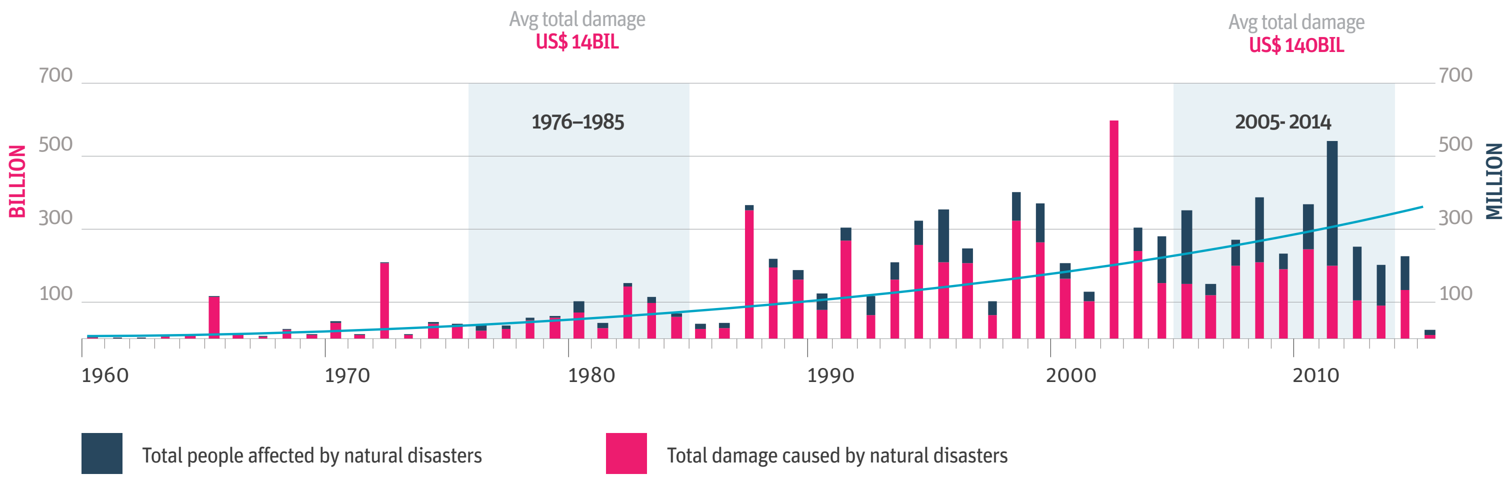
THE MAKING OF A RISKIER FUTURE

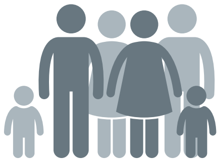
Disaster risks are increasing rapidly.

While annual losses and deaths from natural disasters vary, **long-term average of total annual damage is increasing at an exponential rate.**



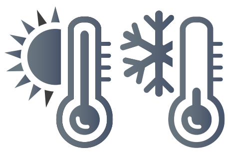
Our decisions are shaping the future of disaster risk, and today's decision makers control the drivers of future risk.

However, four key areas are often excluded from risk assessments that support those decisions:



