Overview

Innovations in disaster risk management

The *2011 Global Assessment Report on Disaster Risk Reduction* (GAR11) – *Revealing Risk, Redefining Development* – is a major initiative of the UN International Strategy for Disaster Reduction (UNISDR). It contributes to achieving the Hyogo Framework for Action (HFA) by monitoring risk patterns and progress in disaster risk reduction. Importantly, it also provides guidance and suggestions to governments and non-governmental actors alike, on how they can, together, reduce disaster risks.

This landmark publication builds on and moves beyond the analysis provided by the inaugural report launched by the UN Secretary-General in 2009. It highlights the need for systematic accounting of disaster losses and impacts, and for the comprehensive assessment of disaster risks. It reviews innovative approaches that are emerging, and suggests a new risk governance paradigm. This includes adapting existing development instruments in areas such as public investment planning and social protection for disaster risk management.

Creative partnerships between civil society and central and local governments in urban areas are already delivering results in risk reduction. The reform of institutional and legislative arrangements for disaster risk management, as well as social and economic development, is essential if countries are to become successful in addressing the underlying risk drivers. This report suggests the need for a new risk governance approach based on reformed institutional and legislative arrangements in central government, realistic decentralization, and the strengthening of accountability and local participation.

What's new in GAR11?

Risk trends by region and income group: An updated version of the powerful global risk model developed for the previous report has been used to analyse trends in mortality and economic loss risk for major weather-related hazards such as tropical cyclones and floods. This information is complemented by new data which measures and compares the capacity of different countries to address underlying risk drivers. This report also outlines a range of emerging, very low-probability and hard-to-measure risks, which countries need to begin to anticipate and prepare for.

More representative geographical coverage: All the national disaster databases used to analyse extensive risk in the last report have been updated. In addition, there has been significant progress in developing disaster loss databases, providing for a more compelling analysis of extensive risk, with a more representative geographical coverage. New case studies also provide further insights into underlying risk drivers.

Disaster impacts on child welfare and displacement: Previous analysis of interactions between disaster risk and poverty is expanded with a comprehensive study of how disasters impact on child welfare and development, and the implications of this on disaster risk management policy. This and other case studies also indicate the significance of how disasters cause internal displacement.

Drought risk: This report includes a specific focus on drought risk, an area that is poorly understood and receives inadequate attention both nationally and internationally. In particular, it points to the adoption of standards for measuring drought risk to improve its identification and management.

The 2009–2011 HFA Progress Review: Currently, 133 countries are reviewing their progress towards the objectives and goals of the Hyogo Framework for Action (HFA) for 2009–2011. By the close of the first quarter of 2011, 82 countries and territories had submitted reports that provide unique insights into how governments themselves view disaster risk management.

Assessing the costs and benefits of DRM: Detailed case studies from Colombia, Mexico and Nepal applied an innovative approach to risk modelling. By measuring and stratifying the full spectrum of extensive and intensive risks, they illustrate the real magnitude of recurrent and future maximum disaster losses faced by governments, paving the way for truly informed decision-making.

Innovation in development practice: There is a review of how governments are scaling up disaster risk management by adapting existing development mechanisms. This report also critically examines other instruments where significant barriers still exist, such as land use planning, building codes and ecosystem management, and where new approaches need to be adopted, based on partnerships with affected populations and civil society.

Risk governance capacities: Finally, there is a critical review of the institutional and legislative arrangements for disaster risk management at national and local levels. This includes key issues such as political authority, decentralization and accountability, and guidance is given on how governments can adopt effective governance arrangements.

GAR11 online edition: In addition to the print edition, GAR11 has also been designed as an interactive electronic report, structured around a set of background papers and databases provided by many institutional and individual contributors. This delivers authoritative evidence for the findings and recommendations, and allows users to explore this data for themselves.

Conclusion

The ability to seriously address disaster risk will be one of the hallmarks of good governance in the years to come. Government leaders and their policy advisors, but also concerned citizens and organizations, are all strongly urged to *invest today for a safer tomorrow*, by close study and then resolute implementation of the recommendations of this report, which indeed reveals risk and redefines development.

Reducing vulnerability to disaster risk

Governments cannot influence the severity of earthquakes, tsunamis and tropical cyclones. Nor, in many countries, is it easy to reduce the exposure of people and economic assets to hazards. On small islands, for example, all assets may be exposed to cyclones. In other contexts, urban centres and infrastructure on coastlines or floodplains are often locked into place by decades or centuries of investment, responding to clear economic imperatives. The main opportunities for decreasing disaster risk, therefore, lie in reducing the vulnerability of people and economies to hazards. This entails addressing the underlying drivers, such as badly managed urban development, environmental degradation and poverty, which generate vulnerability in the first place.

The impacts of very infrequent but *intensive* disasters are heavily determined by how many people and assets are exposed to what may be extreme events. This means that there are clear limits to how much risk can be reduced, however much is invested in protective infrastructure, as was highlighted by the 9.0 magnitude earthquake and 10 metre tsunami that struck the north-eastern coast of Japan on 11 March 2011. In contrast, frequent but low-severity *extensive* disasters, associated for example with localized flooding, are largely shaped by people's access to safe infrastructure, housing and basic services, levels of poverty and the health of the environment they live in. By conserving ecosystems, providing protective infrastructure, improving the safety of buildings and creating functioning social safety nets, countries can significantly reduce vulnerability and disaster risk with relatively small levels of investment.

With tropical cyclones, for example, vulnerability is higher in poor countries. As a proxy for vulnerability, GDP per capita strongly determines the risk of mortality from weaker Category 1 cyclones, but its influence lessens as the severity of a cyclone increases. With severe Category 4 cyclones, exposure to the hazard has a greater influence on mortality risk than vulnerability. The implication is that addressing vulnerability is more effective in reducing the risks associated with more frequent low-severity cyclones, than those associated with infrequent, high-severity cyclones.

This does not imply that intensive risk cannot be reduced, however. As highlighted by the impact of cyclone Yasi in Australia in February 2011, sound disaster management can go a long way to minimize mortality, even in the case of ferocious cyclones. But reducing vulnerability to very severe hazards may have unacceptably high costs and trade-offs, given the enormous investments required and the potentially long periods before the benefits are realized. The Netherlands, for example, has constructed its dykes to resist a 10,000-year storm surge as a national priority. In most low- and middle-income countries, such investments are not affordable even if they were technically feasible and politically important.

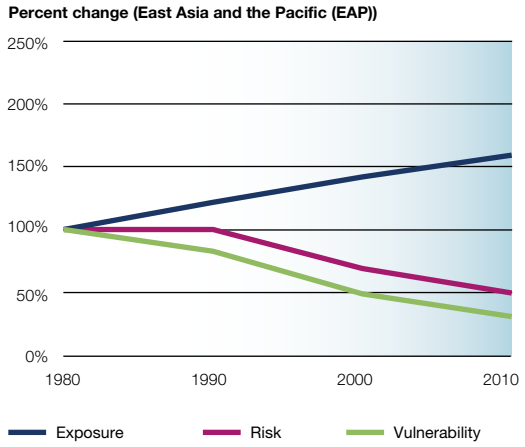
Contribution of cyclone severity, exposure and vulnerability parameters to tropical cyclone risk

Risk factors	Correlation	Category 1	Category 2	Category 3	Category 4
Population exposure	positive	9.0%	46.4%	45.1%	62.9%
GDP per capita	negative	91.0%	53.6%	46.3%	37.1%
Distance to city	positive	not significant	not significant	8.6%	not significant

Cyclone strength categories follow the Saffir-Simpson Scale, with 5 being the strongest ever recorded (www.nhc.noaa.gov/pdf/sshws.pdf).

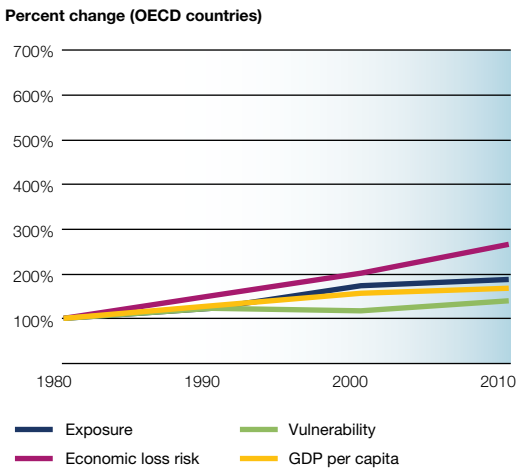
Risk of economic loss now rising faster than wealth creation

In most parts of the world, the risk of being killed by a tropical cyclone or a major river flood today is markedly lower than it was in 1990. Mortality risk associated with major weather-related hazards is declining globally, including in Asia where most of the risk is concentrated. In East Asia, mortality risk from these hazards is only half the level of 20 years ago, despite a rapid increase in the number of people moving to floodplains and cyclone-prone coastlines. Improving social and economic development, including disaster management capacities, has meant that vulnerability has fallen faster than exposure to hazard has increased.



Percentage change in tropical cyclone mortality risk, exposure and vulnerability, as modelled, 1980–2010 (compared to baseline year 1980)

In contrast, economic loss risk continues to rise across all regions, but particularly in high-income countries, as rapid increases in exposure are not being compensated for by matching reductions in vulnerability. For example, the value of global GDP exposed to tropical cyclones tripled from US$525.7 billion in the 1970s to US$1.6 trillion in the first decade of the 2000s; in East Asia and the Pacific the GDP exposed in 2009 was nearly six times greater than in 1970. Since 1980, economic loss risk to tropical cyclones increased by 262 percent in high-income countries, and was 155 percent higher in low-income countries. In high-income countries, economic loss risk to floods and tropical cyclones is increasing faster than GDP per capita is increasing. Put simply, this means the risk of losing wealth in weather-related disasters is now outstripping the rate at which the wealth itself is being created.

