

**AMICUS BRIEF FROM GLOBAL ACTION PLAN & KYKLOS (CHILE):**

**CHILDREN'S RIGHTS: Q IV.C(1)**

**A. INTRODUCTION**

1. This amicus is presented by Global Action Plan ('GAP') and Kyklos (Chile) with pro bono assistance from Ben Cooper KC, Toby Fisher, Finnian Clarke and Louise Willocx, pursuant to Article 44 of the American Convention on Human Rights, following the invitation from the President of the Court.
2. GAP is an environmental charity focused on the connection between the health of people and our planet with a current focus on air pollution, big tech, and the education system. It works with children and young people internationally to ensure policy makers better understand the strength of the feeling and growing anxiety they share. For nearly 30 years, GAP has driven action on the climate and nature crises through behaviour change programmes and mobilised a network of businesses, NGOs, local authorities, schools and healthcare professionals to take action against the systems that harm us and our planet.
3. Kyklos has been working with children and teenagers from rural and urban areas across Chile for 11 years with environmental education programs. Kyklos' purpose is to promote the living of a life in harmony with our environment, which is strongly impacted by climate change. Despite only being responsible for 0.25% of global emissions and ranking 6th in the world and 1st in the Americas on the Climate Change Performance Index, Chile currently meets 7 of the 9 vulnerability conditions defined by the UN.
4. These submissions address the different impacts of climate change on children and articulate the human rights obligations arising for States Parties to the American Convention on Human Rights ('States Parties') ('the Convention'). In particular, we address question IV.C(1) of the *Request for an advisory opinion on the Climate Emergency and Human Rights*

*submitted to the Inter-American Court of Human Rights by the Republic of Colombia and the Republic of Chile, namely:*

*“Pursuant to Article 19 of the American Convention, in light of the corpus iuris of international human rights law, including article 12 of the Convention on the Rights of the Child, and recognizing the consensus of the scientific community which identifies children as the group that is most vulnerable in the long term to the imminent risks to life and well-being as a result of the climate emergency:*

*(1) What is the scope of the State’s duty of prevention with regard to climate events caused by global warming, including extreme events and slow onset events, based on the obligations under the American Convention, in light of the Paris Agreement and the scientific consensus which recommend that global temperatures should not increase beyond 1.5°C?”*

5. This brief draws from two expert reports which focus on the impacts of climate change on the physical and mental health of children and thereby relies on the most up to date and authoritative research. These new reports were prepared by pre-eminent experts specifically to assist this Court’s Advisory Opinion.
6. Climate change is an existential threat to the enjoyment of human rights across the Americas, posing a heightened threat to children. As the Intergovernmental Panel on Climate Change (IPCC) emphasised in its AR6 report, *“climate change is a threat to human well-being and planetary health (very high confidence). There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all (very high confidence)... The choices and actions implemented in this decade will have impacts now and for thousands of years (high confidence)”*<sup>1</sup>.
7. The 1.1 degree rise in global average temperature that has already occurred has brought devastating damage by increasing the regularity of floods, heat waves, wildfires, droughts, and extreme weather events such as hurricanes and storms. It is contributing to crop failures, encouraging the spread of disease, causing ocean acidification and sea level rise and exacerbating the biodiversity crisis both on land and in the ocean.

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<sup>1</sup> [IPCC, 2023: Summary for Policymakers. 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 \[C.1\].](#)

8. The science is clear that, to avoid the worst impacts of climate change, it is necessary to limit global average temperature increase to 1.5 °C above pre-industrial levels. Deep, rapid and sustained reductions in greenhouse gas ('GHG') emissions are essential to achieve this outcome. As emphasized in the 13 December 2023 outcome of the first global stocktake under the Paris Agreement, historical cumulative net carbon dioxide emissions already account for about four fifths of the total carbon budget for a 50 per cent probability of limiting global warming to 1.5 °C<sup>2</sup>.
9. The climate crisis is a child rights crisis: children are particularly vulnerable to the impacts of climate change; climate change will affect a greater proportion of those who are currently children as compared to those who are currently adults; and current delay in taking effective measures to mitigate and adapt to climate change increases the future mitigation and adaptation burden on those who are now children as well as the losses and damage they will suffer.

## **B. THE IMPACTS OF CLIMATE CHANGE ON CHILDREN'S HEALTH**

10. The Court is referred to the two expert reports annexed to this brief which highlight the serious harm caused by climate change to the physical and mental health of children.
11. At **Annex A: *Impacts of Climate Change on Children's Physical Health*** (December 2023)<sup>3</sup>, leading child health experts Dr Ana Bonell, Dr Robert Hughes, Dr McKenna Parnes and Prof Audrey Prost address the most up-to-date research demonstrating that climate change seriously impacts children's health from before birth and throughout childhood. In particular, they establish that:
  - a. The increased incidence of extreme heat waves and increased frequency of hot days associated with climate change increases the

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<sup>2</sup> Decision x/CMA.5. See also: UNFCCC, *Technical dialogue of the first global stocktake – Synthesis report by the co-facilitators on the technical dialogue* (2023).

<sup>3</sup> This is referred to as 'Bonell et al' throughout this submission.

risk of adverse birth outcomes, infant mortality and heat-related illnesses.

- b. Ecological changes associated with climate change, together with temperature and rainfall changes, materially increase the risk of children contracting infectious and vector-borne diseases including malaria, dengue, Chikungunya and Zika with consequent serious impacts on physical health.
  - c. Climate change is disrupting food systems and access to clean water, thus increasing child malnutrition as well as food- and water-borne disease.
  - d. Climate change exacerbates the existing public health crisis of air pollution with severe impacts on the health of children from increases in particulate matter, methane and ground level ozone.
  - e. The increase in extreme weather events associated with climate change is accompanied by an increase in child injuries, fatalities, displacement, and long-lasting disadvantage.
12. At **Annex B: *Psychological impacts of the climate emergency on children*** (December 2023)<sup>4</sup>, Prof Ann Sanson, Dr Lynne Jones, Dr Emma Lawrance and Dr Ans Vercammen identify up-to-date research demonstrating that climate change seriously impacts children’s mental health and emotional wellbeing. They highlight:
- a. The direct psychological impacts on children arising from:
    - i. climate change-related extreme weather events which, on account of children’s stronger psychological reactions to extreme weather events, increase the risk of post-traumatic stress disorder (PTSD), depression and anxiety, sleep disorders, attachment disorders, regressive behaviours, somatic complaints, cognitive deficits, and learning problems.

