The impact of disasters on development is now well documented. While disaster deaths now seem to be decreasing over time, the number of people affected and the economic losses are still increasing exponentially.

UNDP believes that increasing disaster loss will seriously compromise and undermine the achievement of the Millennium Development Goals in its programme countries, unless decisive action is taken to reduce disaster risk. Disasters destroy vital social infrastructure, set back the economy and have a devastating effect on local livelihoods and set back hard earned development progress.

The humanitarian community has made progress in mitigating the losses and suffering associated with disasters through improved response preparedness and early warning. However, humanitarian actions do not address the development processes that are shaping disaster risk in the first place. The development community, on the other hand, generally continues to view disasters as exceptional natural events that interrupt normal development and that can be managed through humanitarian actions.

Neither community is doing sufficient to address the configuration and accumulation of disaster risk through appropriate development. That is development that makes people and their livelihoods more vulnerable as well as development that magnifies the impact of natural hazards. Examples of both are found in this Report.
Reducing Disaster Risk: a challenge for development

What are the objectives of the Report

- Demonstrate through quantitative analysis that disaster risk is an unresolved problem of development
- Identify and promote development policy alternatives that can reduce disaster risk and therefore facilitate the achievement of the MDGs
- Contribution by UNDP to the UN International Strategy for Disaster Reduction (ISDR)

Other reports, such as the World Disasters Report produced by the IFRC, have documented the impact of disasters on development. The present Report focuses on a question that has received far less attention: how development itself configures (both positively and negatively) disaster risk. To do so, the Report uses quantitative analysis to show that inappropriate development processes are contributing to risk accumulation. In other words that disaster risk is an unresolved problem of development.

While humanitarian action to mitigate disaster impact continues to be vitally important, a critical challenge facing the global community is to anticipate disaster risk through the adoption of modes of development that lead to its sustainable reduction. Unless countries adopt policies that avoid the generation of new risks, the threat to social and economic well-being can only get worse. The Report therefore seeks to identify development policies that can reduce disaster risk and facilitate the achievement of the MDGs.

The Report is a crucial contribution by UNDP to the objectives of the UN International Strategy of Disaster Reduction (ISDR). This Report and the global review of disaster risk reduction, Living with Risk, published by the ISDR Secretariat are two complementary and coordinated initiatives aiming at assisting countries and international organizations to achieve the goal of the ISDR, namely to enable communities to become resilient to natural hazards and related technological and environmental disasters, in order to reduce environmental, human, economic and social losses.
How are development and disaster risk linked

- Disaster risk is lower in high development countries than in low development countries.
- Development processes intervene in the translation of physical exposure to hazards into disaster risk.

In order to begin to visualize the relationship between disaster and development we compared the number of people killed in natural disasters with the number of people exposed to natural hazards for high and low human development countries, showing up a dramatic contrast.

Low human development countries concentrate only 11% of the world's population exposed to natural hazards between 1980 and 2000 but 53% of the total deaths in this period. High human development countries concentrate 15% of the exposed population but only 1.8% of the deaths. In other words, Countries with similar patterns of natural hazard have widely varying levels of disaster risk. These risks have been configured historically through different development paths and processes.

The key message of the Report is that flawed, inappropriate development in itself is responsible for configuring disaster risk. flawed, inappropriate development in itself is responsible for configuring disaster risk. As such disaster risk is not inevitable but on the contrary can be managed and reduced through appropriate development policy and actions. This means that the answer to disaster risk is not simply more development per se. More and faster inappropriate development will simply increase risks and lead to greater social and economic losses.
Reducing Disaster Risk: a challenge for development

Disaster Risk Index (DRI)

- A global index that compares risk of mortality between countries
- Measures the population exposed to earthquakes, tropical cyclones and floods in each country
- Calculates the relative human vulnerability to each of the hazard types
- Identifies vulnerability indicators that correlate with risk

The DRI is the centrepiece of the Report. It enables the measurement and comparison of relative levels risk of death in natural disasters between countries. It does not measure risk to physical infrastructure and to the economy but only one aspect of risk to human development, namely the risk of mortality.

