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UNITED NATIONS DEVELOPMENT PROGRAMME

CLIMATE AND DISASTER RESILIENCE

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"Allow me to be blunt. The world is in a mess. […] But one overriding megatrend is far and away at the top of that list – climate change. Climate change is a direct threat in itself and a multiplier of many other threats — from poverty to displacement to conflict. The effects of climate change are already being felt around the world. They are dangerous and they are accelerating."

– United Nations Secretary-General Antonio Guterres, 30 May 2017[1]

Abstract: The scientific consensus agrees that climate change is a real, man-made phenomenon that can result in global warming,[2] and that global warming will have profound impacts on weather patterns, among them more extreme natural disasters than in years past.[3] The United Nations Development Programme (UNDP), in partnership with member-states and other nongovernmental organizations, works to increase resilience for communities prone to suffer from climate-driven disasters to not only lessen their potential impacts, but to provide means for economic recovery thereafter. This may include long-term projects to reinforce or replace elements of a country's infrastructure to harden them against the damage natural disasters can bring, or the development of emergency response plans in the event of such an occurrence. Work done to these effects can have an unforeseen benefit to countries' economies as well: by putting people to work to foster resilience to disasters, new classes of workers are trained, new industries are developed and economic growth can take place.

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[1] Antonio Guterres, "Climate action: mobilizing the world," speech given on 30 May 2017, New York, http://www.un.org/sustainabledevelopment/blog/2017/05/secretary-generals-climate-remarks-at-nyu-stern/.

[2] Susan Solomon, et. al., "Irreversible climate change due to carbon dioxide emissions," *National Academy of Sciences of the United States*, vol. 106, no. 6, 10 February 2009, http://www.pnas.org/content/106/6/1704.full.pdf.

[3] Susan Solomon, et. al., "Technical Summary. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change," 2007, https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ts.html.

Introduction

As emissions of greenhouse gases have increased over time, their ability to escape Earth's atmosphere or be otherwise absorbed by carbon sinks, like plants and oceans, becomes limited. Accordingly, these gases, which trap heat closer to Earth's surface, cause the surfaces of the planet to warm, leading to (among other effects) a melting of polar ice caps resulting in rises in sea level. These are processes that are already taking place, and have been for several years. The Intergovernmental Panel on Climate Change, or IPCC, says the relative impact of global warming will not be uniform, and will vary considerably, depending on location:

> "The projected 21st-century temperature change is positive everywhere. It is greatest over land and at most high latitudes in the NH [Northern Hemisphere] during winter, and increases going from the coasts into the continental interiors. In otherwise geographically similar areas, warming is typically larger in arid than in moist regions. In contrast, warming is least over the southern oceans and parts of the North Atlantic Ocean. Temperatures are projected to increase, including over the North Atlantic and Europe, despite a projected slowdown of the meridional overturning circulation (MOC) in most models, due to the much larger influence of the increase in greenhouse gases.[4]"

This has a knock-on impact on sea level rise, which IPCC estimates say may vary depending on changing rates of ocean salinity,[5] existing coastlines and other factors. IPCC scientists also say the frequency of so-called "extreme" heat waves[6] will increase as climate change continues, along with thawing of permafrost, increases in pressure in subtropical seas (leading to more severe weather), increases in average yearly rainfall and other impacts.

Again: these changes in weather patterns and in climate are already visible, and are expected to continue over the near term. Even as humans begin various processes to try and stop what's already happening, mitigation strategies will need to take effect in order to prevent damaging impacts of what is already wrought. For example, flooding in the city of Venice, Italy – one of the locale's hallmarks – has become more severe in recent years, leading residents to have to improvise their own flood strategies, like special barriers in front of their homes and shops to prevent ever-increasing waters from encroaching.[7] During the current Atlantic hurricane season (as of September 19, 2017), questions about potential links between extremely large and powerful storms, including Hurricanes Harvey, Irma, and Maria, and climate change have been discussed by policy-makers, scientists, and journalists.[8]

So, what is to be done? UNDP has identified four main areas of focus: reducing the risk of disasters, addressing climate change (which is woven throughout the following

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[4] Ibid.

[5] As ice caps melt into the ocean, saltwater will dilute.

[6] Defined as "above the 95th percentile of the simulated temperature distribution for the 20th century."