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<sup>4</sup> This is referred to as ‘Sanson et al’ throughout this submission.

- ii. climate change-related slow onset events such as rising temperatures, poor air quality, sea level rise, and loss of biodiversity which increase the risk of anxiety, depression, bipolar disorder, cognitive function impairment, and interpersonal aggression.
  - b. The indirect impacts on the mental health of children arising from climate change related disasters and the consequent family disruption, food shortages, intergroup conflict, economic dislocation, and forced migration. Following extreme weather, children disproportionately bear the brunt of the follow-on effects thereof, for example increased risks of violence, abuse, neglect and disrupted education.
  - c. The psychological impacts on children of knowledge of climate change and frequent exposure to distressing information about its likely future impacts which can give rise to a state of hopelessness and helplessness, and may contribute to clinically relevant disorders such as Generalised Anxiety Disorder and Major Depressive Disorder.
13. The evidence presented in the reports aligns with and draws on evidence produced by others about the impacts of climate change on children internationally and in the Americas.

*The serious harm to children caused by climate change*

14. Children are most vulnerable to the lifelong and cumulative effects of climate change<sup>5</sup>. According to the World Health Organisation ('WHO'), more than 88% of the existing disease burden attributable to climate change affects children under the age of 5 years<sup>6</sup>. Children are at greater

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<sup>5</sup> Clark H et al, A future of the world's children? A WHO-UNICEF-Lancet Commission (2020) *Lancet*, Vol. 395, 605–658, at page 609; UNHRC, Analytical study on the relationship between climate change and the full and effective enjoyment of the rights of the child, Report of the Office of the United Nations High Commissioner for Human Rights (4 May 2017) UN Doc. A/HRC/35/13; Human Rights Council, Report of the Independent Expert on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment, John H. Knox (30 December 2013), UN Doc. A/HRC/25/53, §§73-75.

<sup>6</sup> Sheffield PE, Landrigan PJ, Global climate change and children's health: threats and strategies for prevention. *Environ Health Perspect*. 2010; 119(3): 291–8.

risk from extreme weather events<sup>7</sup>. Children are less able to regulate body temperature, as there is a greater temperature transfer between environment and children's bodies<sup>8</sup>, giving rise to greater risks associated with a warming planet of electrolyte imbalance, fever, kidney and respiratory disease<sup>9</sup>, plus heart attacks<sup>10</sup>. In addition, over their lifetimes, children will experience substantially more extreme heat events compared to today's adults: by 2100 around 74% of the world's population are likely to be exposed to heatwaves so extreme that they can kill<sup>11</sup>.

15. Nine out of 10 children in Latin America are exposed to at least two overlapping environmental and climate change shocks<sup>12</sup>. Climate change is poised to worsen the global primary causes of death and disease in children under five years in South and Central America. These include complications from preterm birth, as well as pneumonia, diarrhoea, and malaria<sup>13</sup>. Americas-based studies indicate that children are more vulnerable than others to environmental degradation due to higher intake of water and air, immature physiology and metabolism and potential for high cumulative exposures over their lifetime<sup>14</sup>. A study of children under five years in Peru, Guyana, Colombia, Dominican Republic, and Haiti found that higher than average temperatures in the

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<sup>7</sup> Bonell et al, page 1.

<sup>8</sup> Xu Z et al, Impact of ambient temperature on children's health: a systematic review (2012) *Environmental Research*, Vol. 117, 120-131.

<sup>9</sup> Watts N et al, The 2019 report of the Lancet Countdown on health and climate change (16 November 2019), Vol. 394, 1836-1878.

<sup>10</sup> Alahmad et al, Associations Between Extreme Temperatures and Cardiovascular Cause-Specific Mortality: Results From 27 Countries, (2023) *Circulation*.

<sup>11</sup> Mora C et al, Global risk of deadly heat (2017) *Nature Climate Change*, Vol. 7, 501-506.

<sup>12</sup> Unicef, The climate crisis is a child rights crisis. Introducing the Children's Climate Risk Index (2021).

<sup>13</sup> Laborde, A., et al. (2015) Children's health in Latin America: the influence of environmental exposures. *Environ Health Perspect.* 123(3):201-9.

<sup>14</sup> Canadian Ministry of Health, Human Health in A Changing Climate (2008), p.20. See also Bonell et al, pages 2-6.

year prior to the survey was associated with significant reductions in child dietary diversity<sup>15</sup>.

16. Children are also more severely impacted by the compounding effect of climate change on the existing public health crisis resulting from air pollution. The WHO reports that in 2016, 543,000 deaths in children under 5 years and 52,000 deaths in children aged 5–15 years were attributable to the joint effects of ambient and household air pollution, and concluded that “[t]here is strong evidence that exposure to ambient air pollution can negatively affect children’s mental and motor development”<sup>16</sup>. Climate change is likely to intensify the impacts of air pollution, contributing to lifelong adverse effects on the physical and mental wellbeing of children<sup>17</sup>. In particular, pollution from methane gas has a significant impact on child and maternal health outcomes<sup>18</sup>, in addition to its greenhouse effects<sup>19</sup>.
17. The physical and mental impacts of climate change on children have a compounding and mutually reinforcing effect. Early exposure to air pollutants such as methane can have cognitive and behavioural impacts later in life<sup>20</sup>. A recent study found that long-term exposure to even low levels of air pollution could cause depression and anxiety<sup>21</sup>. More broadly, increasing awareness of the existential threats posed by climate change has the potential of impacting youth mental health<sup>22</sup>. Studies

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<sup>15</sup> Bonell et al, page 4.