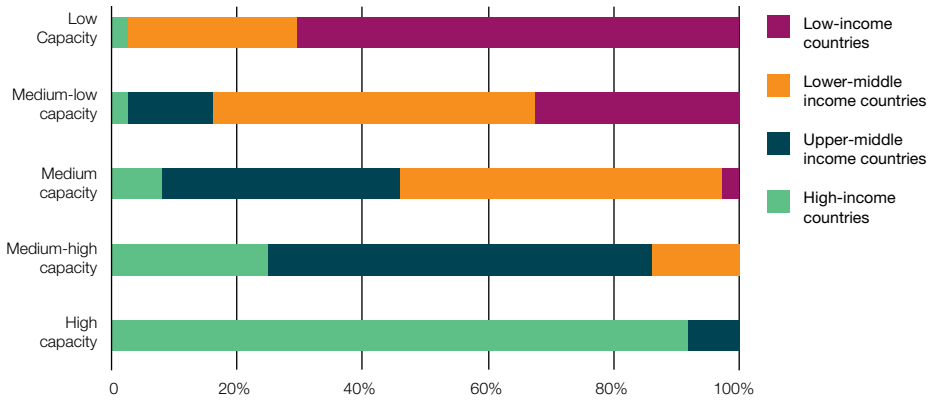


Percentage change in economic loss risk, exposure and vulnerability to tropical cyclones in OECD countries as modelled, 1980–2010 (compared to baseline year 1980)

These trends are also reflected in exponential increases in loss, from frequently occurring, low-severity extensive disasters. These provide a *real time* window on how drivers such as badly planned and managed urban and regional development, environmental degradation and poverty, increase risk over time. Although extensive disasters do not usually cause significant numbers of casualties, they are responsible for a large proportion of damage to local infrastructure and the housing and livelihoods of low-income households and communities. In a sample of 19 African, Asian and Latin American countries and two states in India, the number of houses damaged per million people in extensive disasters has increased sixfold over the last 20 years. These losses are happening everywhere there is development, and not just along seismic fault lines or cyclone prone coastlines.

How well a country is able to address these risk drivers is an indicator of its risk governance

capacities. In general, countries with weak governance and that have great difficulty addressing these drivers are low- and lower-middle-income countries, such as Nepal or Nicaragua. The countries with the most deficient risk governance capacities, such as Afghanistan, Haiti or Chad, are also experiencing conflict or political instability and have development trajectories well below those of successful low- and middle-income countries as well as high-income countries. Some middle-income countries such as Costa Rica or Chile, have comparatively mature risk governance capacities. But even there, disaster mortality rates are being cut but housing damage continues to increase, highlighting again that vulnerability reduction is not compensating for the increasing exposure that accompanies economic growth.



Risk governance capacity and World Bank country classification

This composite graph displays countries' risk governance capacities and their relative wealth by World Bank income regions. Approximately 90 percent of the countries with the strongest capacities are high-income countries. In contrast, low- and lower-middle income countries account for more than 95 percent of the quintile with the lowest capacities. These rankings derive from an analysis of indicators of the disaster risk drivers identified in GAR09: poverty, weak urban and local governance, ecosystem degradation, and government effectiveness and accountability. Each quintile is then subdivided based on the number of countries per World Bank category within it.

Drought – the hidden risk

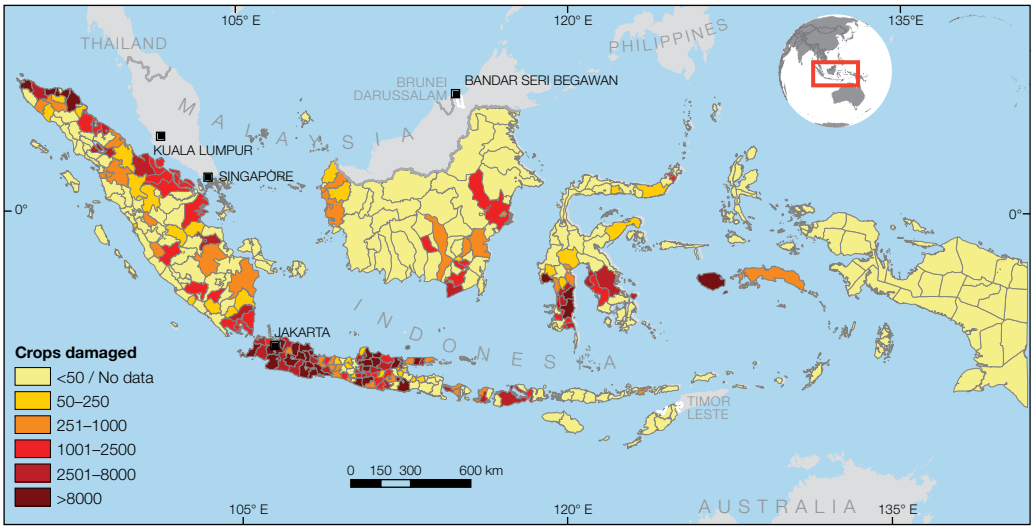
With improving development conditions and better early warning, preparedness and disaster response, internationally reported drought mortality is now insignificant, with only 4472 fatalities recorded over the past 20 years. But the social and economic impacts of drought are still high, and are disproportionately concentrated on poor rural households that depend on rain-fed agriculture for their subsistence.

In the absence of a credible global risk model, drought remains an often under-reported and virtually hidden risk, but one which causes dramatic impacts at the local level. In Mozambique for example, there were only 18 drought-related deaths reported internationally since 1990, though the government's own national disaster database recorded 1040 deaths. In Indonesia, 1.6 million hectares of crops have been damaged since 2003, affecting 185 out of 484 districts, with serious negative downstream impacts on health, education, nutrition and productivity.

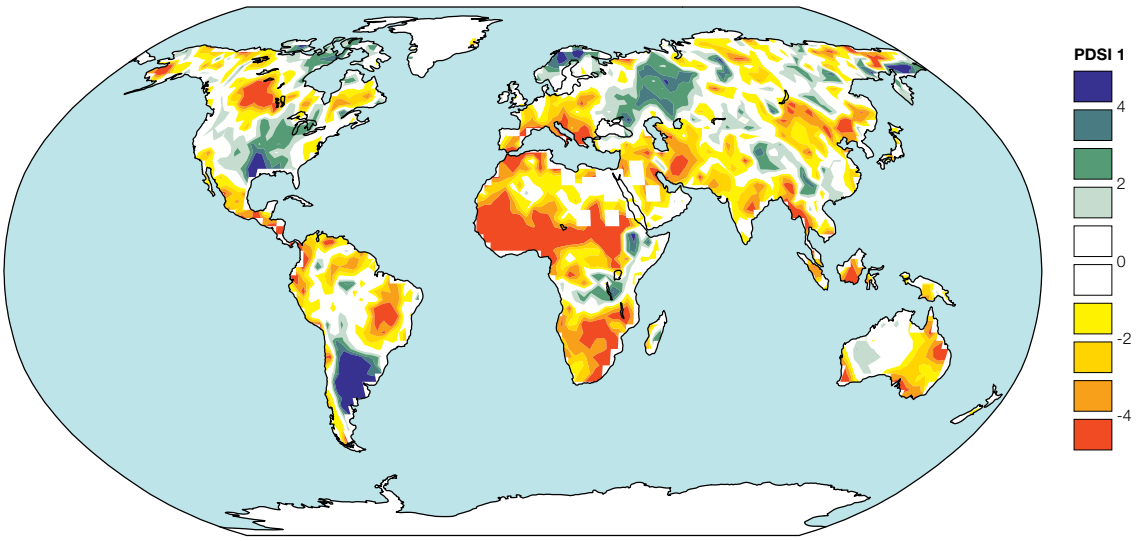
Risks associated with drought remain poorly understood and badly managed. The lack of rain (meteorological drought) does not automatically translate into water scarcity (hydrological drought) or crop loss or reduced harvests (agricultural drought). Inadequate water and soil management policies and practices are at least as much a driver of lost agricultural yields and urban water shortages as are long periods without rain. Maybe more than any other disaster risk, drought risk is constructed more by economic decisions and social choices than by physical hazards.

Factors that translate meteorological drought into risks for people and their livelihoods include:

- *Decreasing rainfall, climate variability and climate change.* Average annual rainfall has been decreasing in the past century. In areas with increasing water stress, even less intense drought episodes are now emerging as agricultural or hydrological droughts.
- *Poverty and rural vulnerability.* Poor rural households whose livelihoods depend on rain-fed subsistence agriculture are very exposed and vulnerable to drought, and



Drought-related crop damage in Indonesia, 1990–2009



Global precipitation trends since 1900 measured using the Palmer Drought Severity Index (PDSI)

A PDSI value of < -3 corresponds to "very dry" ("severe drought" in the original 1965 classification); a PDSI value of > 3 corresponds to "very wet."

even minor droughts can lead to yield reductions with devastating livelihood impacts.

- *Increasing water demand due to urbanization, industrialization and the growth of agribusiness.* Economic growth in sectors such as tourism, where per capita water consumption may be 3–10 times greater than local domestic consumption, can result in increased and conflicting demands for often declining water resources, unless they are carefully managed.

- *Inappropriate soil and water management.* Unsuitable agricultural or livestock practices are drivers that contribute to drought risk, and can occur even where rainfall is high, above average or increasing.

- *Weak or ineffective risk governance.* Given that drought losses and impacts are not systematically recorded and mainly affect rural and subsistence households, there is often little or no political incentive to seriously address drought risk.

All these drivers increase drought risks but, as many impacts are absorbed by poor, rural households, there is currently little political or economic incentive to address them. International efforts to develop and apply standards for drought identification and monitoring are an important starting point. Such initiatives need, however, to complement mechanisms which systematically account for drought losses and impacts, and that comprehensively assess and estimate drought risks as a crucial next step to raising the profile of this beguiling hazard.

