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PART 2

PAPER PRESENTATIONS

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by James P. Bruce

THE IDNDR: ITS IMPORTANCE FOR METROPOLITAN AREAS

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RESPONSE TO AGENDA '21

When world leaders convened in Rio de Janeiro in June 1992 for the landmark UN Conference on Environment and Development, a major blueprint for the next century was adopted -- "Agenda '21". While natural disasters are touched upon in many chapters of Agenda '21, such as atmosphere, water, desertification, and oceans, they receive their greatest attention under chapter 7, "Promoting Sustainable Human Settlement Development". In this chapter the problem of human settlements in "disaster-prone areas" is given special attention as is the International Decade for Natural Disaster Reduction.

VULNERABILITY OF CITIES

It is perhaps not surprising that the most complete treatment of disaster reduction activities in Agenda '21 comes under the heading of "sustainable human settlements", for it is our cities in all parts of the world that are the most vulnerable to large losses in natural disasters, both economic and human.

It is not difficult to think of examples. Hurricane Andrew in 1992 brushed Miami to the south, and still did an estimated US$25 billion worth of damages. If it had been a bare 30 km further north, the damages could have been several times greater. As it was, the losses were greatly magnified by the enormous increases in development in the coastal regions of Florida since the 1940s. It is estimated that the population of Florida coastal counties has increased nine times in this fifty-year period -- exposing ever larger cities, towns and suburban areas to the hazard of tropical storms and accompanying storm surges. Coastal communities throughout the world are growing rapidly.

Cities such as Tokyo, Mexico City, San Francisco and many others continue to develop and expand in the face of well known earthquake hazards. In the developing world, Manila in the Philippines, Lagos, Nigeria, and Accra, Ghana, have grown in a manner that greatly exacerbates flood problems with squatter settlements along waterways, and ever-increasing spread of roads and roofs, impermeable to rainwater, yielding ever more rapid runoff. The recent experience of Caracas, Venezuela, with severe landslides and floods due to a tropical cyclone (hurricane) which tracked much further south than normal, indicates the role of poverty in increasing the risks. Almost all of the deaths and the destruction were visited upon the settlements of the poor, on the steep slopes of the city and its outskirts. This was simply a dismal repeat of similar catastrophes in Caracas in 1989, Rio de Janeiro, Brazil, in 1988 and Medellin, Columbia, in 1987.

But urbanization does not have to increase exposure to natural disasters. The tail-end of Hurricane Hazel in 1954 caused floods which killed eighty people and did more than

US$100 million damage in Toronto. The city took the opportunity to remove non-recreational development from the flood-plains of the rivers flowing through the urban and suburban areas, creating a network of ravine parks with little or no flood losses since. In cities such as Tokyo and San Francisco, all larger buildings are designed to withstand severe earthquakes. Unfortunately, many of the world's large cities do not have the initial capital funds of those in Japan, USA and Canada, even though investment in these disaster mitigation measures are economically beneficial in the long run.

While it is generally assumed that large cities are more vulnerable to disasters, it must be recognized that there are some aspects of urban areas that can reduce disaster losses. Anderson (1992) points out that well developed urban centres have better services -- hospitals, ambulances, water, and electricity -- than most rural areas. They have better educational facilities and thus opportunities for disaster preparedness training and awareness. Warning systems, communications and evacuation capabilities are more developed.

Unfortunately, and especially in developing countries, these positive aspects of cities in dealing with disasters are offset by the increased hazards of **concentrations** and **crowdedness**, the sheer **numbers** of people, buildings and facilities at risk, the environmental degradation (e.g. removal of vegetation), and the increased proximity to technological hazards which are often triggered by natural disasters.

It is a characteristic of many cities in industrialized countries that they maximize the advantages and minimize their disadvantages for disaster loss reduction. For most cities in developing countries, it is just the reverse. It is one of the major challenges of the IDNDR to begin to reduce the disaster proneness so prevalent in urban areas of the developing world.

GROWTH OF URBAN POPULATIONS

According to the World Bank, the world's urban population has grown at 4 per cent per year since 1950 whereas the total population growth rate has been about 1.7 per cent per year (Kreimer and Munasinghe, 1992). Even more alarmingly, the growth rate of cities in developing countries has been triple that of the developed world. In the past thirty years, 94 per cent of Latin America's population growth has been in urban areas. In Africa, a demographic surge to the cities is underway, driven by drought, famine and civil conflict. In the past fifteen years, Asia's urban population has increased from 22 per cent to 41 per cent of the total. By 2025, Asia's population in urban areas is expected to rise to 2.6 billion people or 50 per cent of the world's city dwellers. Cities in India are growing by a total of 600,000 people each month. The developing countries have more than their share of very large cities -- mega-cities. Indeed, by the year 2000, it is projected that twenty cities in the world will have populations greater than 10 million people. Of these, seventeen will be in developing nations.

