2 THE CLIMATE HAS ALREADY CHANGED

. . . we all urged him to bring us to the water source, each of us intently hoping to plunge into the pool. While leading us to the wellspring, he recalled his grandfather's memory of a lagoon with a flock of herons and other varieties of birds, sometimes being stalked by monitor lizards. What we saw was a knee-deep spring whose jade-green stillness mirrored the lowering clouds. There was no ever-flowing water; hence we ended up exchanging guesses as to what had happened to the once-upon-a-time lagoon and waterfall.

From 'Agayayos', by Arnold Molina Azurin.[1]

'It does not seem right, the way the planet is now,' says Ramon Apla-on, a smallholder farmer and community elder in Barangay Marupok, Sipalay City, the Philippines. 'The weather keeps rapidly changing.' The Philippines is already severely affected by climate change. The fifth-largest island state in the world, it is increasingly hit by flooding from tropical cyclones and heavy rainfall events. 'Our eggplants get beaten by the rains, and then the next day is too hot,' explains Apla-on. 'The weather keeps rapidly changing.'

The evidence is far from anecdotal. Studies show that extreme precipitation events have become more frequent in the twenty-first century. The IPCC finds that the average precipitation has significantly increased since the mid twentieth century over land: light, moderate, and heavy daily precipitation have all intensified.[2] The reason for this is simple. For every degree Celsius that Earth's atmospheric temperature rises, the amount of water vapour in the atmosphere increases by 7%.[3] As global average temperatures have already risen by

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1.1 °C since pre-industrial times, this has therefore already increased the rate of evaporation and the percentage of water vapour held in the air. Rainfall has thus become heavier and more intense, followed by longer periods of drought as the land moisture evaporates more quickly, too. This change, already observed, has severe consequences.

'Our rice is not good because it rains too much and it suddenly becomes too hot again,' continues Apla-on. 'In the old days . . . we would be able to plant by June. The strong rains and sudden heat – we did not have this before. But now it is different because when the rain suddenly pours, the rivers and creeks flood our fields, then the next day it is hot – extremely hot. It is really too hot. In the fields you can only stay for half an hour, maximum two hours. The heat is unbearable, as if you are being cooked alive.' This never used to be the case, he says. Before, he and his workers could stay out for hours; the heat was 'only mild,' he says. 'I cannot seem to understand how the weather behaves now.' The younger generation, having grown up in a changing climate, are no longer interested in farming, he says – the conditions are too extreme. The Lancet Countdown estimates that approximately 470 billion potential labour hours were lost globally owing to heat in 2021, a 37% increase compared with the 1990s.

It is a story now familiar around the world. Nadia Cazaubon of the non-profit organisation Waterways, in the Caribbean Island of Saint Lucia, says that 'rainfall patterns are different: we get shorter periods of intense rainfall and longer periods of droughts. This has an impact.' Aside from the human impact, 'We've observed impacts on the marine environment too, with instances of coral bleaching events when sea temperatures are high,' she says. 'We've seen more sedimentation due to intense heavy rainfall events, leading to more landslides and soil erosion . . . Sadly, the outlook is that it's going to get worse.' Indeed, *The Monitor* finds that the global mean sea level has risen faster since 1900 than in any preceding century in the past 3,000 years. It has risen by 0.20 m since the beginning of the

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twentieth century and at an increasing speed since the 1970s. Heavy precipitation has also become more frequent and more intense since the 1950s, combined with an increase in droughts due to increased land evapotranspiration.

Traditional, centuries-old customs and ways of life are now at risk. Like his ancestors before him, Isaac Nemuta of the Maasai tribe in Kajiado County, Kenya, is a pastoralist herder of cows and goats. 'In a span of 10–15 years, we have experienced a changing climate,' he says. 'Often when we are expecting rain, the rain comes for a short period and disappears – or it rains heavily for almost three days and disappears ... Consequently, we start moving to different places, looking for pasture up until the drought becomes unbearable. Right now, our cattle are dying for lack of pasture. We are forced to buy hay as a supplement, as they lack anything to eat.' His herd has declined from a peak of 370 goats and 70 cattle to just 100 goats and 20 cattle. Although he doesn't want to say it, the trajectory points to an inevitable conclusion – an end to this way of life. 'When the animals start dying and lack pasture, I am forced to sell two cows in order to feed the rest. Or I sell ten goats to buy grass for the rest. We continue that way and ... the number of animals keeps on reducing.'

