Countering Disasters, Targeting Vulnerability

What is a natural hazard?

Natural hazards comprise phenomena such as earthquakes; volcanic activity; landslides; tsunamis, tropical cyclones and other severe storms; tornadoes and high winds; river floods and coastal flooding; wildfires and associated haze; drought; sand/dust storms; insect infestations.

What is a natural disaster?

A natural disaster is the result of the impact of a natural hazard on a socio-economic system with a given level of vulnerability, which prevents the affected society from coping adequately with this impact. Natural hazards themselves do not necessarily lead to disasters. It is only their interaction with people and their environment that generates impacts, which may reach disastrous proportions. The ISDR encompasses technical and environmental disasters only when caused by natural hazards. A disaster is usually defined as a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources (IDNDR/DHA 1992).

What is vulnerability to disasters?

Vulnerability to disasters is a status resulting from human action or from an inherent situation such as poverty. It describes the degree to which a society is threatened by the impact of natural hazards. The degree of vulnerability depends on the condition of human settlements and their infrastructure, the way in which public policy and administration are engaged in disaster management, the level of information and education available about hazards and how to deal with them, among other aspects.

Why target society's vulnerability to disasters?

Although societies have always experienced major natural disasters, they have, in recent years, been increasingly affected by their adverse impact. In early 2001 alone, three consecutive earthquakes in El Salvador and one in India, together with recurring floods in Mozambique caused significant loss of life and damage to economic and social infrastructures in these countries. This global development is directly linked to a number of trends such as increasing poverty, population growth and density particularly in the context of rapid urbanization, environmental degradation and climate change.

What is Disaster Reduction?

Solutions to counter the increasing impact of natural hazards world-wide exist. The knowledge and technology necessary to apply these solutions are widely available. Disaster reduction is the sum of all the measures, which can be undertaken to reduce the vulnerability of a socio-economic system to natural hazards. The measures cover a wide spectrum of activities ranging from avoiding disasters all together (disaster prevention) to measures aimed at limiting the severity of a disaster when it strikes. Sound information and political commitment are the basis of successful disaster reduction measures.

This is an ongoing process which is not limited to a single disaster. It seeks to motivate societies at risk to become engaged in conscious disaster management, beyond the traditional response to disasters. Disaster reduction is multisectoral and interdisciplinary in nature and involves a wide variety of interrelated activities at the local, national, regional and international level.

DEFINITIONS OF CORE CONCEPTS

DISASTER REDUCTION
involves measures designed to avoid (PREVENTION) or limit (MITIGATION and PREPAREDNESS) the adverse impact of natural hazards and related environmental and technological disasters.

PREVENTION

involves the outright avoidance of the adverse impact of natural hazards and related environmental and technological disasters. Good planning is an example of disaster prevention, i.e the decision not to build houses in a disaster-prone area for example.

MITIGATION

involves measures taken to limit the adverse impact of natural hazards and related environmental and technological disasters. Examples of mitigation are the retrofitting of buildings or the installation of flood-control dams, training and legislation

PREPAREDNESS

involves measures taken in advance to ensure effective response to the impact of disasters. Preparedness measures include effective evacuation infrastructures or the regular testing of warning systems.

Risk Mapping Contests Guidelines

(developed by the ISDR Secretariat with the Pan-American Health Organization PAHO)

Risk Mapping Contests
for local communities and children.

What Is a Risk Map?

A risk map is a map of a comunity or a geographical zone that identifies the places and the buildings—homes, schools, health facilities and others—that might be adversely affected in the event of hurricanes, earthquakes, tsunamis, floods, volcanic eruptions, landslides, and other natural hazards and related technological or environmental disasters.

Risk mapping is a group effort. Many people with various kinds of expertise—emergency management, geology, meteorology, history, or simply a good knowledge of the locality—participate in the effort by providing their own input about which places in the community are vulnerable to hazardous events.

Who Can Participate?

Community organizations.	Municipalities.	Children
Local healthcare workers.	Local Emergency Committees.	
Religious groups.	Non-governmental organizations.	