Global disaster risk management performance – mixed results

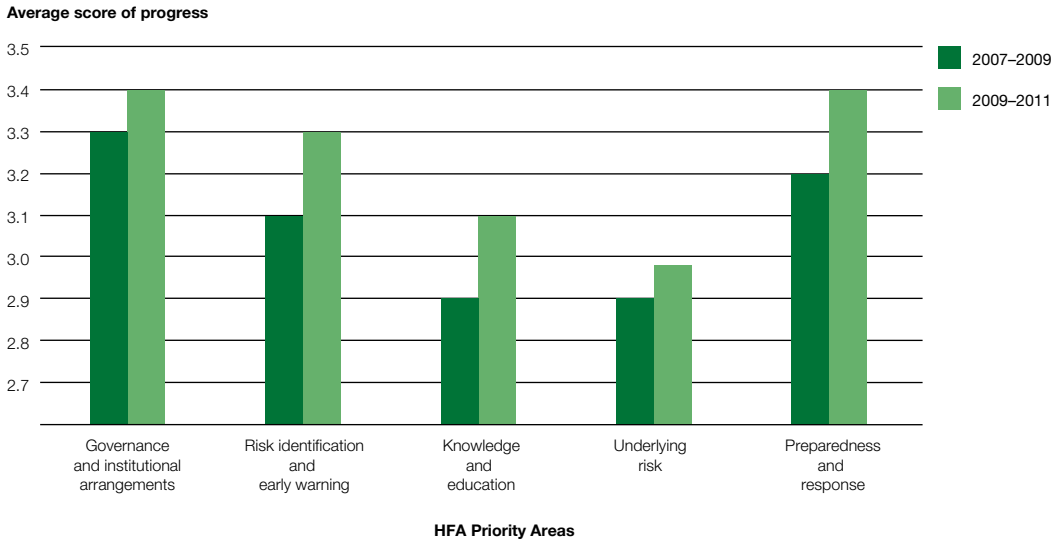
Governments report improved progress against the objectives and goals of the Hyogo Framework for Action (HFA), the internationally agreed framework for reducing disaster risk. The number and quality of country reports monitoring progress against the HFA reflects a growing concern and interest in disaster risk management (DRM), with a total of 133 countries or territories participating in the 2009–2011 review cycle, compared to 102 in 2007–2009.

But this progress is skewed. Countries have strengthened their capacities in the broad area of disaster management, namely in early warning, preparedness and response, and the institutional arrangements needed to underpin it. But many still struggle to reduce their vulnerability and address the underlying risk drivers. Most countries continue to have difficulty integrating risk reduction into public investment planning, urban development, environmental planning and management, and social protection.

Few countries are systematically accounting for disaster losses or are able to comprehensively assess their risks. As a consequence, most find it difficult to justify investments in DRM. or to set aside reserves to cope with disaster loss. Resources allocated for DRM within sectors and for local governments are even more limited.

Two additional challenges include improving public awareness of risks and risk reduction, and taking into account gender considerations. In both areas, there has been very limited improvement since 2009. Although a lack of progress is a reason for concern, the reports submitted by some governments reflect a growing and sophisticated understanding of the complexities involved.

Governments and regional organizations are starting to review their progress in a manner that allows them to identify strengths and gaps at local, national and regional levels; catalysing both strategic and action-oriented planning. Where governments have made serious efforts to engage key public, civil society and academic stakeholders in the review process, a common approach has emerged, allowing real dialogue among different government actors and with civil society.



Global averages of reported progress against the HFA: average achievement ratings score from 1 (minor) to 5 (comprehensive)

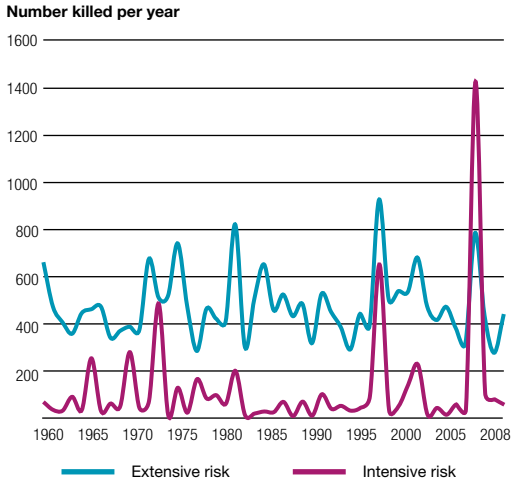
Safe from disasters in the United States of America

Anyone looking for a safe place to live in the United States of America should consider moving to Prince of Wales–Outer Ketchikan County in Alaska. This is the only community that did not report any disaster losses in the SHELDUS database, which contains more than 640,000 local level disaster loss reports for the period 1960–2009, and provides a unique look at risk in a high-income country.

Unlike most low- and middle-income-countries, most disaster mortality in the USA is caused by extensive disasters, making up 89 percent of all disaster-related deaths since 1960. In contrast, two-thirds of the economic loss is intensively concentrated in only 0.4 percent of the loss reports.

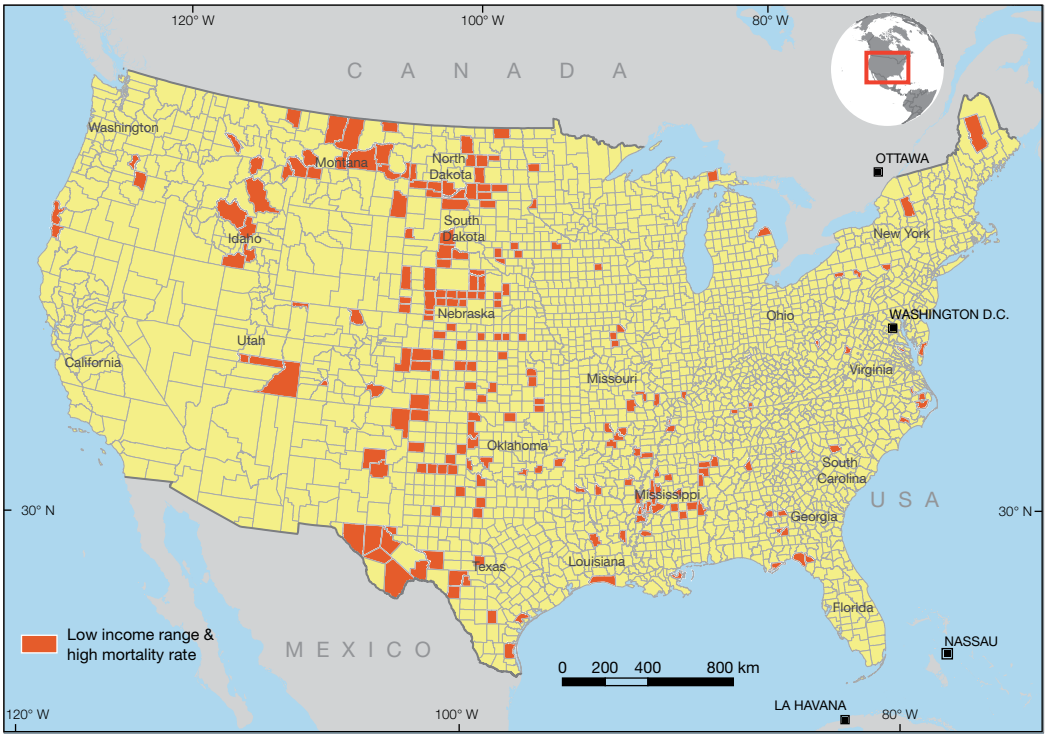
The highest extensive risk mortality rates are strongly associated with a wide geographical corridor that stretches from the north to the southwest, through North and South Dakota, Nebraska, Kansas, Oklahoma and Arkansas.

Of the 302 counties with the highest mortality rates of greater than 15 deaths per million people per year, 220 out them or almost three quarters, also had the lowest average household incomes in the country of less than US$40,000 per year.



Extensive and intensive mortality in the USA*

* The threshold between intensive and extensive risk used in this analysis is 30 deaths or US$15 million in economic losses per loss report.



Counties with low average annual income and high disaster mortality rates (in red), United States of America, 1960–2009 (mortality due to Hurricane Katrina not included)

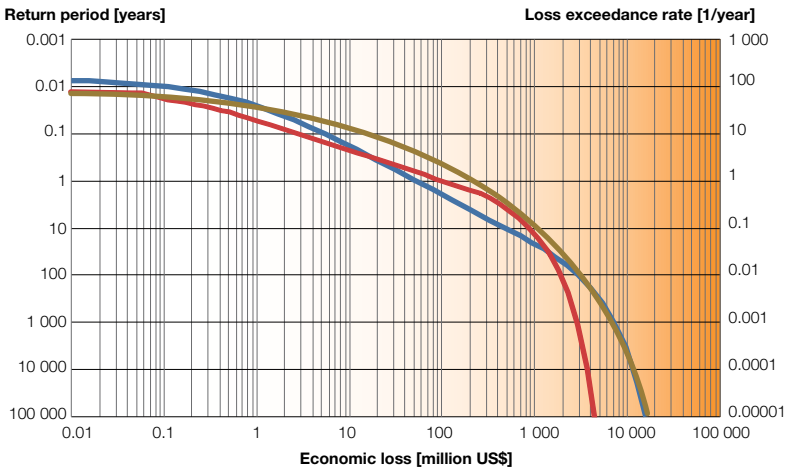
Revealing risk – visible trade-offs for informed choices

When disaster losses, impacts and risks are properly accounted for, the sheer scale of recurrent costs and the likely maximum future losses may be enough to shock governments into action. In Colombia, for example, the estimated annual loss through recurrent disasters is approximately 1 percent of GDP. The cost of this to the national economy is higher than an inflation rate of 5 percent, and is effectively comparable to the cost of the country's ongoing armed conflict. A once-in-500-year disaster could cost the country 2.3 percent of its GDP, similar to losses incurred due to various financial crises over recent decades. If decision-making were based on realistic assessments of social and economic costs and benefits, disaster risk management would merit similar public policy importance as controlling inflation or resolving armed conflict.

Calculations also show that the government may have to address losses in publicly owned infrastructure as well as the uninsured private assets of low-income groups ranging from US$100,000 one hundred times per year to US$1 billion at least once every 30 years. In Mexico, excluding impacts from drought and in the agriculture sector, the government is likely to incur losses from weather-related disasters of more than US$1 million at least 50 times a year, and over US$1 billion at least once every 6 years. In Nepal, the government is implicitly liable for losses amounting to US$1 million almost 10 times per year, and of US$100 million almost every second year.

Few governments have reserves set aside to cover these losses, meaning that disaster costs are often transferred to the low-income households and communities that generally suffer the most. In the case of major catastrophes, governments and their budgets may be equally unprotected. Although governments may be able to insure part of their catastrophic risk, obtain contingency financing facilities, or transfer the risk to capital markets, they will normally have to retain most of the extensive risks – which would be considered as a deductible from an insurance perspective. In the case of Colombia, this represents annual average losses of approximately US$200 million per year.