Zeynab Wandati, a Kenyan journalist covering climate change, explains that Kenya and the greater Horn of Africa 'are experiencing a drought considered to be the worst in 40 years, affecting at least 50 million people across the region. In Kenya alone, about 3.5 million people are affected, a number expected to rise to 4.5 million if the projected rainfall fails.' The lack of rainfall in the 2022 October–December 'short rains' season was the fifth consecutive failed season. Scientists from the World Weather Attribution Study confirmed: 'This change in drought severity is primarily due to the strong increase in evaporative demand caused by higher temperatures. Climate change has made events like the current drought much stronger and more likely; a conservative estimate is that such droughts have become about 100 times more likely.'[4] Wandati

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explains that this is 'placing vulnerable people, particularly those in rural communities who depend on this rain for their daily livelihood, in a precarious position.' And when the rains do come, they don't always alleviate the pressure, but often lead immediately to flooding. 'About two years ago, heavy rains in parts of the country led to a phenomenon known as the rising lakes,' she continues. 'All the lakes along the Rift Valley rose beyond their usual levels, broke their banks, and flooded people's homes, causing displacements that continue to this day. When scientists investigated why the lakes were rising, they found that climate change was a major factor.'

The changes we are now seeing in the climate system are unprecedented. Temperatures are higher than they have ever been in the past 125,000 years. Human influence is unequivocal. The extent to which it will worsen in the coming decades depends directly on whether industrialised countries reduce their greenhouse gas emissions rapidly and on a sufficiently large scale. If global warming is limited to 1.5 °C, the risk of flooding is significantly lower than if temperatures rise to 2 °C or more. The World Meteorological Organization (WMO) has confirmed that the past eight years were the hottest ever registered. Record-breaking extreme weather events occurred in every continent in 2022, and July 2023 was the hottest month ever recorded. Multiple detection and attribution studies show the influence of climate change in making many of these events more severe or more likely to occur.[5]

Current levels of climatic change have already caused observable and scientifically documented climate impacts with negative effects on habitats, economies and health across the world. One-third of all heat-related deaths today can already be attributed to climate change.[6] The negative impacts of these changes are observed across natural and human systems: from terrestrial to coastal to ocean ecosystems, and through several aspects of human life, including economies, food systems, cities and infrastructure; ultimately undermining people's health, wellbeing, and survival.

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Evidence shows that climate change has already altered terrestrial, freshwater, and ocean ecosystems across the globe on all scales, impacting the timing of seasonal life cycles (see Figure 2.1). Currently, 85% of the global population live in areas that are experiencing significant change in temperature or precipitation, and these trends can be attributed to human influence on the climate. When *The Monitor* published in 2022, a total of 27,737 studies already provided evidence of climate change impacts in CVF member countries alone.[7] Thousands more studies have been produced since. The evidence is overwhelming.

