

Under EMBARGO until 12:30 p.m. EDT on Thursday, 25 July 2024

# United Nations Secretary-General's Call to Action on **Extreme Heat**



**United  
Nations**

# “The world must rise to the challenge of rising temperatures.”

António Guterres, United Nations Secretary-General

## 1. Introduction

Extreme heat is deadly and disrupts economies and societies. Modelled estimates show that between 2000 and 2019, approximately 489,000 heat-related deaths occurred each year, with 45 per cent of these in Asia and 36 per cent in Europe<sup>1</sup>. Heat exposure-related loss in labour capacity resulted in average potential income losses equivalent to US\$863 billion in 2022<sup>2</sup>. In the past 100 days alone, we witnessed heat-related deaths in countries from Saudi Arabia to India, heatstroke warnings across Japan, schools closing in Bangladesh and the Philippines, severe heat warnings issued by governments in Southeast Europe, and new temperature records across the United States.

The climate crisis is driving crippling heat everywhere. June 2024 was the 13th consecutive month to break global temperature records.<sup>3</sup> As of writing, it is increasingly likely that 2024 will be one of the, if not the, hottest year in recorded human history.<sup>4</sup> Billions of people around the world are wilting under increasingly severe heatwaves driven

largely by a fossil-fuel charged, human-induced climate crisis. This is a taste of the future and impels us to take bold decisions to change the way we live to avoid an even more scorched Earth in the future.

Everyone is at risk. But extreme heat, like other facets of the climate crisis, does not affect everyone equally. It is the most vulnerable and exposed communities in society who are hit hardest. In many countries, air conditioning and green neighbourhoods are a luxury of the wealthy. Urban poor and displaced persons are particularly defenceless in the face of extreme heat. The very young, elderly, persons with disabilities, pregnant women, people with comorbidities, and outdoor workers are particularly vulnerable. Measures to protect workers against extreme heat remain inadequate. Policies to address extreme heat so far remain scattered, disjointed and underfunded.

Climate change is delivering a hotter and more dangerous world for all of us. And we are not

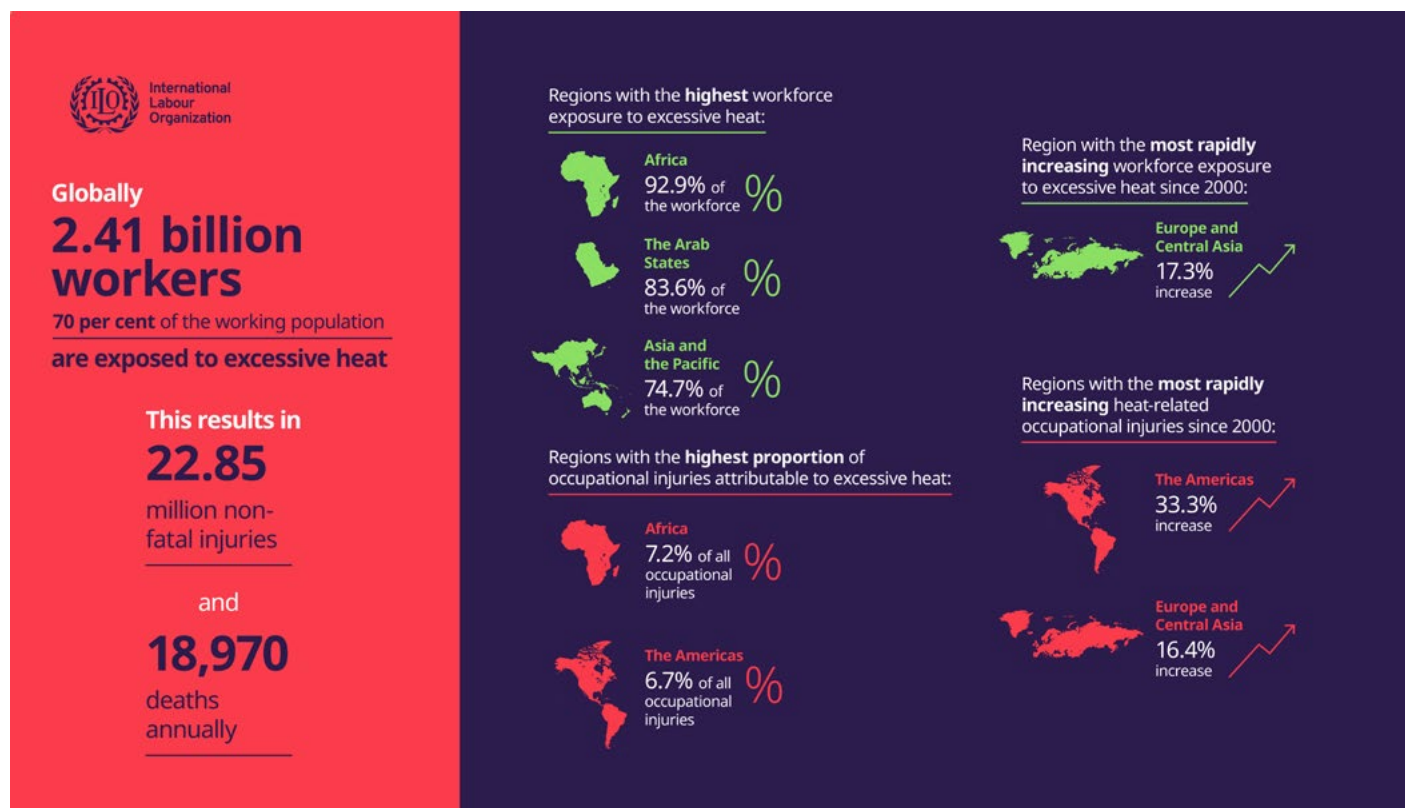
1 Zhao et al, 2021 Global, regional, and national burden of mortality associated with non-optimal ambient temperatures from 2000 to 2019: a three-stage modelling study <https://pubmed.ncbi.nlm.nih.gov/34245712/>

2 <https://www.lancetcountdown.org/about-us/interact-with-the-key-findings/>

3 <https://climate.copernicus.eu/june-2024-marks-12th-month-global-temperatures-15degc-above-pre-industrial-levels>

4 <https://wmo.int/publication-series/state-of-global-climate-2023>





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Source: ILO. 2024. Heat at work: Implications for safety and health. Geneva: ILO.

prepared. In response to this growing crisis, the Secretary-General is issuing a global call to action on extreme heat in four critical areas: **Care for the vulnerable; protect workers; boost the resilience of our economies and societies using data and science, and limit temperature rise to 1.5°C.** Extreme heat impacts virtually everything we do, and every aspect of our lives. The health and well-being of humans and ecosystems are in immediate peril. Economic growth is reduced, labour productivity diminished, water supplies exhausted, energy demand increased, precious crops decimated, school days missed, key infrastructure degraded and homes made uninhabitable, all of which puts more pressure on already-stretched public services and may overwhelm humanitarian assistance, essentially putting multiple Sustainable Development Goals (SDGs) at risk.

