Turkey, 2020. Flash floods in Giresun province left many people injured, some missing and at least 6 people dead. Since the 1960s, floods have been by far the most significant climate- and weather-related hazards.

2

HAZARDS EVERY-WHERE

Looking at climate and disaster trends and impacts

Contents

Definitions

Disasters are included based on a 'significance' threshold, defining disasters as incidents where more than 10 people were killed, or more than 100 affected.

This report looks at disasters triggered by **natural hazards** – that is by biological, geophysical and climatological hazards.

Human-induced disasters: Disasters can also be caused by transport or industrial accidents (known as technological hazards). These can include fires, explosions and structures that collapse, or may be connected to leaks of nuclear, biological or chemical materials, including contamination and radiation.[1]

Extreme climatological events are rare for the place where they occur and appear in the top or bottom of the range (in terms of temperature, wind speed, volume of rain and so on) observed for that location. Not all extreme events will lead to a disaster, as this will depend on a variety of factors including location, levels of exposure and vulnerability of the people in the affected area, and whether it occurs simultaneously with other shocks or hazards (IPCC, 2012).

Global data for what can be considered **extreme** is patchy, difficult to compare and tends to be subjective (for example floods are often defined by whether they are of sufficient magnitude to be considered a 5-year, 10-year, 20-year or 100-year flood for that location, based on how regularly such magnitude has been seen previously). Therefore, we have focused mostly on disasters rather than extreme events (thereby including the impacts). Storms, however, do have clear categories (based on their wind speed), and cyclone levels 4 and 5 (based on the Saffir-Simpson Hurricane Wind Scale which is used across regions) can be defined as extreme.

1 An example of how human-induced hazards can cascade following natural hazards was when a tsunami disabled the power supply of the Fukushima Daiichi nuclear reactors in Japan in 2011, leading to a major nuclear accident. Tracking human-induced hazards can be challenging due to the wide variety of typologies, categories and definitions used by different organizations, as well as the potential areas of overlap with disasters triggered by natural hazards.

INTRODUCTION
HAZARDS, EXTREME EVENTS AND DISASTERS

In the past ten years (2010–2019), there have been 2,850 disasters triggered by natural hazards[2] which have killed 10 or more people and/or affected 100 or more people (EM-DAT database).[3] The overwhelming majority of these (83%) were caused by climate- and weather-related extreme events, such as floods, storms and heatwaves.[4]

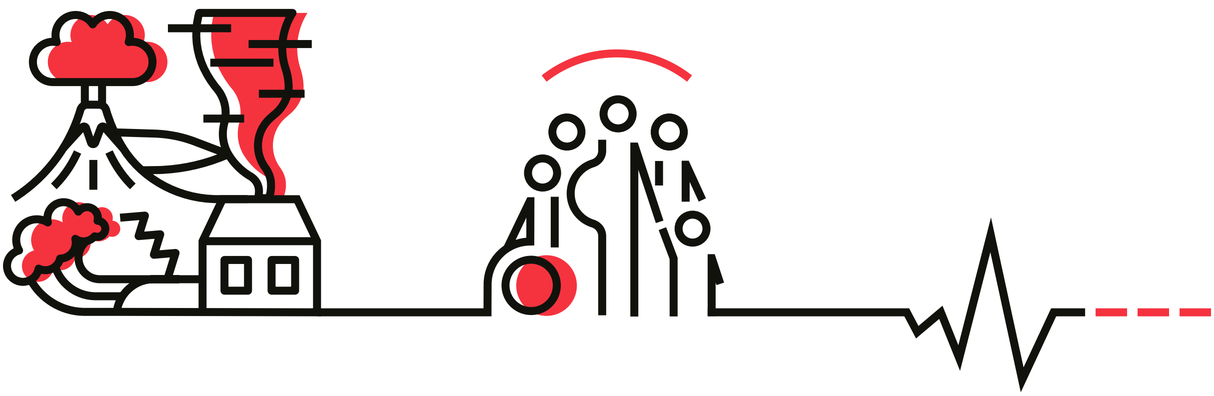
These disasters affected close to 1.8 billion people – many of whom were injured, left homeless or without livelihoods – jeopardizing the progress made in sustainable development and adding to the burden of an already overstretched humanitarian system. Of the almost 1.8 billion people affected, 97% were affected by extreme weather and climate events.[5]

Figure 2.1: 2019 snapshot of disasters triggered by natural hazards

308
disasters triggered by **natural hazards**

97.6
million
people affected

24,396
people have died
as a result

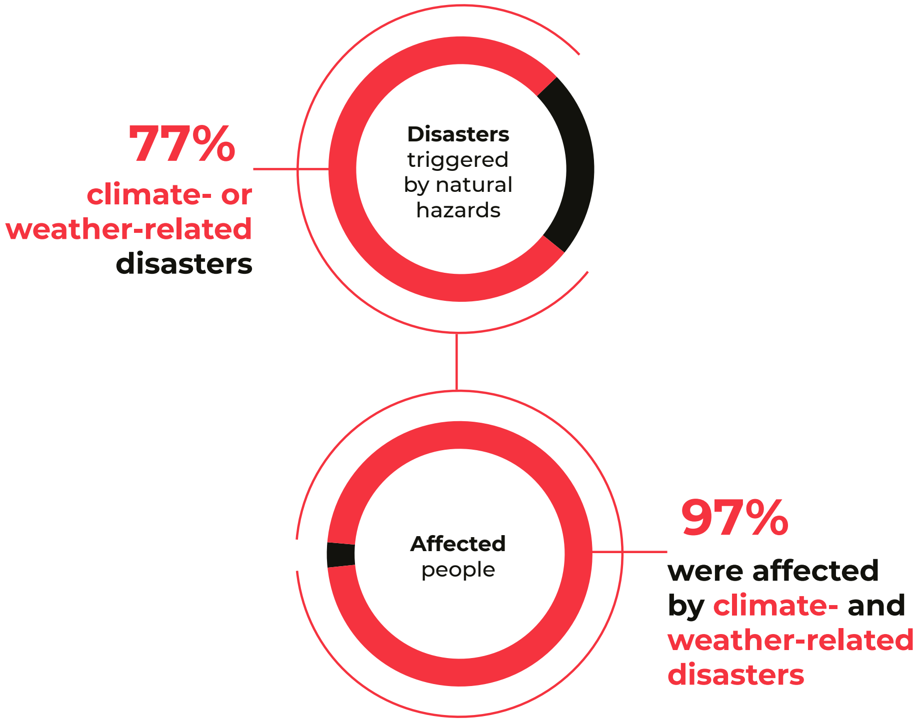


Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb, Public Health England and IFRC GO

2 Disasters are included based on a 'significance' threshold, defining disasters as incidents where more than 10 people were killed, or more than 100 affected. This report focuses mainly on disasters triggered by natural hazards – that is by biological, geophysical and climate- and weather-related hazards.
3 EM-DAT considers people to be affected by disasters where they require "immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance." This therefore includes people displaced, even if only for one day, but also people who lose their houses or sustain life-changing injuries.
4 For a detailed list of definitions see WMO, 2018.

The percentage of disasters attributable to climate- and weather-related events has increased from 73% in the 1990s, to 76% in the 2000s to 83% in the 2010s. These climate- and weather-related disasters have claimed more than 410,000 lives in the past ten years, the vast majority in low and middle income countries.

Figure 2.2: Disasters triggered by climate- and weather-related hazards in 2019



Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb, Public Health England and IFRC GO

This report focuses mainly on disasters triggered by natural hazards. This chapter looks at the nature, frequency and location of disasters triggered by natural hazards over the past year (2019)[6] as well as the past decade, and compares these with disaster trends back to the 1960s (global disaster data before then is less reliable). Some details of specific events in 2020 have also been included where the data is available. The chapter also notes some of the gaps in the available data, and how this might skew our understanding of today's risk environment.

In addition, the chapter looks at how the climate has changed and how today's trends are expected to evolve in the coming years – by 2030 and 2050 – looking at some best-case and worst-case projections and scenarios, including some of the potential future impacts of disasters triggered by extreme weather and climate events.

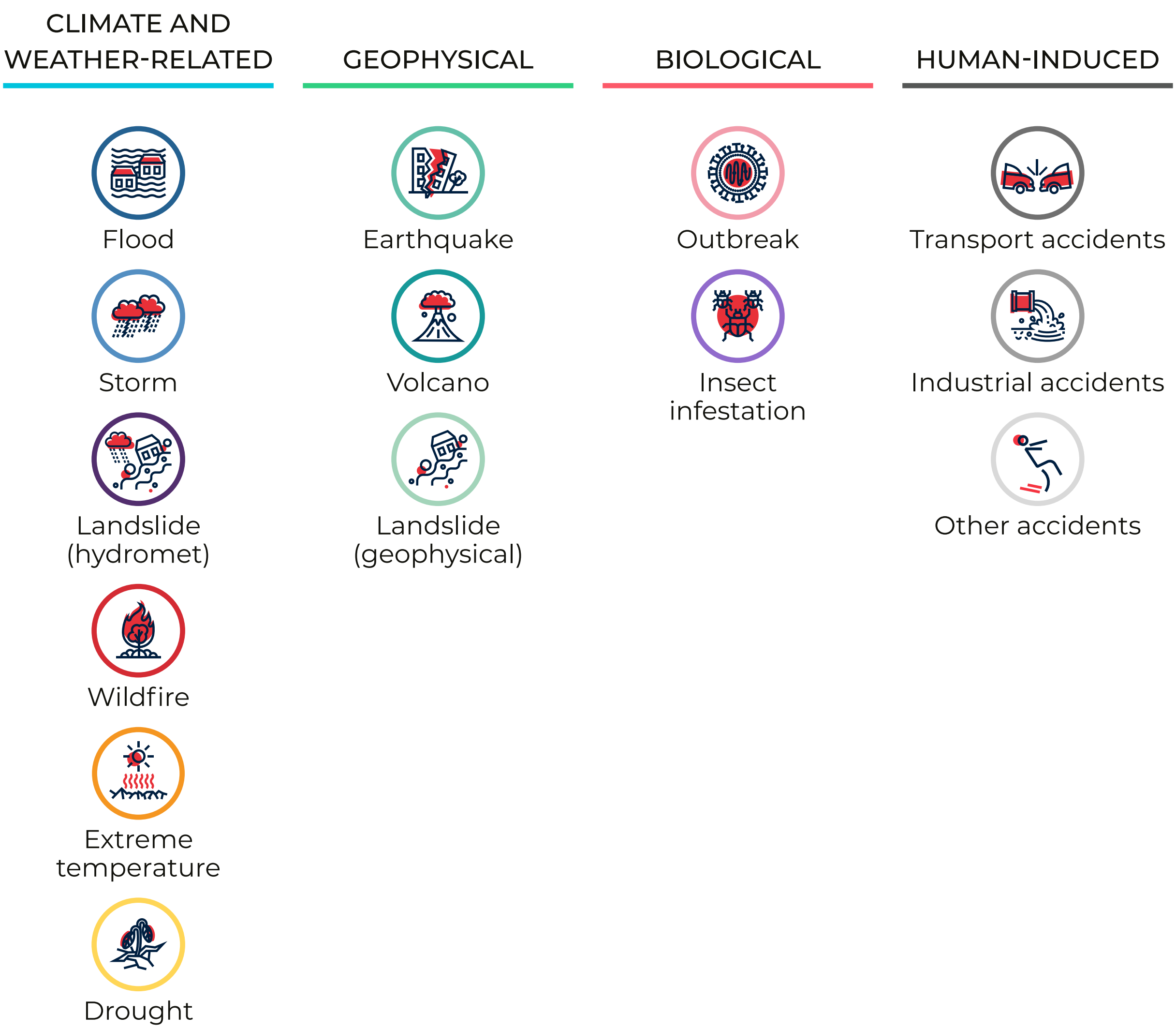
5 Extreme climatological events are rare for the place where they occur and appear in the top or bottom of the range (in terms of temperature, wind speed, volume of rain and so on) observed for that location. Not all extreme events will lead to a disaster, as this will depend on a variety of factors including location, levels of exposure and vulnerability of the people in the affected area, and whether it occurs simultaneously with other shocks or hazards (IPCC, 2012). Global data for what can be considered extreme is patchy, difficult to compare and tends to be subjective (for example floods are often defined by whether they are of sufficient magnitude to be considered a 5-year, 10-year, 20-year or 100-year flood for that location, based on how regularly such magnitude has been seen previously). Therefore, we have focused mostly on disasters rather than extreme events (thereby including the impacts). Storms, however, do have clear categories (based on their wind speed), and cyclone levels 4 and 5 (based on the Saffir-Simpson Hurricane Wind Scale which is used across regions) can be defined as extreme.

6 We also use examples from 2020, but these are not included in statistics.

An important component of understanding disasters is understanding who has been affected, how and why. Not all natural hazards lead to disasters and while the intensity and frequency of hazards is clearly significant, these are not the sole determinants of risk. Disaster risk is a function of exposure to hazards as well as the vulnerability of people to climate-related hazards and their capacity to manage shocks. Chapter 3 looks at how vulnerabilities and exposure are changing and the factors exacerbating them.

While hazards may be natural and inevitable, disasters are not. Disasters occur when a community is "not appropriately resourced or organized to withstand the impact, and whose population is vulnerable because of poverty, exclusion or socially disadvantaged in some way" (Mizutori, 2020). Disasters therefore can and should be prevented. We can seek to prevent hazards from leading to disasters by reducing risks (created by a combination of a hazard, exposure and vulnerability) and promoting resilience.

Hazards and disasters



> **There is no such thing as a natural disaster… Disasters result when a hazard affects human settlement which is not appropriately resourced or organized to withstand the impact, and whose population is vulnerable because of poverty, exclusion or socially disadvantaged in some way.**

Mizutori, UNDRR, 2020

2.1 THE DATA WE HAVE AND THE DATA WE NEED

Data in this report is drawn from multiple sources (outlined at the end of the chapter). However, the data is not always easily comparable, and it is difficult to map events without a standard and globally agreed taxonomy for disasters and or for extreme weather and climate events (Guha-Sapir and Below, 2002).

Furthermore, not all locations or all disasters have robust reporting. Forecasting and reporting capacities differ between and within countries. A number of less developed countries have only "sparse observational networks of climate data", and, for example, heatwaves in sub-Saharan African (including a specific severe event in 1993) appear to be missing from EM-DAT (Harrington and Otto, 2020). Data monitoring is also far weaker for extreme temperatures, disease outbreaks and wildfires than for floods and storms.

Often wildfires and extreme temperature events are not considered disasters but as "environmental events" without recognition of the human consequences. Disease outbreaks or epidemics are sometimes categorized as disasters (recognizing their multiple triggers) and sometimes as health emergencies. IFRC includes epidemics and other major disease outbreaks as disasters in this report due to their significance in terms of their impacts on vulnerable populations, as well as the connection between epidemics and climate change, but notes ongoing challenges in ensuring robust datasets that cover all events.

Longitudinal analysis is also a challenge. The older the disaster data is, the less reliable it is, often with significant under-reporting (Ritchie, 2019). For this reason, this report does not use data from before the 1960s, noting that even this early data may be incomplete and challenging to compare with modern data, given substantial advancements in reporting and recording of events.

Recording of the impacts of disasters has also changed over time. While recent years have seen greater recognition of the multiple and/or cascading effects of disasters, secondary impacts are rarely captured in standard datasets.

Compounding and cascading hazards are also challenging to record and analyse in terms of impacts. For example, Cyclones Idai and Kenneth hit areas already affected by drought, where they triggered floods and later led to a cholera outbreak.

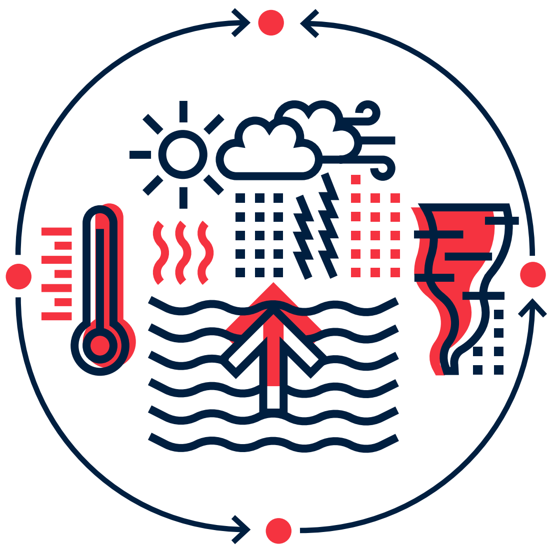
Access to quality data facilitates faster, more effective action with greater reach and impact. Yet there remains a data and digital divide globally. Digital access, inclusion, literacy and processes are necessary components for organizations, including humanitarians, to access timely, accurate data for analysis.

Open source technologies and open data[7] would drastically improve the available data for the humanitarian and development sectors so that we can generate better analysis and trends, and better serve vulnerable communities around the world (see also, Web Foundation, 2020).

7 For example, see Open Source Initiative, State of Open Data, and Gov Lab.

2.2 CLIMATE AND DISASTERS – A DANGEROUS RELATIONSHIP

2.2.1 How has the climate changed?



Global temperatures have warmed significantly in recent decades. According to the Intergovernmental Panel on Climate Change (IPCC) "Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels" (IPCC, 2018). One degree may not seem like much, but it represents a massive increase in energy in the atmosphere, and can in some ways be compared with a human who has a fever: a small increase has a big impact on well-being and ability to function.

The changes are being felt in the oceans as well as on land, and are leading to more frequent heatwaves in most land regions (high confidence) and increased frequency and duration of marine heatwaves (high confidence). In addition, the IPCC notes that there is "substantial evidence" of an increase in the frequency and intensity of heavy precipitation events globally (medium confidence – IPCC, 2018).

The five years from 2015 to 2019 are the warmest five on record (NOAA, 2020b), and the first three months of 2020 were second only to the El Niño-influenced start of 2016 for warmth. In general, global temperatures are currently running at or above the level projected by the climate models featured in the IPCC's AR5 (CarbonBrief, 2020).

Similarly, **sea levels** are continuing to rise, driven by the retreat of glaciers, the melting of sea ice sheets and the thermal expansion of warming water (IPCC, 2019a). According to NASA, sea levels have risen 83.5 mm in the last 25 years (see Figure 2.4). The IPCC states that it is "virtually certain" that the global mean sea level is rising and accelerating (high confidence), and that glacier and ice sheet contributions are now "the dominant source" of this (very high confidence) (IPCC, 2019a). It warns that, due to the projected global mean sea level rise, historically rare extreme sea levels – the so-called 'hundred year events' – will become common by 2100 (high confidence), and communities living in low-lying cities and small islands will experience extreme sea levels every year by 2050.

Carbon dioxide is the main driver of human-induced climate change. Carbon dioxide levels have also been rising and in July 2020, the World Meteorological Organization (WMO) announced they had reached a new peak (WMO, 2020).

2.2.2 The role of climate change in extreme weather events

In the past, the effect of climate on extreme events could only be seen in statistics: a trend in the occurrence of extremes based on an analysis of many events over a long period of time. Science has advanced so that it is now possible to determine the role of climate change in some specific extreme weather events (National Academies of Sciences, Engineering and Medicine, 2016). Some types of extreme weather events, such as extreme cold and heat, can be attributed to climate change with higher confidence than others. Thunderstorms, cyclones and compound hazards are more difficult to attribute to climate change because so far the tools to do so are lacking. However, scientists are rapidly developing new methodologies to improve our capability to analyse and understand the role of climate change in these events.

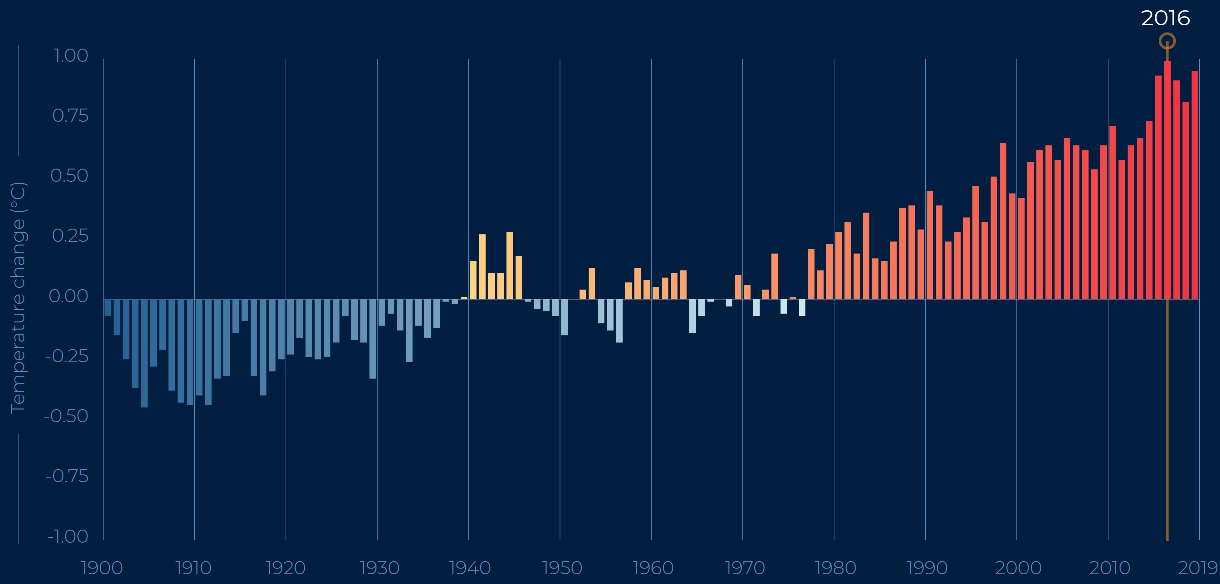
In 2019, scientists concluded that the record-breaking heatwaves in June and July in Europe were made more likely and more intense due to climate change (van Oldenborgh et al, 2020). Scientists came to similar conclusions about the southeastern Australian bushfires in 2019–2020 (van Oldenborgh et al, 2020) (see Box 2.4).

While limited time and lack of data in some regions make it impossible to conduct an attribution study for every extreme event that has occurred during 2019, many of the changes that are expected to occur with climate change are consistent with the disasters and extreme events outlined already. We are seeing climate change in many events around us, every day.

2.2.3 And the climate continues to change

In 2017, the IPCC noted that while the estimated level of human-induced warming had reached around 1°C above pre-industrial levels, many regions and seasons have already experienced warming greater than the global average – with land regions experiencing warming above global average, and most ocean regions warming at a slower rate (IPCC, 2018).

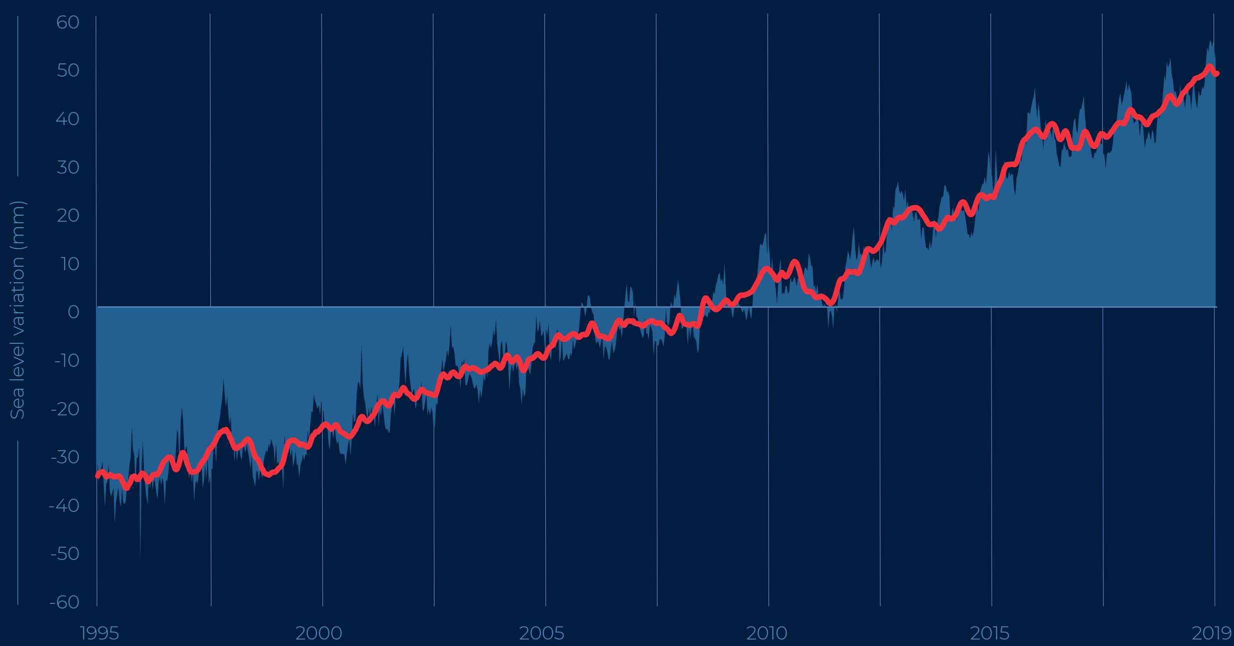
Figure 2.3: Global temperature change in °C, 1901–2019



Source: National Oceanic and Atmospheric Administration (NOAA)

Note: Graph illustrates the change in global surface temperature relative to 1951–1980 average temperatures (zero). This is based on the annual mean temperature anomaly. A cold year is negative and a hot year is positive. The hottest year was 2016 with +0.99°C.