01 **Population increase**

02 **Rapid urbanization**



03 **Climate change**

04 **Environmental conditions**

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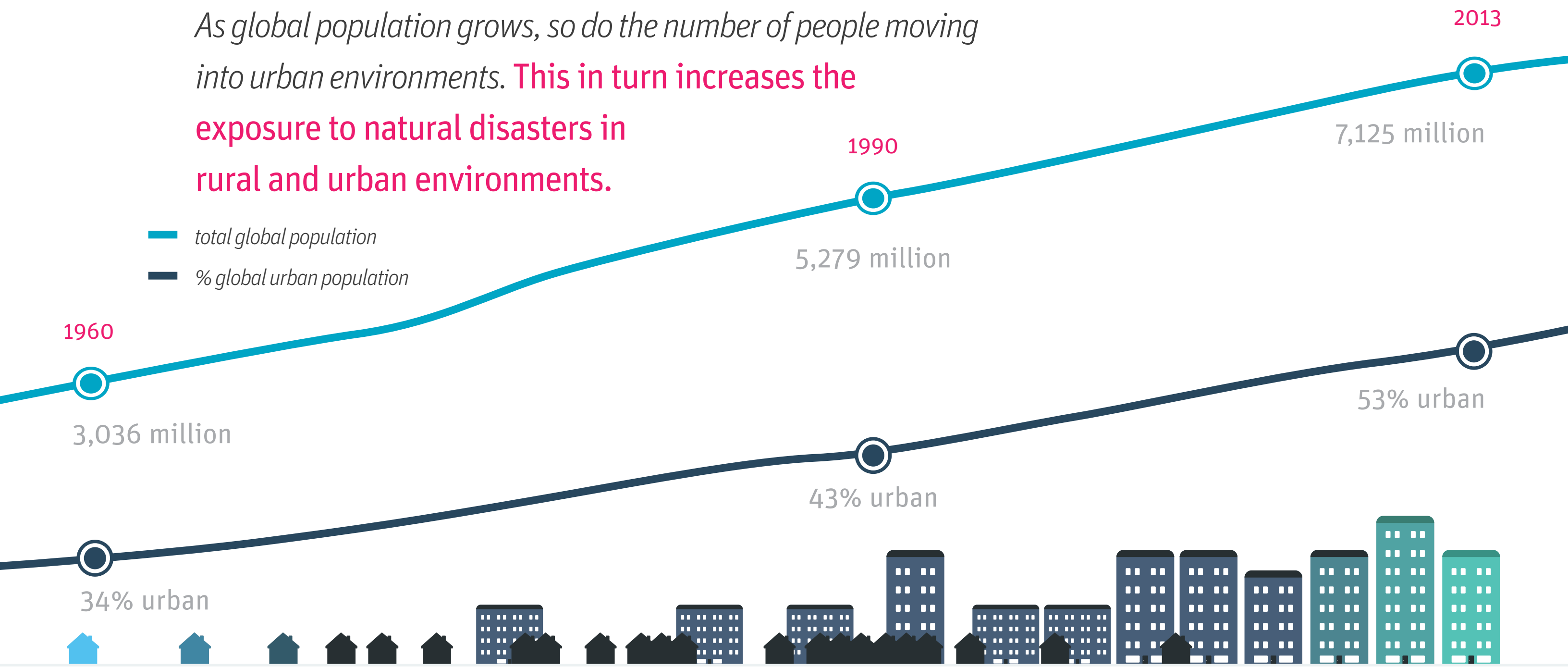
- Most disaster risk assessment today is static, focusing only on understanding current risks. A paradigm shift is needed toward dynamic risk assessments, which reveal the drivers of risk and the effectiveness of policies focused on reducing risk.

- Global disaster risk is changing extremely fast, due to combined dynamics of hazard, exposure, and vulnerability.

- The drivers of disaster risk are in the control of policy makers, society, and individuals—but accurate assessment and continuous reevaluation of risk are required to enable effective risk reduction and prevent drastic increases in future losses.

01 Population increase

As global population grows, so do the number of people moving into urban environments. **This in turn increases the exposure to natural disasters in rural and urban environments.**



02 Rapid urbanization

As more and more people move to cities, urban population densities are generally declining. This results in expansion of urban areas into new undeveloped land.

As well as increasing exposure to hazards, this also increases flood risk by converting natural land cover to paved surfaces, over which rainfall runs more rapidly into drains and rivers.

Flood risks in Indonesia are expected to increase significantly if current urbanization trends continue over the next 30 years

166% **INCREASE** *river flood risk* + *455%* **INCREASE** *coastal flood risk*

04 Environmental condition: Sinking Land

Densely populated coastal cities are sinking due to groundwater extraction. When coupled with rising sea levels, the effects can significantly affect large populations.

With no adaptation to increased sea level, and sinking land, annual loss in 136 coastal cities will increase from

US$ 6 **BILLION** *in 2010*

US$ 1,000 **BILLION** *in 2070*

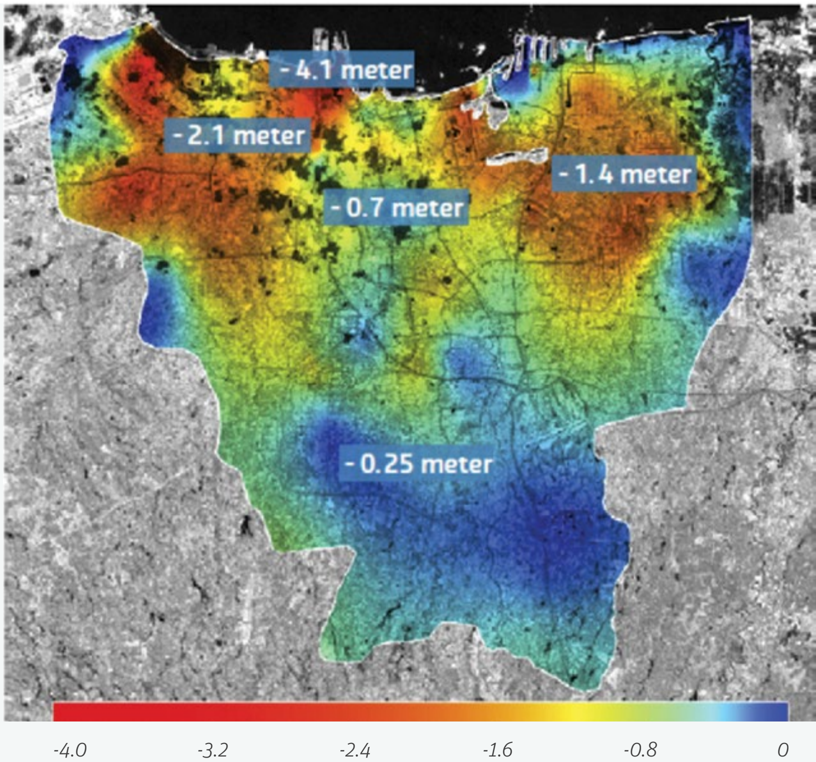
The rate of subsidence (the gradual sinking of an area of land) can exceed that of sea-level rising – meaning that subsidence may be a **greater influence on increased coastal flooding hazard than climate change.**