**New data from the International Labour Organization (ILO) warns that over 70 per cent of the global workforce – 2.4 billion people – are now at high risk of extreme heat, resulting in 22.85**

**million injuries and 18,970 deaths annually among workers.** Workers in Africa, the Arab states, and Asia and the Asia-Pacific are most exposed to excessive heat. In these regions, 93 per cent, 84 per cent, and 75 per cent of the workforce are affected, respectively.<sup>5</sup> As daily temperatures rise above 34°C (93.2°F), labour productivity begins to drop by 50 per cent.<sup>6</sup> 01

**But the good news is there are opportunities to reduce extreme heat risk, and actions and tools at our disposal to save lives and significantly limit the impacts of extreme heat.** Sensible occupational safety and health measures could save US\$361 billion a year, says the ILO. The Intergovernmental Panel on Climate Change (IPCC) indicates that **Heat Action Plans**, which include early warning and response systems are effective adaptation options for extreme heat (AR6 - SPM.C.2.6). According to estimates produced by the World Health Organization (WHO) and World Meteorological Organization (WMO), the **global scale-up of heat health-warning systems for 57 countries alone has the potential to save an estimated 98,314 lives per year.**<sup>7</sup> A triple strategy

5 ILO. 2024. Heat at work: Implications for safety and health. Geneva: ILO.

6 ILO. 2019. Working on a warmer planet: The effect of heat stress on productivity and decent work. Geneva

7 WHO. 2024. All for Health, Health for All: investment case 2025-2028. Geneva: WHO



Heat stress impacts agricultural workers in Jalisco, Mexico. April 2024. **Photo:** Rafael Duarte/ ILO

of passive cooling, higher energy efficiency and fast phasedown of climate-warming refrigerants offers the opportunity to reduce emissions from the cooling sector while protecting an additional 3.5 billion people at risk from heat by 2050.<sup>8</sup>

Rather than continuing on the path to deadly heat and energy poverty, **wise and concerted action to reduce energy demand in the cooling sector globally could save populations US\$1 trillion and the power sector up to US\$5 trillion by 2050.**<sup>9</sup>

The world needs a strategy to deal with heat that serves to mobilize Governments, policy makers and all stakeholders to act to: prevent and reduce heat risk; increase resilience to heat; manage extreme heat crises; and mitigate its worst impacts. The United Nations will continue to mobilize global heat, health ecosystem and policy experts and bring together the existing expertise and ongoing work of the UN and scientific and technical communities on extreme heat.

The crisis we see unfolding globally requires an urgent response. Deadly heat is becoming commonplace. Now is the time **to strengthen global action on extreme heat** that:

1. Recommends concrete measures that can be taken now by Governments and communities to ease the suffering of people everywhere, while

building resilient economies and protecting lives and livelihoods.

2. Supports Governments and communities everywhere by collecting good practices in policy and governance, risk reduction and management, and including the latest data and science on extreme heat. This is information that can help Governments, and their partners, build resilience to heat risk and save lives.
3. Identifies key areas of national and international cooperation to help address extreme heat risk.

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<sup>8</sup> UNEP 2023 Global Cooling Watch report, *Keeping it Chill: How to meet cooling demands while cutting emissions*. Nairobi. UNEP-led Cool Coalition <https://www.unep.org/resources/global-cooling-watch-2023>

<sup>9</sup> Ibid.

## 2. Extreme Heat: The Science

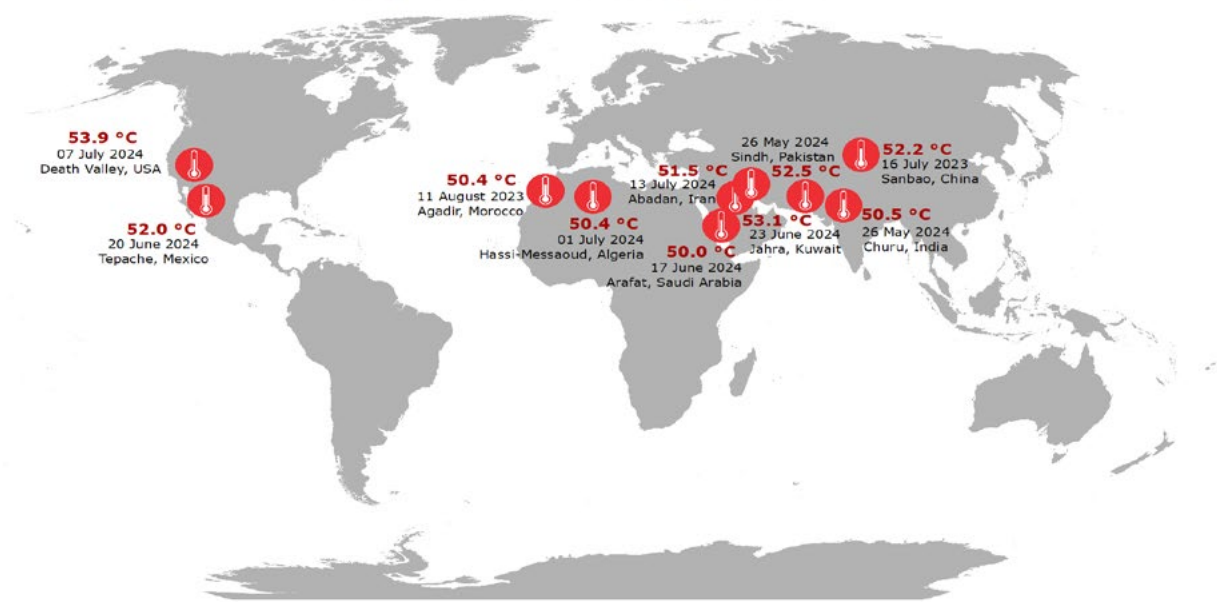
Heatwaves and prolonged periods of excess heat that accumulate over a sequence of unusually hot days and nights are increasing in frequency, duration, intensity and magnitude due to climate change.<sup>10</sup> Even low and moderate intensity heatwaves can impact the health and well-being of populations, particularly the vulnerable. Most of the world's population resides in tropical and sub-tropical climates, and in cities. These regions experience dangerous chronic heat conditions, or long periods of excess high daytime and night-time temperatures, that are sometimes punctuated by seasonal or exceptional heatwave events combined with high humidity.

**In recent decades, there has been a rapid rise in the scale, intensity, frequency and duration of extreme-heat events against a background of**

**rising average global temperatures.** The IPCC is clear: **“There is high confidence that concurrent heatwaves and droughts have increased in frequency over the last century at the global scale due to human influence.”**<sup>11</sup> The WMO is equally blunt: “Unbearable temperatures over 40°C and even 50°C are increasingly frequent in many parts of the world.”<sup>12</sup> <sup>02</sup>

The year 2023 stands out as the warmest year on record by a significant margin due to a combination of long-term climate change, El Niño and other factors.<sup>13</sup> That trend continued in 2024. **June 2024 was the thirteenth month in a row of record global temperatures.**<sup>14</sup> The latest projection warns that at least one of the next five years will be the warmest on record, beating 2023.<sup>15</sup> In 2023-2024, almost all world regions were impacted by prolonged

### Extreme daily temperatures of 50°C or more July 2023 to July 2024



Note: Based on reported daily maximum near surface air temperature by NMHSs. List is not exhaustive and includes provisional data.