Any other groups wishing to participate and organize themselves to do so.

Please send your risk maps by 31 December 2001 to:

Risk Mapping Contest:

UN Secretariat for ISDR
Palais Wilson
United Nations
52 rue des Pâquis
1201 Geneva CH

or

Risk Mapping Contest:
Estrategia Internacional para la Reducción de Desastres

Apartado Postal 3745-1000
San José, Costa Rica

What Should the Risk Map Include?

It should be a map of the community or area at risk indicating the most significant facilities, such as schools, hospitals, churches, the Red Cross, fire-fighters or police headquarters, the City Hall or other municipal buildings.

The Risk Map should also include especially hazardous buildings in the area, such as factories or other work places. The different types of buildings should be identified by a distinctive symbol. The map may also include the main streets, roads, and bridges; significant electricity and water supply lines; areas exposed to flooding or landslides due to excessive deforestation or any other reason; and densely populated areas that are vulnerable to natural disasters. Different colors may be used to indicate the degree of risk: severe, moderate or light.

How Should the Risk Map Be Produced?

- Organize a series of walks or drives around the community or the area under consideration to identify areas or features at risk.

- Hold meetings to discuss the findings of this reconnaissance effort and the reasons why some areas are considered at risk.

- Discuss possible solutions to reduce risk.

- Collaborate in the drawing of the map.

What Will the Prizes Be?

The winners of the contests will receive grants towards disaster reduction projects in their schools and local communities. In addition, the winning maps—and any others considered noteworthy—will be published in a commemorative volume and will be exhibited. All maps submitted will become the property of the ISDR Secretariat and will not be returned to the contestants. Participants are encouraged to keep copies of their maps and distribute them as widely as possible in their community.

The International Strategy for Disaster Reduction

The UN has established the International Strategy for Disaster Reduction as a global framework for action with a view to enabling all societies to become resilient to the effects of natural hazards and related technological and environmental disasters, in order to reduce human, economic and social losses. It involves a conceptual shift from an emphasis on disaster response to the management of risk through the integration of disaster reduction into sustainable development. The implementation of the Strategy is premised on the establishment of partnerships between governments, non-governmental organizations, UN agencies, the scientific community, the media as well as other relevant stakeholders in the disaster reduction community. The four goals of the Strategy are to increase public awareness about disaster reduction, to obtain commitment from public authorities, to stimulate inter-disciplinary and inter-sectoral partnerships, and to improve the scientific knowledge of the causes of natural disasters and the consequences of the impact of natural hazards. The UN General Assembly has mandated two additional tasks which are directly relevant to disaster reduction; the continuance of international cooperation to reduce the impacts of El Niño and La Niña and the strengthening of disaster reduction capacity through Early Warning measures.

The United Nations Interagency Secretariat of the International Strategy for Disaster Reduction

The UN Interagency Secretariat of the International Strategy for Disaster Reduction (UN/ISDR) serves as the focal point within the UN system for the coordination of strategies and programmes for natural disaster reduction. It is dedicated to the building of disaster resilient societies by promoting increased awareness of the importance of disaster reduction initiatives and by supporting such initiatives in order to reduce human, economic and social losses. The ISDR Secretariat also supports a UN Inter-Agency Task Force for Disaster Reduction. The Task Force, which is chaired by the Under-Secretary-General for Humanitarian Affairs of the United Nations and which comprises representatives from a selected number of UN agencies, regional institutions and the NGO community, functions as the main forum for devising policies on disaster reduction.

The United Nations World Disaster Reduction Campaigns

The UN World Disaster Reduction Campaigns are organized on an annual basis. Their aim is to increase public awareness, worldwide and across all professional sectors, about what can be done to reduce the vulnerability of societies to the socio-economic impact of natural hazards. The campaigns are based on a different theme every year. Each campaign culminates on the International Disaster Reduction Day, on the second Wednesday of October. Information on past campaigns can be obtained from the UN Secretariat for the ISDR or from the ISDR website www.unisdr.org

Natural Disasters:
Counting Costs and Counting People

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Most decision-makers agree that the integration of disaster reduction measures into policy development is key in reducing the vulnerability of human settlements to natural hazards. Yet, funding patterns, an undeniable indicator of real priorities, show that it is disaster relief and not reduction that tops the list of all disaster management funding. And this is true for donor countries as well as the disaster prone countries themselves. There are several reasons for this.

