BRIEFING PAPER

GLOBAL CLIMATE RISK INDEX 2019

Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017

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GERMANWATCH

Brief Summary

The Global Climate Risk Index 2019 analyses to what extent countries and regions have been affected by impacts of weather-related loss events (storms, floods, heat waves etc.). The most recent data available — for 2017 and from 1998 to 2017 — were taken into account.

The countries and territories affected most in 2017 were Puerto Rico, Sri Lanka as well as Dominica. For the period from 1998 to 2017 Puerto Rico, Honduras and Myanmar rank highest.

This year's 14th edition of the analysis reconfirms earlier results of the Climate Risk Index: less developed countries are generally more affected than industrialised countries. Regarding future climate change, the Climate Risk Index may serve as a red flag for already existing vulnerability that may further increase in regions where extreme events will become more frequent or more severe due to climate change. But the 2017 Atlantic hurricane season also proved: High income countries feel climate impacts more clearly than ever before. Effective climate change mitigation is therefore in the self-interest of all countries worldwide.

At this year's Climate Summit in Katowice (COP24), countries should adopt the 'rulebook' needed for implementing the Paris Agreement, including the global adaptation goal and adaptation communication guidelines. Loss and damage appears as a cross-cutting issue with significant risk of being used as a negotiation chip.

Imprint

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Content

Qualifier:
How to read the Global Climate Risk Index

The Germanwatch Global Climate Risk Index is an analysis based on one of the most reliable data sets available on the impacts of extreme weather events and associated socio-economic data. The Germanwatch Climate Risk Index 2019 is the 14th edition of the annual analysis. Its aim is to contextualize ongoing climate policy debates – especially the international climate negotiations – with real-world impacts during the last year and the last 20 years.

However, the index must not be mistaken for a comprehensive climate vulnerability[1] scoring. It represents one important piece in the overall puzzle of climate-related impacts and associated vulnerabilities but, for example, does not take into account important aspects such as rising sea-levels, glacier melting or more acidic and warmer seas. It is based on past data and should not be used for a linear projection of future climate impacts. Specifically, not too far-reaching conclusions should be drawn for political discussions regarding which country or region is the most vulnerable to climate change. Also, it is important to note that the occurrence of a single extreme event cannot be easily attributed to anthropogenic climate change. Nevertheless, climate change is an increasingly important factor for changing the likelihood of occurrence and the intensity of these events. There is a growing body of research that is looking into the attribution of the risk[2] of extreme events to the influences of climate change.[3]

The Climate Risk Index (CRI) indicates a level of exposure and vulnerability to extreme events, which countries should understand as warnings in order to be prepared for more frequent and/or more

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[1] According to IPCC (2014b) we define vulnerability as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt".

[2] According to IPCC (2012) we define disaster risk as "the likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

[3] See, for instance: Herring et al. (2018), Trenberth et al. (2018), Zhang et al. (2016); Hansen et al. (2016); Haustein et al. (2016) & Committee on Extreme Weather Events and Climate Change Attribution et al. (2016); Stott et al. (2015)

severe events in the future. Not being mentioned in the CRI does not mean there are no impacts occurring in these countries. Due to the limitations of the available data, particularly long-term comparative data, including socio-economic data, some very small countries, such as certain small island states, are not included in this analysis. Moreover, the data only reflects the *direct* impacts (direct losses and fatalities) of extreme weather events, whereas, for example, heat waves – which are a frequent occurrence in African countries – often lead to much stronger *indirect* impacts (e.g. as a result of droughts and food scarcity). Finally, the index does not include the total number of affected people (in addition to the fatalities) since the comparability of such data is very limited.

Key messages

- Puerto Rico, Sri Lanka and Dominica were at the top of the list of the most affected countries in 2017.
- Between 1998 and 2017, Puerto Rico, Honduras and Myanmar were the countries most affected by extreme weather events.
- Altogether, more than 526 000 people died as a direct result of more than 11 500 extreme weather events; and losses between 1998 and 2017 amounted to around US$ 3.47 trillion (in Purchasing Power Parities).
- Storms and their direct implications – precipitation, floods and landslides – were one major cause of damage in 2017. Of the ten most affected countries in 2017, four were hit by tropical cyclones. Recent science has found a clear link between climate change and record-breaking precipitation of 2017's hurricanes. It also suggests that the number of severe tropical cyclones will increase with every tenth of a degree in global average temperature rise.
- In many cases, single exceptional disasters have such a strong impact that the countries and territories concerned are also ranked high in the long-term index. Over the last few years another category of countries has been gaining relevance: Countries like Haiti, the Philippines and Pakistan that are recurrently affected by catastrophes continuously rank among the most affected countries both in the long-term index and in the index for the respective year.
- Of the ten most affected countries and territories (1998–2017), eight were developing countries in the low income or lower-middle income country group, one was classified as an upper-middle income country (Dominica) and one an advanced economy generating high income (Puerto Rico).
- The Climate Summit in Katowice should adopt the 'rulebook' needed for the implementation of the Paris Agreement, including the global adaptation goal and adaptation communication guidelines. Furthermore, COP24 must increase efforts to properly address loss and damage, which appears as a cross-cutting issue referenced throughout various negotiation streams, with significant risk of being omitted from final negotiation text. The risks of future climate-related losses and damages are far too severe to simply function as a negotiation chip.

1 Key Results of the Global Climate Risk Index 2019

People all over the world have to face the reality of climate change – in many parts of the world manifesting as increased volatility of extreme weather events. Between 1998 and 2017, more than 526 000 people died worldwide and losses of US$ 3.47 trillion (in PPP) were incurred as a direct result of more than 11 500 extreme weather events. The UNEP Adaptation Gap Report 2016 warns of increasing impacts and resulting increases in global adaptation costs by 2030 or 2050 that will likely be much higher than currently expected: "[...] two-to-three times higher than current global estimates by 2030, and potentially four-to-five times higher by 2050".[4] Costs resulting from residual risks or unavoidable loss and damage are not covered in these numbers. Similarly, the Intergovernmental Panel on Climate Change (IPCC) estimates in its recent Special Report on "Global Warming of 1.5°C" that the "mean net present value of the costs of damages from warming in 2100 for 1.5°C and 2°C (including costs associated with climate change-induced market and non-market impacts, impacts due to sea level rise, and impacts associated with large scale discontinuities) are $54 and $69 trillion, respectively, relative to 1961–1990".[5] This gives the indication that the gap between necessary financing to deal with climate induced risks and impacts is even bigger than earlier projected. On the other hand, the report highlights the importance of enhanced mitigation action towards limiting global temperature increase to below 2°C or even 1.5°C, which can avoid substantive costs and hardships.[6]

The **Global Climate Risk Index (CRI)** developed by Germanwatch analyses quantified impacts of extreme weather events[7] – both in terms of fatalities as well as economic losses that occurred – based on data from the Munich Re NatCatSERVICE, which is worldwide one of the most reliable and complete databases on this matter. The CRI examines both absolute and relative impacts to create an average ranking of countries in four indicating categories, with a stronger emphasis on the relative indicators (see chapter "Methodological Remarks" for further details on the calculation). The countries ranking highest (figuring in the "Bottom 10"[8]) are the ones most impacted and should consider the CRI as a warning sign that they are at risk of either frequent events or rare, but extraordinary catastrophes.

The CRI does not provide an all-encompassing analysis of the risks of anthropogenic climate change, but should be seen as just one analysis explaining countries' exposure and vulnerability to climate-related risks based on the most reliable quantified data – along with other analyses.[9] It is based on the current and past climate variability and – to the extent that climate change has already left its footprint on climate variability over the last 20 years – also on climate change.

Countries most affected in 2017

Puerto Rico, **Sri Lanka** and **Dominica** were the most affected countries in 2017 followed by **Nepal**, **Peru** and **Vietnam**. Table 1 shows the ten countries that were most affected in 2017, with their average weighted ranking (CRI score) and the specific results relating to the four indicators analysed.

[4] UNEP 2016, p. xii
[5] IPCC 2018a, p 153
[6] Ibid. 2018a
[7] Meteorological events such as tropical storms, winter storms, severe weather, hail, tornados, local storms; hydrological events such as storm surges, river floods, flash floods, mass movement (landslide); climatological events such as freezing, wildfires, droughts.
[8] The term "Bottom 10" refers to the 10 most affected countries in the respective time period.
[9] See e.g. analyses of Columbia University; Maplecroft's Climate Change Vulnerability Index

Table 1: The Climate Risk Index for 2017: the 10 most affected countries

Ranking 2017 (2016)	**Country**	**CRI score**	Death toll	Deaths per 100 000 inhabitants	Absolute losses (in million US$ PPP)	Losses per unit GDP in %	Human Development Index 2017[10]
1 (105)	Puerto Rico[11]	1.50	2 978	90.242	82 315.240	63.328	-
2 (4)	Sri Lanka	9.00	246	1.147	3 129.351	1.135	76
3 (120)	Dominica	9.33	31	43.662	1 686.894	215.440	103
4 (14)	Nepal	10.50	164	0.559	1 909.982	2.412	149
5 (39)	Peru	10.67	147	0.462	6 240.625	1.450	89
6 (5)	Vietnam	13.50	298	0.318	4 052.312	0.625	116
7 (58)	Madagascar	15.00	89	0.347	693.043	1.739	161
8 (120)	Sierra Leone	15.67	500	6.749	99.102	0.858	184
9 (13)	Bangladesh	16.00	407	0.249	2 826.678	0.410	136
10 (20)	Thailand	16.33	176	0.255	4 371.160	0.354	83

PPP = Purchasing Power Parities. GDP = Gross Domestic Product.

Puerto Rico (1) and **Dominica** (3) were severely hit by hurricane Maria in September 2017. When Hurricane Maria hit the Caribbean Islands, the regional hurricane category strength changed from category 4 to 5. After making landfall in Dominica, the intensity of the storm decreased to category 4, then Maria moved over Puerto Rico and covered almost the whole island.[12] The islands' infrastructure was almost completely destroyed by Maria. Most of the people in this region lived without electricity for months as the hurricane brought down the already dilapidated power grid.[13] Maria was the first Category 4 storm to directly lash Puerto Rico since 1932, and the second strongest cyclone after hurricane Irma (2017) to make landfall in Dominica.[14] The government of Puerto Rico later drastically corrected the number of fatalities upwards – from 64 to 2 975 dead; in Dominica the storm left over 31 dead.[15] In Dominica, the hurricane caused around US$ 1.2 billion in damages.[16] Thousands of people were left without homes and 90% of the country's roofs were destroyed.[17]

In May 2017, heavy landslides and floods occurred in **Sri Lanka** (2) after strong monsoon rains in southwestern regions of the country.[18] More than 200 people died after the worst rains on the Indian Ocean island since 2003.[19] The monsoons displaced more than 600 000 people from their homes

[10] Human Development Indices and Indicators 2018 Statistical Update
[11] Note: Puerto Rico is no independent national state but an unincorporated territory of the United States. Still, based on its geographical location and socio-economic indicators Puerto Rico has different conditions and exposure to extreme weather events than the rest of the USA. The Global Climate Risk Index aims to provide a comprehensive and detailed overview about which countries and regions are particularly affected by extreme weather events. Therefore, Puerto Rico was considered separately in our analysis.
[12] Munich RE 2017a
[13] Süddeutsche Zeitung 2018
[14] The Washington Post 2017
[15] Süddeutsche Zeitung 2018
[16] BBC 2017
[17] The New York Times 2018
[18] CNN 2017c
[19] The Guardian 2017a

and 12 districts were affected.[20, 21] The inland southwest district of Ratnapura was most affected where over 20 000 people faced flash floods.[22]