Source: World Meteorological Organization, 2024

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<sup>10</sup> A heatwave is an extreme-heat event, defined as “a marked unusual period of hot weather over a region persisting for at least two consecutive days during the hot period of the year based on local climatological conditions, with thermal conditions recorded above given threshold” <https://www.preventionweb.net/understanding-disaster-risk/terminology/hips/mh0047>

<sup>11</sup> <https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-11/>

<sup>12</sup> <https://wmo.int/media/news/more-extreme-heat-demands-coordinated-action>

<sup>13</sup> WMO, 2023 State of Climate <https://wmo.int/publication-series/state-of-global-climate-2023>

<sup>14</sup> <https://pulse.climate.copernicus.eu/>


<sup>15</sup> <https://wmo.int/publication-series/wmo-global-annual-decadal-climate-update-2024-2028>



extreme heat, with major health, environmental and societal impacts. There were dozens of new daily maximum temperature records. Robust assessments from the IPCC show a clear link between this extreme heat and climate change.

Urban centres and cities are warmer than the surrounding rural areas due to what is known as the **urban heat island effect**. This results from several factors, including reduced ventilation and heat trapping due to the close proximity of tall compact buildings, waste heat generated directly from human activities (such as industrial processes, transport and air conditioning), the heat-absorbing and thermal properties of concrete and other materials commonly used in urban surfaces and building materials, and diminishing blue spaces, green cover and vegetation (see Box 1).

**Future extreme heat will test society.** The extent to which current and future generations will experience a hotter and different world depends on the choices we make today and in the coming years

(IPCC AR6). Even for future pathways with very low emissions, the world will see significantly hotter and more dangerous temperatures than today. As warming accelerates, some regions of the world will become uninhabitable as temperatures exceed the physiological limits of human liveability and survivability by the end of this century. According to the IPCC, there is “high confidence” that **Central and South America, southern Europe, Southern and Southeast Asia, and Africa will be the most affected by climate change in terms of heat-related mortality** by 2100, based on 1.5°C, 2°C and 3°C increases in the global temperature. The IPCC projects that peak temperatures in heatwaves will increase significantly faster than global mean and local average temperatures. An extreme-heat event that would have occurred once in 50 years in a climate without human influence is now nearly five times more likely. **Such an event is projected to be nearly 9 times more likely under 1.5°C and 14 times more likely under 2°C and bring heat and humidity levels that are far more dangerous.**<sup>16</sup> 



Athens is among many cities suffering extreme heat. High temperatures and strong winds caused wildfires in Greece in 2023. **Photo:** Unsplash / Anasmeister

16 Working Group I to the Sixth Assessment Report of the IPCC [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. World Bank. (2020). *Climate Change 2021: The Physical Science Basis - Summary for Policymakers*. Intergovernmental Panel on Climate Change. [www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_SPM\\_final.pdf](http://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf)

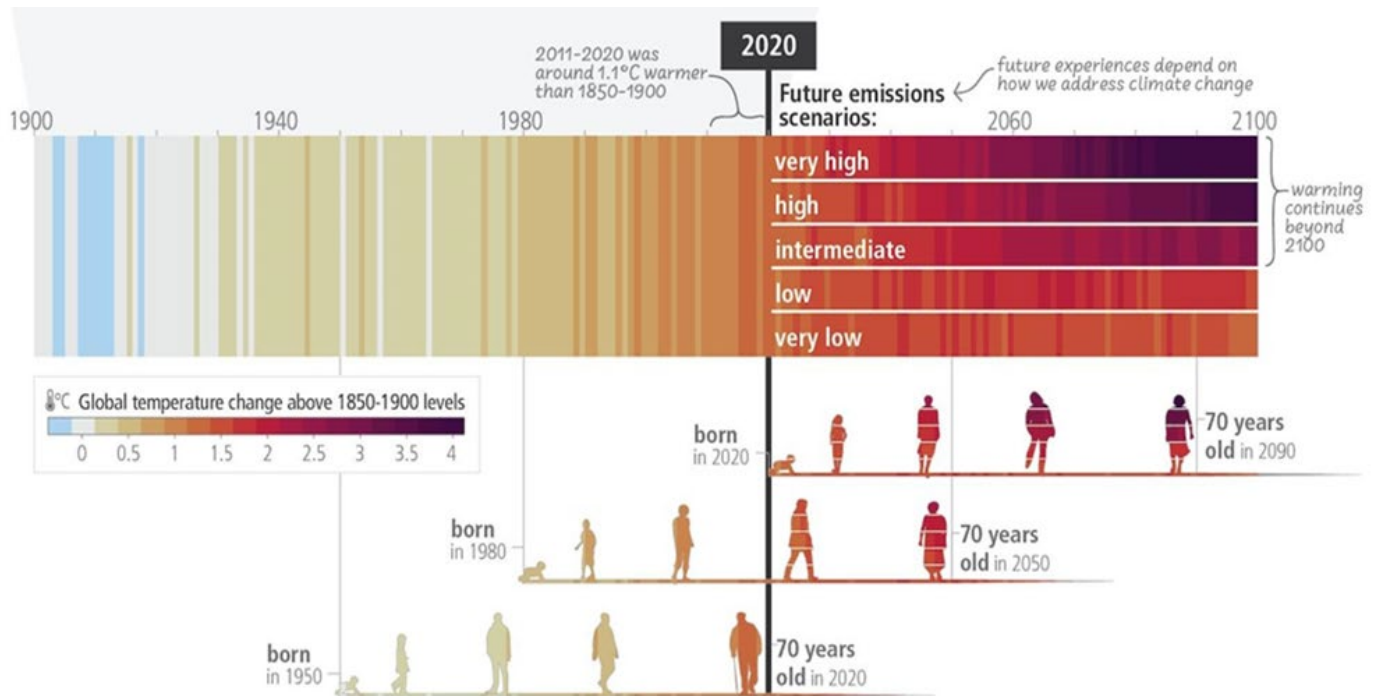
**BOX 1 EXTREME HEAT AND URBAN HOTSPOTS**

**The world's cities are heating up at twice the global average rate due to rapid urbanization and the urban heat island effect.**<sup>17</sup> Heatwaves present an acute danger to urban centres, where structural, socio-economic, and demographic factors magnify their impacts. Urban areas house more than half of the world's population, and another two and a half billion people could be added to urban areas by 2050.<sup>18</sup> As the world is heating up faster than anticipated, cities are bearing the brunt, as congestion, the built environment and concentrated energy use trap and amplify temperatures. Layering city locations over IPCC models<sup>19</sup> shows many cities becoming places where extreme temperatures persist for nearly half the year. At 1.5°C of warming, 67 cities will experience 150 or more days a year of temperatures exceeding 35°C. Under 3°C of warming, it rises to 197 cities.<sup>20</sup>

The impacts of extreme heat will not be evenly shared between or within cities, and addressing thermal inequality is an urgent challenge. Between 1.5°C and 2°C of global warming, the most appreciable temperature rises will occur in the tropics, which house a disproportionate amount of people living below poverty lines.<sup>21</sup> By 2050, studies project **“a 700 per cent global increase in the number of urban poor living in extreme-heat conditions, with the largest increases across West Africa and South-East Asia.”**<sup>22</sup>

- 17 UNEP 2021 Beating the Heat: A Sustainable Cooling Handbook for Cities. Nairobi. UNEP-led Cool Coalition <https://www.unep.org/resources/report/ beating-heat-sustainable-cooling-handbook-cities>
- 18 <https://www.un.org/en/desa/around-25-billion-more-people-will-be-living-cities-2050-projects-new-un-report>
- 19 [https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\\_AR6\\_WGII\\_Chapter06.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter06.pdf)
- 20 <https://www.wri.org/insights/future-extreme-heat-cities-data>
- 21 <https://www.ifrc.org/sites/default/files/2022-10/Extreme-Heat-Report-IFRC-OCHA-2022.pdf>
- 22 Urban Climate Change Research Network. (2018, February). How Climate Change Could Impact the World's Greatest Cities: UCCRN Technical Report. C40 Cities. [1789\\_Future\\_We\\_Dont\\_Want\\_Report\\_1.4\\_hi-res\\_120618.original-compressed.pdf](https://www.c40cities.org/sites/default/files/2018-02/1789_Future_We_Dont_Want_Report_1.4_hi-res_120618.original-compressed.pdf)

## The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near term



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**Source:** IPCC, 2023: Summary for Policymakers. Figure SPM.1. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001.

