to live with them.

The predicted increases in the surface temperature of the oceans will undoubtedly lead to increased water content of the atmosphere, since the vapor pressure of water rises exponentially with temperature. Thus, it is highly likely that at least some regions of the globe will experience increasingly severe cyclonic activity and higher precipitation and more frequent flooding in the global warming world (IPCC 1996).

The present, highly urbanised, highly vulnerable, mega-city situation (Fuchs 1994; Lo and Yeung 1998) with its extremely disabling catastrophe-proneness (Mitchell 1999) is at the centre of future concerns, as these cities are of global significance. An extreme impact event in

one such city, Kobe-Osaka, vividly illustrates this:

The Great Hanshin earthquake of 17 January 1995 was a signal event in the history of urban disasters. Not only was it Japan's most deadly and destructive natural disaster in over 70 years, it also raised disturbing questions about existing hazard-management policies and programmes that had been regarded as among the most effective in the world. Despite decades of attention to the goals of hazard reduction by Japanese governments, industries, and citizens organisations, over 6,000 residents of the country's second-largest metropolitan area were killed, 10 times as many were injured, and large parts of the Kobe-Osaka urban region experienced heavy damage and disruption. Fires took hold rapidly and burned out of control, structures and lifelines that had been designed and built to hazard-resistant standards gave way, emergency management operations failed to live up to expectations, and recovery programmes dragged on well beyond their targeted completion dates.

Not since the massive Kanto earthquake of 1923 devastated Tokyo and Yokohama killing more than 140,000 people, has a major Japanese urban area been so grievously stricken by natural disaster. Indeed, this was the first time that Japan's annual disaster death tolls have climbed back above double digits into the thousands since the Ise Bay typhoon of 1959 killed over 5,000 people around Nagoya and triggered a major restructuring of the country's hazard-management systems. Economic losses may have exceeded a staggering US$100 billion! (JNDS 1995).

Supporting Mitchell (1999), we see the Hanshin (Hanshin-Awaji; Hyogoken-Nambu) earthquake as just one recent extreme event in a string of natural disasters that have inflicted unprecedented losses on cities and towns and across countrysides around the world. Often these have involved earthquakes, but hurricanes, water inundations, storm-surges and wildfires and deep-freezes, have also led to heavy losses. Though the upward trend in economic and material losses is most striking, deaths and injuries have also been substantial. These events have far-reaching implications for most of the world's population (IDNDR 1996; ADPC 1999).

The above case-study on a natural hazard disaster in a mega-city was chosen because it illustrates the potential for similar massively debilitating nature-sourced urban catastrophes (Lewis 1999; Zamecke and Buchanan 1999). Various other kinds of hazards are also capable of producing urban catastrophes (Bryant 1992; Davis 1992; Blackie et al. 1994; IDNDR 1996; Blanke and Smith 1999; Mans 2000; Romei 2000).

Wars too have frequently been associated with large-scale destruction of urban areas, especially in the twentieth century e.g. Hiroshima, Dresden, Phnom Penh, Kabul (Hobsbawn 1996). Political terrorism, crime and cyber-terrorism are also potent agents of urban destruction (PCCIP 1997). So too are hazardous or interruption-prone industrial technologies (e.g. Auckland (Electricity), Bhopal (Chemical), Chernobyl (Nuclear), Melbourne (Energy-Gas), Sydney (Water), Texas City (Tornado-inflicted outages)) and ubiquitous air-pollution (Perrow 1984; Mitchell 1996).

The increasingly complex community safety and hazard coping issues which are associated with new multi-faceted types of hazard are noted by Mitchell (1999, 35-36):

The adequacy of existing means for managing natural hazards and other types of environmental hazards is increasingly being called into question in the United States and the global community. This is illustrated by a sampling of the issues that have recently emerged in professional and lay forums.

Novel problems are posed by new types of hazard. These come in several varieties. Some are amalgams of natural and technological hazards. When a storm or a tsunami affects a chemicals manufacturing or storage facility it is not just the threat of high water and strong winds that is of concern; it is also the possibility that toxic materials may be dispersed throughout surrounding areas (e.g. Nagoya 1959; Times Beach, Midwest floods, 1993, Hanshin-Kobe, 1995). If an earthquake affects a nuclear reactor site, radioactive materials may be released. The flooding of old mines can cause surface collapses; dam fractures can cause inundations, damage and deaths.

Given the expanding variety of technological hazards, the possibilities for new or unusual combinations of natural and technological hazards are spiralling upwards. For example, five classes of technological hazard pose quite different sets of problems when combined with natural hazards:

(a) Unsuspected hazards involve substances or activities that were regarded as harmless or benign until scientific evidence or human experience showed otherwise (e.g. DDT, asbestos, maintaining cooling towers).

(b) Improperly managed hazards involve failures of various kinds of hazard-control systems (e.g. nuclear facilities such as Windscale, Three Mile Island, Chernobyl; chemical plants such as Seveso, Basle, Bhopal; power supply systems, Auckland and Longford; transportation systems such as the US space shuttle Challenger and super-tankers such as the Exxon Vaildez and highjacking; storage and disposal sites for toxic materials such as Kyshtyni, Times Beach, Love Canal, Minamata, Central Australia).