[7] Christopher Livesay, "Climate change challenges sinking city of Venice," *PBS NewsHour*, 23 July 2017, http://www.pbs.org/newshour/bb/climate-change-challenges-sinking-city-venice/.

[8] John Schwartz, "The Link Between Hurricanes and Climate Change," *New York Times*, August 25, 2017.

discussion points), disaster recovery initiatives, and development of sources of sustainable energy production. In this background guide, elements of each tenet will be explored in brief, along with current strategies to address these topics & efforts from the past that may be used as exemplars moving forward.

Fewer disasters, fewer problems?

> "Over the past decade more than 1.5 billion people have been affected by disasters that have cost at least US$ 1.3 trillion. Climate change, weak governance, and an increasing concentration of people and assets in areas exposed to natural hazards are driving disaster risk upwards, especially in poor and fragile countries."[9]

Consider the steps necessary for disaster preparedness. First, before a problem even exists, a plan must be put in place to address any variety of scenarios, even if they may have a minute chance of actually occurring. Then, if a disaster does actually happen, recovery must take place in both immediate and long-term manners: for example, restoring access to food, clean water and electricity following a natural disaster is a much more pressing and urgent concern than, say, rebuilding a bridge that has been destroyed. Similarly, capacity for hospitals and other medical facilities must be strong enough to handle massive instances of trauma, and be able to operate functionally and as close to fully as possible in the event of a natural disaster, even if access to utilities is scant or otherwise unavailable.

Instead of focusing exclusively on preventing disasters, member-states need to work to develop methods of understanding what risks they face due to natural disasters, and what steps would need to be undertaken were one to take place. This method of finding actionable risk information is one of UNDP's benchmarks in the area, working with stakeholders from multiple sectors in order to figure out what would be left most vulnerable, for instance, in the event of varying natural disasters. Such assessments need not only to take into account issues of infrastructure, but also those surrounding people. For example, consider an agrarian society where women are responsible for cultivation of a crop. Profits from that crop are then used to send younger generations of women and girls to school. Were a flood to take place and wash out a cultivation area, not only are the women impacted left without stable work, but their children are unable to gain an education as a result.

Thinking of disaster readiness as a series of interlocking issues helps member-states and UNDP better address problems at hand,[10] but also dovetails with the Sendai Framework for Disaster Risk Reduction, borne from the UN Office for Disaster Risk

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[9] "Climate and disaster resilience: Disaster risk reduction," UNDP, 2017,
http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/disaster-risk-reduction.html.
[10] "Climate and disaster resilience: Actionable risk information," UNDP, 2017,
http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/disaster-risk-reduction/actionable-risk-information.html.

Reduction (UNISDR).[11] This arm of the UN System works with other organs of the organization and with member-states in order to coordinate disaster response and to develop sets of best practices on how to address disasters before, during and after their arrival. It acts as a liaison with officials developing UN country development frameworks to ensure disaster recovery and response are elements of those plans, and helps address ways UN agencies and other affiliated groups, like the World Bank, can respond better to disasters in times of need. However, participation in UNISDR's plans is not universal: estimates from 2014 put the figure around 70 percent. While laudable, more member-states could take advantage of these programs to better address the issues of disaster preparedness and response where applicable.[12]

Another important facet of disaster preparedness concerns alerting people of oncoming events. Events like the South Asian earthquake and tsunami of 2004 took place without much, if any, advance warning to populations, leading to wide-scale tragedy. While some natural disasters, like tropical cyclones, can be forecasted and predicted within days of making landfall, other events do not have the same kind of luxury, either because of a lack of infrastructure in developing parts of the world, or because science has not caught up fully to studying such occurrences. UNDP works with information and communication technologies (ICT) firms to develop ways to put early warning systems in the developing world to try and add an extra layer of support when disaster strikes. This may be as simple as the installation of sirens alerting populations to immediate, inclement weather, or as sophisticated as sending SMS or other alerts to mobile phones in the event of an oncoming disaster.[13] Even allowing people a few minutes' notice of a tornado or other event can mean the difference between life and death.