### Mitigation: Essential

While short-term plans to protect populations from extreme heat are essential, unless Governments take tougher steps to meet the goals of the Paris Agreement and cut fossil fuel production and consumption in line with the 1.5°C warming goal, more human suffering, death and ecosystem collapse will be attributable to a changing climate. Scientists at the IPCC were very clear in the 2022 AR6 report that existing and planned fossil fuel infrastructure will already “exhaust the remaining carbon budget for 1.5°C.” Radical cuts in coal, oil and gas are required for Governments to ensure that global temperatures and killer heatwaves do not escalate through this century – posing increasingly serious risks to populations globally.

Alongside those cuts, the reduction of short-lived climate pollutants is essential. Methane, black carbon, ozone and Hydrofluorocarbons (HFCs)

are responsible for a third of current warming. Given their shorter lifetime in the atmosphere, mitigation measures could reduce warming by 0.2 °C by 2040. While some of this can be harnessed via decarbonisation efforts, targeted measures, which are cost effective, and often at negative cost, can help reduce the risk of dangerous tipping points.<sup>23</sup> Reductions of HFCs in line with the Kigali Amendment of the Montreal Protocol are expected to avoid up to 0.5°C of warming by 2100.<sup>24</sup>

23 Chapter 6: Short-lived Climate Forcers | Climate Change 2021: The Physical Science Basis (ipcc.ch)

24 UNEP-WHO, Twenty Questions and Answers About the Ozone Layer: 2022 Update, Scientific Assessment of Ozone Depletion: 2022 ,



## 3. Extreme Heat: A Silent Killer

**Heat stress is the leading cause of extreme weather-related deaths.** Acute and prolonged exposure to excess heat causes heat stress on the body and exacerbates underlying illnesses including cardiovascular disease, diabetes, mental health, asthma and kidney disease, and can increase the risk of accidents, adverse pregnancy and birth outcomes, and transmission of some infectious diseases. In extreme heat conditions, unremedied heat stress can lead to heat stroke, which can be a fatal medical emergency.

**Termed the ‘silent killer’, extreme heat dwarfs the impact of more visible weather hazards** such as tropical cyclones (16,000 deaths per year).<sup>25</sup> Modelled estimates show that **between 2000 and 2019, approximately 489,000 heat-related deaths occurred each year, with 45 per cent of these in Asia and 36 per cent in Europe.**<sup>26</sup> Worldwide, the official diagnosis and reporting of heat-related illness, injuries and deaths are recognized to be under-reported. **The lack of uniform reporting standards makes the aggregation and comparison of nationally reported statistics challenging.**

High-intensity heatwave events in temperate regions can bring high acute mortality due to factors including limited acclimatisation – the summer heat of 2022 drove over 61,000 excess deaths in Europe, while in British Columbia, Canada, 619 lives were lost in only seven days during the 2021 Western Heat dome event, which may have killed over one billion marine animals.<sup>27, 28, 29</sup> However, extremely high temperatures in tropical and subtropical regions can also have significant impacts as they push the physiological limits of the human body. For example, India reported 40,000 cases of suspected heat stroke and over 100 deaths since the onset of the heat season in 2024, as of mid-June<sup>30</sup>.

### AT-RISK POPULATIONS

Anyone can be impacted by heat, but **some people are disproportionately exposed to, and impacted by, extreme heat** due to physiological factors. This includes:

- ▶ People living in **poverty**
- ▶ **Older** persons
- ▶ Those with pre-existing **health conditions**, including mental health and persons with disabilities
- ▶ **Women**, pregnant women, infants and young **children**
- ▶ **Workers**, particularly outdoor workers, those in physically demanding roles or those working in unventilated indoor environments.

Multiple vulnerabilities determine the impact of extreme heat on people, including **physiological factors** (such as age, pre-existing medical conditions and pregnancy) and **exposure factors** (due to the nature of jobs and housing). **Gender** can play a significant role in determining heat exposure and exacerbate gender inequalities. For example, women are often responsible for cooking indoors during hot weather and, proportionally to men, participate in less-protected informal labour. In addition, pregnant women are at higher risk of developing gestational

25 <https://wmo.int/topics/tropical-cyclone>

26 Zhao et al, 2021 Global, regional, and national burden of mortality associated with non-optimal ambient temperatures from 2000 to 2019: a three-stage modelling study <https://pubmed.ncbi.nlm.nih.gov/34245712/>

27 Heat-related mortality in Europe during the summer of 2022 | Nature Medicine

28 Surviving the heat: The impacts of the 2021 western heat dome in Canada (science.gc.ca)

29 Cecco, L. (2021, July 8). ‘Heat dome’ probably killed 1bn marine animals on Canada coast, experts say. The Guardian. [www.theguardian.com/environment/2021/jul/08/heat-dome-canada-pacific-northwest-animal-deaths](http://www.theguardian.com/environment/2021/jul/08/heat-dome-canada-pacific-northwest-animal-deaths)

30 National Center for Disease Control, Govt of India.



A child sits in a tub of water to beat the heat in Al-Hamra camp for internally displaced people in Syria's Idlib governorate. **Photo:** OCHA/Bilal Al-Hammoud

diabetes and gestational hypertension if exposed to extreme heat, as well as hospitalizations.<sup>31</sup> In utero exposure to heat is more likely to result in stillbirth, low birthweight, and preterm birth.<sup>32</sup> Extreme heat further increases the risk of gender-based violence.<sup>33</sup>

Urban and rural poor are disproportionately exposed to heat due to low quality housing and lack of access to cooling. Due to building materials, informal settlements and camp environments that host refugees and internally displaced people are often significantly hotter than other urban areas in some cities.<sup>34</sup> Further, heat amplifies the toxicity of air pollution, and compounds the health risks. People with pre-existing medical conditions including

persons with disabilities face added risks. Compared to adults, infants and children are uniquely affected by heat stress, in part because of their developing immune and heat regulation systems as well as their dependence on caregivers, leaving them more vulnerable to its short- and long-term effects due to their physiological characteristics. UNICEF found that, **by 2050, if the current trend continues, almost every child under 18 in the world – nearly 2.2 billion – will be exposed to high heatwave frequency, up from only 24 per cent of children in 2020.**<sup>35, 36</sup> **Heat-related mortality for people over 65 years of age increased by approximately 85 per cent between 2000-2004 and 2018-2022.**<sup>37</sup>

31 <https://www.unicef.org/documents/protecting-children-heat-stress-technical-note%C2%A0>

32 <https://www.unicef.org/documents/protecting-children-heat-stress-technical-note%C2%A0>

33 <https://www.unfpa.org/news/five-ways-climate-change-hurts-women-and-girls>

34 Extreme Heat: Preparing for the Heatwaves of the Future. United Nations Office for the Coordination of Humanitarian Affairs and International Federation of Red Cross and Red Crescent Societies, 2022.