Massive rainfalls have led to floods across **Nepal** (4), **Bangladesh** (9) and **India** (14), which affected more than 40 million people. 1 200 people lost their lives in these three countries and millions were displaced throughout the region.[23, 24] The floods spread across the foothills of the Himalayas and brought landslides leaving tens of thousands of houses and vast areas of farmland and roads destroyed.[25] Nepal experienced flash floods and landslides in August across the southern border, amounting to US$ 600 million in damages.[26] Nearly 250 people were killed by collapsed buildings or drowning in regions of India, Nepal and Bangladesh. 950 000 houses were damaged or destroyed in the floods.[27]

In March 2017, heavy rainfall killed 67 people and damaged 115 000 homes in **Peru** (5).[28] Peru's worst floods in the last few decades came after an extreme drought.[29] Weather experts describe the phenomenon as a "coastal El Niño" – a very infrequent, localized version of the el Niño phenomenon, which was last seen nearly one century ago.[30] During El Niño, the middle and often also the eastern part of the tropical Pacific heat up due to changes in ocean currents. El Niños occur about every two to seven years. Rising water temperatures due to climate change have had and will continue to have an increasing impact on weather patterns.[31] This natural disaster of 2017 caused US$ 3.1 billion (circa GBP 2.5 bn) of damage.[32]

Vietnam's (6) persistent weather extremes in 2017 included storms, typhoons and droughts. Storms in April 2017 destroyed thousands of houses, 21 people were injured and the infrastructure was damaged.[33] In the summer, the tropical storms Kirogi and Talas made landfall in Vietnam, leaving over 15 dead.[34] At least 100 people lost their lives because of a typhoon and ensuing floods in November of the same year.[35] The typhoon Damrey, with winds of 135km/h, hit more than 80 000 homes. Water supplies were destroyed.[36]

Madagascar (7) was hit by the biggest storm for more than a decade in March 2017. Cyclone Enawo affected Madagascar's north-east coast with winds of up to 290km/h.[37] In particular, the devastating quantities of water on the deforested slopes of the country's high plateau led to major floods and landslides. 270 000 people lost their homes and more than 80 died.[38] Enawo was similar to Cyclone Ivan, which hit 525 000 people on the island in 2008 displacing 195 000 of them.[39] In figures, Cyclone Enawo has affected 58 districts and 433 000 people, leaving 81 of them dead, 253 injured and

[20] The Guardian 2017h
[21] Reliefweb 2017a
[22] Ibid.
[23] The New York Times 2017
[24] The Guardian 2017b
[25] Ibid.
[26] The Diplomat 2018
[27] CNN, 2017a
[28] The Guardian 2017c
[29] Ibid.
[30] Ramírez and Briones 2017
[31] Neue Zürcher Zeitung 2017
[32] The Guardian 2017d
[33] Independent 2017
[34] Forbes 2017
[35] The Guardian 2017e
[36] Ibid.
[37] The Guardian 2017f
[38] Ibid.
[39] OCHA 2017a

246 842 displaced. More than 83 000 houses were damaged and critical infrastructure was destroyed and there was also extreme damage to food reserves.[40]

After devastating mudslides with nearly 500 dead in **Sierra Leone** (8) the country is facing significant health challenges, like cholera and malaria.[41] Rising floods were caused as massive landslides slipped into the Babadorie River.[42] After these weather extremes, more than 20 000 people were displaced in August 2017, including 5 000 children.[43] The extreme weather caused US$ 31.65 million of damage.[44]

Heavy floods also occurred in **Thailand** (10) in 2017. At the beginning of the year, the rain lasted well into the dry season, causing floods in the south, disrupting road and rail links and affecting some 1.6 million people.[45] More than 40 people lost their lives in January alone.[46] Extreme rainfall in southern Thailand triggered a tidal wave that claimed at least 18 lives and partially flooded thousands of villages.[47] In addition, the rains turned roads into rivers, flooded farmland and damaged more than 1 500 schools in the region.[48] Extreme rainfall totaling over 700 mm was measured over the Gulf of Thailand.[49]

Countries most affected in the period 1998–2017

Puerto Rico, Honduras and **Myanmar** have been identified as the most affected countries in this 20-year period. They are followed by **Haiti, Philippines,** and **Nicaragua**. Table 2 shows the ten most affected countries in the last two decades with their average weighted ranking (CRI score) and the specific results relating to the four indicators analysed.

Table 2: The Long-Term Climate Risk Index (CRI): the 10 countries most affected from 1998 to 2017 (annual averages)

CRI 1998–2017 (1997–2016)	**Country**	**CRI score**	Death toll	Deaths per 100 000 inhabitants	Total losses in million US$ PPP	Losses per unit GDP in %	Number of events (total 1998–2017)
1 (100)	Puerto Rico	7.83	150.05	4.061	5 033.16	4.204	25
2 (1)	Honduras	13.00	302.45	4.215	556.56	1.846	66
3 (3)	Myanmar	13.17	7 048.85	14.392	1 275.96	0.661	47
4 (2)	Haiti	15.17	281.30	2.921	418.21	2.642	77
5 (5)	Philippines	19.67	867.40	0.971	2 932.15	0.576	307
6 (4)	Nicaragua	20.33	163.60	2.945	223.25	1.009	45
7 (6)	Bangladesh	26.67	635.50	0.433	2 403.84	0.640	190
8 (7)	Pakistan	30.17	512.40	0.315	3 826.03	0.567	145
9 (8)	Vietnam	31.67	296.40	0.350	2 064.74	0.516	220
10 (44)	Dominica	33.00	3.35	4.718	132.59	21.205	8

[40] The Watchers 2017
[41] CNN 2017b
[42] Reliefweb 2017b, p. 1
[43] CNN 2017b
[44] The Guardian 2017d
[45] Reuters 2017
[46] Ibid.
[47] The Guardian 2017g
[48] Ibid.
[49] NASA 2017

Compared to the CRI 2018, which considered the period from 1997 to 2016,[50] there has been a change at the top of the CRI ranking: the devastation of Hurricane Maria promotes Puerto Rico to the top of the list, with Dominica entering at 10th place. Besides that, almost all countries that made the Bottom 10 last year appear again in this year's edition. Honduras and Myanmar remain among the top three most affected countries over the past two decades. These rankings are attributed to the aftermath of exceptionally devastating events such as Hurricane Mitch in Honduras. Likewise, Myanmar has been struck hard, most notably by Cyclone Nargis in 2008, responsible for an estimated loss of 140 000 lives as well as the property of approximately 2.4 million people.[51]

Particularly in relative terms, poorer developing countries are hit much harder. These results emphasise the particular vulnerability of poor countries to climatic risks, despite the fact that the absolute monetary losses are much higher in richer countries. Loss of life, personal hardship and existential threats are also much more widespread especially in low-income countries.

Exceptional catastrophes or continuous threats?

The Global Climate Risk Index 1998–2017 is based on average values over a twenty-year period. However, the list of countries featured in the long-term Bottom 10 can be divided into two groups: those that have a high ranking due to exceptional catastrophes and those that are continuously affected by extreme events.

Countries falling into the former category include Myanmar, where Cyclone Nargis in 2008 caused more than 95% of the damage and fatalities in the past two decades, and Honduras, where more than 80% of the damage in both categories was caused by Hurricane Mitch in 1998. The latest addition to this group is Puerto Rico, where Hurricane Maria in 2017 accounted for over 90% of the total damage of the past 20 years. With new superlatives like Hurricane Patricia in October 2015 being the strongest land-falling pacific hurricane on record, it seems to be just a matter of time until the next exceptional catastrophe occurs.[52] Cyclone Pam, that severely hit Vanuatu in March 2015, once again showed the vulnerability of Least Developed Countries (LDCs) and Small Island Developing States (SIDS) to climate risks.[53] The 2017 hurricane season also left a lot of damage behind and cost human lives[54] (see chapter 2).

The appearance of some European countries among the Bottom 30 countries[55] can to a large extent be attributed to the extraordinary number of fatalities due to the 2003 heat wave, in which more than 70 000 people died across Europe. Although some of these countries are often hit by extreme events, the relative economic losses and the fatalities are usually relatively minor compared to the countries' populations and economic power.

The link between climate change and extreme weather events

Climate change-related impacts stemming from extreme events such as heat waves, extreme precipitation and coastal flooding can already be observed as the Fifth Assessment Report of the Intergovernmental Panel on Climate Change from 2014 (IPCC) stresses.[56] The frequency of heat waves has increased in large parts of Europe, Asia and Australia. Likewise, the number of heavy precipitation events has risen in most land regions. Especially in North America and Europe, the frequency or intensity of heavy precipitation events has increased.[57]

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[50] See Eckstein et al. 2017
[51] See OCHA 2012
[52] The Weather Channel 2015
[53] BBC 2015
[54] Munich RE 2017b
[55] The full rankings can be found in the Annexes.
[56] IPCC 2014a, p.12
[57] IPCC 2013, p.3

The IPCC has already predicted that risks associated with extreme events will continue to increase as the global mean temperature rises.[58] However, the link between certain weather events and climate change is still a frontier in science. In general, many studies conclude that “the observed frequency, intensity, and duration of some extreme weather events have been changing as the climate system has warmed”.[59] Nevertheless, it is not easy to investigate the impact of climate change on a single weather event as different regional circumstances need to be taken into account and data might be very limited.[60] Over the past few years more and more research has been conducted on the attribution of extreme events to climate change, i.e. in how far anthropogenic climate change has contributed to the events’ likelihood and strength.[61] In the field known as Probabilistic Event Attribution (PEA), based on climate model experiments, studies compare the probability of an extreme weather situation, in today’s world with human-caused greenhouse gas emissions, to a world without human induced climate change.[62] Due to methodological improvement, “fast track attribution” is now more feasible and can be undertaken within months of the event.[63] Additionally, more knowledge is generated about how underlying factors contributing to extreme weather are influenced by global warming. For example, higher temperatures intensify the water cycle, leading to more droughts as well as floods due to drier soil and increased humidity.[64] Of course, these approaches can only make statements about the change in probability of a certain event happening.

Considering this, the report “Explaining Extreme Events of 2016 From a Climate Perspective” offered new findings. It has been published on an annual basis since 2012 by The American Meteorological Society in its bulletin, analyzing selected extreme weather events with regard to the influence of human made climate change on them. [65] Out of the 27 papers examined in the most recent edition covering 2016, 21 “identified climate change as a significant driver of an event”[66]. Among others, a link between anthropogenic climate change and the drought in southern Africa in 2015/16 was found.[67] Furthermore, for the first time in the six-year appearance of the report, three of the papers concluded that “the extreme magnitude of a particular weather event was not possible without the influence of human-caused climate change”.[68]

The data on countries in the CRI 2019 show how destructive extreme precipitation can be, namely through the floods and landslides which have hit many regions in South and South East Asia and Africa – regions which now feature in the Bottom 10. Extreme precipitation is expected to increase as global warming intensifies the global hydrological cycle. Thereby, single precipitation events are expected to increase at a higher rate than global mean changes in total precipitation, as outlined by Donat et al. 2016. Furthermore, those increases are expected in wet as well as dry regions.[69] A study by Lehmann et al. 2015 strengthens the scientific link between record-breaking rainfall events since 1980 and rising temperatures. According to the scientists, the likelihood of a new extreme rainfall event being caused by climate change reached 26% in 2010.[70] A recent study by Blöschel et al. 2017 concludes that the timing of floods is shifting due to climate change. The research focuses on Europe and shows that floods occur earlier in the year, posing timing risks to people and animals.

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[58] IPCC 2014a, p.12
[59] Committee on Extreme Weather Events and Climate Change Attribution et al. 2016, p. 2
[60] Hansen et al. 2016
[61] Stott et al. 2015
[62] Carbon Brief 2014
[63] Haustein et al. 2016
[64] WMO 2017
[65] Herring et al. 2018, the report covering 2017 is expected to be available early 2019
[66] Herring et al. 2018, p. Sii
[67] Yuan, Wang, & Wood 2018
[68] Herring et al. 2018, p. S1
[69] Donat et al. 2016
[70] Lehmann et al. 2015

Flooding rivers affect more people worldwide than other natural disaster and account for multibillion dollars in damage annually.[71] Nevertheless, the study is not fully able to single out human-induced global warming as a cause – a problem researchers on extreme weather attribution are still facing.