POVERTY AND DISASTER LOSSES

These are the demographic trends that are resulting in increased exposure to hazards, both natural and technological, in the world's burgeoning cities. As Burton *et al.*, in 1978, pointed out "about 95 per cent of disaster-related deaths occur among the two thirds of the world's population that occupy developing countries". And with enormous growth of the cities in developing countries these tragedies are compounded. In terms of economic losses, the largest total damages occur in industrialized countries, but proportionately they are much

more devastating in developing countries. For example, the US$1 billion loss in the 1992 drought in southern Africa represents a much greater setback to economic development than the US$25 billion Hurricane Andrew loss in southern USA, where per capita income is up to forty times greater. Indeed natural disasters, time after time, are seen to wipe out several years of economic development in many poorer countries, making such development efforts unsustainable without significant disaster mitigation efforts.

TRENDS IN DISASTER LOSSES

One of the most comprehensive sets of disaster loss statistics have been compiled by the insurance industry, especially Munich Re-insurance (Berz and Conrad, 1993). It indicates that financial losses in constant dollars, due to "great" natural disasters have increased an average of three times between the decade of the 1960s and the decade of the 1980s. In the first three years of the 1990s, worldwide losses in "great" disasters have shown a tenfold increase over the 1960s averages. In 1992, with Hurricane Andrew in the Bahamas and southern USA, tropical storm Iniki in Hawaii, major floods in Pakistan and North India, droughts in southern Africa and severe earthquakes in Egypt, Indonesia and Japan, losses were estimated at US$62 billion for all disasters, great and small, the largest on record. Floods in south Asia and midwestern North America, tsunami and repeated typhoons in Japan and the Asian Pacific seem likely to set new records for 1993.

Information on the natural hazards causing these disasters and on the numbers of people affected has been compiled by the US Office of Disaster Assistance (OFDA) (1991). Their figures for the period 1964 to 1989 indicate that drought and related famine has affected the largest numbers of people, more than 1 billion in that period, with floods and storms affecting almost as many. However, the numbers of people killed by natural disasters in this period has been roughly equal from:

(1) droughts and famine;
(2) geophysical hazards (earthquakes and volcanoes); and
(3) hydrometeorological hazards (storms and floods).

Wildfires, landslides and other hazards were significant, but belonged to the smallest category. Munich Re notes that "the rising trends in disaster losses established earlier have continued to rise steeply in recent years, especially in the case of windstorm disasters" (Berz and Conrad, 1993).

Data on trends of numbers of people affected are not readily available but they must be similar to that for financial damages. The trends in number of lives lost is more encouraging because of improvements in warning systems.

Thus, there is disturbing evidence of rapid growth in economic disaster losses. A large percentage of the people affected and the losses are due to droughts, storms and floods -- hazards whose frequency and severity may well be affected by global environmental change caused by human activities.

DISASTERS AND GLOBAL CHANGE

Land Use

The relationship is well understood between floods and landslides on the one hand, and the removal of forests and other vegetation on the slopes of watersheds. Flood peaks and landslides are substantially increased by loss of vegetation on the hillsides. This is especially true in smaller watersheds. In large basins the effect of land–cover changes tend to be masked by many other factors. However, this is a factor which has been cited, for example, as contributing to increasing flood hazards on the upper reaches of the rivers of Nepal (Russell, Ancharya, and Pant, 1991).

In addition, the expansion of cities with accompanying increases in paved and roofed areas results in higher run–off rates and greater floods in urban and suburban areas. For example, in one study in southern Ontario, the percentage of rain and snowmelt which runs off increased from 10 per cent to 43 per cent with urbanization of the watershed (Bras, 1993). Thus, human actions are undoubtedly increasing the percentage of rain or snowmelt that runs off quickly, causing floods.

In the case of droughts, studies in the Sahelian region and elsewhere have shown that while drought periods are caused by large–scale changes in the general circulation of the atmosphere, local actions can prolong the dry periods and make their effects more devastating. Removal of vegetation for firewood, or by grazing animals, changes the albedo or reflectivity of the land surface and the surface roughness, both leading to prolongation of dry weather and its adverse effects (Bras, 1993). Losses of vegetation can also reduce the penetration of water into the soil accelerating run–off and leave little flow for the dry season. From these examples it is evident that human actions in affecting land uses and vegetation are already having significant effects on severity of floods and droughts.

The growth of cities not only results in vegetation loss and soil changes in their area of urban sprawl, but large cities can cause devastation far beyond their boundaries. For example, urban demand for fuel wood often leads to clear cutting of nearby forests that had served local populations for generations. To illustrate, Delhi, India, needs 612 tons of firewood a day, and much of this wood now comes from forests as far as 700 km away (Kreimer and Munasinghe, 1992).