(c) Instrumental hazards that are intended to cause harm and are consciously employed towards that end; they include sabotage, arson, and warfare. Military industrial technologies belong to this group (e.g. nuclear, biological, and chemical weapons such as defoliants and nerve agents; deliberate oil-spills and oilfield conflagrations).

(d) Cyber Terrorism and Information Technology discontinuities causing communications and data-flow stoppages (Optical cable severance's). Computer viruses (Michelangelo; 1991; Melissa 1999; I love you 2000; SMASH 95, 2000); illegal 'hacking' access and sabotage; the fragility of contemporary electronics and satellite communications nets.

(e) Hazards of global environmental change constitute a separate but related class of events that are now making their way onto the public policy agenda. It is widely accepted that a build-up of greenhouse gases in the atmosphere might trigger climate changes and other repercussions such as sea-level rises and inundations.

Some of the industrial hazards are sufficiently well known to be classifiable as 'routine' hazards, but others including components of many of the above and most of the hazards connected with global environmental change—are entirely unprecedented in the human experience. They are best considered 'surprises' (Mitchell 1996). How should public policies be changed to take account of the widening range of threats to human survival?

In view of this situation, why single out natural hazards out for special consideration?

The answer is that natural hazards are joint products of nature and society and may affect vast reaches of landscapes and seascapes and impact globally.

The recent (1991, 1999-2000) inundation of Bangladesh, Mozambique and Timor; Pacific tsunamis (Aitape/Sissano 1998); United States hurricanes (Andrew

1992); and the Ethiopian and African famines; all attest to this. Unlike the other threats just mentioned, they are only partly created by humans. This gives them a special place of concern in debates about humanity's future because they are not, ipso facto, entirely susceptible to human will. Indeed many aspects of nature are uncontrollable by humankind. They represent an 'other' that can sometimes be modified by humans, but is not ultimately amenable to complete human amelioration, in either the material sense or the mental one.

Whatever the scale of the human habitat, 'all major disaster problems in the Third World (and elsewhere) are essentially unresolved development problems. (Often, too, these problems are exacerbated by corrupt and/or inefficient governments.) Disaster prevention is thus primarily an aspect of development management and this must (ideally) be for settlements that function within sustainable limits' (Grann, Norwegian Red Cross).

Confirming Mitchell (1999), we can conclude that the severity of naturally induced hazards invites humans to recognise that our knowledge of the Earth and its peoples is incomplete, uncertain, disjointed, and currently subject to inabilities to control many contingencies. It is likely to remain so in the foreseeable future. We should prepare ourselves and our institutions, and instigate environmental hazard mitigation strategies for the twenty-first century, with this firmly in mind, especially as the mega-cities become the pivots and nodes of a truly global society (Lo and Yuen, 1998). For mega-cities are, in effect, crucibles where new kinds of hazards are being fashioned and old ones reshaped so that existing ways of dealing with both are inadequate (Lewis 1999; Mitchell 1999; White 2000).

Most currently held notions about the security of cities in the face of natural extremes are no longer tenable and future disasters in intricate, large, urbanised cities are likely to pose very complex problems for society and across the world. The following comments expanded from Mitchell (1999, 27-28) **characterise urbanisation as a predisposition for disaster:**

Urban development increases disaster-susceptibility in a number of ways. First is the frequent association of cities with naturally risky locations such as seacoasts and floodplains because such places also confer important benefits (e.g. buildable land, well-appointed sites for the collection and transshipment of goods, and fertile hinterlands). Initial settlements may take advantage of available safe sites, but subsequent growth typically spills over into adjacent high-risk areas. Coastal metropolises of Australia and the United States and the seaward-expanding cities of Asia are good examples.

Secondly, the physical process of building cities often creates or exacerbates existing

Above: Wars have frequently been associated with large-scale destruction of urban areas. (Image courtesy International Federation of Red Cross and Red Crescent Societies)

Above: Many aspects of nature are uncontrollable by humankind. Above: the 2001 Indian Earthquake, and the 2000 floods in Vietnam. (Images courtesy International Federation of Red Cross and Red Crescent Societies)

environmental risks. For instance, paving over water-sheds reduces infiltration, speeds runoff, and increases flood volumes; constructing coastal defences may reduce supplies of beach sand and facilitate erosion during storms. As the leading edge of urban development marches across the landscape, the incidence of natural disasters tends to keep pace. The human role in creating conditions for disaster is clearly visible. Bangkok klongs (canals) that used to accommodate overflow from the Chao Phraya River have been filled in to create streets that are now chronically flood prone, while the city continues to subside owing to pumping of water from underlying aquifers. Similar problems exist in London, Venice and the low countries of Europe, and in Queensland's Cairns, Townsville, Brisbane and the Gold and Sunshine Coasts.

Thirdly, cities increase disaster potential by concentrating people and investments. A disproportionate amount of material wealth is bound up with cities in the form of buildings (ceremonial, commercial, industrial, and residential) and infrastructure (i.e. the complex and expensive networks of lifelines that sustain urban populations and make it possible for them to interact with each other and the outside world).