Researchers also found evidence that sea surface temperature plays a key role in increasing storm wind speeds and precipitation.[72] Another study on this subject showed that the rainfall during storms like Hurricane Harvey in 2017 is equivalent to the amount of evaporation over the ocean and thus the corresponding cooling effect of tropical cyclones on sea temperature. It is difficult to distinguish between natural variability and human-induced extremes, but the rising sea level, which is largely caused by climate change, is responsible for the increased intensity of floods, storms and droughts. For example, a study shows that the 2016 torrential rains in Louisiana, USA, are now 40 percent more likely than in pre-industrial times. The rainfall was increased because the storm was able to absorb abnormal amounts of tropical moisture on its way to the US coast, releasing three times the precipitation of Hurricane Katrina in 2005.[73] Another example is a regional model used to analyse the occurrence of heat waves in India, finding causalities regarding the 2016 heat wave and climate change. The model indicated that sea surface temperatures influence the likelihood of record-breaking heat.[74] Other studies have found similar results. A publication regarding the 2015 Southern African droughts also found causalities with regards to sea surface temperatures causing reduced rainfall, and increased local air temperatures.[75] Moreover, the above mentioned study from 2018 concludes that Hurricane Harvey could not have produced such an enormous amount of rain without human caused climate change.[76]

Furthermore, there is increasing evidence on the link between extreme El Niño events and global warming. As a simulation by Cai et al. 2014 showed, the occurrence of such events could double in the future due to climate change.[77] In addition, the IPCC's Special Report "Global Warming of 1.5°C" was published in October 2018. It aimed to determine the difference in consequences of 1.5°C climate change compared to 2°C. For that, it investigated effects of past global warming of the same degree. It identifies trends of increasing intensity and frequency of weather extremes during the past 0.5°C global warming. Furthermore, it shows that, at least in some regions, the likelihood of droughts and heavy precipitation is higher under a climate change of 2°C, compared to one of 1.5°C.[78]

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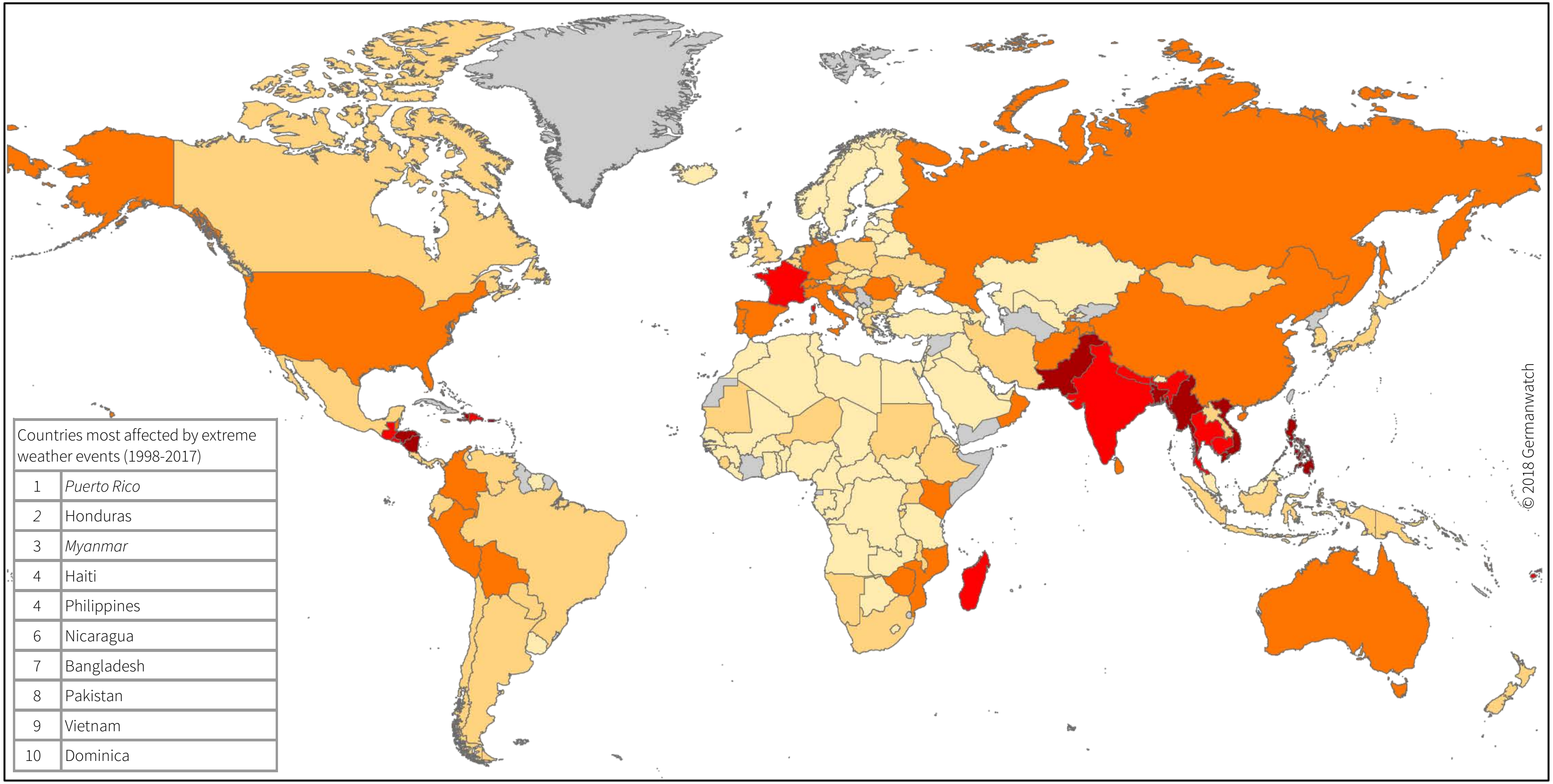
[71] Blöschl et al. 2017
[72] Trenberth et al. 2015; Zhang et al. 2016
[73] Climate Central 2016a
[74] Climate Central 2016b
[75] Funk et al. 2016
[76] Trenberth et al. 2018
[77] Cai et al. 2014
[78] IPCC 2018a



Countries most affected by extreme weather events (1998-2017)	
1	*Puerto Rico*
2	Honduras
3	*Myanmar*
4	Haiti
4	Philippines
6	Nicaragua
7	Bangladesh
8	Pakistan
9	Vietnam
10	Dominica

Italics: Countries where more than 90% of the losses or deaths occurred in one year or event

Climate Risk Index: Ranking 1998 - 2017 1- 10 | 11 - 20 | 21 - 50 | 51 - 100 | >100 | No data

Figure 1: World Map of the Global Climate Risk Index 1998–2017

Source: Germanwatch and Munich Re NatCatSERVICE

2 Stormy Prospects for COP24

The powerful rotating storm systems that appear in the Indian, Atlantic and Pacific Ocean are known as tropical cyclones. In 2017, these cyclones impacted millions of people and caused an extremely large number of losses and a great deal of damage. The 2017 Atlantic hurricane season really stood out: With ten hurricanes between 7 August and 15 October, six of which were categorized as major ones, the season was extremely active (Figure 2). The devastating impacts of hurricanes like Maria, Irma, Harvey and Nate were all over the news. Hurricane Irma even broke records being the most powerful hurricane ever recorded over the Atlantic. Harvey also set a record as the storm which brought the most rain to the continental United States.[79] Measuring the combined intensity and duration of the storms based on the Accumulated Cyclone Energy index, the hurricane season in 2017 was the seventh most active season since records started in 1851 and the most active one since 2005.[80]

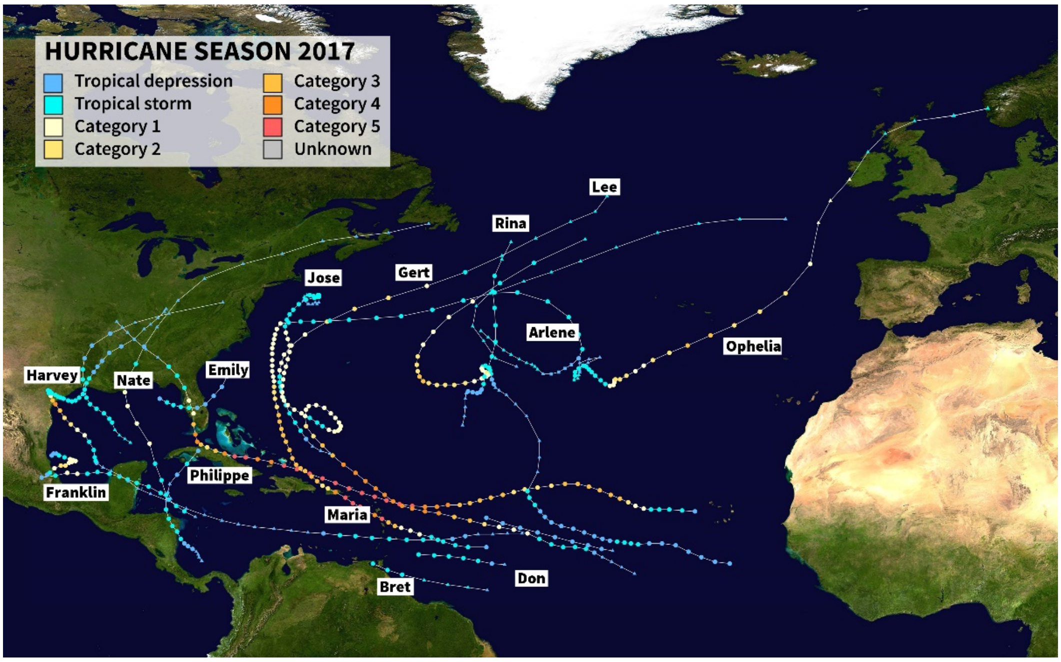


Figure 2: Atlantic Hurricane Season 2017
Source: Wikimedia Commons/public domain (amended), background image by NASA

Tropical cyclones have different names depending on where they occur. In the Atlantic and Northeast Pacific, the weather phenomenon is described by the term hurricane whereas the term cyclone is used when the storm occurs in the South Pacific and Indian Ocean. The term typhoon describes the same weather event in the Northwest Pacific. Moreover, such storms have different scales to classify their intensity depending on the region where they occur. There are at least five common tropical cyclone scales and all are based on wind speeds. The line between storms and tropical cyclones is drawn very differently in different regions of the world, which makes it difficult to compare the storms based on categories. For example, a cyclone in Australia and Fiji starts at 63 km/h, while a hurricane will only be defined as such from 119 km/h upwards. Then again, the highest category of hurricanes – category five – starts at 252 km/h. In Australia and Fiji, a cyclone has to reach 280 km/h to reach the highest classification, which is also named category five.

[79] Blake & Zelinsky 2018
[80] NOAA 2017

As the seventh most active hurricane season since records began in 1851 and the most active one since 2005[81], it may come as no surprise that the 2017 hurricane season was very costly. Worldwide damage from storms amounted to an estimated sum of US$369.6 billion, being the second most-costly year since 1960.[82] Of this, the hurricanes that hit the United States alone caused roughly US$200 billion in damage, making it the costliest season for the US ever.[83] But costs of course are only one aspect of the situation. The poorest and often most vulnerable people have less costly property that may be damaged by a hurricane, but the catastrophic impact on their livelihoods is much greater.

How tropical cyclones form

Vast amounts of water evaporate; humid air ascends spinning around an eye, creating a self-reinforcing process fueled by ever warmer humid air. Once tropical cyclones hit the shore, this supply is interrupted and the storm weakens. Highest wind speeds are reached directly around the eye at the so-called eye-wall. Precipitation is most intense in that area as well. Huge storms can have several eyewalls.