First, relief is immediate and urgent, it is also media friendly, action oriented and easy to quantify (tons of food distributed, number of family shelters shipped) and easily accountable to donor constituencies as concrete actions in relation to the disaster.

Secondly, as development aid is decreasing in real and in relative terms, emergency relief is easier to obtain since it is morally difficult to refuse aid in the face of sudden destruction, death and misery.

Also, the reality is that development programmers often neglect the importance of disaster reduction due to the lack of convincing analyses of trends and estimated losses. There is little demand for reliable and systematic data on disasters by the development sector to assess their socio-economic impact in the short term and, even less, in the long term[1]. Therefore, disaster reduction activities often seem costly.

TRENDS

The focus of interest, for the international community, is how disasters affect human populations and what we can do to reduce their effects. As such, only those that occur where humans live are included in this analysis.

As Table 1 shows, there has been an increase of 22 percent in the number of disasters[2] and a 35 percent increase in the number of affected people. In Figure 1 (next page), linear trend lines illustrate that the rapidity of the increase among affected people is greater than the rapidity of the increase in the number of events. For both categories, hydro-meteorogical phenomena such as floods, landslides and windstorms (hurricanes, typhoons, cyclones and storms) constitute the main contributory factor. They represent 61 percent of all disasters from 1980 to June 2001 and are the phenomena linked to global warming and the El Niño/Niña phenomenon.

Table 1: Distribution of natural disaster events and their impact by decade

	1980-89			1990-99			2000-01		
	Nber events	Nber killed	Nber affected ('000)	Nber events	Nber killed	Nber affected ('000)	Nber events	Nber killed	Nber affected ('000)
Flood + Slide	699	67 330	543 376	939	103 150	1 429 177	235	8 170	66
Wind storm	670	43 923	138 453	784	209 526	258 622	133	1 553	17
Earthquake	292	55 794	31 629	226	101 873	17 189	38	21 389	21
Volcano	40	24 972	701	51	975	2 085	6	0	124
Others*	541	610 961	740 468	744	377 477	253 790	273	12 169	189
Grand Total	2 242	802 980	1 454 627	2 744	793 001	1 960 863	685	43 281	293

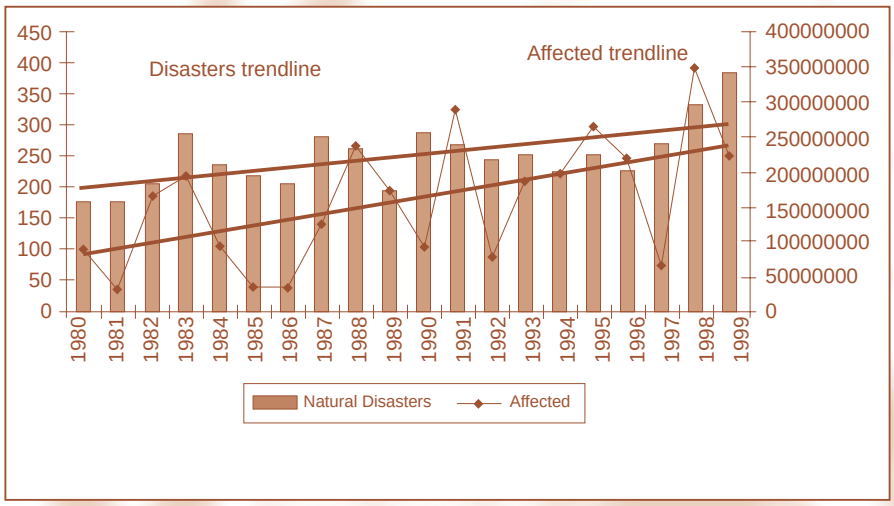
*Includes: Drought, epidemic, extreme temperature, famine, insect infestation, wave/surge, wild fires