It is far more cost effective for governments to invest in reducing these risks, than to simply

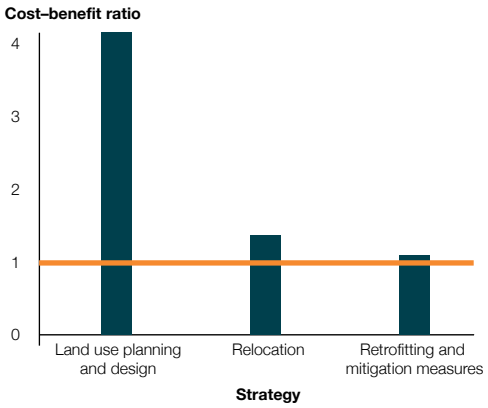


Hybrid loss exceedence curves for Colombia, Mexico and Nepal

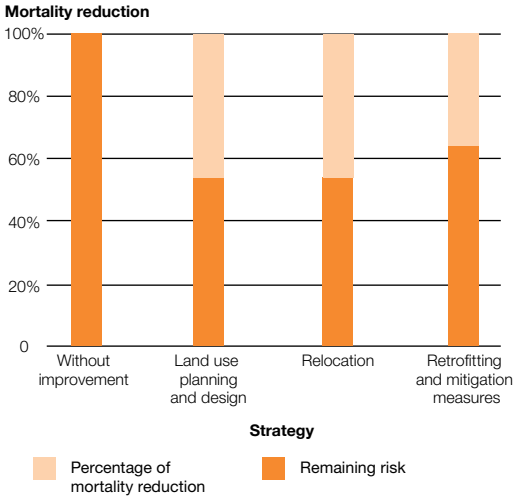
A loss exceedance rate of 10 means it is likely that the associated loss will be exceeded 10 times a year in events with a return period of 0.1 years (1.2 months).

absorb the losses. In this case, prevention is better than cure. Using land use planning and improved building standards to avoid risk in the first place deliver benefit to cost ratios of up to 4 to 1. Retrofitting buildings or relocating vulnerable communities is more expensive and only marginally cost effective. However, both measures can lead to a reduction in mortality of around 40 percent. If avoiding loss of life and injury are taken into account then there is a powerful political and economic incentive to invest in disaster risk management.

Even if governments are aware of the full cost of disasters and the benefits of reducing risks, they may still choose not to invest in disaster risk management. But at least they will be in a position to weigh up the trade-offs between different options and take decisions with eyes wide open.



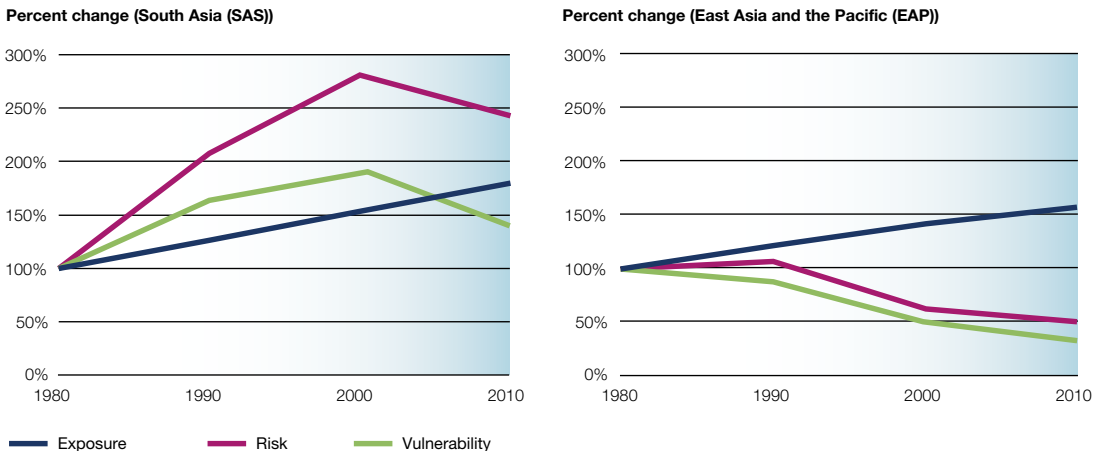
Comparison of the cost–benefit ratios of improved land use planning, relocating exposed settlements, and retrofitting and mitigation measures in Colombia



The percentage reduction of mortality in Colombia due to different risk reduction strategies

Asia and the Pacific – progress and innovation

Globally, mortality risk for all weather-related hazards is declining – a positive global trend largely determined by progress in Asia. The major success story in recent years has been in East Asia, where despite rapidly increasing exposure, flood and cyclone mortality risk has more than halved since 1990. South Asia is reducing its vulnerability at a much slower pace, but even there both flood and cyclone mortality risk has started to decline since 2000.

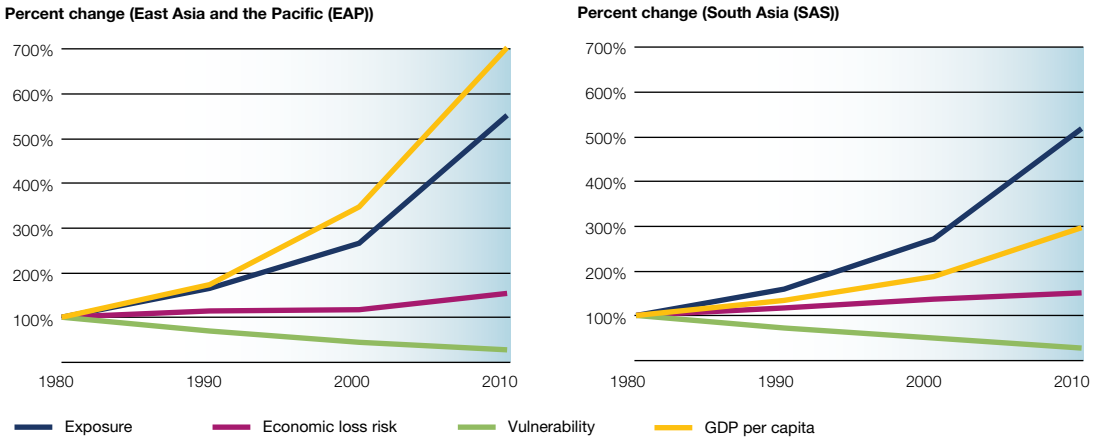


Percentage change in flood mortality risk, exposure and vulnerability, as modelled, from 1980–2010 (compared to baseline year 1980)

This achievement is even more impressive when considering that exposure has been increasing over the same period. More than 90 percent of the global population exposed to floods live in Asia. In South Asia the number of people exposed rose from 19.3 million in 1970 to 44.7 million in 2010.

In contrast economic growth in the region has been accompanied by rising risks of economic loss. Countries are reducing their vulnerability but not quickly enough to offset the rapidly increasing exposure of assets. However, the estimated economic loss risk in Asia is rising at a slower pace than GDP per capita.

The difficulties Asian countries face in accompanying economic growth with vulnerability reduction is highlighted by the rapidly increasing rates of housing damage in frequently occurring, low-severity extensive disasters since 1990. These trends provide a



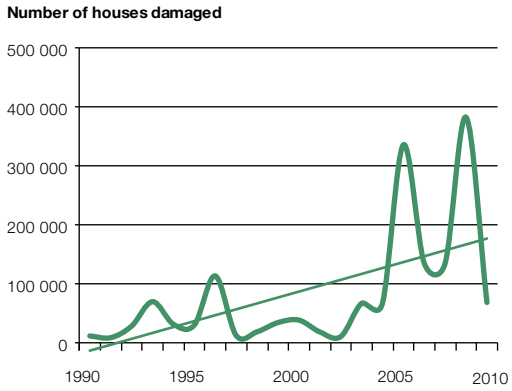
Percentage change in economic loss risk, exposure and vulnerability to tropical cyclones in East Asia and the Pacific and South Asia as modelled, 1980–2010 (compared to baseline year 1980)

Sources and citations for the content of all 2011 Global Assessment Report products are set down in the main report and associated documentation.

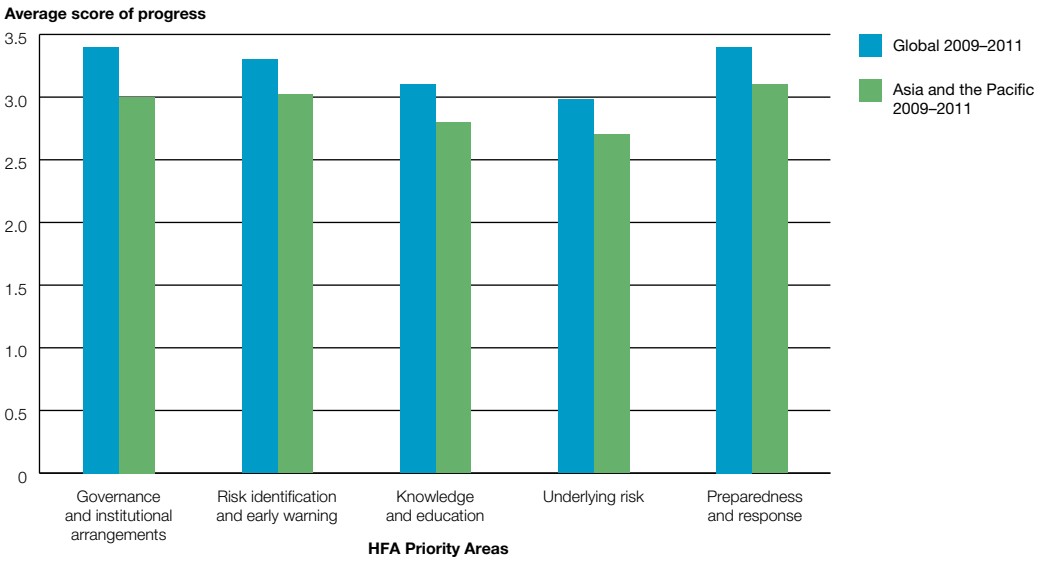
real-time window into how development is configuring risk, through drivers such as badly planned and managed urban development, environmental degradation and poverty.