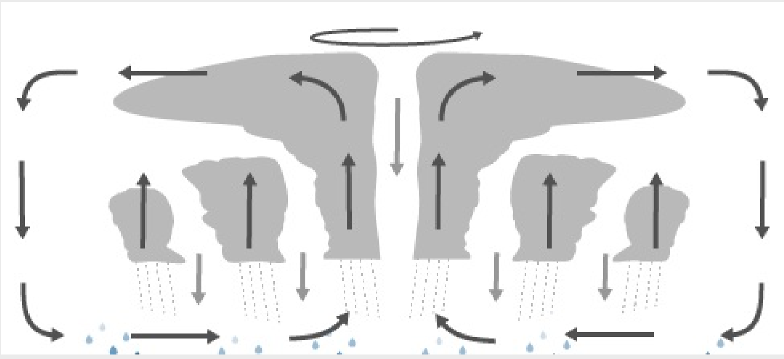


Illustration: eskp.de/CC-BY (modified).

For a tropical cyclone to form, several conditions need to be fulfilled. Usually sea temperature has to reach 26.5°C down to 50 meters below sea level. The atmosphere needs to be unstable i.e. there has to be a significant difference in air temperature at different altitudes allowing for convection. In contrast, the (vertical) wind shear should be low, otherwise the energy will be scattered over an area too large to form a strong storm. This is the main reason why tropical cyclones are extremely rare in the Southern Atlantic Ocean (NASA, 2004). High humidity in the lower to middle levels of the troposphere – the lowest layer of the Earth's atmosphere and the one where most weather takes place – contributes to the convection of air masses. Furthermore, sufficient Coriolis force is needed. Last but not least, tropical cyclones do not form out of nowhere. They need at least some form of disturbance close to the surface with a horizontal inflow of air (convergence) and a certain degree of horizontal circulation (vorticity) (NOAA 2018).

As outlined through the results of our index, the Caribbean was struck especially hard – mostly by Hurricane Maria – with unprecedented levels of destruction.[84] More than 160 000 people were directly affected and many more indirectly.[85] **Puerto Rico** (1) and **Dominica** (3) suffered with almost

[81] NOAA 2017
[82] Sullivan 2017
[83] Ibid.
[84] OCHA 2017b
[85] UNDP 2017

all their infrastructure on the islands being destroyed and a reversal of their socioeconomic development.[86] A review by the World Meteorological Organisation (WMO) on the hurricane season in the Caribbean came to the conclusion that significant changes to early warning systems are necessary in order to strengthen resilience. To this end, a regional strategy must be put in place that addresses the critical challenges and strengthens institutions, increases resources and builds more resilient operational structures.[87] Though forecasts were generally accurate and timely, rapid changes in intensity – especially for hurricane Maria in Dominica – were challenging. In order to include impact-based forecasting, warnings of secondary hazards, such as flooding and coastal inundation must be improved as they were found to be insufficient. Furthermore, risk assessment and response plans were not sufficiently connected and risk knowledge in general was limited.[88]

Though cyclone seasons in other regions were not overly active in 2017, this does not mean that these regions did not suffer harshly from the impacts of tropical cyclones. **Vietnam** and **Madagascar**, ranking number 6 and 7, both were hit by storms that led to the loss of life, injuries and the destruction of homes as well as causing other severe damage to, inter alia, critical infrastructure (see Table 3). Furthermore, some countries were still in the process of recovering from the previous year's impacts. For instance, Fiji struggled to cope with the losses and damage produced by cyclone Winston in 2016 – the strongest cyclone on record to hit the Southern hemisphere.[89]

The impact of the tropical cyclones in 2017 should send a stark signal that knowledge about and pre-hazard responses to existing vulnerabilities and risk exposure in the Caribbean and other regions remains a critical issue – even more so with expected increasing impacts of climate change on the behaviour of tropical cyclones. Communities that have been hit by cyclones are often left more vulnerable to other hazards and impacts of climate change. Furthermore, they have fewer resources available to respond to future impacts and lack the ability to deal with such events adequately as they lack the institutional, financial or technological capacity to do so.[90] Understandably, focus is often put on short-term needs in the aftermath of a disaster. This, however, leaves fewer resources available to the much needed adaptation projects and risk management strategies. Hence, integrated risk management strategies are required that include prevention, preparation, response, recovery and the management of residual risk.

[86] WMO 2018
[87] Ibid.
[88] Ibid.
[89] Voiland 2016
[90] Thomas et al. 2018

How will climate change affect tropical cyclones?

There is little doubt that climate change will bring about the following challenges:

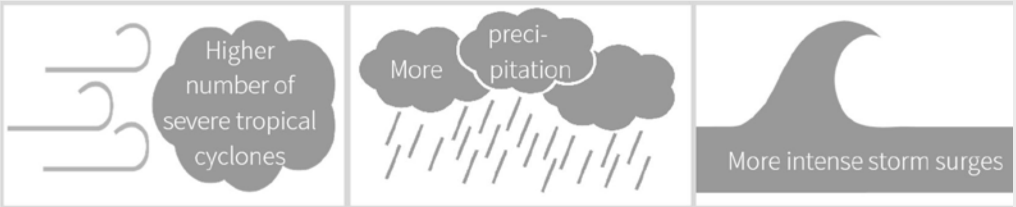


Illustration: Germanwatch

If climate change is limited to 1.5°C or even 2°C, the total *number* of tropical cyclones is actually expected to decrease. However, according to the recent IPCC Special Report, this is not good news as the *intensity* of the storms is likely to increase and more of the highest category tropical cyclones will occur. This is due to warmer oceans working like fuel: the heat provides more energy to feed the storms, hence making them stronger and thus potentially more damaging. In addition, warmer air can absorb more moisture leading to a rise in precipitation coming with the storms. Tropical cyclones are also getting slower. As a consequence, they can release more rain on the affected area,[91] although a scientific debate about that continues.[92] Peak winds and precipitation will thereby most likely increase more significantly if average temperatures rise by 2°C compared to if they only rise by 1.5°C.[93] Further rises in sea levels will result in more severe storm surges.

The 2017 hurricane season provided an insight into what we might have to deal with worldwide in the future. In the Gulf of Mexico, research showed that storms intensified much faster shortly before they hit landfall as a result of the warmer waters.[94] Furthermore, there is scientific evidence that Harvey's exceptional amounts of precipitation can be directly linked to the temperature of the sea surface, which in turn, is increased by climate change.[95] 2017 was the hottest year ever recorded for the world's oceans.[96] The succession of storms also plays a significant role for the affected countries. Even if the number and the intensity of tropical cyclones do not change, the burden can increase if they appear in a more rapid succession. A series of storms does not leave time for much needed disaster relief – let alone recovery or reconstruction. In 2017, Harvey, Irma and Maria – three hurricanes of the two highest categories – plagued the Western Atlantic, with Irma and Maria even reaching the highest category. Only once before have two hurricanes of the highest magnitude made landfall in a single year.

As tropical cyclones pose similar threats all over the world, sharing knowledge and best practices is crucial. Australia has noted successes by tightening building codes: buildings are required to be constructed in a way that makes them less vulnerable to extreme winds.[97] In Bangladesh, a dense network of small cyclone shelters, in vulnerable areas, that can also serve as everyday public buildings, such as schools, has proven much more efficient than large scale cyclone centres.[98] Combined with a swift early-warning system this has reduced fatalities dramatically.[99] Another development in

[91] Kossin 2018
[92] Guglielmi, G., 2018
[93] IPCC 2018b, Patricola & Wehner 2018
[94] Emanuel 2018
[95] Trenberth et al. 2018, IPCC 2018b
[96] Cheng & Zhu, 2018
[97] Mason & Haynes 2010
[98] Haque et al. 2012
[99] Ibid.

Bangladesh is growing crops on floating rafts, which can at least help to minimize flood damage.[100] Furthermore, there are community-based adaptation projects aimed at building better flood barriers.[101] Planting mangrove trees can prevent coastal erosion,[102] a solution that is now used in, for example, Puerto Rico.[103] In case of an emergency, awareness and preparation are key for people to be able to react swiftly. Training and checklists can support this,[104] and evacuation plans are essential.[105] Furthermore, there is the possibility of large-scale engineering projects like floodgates and dams. Such measures, however, are expensive, and often have adverse impacts on ecosystems.

Table 3: The 10 countries with the highest CRI score which were hit by tropical cyclones in 2017

Ranking CRI	Country	CRI score	Death toll	Deaths per 100 000 inhabitants	Absolute losses in US$ million (PPP)	Losses per unit GDP in %
1	Puerto Rico	1.50	2 978	90.242	82 315.24	63.33
3	Dominica	9.33	31	43.662	1 686.89	215.44
6	Vietnam	13.50	298	0.318	4 052.31	0.62
7	Madagascar	15.00	89	0.347	693.04	1.74
12	United States	19.83	389	0.119	177 981.95	0.91
13	Antigua and Barbuda	20.67	3	3.297	1 101.44	45.93
20	Philippines	33.17	250	0.238	505.78	0.06
21	Costa Rica	33.83	11	0.221	273.68	0.33
25	Nicaragua	36.00	23	0.370	52.70	0.14
27	Haiti	37.33	18	0.164	88.87	0.44

PPP = Purchasing Power Parities. GDP = Gross Domestic Product. Note: this table includes impacts from all disasters, not only tropical cyclones. However, tropical cyclones are responsible for a significant share of the disasters due to major storm events.

International initiatives such as the Global Commission on Adaptation can help in increasing awareness and pushing issues such as mobilizing finance. It is essential that such funding is also available to non-governmental actors such as city councils or farmers. The latter should also be provided with information on inexpensive small-scale measures which can be taken.[106]

Some ambitious initiatives already exist which aim to address at least part of the need that stems from tropical cyclones, in poor and vulnerable states, for quickly released financial support. For example, the "**Caribbean Catastrophe Risk Insurance Facility**" (CCRIF SPC) is a regional catastrophe fund for Caribbean and Central American governments to limit the financial impact of devastating tropical cyclones, excessive rainfall and earthquakes. In order to do so, the insurance facility provides financial liquidity to the respective member state when a policy is triggered. Following hurricane Maria, Dominica received a pay-out of US$ 19 294 800 within 14 days. Another example of an initiative is the "**Pacific Catastrophe Risk Assessment and Financing Facility**" (PCRAFI), a regional risk pool in the Pacific, which aims to provide disaster risk management and finance solutions to

[100] Huq 2008
[101] IIED 2018
[102] Reid 2016
[103] U.S. Climate Resilience Toolkit 2017
[104] American Red Cross 2018
[105] Haque et al. 2012
[106] Horstmann 2018

help build the resilience of Pacific Island states. Countries can insure themselves against tropical cyclones, earthquakes and tsunamis. In parallel, disaster risk management work is being conducted under the Pacific Resilience Program, which aims to strengthen early warning systems and preparedness and improve countries' post-disaster response capacity.

While these initiatives are an important step to address the particularly vulnerable countries and can help to provide the necessary financial backup in case of tropical cyclones and other extreme events, direct access to international climate finance through national entities is still fairly limited for some of the most affected countries.

As extreme weather events are likely to increase in quantity and severity with ongoing climate change, it is extremely important that more emphasis be put on the issue of loss and damage. The term loss and damage refers to the adverse effects of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts. How such loss and damage should be provided for is so far largely unsolved in the international negotiations.

3 Rulebook for resilience and beyond: International policy needs to deliver in 2019

As the central cornerstone of international climate policy, the Paris Agreement equally anchors mitigation and resilience in its main goals, even though this intention is not yet fully reflected in the negotiations. Now, three years after its adoption and two years after it came into force, enabling the implementation of the agreement is the core task on the table. While mitigation takes centre stage, adaptation will headline several negotiating threads during COP24 in Katowice. By way of contrast, loss and damage appears as a cross cutting issue in adaptation, finance (Art. 9.5 and 9.7), the Enhanced Transparency Framework and the Global Stock-Take (GST): In all these areas it is subject to the risk of being used as a negotiation chip and ultimately not being provided for. Fostering resilience, however, requires both stepping up adaptation efforts and a provision for loss and damage. In addition, mitigation's prominent role will not play out if it is not accompanied with (signs of imminent) increases in ambition.