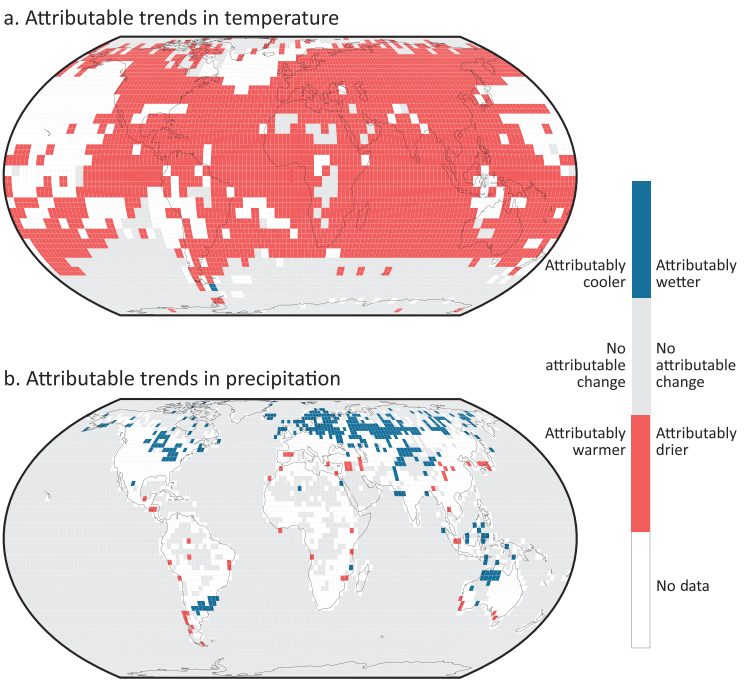

Figure 2.1 Evidence of the impacts of observed climate change. Plots a and b show trends in temperature and precipitation that are attributable to human influence (consistent with model estimates including anthropogenic forcing, and inconsistent with model estimates with natural forcing only) (CVF-V20 et al. *Climate Vulnerability Monitor*, 3rd ed. (*CVM3*): *A Planet on Fire*. 2022. p. 37).[8]

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In 2020, the United Nations Office for Disaster Risk Reduction (UNDRR) report titled 'The Human Cost of Disasters 2000–2019', provided the first ever analysis to estimate the economic losses attributable to anthropogenic climate change. From 2000 to 2019, a 74.5% increase in climate disaster events was recorded compared with the previous 20-year period. These extreme events have affected over 4 billion people worldwide, claimed approximately 1.23 million lives, and resulted in approximately $2.97 trillion in economic losses (an increase of over 82% over the previous period). Such events have hit the poorest countries hardest, where communities and individuals already struggle with strained resources and acute vulnerability.[9] In 2020 alone, over 1,770 recorded weather-related events led to about 30 million new displacements; displacement rates were almost five times higher in countries with the lowest incomes compared with those in high-income countries. This is a consequence of vulnerable countries being 'vulnerable'.[10] The V20 argued that 'climate change's appropriate tense is not just the future, but the present, as its consequences are increasingly being felt'.[11]

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Geneva Oliverie and Christon Herbert are both based in Barbados – one of six Caribbean islands that boast the unwanted record of being amongst the most indebted nations in the world.[a] But there's a reason why it accrued that debt: the high costs of dealing with multiple climate shocks. 'In Barbados, we now see droughts when we never used to,' says Herbert. 'In certain parts of the island, mainly the rural areas, there is significant water scarcity. The government provides water tanks, but they are not enough for the farming community. We also experience the mental health impacts. People are scarred for life after losing homes or family members to

[a] Under the leadership of Prime Minister Mia Amor Mottley, Barbados assumed the Chair of the Climate Vulnerable Forum and its V20 Finance Ministers in 2024.

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hurricanes. Dealing with climate change and excessive heat is very challenging.' Oliverie, originally from Trinidad and Tobago, explains that 'in Trinidad, we are much more mountainous and greener than Barbados ... I'm from the eastern side, where we usually have rain even if the western side doesn't. But it's gotten increasingly hot, especially over the last two to three years ... In the dry season, we have more forest and bush fires than before. In the rainy season, there's more flash flooding, causing damage in new areas. The weather has become more extreme ... certain fruits, butterflies, and flowers I grew up seeing are now disappearing.' The two rainy seasons are now much shorter and more intense, she says. 'Our reservoirs are not refilling as they used to. After the rainy season, they used to be at about 90% capacity, but now we're seeing only about 60% because the season is so short.' The intensity of the rain when it arrives causes flash flooding, too. Herbert says that 'in Barbados recently, in 2023, this rainy season has been something that I've not seen in my life in terms of the level of rain and flooding. This is something new to me.'