<sup>16</sup> World Health Organisation (2018) Air Pollution and Child Health: Prescribing Clean Air, 5, 12–13.

<sup>17</sup> UNHRC Resolution, Rights of the child: realizing the rights of the child through a healthy environment (5 October 2020) UN Doc. A/HRC/45/L.48/Rev.1, page 3.

<sup>18</sup> Unicef, Unless we act now: The impact of climate change on children (2015), p.44.

<sup>19</sup> Smith, Woodward et al, Human health: impacts, adaptation, and co-benefits, *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, §11.9.1.4.

<sup>20</sup> Perera F et al, Towards a fuller assessment of benefits to children's health of reducing air pollution and mitigating climate change due to fossil fuel combustion (2019) *Environmental Research*, Vol. 172 55-72.

<sup>21</sup> T Yang et al, Long-term Exposure to Multiple Ambient Air Pollutants and Association With Incident Depression and Anxiety (2023) *Journal of the American Medical Association Psychiatry*.

<sup>22</sup> Clemens V et al, Report of the intergovernmental panel on climate change: implications for the mental health policy of children and adolescents in Europe - a scoping review, *European Child & Adolescent Psychiatry* (2022) Vol. 31, 701–713.

examining the effect of climate anxiety on children in Brazil noted that 59% were very or extremely worried and 84% at least moderately worried about climate change<sup>23</sup>. Research suggests that global warming beyond 1.5°C therefore poses a very real risk of irreversibly harming mental health across the Americas<sup>24</sup>.

18. The expert reports, together with the broader scientific evidence, underscore the particular vulnerability of children to the effects of climate change and reinforce the need to consider children specifically when addressing the scope of States Parties' duties of prevention with regard to climate events caused by global warming.

### **C. THE APPLICATION OF THE CONVENTION IN LIGHT OF THESE IMPACTS**

#### **(i) The impacts of climate change on children interfere with the enjoyment of human rights protected by the Convention**

19. The climate crisis is a child rights crisis. As acknowledged by the UN Child Rights Committee in its General Comment 26, the extent and magnitude of the triple planetary crisis, comprising the climate emergency, the collapse of biodiversity and pervasive pollution, is an urgent and systemic threat to children's rights globally<sup>25</sup>. The effects of environmental harm from climate change undermine the enjoyment of a vast range of the rights of the child recognised by international law, including (amongst others) the rights to life, human dignity, personal integrity, and a healthy environment<sup>26</sup>. Acknowledging that human rights are universal, indivisible and interdependent:

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<sup>23</sup> Hickman et al, Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (2021), *The Lancet*.

<sup>24</sup> Hicke J. A. et al. (2022) Chapter 14: North America, in CLIMATE CHANGE 2022: IMPACTS, ADAPTATION, AND VULNERABILITY, Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Pörtner H.-O., Roberts D. C., Tignor M., Poloczanska E. S., Mintenbeck K., Alegría A., Craig M., Langsdorf S., Lösschke S., Möller V., Okem A., & Rama B. (eds.), 1931.

<sup>25</sup> [UNCRC, General Comment 26, UN Doc. CRC/C/GC/26, 22 August 2023.](#)

<sup>26</sup> [UN Human Rights Council, Resolution on realising the rights of the child through a healthy environment, UN Doc. A/HRC/45/30, 7 October 2020; IACtHR, Advisory Opinion OC-23/17 of 15 November 2017, On the Environment and Human Rights.](#)



- a. As to the **right to life**, in General Comment 36 the UN Human Rights Committee acknowledged that *“environmental degradation, climate change and unsustainable development constitute some of the most pressing and serious threats to the ability of present and future generations to enjoy the right to life”*<sup>27</sup>. Similarly, in General Comment 26, the UN Committee on the Rights of the Child recognised that climate change, pollution and biodiversity loss directly threaten the right to life<sup>28</sup>. It also recognised that the climate emergency is closely linked to, and exacerbates, other fundamental challenges impeding the realization of this right, such as poverty, inequality and conflict<sup>29</sup>. This Court deprecates a restrictive approach to the right to life, acknowledging that it must be construed as the right to live in conditions sufficient to guarantee a life with dignity<sup>30</sup>.
- b. As to the **right to human dignity**, the Court has found that the failure to ensure environmental protection may amount to a failure to protect a dignified life<sup>31</sup>. Indeed, the preamble of the Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights (**‘the AP’**) recognises the close relationship between the right to human dignity and economic, social, and cultural rights, including the right to a healthy environment<sup>32</sup>. The direct link between a life with dignity and a healthy environment has also been stressed by the UN Human Rights Council: *“Implementation of the obligation to respect and ensure the right to life, and in particular life with dignity, depends, inter alia, on measures taken by States parties to*

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<sup>27</sup> [UNHRC, General Comment 36, UN Doc. CCPR/C/GC/36, 3 September 2019, \[62\]](#).

<sup>28</sup> UNCRC, General Comment 26, [20], supra note 24 at p.9.

<sup>29</sup> Ibid.

<sup>30</sup> [IACtHR, Indigenous Community Yakye Axa v Paraguay, Judgment of 17 June 2005, Series C No. 125, \[162\]](#); [IACtHR, “Street Children” v Guatemala, Judgment of 19 November 1999, Series C. No. 63, Joint Concurring Opinion of Judges Cançado Trindade and Abreu Burelli, \[7\]](#).

<sup>31</sup> [IACtHR, Kaliña and Lokono Peoples v. Suriname, Judgment of 25 November 2015, Series C No. 309 \[172\]](#).