Climate Change and Disasters

There is also much concern that human actions, especially burning of fossil fuels, which results in increased greenhouse gas concentrations in the global atmosphere, threatens to change even more profoundly the frequency and severity of natural hazards. The changes in the chemical composition of the global atmosphere are changing the radiation balance and are projected to result in a significant warming, at an average of 0.3°C per decade, of the climate of the planet. Higher sea surface temperatures, a redistribution of precipitation, and a two to four times more rapid rise in mean sea level than we have experienced in the last century are also projected (Houghton *et al.*, 1990, 1992). While there is considerable confidence in these global projections, if emissions of greenhouse gases go largely unchecked, the scenarios for future regional changes are more uncertain.

However, the increasingly realistic mathematical models of global climate tend to suggest a more hazardous world in the future. They indicate in some areas more rain, but no more rain days, suggesting the possibility of greater floods. Monsoon circulations will likely increase with greater flood potential in parts of South Asia. There are suggestions that severe

storms in western Europe could be more frequent. Droughts in southern Africa, northeast Brazil and Australia could occur more often and be more severe with intensified El Niño–Southern Oscillation events. Sea level rise is making storm surges from tropical cyclones and tsunami from earthquakes, ever more dangerous.

Let us recognize that these are only preliminary indications from the climate models, with increasing radiative forcing by greenhouse gases, but they are consistent with our recent disaster experience.

Whether tropical cyclones will increase in frequency, intensity and greater geographical range, or may be already showing such signs, is a matter of vigorous scientific debate. Some scientists consider that with increasing sea surface temperatures and thus evaporation, the latent heat energy which drives the tropical storms will increase and they will become more intense and perhaps more frequent. Other scientists point to some evidence in the climate model projections which suggest a more stable atmosphere and change in upper winds near the tropics in future, and think that this could offset the stimulating effects of a sea surface temperature rise. Such models do not yet take into account changes in vertical distribution of ozone -- generally depletion in the stratosphere and increases in the troposphere. This factor has the potential to radically alter initial conclusions about atmospheric stability changes.

Whatever the outcome of these atmospheric changes, the projected rise in sea level will mean that storm surges accompanying tropical cyclones will inundate more and more coastal and island regions.

With ever-expanding urban areas in coastal zones throughout the world, it appears that the trend towards increase in disaster losses on coasts will continue in the decades to come, unless strong actions are taken to reduce the rate of global warming and/or large and costly protective works are built. One estimate from China is that a further 80 cm rise in mean sea level would force the abandoning of some 40,000 coastal towns.

ACTIONS NEEDED

Is the situation then entirely hopeless? Are there actions that could be taken within the framework of the IDNDR that will reduce vulnerability of cities to natural hazards? As noted, successful disaster mitigation measures have been undertaken in many cities of wealthy countries. The urgent need is to expand their use, adapting them to the special needs of metropolitan areas of developing countries. These well known measures include, among many others:

(1) Earthquake and strong wind resistant buildings;
(2) "Hardened" services -- electricity, water purification, etc.;
(3) Hospital, ambulance services, evacuation plans and other preparedness measures;
(4) Reliable early warning and communication systems;
(5) Flood abatement projects; and
(6) Flood plain and hazard land zoning.

"Most of these offer important opportunities for investment by international donor agencies" (Anderson, 1992).

THE IDNDR -- NATIONAL ACTIONS

The IDNDR provides an international framework in which such investments can be made to help ensure sustainable development in the developing world. It also provides the occasion for all countries to take action on their own to reduce the vulnerability of their cities. The 110 national committees or focal points established for the Decade have a multiagency, multidisciplinary approach which is essential to tackling problems of reducing the vulnerability of cities. Their actions need further stimulation and mobilization in the second half of the Decade.

THE IDNDR PROJECTS

About 125 IDNDR projects are registered with the Secretariat in Geneva, and there are probably far more being undertaken around the world in the name of IDNDR, which have not been registered. Of these, twenty-five are International Demonstration Projects endorsed by the STC as examples of projects that can be conducted at the international level. An additional ten International and Regional Projects (IRIPs) have been recognized. Some forty national and UN agency projects have been registered with the Secretariat along with about fifty projects which involve technology transfers between countries, especially developed for developing countries. Many of these projects have applicability to reducing disaster losses, human and economic, in urban areas.