Not all Caribbean countries are as 'lucky' as Barbados and Trinidad and Tobago. Hurricane Maria hit the southwest coast of Dominica on 18 September 2017, with wind speeds of 220 mph. When Maria finally passed, it had damaged or destroyed a staggering 95% of Dominica's housing and 90% of crops and livestock. Five days later, Dominica's Prime Minister Roosevelt Skerrit addressed the 72nd United Nations General Assembly (UNGA), saying: 'I come to you straight from the front line of the war on climate change ... We as a country and as a region did not start this war against nature! We did not provoke it! The war has come to us.' For its part, Dominica released a climate-resilience policy framework in 2018 to guide its recovery journey in the form of the National Resilience Development Strategy 2030 (NRDS). Dominica is doing what it can. But its recovery hasn't been swift. Skerrit

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challenged the UNGA, saying, 'While the big countries talk, the small island nations suffer. We need action.'

Hurricane Maria caused damage amounting to 226% of Dominica's GDP.[12] 'Even with aid, it wasn't enough for rebuilding,' says Oliverie. 'Dominica is still a shadow of itself. We need a mechanism to boost resilience in heavily indebted small island states like ours, which rely heavily on sectors like tourism and agriculture that are vulnerable to climate events.' Herbert adds that many houses in Dominica remain without roofs, despite the government having rebuilt or relocated over 7,000 homes: 'Dominica is still recovering from Maria … The mental health impact is significant. People in Dominica still speak of Maria as if it were yesterday … that fear that runs through the community is still very much here.' Indeed, when the United Nations Foundation spoke to residents in 2023, Margarite August, a 70-year-old retired teacher, said, 'Every year, every year, it's fearful.' Her house still didn't have a roof, almost six years on. August, along with her 75-year-old husband who suffered a stroke, was living in a converted hillside bar. Christine John of the Dominica Red Cross said, 'I don't think anybody ever got over Maria. A lot of persons today, if it just starts to rain outside, they get anxious.'[13] Donalson Frederick, who helped to manage the Dominica government response after Maria, told NPR in June 2023, echoing Prime Minister Skerrit's words from over half a decade ago, 'Dominica is on the front line. Climate change is not something that is happening tomorrow. It's happening now and it's affecting our livelihood now.'[14]

Hurricane Maria went on to hit Puerto Rico, knocking out power to the entire island and killing nearly 3,000 people, becoming one of the deadliest natural disasters in US history.[15] Research in *Geophysical Research Letters* has found that Maria was made about 'five times more likely' by climate change.[16] When the researchers compared Maria to Hurricane Georges, the last major storm to make landfall on the island of Puerto Rico in 1998, and previously the costliest weather event,

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Maria produced 66% more total rainfall. 'Due to anthropogenic climate change it is now much more likely that we get these hurricanes that drop huge amounts of precipitation,' lead author David Keellings told the American Geophysical Union. At the beginning of the observational record in the 1950s, a storm like Maria was likely to drop that much rain once every 300 years, he said. But by 2017, after decades of man-made climate change increasing atmospheric moisture, that likelihood had changed to about once every 100 years.[17]

In the Northwest Pacific, hurricanes are known as typhoons – both are technically tropical cyclones. When Typhoon Odette hit the Philippines in December 2021, it became the costliest typhoon in Philippine history. Over 400 people were killed by Odette in the Philippines, many of whom drowned in the flood-waters. Thelma Jaromay was amongst more than 100,000 people forced to move to higher ground in the night while their homes were destroyed. 'We heard the roaring rain come down on us,' she recalls. 'We could not tell if it was water or wind because the wind was very strong.' Her son-in-law ran to get them out. 'Finally, we went up to higher ground. Around midnight a lot of people were asking for help . . . None of them were able to salvage their belongings.' By 4 a.m., they could still hear people calling for help below in the rising waters, but it was too late to save them. 'How could we help when the wind and water were already too strong?' Houses and mature trees disappeared under the rising water. All the houses in her village were destroyed – only the people who made it to higher ground in time, like Thelma, escaped with their lives. 'Odette's fury was really upon us,' she says. It is estimated that Odette alone caused $1.02 billion in damages.