How to respond

In the immediate response to a natural disaster, aid, personnel and other equipment must make their way to a disaster zone quickly, oftentimes from far-flung ports of call. Often, this calls for aerial support. As UNDP notes, airports following natural disasters may "become vital hubs where terrified people seek a passage out and where incoming aid is coordinated and distributed." Smaller airports may not have the capacity on a clear day to deal with a sudden influx of flights, cargo and people; in the wake of a natural disaster, those problems are exacerbated by orders of magnitude.[14]

But natural disasters do not discern – airports and other vital public and private infrastructure are not left out of their line of attack. An event like a tropical cyclone can keep an airport closed for days at a time, grounding thousands of commercial and cargo flights; in the aftermath of Hurricane Harvey, which struck the southeastern coast of

[11] "Sendai Framework for Disaster Risk Reduction 2015-2030," UNISDR, 2015, http://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf.
[12] "UNISDR in the UN System," UNISDR, http://www.unisdr.org/who-we-are/unisdr-in-un.
[13] "Climate and disaster resilience: Preparedness & early warning," UNDP, 2017, http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/disaster-risk-reduction/preparedness-and-early-warning.html.
[14] "Preparing airports for disasters," UNDP, http://www.undp.org/content/undp/en/home/ourwork/our-projects-and-initiatives/gard/.

Texas in late August 2017, both major airports in the Houston area took days to reopen to any kind of traffic.[15] Without proper preparation in place, an airport in a devastated region may not get back to full operations for some time – much less in a part of the world that is less developed than the American Gulf Coast.

To wit, UNDP has been working to tackle this specific issue in conjunction with private partners. Deutsche Post DHL, a German logistics company, has developed a training scheme with UNDP officials called, appropriately, Get Airports Ready for Disaster, or GARD. It is a series of training courses for airport staff in order to prepare them for what would happen in the event of a major natural disaster, as well as a study of the airport's existing infrastructure to determine what needs to be augmented or upgraded before a disaster strikes. Deutsche Post DHL and UNDP have partnered in more than 40 GARD schemes across the world since the program was developed in 2009. One success story was the airport in Kathmandu, Nepal, which was the site of the first GARD workshop. UNDP argues that despite a dire humanitarian crisis following earthquakes in 2015, the response was improved because of the GARD program; lessons learned from that experience were discussed in a follow-up workshop at the airport in 2017.[16]

The GARD program is not exhaustive and all encompassing. Instead, it merely addresses one facet of disaster recovery that can sometimes be overlooked in the immediate aftermath of a disaster – as well as, frankly, in the calmer days before such is even anticipated. Governments, on local and national levels, need to create and implement policy to ensure areas of great importance and necessity may obtain needed resources swiftly and efficiently. By partnering with private entities in a variety of sectors – transport, healthcare, public utilities, and the like – as well as by learning from other countries that have had similar issues befall them, member-states can adopt a set of best practices that works for their populations and their countries to aid them in bouncing back from disaster much more quickly and effectively.

International institutions, national and local governments, private firms, and nongovernmental organizations (NGOs) undoubtedly confront costs and pressures in their planning to mitigate and/or prevent disasters but they may all also realize considerable opportunities from said planning. Dutch officials and firms are currently in high demand in countries around the world due to their experiences with, and expertise in planning for, flooding. Rotterdam's system of floodgates and flood mitigation have been studied by port authorities, private firms, and even national military forces from Indonesia, Vietnam, and the United States, amongst others.[17]

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[15] Ben Mutzabaugh, "Harvey: Houston airports remain closed, cancellations top 6,400," *USA Today*, 28 August 2017, https://www.usatoday.com/story/travel/flights/todayinthesky/2017/08/28/harvey-cancellations-now-above-5-000-extend-into-tuesday/606952001/.

[16] Deutsche Post DHL, "Disaster preparedness program: "Get Airports Ready for Disaster" (GARD)," 30 May 2017, http://www.dpdhl.com/en/responsibility/corporate_citizenship/disaster_management/disaster_preparedness_gard.html.

[17] Michael Kimmelman, "The Dutch Have Solutions to Rising Seas. The World is Watching," *New York Times*, June 15, 2017.

Sustainable energy

Another facet in addressing disaster and climate resilience comes from the need to develop and utilize cleaner forms of energy. From trying to reduce carbon emissions to producing materials with high rates of recycling and little waste byproduct, it's not that easy being green.[18] Lesser developed countries have often complained that protocols and initiatives put in place to reduce environmental degradation do little to benefit them; instead, they perpetuate inequality by limiting their capacity for economic growth because they are not allowed to industrialize as quickly — or as dirtily — as their western counterparts have done throughout time.