Between 2009 and 2011, 72 percent of countries and territories in Asia and 28 percent in Oceania reviewed their progress towards the Hyogo Framework for Action (HFA). There are also a growing number of regional frameworks for risk reduction. For example, the South Asian Association for Regional Cooperation (SAARC) agreed on a Comprehensive Regional Framework on Disaster Management, while in October 2010, 50 Asian and Pacific governments approved a five-year regional roadmap to integrate disaster risk reduction and climate change adaptation at all levels. However, the progress reported by Asian countries is still lower than the global average across all five HFA Priority Areas.

Asia, nevertheless, is generating innovative disaster risk management initiatives. Major progress is being made in accounting for disaster loss. The Indonesian Disaster Data and Information Management Database is already being used for national policy, planning and budgeting in disaster risk management. Viet Nam is also currently transforming the disaster loss data collected by the Central Committee of Flood and Storm Control into a comprehensive national disaster database. In terms of social protection, the Mahatma Gandhi National Employment Guarantee Scheme reaches out to around 68 million people whose livelihoods are affected by drought and other hazards. China has an innovative twinning programme that facilitates the transfer of financial and technical support from one province or municipality to a disaster-affected area with less resources. Albay Province in the Philippines adopted a zero casualty policy and allocated 4.5 percent of its 2010 budget to risk reduction and climate change adaptation, something that its Governor, Joey Salceda, sees as "an investment that increases business returns". The political and economic imperative for disaster risk reduction is beginning to become visible.



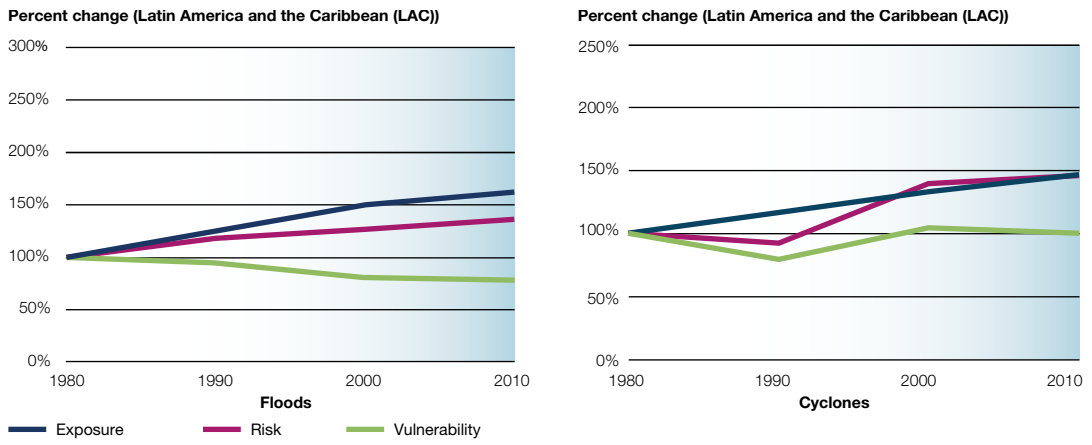
Number of houses reported damaged or destroyed by weather-related extensive risk events (Indonesia, Nepal, Sri Lanka and Orissa and Tamil Nadu, India)



Average reported progress in Asia and the Pacific compared to global progress

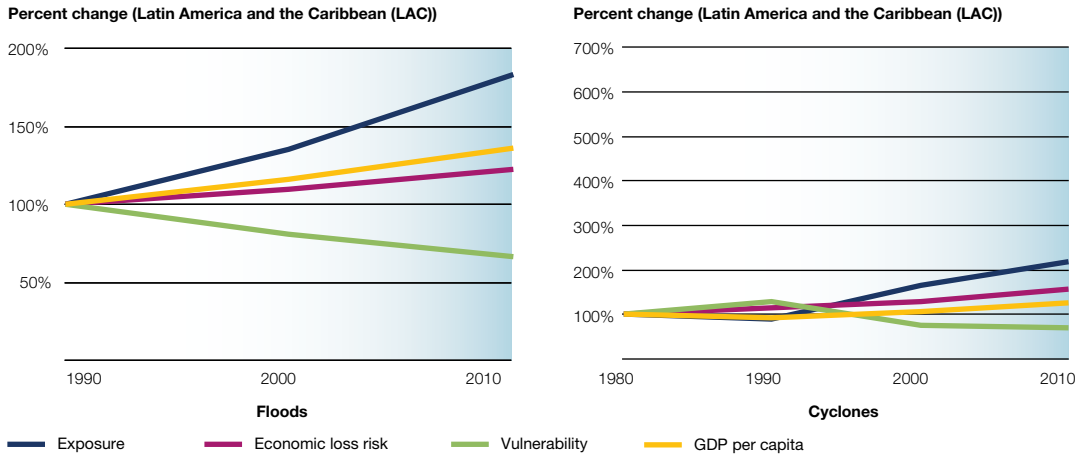
Mortality and economic loss risks rise in Latin America and the Caribbean

Only 2% of the global population exposed to floods and 4% of the global population exposed to tropical cyclones lives in Latin America and the Caribbean. Globally, mortality risk to both hazards is now decreasing. In contrast, in Latin America and the Caribbean it continues to rise, implying that vulnerability reduction is not offsetting increases in exposure.



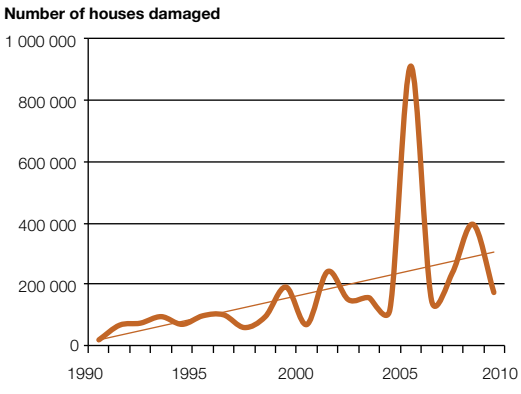
Percentage change in flood and tropical cyclone mortality risk, exposure and vulnerability, as modelled, 1980–2010 (compared to baseline year 1980)

Economic loss risk is also continuing to increase. In the case of tropical cyclones, this increase is outpacing growth in GDP per capita implying that the risk of losing wealth in weather-related disasters is now outstripping the rate at which the wealth itself is being created.



Percentage change in economic loss risk, exposure and vulnerability to floods and tropical cyclones in Latin America and the Caribbean, as modelled

However, as flooding and landslides in Brazil, Colombia and Costa Rica in 2010 highlighted, a significant proportion of disaster damage in Latin America is associated with frequently occurring weather-related extensive disasters. In a group of 12 countries in Latin America, which now have national disaster databases, housing damage has increased approximately four-fold since 1990.



Housing damage in Latin America associated with extensive weather-related disasters

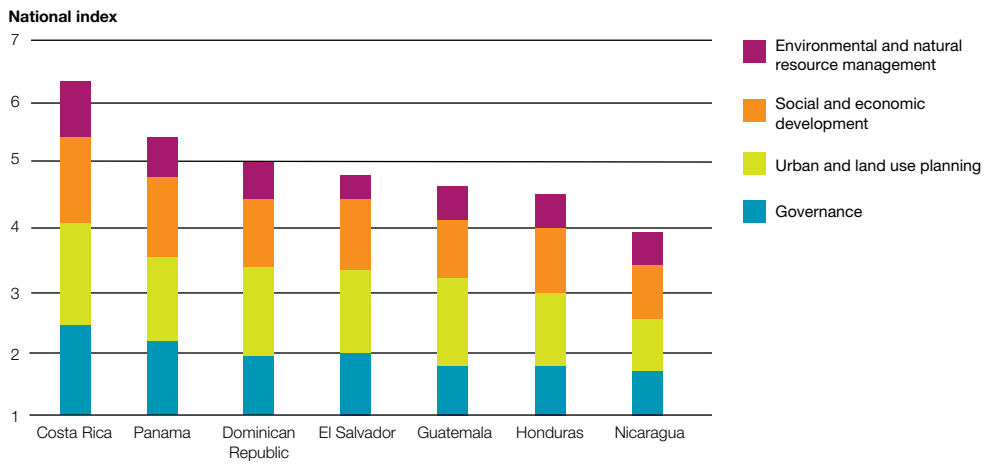
Sources and citations for the content of all 2011 Global Assessment Report products are set down in the main report and associated documentation.

These losses place considerable strain on public finances. In Mexico in 2010, the disaster contingency fund (FONDEN) ran out of money. With an annual budget of 12 billion pesos, it had already spent 25 billion by September and estimated that it needed another 25 billion by the end of the year. In Colombia the cost of extensive flooding in 2010–2011, which affected more than 700 municipalities, has been estimated at US$5.4 billion, far exceeding available contingency funds and lines of credit.

The region, however, is making considerable progress in disaster risk management. Countries report consistently higher progress against the priority areas of the HFA compared to global averages, although addressing underlying risk, particularly in development sectors, continues to be particularly challenging.

The capacity of countries to address the underlying risk drivers, such as badly planned and managed urban development, environmental degradation and poverty, is further explored by a new Risk Reduction Index piloted in Central America and the Caribbean. According to this index, Costa Rica, for example, has been more successful in addressing these drivers and has stronger governance than Nicaragua.

But a number of countries in the region are also showing how innovative strategies can reduce risks. Peru and Costa Rica have included risk reduction considerations in their evaluation of public investment projects. Chile, Mexico and Nicaragua have adapted conditional cash transfer programmes, originally designed to address structural poverty, to strengthen household resilience to disaster loss. Caribbean countries and their regional body CDEMA (Caribbean Disaster and Emergency Management Agency) have adopted a strategy and framework for comprehensive disaster management.