Source: EMDAT database, Centre for Research on the Epidemiology of Disasters (CRED), School of Public Health University of Louvain–la-Neuve, Brussels, Belgium

[1] The World Health Organization Collaborating Centre for Research on Epidemiology of Disasters set up a public access disaster database in 1985 where disaster data from every country is posted starting from 1900. Sponsored by the USAID - Office for Foreign Disaster Assistance, the EM-DAT database report data from various sources on the different human and economic impact variables on a standardized format and standard criteria. Trends in human impacts and scattered economic loss estimates are drawn from this source.

[2] Which meet the CRED criteria described in www.cred.be

Figure 1
Trends in natural disaster events and population affected by year



Source: EMDAT database, Centre for Research on the Epidemiology of Disasters (CRED), School of Public Health University of Louvain–la-Neuve, Brussels, Belgium

COUNTING THE COST OF DISASTERS

The economic impact of disasters has been recently underscored by Hurricane Mitch in Central America (1998), the earthquake in Turkey in 1999 followed by the earthquake in San Salvador and then the earthquake in Gujarat, India in 2001. In 1998, the floods of the Limpopo river devastated Mozambique, a country already crippled by years of civil strife. All of these mega-disasters received much media attention and the setbacks that these events created for the development process were also noted. The smaller but recurrent disasters often receive neither media attention nor are their pernicious economic erosion assessed. Although the evaluations of economic damages are not systematically undertaken and methodologies differ between one disaster and another, the magnitude of the problem can be appreciated from a few one-off examples.

The used figures are not the absolute amounts (which are inevitably higher in rich countries due to higher property value and dense infrastructure) but as a proportion of GDP of the country, which gives a better indication of the significance of the loss. As Table 2 shows, US$ 22 billion damage in Florida is a minor part of its GDP, allowing the State to recuperate faster than US$ 40 million loss in Niue, where replacing the government buildings alone absorbed 40 percent of its GDP.

Table 2 :
Natural disasters and estimated economic losses as a percent of GDP

Place and year	Estimated economic loss
Mexico city earthquake, 1985	3 percent of GDP
San Salvador earthquake, 1986	24 percent of GDP
Nicaragua hurricane, 1988	40 percent of GDP
Bangladesh -Recurrent floods	5 percent of GDP annual loss
Niue, (South Pacific) Hurricane Andrew, 1990 (4 million damage)	40 percent of GDP to replace only the government buildings
Florida, Hurricane Andrew, 1990 (22 billion damage)	0.3 percent of State GDP

Source: EMDAT database, Centre for Research on the Epidemiology of Disasters (CRED), School of Public Health University of Louvain–la-Neuve, Brussels, Belgium

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Vulnerability Factors

Dependence on agriculture. Nearly two-thirds of all natural disasters in the last two decades have been of hydro-meteorological origin. They have their greatest impact on the agricultural sector. Therefore, countries or communities that are heavily dependent on agriculture become increasingly vulnerable as these disasters get more widespread.

Forced displacements. Inequitable development practices can force people to live in high risk areas, with no other options. A good example is the expansion of the cotton plantations in the 1960s in Nicaragua, which forced the peasants to move from fertile plains to makeshift shantytowns on the slopes of the Casitas volcano. In 1998, the shantytowns beneath the now deforested volcanic slopes were completely exposed to Hurricane Mitch. When the crater lake collapsed under the pressure of the water from the hurricane and created a deadly landslide, killed dozens of slum dwellers. Hurricane Mitch caused damages of US$ 6 billion in Honduras and US$ 1.5 billion in Nicaragua, setting back the development process by 20 years.