	Mean cumulative subsidence, 1900–2013 (mm)	Mean current subsidence rate (mm/year)	Estimated additional mean cumulative subsidence until 2025 (mm)
Jakarta	2,000	75–100	1,800
Ho Chi Minh City	300	Up to 80	200
Bangkok	1,250	20–30	190
New Orleans	1,130	6	> 200
Tokyo	4,250	Around 0	0

Case Study: Jakarta

Land in Jakarta sank by between 0.7m and 4.1 m in suburbs close to Jakarta Bay, in the 36 years period 1974-2010; In comparison, sea levels are estimated to rise by up to 0.6 m over next 85 years.

The combined effect of sinking land and rising sea levels both need to be considered – currently, Disaster Risk Management focuses mostly on sea level rises.



Cumulative land subsidence over the period 1974–2010 in Jakarta, Indonesia, based on GPS (Institut Teknologi Bandung) and conventional benchmark measurements (Water Resources Management Study).

Source: Modified from JCDS 2011.

02 Rapid urbanization : Earthquake

Informal and uncontrolled construction leads to higher levels of risk and damage from earthquakes. Building construction and regulation are key to mitigating risk of damage in the future.

COMPLIANT	*Paso Robles, California* *30,000 population* *December 26, 2003*	*6.6* **RICHTER** *scale*	*<1%* **BUILDINGS** *damaged*	*2* **DEATHS**
INFORMAL	*Bam, Iran* *90,000 population* *December 23, 2003*	*6.5* **RICHTER** *scale*	*50%* **BUILDINGS** *destroyed*	*40,000* **DEATHS**

Case Study: Kathmandu

Kathmandu is located in a seismically active region. It has a long history of earthquake, with 71 events of magnitude 5 or greater recorded between 1911 and 1991. One of the largest earthquake in the recent history of the region, the Great Nepal-Bihar Earthquake, occurred on January 16, 1934. The event was estimated to be of magnitude 8.1 and caused extensive damage in the region.

Incremental building expansion is a common component of informal construction. If the 1934 earthquake occurred in 2021, an estimated 25% of buildings would be expected to collapse. Ongoing informal construction in Kathmandu is expected to increase vulnerability to earthquakes in the city. Based on the modeled effects of informal construction, the buildings present in 2045 would be much more susceptible to earthquake damage: 50% percent of buildings would collapse if the same earthquake occurred in 2045. Building regulation can help to ensure that buildings are built to withstand earthquakes, reducing vulnerability and the potential collapse rate in future earthquakes.

Photo credit: International Organisation for Migration

03 Climate change : Wind

Tropical Cyclones, Hurricanes, or Typhoons as they are known in different parts of the world are projected to increase in intensity and frequency as global temperatures increase.

There is an exponential relationship between cyclone wind speed at landfall and normalized economic loss