In a first phase of the development of the DRI, physical exposure was calculated as the average number of people exposed to a hazard event in a given year. Three types of hazard were analysed, namely earthquakes, floods and tropical cyclones.

The DRI then used the number of people actually killed by each hazard type in each country as a proxy for manifest risk. The relative vulnerability of a given country to a given hazard was calculated by dividing the number of people killed by the number exposed.

It then examined risk for each hazard type against a bundle of 26 social, economic and environmental indicators through a statistical analysis. This enabled the identification of those vulnerability indicators that were most closely correlated with risk for each hazard type (earthquakes, floods and tropical cyclones).
Reducing Disaster Risk: a challenge for development

Physical Exposure

- Physical exposure = Number of people located in areas where hazardous events occur combined with the frequency of hazard events.
- Absolute exposure is larger in countries like India and China. Relative exposure is higher in small-island developing countries.

An important innovation in the DRI is the calculation of physical exposure to earthquakes, tropical cyclones and floods at the global level.

Physical exposure was calculated using a Geographical Information System that combined data on population densities with the extent and frequency of natural hazards. Physical exposure increases with greater population exposed or with more frequent hazard events. In other words physical exposure would be five times higher in an island inhabited by 1000 people and that suffered 5 cyclones a year than in a similar island that only experienced 1 cyclone a year. Similarly physical exposure would be five times higher in island inhabited by 5000 people and that experienced 1 cyclone a year than in the island inhabited by 1000 people and that experienced 1 cyclone a year.

In the DRI physical exposure is expressed both in absolute terms (the number of people exposed in a country) and in relative terms (the number of people exposed per million people). Absolute physical exposure is clearly far higher in large countries like India and China, where the total population exposed is far higher. If the population exposed is expressed in relative terms as a percentage of the total population then small island states and other small countries have a far higher relative physical exposure as the entire population may be exposed to a given hazard.
The above graph that looks at physical exposure to tropical cyclones illustrates the differences between absolute physical exposure (in the left hand column) and relative physical exposure (in the right hand column).

Absolute exposure to tropical cyclones is greatest in China and India. In contrast small island states such as Guam, the British Virgin islands and Vanuatu have high relative exposure levels. The relative exposure graph is dominated by small island developing states.

The Philippines, Japan and Cuba have high physical exposure to tropical cyclones in both absolute and relative terms.
Reducing Disaster Risk: a challenge for development

Relative Vulnerability

- The key indicator in the DRI
- Measures the number of people killed in a country due to a particular natural hazard with respect to the number of people exposed.
- Countries that suffer a far higher loss of life than others who are equally exposed have a higher relative vulnerability to the hazard in question

The calculation of physical exposure represents an important advance but it still does not explain why so many more people are being killed by natural disasters in some countries, compared to others with similar levels of exposure.

The key indicator in the DRI and the one that really takes the naturalness out of natural disasters is the indicator of relative vulnerability. By removing physical exposure from the risk equation we are left with all the other human related factors that configure disaster risk: both factors such as environmental degradation that may magnify the impact of hazards as well as factors such as unsafe building, poverty or lack of social safety nets that make people more likely to lose their lives. In other words, relative vulnerability points to the influence of development (or lack of it) on risk patterns.

To arrive at this indicator the average number of people killed per year in a country between 1980 and 2000 due a particular kind of hazard (as an indicator of manifest risk) was divided by the average number exposed. Those countries with a higher loss of life compared to exposure are therefore more vulnerable.
Interactive maps on relative vulnerability

http://gridca.grid.unep.ch/undp/analysis/result.php

The graphs in the web page show the relative vulnerability for each hazard type in an interactive way. When possible and necessary, the speaker can base partially the presentation in available web graphs. However, it is highly recommended to keep the graphs in the current presentation in order to avoid any technical problem (e.g. internet connection).

Note: in order to activate the link, click in “slide show” on the bottom left of the screen (screen icon) and then click on the link. It would also be useful to move from the presentation to the web page pressing simultaneously “alt” and “tab”.
Reducing Disaster Risk: a challenge for development

Earthquakes

This graph shows relative vulnerability to earthquakes. Vulnerability increases from the bottom right of the graph towards the top left.