Figure 2.4: Sea level change, 1995–2019



Source: NASA

Note: Sea level variation around 1995–2020 mean based on satellite sea level observations. Line is smoothed 60-day moving average. According to NASA, global mean sea levels have risen by 83.5 mm in the last 25 years.

The report warned that global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. We know that different degrees of global warming have different implications for humanitarian needs. IPCC findings indicate that warming of 2°C will have a much greater impact than 1.5°C, and will lead to greater extremes of heat, sea level rise, food insecurity and other climate-related hazards.

While a 2°C or 1.5°C increase may sound like a small change, it is significant because the global average temperature has not changed this quickly in at least the past 10,000 years (Global Monitoring Laboratory, no date) and these changes are occurring on a global scale. 1.5°C and 2°C are also significant benchmarks because in 2015 world leaders agreed to limit long-term temperature warming to below 2°C before 2100, while 'pursuing efforts' towards the much more ambitious limit of 1.5°C (UNFCCC, 2015).

Given current emissions, and even if current pledges under the Paris Agreement on climate change are met, the world is still on track to see a global temperature rise of 3 to 5°C by 2100 (Climate Action Tracker, 2019; UNEP, 2018).

Greece, 2018. Members of the Hellenic Red Cross look for survivors in the town of Mati after devastating wildfires claimed more than 90 lives. Continued global warming is expected to increase heat-related events, as well as droughts and wildfires.

© IFRC

BOX 2.1: GEOENGINEERING: WHAT IF OUR GLOBAL CLIMATE COULD BE MANIPULATED?

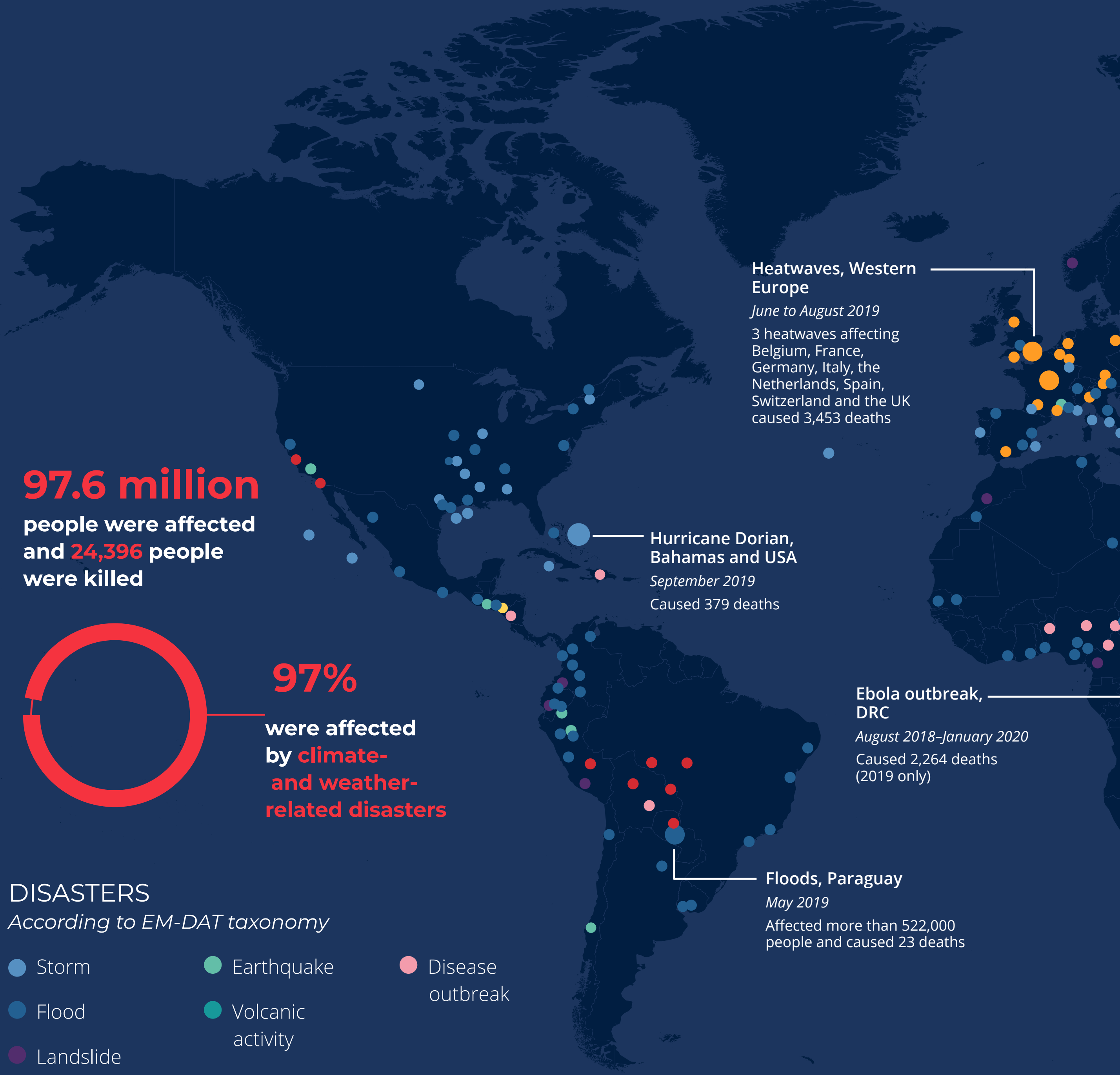
If you put a gigantic umbrella between the sun and the earth, our planet would not warm up as much. Clearly we cannot do that, but what if we deployed billions of tiny umbrellas? What if someone carried planeloads of sulfur dioxide, and released it up above where planes fly? Each particle, like a mini-parasol, casts a tiny shadow and cools our Earth below.

This would be an attempt to intentionally manipulate the global climate. Experts say it could be done, with some billion dollars and some time. The IPCC explains: "Most, but not all, [geoengineering] methods seek to either (1) reduce the amount of absorbed solar energy in the climate system (Solar Radiation Management) or (2) increase net carbon sinks from the atmosphere at a scale sufficiently large to alter climate (Carbon Dioxide Removal)."

There is no treaty, no 'geoengineering governance' in place, to guide how to make such decisions about whether to deploy these types of initiatives, when and where and who is affected. Then who should make these decisions and with what consultation process?

Altering the Earth's climate is an experiment in which every person on our planet is a test subject. If resources must be directed towards exploring geoengineering options, full consideration should be given to the needs and role of the most vulnerable people (Suarez and van Aalst, 2017).

DISASTERS IN 2019



97.6 million

people were affected and 24,396 people were killed

97%

were affected by climate- and weather-related disasters

DISASTERS

According to EM-DAT taxonomy

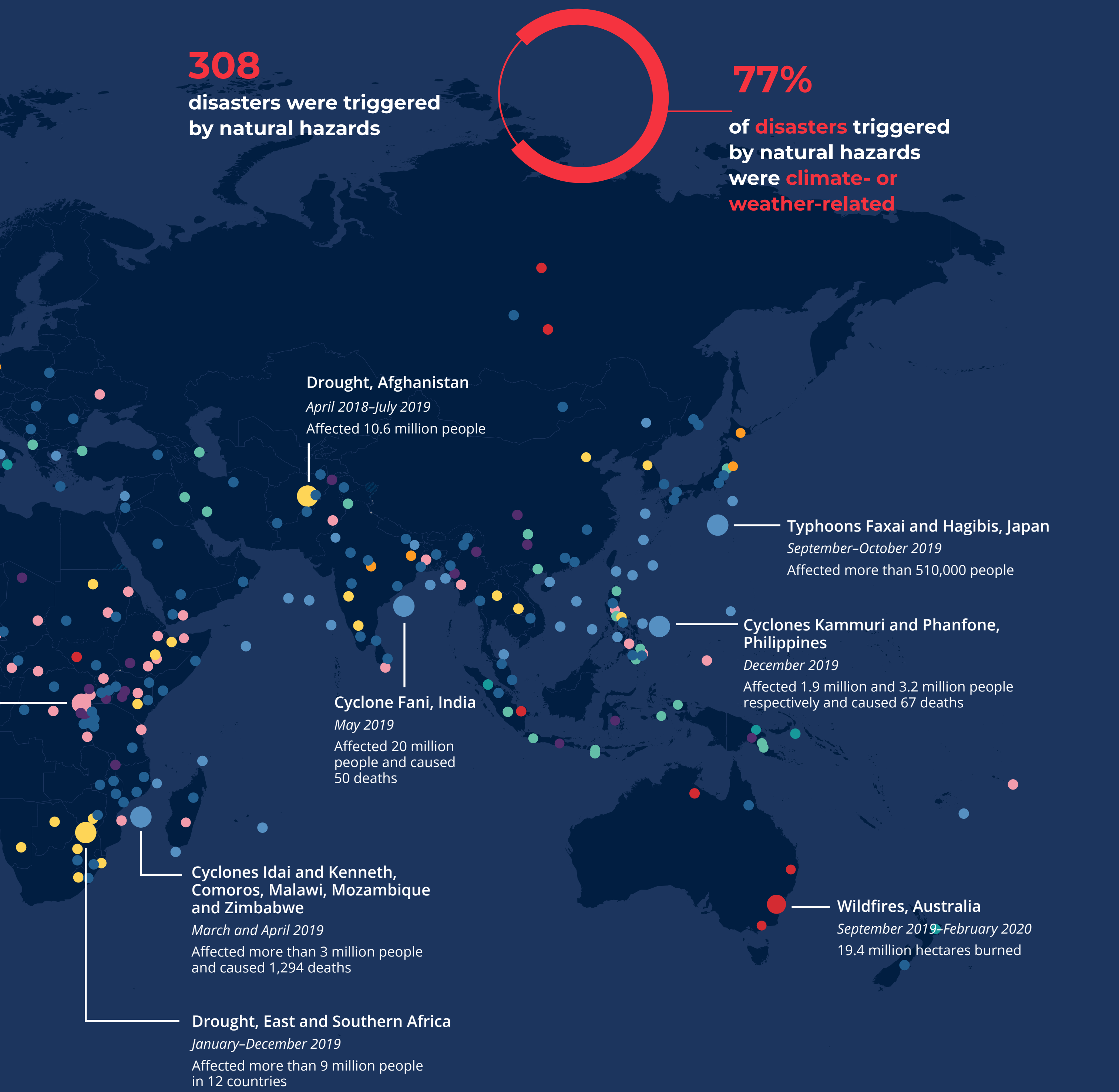
- Storm
- Flood
- Landslide (hydromet)
- Wildfire
- Heatwave
- Drought
- Earthquake
- Volcanic activity
- Disease outbreak

Sources: EM-DAT, NCEI (NOAA), WHO, DFO, FIRMS (NASA), National Hurricane Center, Joint Typhoon Warning Center, IBTrACS (NOAA), ReliefWeb, secondary data review

Note: A selection of major disasters affecting over 250,000 people have been highlighted.

308
disasters were triggered by natural hazards

77%
of disasters triggered by natural hazards were climate- or weather-related



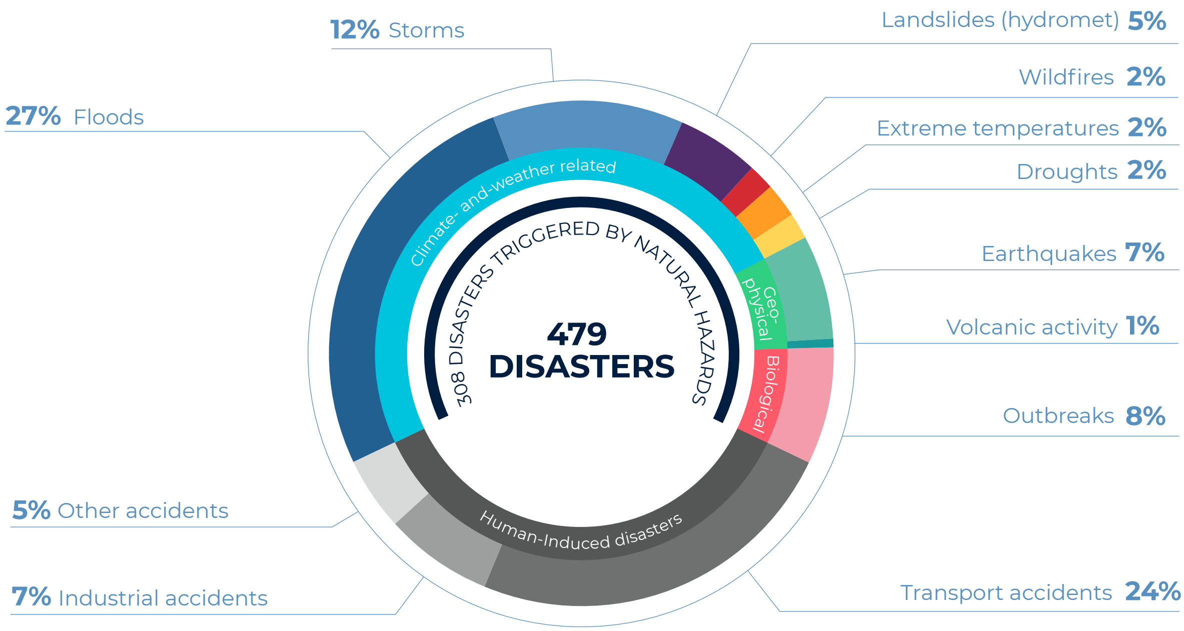
127	59	25	8	10	8	32	3	36
Floods	Storms	Landslides, hydromet	Wildfires	Extreme temperatures	Droughts	Earthquakes	Volcanic activities	Disease outbreaks

2.3 DISASTER TRENDS AND PROJECTIONS

2.3.1 Disasters in numbers

In 2019 there were 308 disasters[8] triggered by natural hazards, affecting 97.6 million people. The most frequent were floods (127), followed by storms (59), disease outbreaks[9] (36), earthquakes (32) and hydrological-related landslides (25). Extreme temperature events (10), wildfires (8) and droughts (8) were less frequent, while volcanic activity was quite rare with only three significant events. In 2019, the vast majority (77%) of these disasters were triggered by climate- or weather-related hazards (storms, floods, droughts, wildfires, extreme temperature or landslides).

Figure 2.5: Disasters in 2019



Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

In the past decade there were 2,850 disasters triggered by natural hazards, and 2,355 of these were climate and weather related. The most frequent were floods (1,298), followed by storms (589).

8 Note that while EM-DAT is country based (so one storm affecting two countries would be counted twice), IFRC uses an events-based analysis, so a hazard that has led to a disaster in one or more countries counts as one disaster.

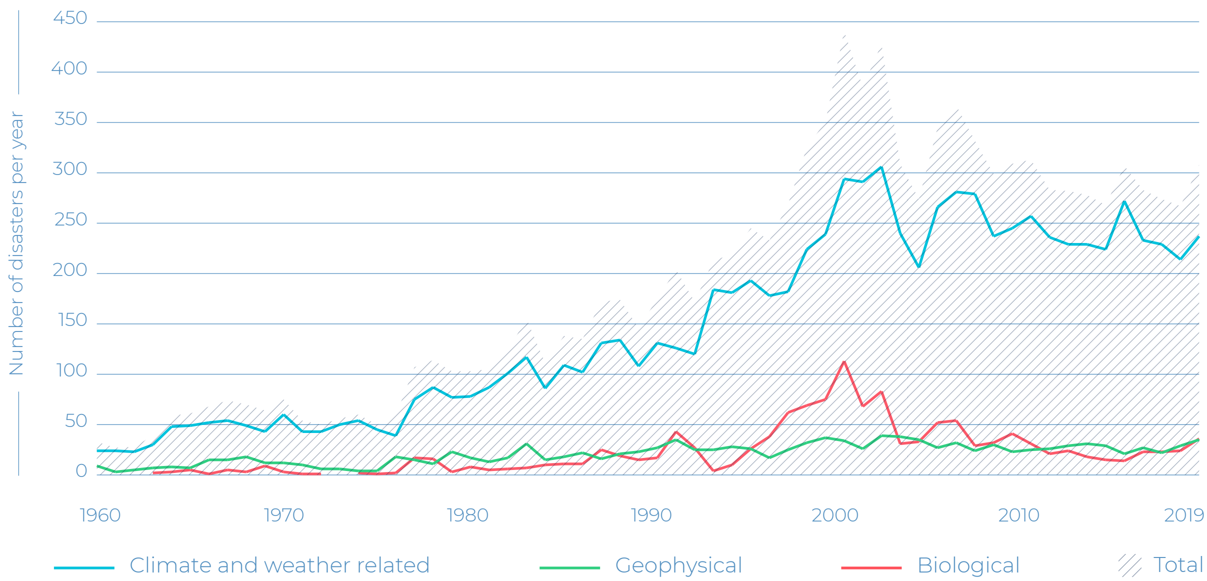
9 This includes disease outbreaks reported as humanitarian disasters through EM-DAT. EM-DAT outbreak data is a compilation of records from UN agencies including WHO, NGOs, insurance companies, research institutes and secondary data review from press agencies. Using this data source allows comparison between all disaster types through the same data collection methodology. But the low data quality of disease outbreak monitoring in some countries, and absence of common definitions for indicators (such as affected people) reduces the quality of the data set.

Since 1960, more than 11,000 disasters triggered by natural hazards have been recorded. The number has also been steadily increasing from an annual total of 33 in 1960 to a peak of 441 disasters in 2000.[10]

Disasters connected to **geophysical or biological hazards**, while rising since the 1960s, have remained relatively stable since the 1980s, with 25 to 50 events each year. The number of recorded **disease outbreaks** has also been rising since the 1960s (see section 2.5) with an apparent peak (according to EM-DAT data) between 1997 and 2002.[11]

The overall number and proportion of **disasters that were triggered by climate- and weather-related hazards** has increased most significantly. While in the 1960s, 76% of reported disasters were climate and weather related, this proportion rose to 83% during the past decade (2010–2019). This is explored in more detail hazard by hazard in section 2.4.

Figure 2.6: Comparison of different types of disasters triggered by natural hazards over time, 1960–2019



Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

Since the 1960s, **floods** have been by far the most significant of the climatological hazards, and the proportion of floods has steadily increased. **Storm events** have been relatively stable in number and have even decreased slightly as a proportion of all extreme weather events during the past three decades, however the number of the most intense storms has increased (see section 2.4). In contrast, and recognizing the poor level of monitoring for both cold and heatwaves, the number of **extreme temperature events**

10 Some of the increases may be attributable to improved recording of events in various countries and regions (in particular improved recording of disease outbreaks over recent years), rather than an increase in the number of hazards. It may also be partially attributable to increases in population and urbanization (discussed further in section 2.5), meaning that more people may be affected by each hazard. However, these factors do not lead to increased numbers across all hazards, which might be expected.

11 Note that data for biological disasters is often less robust, especially because definitions differ between countries, and because diseases are dynamic events where multiple factors promote or contain the spread at different times. Also, reporting numbers of people who are killed or affected by ministries of health may be incomplete or not include cause of death or illness.

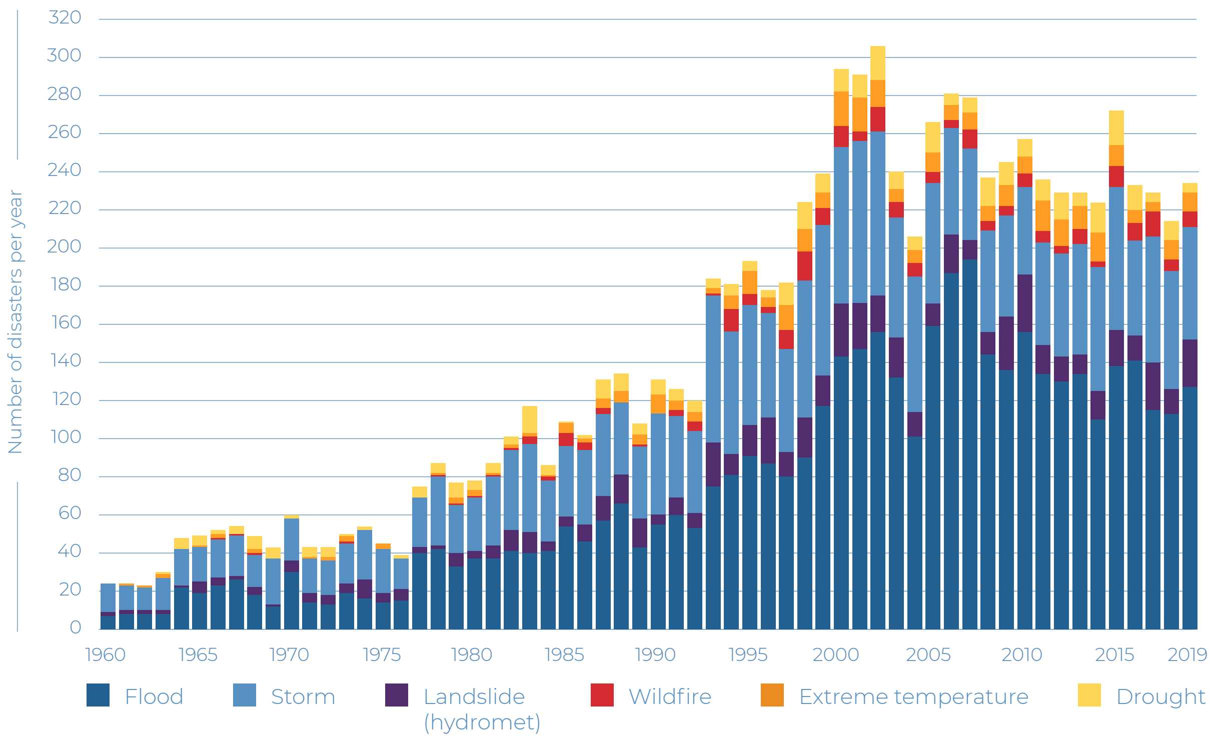
that triggered disasters appears to have increased in the 2000s from the decades before, but has remained relatively stable since then.[12]

Global warming has already led to reduced glaciers, polar sea ice and snow cover, and increased permafrost thaw. This is projected to continue due to increases in the surface air temperature (IPCC, 2019a). Similarly, further acidification of the oceans and increased ocean temperatures are "virtually certain". This will destroy coral reefs, reduce the global biomass of animals across marine ecosystems and diminish the productivity of fisheries, affecting the livelihoods, income and food security of communities that rely on the ocean (IPCC, 2019a).

On land, projected warming is expected to shift certain climate zones in the direction of the poles, and increase heat-related events, droughts, wildfires and pest outbreaks. This will also lead to increased water scarcity in dryland areas, reduced crop and livestock production in certain areas and unstable food supplies. It will also lead to increased land degradation due to a combination of more intense storms and sea level rise (IPCC, 2019b).

Hazards, such as storms, floods, heatwaves, droughts and wildfires, are projected to increase in number, intensity and variability. While some regions will face higher risks, others will face new risks that have not been experienced or anticipated before (IPCC, 2019b; 2019a). Section 2.4 outlines how these disasters will change.

Figure 2.7: Annual numbers of climate- and weather-related disasters by hazard, 1960–2019



Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

12 These numbers do not reflect the severity of the extremes, numbers of people affected or the overall average temperatures, which have been increasing over time, with 2016 and 2019 described as the two hottest years on record (WMO, 2020). Further, the regions that are predicted to see the highest increase in extreme temperatures, such as Africa and the Americas (in particular certain countries in South America), are also those that are monitored the least and lack coping capacities (ESRI, no date).