When examining how to address issues concerning sustainable consumption and production, economics plays a crucial role: nation-states and the corporations that call them home will see little incentive to spend capital and resources in order to improve their environmental standing unless there is some kind of net positive benefit for them to do so. For example, although the amount of carbon emissions related to energy production by nuclear energy is far lower than that of a coal- or gas-fired power plant,[19,20] the cost per kilowatt-hour for such electricity is higher than that of a fossil fuel powered plant given certain economic conditions.[21] Though this is but one example, it is an exemplar of how high-cost, high-reward situations in environmental policy are not as readily accepted as ones with lower costs and dubious, if any reward.

However, as stated previously, emissions of greenhouse gases from industrial activities have gotten the world into the predicament it faces now; encouraging countries to continue to emit such gases will not solve the problem. One manner of addressing the problem can come from actionable policy. Consider, by way of example, the idea of implementing a Pigovian-type of tax[22] on emitters. By taxing emissions at a flat rate per ton, it incentivizes producers to find new, more environmentally friendly ways to produce their goods because the subsequent emissions reduction acts as a tax cut. In some instances, such as a carbon tax that was approved in Australia, this type of scheme is used as an intermediary before shifting to a full cap-and-trade mechanism. Australia's carbon tax, which was introduced during the summer of 2012, put a price of 23 AUD on every ton of carbon emitted; by 2015, the scheme was due to evolve into a full emissions trading scheme.[23] However, this indirect form of taxation is not always popular with consumers, who may face increased costs when purchasing goods produced by industries

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[18] Just ask Kermit the Frog.

[19] National Renewable Energy Laboratory (U.S.), "Life cycle assessment harmonization results and findings," 21 July 2014, http://www.nrel.gov/analysis/sustain_lca_results.html.

[20] U.S. Energy Information Administration, "How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels?" 29 February 2016, https://www.eia.gov/tools/faqs/aq.cfm?id=74&t=11.

[21] International Energy Agency and Nuclear Energy Agency, "Projected costs of generating electricity," 2015, https://www.iea.org/Textbase/npsum/ElecCost2015SUM.pdf.

[22] A Pigovian tax taxes negative externalities, or deleterious side effects of doing something positive, such as manufacturing products; in this instance, the emission of greenhouses gases such as CO_2 is considered a negative externality of production.

[23] "Carbon tax gets green light in Senate," *Sydney Morning Herald*, 8 November 2011, http://www.smh.com.au/business/carbon-tax-gets-green-light-in-senate-20111108-1n4rp.html.

that produce large amounts of greenhouse gas emissions – a nonscientific poll conducted by the *Melbourne Herald Sun* showed nearly 82% of respondents were opposed to the introduction of a carbon tax in Australia, or with lawmakers who do not support government intervention in the market – Australia's tax passed in the lower house of parliament with 74 members of parliament in favor and 72 against.[24] However, following a general election, the tax was repealed in 2014 before fully coming online,[25] illustrating how changes in domestic governments can have unexpected impacts on environmental policies.

These kinds of policies, though, are not effective everywhere. Accordingly, UNDP promotes the development of sustainable sources of energy generation more prominently. In fact, access to clean, sustainable energy is part of the Sustainable Development Goals, which supplanted the Millennium Development Goals. SDG 7 aims to provide access to affordable and efficient renewable energy for all people,[26] and UNDP works to facilitate these goals through its work. For example, UNDP projects have brought renewable, clean hydropower to Nepal; this in turn promoted increases in school attendance, helped foster more economic growth through business development & improved healthcare quality by making electricity more readily available at a low cost.[27] Relatedly, UNDP's Green Climate Fund helps bankroll energy efficiency schemes around the world to cut costs incurred from older equipment and systems,[28] and more sustainable forms of transportation. These help in the fight against climate change by attacking greenhouse gas emissions at their sources. With fewer gases emitted, populations can start to work on ways to become greener and reduce the impacts they may have had at one point on the environment; because higher emissions can lead to more severe weather events and natural disasters, these methods work to increase the overall resilience of populations in light of potential tragedy.

Conclusion

Climate change is real and happening. It leads to more violent natural disasters, with the potential to wreak havoc on populations worldwide. Accordingly, member-states must adapt a variety of strategies, from mitigation to resilience, in order to prevent being caught off-guard when one invariably afflicts them. UNDP efforts to work with member-

[24] Hudson, Phillip and Matt Johnston, "Protesters disrupt Question Time after carbon bills pass lower house," *Melbourne Herald Sun*, 12 October 2011, http://www.heraldsun.com.au/news/more-news/carbon-tax-bills-pass-lower-house-of-federal-parliament/story-fn7x8me2-1226164570957.