Deforestation. The Yangtze river floods in China in 1998 killed over 3 000 people outright, a remarkably high death figure from floods, which usually kill fewer than they affect. The country incurred immediate losses of US$ 45 billion having also to cope with 230 million displaced. While these figures have been widely reported, less known is the fact that the Yangtze basin had lost, in the recent decades, nearly 85 percent of its forest cover due to logging, damming the river and draining wetlands. Recognizing these weaknesses in the development schemes of the river basin, the Chinese government has earmarked US$ 3 billion to reforest the watershed.

Soil depletion, erosion, waterlogging, deforestation are preventable risk factors for disasters. Many of these are particularly suitable to be properly dealt with at the community level. For example, the Humboldt Centre in Nicaragua has undertaken a successful community-wide exercise to identify where and how houses should be built to minimize risks against floods and landslides.

Fortunately, natural disaster reduction is no longer a completely marginal issue. Especially after the devastation witnessed in Mozambique, India, Central America and Kobe, the consequences of natural disasters are clearly not relegated to a divine hand and development actors are taking action. Activities to reduce the impact of hydro-meteorological events are possible and indeed, have been successfully employed in many disaster prone countries. Addressing basic environmental measures which reduce global warming are easily the most effective in the long run. But in the short run, local efforts in flood management and cyclone mitigation actions have been shown to be extremely cost-effective. The European Commission Humanitarian Programme (ECHO), as one of the single largest humanitarian aid programmes, has placed emphasis on the prevention and mitigation aspects through a dedicated programme called Dipecho which has financed several successful community based mitigation projects[3]. But having an emergency programme devote some funds to disaster mitigation and reduction is not a real solution. This approach should be built into community development plans, national industrial and urban plans and international development programmes. It should be an integral part of development programming. The World Bank, for example, has established a Disaster Management Facility to assist its loan and grant giving services to integrate disaster prevention and mitigation policies. UN entities, regional organizations and NGOs run successful disaster reduction programmes. Many developing countries have initiated national programmes for this purpose. But all too often, thinking on disaster reduction practices only takes place after a disaster has happened.

The time to take action is now. Rising sea levels caused by climate change threaten 10 million people living in low-lying areas of Bangladesh, Maldives, China and Egypt. Global warming is also expected to affect water supplies and reduce food production in the tropics, putting an additional 50 million people at risk of hunger by 2100.

There is still a long way to go. However, the repeated tragedies in the last decade have been an effective motivator and perhaps this century will see fewer devastating events than the last.

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[3] Under the leadership of Commissioner Poul Nielssen, the European Commission is currently taking steps to mainstream disaster vulnerability policies with its development programmes.

Climate Change and Disasters

For several years, issues around global warming have been fiercely debated in the scientific community. However, in February and March 2001, the Intergovernmental Panel on Climate Change (IPCC), a UN-designated body of scientists worldwide, in its Third Assessment on climate change reflecting years of research, now confirmed what many have long suspected… that our world is becoming warmer due primarily to human actions – and not because of Nature.[1] This assessment comprises three comprehensive reports covering the 'Scientific Basis' for climate change, its implications for 'Impacts, Adaptation and Vulnerability', and a focus on 'Mitigating' the impacts of climate change.

What is Climate Change? … Why has it happened?

In IPCC terms, **'climate change'** means **any change in climate over time, whether due to natural variability or as the result of human activity'.**

While our planet has indeed witnessed repeated processes of warming and cooling during its existence, the past hundred years have seen unprecedented warming. Natural processes, including solar output and volcanic eruptions, have always contributed to temperature changes. However, research far back into the Earth's climate history suggests that human rather than natural influences have shaped late twentieth century climate trends.[2]

Much of the explanation for these rising temperatures is attributed to the rapid increase in 'greenhouse gas' emissions over the past century. Since 1751, the beginning of the Industrial Revolution, there has been large-scale combustion of carbon-based fossil fuels, such as wood, coal and oil as well as increasing concentrations of other greenhouse gases, such as methane, nitrous oxide and halocarbons. These gases absorb infrared radiation reflected from the Earth's surface and reduce its likelihood of escaping into space. This causes atmospheric temperatures to rise.[Ibid]

In fact, the IPCC reports that the atmospheric concentration of carbon dioxide has risen by 31% since 1750. This level has never been exceeded in the past 420 000 years, or even as far back as 20 million years. Atmospheric concentrations of both methane and of nitrous oxide have also increased significantly since 1750 (by 151% and 17% respectively). The IPCC's findings confirm the long-suspected link between rising greenhouse gas emissions and continued global warming.