A few examples may serve to illustrate the range of IDNDR project activity especially relevant to cities:

(1) (a) Disaster Prevention and Mitigation in Metropolitan Areas: World Bank, UNDP, and UN Centre for Human Settlements -- to reduce vulnerability to extreme events.
(b) Mega-cities: Protection and Construction --World Federation of Engineering Organizations (WFEO) and Unions les Association Techniques International (UATI)
(c) The Physical Instability of Mega-cities --special emphasis on Los Angeles, La Paz, Moscow, Tokyo -- International Union of Geological Sciences and International Council of Scientific Unions.

Additional projects on mega-city disasters are under development.

(2) World Seismic Safety Initiative has begun with two workshops (Bangkok, Okinawa) and spawned special committees on earthquake disaster reduction in several countries -- International Association of Earthquake Engineering.

(3) Tropical Cyclone Warning and Preparedness System for South-West Indian Ocean (and cities of Southeast Africa) -- World Meteorological Organization, funded by European Community Development Fund.

(4) Safer Buildings:
(a) Reconditioning of existing adobe housing to mitigate earthquake effects -- Regional Centre of Seismology for South America (CERESIS), funded by Germany.
(b) Implementing Available Know-how for Protection of Non-Engineered Housing from Natural Hazards -- India.

(c) Design of (engineered) structures to withstand earthquakes and extreme winds -- WFEO/UATI.

(5) Training and Techniques
(a) Community Emergency Preparedness Manuals (for first 72 hours after a disaster) -- World Health Organization (WHO) and partners.
(b) Disaster Management Training Programmes -- many training workshops, manuals, guidebooks, etc. -- Department of Humanitarian Affairs (DHA) and UN Development Programme.
(c) Strengthening Health Sector Preparedness and Response -- Ethiopia, Indonesia --WHO.
(d) Disaster Mitigation Guidelines for Hospitals and other Health Care Facilities in the Caribbean and Latin America -- PAHO (WHO).

IDNDR AWARENESS

A few of the latter projects emphasize the theme of IDNDR Day for 1993 (13 Oct.) "STOP DISASTERS: FOCUS ON SCHOOLS AND HOSPITALS". This theme was designed to encourage all communities, large and small, to ensure that their schools and hospitals and the lifelines to them, are safe in case of a disaster. Such buildings and facilities are often used as shelters and post-disaster havens. In addition, the theme encouraged schools to undertake disaster awareness programmes to sensitize children to the actions they should take to protect themselves, their friends and families.

IDNDR -- THE NEXT STEP

Governments and National Committees in all parts of the world are now preparing for the World Conference on Natural Disaster Reduction, to be held in Yokohama, 23-27 May 1994. Each country has been asked to prepare a national report indicating what steps they have taken so far to meet the targets[1/] of the IDNDR, and their plans for the second half of the Decade. Six theme sessions are planned in addition to Ministerial presentations and discussions. These cover the issues of:

(1) The benefits and costs of disaster mitigation actions;
(2) Drought management;
(3) Interrelationships between technological and natural disasters;
(4) Building of hazard-resistant structures;
(5) Warning systems and preparedness; and
(6) Protecting specially vulnerable groups, e.g. coastal communities, children.

This timely conference on disasters and metropolitan areas, here in Aichi/Nagoya can send a strong message to the World Conference next year. Unless the deliberations at Yokohama and the programme for the second half of the Decade focus on reducing losses in urban areas, our efforts at saving lives and reducing economic losses will be largely in vain.

NOTE

1/ Targets adopted by the UN General Assembly for the IDNDR are:

By the year 2000 all countries, as part of their plans to achieve sustainable development, should have in place:

- Comprehensive national assessments of risks from natural hazards, with these assessments taken into account in development plans.
- Mitigation plans at national and/or local levels, involving long-term prevention and preparedness and community awareness.
- Ready access to global, regional, national and local warning systems and broad dissemination of warnings.

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PLENARY SESSION: WORLDWIDE LOSS OF LIFE AND PROPERTY FROM NATURAL DISASTER

The world is now reaching a turning point; the urban population, only one-seventh of the world population 100 years ago, will soon exceed the rural population. Over the past 100 years, this rapid urban population growth has dramatically increased the potential for loss of life and property from natural disasters.

Concrete estimates of possible loss from disasters are essential to the development of effective disaster responses. These estimates must consider the varied requirements of particular nations and regions. In this session, we will discuss the potential for loss and property in urban areas by examining past catastrophes.

This session was held based on the above mentioned concept, and was comprised of the following three presentations.

Impacts of Volcanic Eruptions and Earthquakes and Disaster Mitigation Measures in the Philippines
by Raymundo S. Punongbayan

Trends in Urban Earthquake Hazard and Earthquake Hazard Mitigation in Developing and Industrialized Countries
by Brian E. Tucker

Emergency Relief in the Context of the World's Natural Disasters
by Tadateru Konoe