When an extreme event occurs, urban losses are often very heavy. In a matter of hours, hurricane Andrew inflicted over US$20 billion of property damage on the Miami metropolitan area, whereas it took about six weeks of heavy flooding in mostly rural sections of nine Midwestern U.S.A. states to produce approximately half as much material loss (Myers and White 1993).

Fourthly, the built environment is continuously wearing out, but the rate of urban replacement rarely matches the rate of urban obsolescence. As a consequence, most cities contain large concentrations of old buildings that fail to meet present standards for hazard-resistant construction. Differential ageing and uneven replacement of the physical stock typically produces a complex patchwork of disas ter-susceptibilities.

Fifthly, many urban areas contain populations that are particularly vulnerable to disaster. For example. Metropolitan areas often attract large numbers of immigrants, most of them poor and all of them separated both from the familiar landscapes of' home, whose risks were known, and from traditional support networks or customary behaviours that provided a modicum of security in the event of disaster.

Finally, few governments of rapidly growing cities hive been able to allocate significant resources to hazard reduction when they are already stretched to breaking point by the task of providing basic support services for their expanding populations.

In short, cities often contain all of the ingredients for disaster: heightened risks, concentrated exposure, and increased vulnerability. In light of the available evidence about intensified urbanisation associated with cities and particularly mega-cities, the potential for a quantum leap in disaster-susceptibility is clear.

When a major natural (or other) disaster strikes, it disrupts-and may destroy-not just the lives of citizens and the city's physical fabric but also the functioning of the metropolis. And all too often, unfortunately, contemporary resurrections after disasters generally reassert fatally flawed past policies and propensities.

Viewed against the emergence of a predominantly urban world, where people increasingly live in towns, cities and giant urban agglomerations (i.e. mega-cities), and with the probability of increasingly extreme weather events in the future, past events and on-going developments confirm the potential for even larger disasters and losses.

Lessons learned

The most important educational goal is learning to learn. Luis Alberto Machado, 'Creating the Future', 1990.

All contemporary learners could benefit from the refinements of a learning approach championed by Rose and Nicholl (1997).

Johns (1999) provides insights on some lessons so far learned from natural disasters:

Above all, the historical and literary study of natural disasters focuses attention forcefully on the human contributions to catastrophe. As Oliver-Smith (1986) claims, *'human groups and institutions play a far more active role in the creation of destructive agents and circumstances than is usually imagined or portrayed'. If a disaster is defined as a physical phenomenon-an earthquake, a hurricane, or a flood, for example-affecting a human group adversely, then surely the activities of that human community, both before and after the event, require investigation.*

The social, political, and economic activities of societies must therefore be examined to determine the extent to which they delayed or exacerbated disaster. For instance, people, locationally enabled by the authorities, are falsely optimistic about their prospects for their enduring survival after building homes on flood plains, earthquake faults, precipitous beach-front cliffs, storm-surge-prone lowlands, or amidst high wild-fire-risk hills and woodlands. Johns (1999) continues:

To what extent, then, do discourses on catastrophe today reinforce or counter perceptions of both disasters and their victims? The dominant perspective, according to geographer Hewitt (1983), sees natural disasters as unique, cataclysmic environmental events, largely unpre-

Old and new hazard management issues
The changing contributions of people, natural systems, and technologies to the creation and enhancement of hazards
Measures to encourage improved use of available information about hazards (including scientific knowledge and folk wisdom)
Attenuation of individual, group and organizational memories
Global interdependence and the vulnerability of most communities (e.g. economies, cities, settlements) to major disruptive events
The relative adverse human impacts of cumulative small-scale hazards and single large disasters
Innovative procedures needed for coping with unprecedented hazards (i.e. unanticipated surprises and extreme catastrophes)
Individual, community and government attitudes toward risks and hazards in the context of competing other values/goals
Equity and inequity in the distribution of hazard costs and benefits
The illumination of polarizing debates about appropriate hazard-management strategies (e.g. 'top-down' versus 'bottom-up', centralization versus decentralisation, rights versus responsibilities, discretion versus direction, anticipation versus reaction)
Effective means for sustaining stakeholder involvement in decision-making beyond periods of acute crisis
Coalition-building between hazards interest groups and others, that address overlapping problems e.g. sustainable development, urbanisation or urban hazards and disasters issues
Note: Most of these issues and topics are interwoven.

Table 1: Old and new hazard-management issues (Developed from Mitchell, 1999)

dictable, and severely damaging to the social, physical, and economic life of human communities. In order to return societies to a pre-disaster status quo, one viewed as 'normal' urban communities require restorative development, modernisation, essential technologies, and accompanying technical expertise.

What is apparent in most urban settlements is an array of scientific and technology-based institutions and falsely protective 'citadels of expertise' that in many instances ignores the natural environment and traditional local practices and grassroots survival ideas and culture (Blackie et al.1994; Skertchly and Skertchly 1999).