A resilience framework: Stocktake of 2018 developments

The great success of international diplomacy in adopting an agreement for all UN member states lies also in positioning resilience policy at its core. As one of its three key aims, the Paris Agreement introduced a **Global Goal on Adaptation** (GGA) and emphasizes the importance of fostering resilience – addressing both adaptation and loss and damage (Article 7 on adaptation provisions and obligations of conduct for countries and Article 8 on measures to address climate induced loss and damage). A process for how to operationalize the GGA needs to be established as soon as possible.

The **Sustainable Development Goals** (SDGs) and the **Sendai Framework on Disaster Risk Reduction** embed the Paris Agreement in a larger resilience framework. Strong interlinkages are made through the SDG sub-targets for resilience (Goal 1: end poverty, Goal 2: end hunger, Goal 9: sustainable infrastructure, Goal 10: cities and Goal 13: fight climate change) and Sendai's international goals to prevent natural catastrophes – through understanding disaster risks, strengthening disaster management governance, investing in risk reduction and resilience building. The **Adaptation Committee** considered a paper on national adaptation goals and indicators and their relationship with the SDGs and the Sendai Framework. The report concluded, inter alia, that enhanced coordination alone can reduce the reporting burden, improve political oversight and enhance cost-effectiveness of measures that contribute to more than one of the three agendas. Carefully, locally and inclusively designed adaptation measures can contribute to achieving the SDGs and increasing the resilience of communities.

Since 2015, the InsuResilience Initiative by the G7 has been focusing on disaster risk finance and insurance solutions. In 2017, it was adopted by the G20 and the V20 and the **InsuResilience Global Partnership for Climate and Disaster Risk Finance and Insurance Solutions** (IGP) was formed. The IGP brings together more than 40 participating partners from governments, civil society, international organisations, academia and industry. So far, the money has mainly been used to support indirect insurance solutions. In particular, the expansion of the African Risk Capacity (ARC), the establishment of the Pacific Catastrophe Risk Insurance Company (PCRAFI) as well as the expansion and extension of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and insurance policies against heavy rain were backed. Most recently, the World Bank announced the establishment of a **Global Risk Financing Facility** (GRiF), in cooperation with the governments of Germany and the United Kingdom, to the tune of US$ 145 million. GRiF will provide technical assistance in the development, testing, scaling and improvement of financing solutions and thus contribute directly to the goals of the IGP.

In October 2018, the **Global Commission on Adaptation** was launched. It is convened by 17 countries and overseen by the former UN Secretary-General Ban Ki-moon and World Bank CEO Kristalina Georgieva. It will, inter alia, submit a flagship report to the UN Climate Summit in September 2019. The focus will be on why and what adaptation action is needed and how it can be implemented. In October 2019 a year of action will be launched.

Mandated by the COP21 in Paris, the **IPCC** prepared the **Special Report on 1.5°C**. While the scientific community demonstrates that a limit of 1.5°C is achievable, it emphasizes the need for urgent mitigation action. Furthermore, it points out that adaptation can contribute to sustainable development and reducing poverty. The results of the report will serve as input for the Talanoa Dialogue and will also be discussed during the High-Level Segment to send a strong signal to the world to implement the Paris Agreement.

Climatic events and climate-induced slow onset changes intensely affect living conditions for people and communities in vulnerable and disaster prone regions. Therefore, forced migration and displacement becomes an additional area of concern. To this end, the Executive Committee (ExCom) of the **Warsaw International Mechanism on Loss and Damage** (WIM), that was established in 2013, will present recommendations to COP24 in Katowice to prevent, minimise and address climate change-related displacement. These recommendations are based on a comprehensive document by the **Taskforce on Displacement** (TfD), which was set up at COP21 in Paris. However, the recommendations that were picked up by the ExCom to be included in the annual report of the WIM are often watered down compared to the recommendations given in the full report. Fortunately, the WIM ExCom advocates that the mandate of the TfD be extended in order to support WIM ExCom in implementing the recommendations. How the WIM ExCom and the negotiating parties can best implement the recommendations will also be a topic at the COP24. Furthermore, the WIM will be reviewed for the second time in 2019, six years after its launch. Another important point that should be considered is the issue of financial security for people resettled or displaced as a result of climate change. Furthermore, the UN Global Compact on Safe, Orderly and Regular Migration is being adopted in Marrakesh on 10th and 11th December this year. The increased awareness for the issue of human mobility can be attributed to the dramatic developments in refugee numbers which reached 68.5 million in 2017.[107]

What's on the agenda for resilience at COP24 in Katowice?

In Katowice, the three-year period to develop the **rulebook** for the Paris Agreement comes to an end. As stipulated in the Paris Agreement, states should regularly communicate their priorities, support needs, plans and activities in the field of adaptation (Article 7, para 10,11). These reports ("**adaptation communications**") shall also inform the global stocktake of countries' climate outputs. Based on the previous negotiations, it will be up to the reporting countries to decide in which document the information will be provided. They may be, for example, part of the National Adaptation Plans (NAPs) or the National Climate Plans (NDCs). Parties still debate whether the guidelines should be identical in both cases, or whether guidelines should be "vehicle-specific", i.e. separate guidelines for NAPs and NDCs. Regardless of the document the information is produced for, it should be publicly accessible in an adaptation register (Article 7 12). The issue here is whether climate protection measures and climate adaptation measures should be made accessible separately or jointly. Apart from that, in Katowice it will be important that the issue of loss and damage finds its way into the rulebook, especially under the global stocktake.

On the basis of a COP21 decision, the Least Developed Country Expert Group, in collaboration with the Adaptation Committee, prepared a report on progress in the process of developing and implementing NAPs. The recommendations of the report will be submitted to COP24.

Scaling-up public **resources for adaptation and loss and damage** as well as tackling the imbalance between financial support provided for mitigation and adaptation is yet another important task for COP24. A good opportunity for looking into the possibilities for new and additional finance for loss and damage would be the technical paper on sources of financial support for loss and damage. The paper is planned to be published in 2019 and received input from the Suva Expert Dialogue that was held at the last session of Subsidiary Bodies (SB48) in May 2018 in Bonn. The current terms of reference and outline for the report, unfortunately though, foresee only looking into existing sources of finance.

Furthermore, the decision for the **Adaptation Fund** to serve the Paris Agreement needs to be finalised in Katowice. As a multilateral climate fund focussing especially on concrete small-scale adaptation projects to address the needs of the most vulnerable people and communities in developing countries, the Fund covers an important niche in the adaptation finance landscape.

Adopting these central decisions at COP24 would be a great opportunity to address and respond in a timely way to the devastating impacts of climate change, such as those caused by tropical cyclones. It will therefore be crucial that loss and damage be significantly represented in the rulebook. The risks of future climate-related loss and damage are far too severe to simply use them as a negotiation chip. Forward looking adaptation communications and the continuous exchange of knowledge on adaptation to climate change that is in line with the Sustainable Development Goals is another aspect of utmost importance.

[107] UNHCR 2017

4 Methodological Remarks

The presented analyses are based on the worldwide data collection and analysis provided by Munich Re's NatCatSERVICE. "The information collated by MunichRe, the world's leading re-insurance company, can be used to document and perform risk and trend analyses on the extent and intensity of individual natural hazard events in various parts of the world."[108] For the countries and territories of the world, Munich Re collects the number of total losses caused by weather events, the number of deaths, the insured damages and the total economic damages. The last two indicators are stated in million US$ (original values, inflation adjusted).

In the present analysis, only weather related events – storms, floods, as well as temperature extremes and mass movements (heat and cold waves etc.) – are incorporated. Geological incidents like earthquakes, volcanic eruptions or tsunamis, for which data is also available, are not relevant in this context as they do not depend on the weather and therefore are not possibly related to climate change. To enhance the manageability of the large amount of data, the different categories within the weather related events were combined. For single case studies on particularly devastating events, it is stated whether they concern floods, storms or another type of event.

It is important to note that this event-related examination does not allow for an assessment of continuous changes of important climate parameters. For instance, a long-term decline in precipitation that was shown in some African countries as a consequence of climate change cannot be displayed by the CRI. Such parameters nevertheless often substantially influence important development factors like agricultural outputs and the availability of drinking water.

Although certainly an interesting area for analysis, the present data does also not allow for comprehensive conclusions about the distribution of damages below the national level. The respective data quality would only be sufficient for a limited number of countries. The island of Réunion, for example, would qualify for a separate treatment but data are insufficient.

Analysed indicators

For the examination of the CRI, the following indicators were analysed:

1. Number of deaths,
2. Number of deaths per 100 000 inhabitants,
3. Sum of losses in US$ in purchasing power parity (PPP) as well as
4. Losses per unit of Gross Domestic Product (GDP).

For the indicators 2–4, economic and population data primarily provided by the International Monetary Fund were taken into account. It must be added, however, that especially for small (e.g. Pacific Small Island Developing States) or extremely politically unstable countries (e.g. Somalia), the required data is not always available in sufficient quality for the entire time period observed. Those countries needed to be omitted from the analyses.

The CRI 2019 is based on the loss figures from 2017 and 1998–2017 of 181 countries. This ranking represents the most affected countries. In each of the four categories ranking is used as a normalisation technique. Each country's index score has been derived from a country's average ranking in all four indicating categories, according to the following weighting: death toll, 1/6; deaths per 100 000 inhabitants, 1/3; absolute losses in PPP, 1/6; losses per GDP unit, 1/3.

[108] MunichRe NatCatSERVICE

For example, in the Climate Risk Index for 1998-2017, Bangladesh ranks 9th in Fatalities among all countries analysed in this study, 41st in Fatalities per 100 000 inhabitants, 11th in losses and 29th in losses per unit GDP (see Annexes, Table 5). Hence, its CRI Score is calculated as follows:

CRI Score = 9 x 1/6 + 41 x 1/3 + 11 x 1/6 + 29 x 1/3 = 26.67

Only 6 countries have a lower CRI Score for 1998-2017, hence Bangladesh ranks 7th in this index category (see Table 2).

The relative consequences also depend on economic and population growth

Identifying relative values in this index represents an important complement to the otherwise often dominating absolute values because it allows for analysing country specific data on damages in relation to real conditions and capacities in those countries. It is obvious, for example, that for richer countries like the USA or Japan damages of one billion US$ cause much less economic consequences than for the world's poorest countries, where damages in many cases constitute a substantial share of the annual GDP. This is being backed up by the relative analysis.

It should be noted that values, and hence the rankings of countries regarding the respective indicators do not only change due to the absolute impacts of extreme weather events, but also due to economic and population growth or decline. If, for example, population increases, which is the case in most of the countries, the same absolute number of deaths leads to a relatively lower assessment in the following year. The same applies to economic growth. However, this does not affect the significance of the relative approach. Society's ability of coping with damages through precaution, mitigation and disaster preparedness, insurances or the improved availability of means for emergency aid, generally grows along with increasing economic strength. Nevertheless, an improved ability does not necessarily imply enhanced implementation of effective preparation and response measures. While absolute numbers tend to overestimate populous or economically capable countries, relative values give more prominence to smaller and poorer countries. In order to take both effects into consideration, the analysis of the CRI is based on absolute (indicators 1 and 3) as well as on relative (indicators 2 and 4) scores. Being double weighted in the average ranking of all indicators generating the CRI Score, more emphasis and therefore higher importance is given to the relative losses.