<sup>32</sup> “Considering the close relationship that exists between economic, social and cultural rights, and civil and political rights, in that the different categories of rights constitute an indivisible whole based on the recognition of the dignity of the human person, for which reason both require permanent protection and promotion if they are to be fully realized, and the violation of some rights in favour of the realization of others can never be justified”.

*preserve the environment and protect it against harm, pollution and climate change caused by public and private actors*"<sup>33</sup>.

- c. As to the **right to a healthy environment**, the right is specifically protected in the AP, but has now arguably achieved customary status in international law<sup>34</sup>. In its resolution on the human right to a clean, healthy and sustainable environment, the UN Human Rights Council specifically recognised the impacts of climate change as an interference with the enjoyment of the right and acknowledged that environmental damage has negative implications, both direct and indirect, for the effective enjoyment of all human rights<sup>35</sup>. In its Advisory Opinion on the Environment and Human Rights, this Court made a similar observation<sup>36</sup>:

“The human right to a healthy environment has been understood as a right that has both individual and also collective connotations. In its collective dimension, the right to a healthy environment constitutes a universal value that is owed to both present and future generations. That said, the right to a healthy environment also has an individual dimension insofar as its violation may have a direct and an indirect impact on the individual owing to its connectivity to other rights, such as the rights to health, personal integrity, and life. Environmental degradation may cause irreparable harm to human beings; thus, a healthy environment is a fundamental right for the existence of humankind.”

- d. As to the **right to personal integrity**, the right includes both physical and psychological integrity. The Court has found that lack of access to conditions that ensure a dignified life may constitute a violation of the right to personal integrity<sup>37</sup>, in particular in cases involving human health<sup>38</sup>. As set out in the expert reports annexed hereto, and

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<sup>33</sup> UNHRC, General Comment 36, [62], supra no. 27 at p.9.

<sup>34</sup> [UN General Assembly. Resolution on the human right to a clean, healthy and sustainable environment. UN Doc. A/RES/76/300](#); UN Human Rights Council, Resolution on the human right to a clean, healthy and sustainable environment, supra note 25, p. 9.

<sup>35</sup> Ibid.

<sup>36</sup> IACtHR, Advisory Opinion OC-23/17, [59] and [60] – [64], supra note 25, p.9.

<sup>37</sup> [IACtHR, "Juvenile Re-education Institute" v. Paraguay. Judgment of 2 September 2004. Series C No. 112. \[170\].](#)

<sup>38</sup> [IACtHR, Chinchilla Sandoval v. Guatemala. Judgment of 29 February 2016. Series C No. 312. \[170\].](#)

as recognised by the UN Child Rights Committee, climate change has severe impacts on children's physical and mental integrity<sup>39</sup>.

20. Children enjoy each of the rights protected generally by the Convention, as well as rights specifically derived from their status as children. Article 19 of the Convention provides that every minor child has the right to the measures of protection required by his condition as a minor on the part of his family, society, and the state. The Court has held that the content and scope of Article 19 is to be determined by reference to the *corpus iuris* of international law on the protection of the rights of the child, and in particular by reference to the UN Convention on the Rights of the Child<sup>40</sup>. On that basis, the Court takes a "*differentiated approach*" to the protection of children's rights on account of their heightened vulnerability, with the result that States Parties are held to a higher standard when considering their obligations as regards the protection of the rights of the child. The Court requires the adoption of measures affecting children to be guided by the four guiding principles of the UN Convention on the Rights of the Child: the principle of non-discrimination, the principle of the best interest of the child, the principle of respect for the right to life, survival and development, and the principle of respect for the opinion of the child in any procedure that affects her or him in order to ensure the child's participation<sup>41</sup>.
21. In addition, the principle of intergenerational equity imposes a higher standard on States Parties to ensure they meet their obligations under the Convention towards future generations of children<sup>42</sup>. In its recent resolution on climate change, the Inter-American Commission on Human

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<sup>39</sup> UNCRC, General Comment 26, [39] - [40], supra note 24, p.9.

<sup>40</sup> [IACtHR, Advisory Opinion OC-21/14 of 19 August 2014, On rights and guarantees of children in the context of migration and/or in need of international protection, \[56-57\]; IACtHR, "Mapiripán Massacre" v. Colombia, Judgment of 15 September 2005, Series C No. 134, \[152\].](#)

<sup>41</sup> IACtHR, Advisory Opinion OC-21/14 of 19, [69], supra note 40, p.12.

<sup>42</sup> UNCRC, General Comment 26, [11], supra note 24, p.9.

Rights (IACHR) emphasised the specific vulnerability of children to the effects of climate change and found that<sup>43</sup>:

“Based on the principle of intergenerational equity, all children and adolescents have the right to enjoy a healthy environment and to live on a planet equal to or in better conditions than their ancestors. States should ensure that the impacts of climate change do not threaten their rights to life, personal integrity, and health because of their special sensitivity to temperature changes and vector-borne diseases.”

(ii) **States Parties have positive obligations to take steps to ensure the full enjoyment by children of rights protected by the Convention**

22. States Parties have a duty to take all appropriate measures to protect and preserve the rights recognized in the Convention, and to organize all the structures through which public authority is exercised so that they are able to ensure, legally, the free and full exercise of human rights<sup>44</sup>. While economic and social rights are to be realised progressively<sup>45</sup>, the right to a dignified life and the right to personal integrity imposes a more hard-edged obligation on States Parties to *“adopt positive and concrete measures, aimed at satisfying the right to a dignified life, especially when it comes to people in situations of vulnerability and risk, to whom they should pay attention as a matter of priority”*<sup>46</sup>. States Parties are bound to comply with these obligations to adopt concrete measures under the Convention with due diligence<sup>47</sup>.

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<sup>43</sup> [IACHR, Resolution on the Climate Emergency: Scope of Inter-American Human Rights Obligations, No. 3/2021, 31 December 2021, \[21\]](#).