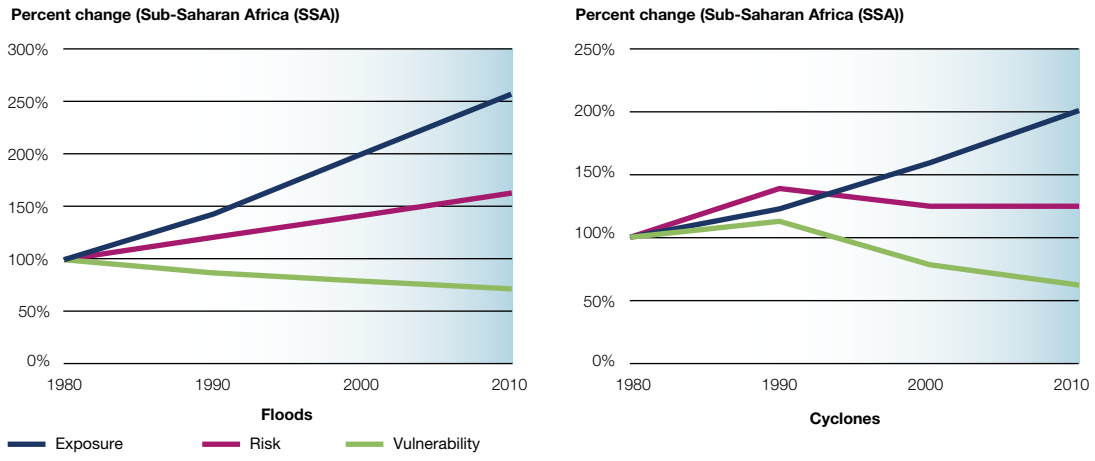
Risk governance capacities across Central America and the Caribbean

Sub-Saharan Africa: the real frontline

The exposure of people to weather-related hazards such as floods and tropical cyclones is increasing at a faster pace in low-income countries than in those with middle- or high-incomes, and in particular in sub-Saharan Africa. The number of people exposed to floods in the region grew from 500,000 per year in 1970 to almost 2 million people per year in 2010. Similarly, exposure to cyclones has increased from around 500,000 per year in the 1970s to 2.7 million per year in the last decade.

Flood mortality risk is still increasing consistently in sub-Saharan Africa, despite a downward global trend. While cyclone mortality risk is not increasing, it is not falling either. The region is not making sufficient progress in reducing its vulnerability to compensate for rapidly increasing exposure.

Sub-Saharan Africa has only a fraction of global GDP exposed to floods and tropical cyclones (approximately 0.1% in both cases).



Percentage change in flood and tropical cyclone mortality risk (as modelled), exposure and vulnerability from 1980-2010 (compared to baseline year 1980)

However, as in other regions, economic loss risk is increasing, again largely due to the difficulty in reducing vulnerability. Many countries in the region are amongst a group of low-income countries whose development achievements, as indicated by GDP per capita, human development, competitiveness and capital formation are diverging negatively not only from OECD countries but also from more successful low- and middle-income countries. Some of these countries may be experiencing resilience traps where disaster losses and impacts cause negative feedbacks into slow development and structural poverty.

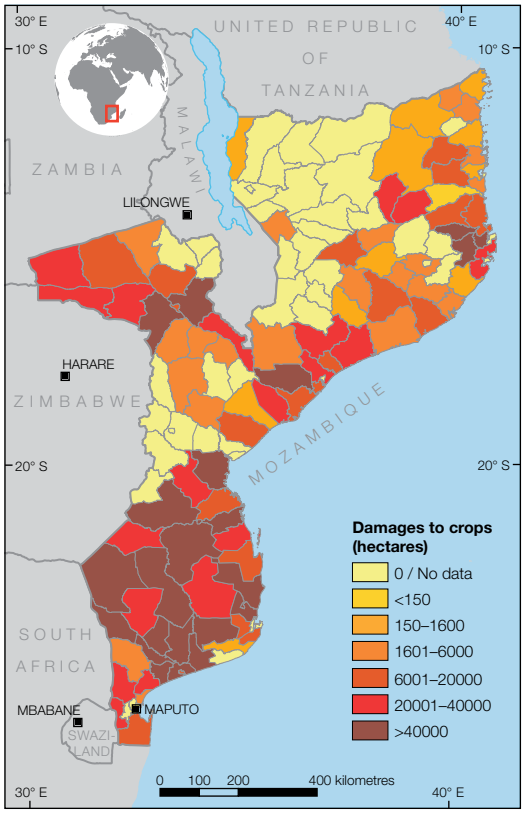
Sub-Saharan Africa also presents high levels of drought risk, though a lack of information and data does not allow that risk to be modelled at the present time. Available evidence, however, provides a sound – and worrying – indication of the magnitude, inter-linkages and impact of drought on mortality, rural livelihoods, food security, agricultural production, economic and urban development, migration, conflict, the environment and public spending in the region.

Mozambique is one of the few countries that systematically records drought losses and where the real scale of the impacts become visible. Since 1990, 8 million hectares of crops have been damaged in droughts, with more than 11.5 million people affected. There can be little doubt that in relative terms, comparable data for the whole of sub-Saharan Africa would show the same trend or worse.

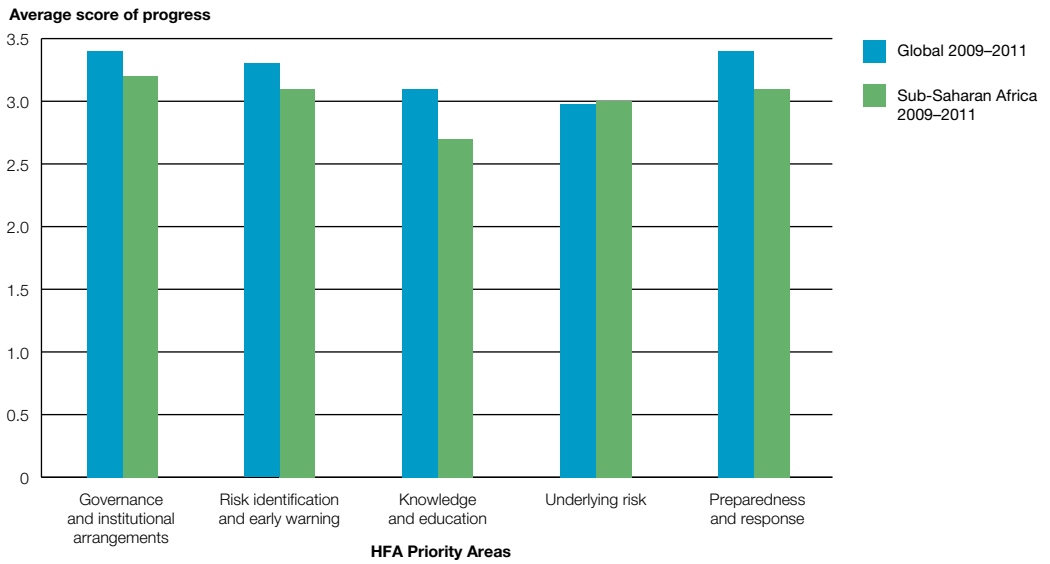
African countries in general report less progress against the five priority areas of the Hyogo Framework for Action (HFA) compared to the global averages. Sixty-one percent of African countries prepared reports and most describe difficulties in comprehensively assessing their disaster risks and factoring risk assessment information into national planning, investment and development decisions. They also find it challenging to identify those policies and innovative practices that can drive change and provide political and economic incentives for disaster risk management.

In fact, several of the 18 sub-Saharan African countries that submitted interim reports awarded themselves some of the lowest progress scores, particularly in education and in addressing the underlying drivers of risk.

However, at a regional level, progress is being made, with the African Union and New Partnership for Africa's Development (NEPAD) developing regional disaster risk reduction frameworks. And in individual countries new approaches are reducing vulnerability and strengthening resilience. Ethiopia, Malawi and Rwanda, for example, are linking social protection instruments to disaster risk reduction. And countries including Benin and Uganda are integrating risk reduction and climate change adaptation into development and investment planning.



Drought-related crop damage in Mozambique, 1990–2009

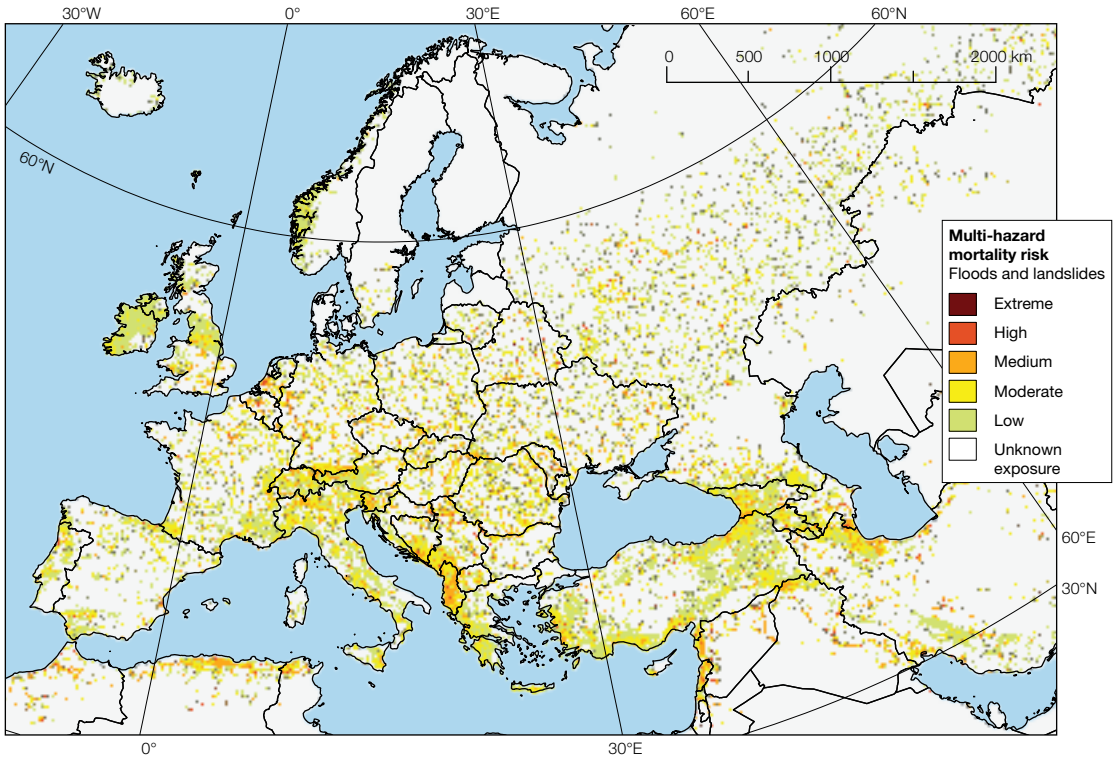


Average reported progress in each HFA priority area in Sub-Saharan Africa 2009–2011

Emerging risks in Europe threaten to erupt

With high GDP and relatively strong governance, most European countries have low-levels of mortality risk to weather-related hazards such as floods.