Figure 2.8: Disasters and their triggers, 1960–2019

	Since 1960		2010–2019		2019
	Total	Annual average	Total	Annual average	Total
CLIMATOLOGICAL	**8,781**	**146**	**2,355**	**236**	**237**
Flood	4,435	74	1,298	130	127
Storm	2,638	44	589	59	59
Landslide (hydromet)	686	11	178	18	25
Wildfire	243	4	75	8	8
Extreme temperature	353	6	109	11	10
Drought	426	7	106	11	8
GEOPHYSICAL	**1,260**	**21**	**274**	**27**	**35**
Earthquake	1,021	17	231	23	32
Volcanic activity	197	3	38	4	3
Landslide (geophysical)	42	1	5	<1	–
BIOLOGICAL	**1,319**	**22**	**221**	**22**	**36**
Disease outbreak	1,315	22	220	22	36
Insect infestation	4	<1	1	<1	–
TOTAL	**11,360**	**189**	**2,850**	**285**	**308**

Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

United States of America, 2020. Hurricane Delta hit areas already damaged by Hurricane Laura six weeks earlier. Since 1960, the USA has been the most-affected country with 341 storms.

2.4 SPOTLIGHT ON CLIMATE- AND WEATHER-RELATED HAZARDS

2.4.1 Heatwaves: the silent killer

Heatwaves are periods of time when temperatures are unusually high and hazardous to human health and well-being.[13] Extreme heat is most acutely felt in cities, where the urban heat island effect[14] exacerbates extreme temperatures and densely built neighbourhoods with little or no green space tend to be even hotter.

In 2019 the most severe heatwaves (seven of them) were recorded in Europe[15] and in India and Japan and killed almost 4,000 people in total. These heatwaves killed 3,453 people across 8 countries in Western Europe, with the highest numbers of deaths in France (1,435) and the UK (892). In India and Japan heatwaves killed 112 and 173 people, respectively, in 2019.[16]

In the **last decade**, EM-DAT recorded 38 heatwaves killing 70,409 people (55,736 in Russia alone in 2010, due to a combination of extreme heat and wildfires). In 2015, 2,500 people died during an extreme heatwave in India, and at least 3,800 people died during an 8-day heatwave in Bangladesh in 2008.

The number of recorded heatwaves per decade has been steadily rising since the 1960s, reaching a peak of 40 in the 2000s. While longer-term data is poor,[17] there have been some particularly notable heatwaves in recent decades, such as in 2003 when 72,250 people died in Europe during one particularly deadly summer. A severe heatwave also affected Africa between January and April 1992 where in some countries in Southern Africa the maximum daily temperature was more than 3°C above average repeatedly over a 4-month period. This coincided with a significant drought affecting 86 million people, but the numbers of people who were affected or died due to the heat is not recorded (Harrington and Otto, 2020).

Heatwaves can put a strain on health systems by exacerbating pre-existing medical conditions, energy systems can be overwhelmed leading to blackouts and transportation can be disrupted. Heatwaves are most dangerous to certain groups including older people; people with pre-existing medical conditions such as heart disease, respiratory illness and diabetes; people who are isolated; young children; pregnant women; people who work outdoors during the hottest times of the day; people who are overweight or obese; and people who are homeless. Low socioeconomic status can further compound vulnerability by limiting access

13 The temperature that will be considered a heatwave varies based on what is considered abnormal for the location. Definitions also commonly vary in: whether or not humidity is included, whether daytime and/or night-time temperatures are considered and how long the conditions need to last before a heatwave is declared.

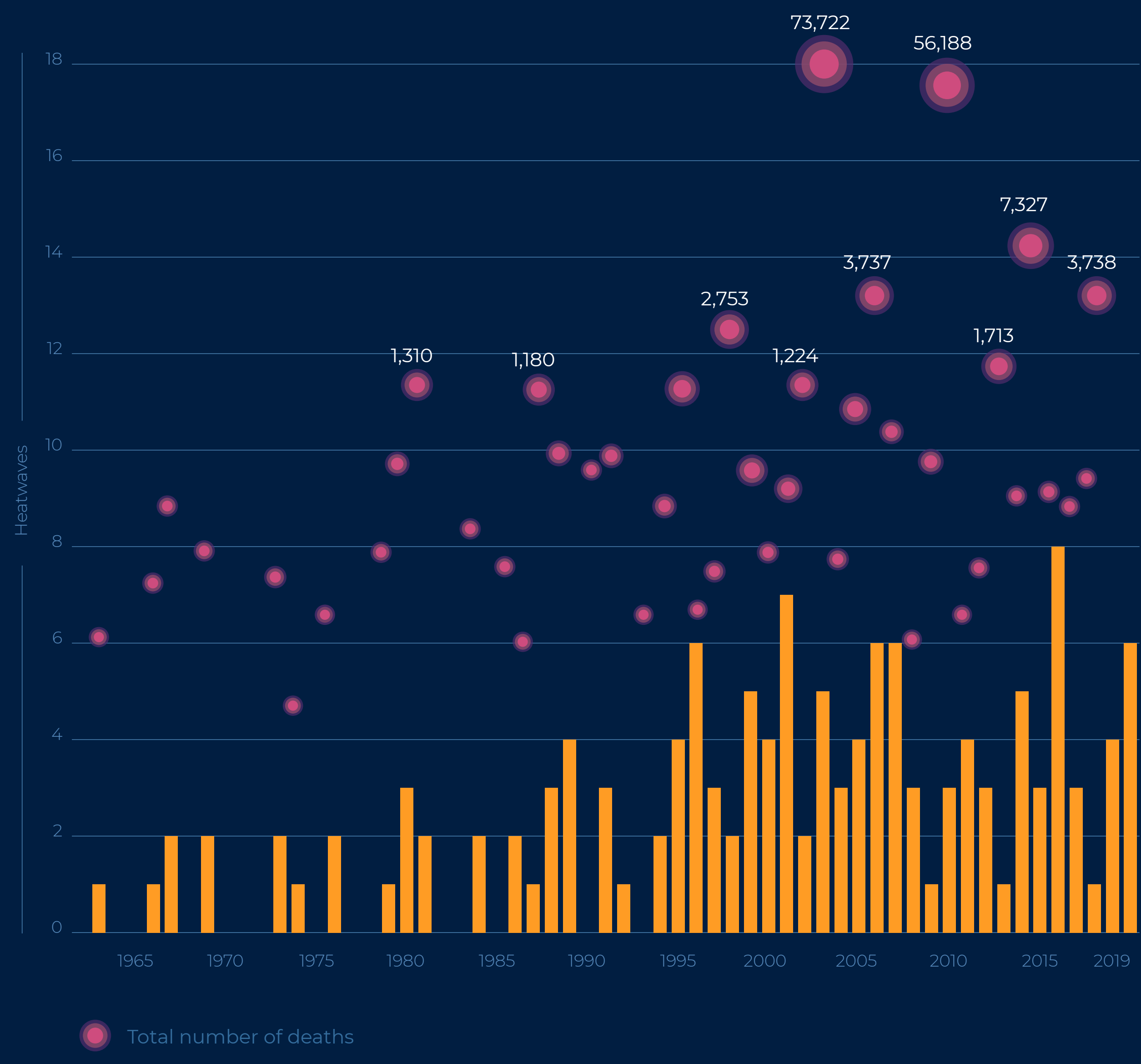
14 The urban heat island effect refers to cities being hotter than surrounding rural areas. This is largely due to density and building materials which absorb and retain heat, as well as concentrated human activity which generates heat.

15 Regional data in this report used a continental breakdown of Africa, Asia, Americas, Europe and Oceania, as this is the breakdown used in EM-DAT, although this differs slightly from the regions usually used by IFRC.

16 Data is compiled from EM-DAT and Public Health England (2019). Heatwave mortality is calculated by using excess mortality correlated with heatwave timespan. Public Health England data is for the UK only and was published several months later, hence is not included in EM-DAT for 2019.

17 Note that heatwave monitoring has historically been poor, and particularly so in certain subregions such as sub-Saharan Africa (See Harrington and Otto, 2020). Heatwave monitoring as a 'disaster' improved after the major heatwaves in Europe and North America in 2003 (WMO and WHO, 2015).

Figure 2.9: Heatwaves, 1960–2019



Sources: EM-DAT and Public Health England

Notes: Heatwave monitoring has historically been poor, particularly in certain regions such as in parts of Africa (See Harrington & Otto, 2020). Heatwave monitoring as a 'disaster' improved after the major heatwaves in Europe and the USA in 2003 (WMO, 2015). Public Health England published additional data for 2019 which has been included to address gaps in EM-DAT data.

to cooling options. As with many hazards, people with limited literacy and non-native language speakers also face heightened risk as they may not be able to understand advisories or read health advice.

The IPCC has high confidence that hot extremes will increase in all inhabited regions due to climate change. In addition, the rising temperatures will exacerbate the urban heat island effect and lead to more heat-related health problems as well as an increase in energy demand for cooling (IPCC, 2018).

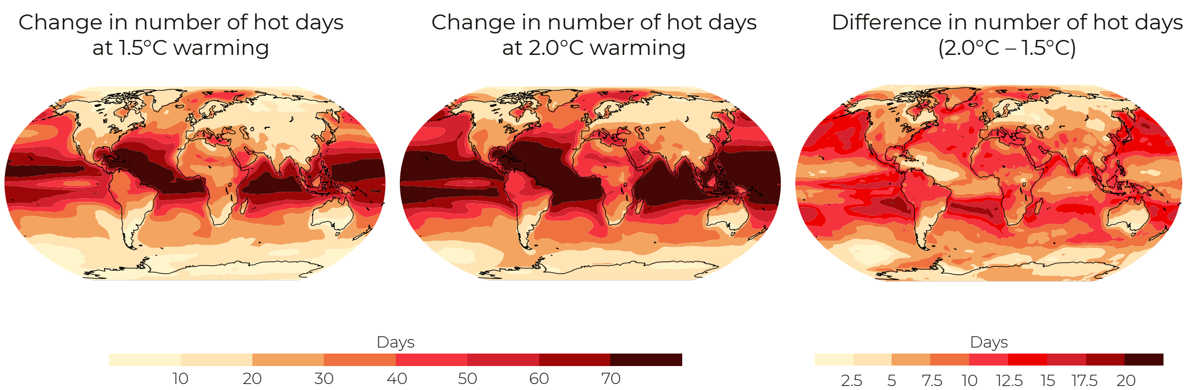
People living in urban areas are among the hardest hit when a heatwave occurs because these areas are hotter than the surrounding countryside. Over half the world now lives in urban areas, and this is projected to increase to two-thirds by 2050.

Some 30% of the global population is already estimated to be exposed to extreme heat (defined as temperatures above 37˚C) for at least 20 days every year. The projections for future impact are sobering: in a scenario with drastic reductions in emissions, in 2100, this number might rise to around 48% of the population. In a scenario with no reductions, and continued growth in greenhouse gas emissions, as many as 74% of the population could be exposed to extreme heat in 2100 (Mora et al, 2017).

Globally, as more and more people live in cities, expanding the built environment as well as the size of informal settlements, their exposure to heat risks is expected to rise. C40 Cities projected that, by 2050, more than 970 cities could experience average summertime temperature highs of 35˚C (C40 Cities, 2018). This is nearly triple today's numbers: as yet only 354 cities are this hot. The number of people exposed to this risk is also projected to rise to some 1.6 billion by 2050, an 800% rise from today.

The rise in the number of cities at risk poses additional risks in terms of inadequate infrastructure, poor heat management processes and emergency response systems in countries that are less used to managing the risks of extreme heat. An example is the more than 70,000 deaths linked to the 2003 heatwave in Europe (C40 Cities, 2018).

Figure 2.10: Projections of heatwave risk (date and degree of global warming)



Sources: Hoegh-Guldberg et al in IPCC, 2018

Note: Based on IPCC projections, of warming of global mean surface temperature compared to the pre-industrial period (1861-1880).

By 2100, 48% of the global population may be exposed to extreme heat (defined as temperatures above 37˚C) for at least 20 days every year – if we drastically reduce emissions. If we don’t, that could reach 74%.

2.4.2 Floods: impacting millions of people each year

Floods affect more people globally each year than any other disaster. **In 2019**, 127 floods affected 69 countries, killed 1,586 people and displaced 10 million more (IDMC, 2019). The highest numbers of floods in 2019 were in Asia with 42 floods across 22 countries while Africa experienced 38 floods across 21 countries. The country most affected by floods was Iran with over 10 million people impacted in 2019, followed by Malawi (991,648 people) and Paraguay (521,191 people). India is the country with the highest flood frequency: in 2019 8 flood-related disasters flooded over 1.2 million km^2, impacting 236,750 people and killing at least 96 people. This was followed by Indonesia, where 7 significant floods killed 136 people and impacted 301,442 more, as well as the USA where 4 significant floods affected 790,199 km^2 and impacted more than 14,000 people (Dartmouth Flood Observatory, 2019).

From 2010 to 2019, 46% (1,298) of disasters triggered by natural hazards were floods, with more than 673 million people affected (EM-DAT, 2020). The economic toll of floods is also significant: in the first half of 2019 alone, flood losses were estimated at around 33.7 billion US dollars (approximately 33 billion Swiss francs) (Aon, 2019).

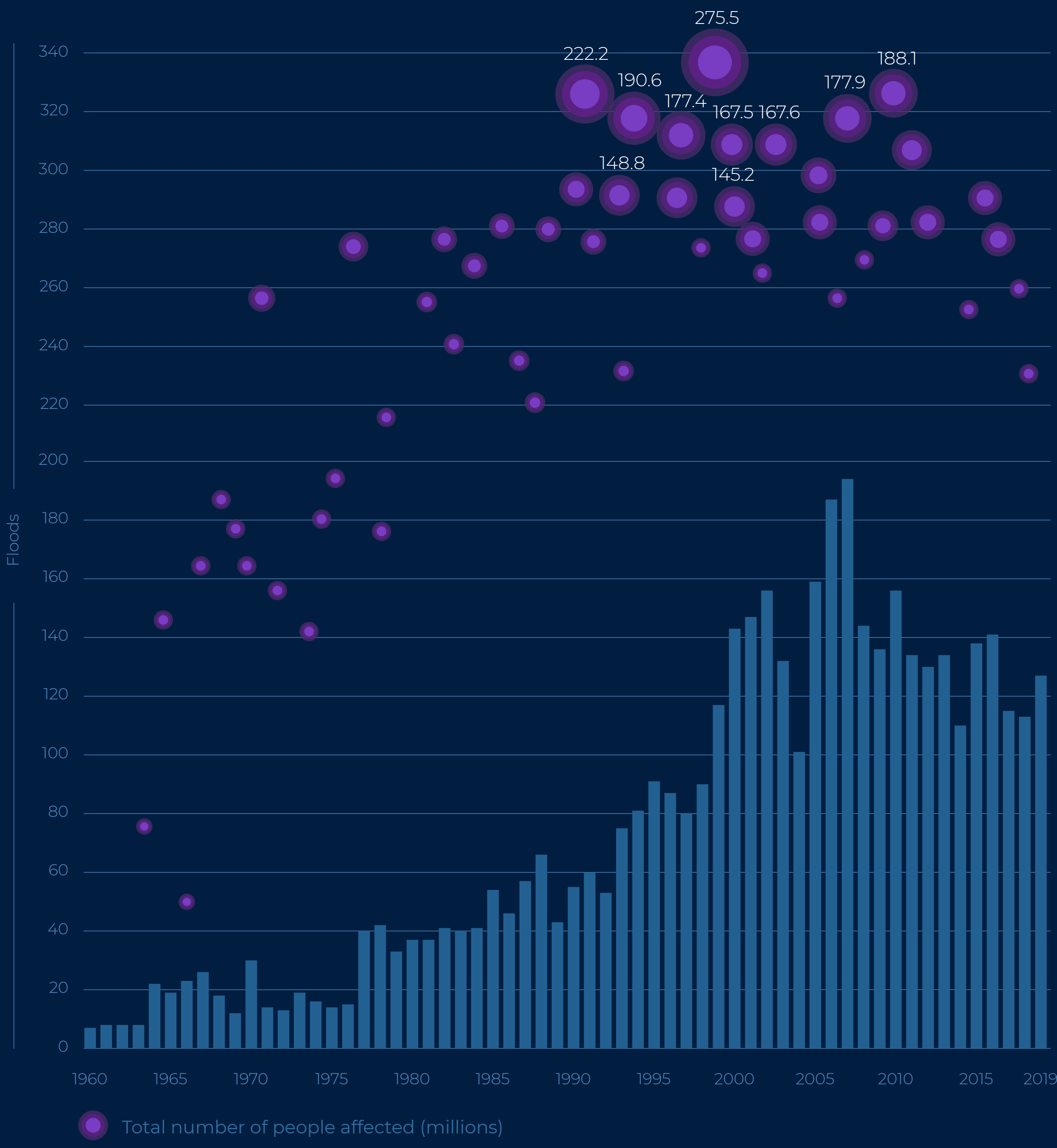
The number of floods increased significantly between the **1960s and the 2000s**. Only 151 disasters caused by floods were observed between 1960 and 1969 rising to 1,499 between 2000 and 2009. Since 2000, flood numbers have remained high with an annual average of more than 128 per year, however, the number of affected people has actually declined.

Floods can cause widespread damage and devastation including injury, death, loss of livelihoods, ruined or destroyed structures and infrastructure, lost assets and fracturing or uprooting of communities. Flooding can also have wide-ranging direct and indirect health impacts. These include immediate impacts such as drowning, injuries and hypothermia, as well as indirect effects in the medium and long term such as food insecurity leading to a rise in malnutrition (FAO, 2018), increased waterborne infectious diseases, mental health problems, respiratory diseases and allergies. Recurrent flooding may also discourage long-term investments by governments and the private sector as these investments are continually, and literally, washed away.

Of the more than 17 million people at risk of being displaced by floods each year, more than 80% live in urban and peri-urban areas (IDMC, 2019). This urbanization coupled with poverty is increasingly resulting in people living in flood zones with limited alternatives or resources for reducing their exposure.

However, it is important to note that while the number of flood events has been high, the number of people affected by floods has decreased since the 2000s. While this may be attributed to various factors, the increased investment in disaster risk reduction/climate adaptation is likely a significant contributor.

Figure 2.11: Flood events, 1960–2019



Sources: EM-DAT, Dartmouth Flood Observatory, ReliefWeb and IFRC GO


NIGERIAN RED CROSS

Nigeria, 2018. Floods in Anambra state caused widespread devastation. John came back from a displacement camp to see what was left of his home and farmland, and found his home completely submerged.

BOX 2.2 / CASE STUDY
KERALA FLOODS REQUIRE LONG-TERM DISASTER RISK REDUCTION

In August 2018, Kerala, in India's southwest, witnessed floods that broke the 100-year record. Between June and August, the state witnessed very heavy rainfall, averaging 42% above normal. All its 44 rivers were flooded, numerous landslides created blockages and the gates of most of the 80 small and medium dams had to be opened to let the swelling waters out. About 23 million people were affected, more than 500 people died, 220,00 people were rendered homeless and 60,000 hectares of cropland were destroyed. While the state was still trying to recover, a fresh wave of floods affected 13 districts in August 2019, triggered by the heaviest rainfall in that month since 1951. Another 180 people lost their lives, 109,896 people were evacuated, more than 16,000 houses were damaged and 13 hectares of cropland were washed away.

The Indian Red Cross Society (IRCS) responded by air lifting relief material for quick response, evacuations and search and rescue of survivors, providing affected communities with first aid and relief items such as food, water, tarpaulins, mosquito nets, linen and kitchen supplies. IRCS volunteers reached many of the remote worst-hit communities cut off by the rising water levels. Clean drinking water became a priority: water purification units were installed to provide potable water and the National Society cleaned hundreds of family wells.

Kerala is accustomed to continuous and heavy precipitation during the six months of its two monsoon seasons. Yet, in recent decades, development linked land-use changes have resulted in massive clearing of forests, over-exploitation of groundwater and reclamation and encroachment of wetlands, changing the natural cycles of its rivers and reducing the absorption capacities of excess water, leaving it more at risk of flooding. Efforts are needed to reduce Kerala's risk to floods.

IRCS follows weather alerts closely, especially for floods and cyclones. Before these strike the National Society endeavours to access emergency funds, mobilize volunteers and pre-position stocks. In February 2019, IRCS headquarters signed a Memorandum of Agreement with the Indian Meteorological Department to expand training of volunteers on weather forecasts and climate shocks. A major recommendation made after the Kerala response was to invest in long-term interventions to mitigate disasters and to construct a preparedness index at IRCS branch level.

Sources: Government of India, Central Water Commission, 2018; Government of India, Ministry of Environment Forest and Climate Change, 2017; Government of India, Ministry of Environment and Forests, 2013; Government of Kerala, Department of Environment and Climate Change, 2014; Hunt and Menon, 2020; Mishra and Shah, 2018; Ramachandran and Reddy, 2017.

From a climate perspective, rainfall is changing, with an increase in extreme precipitation. In time, it is very likely that extreme precipitation events will be more frequent and more intense, particularly in the mid-latitudes and wet tropical regions of the world (IPCC, 2014b). The IPCC indicates that increasing warming may result in a larger fraction of the global population being affected by major river floods (IPCC, 2014b). And there is very high confidence that coastal ecosystems and low-lying areas will experience more coastal flooding events. With more and more people and assets concentrated in coastal areas, the IPCC expects increasing exposure to coastal risks such as flooding, erosion, sea level rise and submergence (IPCC, 2014b). Regionally, the IPCC indicates that flood hazards are likely to increase in parts of Asia (in particular in south and Southeast Asia), in Africa (mostly in tropical areas), in Europe (in particular in far north eastern countries) and in the Americas (in particular in South America), while they are likely to decrease in other parts of the world (IPCC, 2014b).

Looking at population increase in areas vulnerable to flooding, the IPCC predicts large rises in the number of people at risk in all populated regions from 1970 to 2030: in Africa (from 850,000 to 3.6 million people), Asia (29.7 million to 77.6 million people), the Americas (from 1.26 million to 2.85 million people) Oceania (30,000 to 60,000 people), and Europe (1.65 million to 1.87 million people) (Handmer et al, 2012). The Aqueduct Floods model estimates that 147 million people will be affected by riverine and coastal floods by 2030 (Kuzma and Luo, 2020).

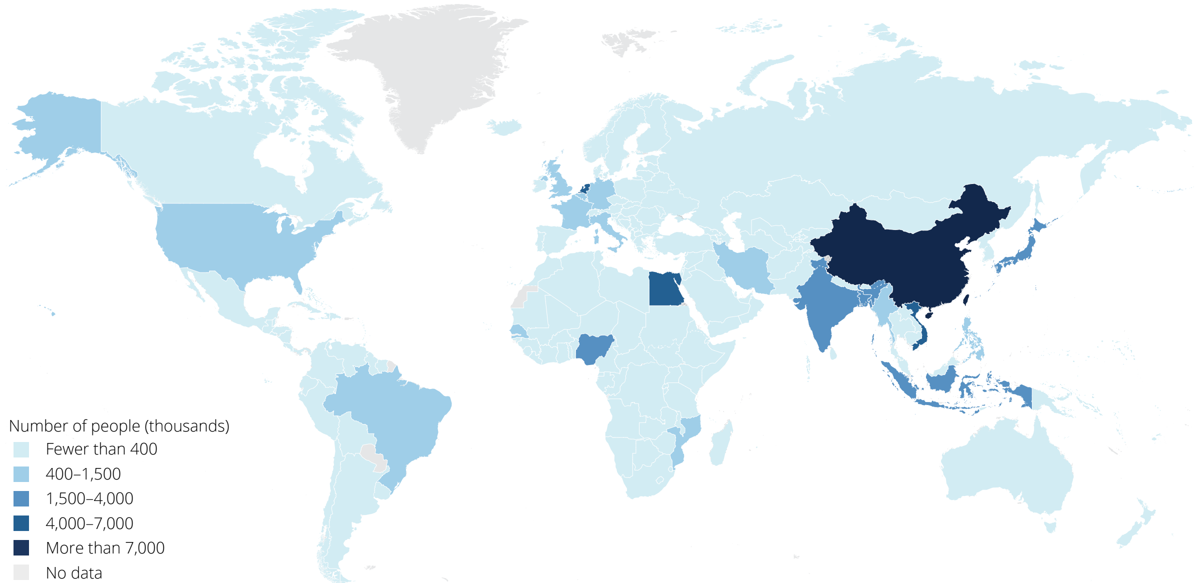
The impacts of future floods will depend on what is done about them. In coastal cities for instance, flood risks are likely to increase so much that doing nothing will be impossible, as some cities would get flooded several times each decade. Therefore the key question is how adaptation, including upgrading city coastal water defences, will take place: proactively or reactively, and in a way that protects the most vulnerable people or one that exacerbates disparities?