<sup>44</sup> See, inter alia, [IACtHR, Velásquez-Rodríguez v. Honduras, Judgment of 29 July 1988, Series C No. 4, \[166\]](#); [IACtHR, Gonzales Lluy v. Ecuador, Judgement of 1 September 2015, Series C No. 298, \[168\]](#); [IACtHR, Ortiz Hernández v. Venezuela, Judgment of 22 August 2017, Series C No. 338, \[100-101\]](#).

<sup>45</sup> IACtHR, Advisory Opinion OC-23/17, [111], supra note 25, p.9.

<sup>46</sup> [IACtHR, Indigenous Community Yakye Axa v Paraguay, Judgment of 17 June 2005, Series C No. 125, \[162\]](#).

<sup>47</sup> IACtHR, Advisory Opinion OC-23/17, [123], supra note 25, p.9.

(iii) **The content of States Parties' positive obligations under the Convention is informed by their co-existing obligations under international environmental law, and should be guided by best available science.**

23. As the Court confirmed in its Advisory Opinion on the Environment and Human Rights, states' obligations under the Convention are to be interpreted in accordance with Article 31(3)(c) of the Vienna Convention on the Law of Treaties and the principle of harmonious interpretation<sup>48</sup>. As a result, the meaning and scope of the positive obligations assumed by States Parties under the Convention, including under Article 19, are informed by the *corpus iuris* of international environmental law and the co-existing obligations applicable between States Parties under that body of law.

24. In the Advisory Opinion on the Environment and Human Rights, the Court identified the following well-established principles of customary international law as relevant to the interpretation of state obligations to protect and preserve the rights recognised in the Convention from the impacts of environmental degradation: the duty to prevent transboundary harm; the precautionary principle; the duty to cooperate; and the procedural duties requiring access to environmental information<sup>49</sup>. Each of those duties informs the scope of the necessary measures to protect and preserve the rights of children recognised in the Convention from the impacts of climate change. Importantly, the duty to prevent transboundary environmental harm requires states to "... to deploy adequate means, to exercise best possible efforts, to do the utmost..."<sup>50</sup> to prevent significant transboundary harm. Contrary to views of some states, the duty is plainly applicable to the climate change context and has not been displaced by the climate change treaty system: the drafters of the United Nations Framework Convention on Climate Change

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<sup>48</sup> Ibid [44].

<sup>49</sup> Ibid.

<sup>50</sup> [ITLOS, Advisory Opinion No. 21 of 2 April 2015 to the Sub-Regional Fisheries Commission, \[129\]. ITLOS, Advisory Opinion No. 17 of 1 February 2011 on Activities in the Area, \[110\].](#)

(‘UNFCCC’) had it expressly in mind as a duty underpinning that climate change treaty system<sup>51</sup>.

25. The obligations in the climate change treaty system represented by the UNFCCC and the Paris Agreement are also highly relevant to the interpretation of the positive obligations of States Parties to the Convention to protect the rights of individuals from the adverse impacts of climate change.
26. In the context of its Article 64 jurisdiction, the Court has repeatedly held that it can *“interpret any treaty as long as it is directly related to the protection of human rights in a Member State of the inter-American system”*<sup>52</sup>. Importantly, the Court has stressed that *“the source of the obligation or the treaty’s main purpose”* is irrelevant<sup>53</sup>, as *“mankind’s universality and the universality of the rights and freedoms which are entitled to protection form the core of all international protective systems”*<sup>54</sup>. Indeed, the Court has often *“reiterated that the task of interpretation it performs in the exercise of its advisory function not only clarifies the meaning, purpose, and the Court’s reasons for international human rights norms, but also, above all, assists Member States and organs to comply fully and effectively with their relevant international obligations, and to define and implement public policies to protect human rights”*<sup>55</sup>.

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<sup>51</sup> [United Nations Framework Convention on Climate Change, 9 May 1992, UN Doc No. 102-38, 1771 U.N.T.S. 107, Preamble, \[8\]](#).

<sup>52</sup> [IACtHR, “Other Treaties” Subject to the Consultative Jurisdiction of the Court \(Art. 64 American Convention on Human Rights\), Advisory Opinion OC-1/82 of 24 September 1982, Series A No. 1, \[21\]](#); [IACtHR, Advisory Opinion OC-17/02 of 28 August 2002, On juridical status and human rights of the child, \[22\]](#).

<sup>53</sup> IACtHR, Advisory Opinion OC-1/82, [34], *supra* note 52, p.14. (34. *Neither the request of the Peruvian Government nor the Convention itself distinguishes between multilateral and bilateral treaties, nor between treaties whose main purpose is the protection of human rights and those treaties which, though they may have some other principal object, contain provisions regarding human rights, such as, for example, the Charter of the OAS. The Court considers that the answers to the questions posed in paragraph 32 are applicable to all of these treaties since the basic problem consists of determining what international obligations the American States have assumed are subject to interpretation by means of an advisory opinion. The Court, therefore, does not consider that the determining factor is the bilateral or multilateral nature of the treaty; equally irrelevant is the source of the obligation or the treaty’s main purpose.)*

<sup>54</sup> *Ibid* [40].

<sup>55</sup> IACtHR, Advisory Opinion OC-23/17, [24], *supra* note 25, p.9.