How will Climate Change affect us?

We are already living with the effects of increasing temperature. During the twentieth century, the Northern Hemisphere possibly experienced the largest increase in temperature in the past 1,000 years. The 1990s was the warmest decade, and 1998, the hottest year. This was accompanied by about a 10% decrease in snow cover since the 1960s and widespread retreat of mountain glaciers. Worldwide, sea-levels rose on average by between 10 and 20 centimetres.

These trends are set to continue during the 21st century. Average surface temperatures are expected to rise between 1.4 and 5.8 C from 1990 to 2100. Our sea temperatures may well become become more El-Niño-like, with greater warming in the eastern Pacific Ocean. It is very likely that we will see higher maximum temperatures and more hot days. Worldwide, sea levels could rise by as much as 90 centimetres, dramatically increasing the risk of flooding for low-lying coastal areas and submerging small island states. We will see more intense rainfall, although this does not mean that total rainfall will necessarily increase. We can also expect more extreme weather patterns – although these will be geographically specific.[1]

Impact on people … impact on our natural environment

In practical terms, these changes will affect everyone. Already, 1.7 billion people live in countries that are water-stressed. By 2025, this number is expected to rise to 5 billion. In regions like southern Africa, central Asia and countries around the Mediterranean Sea, climate change could further diminish the amount of water flowing through our streams and rivers, as well as the rate that underground aquifers recharge their water reserves. This is likely to worsen existing conditions of water stress in many countries, including those in southern Africa.[3]

At the same time, floods will increase in many places, because of more frequent and intense rainfall. This is especially the case for regions such as southeast Asia. The combined effect of heavier rainfall and sea-level rise means that many coastal areas will experience greater flooding and erosion, shrinking wetlands and mangroves, as well as intrusion of seawater into their fresh water sources. The extent and severity of storm impacts, including storm-surge floods and shore erosion will also increase because of climate change.

Increasing temperatures, changing rainfall patterns and rising sea levels have serious implications for people and for the places in which we live. Many insect-borne, food and water-borne diseases are very sensitive to climate changes. For instance, we expect mosquito-transmitted diseases like malaria and dengue fever to spread beyond their current geographic range in the 21st century. Moreover, if cyclones increase regionally (like in South Asia or in the Southwestern Indian Ocean), there could be devastating loss of life, as well as property damage and destruction to crops. These impacts will be far worse for congested coastal or poor isolated rural communities – than for those living in areas with dependable infrastructure, municipal services and telecommunications systems. It is possible that the number of people at-risk from coastal storm surges alone could be as high as 200 million by 2080.[Ibid]

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While flooding is likely to be worst for those living in flood plains or in low-lying coastal areas and near rivers, flood risk will increase wherever there are inadequate storm water drains, water supply and waste management systems. Urban areas, particularly crowded informal settlements, with limited access to public services - already vulnerable to extreme weather events - will become even more flood-exposed.

Higher temperatures and reduced rainfall in regions like southern Africa (which depends heavily on rain-fed agriculture), are likely to bring poorer harvests – particularly for crops like maize, which depend heavily on seasonal rainfall. In fact, those countries with economies that rely mainly on agricultural exports for foreign exchange will be particularly vulnerable to climate extremes. Likewise, farmers living in arid and semi-arid areas may find themselves battling to protect their families, their animals and their crops from the impact of severe water scarcity.