35 High heatwave frequency is defined as 'living in areas where the average yearly number of heatwaves is equal to or above 4.5'. UNICEF (2022) 'The Coldest Year of the Rest of Their Lives'.

36 <https://www.unicef.org/reports/coldest-year-rest-of-their-lives-children-heatwaves>

37 Lancet Countdown: Heat-related Mortality. 2023. <https://www.lancetcountdown.org/data-platform/health-hazards-exposures-and-impacts/1-1->

Excessive heat poses a critical threat to the safety, health and well-being of workers globally. Exposure to excessive heat in the workplace leads to both acute impacts such as accidents and injuries, as well as chronic health conditions. It is estimated that more than 22.85 million workplace injuries occur worldwide due to excessive heat. Moreover, long-term exposure to excessive heat stress can lead to illnesses with long latency periods, such as chronic kidney disease. It is estimated that in 2020, there were 26.2 million people worldwide living with chronic kidney disease attributable to heat stress at work.<sup>38</sup> The mental health impacts of working in excessive heat must also be considered.

## HUMID HEAT RISKS

High heat combined with high humidity limits the human body's main cooling mechanism – evaporative cooling through sweating. Reduced evaporation of sweat from the skin accelerates the accumulation of heat stress in the body, making exposure to high heat and humidity dangerous.<sup>39 40</sup>

**Thermal heat stress indices**, such as Wet Bulb Globe Temperature, Universal Thermal Climate Index, Heat Index and Humidex, are used to estimate the level of heat stress that a person may experience in a given environment due to a combination of heat, humidity and other factors.

**As heat stress increases, it will degrade thermal comfort, livability, and even human limits to survivability.**

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health-and-heat/1-1-5-heat-and-sentiment

38 ILO. 2024. Heat at work: Implications for safety and health. Geneva: ILO

39 Humidity's Role in Heat-Related Health Outcomes: A Heated Debate - PubMed (nih.gov)

40 New research on health effects of combined exposure to heat, humidity, air pollution – Red Cross Red Crescent Climate Centre



# 4. Extreme Heat = Extreme Impacts on Lives, Livelihoods and Environment

## ECONOMIC IMPACTS

Extreme heat is having devastating impacts on the global economy. One important channel is through diminished worker productivity. When temperatures rise above 24-26°C, labour productivity begins to decline.<sup>41</sup> **At 33-34°C, productivity drops by 50 per cent.** In 1995, the economic loss due to heat stress at work was US\$280 billion.<sup>42</sup> **That figure is rising as temperatures increase, with expectations that economic losses will reach US\$2.4 trillion in 2030.** This is 2.2 per cent of total working hours worldwide – a **loss equivalent to 80 million full-time jobs.**<sup>43</sup> Further, heat exposure-related loss in labour capacity resulted in **average potential income losses equivalent to US\$863 billion in 2022.**<sup>44</sup>

**Implementing occupational, safety and health (OSH) measures to prevent occupational injuries related to excessive heat could save over US\$361 billion globally.** At the regional and country level, this ranges from 0.004 per cent of GDP in Europe and Central Asia to 0.1 per cent in Africa, with some countries experiencing national GDP losses exceeding 1.5 per cent. Notably, the largest national cost burden is observed in low- and lower-middle-income economies.<sup>45</sup> In addition to impact on workers, extreme heat negatively impacts key sectors of the economy (agriculture, power and infrastructure), puts enormous pressure on social and service sectors (education, healthcare and tourism) and disrupts international trade and supply chains.

## SOCIAL COSTS

While extreme heat is impacting virtually everyone, everywhere, the costs and burdens are not shared equally. Higher temperatures mean more poverty

and greater inequality. World Bank research shows that a 1°C increase in temperature leads to a 9.1 per cent increase in poverty, using the US\$1.90 daily poverty threshold. A similar increase in temperature causes a 0.8 per cent increase in the Gini inequality index.<sup>46</sup> According to the Food and Agriculture Organization (FAO), **in an average year, poor rural households lose 5 per cent of their total income due to heat stress relative to better-off households.** Inequality is further exacerbated as heat stress widens the income gap between female-headed and male-headed households by US\$37 billion a year. The FAO report found that extreme temperatures push children to increase their weekly working time by 49 minutes relative to prime-aged adults, mostly in the off-farm sector, closely mirroring the increase in the work burden of women, which increases by 55 minutes a week more than men.<sup>47</sup> Many of the world's most vulnerable people have limited or no access to modern cooling technologies – such as air conditioners and refrigerators – whether at home, at school or in the workplace. Cooling is increasingly being understood as a critical infrastructure service, akin to energy, water and others.<sup>48</sup> Without adequate cooling, the challenge of achieving the SDGs will be further exacerbated.

## HEALTHCARE SECTOR

Repeated seasonal heatwaves can place significant stress on healthcare service delivery and systems. Demand for ambulatory services and healthcare can dramatically increase during extreme heat conditions. When considering that close to one billion people in low- and lower-middle income countries are served by healthcare facilities with

41 ILO (2019) [https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms\\_711919.pdf](https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_711919.pdf)

42 Ibid

43 Ibid

44 <https://www.lancetcountdown.org/about-us/interact-with-the-key-findings/>

45 ILO. 2024. Heat at work: Implications for safety and health. Geneva: ILO.

46 Does Hotter Temperature Increase Poverty and Inequality? Global Evidence from Subnational Data Analysis (worldbank.org)

47 FAO. 2024. The unjust climate – Measuring the impacts of climate change on rural poor, women and youth. Rome. <https://doi.org/10.4060/cc9680en>

48 UNEP 2023 Global Cooling Watch report, Keeping it Chill: How to meet cooling demands while cutting emissions. Nairobi. UNEP-led Cool Coalition <https://www.unep.org/resources/global-cooling-watch-2023>

unreliable electricity supply or with no electricity access at all, this implies they also have no access to cooling, fans and refrigeration, which require a power supply to protect patients and health workers from additional heat strain.<sup>49</sup> In many South Asian and sub-Saharan African countries, more than 1 in 10 health facilities lack any electricity access, with unreliable power for half of facilities in sub-Saharan Africa. Water is essential to treat heat stress and heatstroke. Unfortunately, global monitoring in 2021 reveals only 53 per cent of health facilities have basic water services, while 20 per cent do not have water access.<sup>50</sup> **Health facility readiness for extreme heat is significantly absent in many of the most exposed regions in the world.** Further, extreme heat can also lead indirectly to greater burdens of infectious diseases spread by heat-tolerant bacteria and viruses, thereby multiplying existing disease burdens.<sup>51</sup>