The indicator "losses in purchasing power parity" allows for a more comprehensive estimation of how different societies are actually affected

The indicator "absolute losses in US$" is identified by purchasing power parity (PPP), because using this figure expresses more appropriately how people are actually affected by the loss of one US$ than by using nominal exchange rates. Purchasing power parity is a currency exchange rate, which permits a comparison of, for instance, national GDPs, by incorporating price differences between countries. Basically, this means that a farmer in India can buy more crops with US$ 1 than a farmer in the USA with the same amount of money. Thus, the real consequences of the same nominal damage are much higher in India. For most of the countries, US$ values according to exchange rates must therefore be multiplied by a factor bigger than one.

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Annexes

CRI = Climate Risk Index; GDP = gross domestic product; PPP = purchasing power parity

Table 4: Climate Risk Index for 2017

CRI Rank	Country	CRI score	Fatalities in 2017		Fatalities per 100 000 inhabitants		Losses in US$ million (PPP)		Losses per unit GDP in %	
			Total	Rank	Total	Rank	Total	Rank	Total	Rank
24	**Albania**	35.83	5	78	0.174	34	275.47	43	0.765	13
123	**Algeria**	112.50	1	101	0.002	107	0.04	116	0.000	122
98	**Angola**	83.17	11	59	0.039	79	7.65	88	0.004	97
13	**Antigua and Barbuda**	20.67	3	86	3.297	4	1 101.44	24	45.932	3
49	**Argentina**	55.50	9	64	0.020	91	1 565.82	23	0.170	32
124	**Armenia**	116.00	0	108	0.000	108	0.00	124	0.000	124
18	**Australia**	30.33	31	30	0.125	43	3 418.74	10	0.274	28
42	**Austria**	52.67	5	78	0.057	69	654.09	30	0.148	35
111	**Azerbaijan**	95.33	5	78	0.051	72	0.08	112	0.000	119
124	**Bahrain**	116.00	0	108	0.000	108	0.00	124	0.000	124
9	**Bangladesh**	16.00	407	4	0.249	19	2 826.68	14	0.410	20
124	**Barbados**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Belarus**	116.00	0	108	0.000	108	0.00	124	0.000	124
82	**Belgium**	77.00	3	86	0.026	85	126.51	58	0.024	74
124	**Belize**	116.00	0	108	0.000	108	0.00	124	0.000	124
120	**Benin**	107.50	0	108	0.000	108	0.27	109	0.001	106
124	**Bhutan**	116.00	0	108	0.000	108	0.00	124	0.000	124
39	**Bolivia**	47.67	22	44	0.199	30	48.95	74	0.058	54
58	**Bosnia and Herzegovina**	61.00	0	108	0.000	108	772.36	28	1.723	7
75	**Botswana**	72.17	0	108	0.000	108	123.43	59	0.316	25
79	**Brazil**	74.67	30	32	0.014	98	264.46	46	0.008	87
124	**Brunei Darussalam**	116.00	0	108	0.000	108	0.00	124	0.000	124
53	**Bulgaria**	58.17	13	54	0.184	32	29.70	75	0.019	78
124	**Burkina Faso**	116.00	0	108	0.000	108	0.00	124	0.000	124
76	**Burundi**	72.50	9	64	0.083	51	0.97	101	0.012	84
115	**Cambodia**	100.67	3	86	0.019	95	0.29	108	0.000	110
112	**Cameroon**	97.00	1	101	0.004	104	5.12	91	0.006	91
42	**Canada**	52.67	15	53	0.041	78	1 773.78	19	0.100	44
124	**Cape Verde**	116.00	0	108	0.000	108	0.00	124	0.000	124
96	**Central African Republic**	82.83	4	82	0.080	52	0.09	111	0.003	100
124	**Chad**	116.00	0	108	0.000	108	0.00	124	0.000	124
16	**Chile**	27.17	40	24	0.218	28	1 039.66	25	0.230	29
31	**China**	42.33	396	5	0.028	84	30 503.26	3	0.131	39
90	**Chinese Taipei**	81.67	3	86	0.013	99	228.46	48	0.019	79
19	**Colombia**	30.67	382	7	0.775	8	314.48	41	0.044	60
124	**Comoros**	116.00	0	108	0.000	108	0.00	124	0.000	124
21	**Costa Rica**	33.83	11	59	0.221	27	273.68	44	0.326	23
83	**Côte d'Ivoire**	77.67	23	42	0.092	47	0.36	106	0.000	112
53	**Croatia**	58.17	1	101	0.024	88	460.61	38	0.451	17
100	**Cyprus**	83.67	2	94	0.234	22	0.01	122	0.000	121
41	**Czech Republic**	51.50	13	54	0.123	44	191.80	51	0.051	58
56	**Democratic Republic of Congo**	59.00	199	13	0.230	24	2.52	97	0.004	98

CRI Rank	Country	CRI score	Fatalities in 2017		Fatalities per 100 000 inhabitants		Losses in US$ million (PPP)		Losses per unit GDP in %	
			Total	Rank	Total	Rank	Total	Rank	Total	Rank
124	**Democratic Republic of Timor-Leste**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Denmark**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Djibouti**	116.00	0	108	0.000	108	0.00	124	0.000	124
3	**Dominica**	9.33	31	30	43.662	2	1 686.89	20	215.440	1
37	**Dominican Republic**	46.83	7	73	0.069	61	511.43	34	0.296	26
17	**Ecuador**	29.50	38	27	0.227	25	370.19	40	0.192	30
124	**Egypt**	116.00	0	108	0.000	108	0.00	124	0.000	124
98	**El Salvador**	83.17	5	78	0.079	54	0.64	103	0.001	105
124	**Eritrea**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Estonia**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Eswatini**	116.00	0	108	0.000	108	0.00	124	0.000	124
46	**Ethiopia**	53.83	9	64	0.010	100	992.38	27	0.495	16
96	**Fiji**	82.83	2	94	0.226	26	0.02	121	0.000	115
124	**Finland**	116.00	0	108	0.000	108	0.00	124	0.000	124
105	**Former Yugoslav Republic of Macedonia**	86.67	3	86	0.145	40	0.03	118	0.000	118
59	**France**	61.17	11	59	0.017	96	2 112.96	16	0.074	50
124	**Gabon**	116.00	0	108	0.000	108	0.00	124	0.000	124
101	**Georgia**	84.50	2	94	0.054	70	2.89	95	0.007	89
40	**Germany**	50.33	27	37	0.033	81	3 574.05	9	0.085	47
93	**Ghana**	82.17	22	44	0.078	57	0.31	107	0.000	114
30	**Greece**	39.50	26	38	0.241	20	179.10	53	0.060	53
124	**Grenada**	116.00	0	108	0.000	108	0.00	124	0.000	124
73	**Guatemala**	69.67	22	44	0.130	42	4.66	92	0.003	99
124	**Guinea**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Guinea-Bissau**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Guyana**	116.00	0	108	0.000	108	0.00	124	0.000	124
26	**Haiti**	37.33	18	49	0.164	37	88.87	65	0.445	18
34	**Honduras**	45.00	16	51	0.193	31	51.80	73	0.112	42
114	**Hungary**	99.00	0	108	0.000	108	14.56	84	0.005	93
124	**Iceland**	116.00	0	108	0.000	108	0.00	124	0.000	124
14	**India**	22.67	2736	2	0.208	29	13 789.86	4	0.146	36
50	**Indonesia**	55.83	152	16	0.058	67	648.77	31	0.020	77
124	**Iraq**	116.00	0	108	0.000	108	0.00	124	0.000	124
62	**Ireland**	64.17	3	86	0.062	63	158.77	55	0.045	59
26	**Islamic Republic of Afghanistan**	37.33	328	8	0.923	7	28.38	76	0.041	63
38	**Islamic Republic of Iran**	47.50	79	20	0.097	46	522.73	33	0.032	70
124	**Israel**	116.00	0	108	0.000	108	0.00	124	0.000	124
35	**Italy**	45.33	28	35	0.046	74	3 100.22	13	0.134	38
89	**Jamaica**	81.33	0	108	0.000	108	26.46	78	0.102	43
36	**Japan**	46.50	53	22	0.042	76	4 059.95	7	0.075	49
124	**Jordan**	116.00	0	108	0.000	108	0.00	124	0.000	124
67	**Kazakhstan**	66.83	11	59	0.060	64	96.16	62	0.020	76
45	**Kenya**	53.50	36	28	0.077	58	89.92	63	0.055	57
124	**Kiribati**	116.00	0	108	0.000	108	0.00	124	0.000	124
85	**Korea, Republic of**	78.83	8	71	0.016	97	284.01	42	0.014	83
124	**Kosovo**	116.00	0	108	0.000	108	0.00	124	0.000	124

CRI Rank	Country	CRI score	Fatalities in 2017		Fatalities per 100 000 inhabitants		Losses in US$ million (PPP)		Losses per unit GDP in %	
			Total	Rank	Total	Rank	Total	Rank	Total	Rank
124	**Kuwait**	116.00	0	108	0.000	108	0.00	124	0.000	124
52	**Kyrgyz Republic**	57.17	34	29	0.543	11	1.04	100	0.004	96
48	**Lao People's Democratic Republic**	55.00	12	58	0.180	33	20.55	82	0.042	62
22	**Latvia**	34.50	11	59	0.564	9	89.09	64	0.165	33
124	**Lebanon**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Lesotho**	116.00	0	108	0.000	108	0.00	124	0.000	124
93	**Liberia**	82.17	0	108	0.000	108	7.44	89	0.122	40
124	**Libya**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Lithuania**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Luxembourg**	116.00	0	108	0.000	108	0.00	124	0.000	124
7	**Madagascar**	15.00	89	19	0.347	15	693.04	29	1.739	6
57	**Malawi**	60.50	13	54	0.068	62	15.81	83	0.071	51
44	**Malaysia**	53.33	28	35	0.087	49	272.20	45	0.029	71
124	**Maldives**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Mali**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Malta**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Marshall Islands**	116.00	0	108	0.000	108	0.00	124	0.000	124
78	**Mauritania**	74.33	9	64	0.232	23	0.07	114	0.000	111
124	**Mauritius**	116.00	0	108	0.000	108	0.00	124	0.000	124
64	**Mexico**	64.67	39	25	0.032	83	470.96	37	0.019	80
124	**Micronesia**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Moldova**	116.00	0	108	0.000	108	0.00	124	0.000	124
117	**Mongolia**	102.00	1	101	0.033	80	0.04	117	0.000	117
124	**Montenegro**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Morocco**	116.00	0	108	0.000	108	0.00	124	0.000	124
28	**Mozambique**	37.67	26	38	0.088	48	162.39	54	0.438	19
69	**Myanmar**	68.33	22	44	0.042	77	86.53	66	0.026	73
124	**Namibia**	116.00	0	108	0.000	108	0.00	124	0.000	124
4	**Nepal**	10.50	164	15	0.559	10	1 909.98	18	2.412	5
108	**Netherlands**	89.50	1	101	0.006	103	104.42	60	0.011	85
70	**New Zealand**	68.67	1	101	0.021	90	216.77	49	0.115	41
25	**Nicaragua**	36.00	23	42	0.370	14	52.70	72	0.145	37
15	**Niger**	26.50	72	21	0.384	13	71.75	68	0.328	22
80	**Nigeria**	75.00	47	23	0.025	87	63.44	69	0.006	92
104	**Norway**	85.00	0	108	0.000	108	133.81	56	0.035	65
103	**Oman**	84.67	3	86	0.073	59	2.69	96	0.001	104
33	**Pakistan**	43.17	262	10	0.133	41	384.52	39	0.036	64
77	**Panama**	74.17	7	73	0.171	35	1.87	98	0.002	102
84	**Papua New Guinea**	78.17	13	54	0.157	38	0.08	113	0.000	113
68	**Paraguay**	68.00	6	77	0.086	50	20.80	81	0.023	75
5	**Peru**	10.67	147	17	0.462	12	6 240.63	5	1.450	9
20	**Philippines**	33.17	250	11	0.238	21	505.78	36	0.058	55
29	**Poland**	37.83	30	32	0.079	53	1 672.88	21	0.149	34
11	**Portugal**	17.33	113	18	1.097	6	1 012.94	26	0.322	24
1	**Puerto Rico**	1.50	2978	1	90.242	1	82 315.24	2	63.328	2
124	**Qatar**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Republic of Congo**	116.00	0	108	0.000	108	0.00	124	0.000	124
66	**Republic of Yemen**	66.17	18	49	0.060	65	23.55	80	0.032	69