We are already living with the effects of these types of extreme weather events. In fact, during the last fifty years, there has been a dramatic increase in disaster-related losses, many of which are weather-related. Around 70% of all disasters, including floods, wind-storms and destructive fires, are triggered by climate processes. Although there are approximately 500-700 natural disasters recorded every year, only a few are classified by Munich Reinsurance as 'serious' disaster events. However, between the 1950s and 1990s, the number of these catastrophic events per decade increased from twenty to eighty-six.[4]

In 2000 for instance, Munich Reinsurance reported 850 catastrophes with a natural trigger, one hundred more than in 1999, and two hundred more than the average for the 1990s.[5] Of these, windstorms dominated last year's list, with more than 300 events. They also accounted for 73% of insured losses. Floods, on the other hand while accounting for a mere 23% of the insured losses, wreaked havoc in southern Africa, Southeast Asia, the Swiss and Italian Alps, as well as Britain. And, the United States, while spared severe hurricane damage, did not escape the impact of devastating wildfires - which left thousands of square kilometers of forest in flames for weeks on end, mainly in the Western United States and New Mexico.

The direct and indirect costs of such events have also risen dramatically in the past fifty years. During the 1990s, the global economic cost of natural disasters exceeded $US 608 billion.[4] This was three times the figure in the 1980s, almost nine times that of the 1960s and more than fifteen times the total of the 1950s. This trend is projected to continue, and even worsen. In fact, Munich Re expects that the world's rising temperatures will trigger major shifts in weather patterns, increasing droughts, causing more frequent tropical cyclones and increasing sea levels. The economic costs alone of these changes could well exceed $US 300 billion per year by 2050.[6] In the African context for example, this intensifying hazard profile is further worsened by rapid urban growth, in which the total population residing in large scale cities (more than one million people) is expected to rise from 33 million in 1990 to 216 million by 2020.[7]

As we have seen in other developing countries, increasing urban density is accompanied by a host of risks and vulnerabilities associated with megacities. The concentration of people, services and physical infrastructure in congested towns and cities makes these centres particularly vulnerable to sudden-onset threats like heavy rain, floods and windstorms, cyclones and fires. However, sprawling urban areas are also increasingly at-risk from slow-onset processes like drought, which trigger water shortages and electricity rationing, due to dwindling water levels in city reservoirs and large dams.

Irrespective of whether the threat is a wind storm, torrential rain or severe drought, exposed cities that fail to consider these realities face the likelihood of severe property damage, human suffering and disrupted services in a world of increasing temperatures, extreme weather and rising seas.

Adaptation: Myth or Reality?

Unfortunately, even if the processes of human-induced climate change were stopped today, their effects would remain with us for centuries. This is because CO2 does not leave Earth's atmosphere quickly, as well as delayed processes of ocean warming. For instance, "even if climate change could be halted today, the surface warming already incurred will progressively penetrate deeper and deeper into the ocean, causing sea levels to rise further" – for at least 500 years.[8]

The long-term solution to human-induced climate change is clearly to reduce the emissions that have caused it. However, in the foreseeable future, we will have to live with the reality of higher temperatures, rainfall extremes and rising sea levels.

Not all countries, cities and communities will be able to face these challenges with the same resources and capacities to adapt. For instance, 'better-off' cities like Tokyo, Venice and Sydney will have the resources to protect themselves from rising sea levels by 'building ever-higher dykes, walls and barricades". In contrast, the costs for protecting rural areas will be largely unaffordable. Protecting the Netherlands, a relatively small country from a "50 centimentre rise in sea level could cost as much as 3.5 trillion US dollars. Yet, in the Maldives, the cost for protecting shorelines is as high as US$13 000" – per metre! [Ibid]

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For many developing countries, already struggling to meet their population's basic needs of shelter, safe water, food security, accessible health services and education, it would be almost impossible to set-aside these kinds of resources to mitigate the impact of future climate processes. Yet, the cost of not doing so could be equally devastating.