This current conventional approach, Hewitt argues, traces its beginning precisely to the Industrial Revolution and the development of scientific method in the seventeenth and eighteenth centuries. In this period economies came to favor the development of cities. But, as Hewitt affirms, the greater the historical or geographic distance a society has 'from urban-industrialism, the surer studies of disaster are to find its people to be "fatalistic", "subjective", and in the thrall of "mystical", "irrational", or at least "pre-scientific" notions.' This is the situation today in much of the Third World.

And in many developed(ing) urbanised settlements natural hazards are grossly under-emphasised or not effectively accommodated (White 2000) .

Hewitt (1983) and anthropologist Oliver-Smith (1986) proffer an alternative to the conventional approach. As Johns (1999) summarises their observations:

From this perspective, disasters, rather than being freak events caused by unexpected forces, are ongoing natural agents in an ever-changing world. Seen from this perspective, natural disasters, which have always occurred everywhere in some form or another, and will continue to do so, are part of well-informed societies' realistic views of what's 'normal' and of the objective ideological approach necessary to adapt to and cope with the overall material and other conditions they need to sustain in order to best maintain their ongoing normalcy and safety.

This well-informed view suggests, in particular, that maintaining the current Western approach to living in the first world and then exporting it elsewhere, breeds economic forces and market pressures that ultimately work to destroy both the local and the global environment, with the implication that natural disasters can appear as innocent, even innocuous, events in the face of self-interest

If globalisation finally gains overall dominance in the twenty-first century via essential economic ties between nations and continents, it can be traced meaningfully to foundations in the eighteenth century by way of cultural responses to ubiquitous natural catastrophes. By looking broadly at disasters in the eighteenth century and up to the present day, we are in a better position to interpret interdependent 'globalisation' and to recognise the impact of catastrophes on the world as a whole rather than to view them partially with an isolated focus only on the wealthiest or worst-hit regions.

Can it be argued that world bodies, and major nations and their relief agencies in particular, operate selflessly, or even predominantly, in the interests of third-world, mendicant disaster victims? A sound and equitable answer to this question is a logical first step to establishing the most useful and fair responses for using global relief resources to ameliorate the dysfunctional devastation of local catastrophes (Johns 1999).

In so doing, we affect a shift in the interpretation of Western progress to embrace increasingly shared concerns for global survivorship. The question that mega-city hazards pose to policy makers goes right to the heart of sustainability and the future of human-kind across the world. How, if at all, can large and rapidly changing cities be made sustainable in the teeth of potentially devastating global events that are also highly uncertain?

Given the current centrality of sustainable development as a necessary guide to apt policy-making for all aspects of the human environment in the future, the contention that it does not — as currently construed — adequately take account of environmental hazards is a serious challenge. A detailed argument in support of that claim is beyond the scope of this paper, but it is appropriate to introduce some important pieces of supporting evidence.

According to Mitchell (1999):

First, urban sustainability is a concept that is contested between advocates of so-called 'green' and 'brown' agendas; hazards play different roles in these agendas and are affected by different kinds of policy responses (Satterthwaite 1996; World Resources Institute 1996).

The green agenda gives pride of place to hazards that are linked with anthropogenic degradation of the physical environment (e.g. resource exhaustion, erosion, pollution) (Beatley 1995; Mitchell and Ericksen 1992). The brown agenda highlights hazards in less developed countries that are linked to poverty and inadequate urban services (Main and Williams 1994; McGranahan and Songsore 1994).

Acute geological, meteorological, and hydrological hazards are not excluded from consideration, but other types of human-constructed hazards that affect the poor on a daily basis are heavily emphasised. Possible surprises (i.e. unprecedented hazards), especially those that may affect more affluent cities, receive little attention. Even if combined, these two agendas do not provide a comprehensive basis for addressing the hazard-management problems of large cities in the global context.

Secondly, differences between hazard mitigation and sustainable development ensure that important parts of each subject remain outside the frame of reference of the other. In other words, safety (a prime consideration in hazards management) does not necessarily find a place in the contemporary sustainability agenda, and disruptive contingencies (of which hazards and disasters are good examples) may require different responses than enduring problems (Mitchell 1992; Berke 1995).

The truth is that large and complex cities require expansive management initiatives that can simultaneously address incommensurable goals. Mega-cities must be prepared to cope with unexpected or unfamiliar events as well as long-term problems; acute natural hazards as well as chronic crises of environmental degradation. Along with the historical evidence about trends in urban hazards, the dysfunctional events of recent history clearly support this claim (Hobsbawm 1996).

To ignore the role of environmental hazards in cities is to deny important lessons of urban history. To assume that sustainable urban development can be achieved without attention to problems of contingency, of which natural hazards are a pre-eminent example, is to court frustration and failure.

The natural hazard problems that confront todays and tomorrows urban cities and settlements 'are the joint products of nature and society' (Mitchell 1999, 2). Table 2: Some Hazard Conceptualisation and Management Problems, reflects also, some further difficulties. And Mitchell (1999, 40) further observes that:

Underlying all of these specific reasons is a larger problem. It is this: contemporary society, in the main, fails to treat natural hazards as complex systems with many components that often require simultaneous attention. We tinker with one or another aspect of these systems when what is required are system-wide community hazard amelioration strategies.