[25] Department of the Environment and Energy (Australia), "Repealing the carbon tax," https://www.environment.gov.au/climate-change/repealing-carbon-tax.

[26] "Climate and disaster resilience: Sustainable energy," UNDP, 2017, http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/sustainable-energy.html.

[27] "Climate and disaster resilience: Energy access," UNDP, 2017, http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/sustainable-energy/energy-access.html.

[28] "Climate and disaster resilience: Energy efficiency," UNDP, 2017, http://www.undp.org/content/undp/en/home/climate-and-disaster-resilience/sustainable-energy/energy-efficiency.html.

states and to foster public-private partnerships to address many of these issues have been good preliminary steps in assisting countries, but more can – and should – be done.

Guiding questions

Has your country experienced any natural disasters of note in recent years? How prepared were officials in handling the aftermath? Does your government have a cabinet/ministerial-level agency or department responsible for preventing, mitigating and responding to natural and man-made disasters?

Has your country taken part in UNISDR plans to foster disaster preparedness plans?

What steps is your country taking to adopt more sustainable forms of energy production?

What kinds of resources does your country lack in adopting proper disaster management plans? Where can it receive help?

United Nations Resolutions:

United Nations General Assembly (UNGA) resolution 71/276 (A/RES/71/276), "Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction" February 2, 2017

United Nations General Assembly resolution 71/226 (A/RES/71/226), "Disaster risk reduction" December 21, 2016

United Nations General Assembly resolution 71/141 (A/RES/71/141), "Protection of persons in the event of disasters" December 13, 2016

United Nations General Assembly resolution 71/128 (A/RES/128), "International cooperation on humanitarian assistance in the field of natural disasters, from relief to development" December 8, 2016