CRI Rank	Country	CRI score	Fatalities in 2017		Fatalities per 100 000 inhabitants		Losses in US$ million (PPP)		Losses per unit GDP in %	
			Total	Rank	Total	Rank	Total	Rank	Total	Rank
63	**Romania**	64.33	9	64	0.046	75	205.33	50	0.042	61
71	**Russia**	69.00	29	34	0.020	92	575.58	32	0.014	82
87	**Rwanda**	79.33	3	86	0.025	86	8.10	86	0.033	66
124	**Samoa**	116.00	0	108	0.000	108	0.00	124	0.000	124
88	**Saudi Arabia**	80.67	7	73	0.022	89	131.83	57	0.007	88
122	**Senegal**	110.67	1	101	0.006	102	0.03	119	0.000	120
32	**Serbia**	42.67	4	82	0.057	68	1 662.87	22	1.573	8
124	**Seychelles**	116.00	0	108	0.000	108	0.00	124	0.000	124
8	**Sierra Leone**	15.67	500	3	6.749	3	99.10	61	0.858	12
124	**Singapore**	116.00	0	108	0.000	108	0.00	124	0.000	124
64	**Slovak Republic**	64.67	8	71	0.147	39	28.12	77	0.016	81
90	**Slovenia**	81.67	0	108	0.000	108	58.31	70	0.082	48
81	**Solomon Islands**	75.33	2	94	0.326	16	0.02	120	0.002	103
23	**South Africa**	35.67	39	25	0.069	60	2 234.52	15	0.291	27
110	**South Sudan**	91.67	0	108	0.000	108	6.54	90	0.033	68
47	**Spain**	54.17	9	64	0.019	94	3 216.92	11	0.181	31
2	**Sri Lanka**	9.00	246	12	1.147	5	3 129.35	12	1.135	10
61	**St. Kitts and Nevis**	64.00	0	108	0.000	108	184.91	52	11.929	4
124	**St. Lucia**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**St. Vincent and the Grenadines**	116.00	0	108	0.000	108	0.00	124	0.000	124
60	**Sudan**	63.00	24	41	0.059	66	58.06	71	0.033	67
124	**Suriname**	116.00	0	108	0.000	108	0.00	124	0.000	124
121	**Sweden**	108.17	2	94	0.020	93	0.01	123	0.000	123
55	**Switzerland**	58.83	4	82	0.048	73	508.50	35	0.097	45
107	**Tajikistan**	88.33	7	73	0.078	55	0.04	115	0.000	116
90	**Tanzania**	81.67	16	51	0.032	82	7.91	87	0.005	94
10	**Thailand**	16.33	176	14	0.255	18	4 371.16	6	0.354	21
74	**The Bahamas**	69.83	0	108	0.000	108	79.30	67	0.658	14
116	**The Gambia**	101.50	0	108	0.000	108	0.37	105	0.007	90
118	**Togo**	106.00	0	108	0.000	108	0.27	110	0.002	101
124	**Tonga**	116.00	0	108	0.000	108	0.00	124	0.000	124
101	**Trinidad and Tobago**	84.50	0	108	0.000	108	26.33	79	0.061	52
95	**Tunisia**	82.33	9	64	0.078	56	0.96	102	0.001	108
72	**Turkey**	69.17	2	94	0.002	106	1 930.67	17	0.088	46
124	**Tuvalu**	116.00	0	108	0.000	108	0.00	124	0.000	124
85	**Uganda**	78.83	20	48	0.053	71	4.02	93	0.005	95
113	**Ukraine**	98.67	4	82	0.009	101	3.33	94	0.001	107
124	**United Arab Emirates**	116.00	0	108	0.000	108	0.00	124	0.000	124
106	**United Kingdom**	87.17	2	94	0.003	105	248.95	47	0.009	86
12	**United States of America**	19.83	389	6	0.119	45	177 981.95	1	0.913	11
124	**Uruguay**	116.00	0	108	0.000	108	0.00	124	0.000	124
124	**Uzbekistan**	116.00	0	108	0.000	108	0.00	124	0.000	124
109	**Vanuatu**	90.00	0	108	0.000	108	0.44	104	0.057	56
119	**Venezuela**	106.83	0	108	0.000	108	1.82	99	0.000	109
6	**Vietnam**	13.50	298	9	0.318	17	4 052.31	8	0.625	15
124	**Zambia**	116.00	0	108	0.000	108	0.00	124	0.000	124
51	**Zimbabwe**	56.83	25	40	0.168	36	9.72	85	0.028	72

Table 5: Climate Risk Index for 1998–2017

(Avg. = average figure for the 20-year period. E.g., 37 people died in Albania due to extreme weather events between 1998 and 2017; hence the average death toll per year was 1.85.)

CRI Rank	Country	CRI Score	Fatalities (annual average)		Fatalities per 100 000 Inhabitants (annual average)		Losses in US$ million (PPP) (annual average)		Losses per unit GDP (annual average)	
			Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
120	**Albania**	109.67	1.850	137	0.062	119	32.900	113	0.131	85
101	**Algeria**	95.00	64.700	38	0.186	72	101.133	84	0.022	152
108	**Angola**	98.83	35.050	56	0.162	74	55.947	99	0.030	145
43	**Antigua and Barbuda**	56.33	0.400	159	0.486	36	70.102	93	4.054	7
83	**Argentina**	81.00	27.900	64	0.070	114	983.883	26	0.133	84
158	**Armenia**	144.17	0.000	173	0.000	173	16.383	132	0.084	107
36	**Australia**	52.83	47.900	49	0.224	68	2 394.190	12	0.252	60
51	**Austria**	59.00	23.900	66	0.288	54	570.298	32	0.167	74
149	**Azerbaijan**	135.33	2.200	132	0.025	157	62.490	98	0.046	134
140	**Bahrain**	126.17	2.900	120	0.284	57	0.571	173	0.001	175
7	**Bangladesh**	26.67	635.500	9	0.433	41	2 403.839	11	0.640	29
153	**Barbados**	142.00	0.050	172	0.018	160	3.983	154	0.092	103
154	**Belarus**	142.33	4.100	111	0.042	134	8.929	141	0.006	167
60	**Belgium**	68.00	106.450	28	0.995	18	169.061	70	0.041	137
30	**Belize**	47.67	2.350	127	0.759	24	66.154	95	2.997	8
150	**Benin**	135.67	3.750	114	0.043	133	5.253	150	0.033	142
105	**Bhutan**	98.17	1.650	139	0.244	66	4.994	152	0.133	83
31	**Bolivia**	48.33	41.450	54	0.435	40	210.270	62	0.377	47
67	**Bosnia and Herzegovina**	72.00	2.350	127	0.063	117	428.442	41	1.291	15
145	**Botswana**	132.17	0.600	152	0.031	153	21.284	125	0.087	105
90	**Brazil**	86.00	145.650	24	0.077	111	1 710.841	18	0.060	126
175	**Brunei Darussalam**	168.17	0.100	170	0.027	156	0.342	175	0.001	176
66	**Bulgaria**	70.33	9.700	86	0.128	87	330.074	48	0.282	57
106	**Burkina Faso**	98.33	7.750	91	0.053	126	40.248	107	0.193	70
81	**Burundi**	79.50	10.400	82	0.125	90	24.897	123	0.404	46
19	**Cambodia**	39.67	53.300	46	0.384	43	242.493	54	0.723	26
147	**Cameroon**	134.50	7.950	89	0.041	138	11.904	136	0.021	153
100	**Canada**	94.17	11.300	80	0.034	148	1 742.019	17	0.130	86
147	**Cape Verde**	134.50	0.250	163	0.052	128	1.872	164	0.074	112
163	**Central African Republic**	151.33	1.300	142	0.031	152	0.988	170	0.030	146
112	**Chad**	101.83	4.600	109	0.048	131	43.355	104	0.202	68
94	**Chile**	88.67	9.700	86	0.058	122	457.600	38	0.142	82
37	**China**	53.33	1 240.800	4	0.094	101	36 601.070	2	0.288	56
42	**Chinese Taipei**	55.83	72.000	36	0.314	50	988.978	25	0.129	87
49	**Colombia**	58.17	125.050	27	0.283	58	628.877	30	0.128	88
135	**Comoros**	119.83	1.000	147	0.153	78	0.669	172	0.066	122
92	**Costa Rica**	87.67	6.700	96	0.153	77	66.303	94	0.117	91
155	**Côte d'Ivoire**	143.33	6.750	95	0.034	147	6.472	147	0.011	162
35	**Croatia**	50.33	35.400	55	0.814	23	181.495	67	0.217	67
114	**Cyprus**	103.17	3.500	116	0.452	37	8.268	143	0.032	143
85	**Czech Republic**	82.00	7.900	90	0.076	112	506.007	34	0.178	72
139	**Democratic Republic of Congo**	125.17	42.750	52	0.064	116	5.938	149	0.015	159
177	**Democratic Republic of Timor-Leste**	171.00	0.100	170	0.010	169	0.266	176	0.004	171

CRI Rank	Country	CRI Score	Fatalities (annual average)		Fatalities per 100 000 Inhabitants (annual average)		Losses in US$ million (PPP) (annual average)		Losses per unit GDP (annual average)	
			Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
131	**Denmark**	115.67	0.750	151	0.014	166	325.448	49	0.142	81
63	**Djibouti**	68.83	3.500	116	0.440	38	9.661	139	0.455	41
10	**Dominica**	33.00	3.350	119	4.718	2	132.586	73	21.205	1
12	**Dominican Republic**	34.00	211.150	19	2.294	8	268.794	53	0.269	58
96	**Ecuador**	90.67	20.600	69	0.143	81	101.452	83	0.071	115
156	**Egypt**	143.50	14.100	75	0.019	159	25.110	122	0.003	173
16	**El Salvador**	37.67	32.300	60	0.530	34	277.547	52	0.758	23
129	**Eritrea**	114.67	0.150	167	0.003	172	45.121	103	0.502	37
161	**Estonia**	150.17	0.450	155	0.033	150	7.272	144	0.022	151
117	**Eswatini**	105.83	0.550	153	0.053	125	24.702	124	0.303	54
59	**Ethiopia**	66.67	86.450	31	0.111	96	240.213	55	0.242	61
20	**Fiji**	39.83	7.000	92	0.837	22	119.983	79	1.896	12
167	**Finland**	155.83	0.200	164	0.004	171	32.078	115	0.016	157
109	**Former Yugoslav Republic of Macedonia**	99.67	2.700	123	0.132	85	25.327	121	0.113	92
18	**France**	38.67	1 120.550	5	1.815	11	2 205.338	13	0.098	96
174	**Gabon**	167.67	0.450	155	0.029	154	0.012	181	0.000	181
102	**Georgia**	95.83	3.800	113	0.093	102	41.922	106	0.159	76
25	**Germany**	42.83	474.750	11	0.584	31	3 945.817	6	0.124	89
113	**Ghana**	102.33	30.750	62	0.137	83	32.380	114	0.044	136
87	**Greece**	83.17	13.700	76	0.125	89	289.632	51	0.098	97
24	**Grenada**	42.00	2.000	135	1.923	10	78.577	91	7.104	3
14	**Guatemala**	36.50	98.600	30	0.709	27	394.455	45	0.408	45
171	**Guinea**	159.67	1.850	137	0.018	162	1.305	167	0.008	165
144	**Guinea-Bissau**	129.33	0.450	155	0.032	151	3.053	159	0.145	80
119	**Guyana**	108.17	0.300	162	0.040	141	20.104	127	0.468	39
4	**Haiti**	15.17	281.300	16	2.921	6	418.205	43	2.642	10
2	**Honduras**	13.00	302.450	13	4.215	3	556.556	33	1.846	13
64	**Hungary**	69.00	34.300	57	0.341	47	213.077	61	0.095	101
177	**Iceland**	171.00	0.000	173	0.000	173	0.727	171	0.006	168
14	**India**	36.50	3 660.600	2	0.316	48	12 822.708	3	0.263	59
69	**Indonesia**	74.17	252.000	17	0.109	97	1 798.562	16	0.083	109
159	**Iraq**	144.67	4.900	105	0.015	163	37.928	109	0.008	164
125	**Ireland**	111.67	2.100	133	0.048	130	173.495	69	0.087	104
26	**Islamic Republic of Afghanistan**	44.33	288.300	15	1.004	17	100.763	85	0.218	66
74	**Islamic Republic of Iran**	76.00	58.900	41	0.082	107	1 387.245	21	0.118	90
138	**Israel**	124.67	3.400	118	0.047	132	80.654	90	0.039	138
28	**Italy**	46.00	1 005.100	6	1.709	12	1 458.029	20	0.072	113
56	**Jamaica**	63.50	4.350	110	0.161	75	155.845	71	0.727	25
93	**Japan**	88.17	79.400	35	0.062	118	2 737.646	10	0.064	124
142	**Jordan**	127.67	2.300	129	0.034	149	43.157	105	0.069	117
157	**Kazakhstan**	143.67	5.750	101	0.036	146	18.727	129	0.005	170
45	**Kenya**	56.83	56.700	43	0.155	76	346.624	46	0.329	50
123	**Kiribati**	110.83	0.000	173	0.000	173	10.529	138	6.183	4
80	**Korea, Republic of**	79.00	55.550	44	0.113	95	1 120.642	24	0.084	108
179	**Kuwait**	171.67	0.400	159	0.012	167	0.128	177	0.000	180
122	**Kyrgyz Republic**	110.33	14.350	74	0.266	61	3.106	158	0.019	154