Hazard conceptualisation and management problems
Lack of agreement about definition and identification of problems
Lack of awareness of natural and unnatural (human-made) hazards
Lack of future forecasting capabilities
Misperception or misjudgment of risks associated with hazards
Deliberate misrepresentation of hazards and risks
Lack of awareness of appropriate responses
Lack of expertise to make use of responses
Lack of money or resources to pay for responses
Lack of coordination among institutions and organizations
Lack of attention to relationship between 'disasters' and 'development'
Failure to treat hazards as contextual problems whose components require simultaneous attention (i.e. reciprocity)
Lack of access by affected populations to decision-making
Lack of public confidence in scientific knowledge
Lack of capable and enlightened political leadership
Conflicting goals among populations at risk
Fluctuating salience of hazards (competing priorities)
Public opposition by negatively affected individuals and groups

Table 2: Some hazard conceptualisation and management problems (Developed from Mitchell, 1999)

Perhaps even more important, we fail to address the direct linkage between natural hazard systems and economic investment decisions that drive the process of 'development' and affect the potential for disasters in the future.

That such links exist has been known for a very long time (The Code of Hammurabi, King of Babylon, c. 2250 B.C.):

If a man owes a debt, and the storm inundates his field and carries away the produce, or if the grain has not grown in the field, in that year he shall not make any return to the creditor, he shall alter his contract and he shall not pay interest for that year.

Currently, these problems are considerable and there is clearly no prospect of a universal panacea. Indeed, as evidenced by their virtual absence of such concerns on the agenda of the 1996 United Nations Conference on Human Settlement (UNCHS 1996), they are, somewhat surprisingly, not presently of widespread concern amongst otherwise able people concerned with planning, building and running human habitats.

However, other international agencies such as the International Red Cross and Crescent, the United Nations Environment Programme, the United Nations Commission on Human Settlements, the World Health Organisation, and the World Bank, are all fully cognisant of the issues and problematique (Mitchell 1999, 503-504). And many programmes undertaken during the International Decade of Natural Disaster Reduction (IDNDR 1996; ADPC 1999) have, too, highlighted the domain. These projects reveal too that there is much existing hazard mitigation 'know-how' that is not utilised effectively (Clark 1972; Higgins 1980; Friedman 1985; Argyris 1993).

Despite the spectacular advances in many aspects of the sciences and technologies of the 20th century, human settlements display increasing alienation from their natural environments and against accommodating better to the prospect of increasingly complex disruptions caused by future natural hazards. The current prediction and expectation is for continuing extreme traditional and novel disasters for every future generation bringing catastrophic suffering and death, and immense and growing material losses (Kundzewicz and Kaczmarek 2000). One commentator even goes so far as to most pessimistically say, 'Nature will, in time, destroy us!' (Newson 1998).

In summary, we may say that **urbanised human settlements are beset by increasingly complex natural hazard and other potentially disruptive problems.**

Following upon Mitchell (1999, 474-475) we may profile the situation thus:

- Agents of natural hazards (e.g. drought, floods, storm surges, earthquakes, landslips, windstorms, snow and ice, fire and volcanoes) are many and the mixes varied.
- Intricate, locationally unique, interrelationships between natural hazards and human settlements exist.
- Hazards issues and interests wax and wane in private and public minds and compete for attention against other settlement problems and interests.
- Natural hazard characteristics and their incidence are imperfectly understood.
- Accommodating natural hazards into sustainable development strategies is often neglected.
- There is a dearth of comprehensive, coordinated, system-wide, multi- and trans-disciplinary design and management of human settlements within their natural environments.
- As the possible impacts of many known hazards are at best handled in a piecemeal fashion and at worst are all but totally discounted, no evident comprehensive provision at all is being made for anticipating and coping with unexpected, unthinkable, extreme catastrophes that are anticipated.

The question confronting us here is how best to cope with such disturbing prospects in the turbulent and vulnerable extreme-hazard-event times that undoubtedly lie ahead.

Coping

Give me a place to stand on, and I will move the earth. Archimedes, 287-212 B.C.

Archimedes enduring aphorism affirms, that rescue-for-survival bases must be solid.

The central thrust of the solution to mitigating the adverse impacts of hazards is to maximise the ability to cope with diverse disasters at the level closest to the centre of the primary impact(s) through provision of the best possible means for short-term survival and then facilitating processes to expeditiously restore normal living (Zamecka and Buchanan 1999). This extant 'motherhood' tenet is not new, but many of the refinements covered herein are.