Landlocked Uganda, East Africa, is far removed from the threat of typhoons and hurricanes. Yet its once moderate climate is also reeling from increasingly frequent extreme weather events. In the past decade, extreme rainfall episodes have led to rivers bursting their banks more frequently, causing floods, mudslides, and landslides that devastate lives and

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property. The floods are then followed by unusually prolonged dry seasons, which kill off crops and livestock (see Table 2.1). In the past four decades (1985–2021), floods in Uganda accounted for most natural hazards (55%), with both flash floods and slow-onset floods becoming more common, impacting the poorest areas the most. According to the Notre Dame Global Adaptation Initiative, out of 192 countries, Uganda ranks 10th in terms of vulnerability to climate change and 163rd for readiness and adaptation actions.[18] Since the 1930s, average temperature in Uganda has increased by 1.7 °C.[19] In addition, the country has experienced a statistically significant reduction in rainfall, especially during March–May, which has witnessed an average decrease of 6.0 mm per month, per decade since the 1960s. As a consequence, droughts have been more frequent and longer-lasting, especially in the western, northern and northeastern regions of the country.[20,21]

Evelyne Ninsiima, Founder and President of Green Environment Promotion (GEP), a social justice and climate adaptation charity based in Kabale, Uganda, explains, 'The risks are being experienced by everybody. Climate change is no respecter of persons, it affects everyone. It is sad that, in Uganda, people in rural communities tend to face it more. They are mainly subsistence farmers who depend on the climate for

Table 2.1 *Most severe floods and droughts in Uganda, by number of people affected (2000–2021) (IMF. Uganda: Selected Issues. 2022)*[22]

Floods	Droughts
2007 (Heavy rain)	2008 (Lack of rain)
2020 (Heavy rain)	2017 (Lack of rain)
2019 (Heavy rain)	2010 (Lack of rain)
2021 (Heavy rain)	2002 (Lack of rain)
2011 (Heavy rain)	2005 (Lack of rain)

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their survival. The change in weather has hampered crop pattern seasons. We have two rainy seasons in Uganda, but that has changed. For example, this year, the rains in August did not happen. People who had planted crops in July, hoping for rains in August, experienced the longest dry spell. When the rains began in September and October, they were so heavy that the crops were washed away.' She describes her region as hilly and overly populated, with a lot of land fragmentation: 'Because of overpopulation, our natural resources, like forests, rivers, and wetlands, are being reclaimed for farming ... practices to ensure that soils are kept intact, like wind barriers, are not being put in place because people tend to cut down trees [for] charcoal.' Ninsiima and GEP started a tree planting and education campaign in 2016 to counter this trend, which was hugely successful, planting over one million trees. But such grass-roots movements can only survive with external funding. 'Our indigenous trees are also good for carbon sequestration, it is ideal for carbon credits ... But when someone plants a tree, it takes three, four, or five years to grow, and if people have no money for food or fuel, they end up cutting them down again.' According to the IMF, Uganda also loses more than 800 square kilometres of its wetlands every year, posing challenges to water access, while the restoration of forests has so far not kept pace with the annual loss.[23]

Half the world away in the Colombian capital Bogota, Daniela Saade Ortega, Assessor in the Ministry of Finance, says that 'we're now seeing the effects and impact of climate change in our daily lives ... Bogota used to be a really cold city, but now people dress differently due to the changing weather. Some days it's very hot. It's very different from what Bogota is used to.' In January 2024 this led to devastating wildfires which encircled the city, shrouding it in smoke. Ortega comes originally from the coastal city of Barranquilla, much lower in altitude and more used to heat. But even there, she says, people find it increasingly hard to cope as the temperature has soared. 'In Barranquilla, when

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we have extreme rains, the streets flood, creating strong currents that can sweep away cars. Many people have died … every time we have heavy rain, the city just stops.' She admits that this is a mix of poor administration combined with extreme weather, but this simply further shows 'how countries are vulnerable not just because of the weather but also due to their [in]ability to adapt.'