Countries like the Islamic Republic of Iran, Afghanistan, India, Turkey and Mexico, for example have far higher relative vulnerability than Chile or the United States of America.

The graph enables us to distinguish between countries that have low exposure but that were exposed to an exceptional catastrophic event between 1980 and 2000, such as Guinea and Armenia and others such as Japan that are heavily exposed but in relative terms less vulnerable. Italy stands out as a high human development country that has a very high level of vulnerability.
The difference in relative vulnerability to earthquakes between different countries is enormous.

The Islamic Republic of Iran is approximately 1000 times more vulnerable than the United States of America and 100 times more vulnerable than Japan, even without taking into account the impact of the recent earthquake in Bam.

Italy is a higher relative vulnerability than either Mexico or Algeria.
Reducing Disaster Risk: a challenge for development

Tropical Cyclones

In the case of tropical cyclones, Honduras, Nicaragua have the highest relative vulnerability even though they are not amongst the countries most exposed, either in relative or absolute terms.

In the case of Bangladesh, high vulnerability accompanies very high physical exposure particularly amongst the heavily populated rural communities along the fertile delta at the confined head of the Bay of Bengal.
This graph examines relative vulnerability in the case of a number of small island states.

Perhaps the most notorious contrast on the graph is between the neighboring islands of Cuba and Hispaniola (Haiti and the Dominican Republic). While all three countries have very similar levels of physical exposure, Haiti has far higher relative vulnerability perhaps linked to its small economy, degraded environment and weak institutions of government. In Cuba in contrast, successful policies and strategies have been put in place for early warning, preparedness and evacuation.
 Relative Vulnerability Indicators for Tropical Cyclones

Honduras 321  
Nicaragua 202  
Bangladesh 54  
Haiti 13  

United States of America 2.49  
Australia 1.21  
Japan 0.17  
Cuba 0.16  

Again the differences in relative vulnerability are quite enormous.

Nicaragua is approximately 80 times more vulnerable than the United States of America. However, the United States of America itself is fifteen times more vulnerable than Cuba and Japan.
In the case of floods, the highest relative vulnerability is found in Venezuela, largely as a result of the catastrophic events of December 1999.

However, in general, high vulnerability is found both in populous Asian countries like China and India as well in mountainous states such as Afghanistan and Nepal.
While much was made of the floods in Germany in recent years, that country has very low relative human vulnerability to floods. Morocco is approximately 400 times more vulnerable than Germany and Mozambique more than 250 times.
Reducing Disaster Risk: a challenge for development

Linking Risk to Development

• Earthquakes: countries with rapid urban growth
• Tropical cyclones: countries with large rural populations and a low rank on the Human Development Index (HDI).
• Floods: countries with low GDP per capita and low local population densities

The DRI then examined the manifest risk for each hazard type against a bundle of 26 social, economic and environmental indicators through a statistical analysis. This enabled the selection of those vulnerability indicators that were most associated with risk for each hazard type.

In the case of earthquakes, there was a strong correlation between risk and countries with rapid urban growth. Urban growth does not explain human vulnerability to earthquakes per se. Rather it is particular processes and factors of urban change that characterise rapidly urbanising countries that increase human vulnerability to earthquakes. The earthquake disasters of Turkey in 1999 and Algeria in 2003 highlighted the lack of enforcement of building regulations as a key factor in generating physical vulnerability. A study of earthquake vulnerability in Lima, Peru showed that a process of deterioration and overcrowding of inner city rental housing was the key process associated with urban growth that was generating earthquake vulnerability. In the 2001 Gujarat earthquake in India, it was non-engineered structures in both rural and urban housing that proved to be a key vulnerability factor.

Tropical cyclone risk was found to be closely correlated with countries with large rural populations and a low rank on the Human Development Index. Countries with relatively poor rural, agrarian economies are generally more vulnerable to loss of life in cyclones. Rural housing in many countries will tend to be more vulnerable to high winds, flooding and landslides than urban housing and will generally be associated with higher mortality. Conversely the weakness or non existence of emergency and rescue services in rural areas of poor countries and lack of access to disaster preparedness and early warning are all other factors that would help to explain mortality rates.