## EDUCATION

It is hard to learn in extreme heat. Many parts of Asia and North Africa experienced **school closures in 2024 due to extreme heat, leaving millions of children out of school**, widening learning gaps.<sup>52</sup> However, even if schools remain open in the midst of heat, rising temperatures can inhibit learning. According to a 58-country assessment, each additional day above 26.7°C (80°F) during the three years preceding an exam lowered scores by 0.18 per cent of a standard deviation, with the effect larger for lower-income populations.<sup>53</sup> Another study found that, without air conditioning, each 0.56°C (1°F) increase in school-year temperature reduces the amount learned that year by 1 per cent.<sup>54</sup> These learning losses and lower levels of education attainment reduce income potential and productivity. Every additional day with mean temperatures above 32°C (89.6°F) in utero and in the first year after birth is associated with a 0.1 per cent reduction in adult annual earnings at age 30.<sup>55</sup>

## ENERGY

More cooling uses more electricity, and around 60% of the world's electricity is currently generated by burning fossil fuels, the very energy source driving climate change in the first place. Greater usage of air conditioners is straining power systems around the world. **Cooling accounts for almost 20 per cent of global electricity consumption<sup>56</sup>** and is a top driver of global electricity demand and of generation capacity additions to meet peak power demand. Cooling is a double burden on the climate – air conditioners and refrigerators have both indirect emissions from electricity consumption and direct emissions from the release of refrigerant gases, the majority of which are much more potent at warming the planet than carbon. There is deep iniquity in access to affordable and efficient cooling systems globally. **Based on current policies, between now and 2050 the installed capacity of cooling equipment globally will almost triple** – rising from 22 TW in 2022 to 58 TW in 2050 (equivalent of 16 billion mini-split air conditioning units) **resulting in electricity consumption more than doubling.<sup>57</sup>** This will lead emissions from cooling to surge by up to 6.1 billion tons of carbon dioxide equivalent (CO<sub>2</sub>e) in 2050, equivalent to more than 10 per cent of global projected emissions that year.<sup>58</sup> Given the existing reliance on fossil fuels, without a strong and urgent transition to renewable energy sources, this will further worsen greenhouse gas emission trends. In both developed and developing countries, the increased demand for cooling power often results in power failures and rolling blackouts. The heatwaves also reduce water available in dams and hydro-electricity production.<sup>59</sup> UNEP finds that **investing in the triple strategy of passive cooling (nature, urban design, reflective surfaces and smart buildings), energy efficiency and a phasedown of climate-warming gases used in cooling equipment could reduce the projected 2050 emissions by over 60 per cent** – around 3.8 billion tons of CO<sub>2</sub>e and save billions from extreme heat through universal access

49 [WHO \(2023\) Energizing Health](https://www.who.int/publications/i/item/9789240066984), <https://www.who.int/publications/i/item/9789240066984>

50 <https://www.who.int/news/item/30-08-2022-half-of-health-care-facilities-globally-lack-basic-hygiene-services--who--unicef>

51 <https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health>

52 <https://www.reuters.com/business/environment/extreme-heat-is-closing-schools-widening-learning-gaps-worldwide-2024-04-30/>

53 Park, R. Jisung, A. Parick Behrer and Joshua Goodman, 'Learning Is Inhibited by Heat Exposure, Both Internationally and within the United States', *Nature Human Behavior*, vol. 5, no. 1, January 2021, pp. 19–27.

54 Harvard Kennedy School, 'When the Heat Is On, Student Learning Suffers', 28 May 2018, accessed 24 April 2023.

55 Isen, Adam, Maya Rossin-Slater and Reed Walker, 'Relationship between Season of Birth, Temperature Exposure, and Later Life Wellbeing', *Proceedings of the National Academy of Sciences of the United States of America*, vol. 114, no. 51, 19 December 2017, pp. 13447–13452.

56 United Nations Environment Programme, [Global Cooling Watch 2023: Keeping it Chill: How to meet cooling demands while cutting emissions](#)

57 *Ibid.*

58 *Ibid.*

59 <https://www.scientificamerican.com/article/climate-fueled-heat-waves-will-hamper-western-hydropower/>



Extreme heat in East and Southern Africa has amplified the risk and impacts of drought. Drought conditions in Zambia have led to crop failure, impacting people's health. **Photo:** UNICEF / Karin Schermbrucker

to cooling.<sup>60</sup> To deliver these benefits, Governments must introduce joined-up approaches to policies that back action in all three areas. Governments have already signalled their commitment to do so through the Global Cooling Pledge at COP28.<sup>61</sup> There is need for much more research and development on cooling alternatives and cooling science overall.

Moreover, there are over 90 billion tonnes of CO<sub>2</sub>e of ozone-depleting substances (ODS) and HFCs currently contained within equipment or expected to enter the market by 2100.<sup>62</sup> This is more than twice the entire planet's annual carbon dioxide emissions. 60 per cent of HFC consumption comes from topping up leaky equipment. Regulation that promotes low to zero global-warming potential alternatives in air conditioning and refrigeration equipment is critical, and so are efforts to avoid the dumping of new inefficient cooling appliances with obsolete refrigerants in developing countries.<sup>63</sup>

## INFRASTRUCTURE AND BUILT ENVIRONMENT

The risk of extreme heat is in part driven and exacerbated by the very practices that prevail in the development of the built environment. Extreme heat poses risks to the built environment, including the transport, energy, water and communication sectors. This critical infrastructure could fail or malfunction in extreme heat resulting in connectivity issues and clogged supply chains. There is an urgent need to **evaluate the resilience of critical infrastructure and the built environment to extreme heat and adopt measures to gradually strengthen their resilience.** The design of urban environments is accelerating the indoor and outdoor heat exposure of residents through the generation of waste heat from transport industrial processes and cooling, combined with heat-trapping that occurs due to limited ventilation and vegetation, and due to heat-absorbing and thermal properties of concrete and other materials commonly used in urban surfaces and buildings.<sup>64</sup> This calls for the urgent need for transformation of the built environment. A transformation that must be supported by the construction industry, which in turn must be supported by market-based mechanisms and enabling policy environment.

60 United Nations Environment Programme, [Global Cooling Watch 2023: Keeping it Chill: How to meet cooling demands while cutting emissions](#)

61 <https://www.unep.org/news-and-stories/speech/keeping-it-chill-how-meet-cooling-demands-while-cutting-emissions>

62 <https://eia.org/report/20221020-the-90-billion-ton-opportunity/>

63 Montreal Protocol Parties Agree to Enhanced Anti-Dumping Actions | Climate & Clean Air Coalition ([ccacoalition.org](http://ccacoalition.org))

64 UNEP 2021, Beat the Heat; UNEP State of Finance for Nature



## AGRICULTURE AND FOOD

Global agriculture and food systems are being severely impacted by extreme heat. Compared with 1981–2010, the higher frequency of heatwave days and drought months was associated with **127 million more people experiencing moderate or severe food insecurity in 2021.**<sup>65</sup> Crop yield can be severely decreased due to extreme heat which can provoke heat stress in crops, reducing photosynthesis, plant growth and yield. Crops like wheat, maize and rice are particularly vulnerable during their flowering and grain-filling stages. Rice yields can be reduced by up to 90 per cent when night temperatures increase from 27°C to 32°C, and temperatures above 30°C are deemed to be harmful to maize production. There is evidence that current warming trends around the globe are already having an impact on agriculture. In parts of Western Europe, despite the wide application of farm technologies in large-scale agricultural production and food processing, **severe drought in 2022 caused crop yields to fall by up to 45 per cent, while wheat and rice yields dropped 30 per cent.**<sup>66</sup> In an attempt to attribute historical crop productivity trends to anthropogenic climate change, the same FAO report discussed four case studies. Particularly in Kazakhstan (wheat), Morocco (wheat) and South Africa (maize), climate change is estimated to have been detrimental to the yields of each crop studied in the countries, and one of the major climatic effects on the crops is related to extreme heat. Further, warming ocean temperatures are causing an increase in the incidence of marine heatwaves, threatening marine ecosystems and negatively impacting fisheries and aquaculture. **Extreme heatwaves can trigger a rapid onset of drought and wildfires, which can also be detrimental to agricultural production.**