Iraq, 2017. Iraqi Red Crescent Society volunteers helped communities to prepare for the potential collapse of Mosul Dam. Flood preparedness is just one aspect of the comprehensive disaster-related work the Iraqi Red Crescent Society has carried out over the past decade.

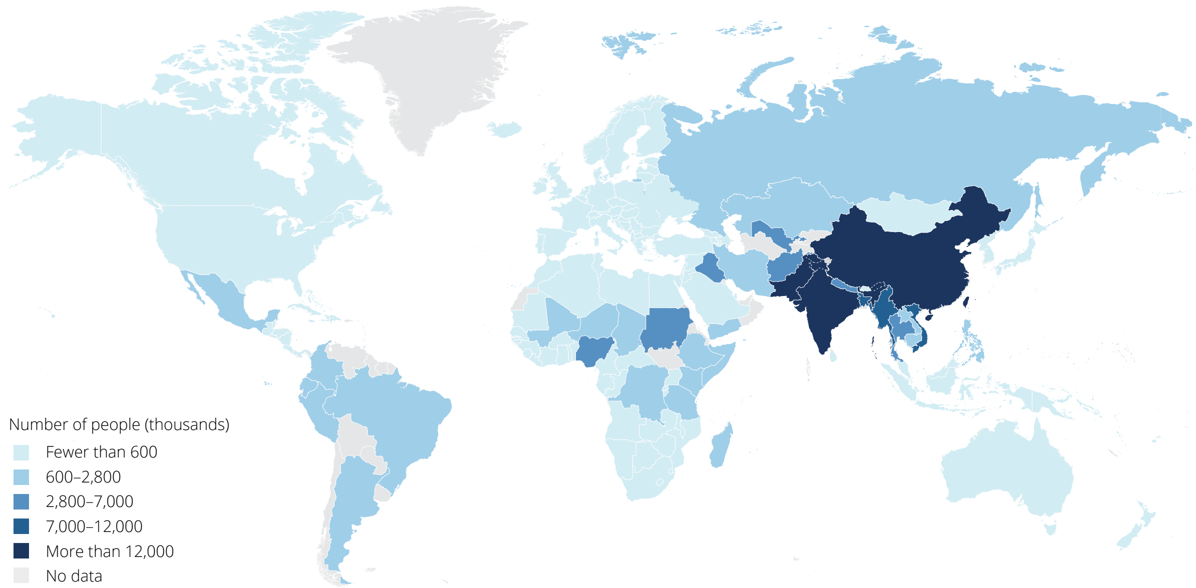
© Iraqi Red Crescent

Figure 2.12: Projections of flood risk

Absolute population exposed to coastal floods in 2050s under SSP3 scenario



Absolute population exposed to river floods in 2050s under SSP3 scenario



Source: INFORM; Marzi et al, 2020.
Notes: INFORM risk projections are based on GAR2015 exposed population, expected annual exposed population based on GLOFAS hazard maps (Dottori et al, 2018, 2016), probabilistic coastal flood simulations of extreme sea level and Standardized Precipitation Evapotranspiration Index from CMIP5 simulations. See also Alfieri et al, 2017; Vousdoukas et al, 2018
SSPs are "Shared Socioeconomic Pathways" which are used by the IPCC to model different future scenarios based on demographic and economic trends. SSP3 is a scenario with high challenges for mitigation and adaptation, meaning slow development, persisting high inequalities and continued competitive and regionalized land and energy policies.

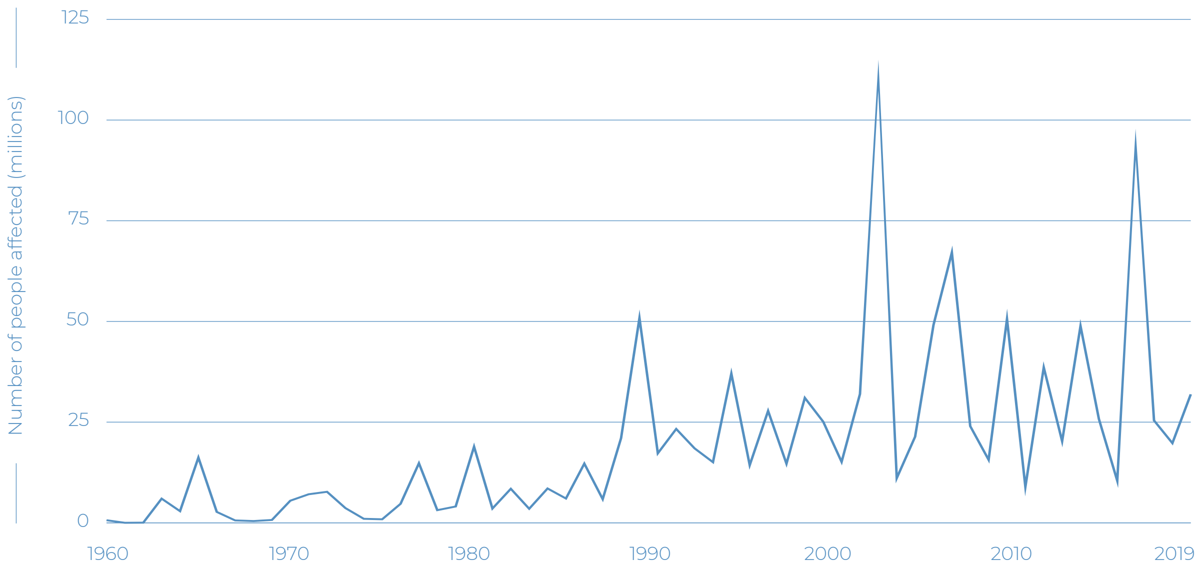
2.4.3 Storms and extreme sea level events: increasing in intensity and impact

Storms are the second most significant type of weather-related disaster (and indeed of all disasters). In **2019**, 59 storms (mostly tropical cyclones[18] and convective storms[19]) affected 37 countries and killed 2,764 people, impacting 31.9 million people. The USA, the Philippines and India were the most-affected countries. In the **past decade**, tropical cyclones and extratropical storms caused 293 disasters while convective storms caused another 289, together killing 27,183 people and affecting an estimated 324 million more.

Since the 1960s, 2,638 storm-related disasters have been recorded, including 1,443 tropical storms,[20] 204 tornadoes and 135 winter storms.

Geographically, disasters triggered by storms have most affected Asia (in particular Southern and Southeastern Asia) and the Americas. Since 1960, the USA has been the most-affected country with 341 storms, followed by the Philippines (333) and China (276), with the latter two affected by cyclones. In Asia, the most-affected countries have been the Philippines, China, India (168) and Bangladesh (159). In the Americas, the USA, Mexico (95) and Haiti (36) have been most affected, while in Africa Madagascar (56) was most affected. In Oceania, Australia (55) and Fiji (31) have been most affected while in Europe the most-affected countries have been France (27) and the UK (22).

Figure 2.13: Number of people affected by storms 1960–2019



Sources: EM-DAT, ReliefWeb and IFRC GO

18 These may be called cyclones, hurricanes or typhoons depending on the region.
19 EM-DAT's definition of convective storms includes derecho, hail, lightning/thunderstorm, rain, tornado, sand/dust storm, winter storm/blizzard, storm/surge, wind, severe storm (more details in Methodology).
20 Tropical storms comprise tropical cyclones and extratropical storms.

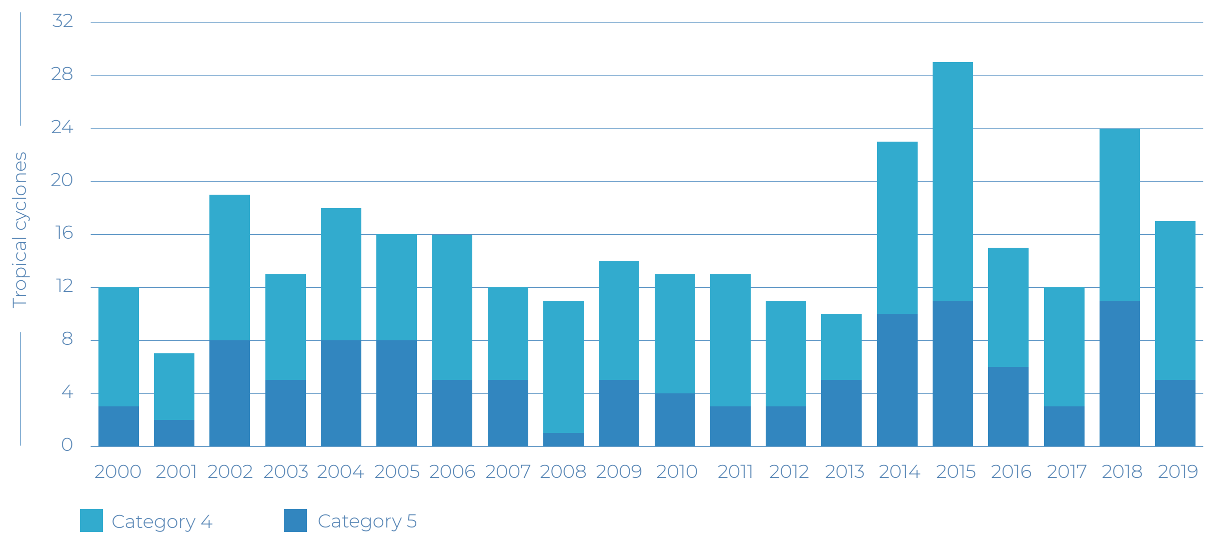
The average intensity of tropical cyclones, including winds and rainfall, is likely to continue to rise. The proportion of category 4 and 5 tropical cyclones is predicted to rise, with impacts exacerbated by higher sea levels.

The number of disasters triggered by storms has been relatively stable over the past three decades, possibly due to increased investment in disaster risk reduction efforts, including storm preparedness. However, due to recent advancements in science and data availability, evidence suggests a rise in the intensity of tropical cyclones between 1982 and 2009, meaning we are seeing more intense tropical cyclones globally (Knutson et al, 2019a; Kossin et al, 2018). The frequency of category 4 and 5 cyclones has also increased (see Figure 2.11). The level of damage that tropical cyclones inflict is, in part, determined by how quickly or slowly they move across a region: the slower they move the more problems they cause due to a longer duration of intense rainfall and wind. Scientists have observed that this 'translation speed' is slowing down globally, resulting in more rain falling locally during a given storm (Kossin et al, 2018). And there is further evidence to suggest that in some ocean basins (such as the north Pacific), there has been a northward shift in tropical storm tracks meaning that new regions are now in the pathway of tropical cyclones (Kossin et al, 2016; Nakamura et al, 2017).

Tropical cyclones combined with higher sea levels can result in higher storm surges: the deadly wall of water that storms often bring onto land as they make landfall. For example, during Hurricane Sandy which made landfall near New York City, scientists found that due to sea level rise the storm surge was 20cm higher than it would have been otherwise, and this resulted in 11.4% more people and 11.6% more homes being affected than would have happened otherwise (Leifert, 2015).

Certain subregions have been particularly affected, given cyclones are by nature formed in areas of warm water. Northwestern Pacific Ocean has frequently been affected by category 5 cyclones with a peak between 2015 and 2016. The Americas have been affected by category 4 cyclones, which increased significantly in the northeastern Pacific, in particular Mexico. Oceania observed an increase of category 4 cyclones, especially in the Central Pacific basin. The number of category 4 and 5 cyclones in Africa has been relatively stable in the past 20 years. Europe has historically been only rarely affected by category 4 or 5 cyclones, though a category 5 cyclone hit the Azores islands and Portugal in late 2019.

Figure 2.14: Number of category 4 and 5 Tropical cyclones, 2000–2019



Sources: National Hurricane Center, Joint Typhoon Warning Center and NOAA.

Note: Classification according to Saffir-Simpson Hurricane Wind scale: Category 4: 209–251 km/h and Category 5 at least 252 km/h.

Mozambique, 2019. Cyclone Idai particularly affected people in densely populated poor areas as these were ill prepared for its magnitude. People living in informal settlements tend to be at increased risk of being affected by disasters.

BOX 2.3 / CASE STUDY

CYCLONES IDAI AND KENNETH – INTENSE STORMS AFFECTING LIVES AND LIVELIHOODS

In March and April 2019, two tropical cyclones – Idai and Kenneth – battered the African east coast, affecting Comoros, Madagascar, Malawi, Mozambique and Zimbabwe. With wind gusts of up to 220 km/h, Kenneth became the strongest cyclone to ever hit the African continent. These two storms brought torrential rains, storm surges and winds, and affected communities already suffering from conflict, drought, weak health systems and food insecurity.[21] The impacts included flooding that damaged or destroyed homes and health facilities, power outages, damage to key transportation routes and bridges and a cholera outbreak.

While Kenneth was the stronger storm, more lives were lost and more people affected by Idai as it hit densely populated poor areas that were ill prepared for its magnitude (Norton et al, 2020). Meanwhile, the lower death rate can most likely be attributed to people reacting positively to the warnings as a result of trauma previously experienced and the lesson learned during Cyclone Idai.

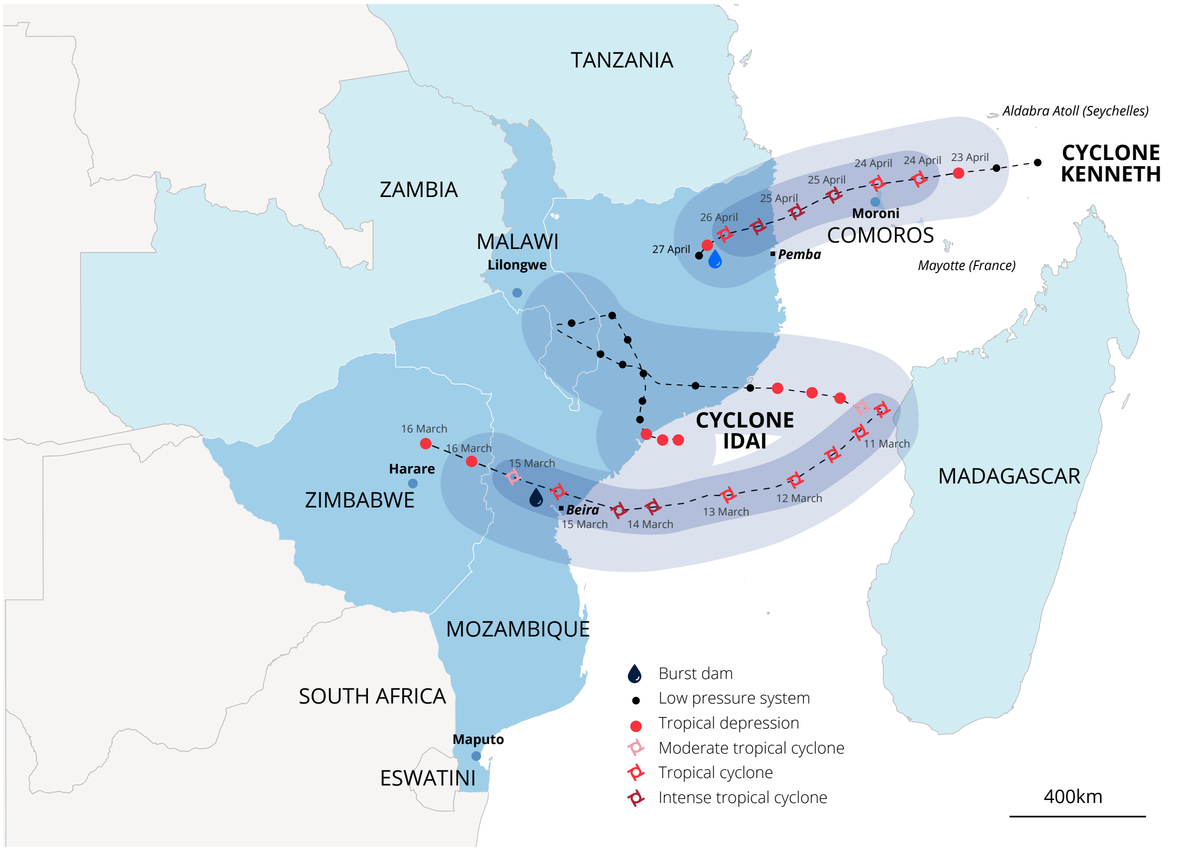
The two storms also massively exacerbated existing food insecurity. In Mozambique, 715,000 hectares of crops were destroyed by Cyclone Idai, while Cyclone Kenneth affected nearly 55,500 hectares of crops in Mozambique, leaving many smallholder farmers without a harvest to sell or on which to subsist. Damaged roads and transport infrastructure also severely limited access to external markets, causing a 100% increase in food prices and leaving 814,700 people severely food insecure (OCHA, 2019; EM-DAT, 2019).

Mozambique, 2019. Matemo island, which lies just off the coast of northern Mozambique, bore the full force of Cyclone Kenneth.

© IFRC / Matthew Carter

21 Both cyclones occurred in areas suffering from chronic undernutrition related to drought affecting Mozambique and Zimbabwe during the 2018–2019 lean season (five districts were in IPC Acute Malnutrition Phase 2). It is observed that countries facing more recurrent and severe droughts are consequently highly impacted by torrential rains, tropical storms and cyclones.

Figure 2.15: Impacts of Cyclones Kenneth and Idai



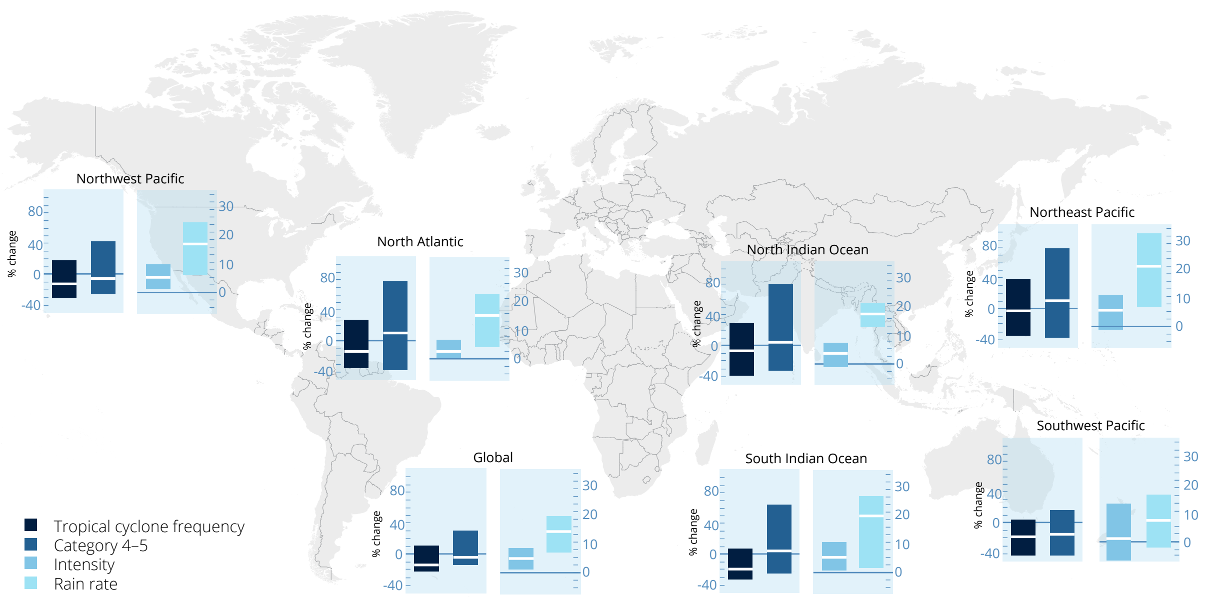
Source: OCHA, 2019

Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the UN. Creation date: 18 March 2019

IPCC projections indicate that the average intensity of tropical cyclones, including winds and rainfall, are likely to continue to rise, as are the proportion of category 4 and 5 tropical cyclones (IPCC, 2019a; Knutson et al, 2019). It predicts with very high confidence that rising mean sea levels will contribute to the higher extreme sea levels linked to cyclones. There is medium confidence that existing coastal hazards will be exacerbated by more intense tropical cyclones and an increase in the storm surges and precipitation rates associated with them. Extreme waves and storm surges are projected to increase in particular across the Southern Ocean, tropical eastern Pacific and Baltic Sea, although they may decrease in the North Atlantic and Mediterranean Sea (GDFL, no date; IPCC, 2019a).

Annual coastal flood damage is also expected to increase, and communities in atoll island (those encircled by coral reefs) and low-lying Arctic locations will be especially affected (IPCC, 2019a). In particular, the IPCC notes that: "extreme sea level events that are historically rare (once per century in the recent past) are projected to occur frequently (at least once per year) at many locations by 2050…especially in tropical regions" (IPCC, 2019a).

Figure 2.16: Predicted increase of category 4 and 5 storms

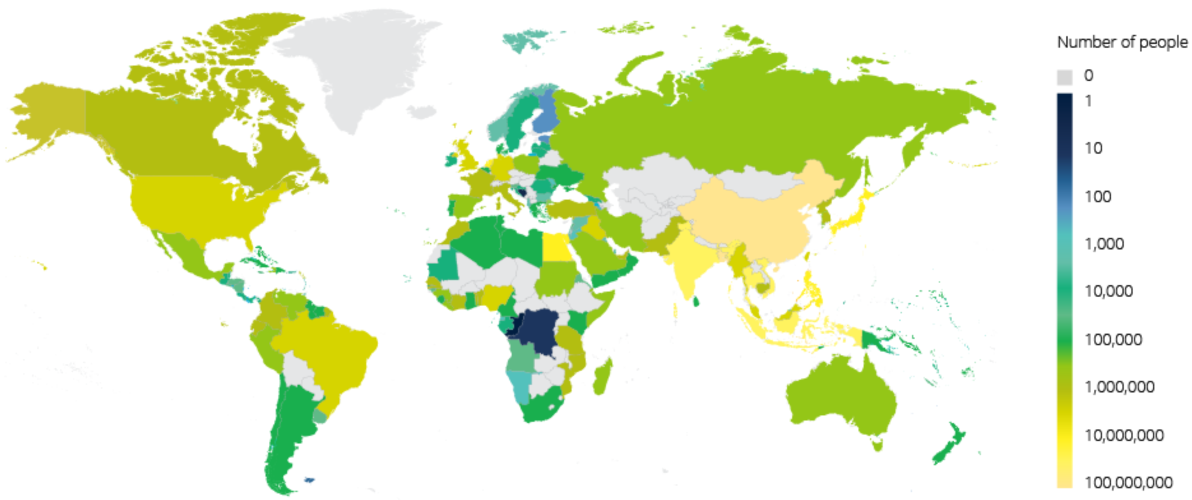


Source: Knuston et al, 2015

Notes: Summary of tropical cyclone (TC) projections for a 2°C global anthropogenic warming. Shown for each basin and the globe are median and percentile ranges for projected percentage changes in TC frequency, category 4–5 TC frequency, TC intensity, and TC near-storm rain rate. For TC frequency, the 5th–95th-percentile range across published estimates is shown. For category 4–5, TC frequency, TC intensity, and TC near-storm rain rates the 10th–90th-percentile range is shown. Note the different vertical-axis scales for the combined TC frequency and category 4–5 frequency plot vs the combined TC intensity and TC rain rate plot.

These changes are likely to impact millions of people. Scientists estimate that nearly 190 million people now occupy land below projected high tide lines for 2100 (Kulp and Strauss, 2019) under a low emissions scenario. In a high emissions scenario this number could be closer to 340 million people by 2050 and 630 million people by the end of the century (Kulp and Strauss, 2019).

Figure 2.17: The number of people on land exposed to high tides by 2050 globally based on RCP4.5



Source: Kulp and Strauss, 2019

Notes: This is based on current population who are living on land below the projected mean higher high water level in 2100. Based on a scenario of intermediate carbon emissions (RCP4.5) and relatively stable Antarctic ice sheets (sea level model K14). Estimates based on coastal digital elevation model.

Bahamas, 2019. Hurricane Dorian (a category 5 tropical cyclone) caused widespread flooding. The average intensity of tropical cyclones, including winds and rainfall, are likely to continue to rise, as are the proportion of category 4 and 5 tropical cyclones (IPCC).