27. In this regard, the decision of the *PSB et al. v. Brazil (on Climate Fund)* is instructive, in which the Supreme Court of Brazil characterised environmental law treaties, including the UNFCCC and the Paris Agreement, as human rights treaties, recording the observation of a UNEP representative that “*there are no human rights on a dead or sick planet*”<sup>56</sup>. The UNFCCC and the Paris Agreement are “*directly related to the protection of human rights in a Member State*” and therefore highly relevant to informing States human rights obligations in light of the climate emergency. Using the Paris Agreement and co-existing customary international law duties to inform the positive obligations of states under human rights law is consistent: (i) with the approach set out in the Joint Statement of the UN Committees on the Elimination of Discrimination Against Women, Economic, Social and Cultural Rights, Protection of the Rights of All Migrant Workers and Members of their Families, Rights of the Child and the Rights of Persons with Disabilities<sup>57</sup>, (ii) with the recommendations of the Committee on the Rights of the Child in General Comment 26<sup>58</sup> and the Human Rights Council in its Resolution on realising the rights of the child through a healthy environment<sup>59</sup>, and (iii) with the approach of national courts in Germany<sup>60</sup>, the Netherlands<sup>61</sup> and now Belgium<sup>62</sup> when applying the European Convention on Human Rights to state’s mitigation obligations.

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<sup>56</sup> [Brazilian Supreme Court, \*PSB v. Brazil \(on Climate Fund\)\*, Judgment of 7 January 2022, \[17\]](#).

<sup>57</sup> Committee on the Elimination of Discrimination Against Women, Committee on Economic, Social and Cultural Rights, Committee on the Protection of the Rights of All Migrant Workers and Members of their Families, Committee on the Rights of the Child and Committee on the Rights of Persons with Disabilities, [Joint Statement on “Human Rights and Climate Change”, UN Doc. HRI/2019/1, 16 September 2019, \[11-12\]](#).

<sup>58</sup> UNCRC, General Comment 26, *supra* note 24, p.9.

<sup>59</sup> UNHRC, Resolution on realising the rights of the child through a healthy environment, [14], *supra* note 25, p. 9.

<sup>60</sup> [German Federal Constitutional Court, \*Neubauer v Germany\*, Judgment of 24 March 2021, 1 BvR 2656/18, 1 BvR 78/20, 1 BvR 96/20, 1 BvR 288/20](#).

<sup>61</sup> [Dutch Supreme Court, \*Urgenda Foundation v the Netherlands\*, Judgment of 20 December 2019, ECLI:NL:HR:2019:2007, 19/00135 \(English\)](#).

<sup>62</sup> [Brussels Court of Appeal, \*VZW Klimaatzaak v Belgium\*, Judgment of 30 November 2023, 2021/AR/1589](#). The Belgian judgment is a clear example where the Belgian State failed to meet its obligations regarding the right to life (Art. 2 ECHR) and the right to family and private life (Art 8 ECHR) and was therefore subject to an injunction to reduce emissions in order to meet their obligations under the European Convention of Human Rights.

28. Further, the duty of States Parties to base their decisions on best available science also informs the interpretation of their obligations under the Convention. The obligation to use best available science derives from the precautionary principle and from the Paris Agreement, in which states agreed on *“the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge”*<sup>63</sup> and agreed to undertake rapid reductions of GHGs in accordance with *“best available science”*<sup>64</sup>.
- (iv) **Rapid and deep reductions in global greenhouse gas emissions, and enhanced carbon sinks, are required to avoid the worst outcomes of climate change.**
29. In the outcome of the first global stocktake under the Paris Agreement of 13 December 2023, Parties to the Paris Agreement agreed that the impacts of climate change will be much lower at a temperature increase of 1.5 °C compared with 2°C and resolved to pursue efforts to limit the temperature increase to 1.5°C. They noted with significant concern that, despite progress, global GHG emissions trajectories are not yet in line with the temperature goal of the Paris Agreement and there is a rapidly narrowing window for raising ambition and implementing existing commitments in order to achieve it. Parties acknowledged the need for deep, rapid and sustained reductions in GHG emissions in line with 1.5 °C pathways and set a pathway for achieving those reductions<sup>65</sup>.
30. That outcome was underpinned by science. As set out in the IPCC’s Sixth Assessment Report, even relatively small incremental increases in global warming (+0.5°C) cause statistically significant changes in extremes on the global scale<sup>66</sup>. Climate models show robust differences between the

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<sup>63</sup> [UNFCCC, Paris Agreement, 12 December 2015, T.I.A.S. No. 16-1104, preamble.](#)

<sup>64</sup> Ibid Article 4.

<sup>65</sup> Decision x/CMA.5. See also: UNFCCC, *Technical dialogue of the first global stocktake – Synthesis report by the co-facilitators on the technical dialogue* (2023).

<sup>66</sup> [IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.](#) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, [1517].



resulting temperature extremes, heavy precipitation, including tropical cyclones, sea level rises and the droughts which would result from limiting global warming by 1.5°C instead of 2°C<sup>67</sup>. Impacts on biodiversity and ecosystems, including species loss and extinction, are also projected to be significantly lower if global warming is limited to 1.5°C<sup>68</sup>. Further, climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to affect several hundred millions of people more if global warming reaches 2°C rather than 1.5°C<sup>69</sup>.

31. As evidenced in the annexed expert reports, these differences would be especially hard felt by children, as they are particularly vulnerable to climate-related health impacts. Failing to limit global warming to 1.5°C would place children at significantly greater risk of adverse physical and mental health outcomes, with consequent impacts on the enjoyment of rights protected by the Convention, including (amongst others) the rights to life, human dignity, a healthy environment, and personal integrity.
32. The IPCC has confirmed that in order to limit global warming to 1.5°C, it is necessary to reduce CO<sub>2</sub> emissions by staying within a total carbon budget, as specified by the IPCC<sup>70</sup>. Further, States must significantly reduce non-CO<sub>2</sub> emissions, including methane and black carbon (35% or more of both by 2050 relative to 2010), most of the cooling aerosols,

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<sup>67</sup> IPCC, 2021, [1517], supra note 65; [IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, \[7\].](#)

<sup>68</sup> IPCC, 2018: Summary for Policymakers, [8], supra note 66, p.17.

<sup>69</sup> Ibid [9].