Livestock are particularly vulnerable to heat stress, which can decrease feed intake, growth rates and reproductive performance. It also increases mortality rates. Combined with water scarcity, higher temperatures can reduce the availability and quality of feed and water resources for animals. Food spoilage and cold chains are also impacted by heat. Huge agricultural losses occur due to spoilage of produce. Already, **the lack of access to sustainable**

**cold chains results in the loss of 526 million tons of food production, or 12 per cent of the total, and contributes to a significant reduction in smallholder farmers' income.**<sup>67</sup> Besides the direct impact on production systems, extreme heat is also impacting rural people, most of whom work outdoors and are thus directly exposed, which detrimentally affects overall productivity. By using appropriate hard and soft technologies (e.g. allowing targeted address of heat impacts at specific points in crop cycles) and forecast information, impacts on agriculture can be reduced.

## ENVIRONMENT

Extreme heat is significantly impacting the global environment. Heatwaves, without concomitant increases in precipitation, can lead to water shortages and increased stress for plants, particularly in arid regions. This has the effect of **reducing plant growth, the basis of energy production and the food chain, with an overall drying out of the landscape.** These hot and dry conditions are favourable to the start and rapid spread of forest fires, which now regularly accompany heatwaves. During the heatwave in Russia in 2010, more than 15 million hectares of forest, vegetation and peatland areas burnt, importantly in areas without fire-tolerant species.<sup>68</sup> The 2023 Canadian wildfires, driven by unusual hot weather, resulted in burning an area more than seven times the long-term average.<sup>69</sup> Warming oceans and marine heatwaves have significant impacts on marine habitats, coral reef systems, fisheries and tourism. Since around 1900, **the ocean has absorbed about 90 per cent of excess heat from the Earth system** as it has warmed due to climate change, increasing global ocean heat content. In 2023, ocean heat content reached its highest level in the 65-year observational record.<sup>70</sup>

## INCREASING DEMAND FOR HUMANITARIAN ASSISTANCE

Recently, countries as diverse as Kazakhstan, France, Mexico, Senegal, and Viet Nam have had to deploy significant emergency responses to severe

65 <https://www.lancetcountdown.org/about-us/interact-with-the-key-findings/>

66 The Impact Of Disasters On Agriculture And Food Security Avoiding And Reducing Losses Through Investment In Resilience, FAO 2023 <https://openknowledge.fao.org/server/api/core/bitstreams/7c48cdf4-6153-41df-b3ed-4db1d09a1b0f/content>

67 <https://www.unep.org/news-and-stories/press-release/amid-food-and-climate-crises-investing-sustainable-food-cold-chains>

68 Gilbert, N. 2010. [Russia counts environmental cost of wildfires](#). *Nature News*.

69 WMO Global State of Climate Report 2023

70 WMO, 2023, <https://library.wmo.int/records/item/68835-state-of-the-global-climate-2023>

heatwaves. The stark scenarios for future heatwaves under current emissions trends, and particularly the increasing likelihood of very high impact events in regions with high vulnerability, point to a future where emergency needs could overwhelm local coping capacities. In some contexts, extreme heat can add to a volatile mix of political and environmental factors that increase vulnerability and act as an accelerator of conflict. These can include **disruption to livelihoods, competition for scarce resources, displacement and increases in food insecurity.**

When conflicts occur, they can significantly increase people's exposure to heat risks, for example by causing displacement, or destroying shelter and the food, water and health systems that are critical to surviving a heatwave. All these point to the potential of extreme heat to further increase demand for humanitarian assistance.<sup>71</sup>

## Extreme heat: Impacts

**489,000**

heat-related deaths occurred 2000–2019 each year, more than from tropical cyclones

**12%**

About 12 per cent of all food produced is lost due to a lack of cooling

**Triple**

The installed capacity of cooling equipment globally will almost triple by 2050

**80 million**

Working hours equivalent to 80 million full-time jobs could be lost due to heat stress by 2030

**9.1%**

An annual 1°C increase in temperature leads to a 9.1 per cent increase in poverty

**80 million students**

More than 80 million students are impacted by worldwide school closures due to heat in 2024

## Extreme heat: Solutions

**98,314**

Scaling up heat health warning systems in 57 countries alone can save about 98,314 lives per year

**\$361 billion**

Occupational safety and health measures can save \$361 billion a year in medical and other costs

**\$1 trillion**

Reducing cooling energy demand can cut electricity bills for end users by \$1 trillion in 2050

71 Extreme Heat: Preparing for the Heatwaves of the Future. United Nations Office for the Coordination of Humanitarian Affairs and International Federation of Red Cross and Red Crescent Societies, 2022.

## 5. Call to Action on Extreme Heat

### CARE FOR THE VULNERABLE

We call on all countries and communities to protect the most vulnerable people from the impacts of extreme heat, reduce extreme heat risk and build their resilience.

1. **Adopt evidence-based policies, regulations and multi-dimensional risk assessments and community-driven actions to protect the most vulnerable.**
2. **Enhance social protection schemes** to integrate specific measures that help address the risks of extreme heat.
3. **Establish and bolster heat early warning systems** in line with the Early Warnings for All initiative, ensuring at-risk populations receive timely alerts that include information on protective actions to undertake and sources of assistance. Strengthening capacities of National Meteorological and Hydrological Services (NMHSs) would be critical.
4. **Increase equitable access to and scale up low-carbon cooling: Invest in the triple strategy of passive cooling** (nature, climate sensitive urban design, reflective surfaces and smart buildings), **improved energy efficiency** of buildings and cooling equipment and **phase-out of climate-warming gases used in cooling equipment** – in line with the Global Cooling Pledge at COP 28.<sup>72</sup>
5. Strengthen health systems and operationalize **heat-health action plans** to prepare healthcare professionals to diagnose and treat heat-related conditions and provide quality care during acute heat emergencies.
6. **Develop and implement targeted public education campaigns**, including in school curriculums, that raise awareness about extreme heat risks and actionable steps that can be taken at all levels, including self-protection.
7. **Develop and expand international, regional and national financing mechanisms** to support early response to heatwaves, with a focus on ensuring that resources reach the local level, at

the right scale and at the right time.

8. **Invest in preparedness for early, locally-led humanitarian responses to severe heatwaves.**
9. Improve standardized surveillance and reporting of heat-related morbidity, mortality, and injuries. Heat-related impacts are significantly under-reported in all at-risk populations worldwide.

### PROTECT WORKERS

We call on all countries to protect all workers in all sectors through appropriate occupational safety and health measures based on a rights-based approach.