© Bahamas Red Cross / Robyn-Ryann Barnett

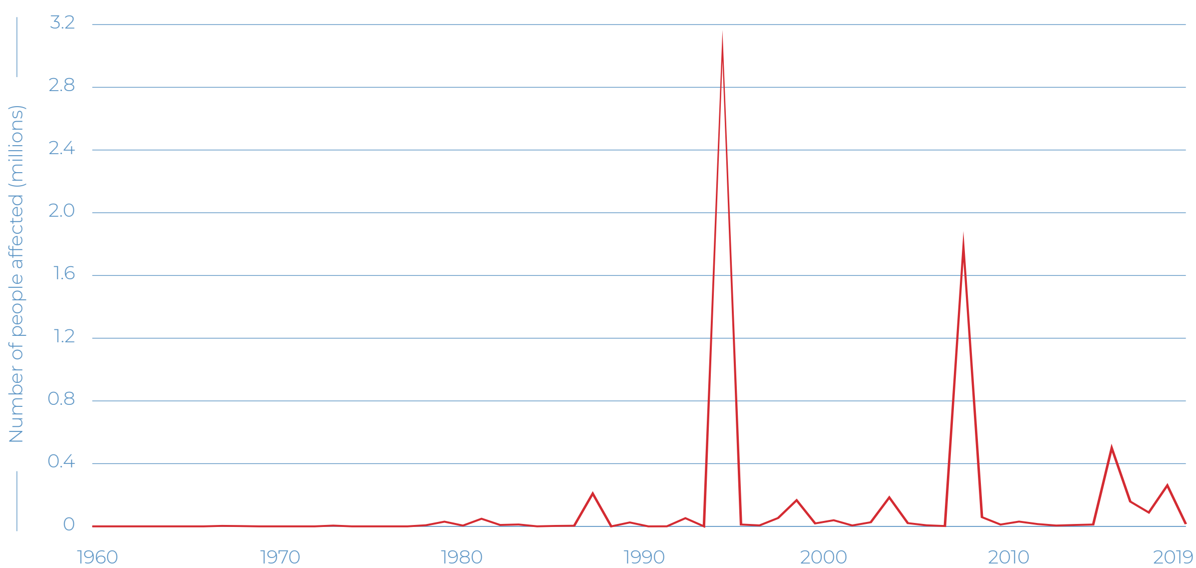
2.4.4 Wildfires: increased heat and destruction

Wildfires have direct physical impacts in terms of deaths and injuries, destruction of buildings and goods, and deaths of livestock and other animals. Fires can have major public health impacts due to fine particle air pollution which affects eyes and lungs, exacerbating existing conditions and creating new ones. They can also have mental health impacts as they create major trauma. They have ongoing impacts on biodiversity due to destruction of forest-based ecosystems and pollution of others, including rivers, lakes and even coral reefs. And they contribute to greenhouse gas emissions, not only by burning trees, but also removing trees that would otherwise be consuming carbon dioxide, creating a "climate feedback loop" (UNEP, 2020).

In 2019, 14,569 people were affected by wildfires around the world. More than half of these people (9,510) were in Australia. In total, 382,600 km^2 (equivalent to the size of Japan) have been burned mainly in Australia (19.7 million hectares), Russia (17 million hectares) and the Amazonian basin (1.3 million hectares). However, in Brazil and Russia, forest fires affect marginalized populations which are frequently under-reported or missed from official reports. For example, in Brazil, local organizations estimated that forest fires affected 148 indigenous territories within the Amazon. The Amazon is home to 306,000 indigenous people, but none are recorded as affected in official reports or in EM-DAT (The Atlantic, 2019; Correa et al, 2019).

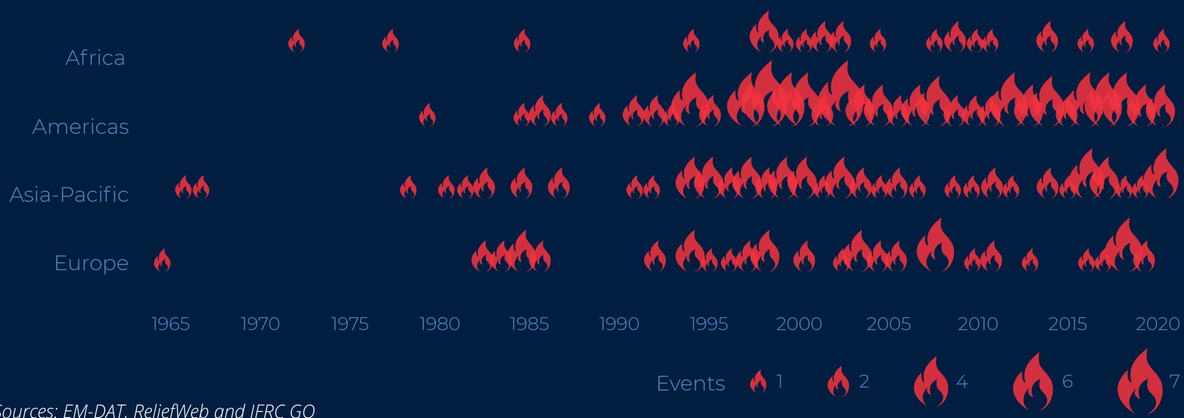
During the **past decade**, 75 severe wildfires occurred, with the highest numbers in the Americas (37), followed by Europe (12) and Oceania (11). The USA was the most-affected country with 24 significant disasters related to wildfires, which killed 198 people and affected 300,342 more. In Asia, Indonesia was hit by only one wildfire that impacted 409,664 people and killed 19 in Sumatra island.

Figure 2.18: Number of people affected by wildfires 1960–2019



Sources: EM-DAT, ReliefWeb and IFRC GO

Figure 2.19: Frequency of wildfires by region since the 1960s



Sources: EM-DAT, ReliefWeb and IFRC GO

Note: Total wildfires reported as disasters by IFRC since 1960.

Figure 2.20 The 5 wildfires that affected the most people, 1960–2019

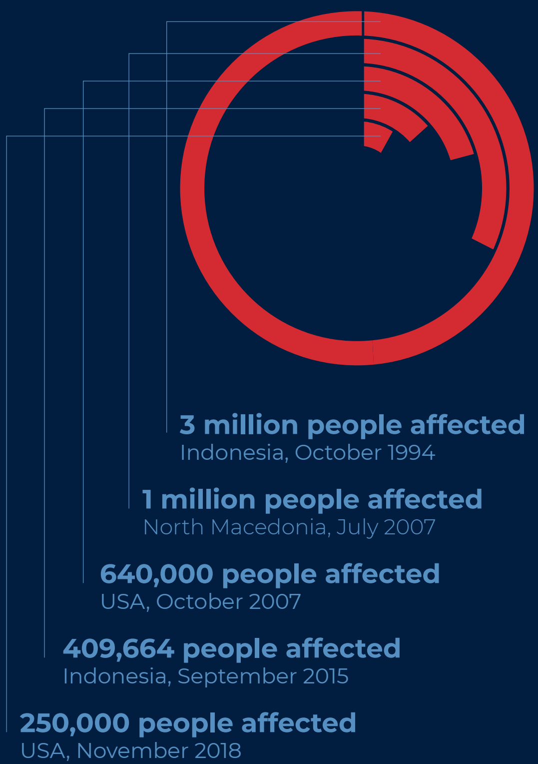
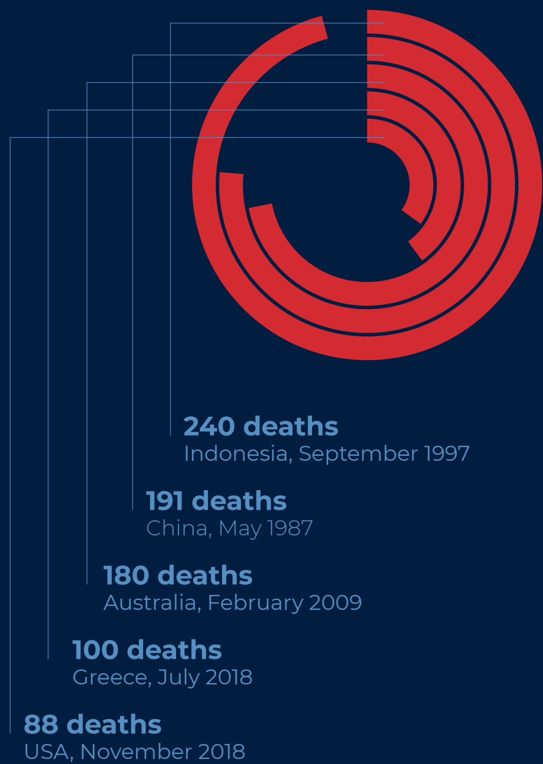


Figure 2.21 The 5 deadliest wildfires, 1960–2019



Sources: EM-DAT, ReliefWeb and IFRC GO

Since the 1960s the Americas has been the most-affected region with 105 wildfire-related disasters. The USA has been the country most affected (65), followed by Australia (24), Canada (17), Spain (10) and Russia (10). In 1994, 3 million people were affected in Indonesia when 5 million hectares burned and caused smog in Sumatra, Kalimantan islands and neighbouring Malaysia (Paton et al, 2014).

The number of wildfires has increased over time. There were only 24 reported disasters related to wildfires in the 1980s, increasing significantly to 64 disasters in the 1990s and 74 disasters between 2000 and 2009.

As time goes on, the situation is likely to get worse. Scientists estimate that in a 2ºC hotter world, the risk of the same intensity of fires would be at least four times more than it was in the 1900s, and this is likely to be an underestimate. Many regions are expected to be increasingly vulnerable to, and affected by, wildfires including the Americas, Europe (in particular around the Mediterranean), Africa (in particular countries in southern Africa) and Asia (in particular Central Asia) (IPCC, 2019b). In China, grassland fires are becoming a bigger risk due to economic development and population growth, whereas droughts, drainage of rice fields and the growth of oil palm plantations are raising the risk of peatland fires in tropical parts of Asia. Droughts are linked to increased wildfire activity in the Americas, and anthropogenic warming has been identified as a contributor to increased wildfires in Canada in particular (IPCC, 2018).

Australia, 2019. Extreme temperatures, dry conditions and winds combined to cause or escalate hundreds of bushfires across five states. Australia's 2019–2020 bushfire season was the most destructive on national record with more than 15,000 bushfires.

© Australian Department of Defence

BOX 2.4: 2019–2020 AUSTRALIAN BUSHFIRES

Following years of prolonged drought and a summer of extreme heat – with record temperatures and extensive thunderstorm activity – Australia's 2019–2020 bushfire season was the most destructive on national record. More than 15,000 bushfires affected the country, beginning in Queensland and northern New South Wales in July 2019 and extending to all states and territories by November. The Bureau of Meteorology found that the fire season in parts of eastern Australia has lengthened by almost four months since the 1950s and attributes this change to a large extent to climate change (Hannam et al, 2020).

When the season finally ended in March 2020, bushfires had burned through about 19.4 million hectares (47.9 million acres) of the country (Huf and Mclean, 2020) – an area more than double the size of Austria. The fires destroyed 3,094 homes and 7,000 outbuildings, and damaged thousands more (Australian Broadcasting Corporation, 2020a Richards and Brew, 2020). They killed 34 people and more than a billion animals, while another 11.3 million Australians are suspected to have been negatively impacted by bushfire smoke (2020, Australian Broadcasting Corporation, 2020b Richards and Brew). The cost of the bushfires was immense, with 1.3 billion US dollars (approximately 1.2 billion Swiss francs) due to direct impacts and 2.4 billion US dollars (2.3 billion Swiss francs) of total impact (CDP, 2019).

Scientists concluded that the bushfires were made more likely and more intense due to climate change. They looked at the Fire Weather Index, a rating that indicates the intensity of a fire, and found that the likelihood of an index score as high as observed during that fire season has increased by at least 30% since the 1900s due to human-caused climate change (van Oldenborgh et al, 2020).

A team of 1,965 Australian Red Cross staff and volunteers provided relief to over 47,000 people during the crisis, thanks to the support of generous community members who donated money and time. Informed by longitudinal research, which emphasizes the long-term mental health and psychosocial impacts of bushfires and the need for long-term recovery support, the Australian Red Cross response focused on assisting the psychosocial recovery of affected people and communities, and supporting and advocating for community-led recovery. This included providing direct cash grants to help address the anticipated relief and recovery needs over immediate-, medium- and long-term time frames, including an allocation for future unmet community requirements. The 30-strong Australian Red Cross recovery team (as at May 2020), includes Indigenous recovery officers and is based in bushfire-affected communities.

2.4.5 Droughts: cascading impacts

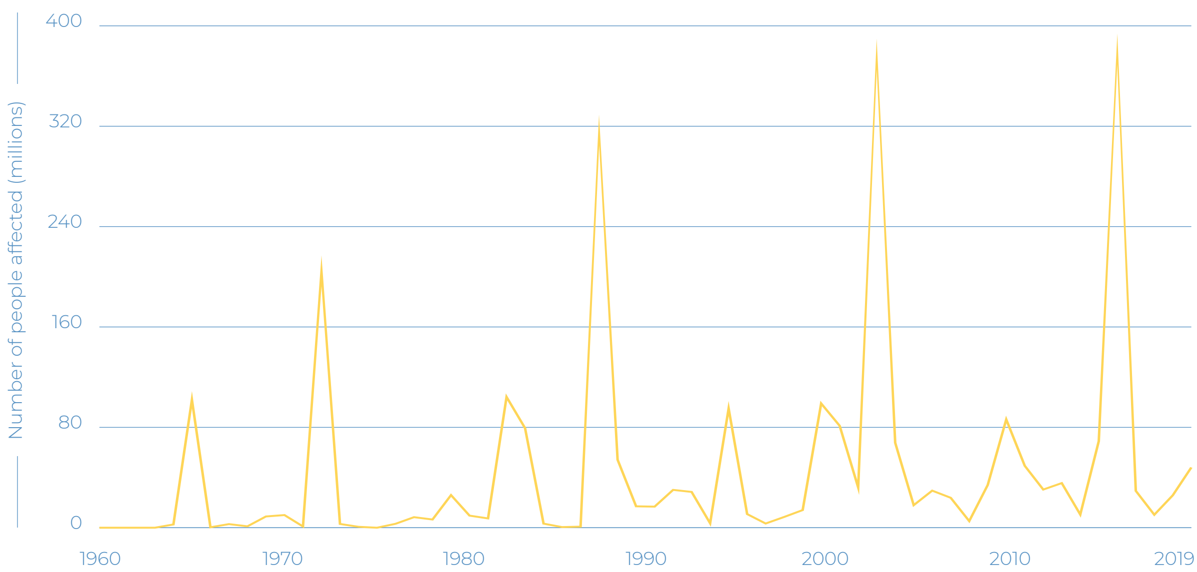
In 2019 there were 8 drought-related disasters affecting 16 countries and impacting 48 million people. In the last decade 106 disasters triggered by droughts affected 66 countries and some 690.2 million people (EM-DAT). Between 2010 and 2011, Somalia, Ethiopia, Kenya and some parts of Djibouti were hit by the deadliest drought in the past ten years. EM-DAT reported 20,000 direct deaths while Food and Agriculture Organization (FAO) and Famine Early Warning Systems Network (FEWS NET) research indicated a far higher number with a further 258,000 deaths attributable to the drought in southern and central Somalia (FAO et al, 2013). In total, 22 million people were affected.

Since the 1960s, a total of 426 disasters driven by droughts in 117 countries killed over 2 million people and affected an average of 46 million people every year.

The IPCC projects that the frequency and intensity of droughts will continue to rise, particularly in Africa (especially in southern Africa) and in Europe (the Mediterranean region). Using a climate scenario that includes medium growth across population and income with only a gradual reduction in inequality, and assumes a continuation of trends in production, consumption and technological progress, it states that "the dryland population vulnerable to water stress, drought intensity and habitat degradation is projected to reach 178 million people by 2050 at 1.5°C warming, increasing to 220 million people at 2°C warming, and 277 million people at 3°C warming" (IPCC, 2019b).

People and communities affected by drought can expect to face related challenges in food and water security, threats to their livelihoods such as the death of livestock, and health risks such as cholera and malaria. Drought can also lead to an increased risk of forest fires and their associated damage to the landscape as well as increased carbon emissions (IPCC, 2012).

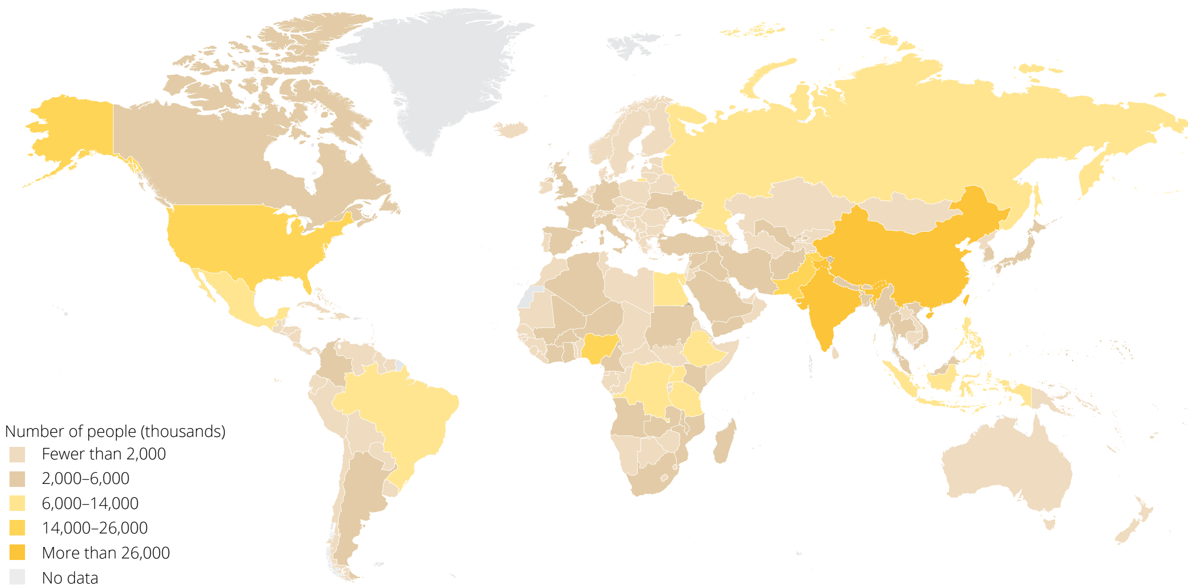
Figure 2.22: Number of people affected by droughts 1960–2019



Sources: EM-DAT, FAO/FEWS NET, ReliefWeb and IFRC GO

Figure 2.23: Projections of drought risk, 2050

Absolute population exposed to droughts in 2050s under SSP3 scenario



Source: INFORM; Marzi et al, 2020.

Notes: The extended INFORM Risk Index considers riverine floods and storm surge for projected climate change via:

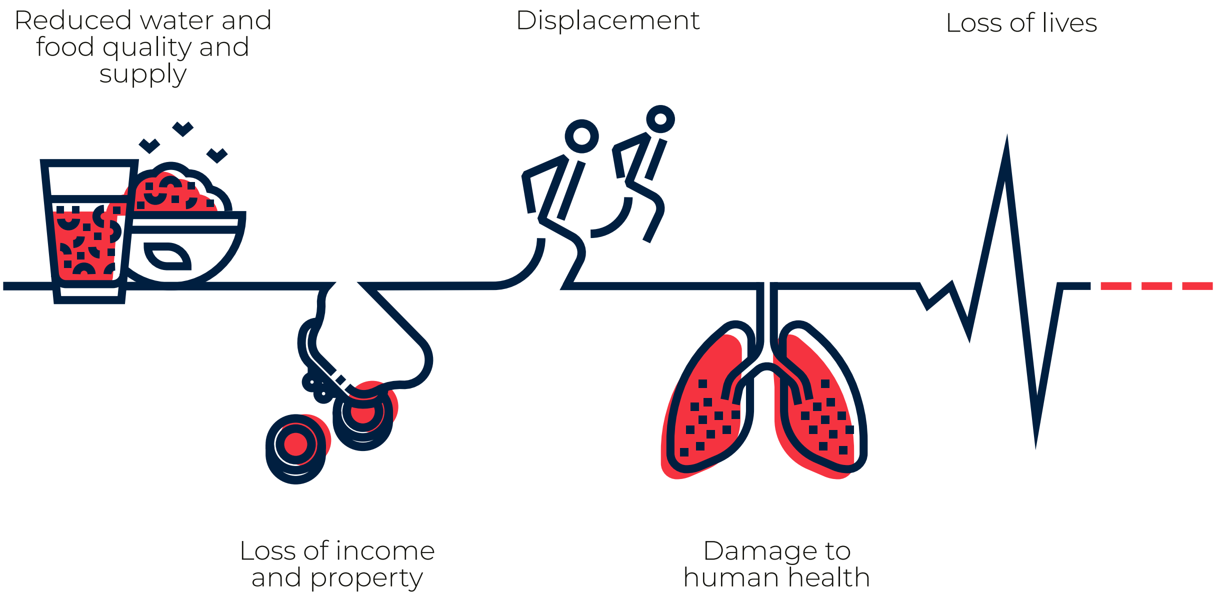
1. Exposure due to amplified climate-related hazards – by adding projections of climate-related hazards

2. Risk due to amplified hazard and exposure – by adding projections of future population

SSPs are "Shared Socioeconomic Pathways" which are used by the IPCC to model different future "pathways" based on demographic and economic trends. SSP3 is a scenario with high challenges for mitigation and adaptation, meaning slow development, persisting high inequalities and continued competitive and regionalized land and energy policies.

Zambia, 2019. In Zambia a local dam dried up when rains were delayed – with no sign of filling with water after two months. The IPCC projects that the frequency and intensity of droughts will continue to rise, particularly in Africa and Europe.

2.5 IMPACTS OF DISASTERS – AFFECTING MILLIONS OF PEOPLE NOW AND IN THE FUTURE



Disasters can have multiple impacts – death, injury and health impacts, displacement, damage to homes and goods, deaths of livestock, food insecurity, disrupted livelihoods and more. The 308 disasters triggered by natural hazards that occurred in 2019 together affected around 97.6 million people and killed 24,396 more across 128 countries.

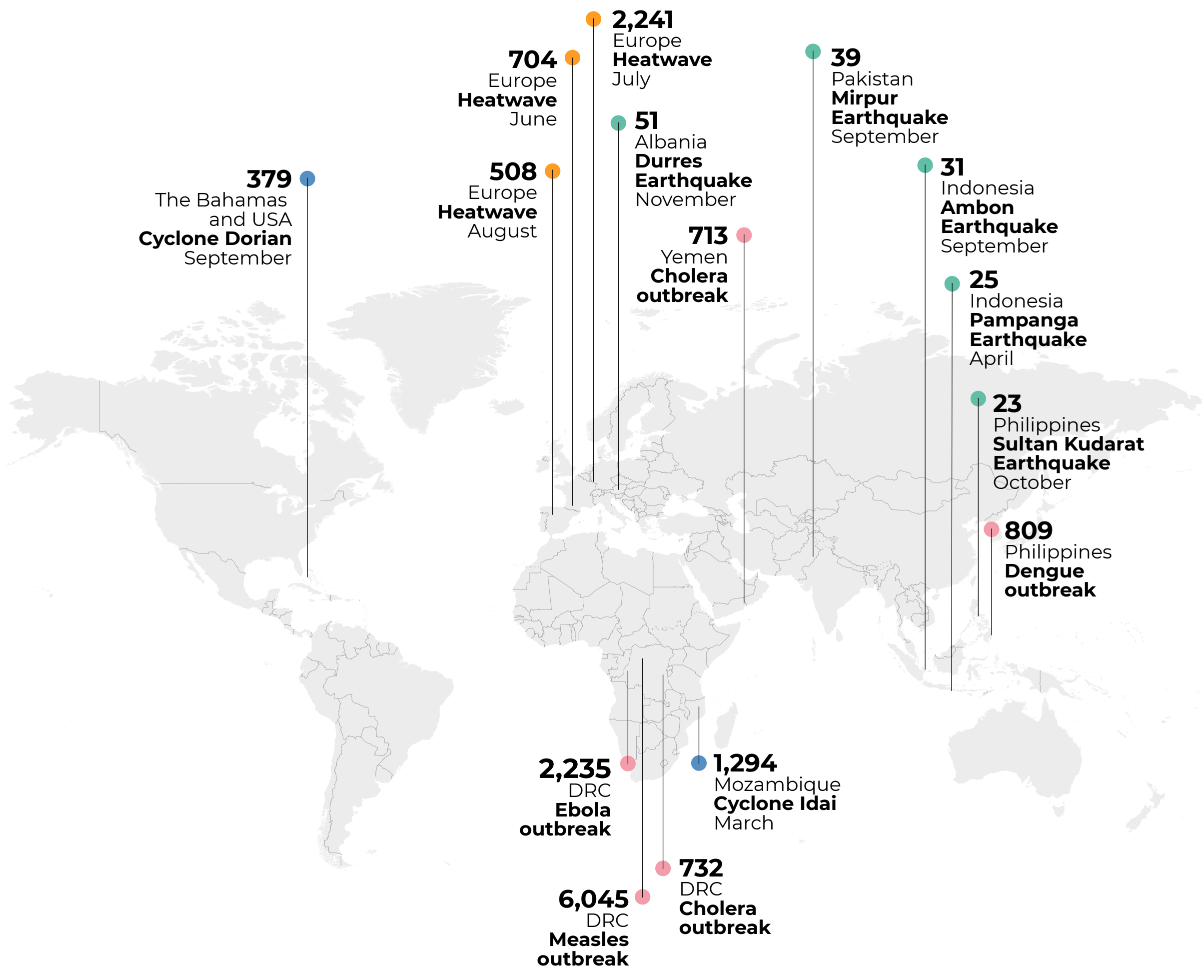
2.5.1 The deadliest disasters

Tracking deaths from disasters is not as simple as it sounds. Some people may be killed directly during the disaster itself, for example drowning in a flood; others may be affected when electricity is cut in a hospital or suffer longer-term health impacts due to smoke inhalation from a wildfire. Disasters can undermine food security or access to healthcare over a period of time which also increases mortality. EM-DAT mortality statistics focus largely on direct deaths, and therefore underestimate the significant secondary impacts of disasters on mortality.