Flood risk was closely correlated with countries with low GDP per capita and low population densities. These are countries with sparsely populated, poor rural areas, where disaster preparedness and early warning is none existent, health coverage is weak and there be low accessibility. In such areas people would have less possibility to evacuate flood prone areas and would be more vulnerable to death through flood related diseases.
Reducing Disaster Risk: a challenge for development

Limitations of the DRI

- Mortality calibrated
- 20 year reporting period
- Large and medium scale disasters
- Only three natural hazards
- Limited bundle of social, economic and ecological indicators.

The analysis we have presented takes us forward in both demonstrating and understanding how development processes shape disaster risk. However, there were many data challenges that limited our analysis and that we have to take into account.

Risk of mortality is only one and not necessarily the most important aspect of disaster risk. Many disasters cause enormous social and economic impact without serious mortality. Deaths capture only very partially human development losses. In the DRI, mortality was chosen as a proxy indicator because reliable data on other aspects of disaster risk (people affected, economic impact) is not available in global databases. While mortality is an indicator of broader risk to human development, the DRI only represents risk to loss of life and cannot be inferred to represent other physical, social and economic aspects of risk.

The DRI has been calibrated using data from the period 1980 – 2000. Access to information from before that period was less reliable. This weighs the Index in favour of countries that suffered catastrophic disaster event in these two decades and against countries that suffered such events in the 1970’s, but not since then. This is critical in the case of earthquakes that may have a long return period but also in some cases for tropical cyclones and floods as well. However, by concentrating in a 20 years period we are highlighting countries that are regularly exposed.

Publicly available global data is currently available for disaster events, defined as those involving more than 10 deaths, 100 affected /and or a call for international assistance. The DRI therefore, does not represent risk associated with small-scale and everyday disasters. International reporting is not capturing all the medium-scale disaster events that occur. However, given the global scale of observation and national level of resolution of the DRI, the data used represents a sample of overall disaster risk that is acceptable to measure the relative levels of risk and vulnerability between countries.

The three hazards included in the Report account for approximately 39% of deaths in large- and medium-scale disaster at the global level. Droughts and famines (also included in the Report as a work in progress) account for another 55%. Nevertheless, in individual countries other hazards such as landslides, debris flows and fires may have an important local impact. At the time of producing the Report global data sets were not yet available on these other hazard types.
Reducing Disaster Risk: a challenge for development

How does Development Configure Risk?

- DRI identified urbanisation and rural livelihoods as key development processes configuring risk
- Urbanisation analysed in the context of economic globalization.
- Rural livelihoods analysed in the context of global climate change.
- Cross-cutting themes: governance, violence and armed conflict; social capital; HIV/AIDS and disease.

As mentioned above the vulnerability indicators used only indicate but do not explain vulnerability. For example, fast urban growth may indicate a likelihood of high vulnerability to earthquakes but does not in itself explain how earthquake vulnerability is configured. It is particular processes of urban change that configure seismic vulnerability and these may be completely different from context to context, for example, the lack of enforcement of building regulations, the deterioration of dense inner city housing or the construction of non-resistant and non-engineered structures by the poor, just to cite a few typical examples.

The Report therefore has looked at a large number of case studies that illustrate how development processes such as urbanization and rural livelihoods contribute to the configuration of risk and we have examined both in the context of broader processes such as global climate change and economic globalization. At the same time we have illustrated how violence and armed conflict, weak governance and social capital, HIV/AIDS and disease all contribute towards risk configuration.

The Report looks, however, not only at how inappropriate development increases risk but also at how appropriate development really can contribute to risk reduction. The good news in the Report is that there are choices in development policy and programmes that can help countries anticipate and reduce risks.
Conclusions and recommendations

• Governance for risk management
• Mainstreaming disaster risk into development planning
• Factoring risk into disaster recovery and reconstruction
• Integrated climate risk management

The Report presents recommendations for policy makers in both programme and donor countries organised around key issues that should be addressed to anticipate and reduce disaster risk.

The first overarching issue is to improve governance for risk management. Most countries (developed and developing) still deal with disaster risk through response focused civil defence type structures. These generally do not address risk considerations, often are excessively centralised and may be impervious to civil society participation. Improving governance, however, means more than just new legislation or new institutions. It means factoring risk considerations into all aspects and levels of government and society.