We have explored many key aspects of current perceptions of the hazard risks and vulnerabilities that confront contemporary cities and communities. The picture that emerges from our explorations includes as main features (Mitchell 1999, 495, 497):

- *the diversity of risks that confront urban populations and growing interactivity among those risks*
- *the extent to which previous urban disasters (especially natural ones) have had deep and long-lasting repercussions on built environments and societal institutions as well as more obvious immediate human effects*

- *the build-up of catastrophe potentials in conurbations and mega-cities*
- *the narrowness and rule-bound-constraints of existing urban hazard-management policies and programmes*
- *important gaps in scientific and technological information*
- *re-organisation of the urban ecology of environmental hazards, most notably reflected in shifting and unknown patterns of exposure and vulnerability as manifest from unexpected, infrequent, and otherwise exceptional events.*

In short, according to the case-study evidence, the environmental hazards of large urban areas are highly significant and they are changing in ways that will increase their salience during the twenty-first century and beyond. Urban managers would do well to pay attention to these trends and to include hazard amelioration management among their priorities. There is a need for the public and private sectors to learn to take disjunctive events into account systematically and deliberately, not just as inconvenient disruptions of 'normalcy'. Broadly construed, hazard mitigation-in all its forms and for a broad range of events-should become a continuing basic integral part of urban governance. To discount the importance of natural hazards in contemporary human settlements is to leave their populations exposed to worsening risks.

According to Campbell (1999, 52) catastrophic disasters possess the following attributes and dimensions :

- they don't have any rules
- there are often not enough emergency services to cope
- vital resources are knocked out
- there are inadequate procedures for dealing with the situation
- resolution is a long way off. Events keep escalating
- the media moves from being very local to very international
- there are serious differences of opinion in how things should be done
- the government of the day and the bureaucracy become seriously involved
- the public takes an armchair position (and is fed by the media)
- the victims and their families become the visual antithesis of the problem (again, projected by the media)
- there are growing numbers of authorities and officials involved
- sometimes there is complete chaos in simply trying to identify which of the emergency services and investigative bodies is doing what
- there is an urgent need to know who is in charge.

At present there is a dichotomy between human settlement planners and those concerned with minimising the adverse effects of hazards. Planners extol the values and virtues of cities and settlements as desirable human achievements, rarely affording concern for hazards a full place in their quests for growth and development (UNCHS 1996).

On the other hand, hazard mitigators (and kindred souls) often possess knowledge, insights and capabilities that are invaluable as resources for contributing to making human settlements safer places, but all too often this material is not put to appropriate use (Higgins 1980; World Problems and Potential 1985; Shiels and Shiels 1991; Berke 1995; McIntire 2000). And even when it is, 'existing public policies strongly favour professionalised warning, evacuation, and emergency-management programmes for a wide range of known acute threats backed up by separate sophisticated engineering technologies for different chronic risks' (Mitchell 1999, 480).

Table 3: Contemporary Counter-Disaster Legacy, summarises the current approach to coping with dysfunctional emergencies.

Currently, there is no provision for creative contingency emergency management responses to novel and unanticipated situations such as, for example, those suggested by Mitchell (1999, 480):

Many improvements to the formal public adjustments are possible, including the upgrading of emergency services and the installation of hazard-warning and evacuation technologies in cities that do not yet possess them, as well as the development of appropriate methodologies for assessing hazards and incorporating risk-management strategies into public budgets, plans, statutes, and other regulatory devices. However, even in relatively well-provisioned cities of Europe, Japan, North America, and Australia, the areal and demographic coverage of formal public sector hazard-management programmes is incomplete, and the extent to which they address the premier hazard concerns of resident populations is often uncertain.

What else that might be done remains missing from the preferred range of management alternatives? Broadly speaking, the neglected approaches involve non-expert systems, informal procedures, non-structural technologies, private sector institutions, and actions taken by individuals, families, neighbourhood groups, firms, and similar entities. Among others, these include measures that:

- *encourage hazard-sensitive decisions about site selection, land management, and facility operations*
- *control the installation and replacement of infrastructure*
- *relieve institutional and social inequities that shift hazard burdens onto certain (already disadvantaged) groups*

Contemporary counter-disaster legacy
Increasingly hazard-prone urban communities perceiving extreme natural and other hazards as abnormal events
Hazard mitigation is viewed as an ancillary, not integral element
Hazard mitigation is but one of a number of important matters
Where in place, most counter-disaster planning and management is focused on a limited range of defined and evident hazards and risks, and overly 'status quo' bureaucratic remediations
No community has in place comprehensive arrangements to cope best with all possible forms of known, let alone as yet to be manifest, catastrophes; extreme contingency management is rudimentary, if evident at all
No community has established an appropriate apportionment of individual, community, private and public sector rights and responsibilities, and of expectations of 'global village' support
No community evidences the best possible ability to 'cope with unexpected or unfamiliar events as well as long-term problems; acute natural hazards as well as chronic crises of environmental degradation' and adequate built environment maintenance
Even in cities (e.g. Tokyo and Los Angeles) and Third World communities (e.g. Pacific Islands and Caribbean) at the 'leading-edge' of counter-disaster measures, major gaps and uncertainties in emergency management knowledge, resources and capabilities exist
Natural and other hazards have yet to be adequately incorporated in sustainable community and urban development programmes
Each human settlement has unique challenges with wide differences in inheritances, values and goals and competing stakeholder priorities and predispositions
There is much world-wide historical knowledge and data, and forecasting capabilities, and continuingly extending emergency and catastrophe management 'knowhow' that may be used as the foundation for 'state-of-the-art' hazard mitigation initiatives, but which currently often lies seriously under-utilised

Table 3: Contemporary counter-disaster legacy

- *buttress local grass-roots capacities for hazard management*
- *promote less environmentally stressful non-structural hazard-mitigation technologies.*

In addition, there is a lack of initiatives that jointly address new and different kinds of hazard, and future unknowns, and a slowness to integrate hazards management with other problem-solving urban programmes, and a failure to investigate the multiplicity of roles that hazards may play in the lives of urban and other residents.