In 2019, more than 24,000 people died due to disasters triggered by natural hazards, and of these people, over 9,000 were killed by climate- and weather-related disasters. Disease outbreaks proved to be the deadliest of natural hazards, killing 15,080 people in total, while heatwaves killed 3,738 people, storms killed 2,806 and floods (despite being the most common disaster) killed 1,586 people.

The measles and Ebola virus disease outbreaks in the Democratic Republic of the Congo (DRC) in 2019 resulted in 310,000 people being infected and 6,045 killed by measles (WHO, 2020), and 3,395 people being infected and 2,235 killed by Ebola[22] in the country's east (WHO, 2020). Of the non-disease related disasters, the heatwaves affecting 8 countries in Europe were the deadliest, killing cumulatively more than 3,400 people, followed by Cyclone Idai which killed 1,294 people in Madagascar, Mozambique and Zimbabwe.

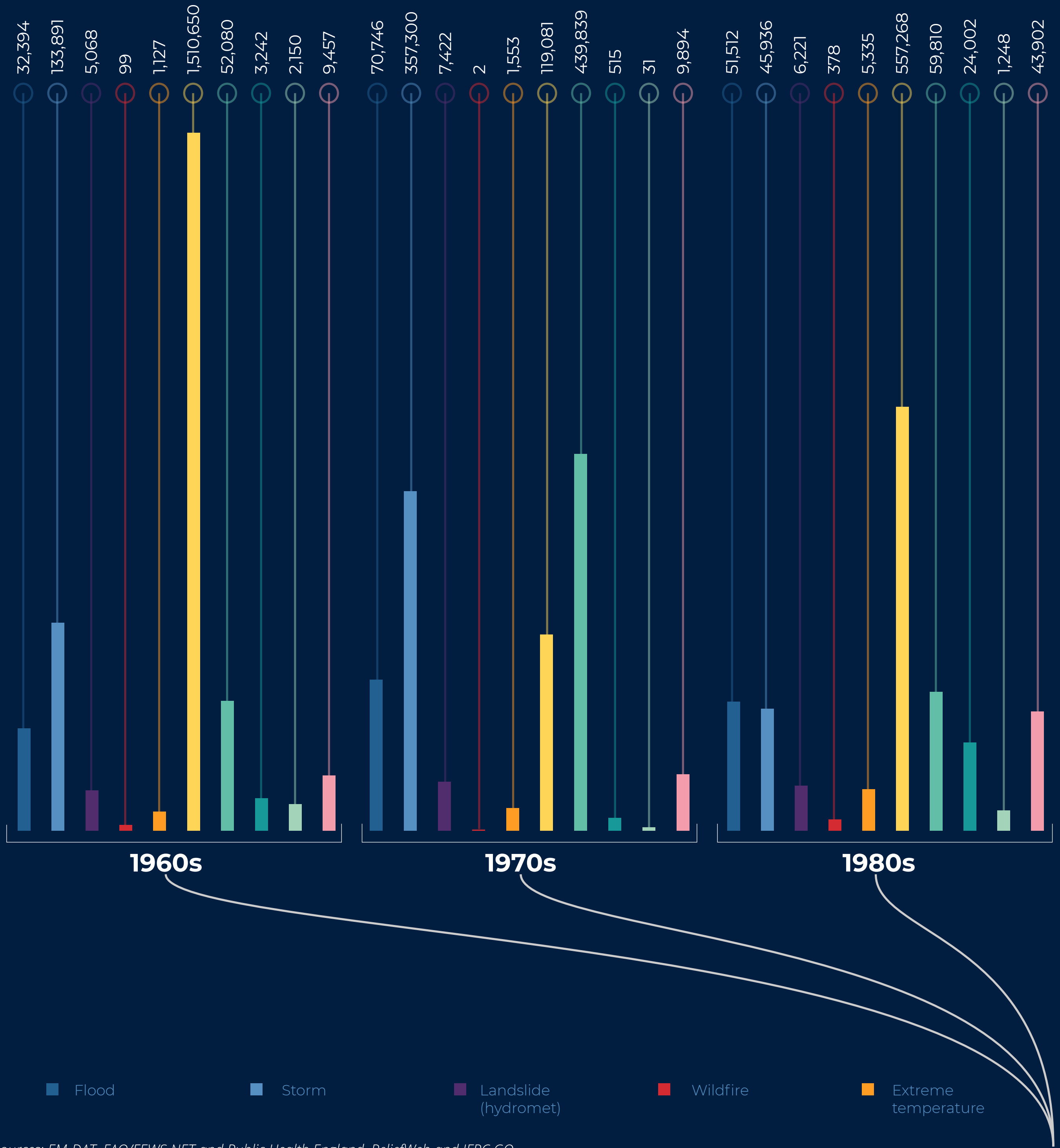
Figure 2.24: The deadliest disasters in 2019



Sources: EM-DAT, FAO/FEWS NET, Public Health England, ReliefWeb and IFRC GO
Note: Map shows the five deadliest climate- and weather-related, biological and geophysical disasters for 2019 and provides the number of people killed in each disaster

22 From 2018 to 2020, the DRC Ebola outbreak infected 3,476 and killed 2,998 people across DRC and Uganda.

Figure 2.25: Total deaths by disaster type, 1960s–2010s



Sources: EM-DAT, FAO/FEWS NET and Public Health England, ReliefWeb and IFRC GO
Note: Bars use a non-linear scale.

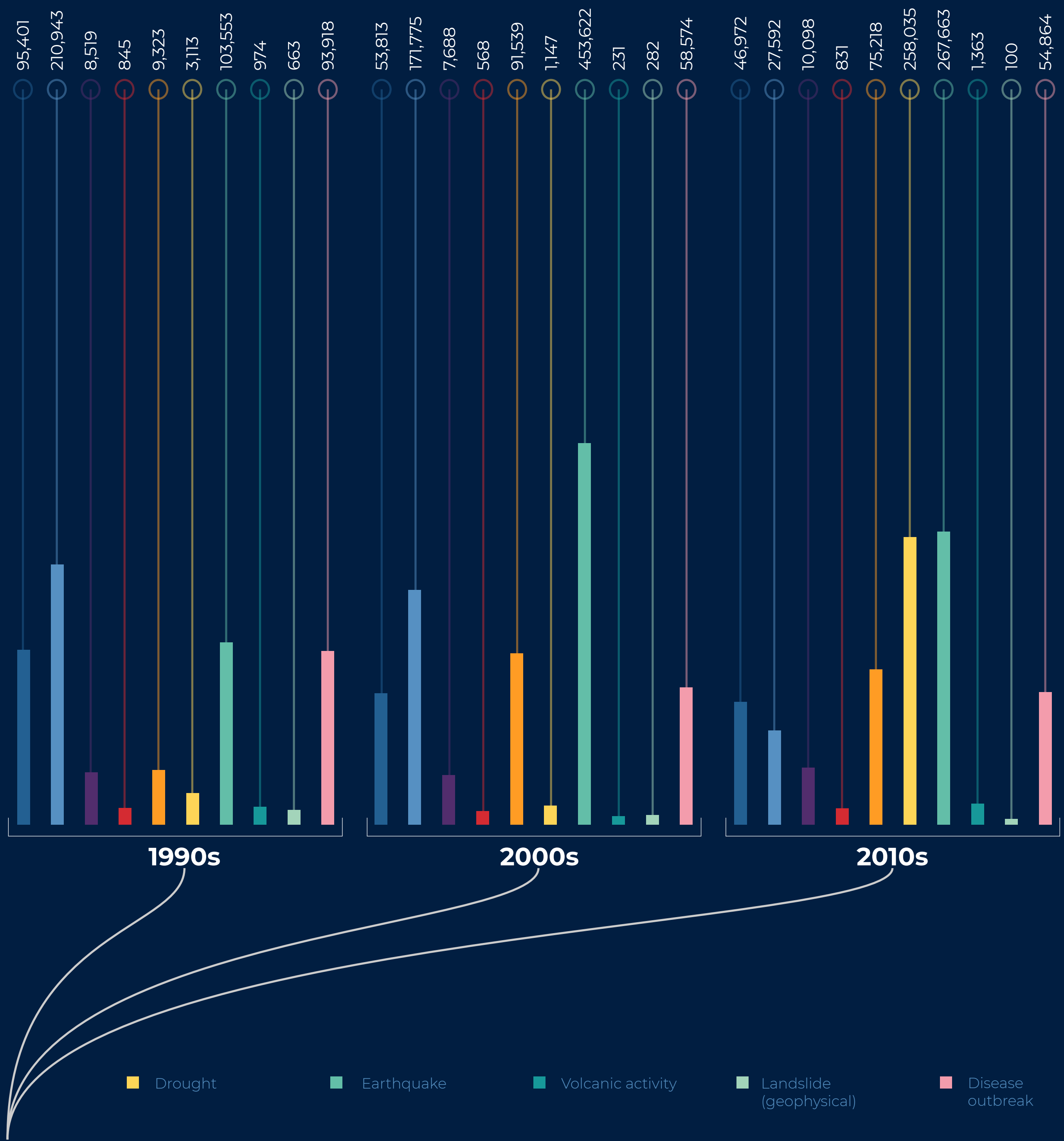
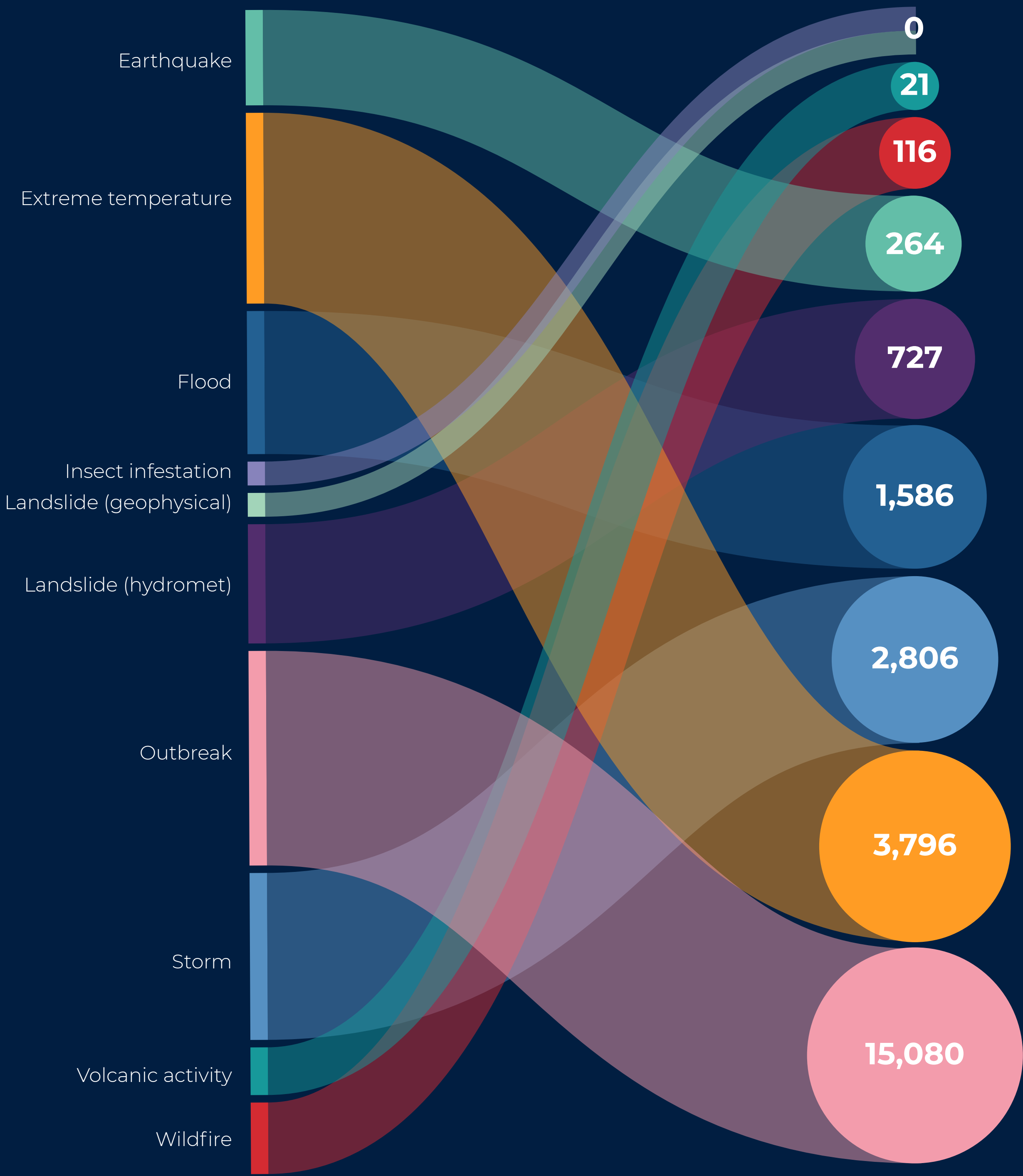

95,401
210,943
8,519
845
9,323
3,113
103,553
974
663
93,918
53,813
171,775
7,688
568
91,539
1,147
453,622
231
282
58,574
46,972
27,592
10,098
831
75,218
258,035
267,663
1,363
100
54,864
1990s
2000s
2010s
Drought
Earthquake
Volcanic activity
Landslide (geophysical)
Disease outbreak

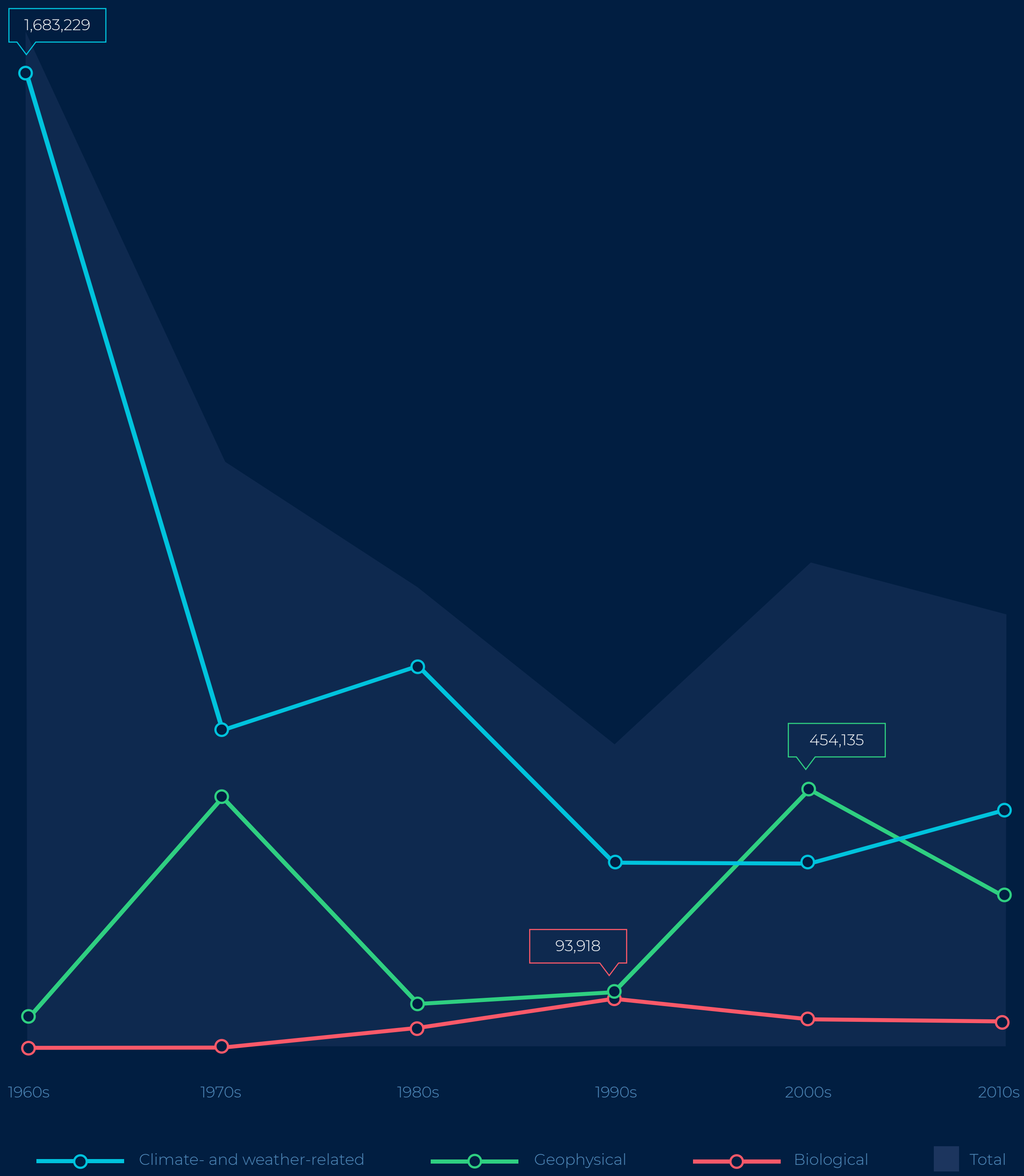
Figure 2.26: Total deaths by disaster type, 2019



Sources: EM-DAT, FAO/FEWS NET and Public Health England, ReliefWeb and IFRC GO

Note: For a full table showing the number of deaths due to each hazard for each decade, see Data tables in the annexes.

Figure 2.27: Number of deaths by disaster group, 1960s–2010s



Sources: EM-DAT, FAO/FEWS NET and Public Health England, ReliefWeb and IFRC GO

In the past decade, 740,000 people died due to disasters triggered by natural hazards, while more than 410,000 people were killed by climate- and weather-related disasters. The greatest number of people were killed by earthquakes (267,663 people) and droughts (258,000 people – all in Somalia as a result of the intersection of drought, conflict and famine).[23] This was followed by extreme temperatures (75,218) – mostly heatwaves – and public health emergencies such as infectious disease outbreaks (51,950).[24]

Since the 1960s, deaths caused by floods and storms have declined, while deaths related to extreme temperatures, disease outbreaks and landslides have increased. For example, in the 1960s, 1,127 deaths were recorded due to heat and cold waves, while in the 2000s more than 90,000 deaths were recorded. Deaths connected to droughts decreased, until the Somalia famine in 2010, triggered by a combination of drought and conflict (which impacted on food security and humanitarian access), reversed this trend.

Overall, the number of people killed by disasters has dropped significantly, in particular those connected to climate- and weather-related hazards. Overall deaths dropped from 1.75 million in the 1960s to less than 0.75 million in the last decade. This is particularly significant given the number of disasters has increased approximately six times since the 1960s and the world population has at the same time increased dramatically. While this may be attributable to many factors, it appears to indicate that efforts at disaster risk reduction, climate adaptation, poverty alleviation and other important initiatives are working.

In the future, the climate crisis is predicted to cause additional deaths, in particular in connection to health factors. WHO estimates 250,000 additional deaths due to climate change between 2030 and 2050 connected to malnutrition, malaria, diarrhoea and heat stress (Rettner, 2018). This does not include deaths due to storms, floods or other extreme events.

2.5.2 People affected by disasters

EM-DAT considers people to be affected by disasters where they require "immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water and sanitation, shelter, sanitation and immediate medical assistance." This therefore includes people displaced, even if only for one day, but also people who lose their houses or sustain life-changing injuries.

Yet in practice, the assessment of how people are affected by a given disaster differs over time and between countries, so numbers are difficult to compare. For example, where there are overlapping threats (such as conflict and drought) leading to food insecurity, causality is tricky. Similarly when droughts lead to an increase in food prices, which affect everyone, it can be a challenge to identify who is affected and needs assistance.

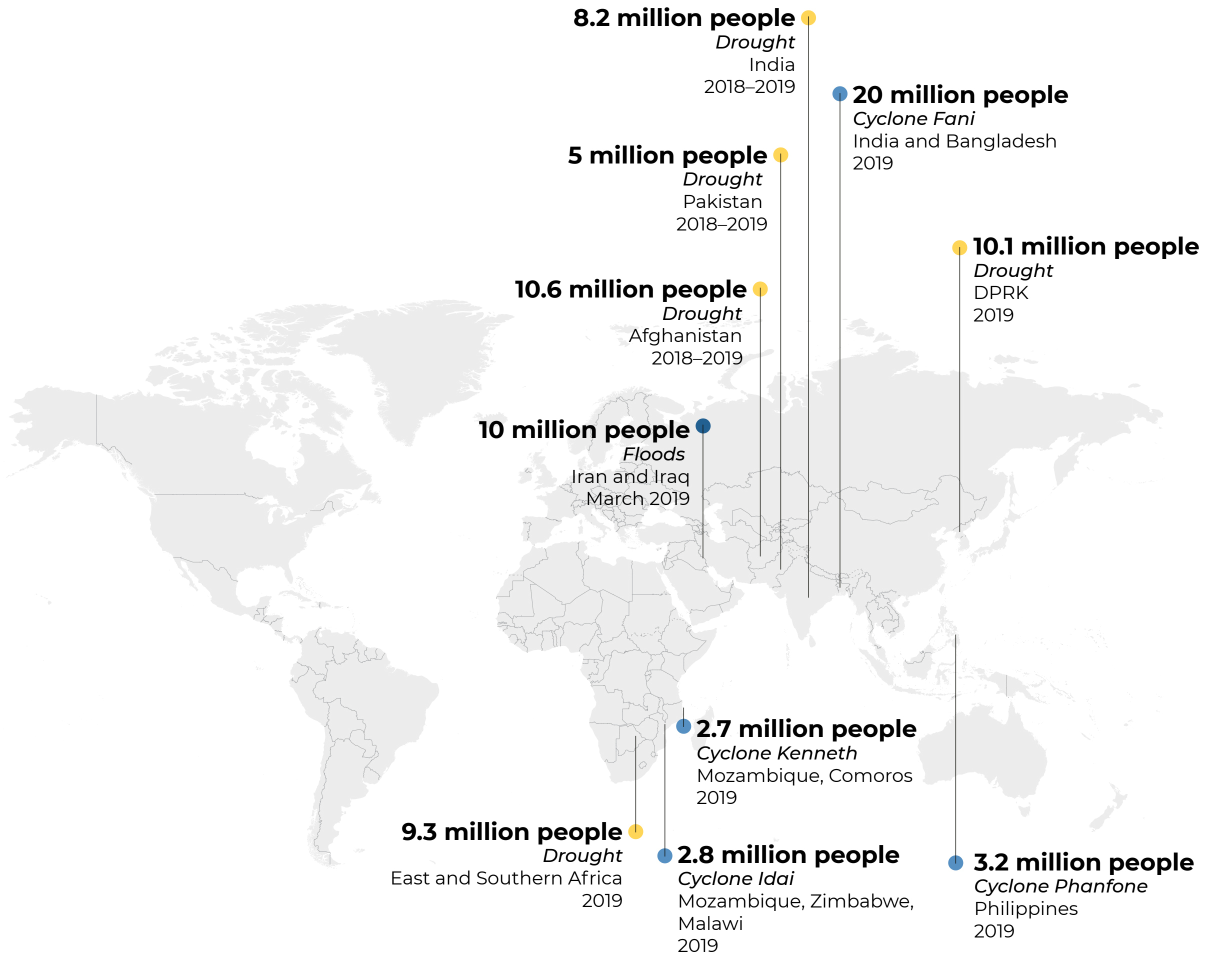
The total number of people affected by disasters in **2019** reached 97.6 million according to EM-DAT and supplementary sources. Droughts affected the greatest number of people at 48 million, while storms affected 32 million people and floods 14 million. Outbreaks of infectious diseases also exerted a major impact, with 1.8 million people affected.