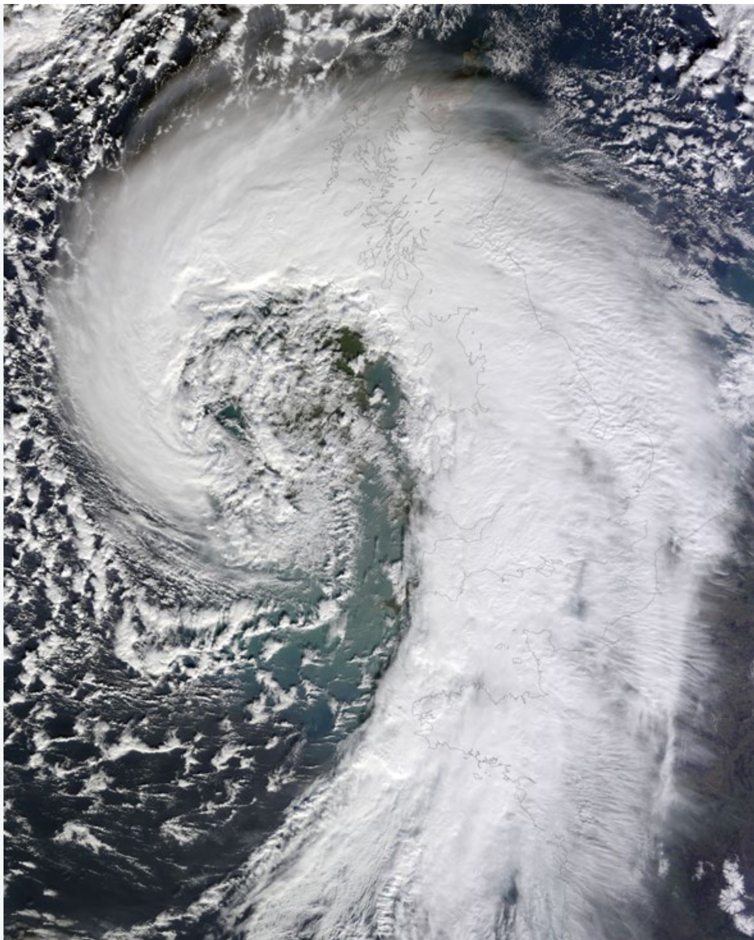
1 m/s INCREASE *in wind speed* = **5% INCREASE** *normalized economic loss*

Storms are projected to increase in strength at a rate of 0.1m/s per year – meaning every 10 years there is a 5% increase in cyclone loss. As such:

18% INCREASE *in intensity* → **64% INCREASE** *in damage*

Case Study: Atlantic Basin

The intensity and frequency of the most extreme tropical cyclones have increased in the North Atlantic since 1980 (Kossin et al. 2007), and some data show the same trend for all basins globally—that is, an increase in the proportion of Category 4 and 5 cyclones and a decrease in the proportion of Category 1 and 2 cyclones (Holland and Bruyère 2014). The increase in the proportion of high-intensity cyclones is expected to impact losses significantly. The Association of British Insurers (2005) estimated that average annual loss (AAL) might increase by 45–118 percent in the United States and 40–100 percent in Japan in response to just a 4–9 percent increase in hurricane wind speeds.

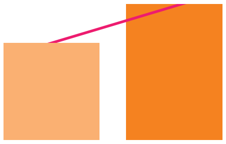


Extratropical cyclone over the United Kingdom. February 16, 2014.
Photo credit: NASA Earth Observatory image by Jesse Allen

03 Climate change : Flood

Coastal and river flooding are a major source of evolving hazard, and when combined with population increase and rapid urbanization, more and more communities are at risk.

922
MILLION
people (2010)



1,300
MILLION
people (2050)

US$ 46
TRILLION
in assets (2010)

US$ 158
TRILLION
in assets (2050)

Climate models suggest that **flood frequency is likely to increase** *in much of South America, central Africa, and East and South-east Asia in the period 2071–2100 compared to 1971–2000.*

Meanwhile, southern South America, southern and Eastern Europe, and Central Asia are likely **to experience decreased flood frequency.**

Case Study: Sub-Saharan Africa

Recent national-level flood risk assessments in Sub-Saharan Africa suggest large increases in population affected by flooding in the region. In Ethiopia in 2010, there was a 10% chance in any one year, that one million people would be affected by flooding. In 2050, that is expected to double to two million due to population increase and climate change. The population affected in 2010 is also expected to double in Kenya, Uganda, and Senegal, while in Niger there could be an increase of up to five times the number of people affected by the 1 in 10 year flooding, at the national level.

Children displaced by floods in South Sudan
Photo credit: UN Photo/JC McIlwaine

Disaster risk is rapidly increasing due to changes in its underlying components: hazard, exposure, and vulnerability. Disaster risk evolves spatially and temporally as a result of changes to one or more of these three components, and the inherent interactions between them – changes to one component can influence the other components. Disaster risk can be influenced by climate, development, and risk management .Over time, disaster risk may increase or decrease, and it may evolve differently at the local, regional, national, and global scales. Risk rarely evolves uniformly in a community or region; it often increases most with respect to particular types of assets, or for sectors of the population with greatest vulnerability.

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SOURCES

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