The implementation of a range of initiatives, such as those outlined above, would do much to enable people and communities to adapt and creatively cope better with their own novel and unique catastrophic circumstances, whenever and however they arise.

Mitchell, Devine and Jagger (1989) have provided a contextual model for the incorporation of the main hazard components-physical processes, human populations, adjustments to hazards, and net losses into human settlement planning and operations. Thus the hazard domain and the settlement domain are integrated into a single all-embracing conceptual framework (Hamilton 1999). Such an ekistic framework (Doxiadis 1968; Skertchly 1990) would provide a state-of-the-art systems-based framework within which orderly, properly prioritised progressive attention could be given to hazard mitigation concerns, issues and problems at different levels of human settlement (Beer 1974, 1975; Bossomaier and Green 1998; Capra 1997; Clarke and Crossland 1985; O'Connor and McDermott 1997; Senge,1990).

Use of a sophisticated interactive hazard-settlement systems framework, integrally incorporating natural and human-made hazards, would facilitate sustainable human settlement development (Berke 1995; Blanke and Smith 1999; Bossel 1999; Lewis 1999; Satterthwaite 1999; Thiele 1999; Zamecka and Buchanan 1999) so maximising anticipated human survival.

Safer human communities: maximising the prospects of survival in sustainable settlements

The modern comprehensive international and inter-disciplinary science of human settlements-ekistics-was initiated by Doxiadis (1968) for the study of human settlements and their problems. As such, it encompasses all aspects of the planning and functioning of communities large and small, including counter-disaster capabilities (Skertchly 1990). However, as we have seen, often the counter-disaster capabilities are all but neglected, as planners and others pursue their specialisations (UNCHS 1996; White 2000). Does not the importance of the domain of hazard mitigation and settlement sustainability for all humankind justify the development of a better integrated methodology for maximising the prospects of survival in human settlements? This article has barely skimmed the surface of the field (e.g. Elms 1998; Heath 1998). The need is for well-informed, attainable, future hazard preparedness, effective hazard mitigation action plans and optimal human survival attributes in all communities (Zamecka and Buchanan 1999; McEntire 2000; and White 2000). Examples of exemplary community hazard mitigation component programmes of the kinds conducive to facilitating safer communities are those acclaimed at the *Safer Communities Awards* (EMA 2000).

In order to systematise the actions and behaviours that would be most conducive to optimising the likelihood of short-term survival and to then optimise the continuation of human life after the advent of a catastrophe, it thus appears necessary to institute a composite approach to optimising survival in human communities. This thrust could be captured in resurrection and extension of the original ekistic concept in the new format of **Safer Human Communities**, whose emphasis is upon maximising human safety in sustainable settlements.

The central focus of Safer Human Futures will be to use leading-edge scientific knowledge and practical know-how to

- prolong inside (individual, group and community) durable and safe quality-of-life; and of short-term optimal likelihood-of-survival, after being impacted by disabling catastrophes
- ensure subsequent adequate outside rescue, recovery and reconstruction help is available and delivered, when needed.

The scope of the Safer Human Communities, hazard mitigating and human settlement vulnerability reduction specialisation, would embrace the whole natural and unnatural hazards field targeting individuals, communities small and large, and global survival, and of the administrative and managerial arrangements and mechanisms pertaining to the communities. It would be an integrated systems (and sub-systems) hazard-settlement paradigm.

Facilitating sustainable and robust, adversity-coping, personal, group, organisational, national and global characteristics, is seen as the best possible foundation for optimising survival in all human communities. *Table 4*: Optimising Catastrophe-Coping: Safer Human Communities, depicts the main entities of the field as it would address survival concerns at different levels of human aggregation. At each level, ongoing and progressive hazard-coping preparations would be taking place through structured learning and experiential simulations. Optimal chances of survival after a disaster or catastrophe would depend initially upon immediate life-support capabilities and then access to whatever level of safe-havens are necessary to cope with the severity and extent of the hazardous event, and later societal reconstruction.

There is no doubt but that the qualities of individual human beings are important in their abilities to cope with extreme life-threatening situations (Paton and Long 1996; Skertchly and Skertchly 2000). Exemplary examples are those of Diver (1999), (Mills 2000) who demonstrated superb survival skills when incarcerated after the Thredbo Village, Australia landslip, and Bulimer (1998), who was similarly incarcerated in his remote upturned yacht. Similar qualities were in evidence in, for instance, the recent inundations in Bangladesh and Mozambique (ABC/CNN 1999-2000) where many individuals and families had to cope on their own in highly dangerous environments for periods of up to weeks before outside help arrived. Such mature survival qualities are the outcomes of hereditary legacies and earlier enabling and developmental experiences (Seligman 1990, 1995; Gottman 1997; Diver 1999; Skertchly and Skertchly 2000).