23 Note this data does not show up on EM-DAT, potentially due to the delay in analysis and reporting, but also given that attributing deaths is challenging when multiple factors have contributed.

24 Note this does not include events not captured in EM-DAT due to limited data, poor or late reporting or where attribution is a challenge. However, where some clear and sizeable irregularities have been identified, we have supplemented EM-DAT with additional sources. For example, a striking omission from EM-DAT is the 2011–2012 drought in Somalia, which has been added based on FAO/FEWS NET figures.

In 2019, 75 million people in Asia were affected by disasters, while 20 million people were affected in Africa and 1 million in the Americas. Of any single disaster in 2019, Cyclone Fani affected the most people, with over 20 million people affected across parts of India and Bangladesh, followed by droughts in Afghanistan and DPRK and floods in Iran. All of the ten disasters that affected the most people were climate and weather related.

Figure 2.28: The 10 disasters that affected the most people in 2019[25]

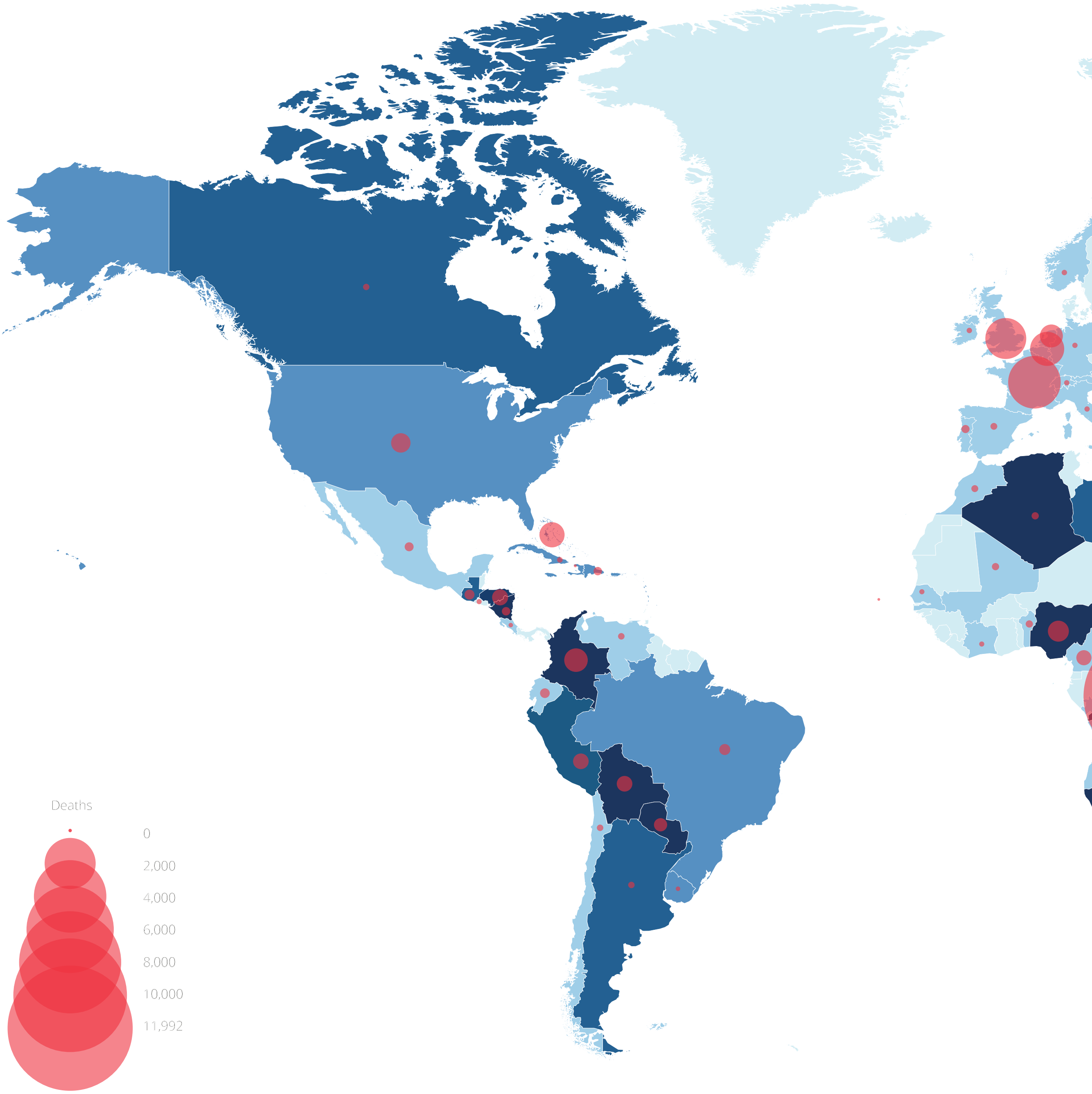


Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

Note: The drought in East and Southern Africa affected 12 countries: Angola, Botswana, DRC, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, United Republic of Tanzania, Zambia, Zimbabwe.

25 Note that in the case of disease outbreaks, numbers of people affected are not systematically collected nor compiled, although cases and deaths may be.

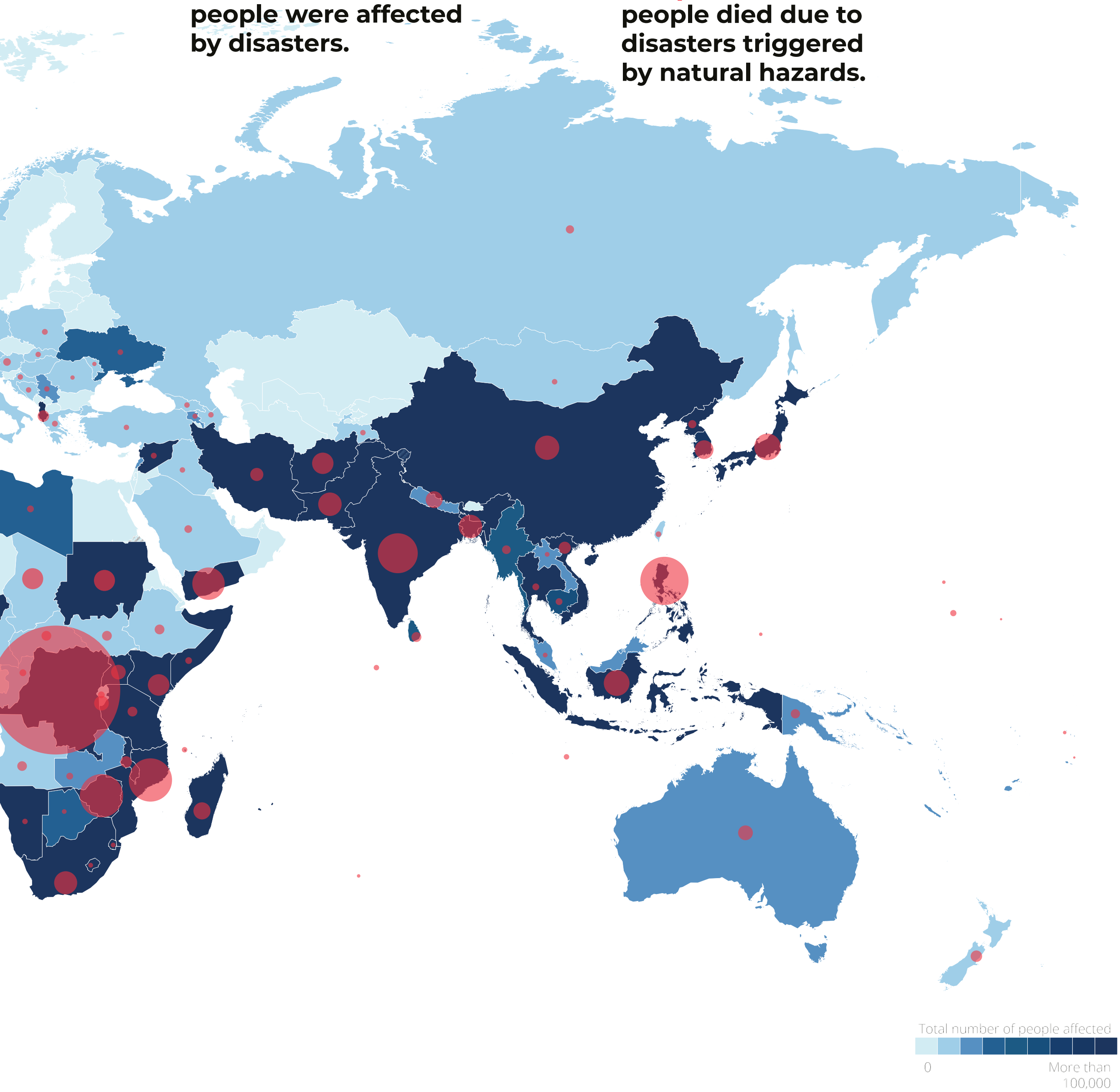
Figure 2.29: Number of people affected and killed by disasters in 2019



Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

In 2019
97.6 million
people were affected by disasters.

More than
24,000
people died due to disasters triggered by natural hazards.



Over the **past decade**, a total of almost 1.8 billion people were affected by disasters, with an average of 175 million people per year. Of these, an average of 170 million people were affected each year by climatological disasters.

Since the 1960s, the number of people affected each year by disasters has risen substantially, from 2.8 million people per year in 1960 (200 million for the decade) to a peak of 659.3 million in 2002 (over 2.3 billion for the decade). The figures then came down to 97.6 million people in 2019 (out of almost 1.8 billion affected this past decade, with a high of 429.7 million in 2015).

Floods, droughts and storms have together accounted for 95.5% of people affected by disasters since the 1960s.

2.5.3 Displacement due to disasters and climate change

Millions of people are displaced each year due to disasters. Disaster displacement can vary significantly across countries, communities and in the context of different hazards – whether sudden or slow onset, weather related or geophysical. Displaced people may flee to evacuation centres, temporary or makeshift settlements, camps and collective centres, or to the houses of relatives and host communities. Displacement may take the form of short-term evacuation (perhaps a matter of hours or days) or longer, prolonged or protracted displacement.[26] It may take place across urban and rural settings and within national borders (internal displacement) or across borders. Although disaster displacement is diverse, the vast majority takes place within national borders and is connected to weather-related hazards.[27]

Displacement is not always entirely negative. Mobility (a more positive framing that indicates greater agency) is a coping strategy that households can activate for their well-being in the context of both sudden- and slow-onset disasters. Conversely, a lack of mobility can be a factor of vulnerability (see Chapter 3). Mobility helps many communities (such as pastoralists) adapt to natural cycles and diversify their livelihoods, while at the same time protecting land and other ecosystems from over-exploitation.

Existing data also shows that, on average, more than 22 million people are newly displaced by disasters every year and 5.1 million people are in prolonged or protracted displacement connected to disasters (IDMC, 2019).

In 2019 almost 25 million people were displaced due to disasters, close to 24 million of whom were displaced due to climate- and weather-related events, with the greatest number due to floods, followed by storms.

26 Prolonged or protracted displacement tends to occur where there are regulatory or physical barriers to return, or to other durable solutions. For example, barriers connected to recurrent risk and declarations of 'red zones' or 'no build zones' or physical barriers such as the permanent loss of land due to river bank erosion.
27 In 2019, around 96% of all disaster displacement was weather related (IDMC, 2019).

Figure 2.30: Total number of people affected by disasters triggered by natural hazards, 1960s–2010s

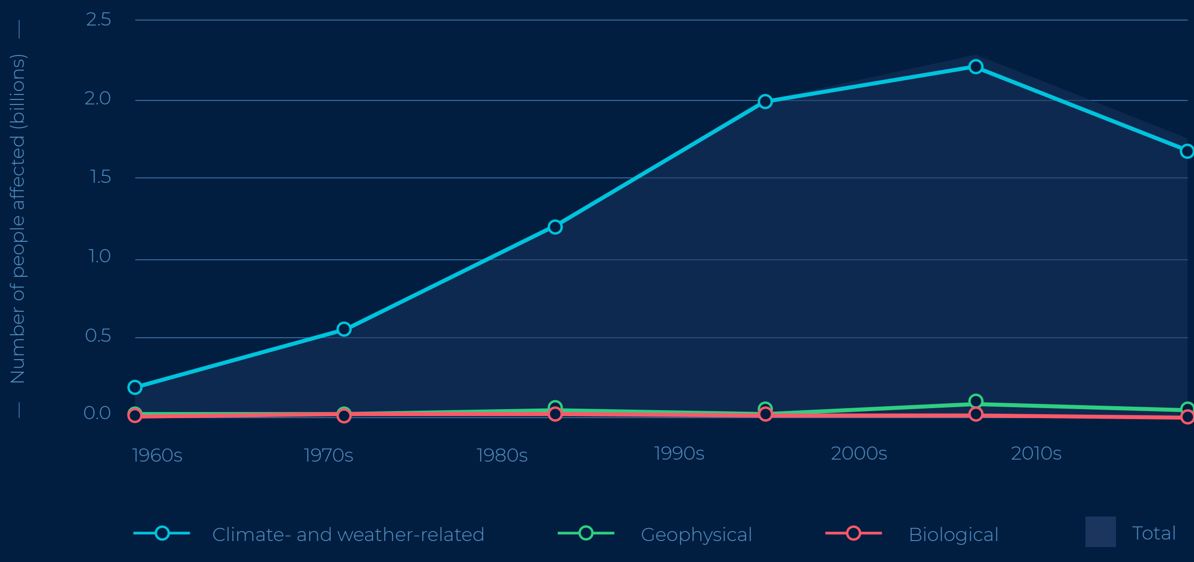
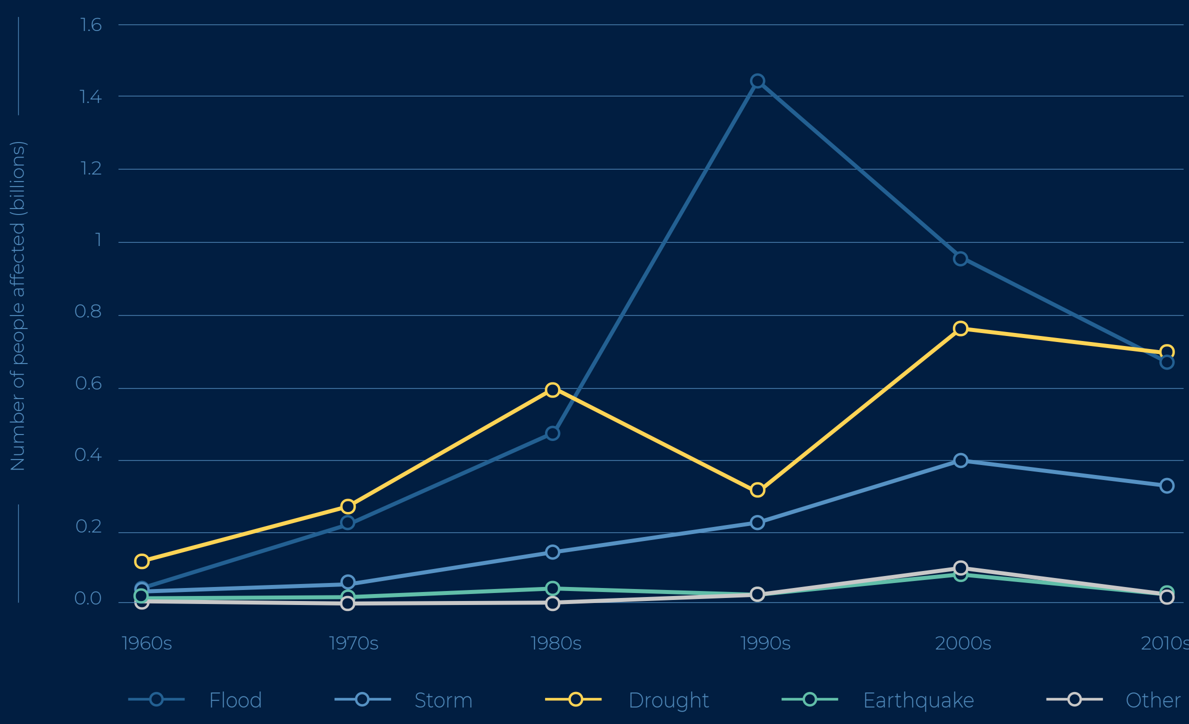


Figure 2.31: Number of people affected by disasters triggered by natural hazards, by type, 1960s–2010s

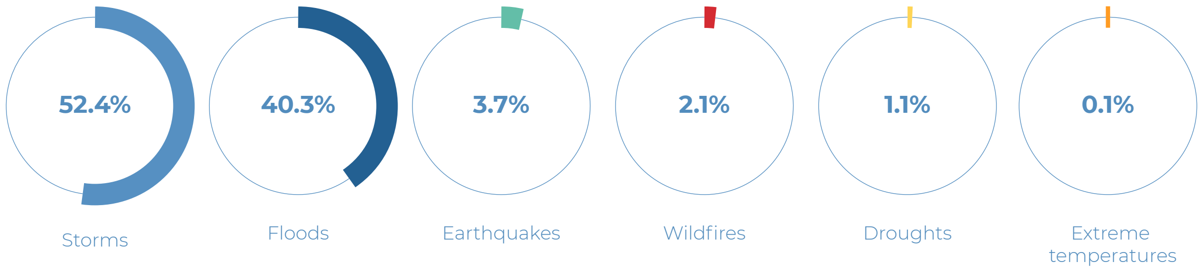


Sources: EM-DAT, FAO/FEWS NET, Dartmouth Flood Observatory, ReliefWeb and IFRC GO

Malawi, 2019. Gift Amos, 11, is living in a camp in Mwalija after her home village was completely destroyed by flooding. More than 22 million people are newly displaced by disasters every year and 5.1 million people are in prolonged or protracted displacement connected to disasters..

© Finnish Red Cross / Saara Mansikkamäki

Figure 2.32: Share of disaster-related new displacements by hazard, 2019



Source: IDMC

Note: Landslides (0.6% of displacements) are included in floods.

The World Bank predicts that "by 2050, up to 143.3 million people or 2.8 percent of the population of Sub-Saharan Africa, South Asia and Latin America could be internal climate migrants under the pessimistic reference scenario" (World Bank, 2018).

2.5.4 Health impacts of disasters and climate change

Climate change and disasters can have various types of impacts on human health. Rises in temperatures and the occurrence of extreme weather or climatic events can take a heavy toll on human lives, in addition to causing anxiety and other psychological disorders. Disasters can contribute to the deterioration of chronic health conditions among affected people, while pre-existing health conditions such as respiratory diseases, certain forms of diabetes, kidney diseases and cardiovascular diseases may be compounded by high temperatures over extended periods. The 2019 *Lancet Countdown* report noted that in the past 30 years, the number of "climatically suitable days for Vibrio bacteria that cause much of diarrhoeal disease globally have doubled" due to climate change (Watts et al, 2019).

There are many examples of possible indirect physical health consequences of disasters and climate change, from a deterioration in air and water quality, to changes in biodiversity and landscape use patterns. Disaster-related disruptions in food and agricultural systems can contribute to increases in malnutrition and associated illnesses. Damage to water supply systems following disasters can result in unsanitary conditions and lead to outbreaks of waterborne diseases like cholera. Displacement, poor quality shelter and communal shelters can contribute to the spread of pneumonia and other respiratory infections. Disasters also affect health systems, for example by cutting the electricity and water needed to provide services and reducing people's ability to access them. While Hurricane Maria in Puerto Rico in 2017 directly claimed the lives of 64 people, more than a thousand additional deaths were attributable to the hurricane over the following months due to subsequent gaps in the health system (Shuman, 2010).

Disasters further affect the social, economic and environmental determinants of health, impacting crop and fishery yields, population nutrition, migration, conflict, health system resilience and so on. Nutrition-related factors contribute to over a third of children's deaths under five years of age worldwide, and are a leading risk factor for child deaths of infectious diseases including pneumonia, diarrhoea and malaria (OECD, 2018).

Climate change may also have an impact on infectious diseases.

Rising temperatures and increased floods and droughts all influence the ecology of disease transmission. We are likely to see a change in geographical distribution of vector-borne diseases, such as those transmitted by mosquitoes, that may be more active in warmer temperatures. Human behaviour in extended dry seasons, such as gathering and keeping water in stored containers, which draws other animals closer, creates breeding conditions for some species of mosquito (Gould and Higgs, 2009, Shuman, 2010). WHO estimates that if the globe warms by 2–3°C as expected, the population at risk for malaria will increase by 3 to 5% and will cause an additional 60,000 malaria deaths annually from the 2030s onwards (WHO, 2014). The changing frequency of floods and droughts can also impact waterborne diseases. By 2030 there is predicted to be a 10% increase in diarrhoeal disease as a result of climate change (Shuman, 2010, WHO, no date).

Long-dormant pathogens can re-emerge through climate change, such as the 2016 outbreak of anthrax in a warming Siberia, and through changes in agricultural practices, disruption of health services and population movement, all of which are among the causes of epidemic transmission.

Climate change is also likely to impact the risk of zoonotic diseases, such as COVID-19, which are infectious diseases caused by a pathogen (such as a bacteria, virus or parasite) that have jumped from an animal to a human. Increased frequency of zoonotic spillover can be attributed to population growth, shifting habitats due to both climate and environmental changes, and changing behavioural patterns (such as storing water in bins during prolonged droughts or increased animal–human interactions). It is estimated that an average of three new zoonotic infections are recognized annually (Johnson et al, 2015, Jones et al, 2008). We are therefore likely to continue to see an increase in emerging or re-emerging infectious diseases with epidemic potential.

Climate change is even creating its own mental health challenges in the form of eco-anxiety, described as "a specific form of anxiety relating to stress or distress caused by environmental changes and our knowledge of them". This can inspire activism, but can equally cause such despair that people become intensely anxious and feel unable to act (Usher et al, 2019). The Red Cross Red Crescent Climate Centre is working with partners to explore the growing area of what has been labelled "climate grief" among other terms. The long-term goal is to alleviate human suffering and promote the well-being of communities at risk, humanitarian workers, researchers and journalists, climate activists, young people and others confronting the risk of emotional darkness and eco-anxiety linked to our changing climate (Climate Centre, 2020).

BOX 2.5: AIR POLLUTION, CLIMATE CHANGE AND HEALTH

Air pollution is the fifth leading risk factor for death worldwide, causing 4.9 million deaths annually (Health Effects Institute, 2019). Fossil fuel combustion is the leading driver of air pollution – and thus meeting the goals set by the Paris Agreement has the added benefit of significantly reducing annual deaths through reductions in air pollution alone (by 1 million annually by 2050). The effects of air pollution are estimated to contribute to a significant percentage of non-communicable diseases including chronic obstructive pulmonary disease, lower respiratory infections, diabetes, stroke, lung cancer and ischaemic heart disease. Ozone in particular has been linked as a major risk factor in causing asthma (14% of children between 5–18 years old have asthma) and increased severity of respiratory illnesses and was linked to close to half a million early deaths worldwide (Health Effects Institute 2019, WHO, 2018). Levels of air pollution in 2019 were estimated to reduce life expectancy globally by 1 year and 8 months, with the highest burden of loss of life expectancy in low and middle income countries with poor air quality.

In addition to external air pollution, household air pollution from wood, charcoal and biomass cookstoves contributes to 50% of pneumonia cases of children five years of age or under, and 1.6 million deaths (2017) (Health Effects Institute, 2019). The burden of poor health outcomes due to air pollution falls disproportionately on populations already at risk, and communities in low and middle income countries who lack access to clean energy.

Poor air quality may be further exacerbated by heatwaves, which are occurring more frequently because of climate change. Heatwaves increase surface temperatures, which decreases the ability of vegetation to absorb ozone, resulting in poorer air quality and heat-related deaths. In some studies levels of ozone increased by more than 50% with increased temperatures. High levels of ozone are linked to several health risks including cardiovascular and respiratory diseases (the burden of which are also experienced by lower-income or marginalized communities) (Kalisa et al, 2018, WHO, 2008, Zhang et al, 2019).