Despite the wide climatic conditions across such a large country as Colombia, one trend remains true for all: hotter, longer dry periods followed by more intense rainfall. In the country's two largest cities, Bogota and Medellin, this means lethal mudslides forming on the surrounding mountainous slopes. In July 2022, a mudslide destroyed a rural elementary school in the mountains of Medellin, killing three young children, after heavy rains.[24] The following year, a mudslide in central Colombia killed 14 people and blocked a key commerce route highway – an example of how climate and economic vulnerability collide.[25] Devastating landslides are becoming an annual occurrence. When the small town of Mocoa suffered flooding in 2019, with a third of the area's average monthly rainfall falling in just one night, the subsequent landslide killed at least 300 people. President Juan Manuel Santos called it 'a direct product of climate change'.[26] For a country only just emerging from the multi-generational trauma of a 50-year civil war, the reality confronting the nation now, as recognised by congressman Duvalier Sánchez in 2023, is that '[t]he majority of displacement during the previous century was due to war and conflict, but most of the displacement this century will be because of the climate emergency.'[27]

Extreme fluctuations in rainfall also present a challenge for the hydro-electric dams to produce around 70% of Colombia's electricity. 'When we have long periods of drought, we face energy insecurity,' says Ortega, who is part of a small team coordinating and leading the climate change strategy for the Ministry of Finance. 'It's a process of learning what we can do from this position, the tools we have, and the kind of policies

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we need to design to support the country in its climate and environmental goals.' Colombia's membership of the V20 has been central to this learning process, and Ortega has personally presented Colombia's priorities for climate adaptation and climate finance at the V20. Previous administrations and domestic right-wing parties try to talk down Colombia's V20 membership, rather than seeing it as a position of strength, she says: 'I'll be honest with you, there's an internal debate because Colombia's past foreign policies have varied. Under President Petro[b] we are [now] much more involved with the V20 ... With past administrations, even though we were members of the V20, we weren't as active, focusing more on forums like the OECD and relationships with developed countries.' Some have even criticised President Petro and Vice President Francia Márquez for travelling to Africa and other developing markets, questioning the economic or commercial benefits for Colombia, she says. 'This change in perspective is interesting. I think it's important for the Global South to unite and be heard.'

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Swenja Surminski is chair of the not-for-profit Munich Climate Insurance Initiative (MCII), a distinguished Professor in Practice at the Grantham Research Institute on Climate Change and the Environment at LSE, and Managing Director at Marsh McLennon. She is a Member of the UK Committee on Climate Change, appointed by Government, and has been a contributing author to the IPCC and co-founder of the Loss and Damage Network. Originally from Germany and now based in the UK, she has seen the European climate change throughout her lifetime, too. 'In the UK, where I currently live, the most noticeable changes have been in flooding and heatwaves. Our house is located away from traditional flood

[b] Gustavo Petro, President of Colombia since 2022, and considered the first left-wing president in the recent history of Colombia.

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risk zones' – the type of thing she checks for, given that she's an international flood risk expert – 'but our neighbourhood homes were surprisingly inundated during a massive rainfall event in 2021. This is similar to my experiences in Germany, where a growing number of relatives and friends also faced unexpected flooding due to heavy rains.' Having just returned from a trip to northern Norway, within the Arctic circle, she describes profound changes there, too. 'Talking to locals, including reindeer herders, it's evident that climate change is not just a gradual trend but rather messy, with spikes and fluctuations. This was quite visible . . . a local reindeer herder shared that there had been unusual mild weather and rainfall, which then froze over. This created a layer of ice that the reindeer couldn't break through to reach food underneath. Such seemingly small changes have significant implications.' Such stories, she says, are symptomatic of how 'the narrative is shifting. While we've always had unusual events, there's now a recognition that these are part of a broader trend that aligns with projections and models . . . there's an increasing awareness among local populations that these changes are part of a long-term climate trend.'