In contrast, economic loss risk to these hazards is increasing faster in the OECD, which includes many western European countries, than in any other income region in the world.

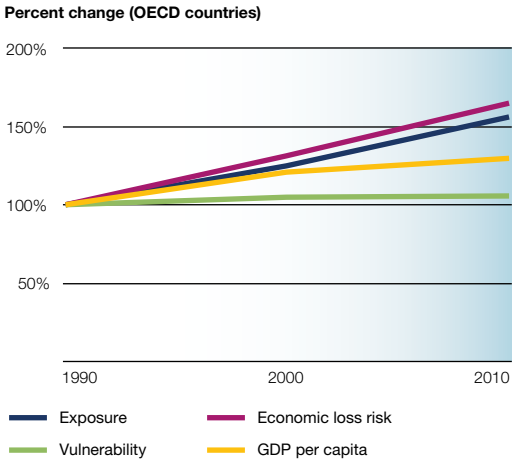


Mortality risk distribution for hydro-meteorological hazards in Europe

Economic loss risk from floods in OECD countries is increasing faster than GDP per capita, indicating that the risk of losing wealth in weather-related disasters is now outstripping the rate at which the wealth itself is being created.

Even though exposure in Europe is increasing at a slower rate than elsewhere, as the 2011 floods in Germany highlighted, even wealthy countries are struggling to reduce their vulnerabilities.

While there is growing recognition of these existing and emerging vulnerabilities and risks, not all European countries are actively engaged



Percentage change in economic loss risk, exposure and vulnerability to floods in OECD countries as modelled 1990–2010 (compared to baseline year 1990)

in disaster risk reduction. In the current review cycle of local, national and regional progress in disaster risk management against the objectives of the Hyogo Framework for Action (HFA), just over half (53 percent) of European countries participated. Many of the existing regional frameworks and strategies remain skewed towards disaster management. The European Commission, for example, admits that its contributions to date have been mostly to HFA Priority Area 5 (preparedness for effective response). But recent initiatives by both the European Commission and the Council of Europe are leading to the adoption of a more comprehensive approach. However, countries report progress against the five Priority Areas of the HFA that is above the global average. In a new Risk Reduction Index the top ten places are occupied by European countries – from Switzerland (ranked 1) to Spain (ranked 10).

Europe is facing a range of emerging risks, which highlight new patterns of vulnerability. In Russia, for example, the heat wave and wildfires in 2010 were associated with an 18 percent increase in mortality rate as well as to sequential impacts in other areas such as air traffic. In August 2010, 41,300 more people died than in August 2009, due to the extreme heat and smoke pollution. While lack of rainfall early in 2010 and July temperatures more than 8°C above the long-term average increased

Impact of forest and wildfires in Russia and Ukraine, 2010

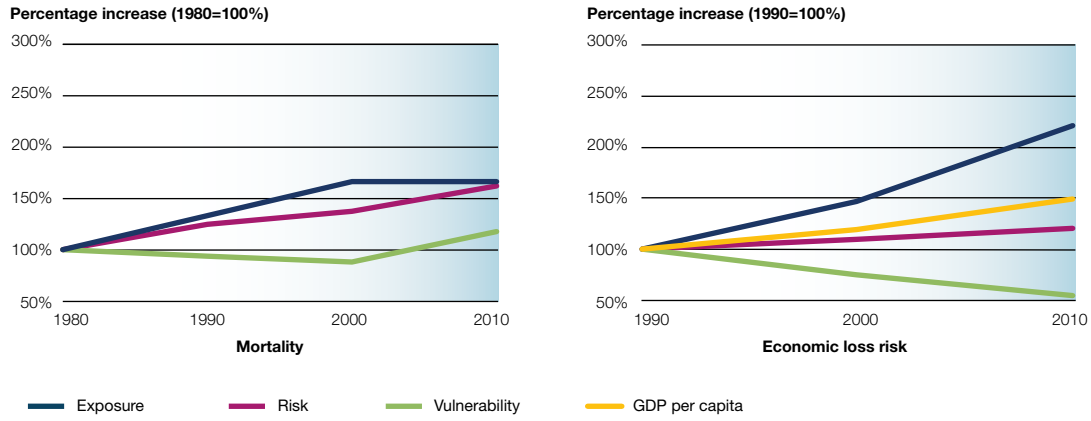
wildfire risk, the disaster was also configured by social and economic change, which has led to declining standards of forest protection and management.

The volcanic ash cloud that affected Western Europe in April 2010 is estimated to have caused US$521 million in lost GDP in the United Kingdom alone. While the disaster was called an unexpected and unprecedented event it was neither. Rather it illustrates the challenges posed by risks for which governments are not prepared. As advanced economies depend increasingly on a complex of interconnected systems, the potential for sequential crisis, where different risks converge and interact, can only increase.

A new impetus for disaster risk reduction in the Middle East and North Africa

In relative terms the Middle East and North Africa have less than 1% of the global population and GDP exposed each year to floods and less than 0.1% of the population and GDP exposed to tropical cyclones. While the region is affected by periodic earthquakes and droughts, disaster risk reduction has not been a priority for the region's governments until recently.

But in the case of floods both mortality and economic loss risk are increasing, highlighting that countries in the region are not reducing the vulnerability of their populations at the speed necessary to address rapid increases in exposure. The GDP exposed to floods in the region, for example tripled from US$300 million to US$900 million between 1970 and 2009.



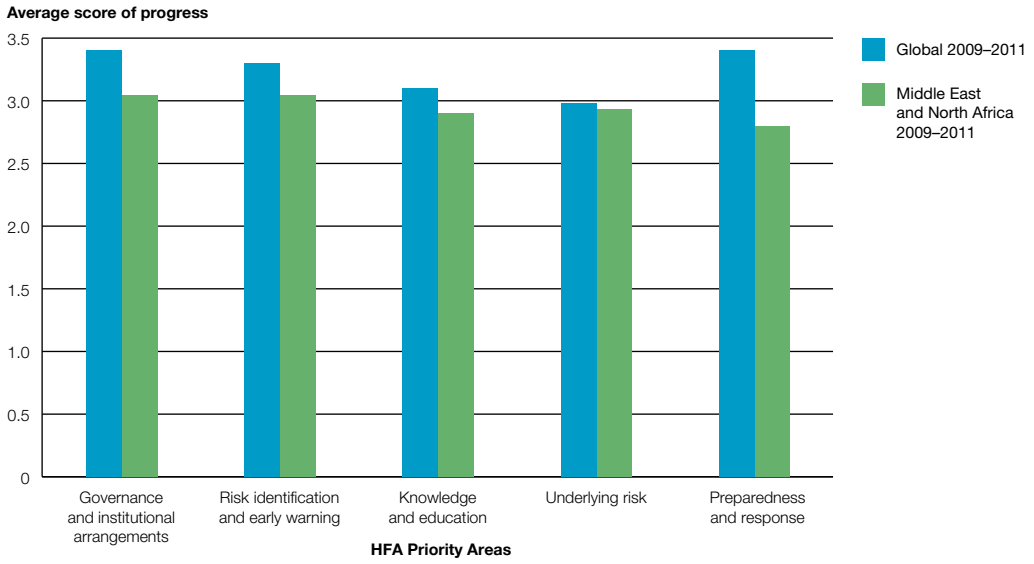
Percentage change in mortality and economic loss risk from floods in the Middle East and North Africa, as modelled

Drought risk is a prominent factor for the region, with GDP and in particular agricultural production affected by it on a regular basis. For example, during the 2007–2008 droughts in the Syrian Arab Republic, 75 percent of the country's farmers suffered total crop failure, and the livestock population was still 50 percent below the pre-drought level more than a year after the drought ended. Inappropriate land use and agricultural patterns are just two of the many drivers of drought risk, which is often influenced by social and economic development choices. The policy of self-sufficiency in wheat production instituted by the Government of Saudi Arabia in 1970 is an example of how unsuitable policies, such as promoting a water-intensive crop in an arid region, can construct risk. The wheat self-sufficiency policy became so expensive and drained aquifers so dramatically that it was eventually abandoned.

Given the relative newness of disaster risk reduction in the region, it is unsurprising that it scores itself lower than the global average in terms of progress against the five Priority Areas of the Hyogo Framework for Action.

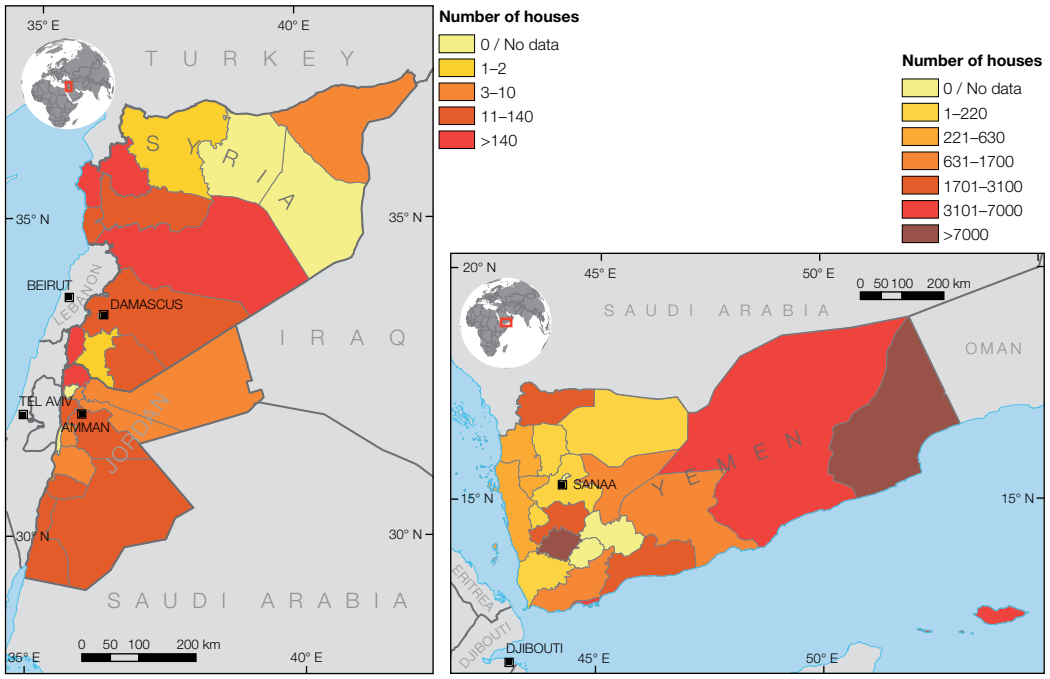
But progress is being made at the regional level. In January 2011, heads of state endorsed the Arab Strategy for Disaster Reduction 2020, which had been adopted by the Council of Arab Ministers Responsible for the Environment (CAMRE). And while the Arab states reported limited progress in addressing transboundary risks, new initiatives such as the Desertification Monitoring and Assessment Network (ADMAnet) are starting to address these issues.