<sup>70</sup> “By the end of 2017, anthropogenic CO<sub>2</sub> emissions since the pre-industrial period are estimated to have reduced the total carbon budget for 1.5°C by approximately 2200 ± 320 GtCO<sub>2</sub> (medium confidence). The associated remaining budget is being depleted by current emissions of 42 ± 3 GtCO<sub>2</sub> per year (high confidence). The choice of the measure of global temperature affects the estimated remaining carbon budget. Using global mean surface air temperature, as in AR5, gives an estimate of the remaining carbon budget of 580 GtCO<sub>2</sub> for a 50% probability of limiting warming to 1.5°C, and 420 GtCO<sub>2</sub> for a 66% probability (medium confidence).” Ibid, [12].

nitrous oxide, and hydrofluorocarbons<sup>71</sup>. This requires rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems<sup>72</sup>. Further, to meet the target of 1.5°C, carbon dioxide removal measures must be taken as well, such as afforestation and reforestation, land restoration and soil carbon sequestration, bioenergy with carbon capture and storage, direct air carbon capture and storage, enhanced weathering, and ocean alkalization<sup>73</sup>.

33. Importantly, the IPCC has emphasised that States' current nationally determined contributions ('NDCs') as submitted under the Paris Agreement would not limit global warming to 1.5°C, even if supplemented by very challenging increases in the scale and ambition of emissions reductions after 2030<sup>74</sup>. As such States must urgently take the measures identified above to reduce global warming to 1.5°C and safeguard children's rights under the Convention.

(v) **The Convention requires States Parties to take: all reasonable mitigation measures within their control to: a) prevent dangerous anthropogenic interference with the climate system; b) protect those within their jurisdiction from the adverse impacts of climate change; and c) support global efforts to mitigate and adapt to climate change.**

#### *Mitigation obligations*

34. Consistent with their obligations under the UNFCCC and the Paris Agreement, and consistent with the duties of prevention and precaution under customary international law, States Parties are required by the Convention to take all reasonable mitigation measures to prevent dangerous anthropogenic interference with the climate system. That requires States Parties to take measures which reflect their highest

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<sup>71</sup> Ibid [12].

<sup>72</sup> Ibid, [15].

<sup>73</sup> Ibid [17].

<sup>74</sup> Ibid [17].

possible ambition, in line with equity and the principle of common but differentiated responsibilities ('CBDR-RC') in light of national circumstances, urgently to: i) make deep reductions to the greenhouse gas emissions under their jurisdiction; and ii) significantly increase carbon sinks, consistent with limiting global temperature rise to no more than 1.5 degrees above the pre-industrial average<sup>75</sup>.

35. The two mitigation measures set out above tie in directly with the key recommendations in Section 3 of the expert report *Impacts of climate change on children's physical health*. First, experts have stressed the need to phase out fossil fuels and transition rapidly to clean energy as it will cut greenhouse gas emissions and reduce exposure to indoor and outdoor air pollution, both of which have systemic effects on children's health<sup>76</sup>. Second, it is necessary to shift to sustainable land use, including the prevention of deforestation. Not only would this significantly increase carbon sinks, it directly promotes child health and nutrition: deforestation increases the risk of infectious disease spread, exacerbates food insecurity, reduces the availability of clean drinking water, and increases the risk of land degradation and floods<sup>77</sup>.
36. There is no agreed algorithm for determining a State Party's "fair share" contribution to the overall mitigation of global emissions. However, any method should be based on best available science, grounded in the principle of CBDR-RC in light of different national circumstances, and demonstrate "highest possible ambition" (per Article 4(3) of the Paris Agreement) in order to comply with the customary international law duty to "do the utmost" to prevent significant transboundary harm. Such mitigation contributions must also be kept under review to ensure they

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<sup>75</sup> Note that following a review of the appropriate long-term temperature goal (LTTG), the "below 2°C" LTTG was replaced with the LTTG of "well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C" (1.5°C LTTG) in Art. 2(1)(a) of the Paris Agreement. The 1.5°C LTTG was ultimately accepted and inter alia the IPCC's and UNEP's findings in the "Sharm el-Sheikh Implementation Plan" were adopted at COP27. [UNFCCC, Sharm el-Sheikh Implementation Plan, 20 November 2022](#).

<sup>76</sup> Bonell et al, page 1.

<sup>77</sup> Bonell et al, page 1.

are consistent – when considered alongside the contributions of others (including through the requirement for Paris Agreement NDCs to be informed by the outcome of the global stocktake<sup>78</sup>) – with the 1.5 degree temperature limitation goal and must be developed with the participation of children as stakeholders. We commend the criteria for rights compliant mitigation measures, as set out by the UN Child Rights Committee at paragraph 98 of General Comment 26<sup>79</sup>.

37. In line with the approach of the Court in its advisory opinion on human rights and the environment, and consistent with customary international law on transboundary harm, the obligations on States Parties to take measures to prevent emissions of GHGs from activities within their jurisdiction or control may be owed to individuals, including children, who are outside their territory but who are foreseeably affected by the transboundary impacts of those emissions<sup>80</sup>.

#### *Adaptation obligations*

38. States Parties are also required to take all reasonable adaptation measures within their jurisdiction to prevent foreseeable and avoidable violations of children’s rights protected by the Convention. In this regard the Court is referred to the recent decision of the Human Rights Committee in *Billy v Australia*<sup>81</sup>. As is clear from that decision, necessary adaptation measures will be fact and context specific but may involve direct physical interventions (e.g. constructing sea defences or facilitating relocations) and/or systemic approaches (e.g. improving air quality, improving access to clean drinking water, constructing resilient health systems, promoting sustainable and healthy diets, expanding green spaces). Systemic approaches may involve addressing environmental harms that are not directly caused by, but whose impacts are exacerbated by, climate

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<sup>78</sup> UNFCCC, Paris Agreement, Article 4(9) and 14(3), supra note 62, p.16.

<sup>79</sup> UNCRC, General Comment 26, [98], supra note 24, p.9.