A key recommendation is to carry out disaster risk analysis for all new development. This not only means ensuring that new development is located and built in such as way as to be more secure but also to ensure that new development does not generate new risk. For example, that new highways do not provoke deforestation that will then generate landslides.

Disasters eliminate accumulated risk. Post-disaster recovery too often consists of rebuilding risks and creating the conditions for further and worse disasters in the future. The post disaster period is a unique opportunity to factor risk considerations into development that is usually squandered.

Climate change is and will alter the frequency, severity and intensity of hazards. While scientists are able to predict some general trends, how this will affect climate in particular places and times is still uncertain. Climate change creates, therefore, greater complexity and uncertainty for disaster risk management now. Integrated climate risk management is an approach that consists of increasing capacities to deal with climate related risks as they exist now as the best way to adapt to future global climatic changes.
In many countries, vulnerable groups and communities are faced not only with natural hazards but also with risks associated with conflict, armed violence, land mines, internal displacement, economic crisis and breakdowns in governance. These risks interact with the risks associated with natural hazards. In such contexts, risk management needs to be multifaceted. Disaster risk management, however, may often be a neutral terrain where it is possible to contribute to strengthen civil society and local governance.

While the overall focus of this Report is on anticipating risk, most countries have large amounts of historically accumulated risk that will inevitably result in large future disasters. It is often politically and financially impossible to significantly reduce historically accumulated risk of this kind. There remains therefore an important role for early warning, disaster preparedness and emergency management to mitigate the losses in unavoidable disasters.

Perhaps the key problem in reducing disaster risk is that we still know far too little about what the problem is. This Report provides a first global overview of disaster risk but much more needs to be done to provide the sort of detailed information that could inform development planning at the national and local levels. In particular, there are critical gaps of information in data on disaster occurrence and loss at all levels that make further advances in analysis difficult. The development of a multi-tiered system of disaster reporting is a critical next step to allow for national level risk indexing and the enhancement of the current global efforts.
The graphs in the web page show relative vulnerability to analyzed hazards in an interactive way. When possible and necessary, the speaker can base the analysis in web graphs. However, it is highly recommended to keep the graphs in the presentation in order to avoid any technical problem with internet connection.

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Interactive maps on relative vulnerability
### Casualties (1980-2000) as recorded in CRED

<table>
<thead>
<tr>
<th>Disaster types</th>
<th>Deaths</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>563'701</td>
<td>46.54 %</td>
</tr>
<tr>
<td>Wind storm</td>
<td>251'384</td>
<td>20.76 %</td>
</tr>
<tr>
<td>Flood</td>
<td>170'010</td>
<td>14.04 %</td>
</tr>
<tr>
<td>Earthquake</td>
<td>158'551</td>
<td>13.09 %</td>
</tr>
<tr>
<td>Volcano</td>
<td>25'050</td>
<td>2.07 %</td>
</tr>
<tr>
<td>Extreme temp</td>
<td>19'249</td>
<td>1.59 %</td>
</tr>
<tr>
<td>Slide</td>
<td>18'200</td>
<td>1.50 %</td>
</tr>
<tr>
<td>Wave/surge</td>
<td>3'968</td>
<td>0.32 %</td>
</tr>
<tr>
<td>Wild fire</td>
<td>1'046</td>
<td>0.06 %</td>
</tr>
<tr>
<td>Insect infestation</td>
<td>0</td>
<td>0.00 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1'211'159</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Papua New Guinea and Ecuador, which are affected by tsunamis (respectively 67.8 and 14.3% of national casualties); landslides are also causing significant impact in Indonesia (13.88%), Peru (33%) and Ecuador (10.2%).

94.4%
Reducing Disaster Risk: a challenge for development

Introduction
Why RDR?
Definitions
Which Hazards
1980-2000

Method
Data

Results
Physical exposure
Statistical analysis
Hazard per hazard
Multiple risk
Multiple risk

Reducing Disaster Risk: a challenge for development

Why a time span of 1980-2000

Due to significant improvement in access to information (telecommunications, media coverage, internet, satellites coverage, etc.) the number of reported disasters is much better covered since 1980 than previously.