CRI Rank	Country	CRI Score	Fatalities (annual average)		Fatalities per 100 000 Inhabitants (annual average)		Losses in US$ million (PPP) (annual average)		Losses per unit GDP (annual average)	
			Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
89	**Lao People's Democratic Republic**	85.67	6.300	98	0.108	98	73.910	92	0.237	64
104	**Latvia**	96.83	5.100	103	0.234	67	29.629	116	0.071	114
141	**Lebanon**	127.00	2.250	130	0.056	124	27.035	118	0.046	133
134	**Lesotho**	119.33	0.200	164	0.010	168	18.799	128	0.410	44
168	**Liberia**	157.33	0.350	161	0.010	170	1.637	165	0.036	139
170	**Libya**	159.00	1.050	146	0.018	161	5.990	148	0.005	169
137	**Lithuania**	121.17	2.600	124	0.081	108	29.329	117	0.044	135
110	**Luxembourg**	100.00	6.500	97	1.325	15	5.076	151	0.011	161
17	**Madagascar**	38.33	71.350	37	0.359	45	221.284	59	0.794	22
83	**Malawi**	81.00	10.250	83	0.069	115	64.916	97	0.494	38
116	**Malaysia**	105.50	21.450	67	0.078	109	182.228	66	0.033	141
176	**Maldives**	168.83	0.000	173	0.000	173	0.549	174	0.013	160
130	**Mali**	115.33	5.900	100	0.042	137	25.486	120	0.095	99
165	**Malta**	153.00	0.150	167	0.036	145	2.831	161	0.024	150
172	**Marshall Islands**	166.17	0.000	173	0.000	173	0.039	180	0.027	149
81	**Mauritania**	79.50	4.800	107	0.152	79	37.926	110	0.324	51
118	**Mauritius**	107.17	0.950	148	0.077	110	26.379	119	0.148	78
53	**Mexico**	61.33	126.050	26	0.114	94	2 954.754	8	0.170	73
48	**Micronesia**	57.50	2.500	126	2.398	7	2.481	163	0.875	21
79	**Moldova**	78.67	2.600	124	0.073	113	130.892	74	0.745	24
62	**Mongolia**	68.67	6.900	94	0.259	62	82.338	88	0.307	53
111	**Morocco**	100.50	15.700	73	0.050	129	174.019	68	0.093	102
21	**Mozambique**	40.83	100.400	29	0.438	39	120.777	78	0.632	30
3	**Myanmar**	13.17	7 048.850	1	14.392	1	1 275.961	22	0.661	27
58	**Namibia**	66.50	11.350	79	0.558	33	34.803	112	0.192	71
11	**Nepal**	33.50	235.300	18	0.896	20	230.830	57	0.438	43
71	**Netherlands**	75.17	84.500	33	0.514	35	220.042	60	0.031	144
88	**New Zealand**	84.50	3.550	115	0.083	106	313.203	50	0.226	65
6	**Nicaragua**	20.33	163.600	20	2.945	5	223.255	58	1.009	17
68	**Niger**	73.33	18.500	71	0.132	86	48.375	101	0.369	48
127	**Nigeria**	112.33	85.500	32	0.058	123	115.347	80	0.015	158
151	**Norway**	140.50	1.100	144	0.023	158	85.677	87	0.028	148
29	**Oman**	46.67	9.150	88	0.309	51	812.226	28	0.579	31
8	**Pakistan**	30.17	512.400	10	0.315	49	3 826.028	7	0.567	33
98	**Panama**	91.17	10.000	85	0.285	56	38.097	108	0.066	121
95	**Papua New Guinea**	89.83	18.250	72	0.285	55	15.065	135	0.076	111
57	**Paraguay**	66.00	6.950	93	0.115	92	334.603	47	0.514	36
45	**Peru**	56.83	80.500	34	0.281	59	433.020	39	0.161	75
5	**Philippines**	19.67	867.400	7	0.971	19	2 932.153	9	0.576	32
72	**Poland**	75.33	52.400	47	0.137	82	639.896	29	0.085	106
22	**Portugal**	41.50	146.750	23	1.407	14	405.569	44	0.152	77
1	**Puerto Rico**	7.83	150.050	22	4.061	4	5 033.157	5	4.204	6
181	**Qatar**	174.00	0.000	173	0.000	173	1.120	169	0.001	178
164	**Republic of Congo**	152.00	2.050	134	0.059	121	0.125	178	0.001	179
77	**Republic of Yemen**	77.83	42.250	53	0.184	73	110.059	82	0.112	93
37	**Romania**	53.33	43.250	51	0.206	71	1 160.849	23	0.310	52
33	**Russia**	49.00	2 944.100	3	2.041	9	2 057.649	15	0.054	129
132	**Rwanda**	118.33	11.450	78	0.122	91	3.704	156	0.029	147

CRI Rank	Country	CRI Score	Fatalities (annual average)		Fatalities per 100 000 Inhabitants (annual average)		Losses in US$ million (PPP) (annual average)		Losses per unit GDP (annual average)	
			Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
75	**Samoa**	77.17	0.450	155	0.245	65	8.499	142	0.952	18
115	**Saudi Arabia**	104.83	25.900	65	0.101	99	238.373	56	0.018	155
143	**Senegal**	128.83	5.100	103	0.042	136	15.276	134	0.046	132
73	**Serbia & Montenegro & Kosovo**	75.83	6.000	99	0.062	120	471.678	36	0.465	40
166	**Seychelles**	153.83	0.000	173	0.000	173	1.156	168	0.069	118
91	**Sierra Leone**	86.83	33.300	58	0.570	32	4.707	153	0.066	123
180	**Singapore**	172.17	0.000	173	0.000	173	2.874	160	0.001	177
107	**Slovak Republic**	98.67	4.650	108	0.086	104	128.091	76	0.095	100
43	**Slovenia**	56.33	12.050	77	0.596	30	128.120	75	0.239	63
75	**Solomon Islands**	77.17	1.900	136	0.381	44	3.908	155	0.442	42
78	**South Africa**	78.50	46.700	50	0.094	100	610.795	31	0.107	95
124	**South Sudan**	111.17	10.700	81	0.093	103	20.462	126	0.059	127
34	**Spain**	49.83	695.050	8	1.569	13	979.181	27	0.069	119
31	**Sri Lanka**	48.33	60.750	39	0.305	53	491.048	35	0.294	55
52	**St. Kitts and Nevis**	60.00	0.200	164	0.401	42	45.781	102	4.240	5
55	**St. Lucia**	61.83	1.100	144	0.666	29	17.739	131	0.940	19
54	**St. Vincent and the Grenadines**	61.50	0.800	150	0.738	25	11.310	137	1.160	16
99	**Sudan**	93.00	48.000	48	0.135	84	95.518	86	0.057	128
173	**Suriname**	167.33	0.150	167	0.029	155	0.115	179	0.002	174
146	**Sweden**	132.50	1.350	141	0.015	165	194.701	64	0.052	130
41	**Switzerland**	54.83	53.400	45	0.698	28	429.576	40	0.107	94
39	**Tajikistan**	54.50	20.400	70	0.279	60	112.570	81	0.654	28
126	**Tanzania**	112.00	20.950	68	0.052	127	52.715	100	0.060	125
13	**Thailand**	34.83	137.800	25	0.209	70	7 894.763	4	0.936	20
22	**The Bahamas**	41.50	2.800	122	0.838	21	207.861	63	2.114	11
85	**The Gambia**	82.00	4.900	105	0.309	52	7.157	145	0.198	69
160	**Togo**	149.00	2.250	130	0.037	143	1.432	166	0.018	156
49	**Tonga**	58.17	1.200	143	1.182	16	6.796	146	1.495	14
162	**Trinidad and Tobago**	151.00	0.550	153	0.042	135	3.662	157	0.010	163
136	**Tunisia**	120.50	4.100	111	0.039	142	66.040	96	0.071	116
121	**Turkey**	110.00	29.350	63	0.041	140	461.532	37	0.036	140
128	**Tuvalu**	114.17	0.000	173	0.000	173	2.629	162	8.294	2
70	**Uganda**	74.33	32.600	59	0.115	93	125.242	77	0.241	62
97	**Ukraine**	90.83	58.550	42	0.127	88	186.671	65	0.050	131
169	**United Arab Emirates**	158.33	0.950	148	0.015	164	18.109	130	0.004	172
60	**United Kingdom**	68.00	152.200	21	0.246	64	1 480.998	19	0.068	120
27	**United States of America**	45.17	450.500	12	0.149	80	48 658.913	1	0.345	49
103	**Uruguay**	96.33	2.850	121	0.084	105	81.661	89	0.146	79
152	**Uzbekistan**	140.67	10.150	84	0.037	144	9.491	140	0.008	166
47	**Vanuatu**	57.00	1.650	139	0.722	26	15.685	133	2.807	9
65	**Venezuela**	69.33	59.650	40	0.218	69	427.136	42	0.097	98
9	**Vietnam**	31.67	296.400	14	0.350	46	2 064.740	14	0.516	35
133	**Zambia**	118.50	5.450	102	0.041	139	37.341	111	0.081	110
39	**Zimbabwe**	54.50	30.950	61	0.247	63	135.272	72	0.535	34

Germanwatch

Following the motto of *Observing. Analysing. Acting.* Germanwatch has been actively promoting global equity and livelihood preservation since 1991. We focus on the politics and economics of the Global North and their worldwide consequences. The situation of marginalised people in the Global South is the starting point for our work. Together with our members and supporters, and with other actors in civil society, we strive to serve as a strong lobbying force for sustainable development. We aim at our goals by advocating for prevention of dangerous climate change and its negative impacts, for guaranteeing food security, and for corporate compliance with human rights standards.

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