2.5.5 Climate and disaster impacts on water and food security and livelihoods

Climate change and extremes are already harming agricultural productivity, food production and cropping patterns and contributing to shortfalls in food availability. This is increasing the risk of food insecurity for the populations at greatest risk, as well as affecting feeding, caregiving and health practices. Climate extremes are often followed by food price spikes and volatility, often combined with losses in agricultural income, reducing access to food and negatively affecting the quantity, quality and dietary diversity of food consumed. Gender inequalities are further exaggerated by climate-related hazards, which for women result in higher workloads, occupational hazards indoors and outdoors, psychological and emotional stress, and higher mortality compared with men.

Food security and rural livelihoods heavily depend on agriculture and the natural resource base and are therefore particularly vulnerable to climate change and variability. The Grantham Centre for Sustainable Futures suggests that the planet has lost around a third of its arable land over the past 40 years, in large part due to climate disasters and poor conservation, and every year more trees and soil are lost due to climate change.

Higher temperatures, water scarcity, extreme events like droughts and floods, and greater CO_2 concentrations in the atmosphere have already begun to affect staple crops around the world. According to FAO (2019), the unpredictable yield for cereal crops in semi-arid regions of the world (like the Sahel region of Africa) is at least 80% the result of climate variability.

The IPCC has noted that changes in climate, water consumption and the spatial distribution of population growth relative to water resource have already had a profound impact (IPCC, 2014a). In the 1900s, 14% of the global population lived with water scarcity (0.24 billion people). In the 2000s, that figure had skyrocketed to 3.8 billion, 58% of the global population. Of this number, some 1.1 billion people (17% of the population) were subjected to serious water shortages and high water stress in the 2000s, mostly in Asia and Africa (IPCC, 2014a).

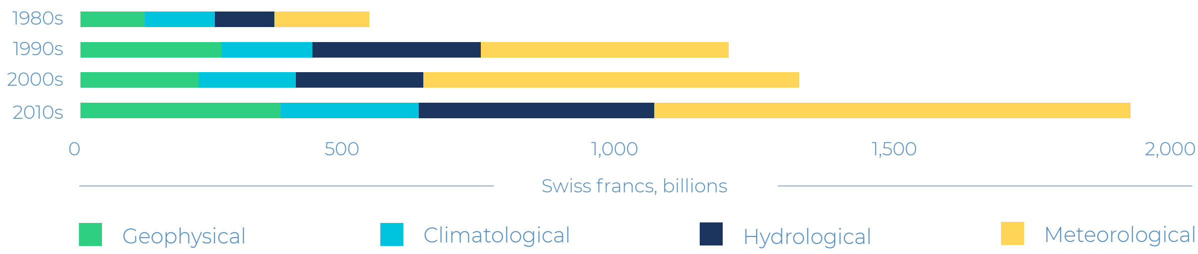
The IPCC warned that food security will be increasingly affected by future climate change, particularly in terms of the rising costs of staple foods, which would hit the world's poorest people the hardest. A projected rise of up to 29% in the price of cereal by 2050, for example, risks putting as many as 183 million more people at risk of hunger. Climate change may also lead to a lower nutritional quality of the food that is available, and damage crop production in many regions due to a change in the distribution of pests and diseases (IPCC, 2019b).

The Global Commission on Adaptation also warned of a potential future where, if no ambitious climate action takes place today, yields may decline by up to 30% by 2050, even as global demand for food is expected to increase by 50%. At the same time, the number of people who may lack sufficient water for at least a month each year could soar from 3.6 billion today to more than 5 billion by 2050 (GCA, 2019).

2.5.6 Financial impacts of disaster losses

The total estimated cost of disaster losses in 2019 was 150 billion US dollars (approximately 147 billion Swiss francs). 139.5 billion US dollars (136.7 billion Swiss francs) was attributed to climatological disasters. For the past decade the estimated cost was 1.92 trillion US dollars (1.88 trillion Swiss francs).[28]

Figure 2.33: Damages by disaster type, 1980s–2010s[29]



Source: MunichRe, 2020

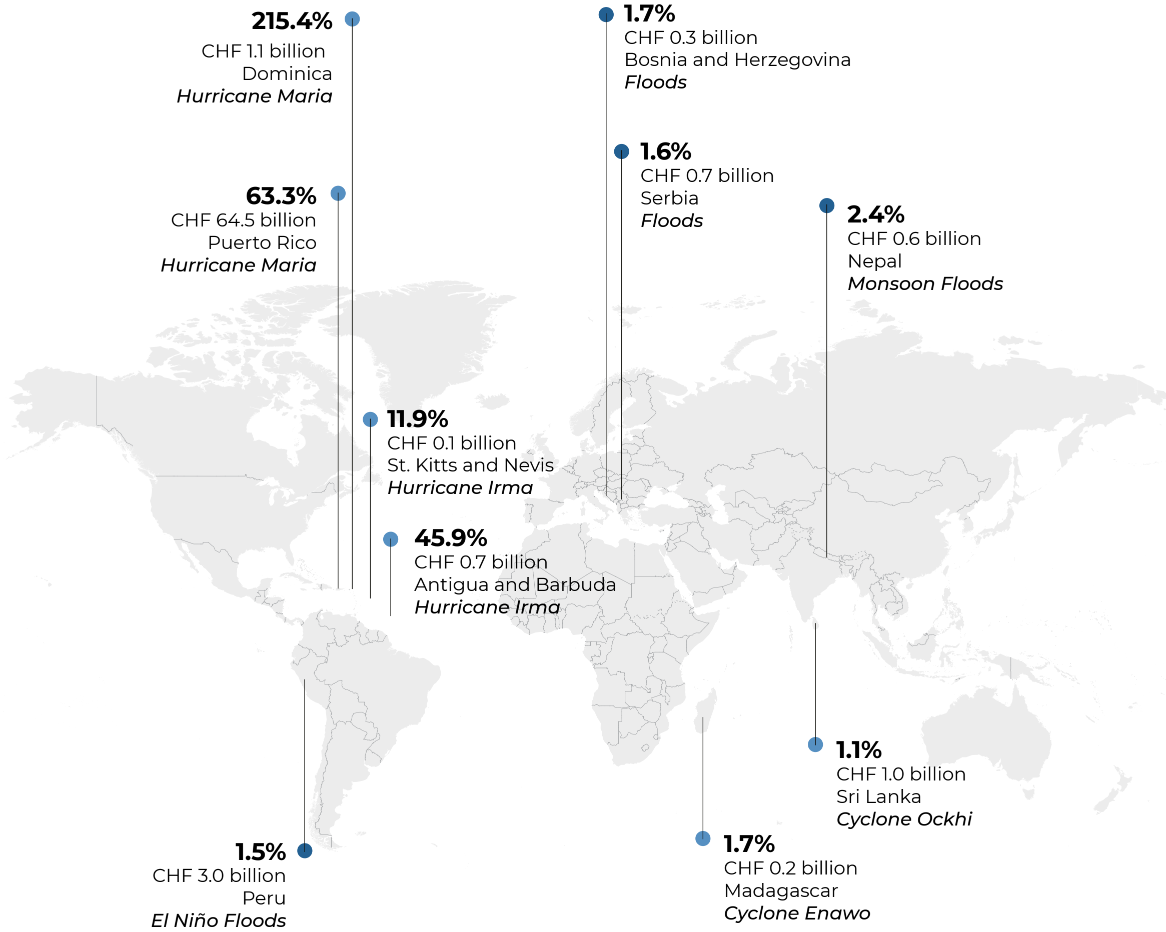
Note: This only includes disasters triggered by natural hazards. Categories are as used by MunichRe.

The data indicates that the highest value of losses are found in high income countries, such as the USA or Japan. It is important to note however, the massive difference between costs and real impacts – for example property in the USA may be valued significantly higher than property in poorer areas of poorer countries. Yet the impact of losing a house in such circumstances may be far greater. Factors such as savings, access to social protection and existence (or not) of insurance are key. Damages as a percentage of GDP are therefore more telling: when national economic losses due to disasters are expressed as a percentage of GDP, the substantial effect of smaller-value losses is clear, particularly in small island developing states.

28 Economic loss assessment is a critical but challenging aspect of disaster analysis (OECD, 2016). There is no centralized data collection process in a harmonized framework, and economic assessments are not undertaken in many countries or for specific hazards (such as heatwaves). Indirect losses, including social and environmental costs, are rarely included. Global economic loss assessments are mainly done by insurance companies such as MunichRe or SwissRe, while EM-DAT undertakes secondary data review from press and official reports.

29 Note that as this only includes physical destruction of property, epidemics do not show up. However all disasters, including epidemics, can have significant impacts in terms of loss of income, productivity and more.

Figure 2.34: Highest disaster damage cost by country as a percentage of GDP, 2017



Sources: Global Climate Risk Index, Germanwatch

Notes: More recent data is not currently publicly available. CHF: Swiss francs.

2.6 COMPOUNDING AND SYSTEMIC RISKS

As disasters increase in frequency and intensity, we can expect not only less time to recover between them, but that multiple disasters will happen at once, in a manner described as compounding shocks. For example, the dangers of cyclones, flooding, drought and heatwaves did not retreat while the world was adapting to the COVID-19 pandemic.

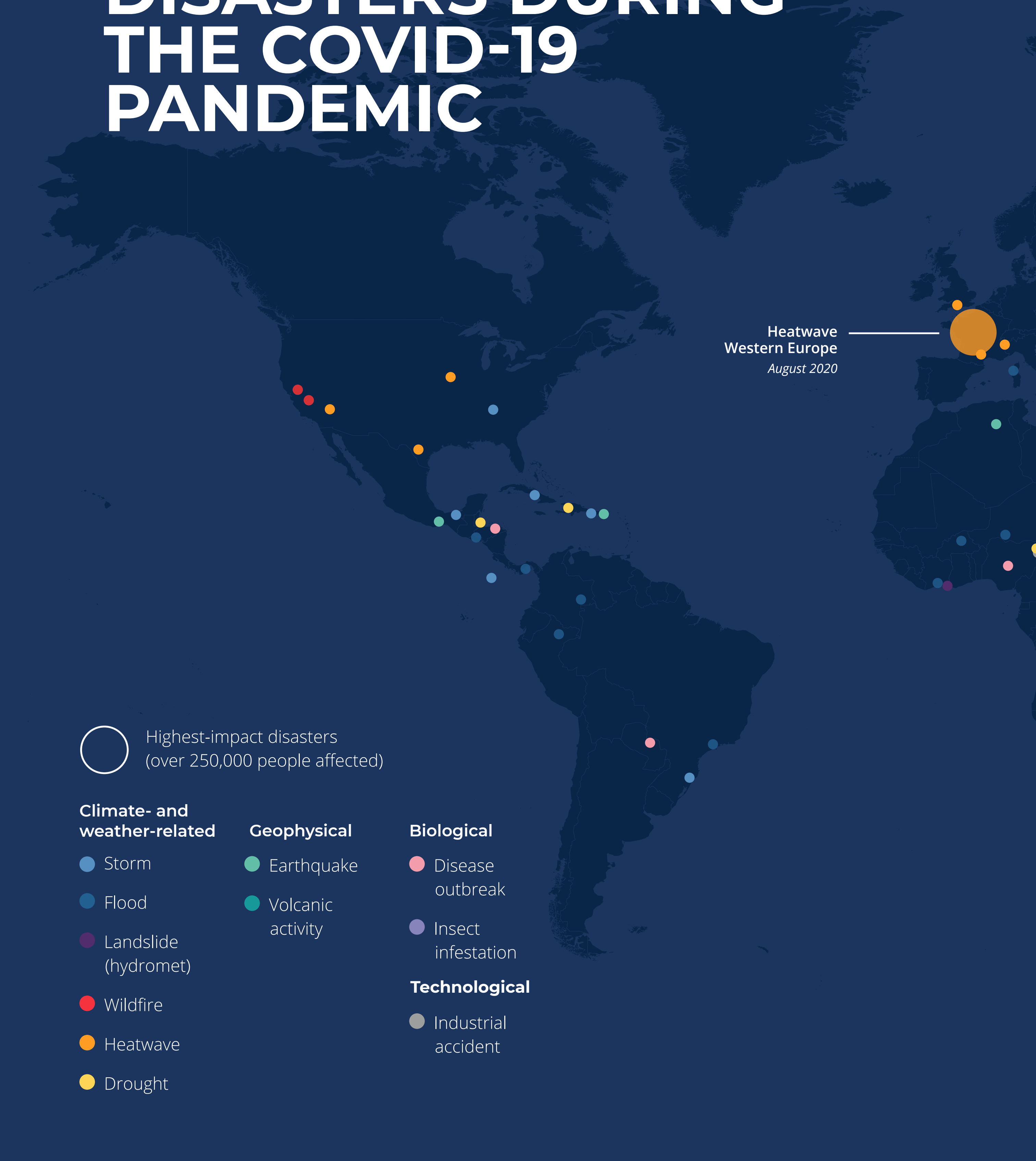
Disasters and conflicts themselves also play a major role in driving vulnerability and exposure to future hazards. Disasters can keep people in, or return people to, poverty and other situations of vulnerability. Estimates for 89 countries show that if we could prevent all natural hazards from becoming a disaster over the course of a year, we would reduce the number of people living in extreme poverty (less than PPP$1.90/day) by 26 million (Hallegate et al, 2016).

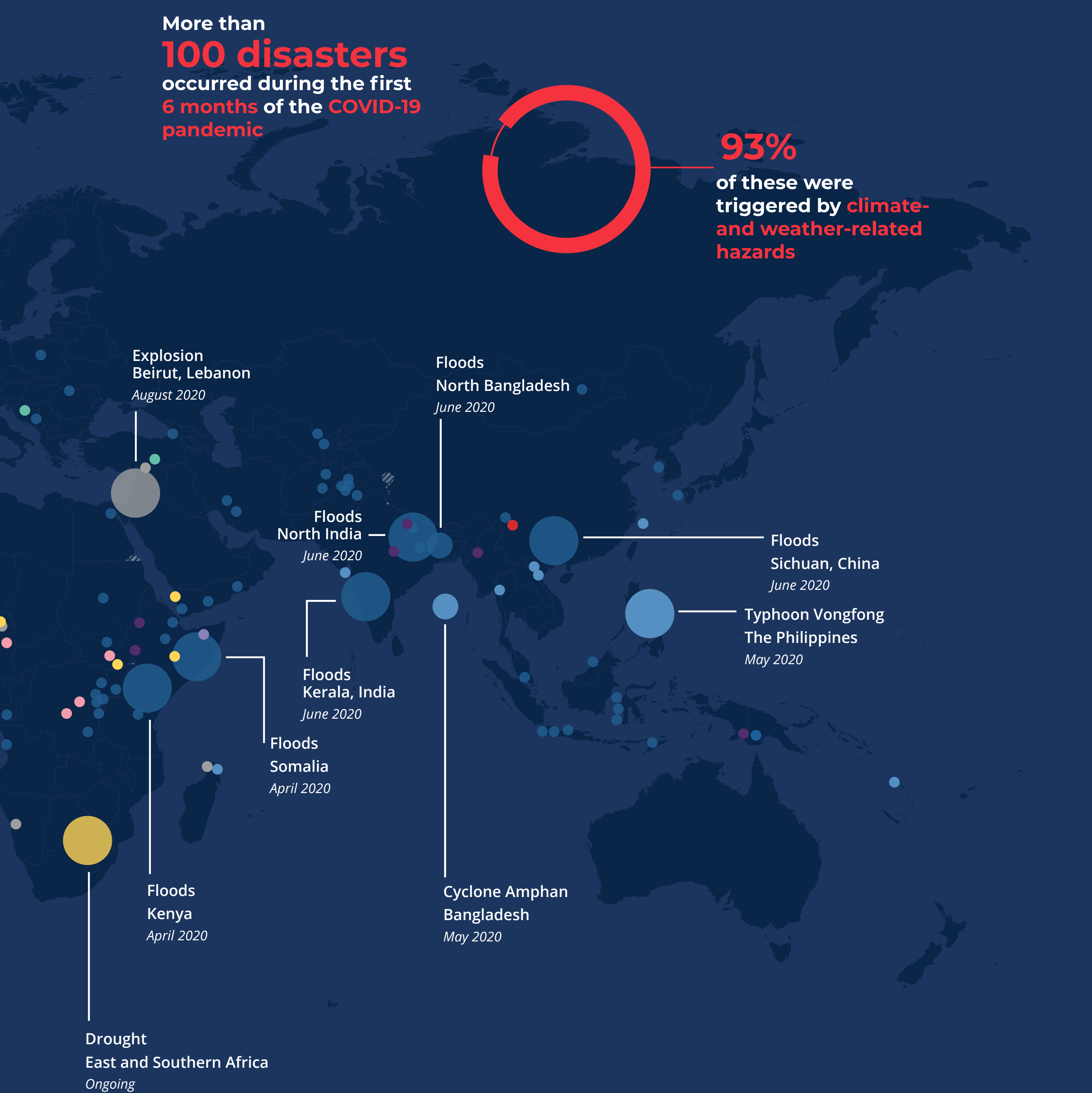
When hazards combine, they can multiply each other's impact in ways governments, civil society and the humanitarian sector have not faced before. These include not only rising climate- and weather-related threats, but also other shocks, such as pandemics and epidemics, earthquakes and financial crashes. For example, in May 2020, countries in Africa were affected by what IFRC described as a 'triple disaster' – heavy flooding that killed more than 300 people and slowed down not only the ongoing humanitarian response to the region's worst locust infestation for decades, but also the life-saving work to prevent the spread of the COVID-19 pandemic. While flooding is a recurrent threat in Africa, the combination of flooding, locusts and a pandemic stretched community coping mechanisms and disaster management capacities in Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Tanzania and Uganda.

That same month, India was hit by heatwaves, with temperatures up to 50°C, and India and Bangladesh were both affected by Cyclone Ampham, described as one of the strongest storms in the Bay of Bengal this century. More than 3 million people were evacuated in the two countries, more than 100 people were killed and thousands of houses were damaged or destroyed.

The map on the next page shows only a snapshot of disasters that took place from the beginning of the month when the epidemic was declared (March 2020) for a six-month period. Over 100 disasters occurred during this period and affected over 50 million people. There were also a number of ongoing crises, including measles in DRC and droughts in parts of east and southern Africa.

DISASTERS DURING THE COVID-19 PANDEMIC





Sources: EM-DAT, FAO/FEWS NET, Floodlist, ReliefWeb and IFRC GO

Notes: This is a snapshot only and includes disasters affecting over 1,000 people. This is preliminary data only, based on what is already available in EM-DAT and IFRC GO, supplemented by additional sources. Final data for a given year is not generally available until the following year. High impact disasters are those with more than 250,000 people affected. WHO declared COVID-19 a pandemic on March 11, hence the first 6 months is calculated from March.

2.7 CONCLUSIONS

The number of disasters is generally increasing and has been for the past 80 years. Climate- and weather-related events are responsible for the vast majority of disasters, and the proportion of events triggered by such climatological events is increasing.

Not only is the frequency of events increasing, but so too is the intensity of extreme events, with more category 4 and 5 storms, more heatwaves breaking temperature records and more heavy rains. At the same time, we see extremes hitting new areas, such as Cyclone Kenneth, the strongest recorded storm to hit the continent of Africa. These events do not occur in isolation; instead, we are seeing significant incidences of compounded risks – such as communities dealing with the impacts of the COVID-19 pandemic, floods and a locust invasion at the same time. A number of these extreme weather events – including the heatwaves in summer 2019 in Europe, the Australian bushfires in 2019–2020 and certain category 4 and 5 storms – have been made more likely by climate change and are therefore likely to increase. The same is true of disease outbreaks – with population growth and the impact on habitats of climate and environmental changes, we are likely to continue to see an increase in emerging or re-emerging infectious diseases with epidemic potential.

The number of people affected by disasters also continues to rise, as more and more floods, storms and droughts in particular wreak havoc on lives and livelihoods, displacing millions of people each year. On a positive note, while the number of disasters has increased, the deaths from these disasters have decreased. This is a good indication of the impact of efforts of disaster risk reduction and climate adaptation, most likely combined with other economic and social developments. There have indeed been significant successes in reducing the impacts of particular hazards, such as floods and droughts. There has been less success at reducing the impacts from hazards such as heatwaves and those with increased intensity such as category 4 and 5 storms in areas not used to these.

Looking to the future, the poorest, the most marginalized and the most at-risk people are the most affected by climate- and weather-related disasters, through loss of life, greater susceptibility to disease, economic setbacks and erosion of livelihoods. But no country or community will be shielded from the effects of climate change in the future.

The projections are sobering. Climate change may push more than 100 million people back into poverty in the coming decade, with the brunt being borne by people in the world's poorest countries. By 2050, more than 140 million people across Africa, Asia and America may be internally displaced as the result of climate change (World Bank, 2018). According to WHO, we can expect there to be 250,000 additional deaths due to climate change between 2030 and 2050.

We do not have complete data, but even with the limited data we have, we know that we have a lot of work to do. Chapter 3 explores how climate change acts as a risk multiplier and can increase vulnerability and exposure, and discusses how these impacts may be experienced by certain groups of people at risk. The following chapters will explore in more detail what we can and must do now to reduce these impacts on lives and livelihoods all over the world. Some hazards are inevitable. But they do not have to become disasters that kill and destroy livelihoods, infrastructure and the environment.

Main data sources used in this chapter

Hazard and impact data is taken mostly from EM-DAT and IFRC GO. EM-DAT is the Emergency Events Database from the Centre for Research on the Epidemiology of Disasters (CRED) at the Université catholique de Louvain. It collects and compiles information on disasters from UN agencies, non-governmental organizations, insurance companies, research institutes as well as secondary data from press agencies. EM-DAT data does not include war, conflict or conflict-related famine as disaster events. Using this data source facilitates a comparison of disasters through the same data collection methodology.

IFRC GO is a publicly available data source that provides information on disasters that have triggered an IFRC Disaster Relief Emergency Fund, emergency appeal or Red Cross Red Crescent Movement-wide appeal. It also contains plans of action, field and situation reports and more, displayed in an easy-to-use interface as well as through maps, charts and infographics. The IFRC launched the GO platform in 2018 to channel emergency operations information across the Red Cross and Red Crescent network.

Risk data is drawn from the INFORM database for disaster risk and the Notre Dame-Global Adaptation Index (ND-GAIN) database for climate risk. **INFORM** quantifies disaster risk based on a model which looks at the interplay between the exposure to hazards, vulnerability and the coping capacity of a country (including institutional components connected to governance, infrastructure and disaster risk reduction investment) (EC, no date). **ND-GAIN** is "a free open-source index that shows a country's current vulnerability to climate disruptions and… readiness to leverage private and public sector investment for adaptive actions." Vulnerability is calculated as a combination of exposure, sensitivity and adaptive capacity, while readiness incorporates economic, governance and social components (Chen, 2015).

Climate science data and projections come mostly from the **Intergovernmental Panel on Climate Change (IPCC)**. The IPCC is a key source for climate science. It is a UN body that requests eminent scientists from its 195 member countries to provide regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. The IPCC does not conduct its own scientific research, but rather assesses the published literature. Each report includes a summary for policy-makers prepared by the scientists based on the underlying assessment, and approved line-by-line by the member governments in an intergovernmental meeting. It thus represents the state of the science as endorsed by all governments, facilitating negotiations in the UN Framework Convention on Climate Change (UNFCCC) and other discussion on climate action around the world.

The IPCC issues **assessment reports**, the latest of which is *Fifth Assessment Report* (AR5) (IPCC, 2014a), as well as **special reports** on topics requested by policy-makers (such as *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (IPCC, 2012), commissioned because of increasing concern about the role of climate change in disasters).

In cases where specific climate projections are cited, to indicate a range of possible futures we include projections for RCP 4.5,[30] which represents a medium stabilization scenario (where greenhouse gases in the atmosphere stabilize due to a substantial reduction in emissions) and for RCP 8.5, which represents a high emissions scenario. Where relevant, we indicate the IPCC confidence levels (very high, high, medium, low and very low) in how correct or likely a given projection is, based on the level of evidence and degree of scientific agreement.

30 RCP stands for a representative concentration pathway – this a projection of greenhouse gas concentration with a trajectory over time as adopted by the IPCC. The IPCC uses four pathways for climate modelling based on different potential levels of greenhouse gas emissions over time.

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