There are many practical steps that can be taken to minimise the impact of these changes. They include environmental measures, educational programmes to encourage more responsible use and conservation of natural resources They require more informed engineering interventions, greater attention to land-use planning so that infrastructural development is carefully managed, especially in coastal areas. They require better public awareness and information strategies so that people in at-risk areas can move out of harm's way in time, or adapt established living practices to new conditions. We can adapt to our changing climate in different ways. One path is to manage each 'climate catastrophe' as it occurs, improving our rescue, relief and rehabilitation responses to save lives. This is a costly route. The other is to strengthen our understanding of climate-induced threats, like droughts and cyclones, and to better identify the communities most exposed. There is a suite of developmental choices that help lessen the impact of extreme weather events – even if this is not a total solution.

Thanks to the latest IPCC Assessment, we now know that human-induced climate change is here to stay, at least during our lives, as well as those of our children and grand-children. Now, the responsibility rests with us to take urgent measures to minimise its impact.

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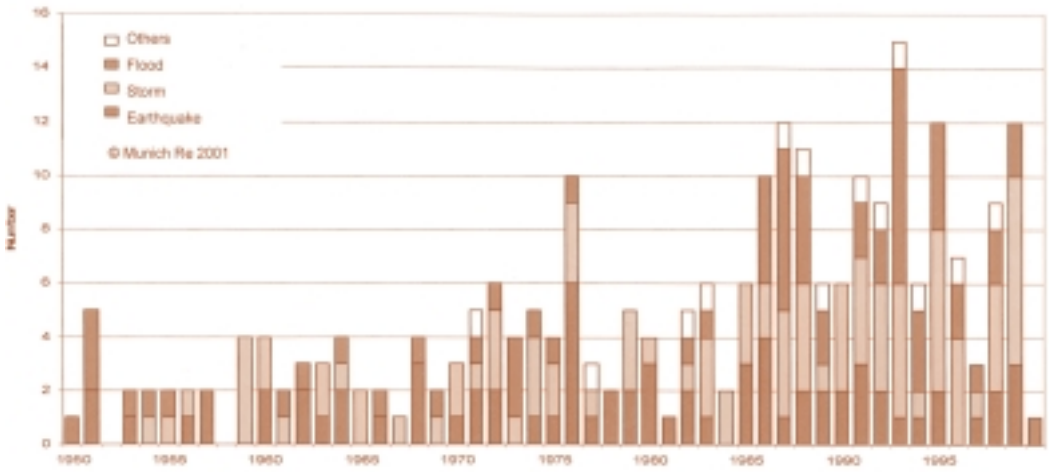
Great Natural Disasters 1950 - 2000

Far exceeding 100 deaths and/or US$ 100m in claims



Münchener Rück
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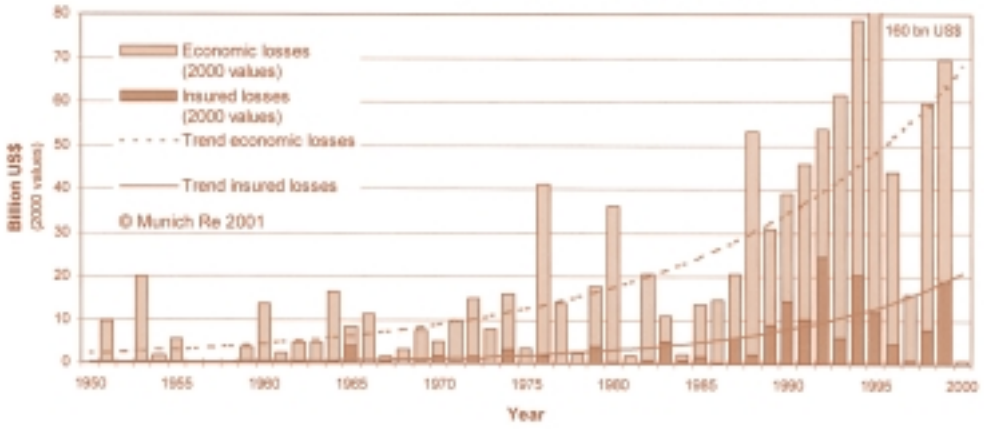
Great Natural Disasters 1950 - 2000

Far exceeding 100 deaths and/or US$ 100m in claims

Economic and insured losses with trends



Münchener Rü
Munich Re