Climate Change Vulnerability Index 2016
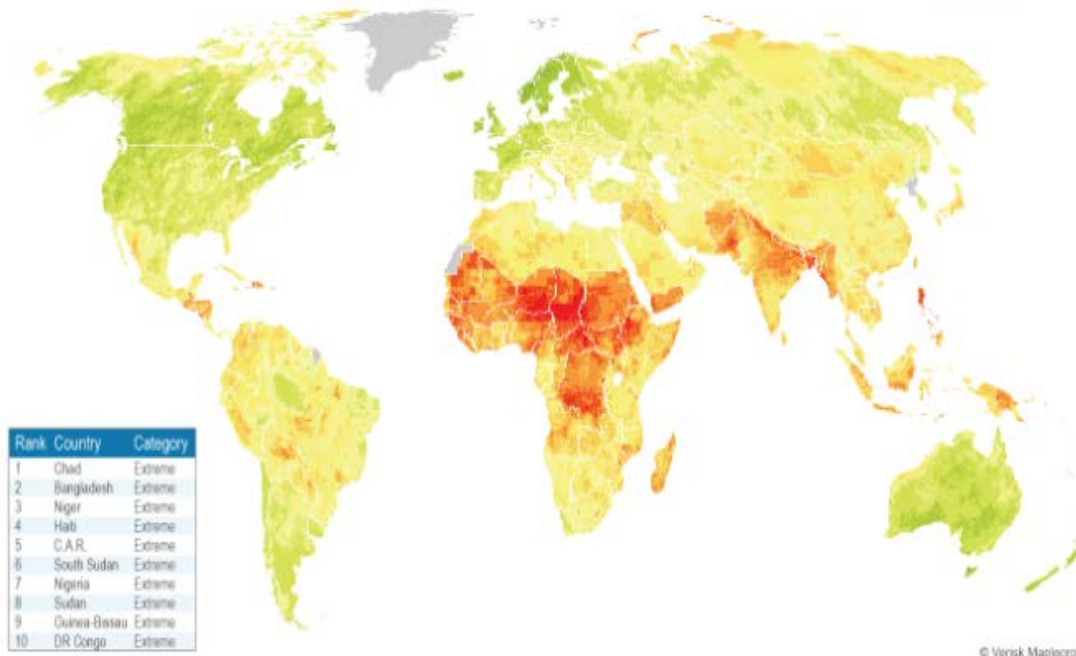
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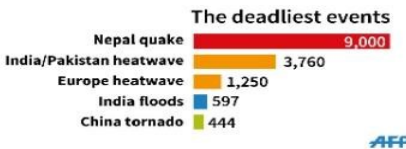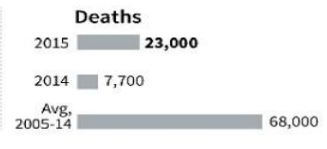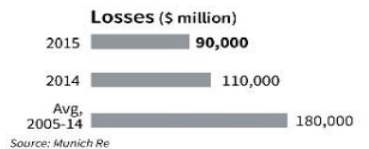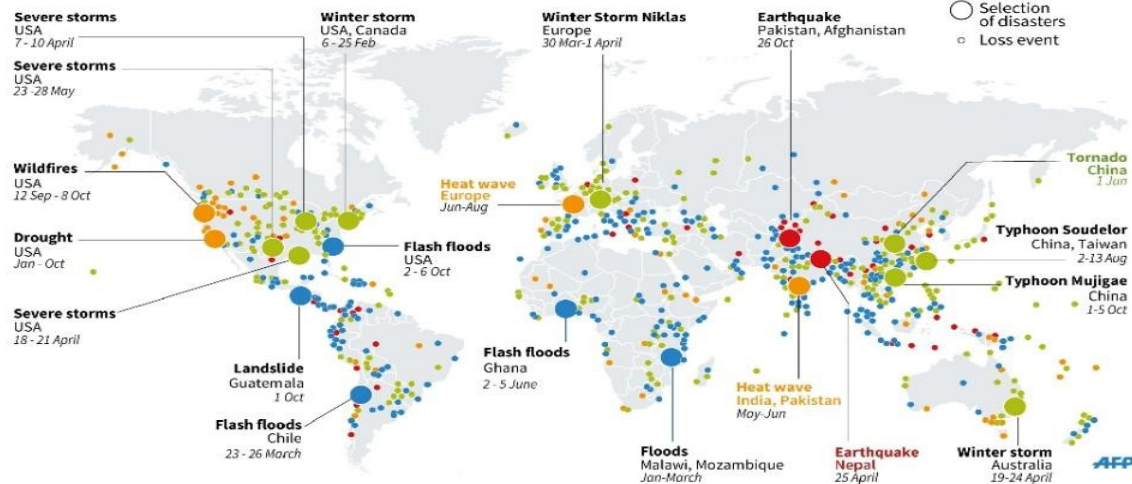| Rank	Country	Category
1	Chad	Extreme
2	Bangladesh	Extreme
3	Niger	Extreme
4	Haiti	Extreme
5	C.A.R.	Extreme
6	South Sudan	Extreme
7	Nigeria	Extreme
8	Sudan	Extreme
9	Guinea-Bissau	Extreme
10	DR Congo	Extreme

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Natural disasters in 2015

Insurers Munich Re recorded 1,060 loss events

Types of disaster

● Earthquake, tsunami, volcano
● Typhoon, hurricane, storm
● Flood, landslide
● Heatwave, drought, forest fire

○ Selection of disasters
○ Loss event

Severe storms USA 7 - 10 April

Severe storms USA 23 -28 May

Wildfires USA 12 Sep - 8 Oct

Drought USA Jan - Oct

Severe storms USA 18 - 21 April

Winter storm USA, Canada 6 - 25 Feb

Flash floods USA 2 - 6 Oct

Landslide Guatemala 1 Oct

Flash floods Chile 23 - 26 March

Winter Storm Niklas Europe 30 Mar-1 April

Heat wave Europe Jun-Aug

Flash floods Ghana 2 - 5 June

Floods Malawi, Mozambique Jan-March

Earthquake Pakistan, Afghanistan 26 Oct

Heat wave India, Pakistan May-Jun

Earthquake Nepal 25 April

Tornado China 1 Jun

Typhoon Soudelor China, Taiwan 2-13 Aug

Typhoon Mujigae China 1-5 Oct

Winter storm Australia 19-24 April

AFP

Losses ($ million)

2015	90,000
2014	110,000
Avg, 2005-14	180,000

Source: Munich Re

Deaths

2015	23,000
2014	7,700
Avg, 2005-14	68,000

The deadliest events

Nepal quake	9,000
India/Pakistan heatwave	3,760
Europe heatwave	1,250
India floods	597
China tornado	444

AFP