According to the 2023 working paper 'Adaptation, Loss and Damage: A Global Climate Impact Fund for Climate Justice,' co-authored by Simona Marinescu, Senior Advisor for Small Island Developing States, UNOPS, and former UN Resident Coordinator in Samoa, Cook Islands, Niue, and Tokelau, 'High-income countries [HIC] are also the countries emitting the largest quantity of CO_2 in per capita terms. Indeed, over the 1850–2020 period, HICs have been responsible for more than 75% of all CO_2 emissions per capita . . . However, as of today, the financial burden of responding to climate impacts through adaptation . . . almost entirely falls on affected nations and not on countries that have been most responsible for climate change' (see Figure 2.2). Vulnerable countries 'are victims of climate-related disasters for which other nations are responsible' which leads to an obvious conclusion, write the authors:

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'climate justice and ... reparations. The concept of climate justice and the search for reparations are intrinsically linked with historical responsibility in GHG [greenhouse gas] emissions and climate change.'[28] In the field of international climate finance, the term for this is 'Loss and Damage'.

Surminski describes Loss and Damage as 'the third pillar under the UN's global climate diplomacy, alongside Mitigation and Adaptation.' COP27, in Sharm El-Sheikh, Egypt, was seen as a turning point in climate justice, as countries agreed on the creation of a specific Loss and Damage Fund. At COP28 in Dubai, the United Arab Emirates, the final agreements were reached to make this operational. 'This has been evolving for a long time,' explains Surminski. 'While the establishment of this fund is a positive step, it's important to remember that it arises from a failure to adequately address the climate change problem in a timely and decisive way.'

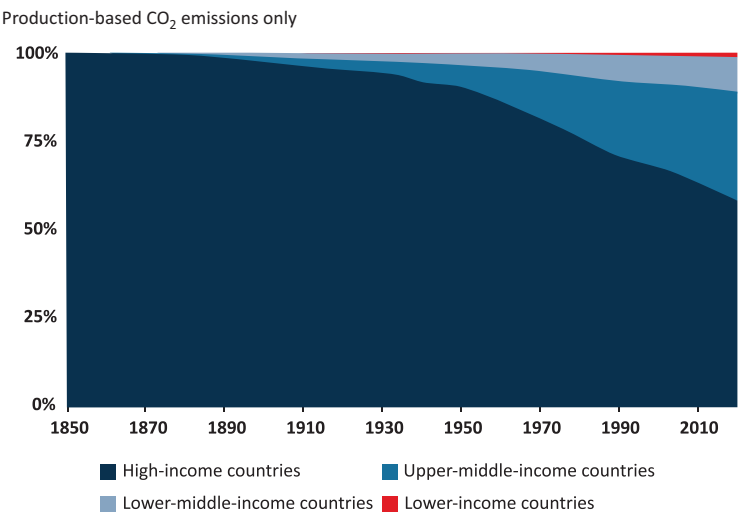

Figure 2.2 Cumulative production-based CO_2 emissions from fossil fuels, by income group (% of global emissions). (SDG Transformation Center. *Adaptation, Loss and Damage: A Global Climate Impact Fund for Climate Justice*. 2023. p. 7)[29]

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Is, then, the term 'reparation' now more appropriate? 'The slow progress of Loss and Damage discussions is partly due to their complexity and contentious nature,' says Surminski, chair of MCII, a non-profit organisation that contributed to the UNFCCC process on defining the role of the Santiago Network on Loss & Damage. 'When Loss and Damage first emerged as a topic, many academics were concerned it might divert focus from mitigation. If developed countries see this as a way to simply pay for their emissions, it undermines the goal of reducing emissions. However, it's not an either–or situation. We now understand that we need all three pillars – Mitigation, Adaptation, and Loss and Damage – and we need them urgently, as the impacts of climate change are already here.' She states that 'the extent to which we acknowledge the scale of compensation, or "reparation", is still debated. It's a delicate issue, balancing the recognition of climate change impacts with other factors that hamper development like mismanagement or corruption.'

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