As examples of the outstanding characteristics of emergency management agencies and their staff, the accounts of Junger, (1997); Skertchly and Skertchly, (1998; 2000); Mundle, (1999); and Brehm and Nelson, (2000), may be cited.

At the higher levels of human aggregation, similar qualities in organisational and institutionalised settings, would form the bases of the enduring solidarity necessary to mount successful response and recovery interventions. In order to optimise the probability of survival, whatever the size of the community (from small tribes/clans to mega-cities) and the features of the disaster and/or catastrophe, it is necessary to first live through the experience, and then be able to initiate, from secure and un-threatened safe resource locations, suitably scaled emer-

Optimising Catastrophe-Coping
Safer Human Communities is the systematic body of ekistic knowledge and capabilities concerned with optimising the probability of surviving natural and other hazards in the safest possible, sustainable, human settlements. It focuses comprehensively upon the many individual and societal functions and their interactive hazard mitigation and vulnerability reduction manifestations embracing all aspects of the hierarchy of increasingly complex and interdependent entities such as:
Individuals: Fostering mentally and physically healthy, robust and optimistic individuals with pertinent life-skills to endure deprivation. Capability to survive alone for at least a week in safe pods or shells.
Groups: Self-sufficient resources and capabilities to basically cope without external aid for several weeks. Easy access to safe havens.
Neighbourhoods: Sufficient redundant resources to support significant numbers of totally devastated members of immediate or near neighbours for several weeks. Access to robust shells/resources.
Communities: Sufficient institutionalised arrangements, resources and safe havens to cope for up to a month with substantially disabled local population components. Emergency management capabilities and resources.
Conurbations: Sufficient counter-disaster capabilities to manage major dysfunctional catastrophes for a large part of the population for extended periods.
Regions within countries: Availability of adequate manpower and resources to either evacuate or come to the aid of extensively devastated nearby population, for indefinite periods.
Countries: National counter-disaster capabilities sufficient to meet indefinitely, all but the most exceptional and disabling catastrophes.
Continents/Oceans: Kindred countries counter-disaster consortia.
World: United Nations and other global counter-disaster/aid bodies.

Table 4: Optimising catastrophe-coping: safer human communities

gency response interventions.

The work of Beer (1974, 1975) provides an especially pertinent, firm basis, for the necessary hierarchical hazard mitigation systems conceptual framework within a complex modern working society.

Over the generations ahead, the findings of a well-supported and adequately disseminated and acted upon, recognised new science of human survival-surviveology, progressively incorporated into sustainable human settlement development programmes, could make an invaluable contribution to ameliorating the impacts of natural and unnatural hazards, that have been and will continue to be, integral players in the turbulent drama of life on earth, and for the many on-going challenging human survival-coping situations presenting throughout the global commons.

Hope in life comes from the interconnections among all the people of the world. We believe that if we all work for what we think individually is good, then we as a whole will achieve more power, more understanding, more harmony as we continue the journey. We don't find the individual being subjugated by the whole. We don't find the needs of the whole being subjugated by the increasing power of the individual. But we might see more understanding in the struggles between these extremes. We don't expect the system to eventually become perfect. But we will feel better and better about it. We will find the journey more and more exciting, but we don't expect it to end.

Should we then feel that we are getting smarter and smarter, more and more in control of nature, as we evolve? Not really. Just better connected-connected into better shape… If we have the individual will, we can collectively make our world what we want. (Berners-Lee 1999, 227-8).

Through understanding the dangers of our hazardous world and building and managing capabilities to minimise their adverse effects we can maximise our prospects for building safer human communities (Elms 1998; Heath 1998; Robertson 1999; Theobold 1999; Skertchly and Skertchly 1999; EMA 2000).

In order to cope best with all future hazard contingencies we should plan and manage communities around the world with a core concern for the enduring safety and well-being of all people within the global commons.

The words of White (2000) are most apposite:

If (the world) is to benefit fully from the growing and deepening knowledge of natural hazards, some effective method must be found to translate that understanding into operative public policy and private procedures. Currently, these policies and procedures are disparate and partly counter-productive. Can the interested professional and citizen groups take initiatives to achieve a unified public program?

Looking back over 25 years, and trying to look ahead to a time when we do not suffer unnecessarily from extreme natural events, these questions seem to me an urgent challenge for all concerned citizens.

It is hoped, then, that, in the immediate future, many emergency workers and citizens will respond to the major unresolved challenges that are entailed to effectively assist humankind throughout the world to cope best with the certainty of increasingly complex catastrophes and disasters in the dauntingly challenging turbulent times that lie ahead. A signifi cant response and future commitment will foster safer human communities.

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For the 'valuable contribution by S.M.I.L.E. to building safer communities' both authors were recipients of the recent Inaugural Safer Communities Awards conducted by Emergency Management Australia.

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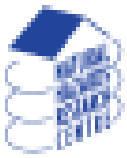

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