Importantly, a group of Arab states are now making progress in systematically reporting disaster losses, providing an indispensable



Average reported progress in each HFA priority area in the Middle East and North Africa 2009–2011

empirical basis for the development of disaster risk management and governance capacities in the region. Jordan, Syria and Yemen have all recently completed national disaster loss databases and will soon be joined by Egypt and Morocco. For the first time, countries in the region will be able to visualize their own disaster risk.



Housing damage by governorate in Jordan and the Syrian Arab Republic (left), and by province in Yemen (right), 1989–2009

Fast facts and figures

The *2011 Global Assessment Report* compendium, in addition to offering sound analysis and guidance on the disaster risk reduction imperative, is also a cornucopia of thought-provoking, DRR-related facts and figures. Here are a few:

Disaster losses

- Since 1989, in nationally reported disasters in 19 African, Asian and Latin American countries and two states in India there were 63,667 schools and 4,873 health facilities damaged or destroyed. During this period, 73,000 kilometres of roads were also damaged, and 3,605 municipal water systems, 4,400 sewer systems and 6,980 power installations were reported damaged and destroyed.
- Of these total losses, 46 percent of the schools, 54 percent of the health facilities, 80 percent of the roads and more than 90 percent of the water, sewer and power installations were damaged or destroyed in frequently occurring, low-severity extensive disasters, rather than in occasional and intensive catastrophes. Since 1989, the rate of housing damage per million inhabitants in these countries has increased six-fold.
- 26,936 people have died in disasters in the United States of America between 1960 and 2008, 89 percent of them in frequently occurring, low-severity extensive disasters. 220 out of the 302 counties (73 percent) with annual mortality rates greater than 15 per million per year had annual household incomes of less that US$40,000. Disaster mortality in the United States of America is therefore strongly associated with poverty.
- The volcanic ash cloud that affected Europe in April 2010 is estimated to have cost US$521 million in lost GDP in the United Kingdom and US$4.7 billion globally. While volcanic eruptions have always occurred, the impacts in 2010 highlighted new vulnerabilities.

Drought

- Drought impacts are heavily under-reported internationally. In Mozambique only 18 drought-related deaths were reported internationally between 1990 and 2009. In the same period the Government's national disaster loss database recorded 1,040 deaths.
- Monitoring drought and estimating drought risks is hampered by the declining number of rainfall stations maintained by governments. In Spain the number of rainfall stations maintained by AEMET, the national meteorological agency, has declined by about 45 percent since its peak in the mid 1970s.
- Per capita water use in the tourism industry is often 3–10 times greater than local demand. Tourism leads to large seasonal variations in water use that can produce droughts, given that the peak season often coincides with drier sunnier periods.
- In the Mediterranean the seasonal tourism industry increases annual water demand by 5–20 percent.

Floods and tropical cyclones

- More and more people are living in areas exposed to floods and tropical cyclones. The world's population increased by 87 percent from 1970 to 2010 (from 3.7 to 6.9 billion). In contrast, the proportion of the population living in flood-prone river basins increased by 114 percent and that on cyclone exposed coastlines by 192 percent. Most of this increase has occurred in low- and lower-middle-income countries.
- Around 26 percent of the population exposed to floods and 44 percent of the population exposed to tropical cyclones live in East Asia and the Pacific. Mortality risk to both floods and cyclones in this region has fallen by 50 percent since 1980, contributing to a drop in global mortality risk since 2000. This is due to significant reductions in vulnerability.
- The high-income countries of the OECD (Organisation for Economic Co-operation

and Development) concentrate 52 percent of the total GDP exposed to floods and 92 percent of the GDP exposed to tropical cyclones. Since 1980, economic loss risk due to floods has increased by over 160 percent and to tropical cyclones by 265 percent in the OECD countries. It has not been possible to reduce vulnerability in a way that compensates for increasing exposure. Economic loss risk to floods and cyclones in the OECD is growing faster than GDP per capita. Put simply, this means the risk of losing wealth in weather-related disasters is now outstripping the rate at which the wealth itself is being created.

Investment

- In Mexico, the annual cost of tax exemptions represented about 6 percent of GDP in 2007. In contrast, investment in disaster risk management was equivalent to only 0.1 percent of the government's income and 0.4 percent of total public investment in 2007. Since 1982, all Mexican governments have had to absorb disaster losses of over US$10 billion in their period in power, without including losses in the agriculture sector.
- Avoiding disaster risks through improving land use management and building is about four times less expensive than absorbing disaster losses in Colombia and Mexico. In contrast, the cost of retrofitting or relocating vulnerable buildings is only marginally less than the losses that could be incurred. Nevertheless, these measures could reduce mortality by around 40 percent.
- Peru's National Public Investment System approved investment of approximately US$10 billion in 2008, in contrast to overseas development assistance of US$266 million in the same year. Peru now evaluates disaster risk in all its public investment projects with huge positive implications for reducing disaster risk.
- In Japan, a country with very high public awareness of disaster risk, a 2005 poll found that although two-thirds of households believed their homes could be hit by a strong earthquake in the next 10 years, only a tenth had evaluated their vulnerability and invested in retrofitting.
- Less than one in five countries reporting progress against the Hyogo Framework for Action in 2009–2011 were able to describe the percentage of their budgets assigned to disaster risk management, indicating that assigning dedicated resources remains the exception and not the norm.
- New York City is investing US$5.3 billion in green infrastructure on roofs, streets and sidewalks to reduce flooding and improve water quality. This is cheaper than the US$6.8 billion that conventional improvements to pipes and tanks would have cost.
- Only 15 percent of low-income countries reported success in using land use planning and urban development to reduce risk in the 2009–2011 HFA review, only 46 percent report on investing in drainage in flood prone areas and only 31 percent in countering landslide risk.

Tsunamis

- Historically tsunamis have devastated coastal cities. The tsunami that destroyed Callao, Peru in 1746 killed all but a handful of its 6,000 inhabitants. Callao now has a population of more than 800,000. Peru is one of the countries that could be hit with a devastating 1-in-500-year tsunami with wave heights of over 6 metres reaching the coastline in less than 15 minutes.
- Japan is the country with the largest GDP (over US$140 billion in 2009) and the second largest population (4.5 million people) exposed to high-severity tsunamis.

Wildfires

- During and after the heat wave and wildfires that affected Russia in August 2010, the country's mortality rate increased by 18 percent. 41,300 more people died in August 2010 compared to August 2009.

Summary of main findings

Risk trends: Economic losses up, mortality down

- The risk of being killed by a cyclone or flood is lower today than it was 20 years ago, except for those who live in a country with low GDP and weak governance.
- Economic loss risk continues to increase across all regions – and seriously threatens the economies of low-income countries.
- Extensive disaster risk mirrors economic development pathways.
- The extensive risk of today can become the intensive risk of tomorrow.
- Disasters impact significantly and negatively on child welfare and cause internal displacement.

Drought: The hidden risk

- Drought impacts most visibly on agricultural production, with significant losses spilling over into other economic sectors.
- Globally, drought is still a hidden risk and locally its social and economic impacts are disproportionately concentrated on poor rural households.
- Maybe more than any other disaster risk, drought risk is constructed by economic decisions and social choices.

Global efforts: The HFA Effect

- The number and quality of Hyogo Framework for Action (HFA) progress reviews is evidence of a growing concern for reducing disaster risk.
- The discussion of indicators and progress helps generate a common language and understanding.
- Whereas good progress is being made in early warning, preparedness and response, countries are still struggling to address the underlying risk drivers.
- Gender and public awareness are still not being adequately addressed.
- Investment in disaster risk management, particularly within sectors and through local governments, is severely limited.

Revealing risk: Visible trade-offs for informed choices

- The sheer scale of recurrent and probable maximum losses should be enough to shock governments into action.
- Governments are liable for a significant part of total expected losses – and they rarely have the contingency financing to match this liability.
- Governments need to decide how much risk they are willing to retain and how much they can afford to transfer.
- A balanced portfolio of prospective, corrective and compensatory risk management strategies is the most cost-effective way to reduce disaster risks and support development.

Redefining development: Scaling up disaster risk management

- Development must be redefined to be sensitive to disaster and climate risks.
- The scale of public investment dwarfs current investment in disaster risk management.
- Existing social protection instruments can be adapted to reach out to millions at relatively low additional cost.
- Temporary employment programmes can contribute to the creation of risk-reducing community assets.
- Ecosystem-based disaster risk management often realizes highly attractive cost–benefit ratios.
- Conventional approaches to land use planning and implementation have failed.
- Truly participatory approaches provide an opportunity for scaling up innovative local initiatives.

Reforming risk governance

- To ensure the coherence of policy and planning, overall responsibility for disaster risk management needs to be located in a central ministry with a high level of political authority.
- Where local capacities are limited, an incremental approach to decentralization may be the best way forward.
- The right to information on disaster risks is central to creating social demand and accountability.
- Engaging citizens and affected communities requires a shift in the culture of public administration.