1. **Implement urgent measures to protect the health and lives of all workers in all sectors and in all regions of the world from the risk of extreme heat through a rights-based approach.** A rights-based approach for workers includes the fundamental right to a safe and healthy working environment, the right to know about heat stress and the right to remove themselves from situations of imminent and serious danger, without undue consequences or retaliation.
2. **Urgently review the laws and regulations on occupational safety and health to integrate provisions for extreme heat, including the right to refuse, and additional protections for vulnerable workers, including pregnant workers, those with disabilities and those with pre-existing health conditions.** Despite the presence of laws and regulations aimed at safeguarding workers from heat stress, many of these provisions were established in the past, often with basic requirements that fail to address the complexities of contemporary heat stress challenges. The safety and health of workers should be protected during all periods of excessive heat throughout the year, not only during heatwaves. These normative frameworks also need to be effectively enforced.
3. **Tailored strategies for different sectors, and both indoor and outdoor workers, should**

<sup>72</sup> <https://www.unep.org/resources/report/global-cooling-pledge>



**be developed and implemented.** Heat stress disproportionately impacts certain sectors and occupations, including outdoor settings but also indoor environments that are poorly ventilated, such as factories. Tailored strategies that are practical and low-cost should be made available for informal settings and micro, small and medium sized enterprises (MSMEs).

- 4. Improved surveillance and reporting mechanisms for morbidity and mortality are needed regarding heat stress in the workplace.** As heat-related illnesses in the workplace are significantly under-reported, it is crucial to enhance monitoring of heat stress at the workplace and implement recording and notification systems that integrate heat stress data with occupational safety and health information.

## BOOST RESILIENCE OF ECONOMIES AND SOCIETIES USING DATA AND SCIENCE

We call on all countries and communities to build sustainable multi-sectoral and multi-scalar partnerships that ensure development and implementation of comprehensive extreme heat action plans, strategies and solutions to build heat resilience.

- 1. Heat action/cooling plans: Develop and implement comprehensive, risk-informed heat action plans (and cooling plans) in all countries and all sectors** that are tailored to local, regional and national contexts, which bring together all State institutions and relevant stakeholders. **Stress-test the heat resilience of current policies, targets, legal and regulatory frameworks and operational practices and protocols.**
- 2. Science and data:** Support the scientific and technical community to enhance understanding of extreme heat risk and impacts, through actionable data and knowledge of current and future heat risks, to ensure science-based decision-making. **Ensure standardized reporting of extreme heat risk and impact data** to better manage the overall risks. **Leverage the innovation, technology and diversity of the private sector to manage extreme heat risks.**
- 3. Build resilience of the built environment and critical sectors to extreme heat:** Foster nature-

positive cities and climate-sensitive urban design and planning that mitigates the urban heat island effect and integrates nature-based and other passive cooling solutions to enhance the resilience of the built environment. Develop short and long-term measures **to reduce extreme heat risks and strengthen heat resilience to reduce societal and environmental vulnerabilities, including critical infrastructure, not least energy, transport, agriculture, water, health and education systems.**

- 4. Appoint 'champions,' or create a dedicated Government department or office that has a cross-sectoral heat-resilience mandate,** to help unify and accelerate Government responses to extreme heat and build the momentum towards heat planning and implementation, and enable cooperation between different sectors, levels of Government, internal and external stakeholders and communities.

## LIMIT TEMPERATURE RISE TO 1.5°C

We call on all countries to accelerate the pace of the just transition away from fossil fuels and scale up investment in renewable energy.

- 1. Every fraction of a degree of warming matters.** With every additional increment of global warming, changes in extremes, impacts and risks become larger. Limiting global warming to below 1.5°C will significantly reduce the risks, adverse impacts and related human suffering from climate change, including extreme heat.
- 2. By early 2025, under the Paris Agreement, every country must submit a new Nationally Determined Contribution (NDC) that is 1.5°C-aligned and economy-wide, providing absolute emissions reduction targets for 2030 and 2035, covering all greenhouse gases and all sectors.**
- 3. Turbo-charge measures to phase out fossil fuels** and to hit global milestones along the way, year after year, decade after decade. That includes contributing to cutting global production and consumption of all fossil fuels by at least 30 per cent by 2030 and making good on commitments made at COP28 – on ending deforestation, doubling energy efficiency and tripling renewables.

4. Take urgent measures to cut super pollutants or short-lived climate pollutants, emanating especially from the cooling sector. Prevent dumping of new inefficient equipment that uses obsolete refrigerants.
5. **Finance is critical to raise ambition on mitigation and enhance adaptation measures.**  
A key focus area of COP29 will be on finance, with countries expected to agree on a new collective quantified goal (NCQG) to succeed the US\$100 billion climate finance goal. We need an outcome that builds trust and confidence, catalyzes the trillions of dollars needed, and generates momentum for reform of the international financial architecture.

# 6. Towards Strengthening Global Action on Extreme Heat

The United Nations system is already supporting countries in reducing extreme heat risks and pursuing the SDGs, including with specific actions such as developing heat action plans, heat early-warning systems and national sustainable cooling plans, and providing humanitarian assistance and

specific guidance on protecting the most vulnerable communities (see Box 2). **These resources need to be coordinated and connected to provide an integrated approach on extreme heat for countries and communities, supporting the strengthening of global action on extreme heat.**

## BOX 2

## EXISTING UN RESOURCES AND EFFORTS ON EXTREME HEAT (NON-EXHAUSTIVE)

### Global Heat Health Information Network

Heat Health Risks | Global Heat Health Information Network [↗](#)

### ILO's work on labour laws, occupational safety and health, and impacts on labour productivity

Heat at work: Implications for safety and health [↗](#)

Ensuring safety and health at work in a changing climate [↗](#)

Working on a warmer planet: The impact of heat stress on labour productivity and decent work [↗](#)

### IOM's work on extreme heat and human mobility

Climate change and future human mobility [↗](#)

Extreme heat and migration [↗](#)

### OCHA-IFRC joint report on extreme heat and humanitarian action

Extreme heat: Preparing for the heatwaves of the future [↗](#)

### UNDRR - WMO Centre of Excellence for Disaster and Climate Resilience

Extreme heat solution package - Consultation workshop report [↗](#)

### UNDRR's work on heat and disaster risk reduction

Innovating heat and wildfire governance [↗](#)

Climate action and disaster risk reduction [↗](#)

### UNEP's work on cooling plans and sustainable cooling

Cool Coalition: flagship resources [↗](#)

National Cooling Action Plan Methodology [↗](#)

Global Cooling Watch report, Keeping it Chill: How to meet cooling demands while cutting emissions [↗](#)

Beating the Heat: A Sustainable Cooling Handbook for Cities [↗](#)

OzonAction [↗](#)

Climate and Clean Air Coalition: cooling solutions [↗](#)

Model Regulation Guidelines - United for Efficiency [↗](#)

### UNHCR's work on impacts of extreme heat on refugees

Moving from reaction to action [↗](#)

### UNICEF's work on heat exposure of children and on protecting pregnant women and children from extreme heat

The coldest year of the rest of their lives [↗](#)

Protecting children from heat stress: a technical note [↗](#)

### WHO heat and health work streams

Heat and health [↗](#)

Heat and health in the European region [↗](#)

Checklists to assess vulnerabilities in health care facilities in the context of climate change [↗](#)

### WMO-WHO joint work on climate and heat services for health

Heatwaves and health: Guidance on warning-system development [↗](#)

### WMO-WHO climate health heat hazards

Extreme heat - ClimaHealth [↗](#)