<sup>80</sup> IACtHR, Advisory Opinion OC-23/17, [102-104], supra note 25, p.9; [UNCRC, Sacchi v Argentina. Decision of 22 September 2021, UN Doc. CRC/C/88/D/104/2019 \[10.7\]; ICJ, Pulp Mills on the River Uruguay \(Argentina v Uruguay\). Judgement of 20 April 2010.](#)

<sup>81</sup> [UNHRC, Billy v Australia, Decision of 23 September 2022, CCPR/C/135/D/3624/2019.](#)

change – such as air pollution from particulates or methane. The Court’s attention is drawn to the measures identified in Section 3 of the *Impacts of climate change on children’s physical health* report. In all interventions, the best interests of children must be a primary consideration.

39. To this end, States Parties should plan for and fund climate adaptation and should carry out child-centred risk-assessments to prioritise adaptation plans with the best interests of children as a primary consideration. Children must be active participants in such assessment and planning exercises as stakeholders. We commend the recommendations of the UN Child Rights Committee at paragraphs 101 - 103 of General Comment 26<sup>82</sup>.

#### *Cooperation obligations*

40. Finally, States Parties are required to comply with their duty to cooperate towards the realisation of human rights and the co-existing duties of cooperation under the Paris Agreement<sup>83</sup>. These duties require high-income states to support adaptation and mitigation efforts in developing countries by:
- facilitating transfers of green technologies;
  - contributing to financing climate mitigation and adaptation;
  - addressing climate-related loss and damage suffered by the most vulnerable countries; and
  - paying particular attention to safeguarding the rights of those who are at particular risk of climate harm and addressing the devastating impact of climate disruptions on children.

## **D. CONCLUSION**

41. GAP and Kyklos invite the Court to ensure the children of the OAS they stand for can secure the fullest protection of their Convention against the harm they face from climate change. The Opinion of the Court is of critical importance if they are to invoke these rights meaningfully to

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<sup>82</sup> UNCRC, General Comment 26, [101-103], supra note 24, p.9.

<sup>83</sup> UNFCCC, Paris Agreement, supra note 62, p.16.

obtain effective remedies from States Parties. The Court is urged to make plain the urgency of the preventative action identified above that is essential to avoid or mitigate otherwise catastrophic and inevitable Convention violations that follow from the perilous status quo.

**18 December 2023**

**GLOBAL ACTION PLAN  
KYKLOS**

**Ben Cooper KC**

**Toby Fisher**

**Finnian Clarke**

**Louise Willocx**

## ANNEX A

## IMPACTS OF CLIMATE CHANGE ON CHILDREN'S PHYSICAL HEALTH, 18 December 2023

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This report was prepared as part of an amicus submission for the Inter-American Court's advisory opinion on the climate emergency.

### 1. INTRODUCTION

Burning fossil fuels produces both air pollution and greenhouse gases - including CO<sub>2</sub> and methane - that drive anthropogenic climate change<sup>1</sup>. Climate change poses unequal and unjust risks to the physical health and survival of children. In 2021, UNICEF reported that virtually all children worldwide, including in South America, now face at least one significant climate or environmental shock or stress<sup>2</sup>. Children in Colombia and Chile are no exception: they are at high risk of exposure to extreme weather events linked to climate change (heatwaves, droughts, cyclones, floods) as well as of exposure air pollution from particulate matter and ozone, which often come from the same sources as greenhouse gases (ibid.). Exposure to extreme weather events in South America is already high: the World Meteorological Organization's 2023 assessment described an acceleration in the region's long-term warming trend, sea level rise above global average, floods killing hundreds, and droughts undermining food production<sup>3</sup>. Extreme weather events are also expected to increase in frequency and intensity: based on existing climate policy commitments, children born in 2020 in Latin America and the Caribbean will experience a two- to four-fold increase in droughts and tropical cyclones compared to individuals born in 1960<sup>4</sup>.

Children are particularly vulnerable to climate-related health impacts because of their developing bodies, rapid metabolism, higher intake of air and water relative to their body size, and limited ability to regulate their body temperature in extreme heat<sup>5,6</sup>. They are also socially susceptible to climate-related impacts due to their reliance on caregivers, especially in the early years<sup>7,8</sup>. Climate change is poised to worsen the global primary causes of death and disease in children under five years in South and Central America. These include complications from preterm birth, as well as pneumonia, diarrhoea, and malaria<sup>9</sup>. Furthermore, climate change will exacerbate underlying causes of death and illness, such as undernutrition, and undermine early childhood development and education, leading to significant and long-term losses in human capital<sup>10</sup>.

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<sup>1</sup> Perera, F., & Nadeau, K. (2022). Climate Change, Fossil-Fuel Pollution, and Children's Health. *New England Journal of Medicine*, 386(24), 2303–2314.

<sup>2</sup> United Nations Children's Fund (UNICEF). (2021). The Climate Crisis is a Child Rights Crisis: Introducing the Children's Climate Risk Index. New York: UNICEF.

<sup>3</sup> World Meteorological Organization. (2023). State of the Climate in Latin America and the Caribbean.

<sup>4</sup> Thiery, W et al. (2021). Intergenerational inequities in exposure to climate extremes. *Science*, 374(6564), 158–160.

<sup>5</sup> Perera, F. (2022). Children's health and the peril of climate change. Scopus.

<sup>6</sup> Perera & Nadeau (2022), supra

<sup>7</sup> Sanson, A. V. et al. (2022). Children and Climate Change (1st ed.). Cambridge University Press.

<https://doi.org/10.1017/9781009118705>

<sup>8</sup> Mitchell, P., & Borchard, C. (2014). Mainstreaming children's vulnerabilities and capacities into community-based adaptation to enhance impact. *Climate and Development*, 6(4), 372–381. Scopus.

<sup>9</sup> Laborde, A., et al. (2015) Children's health in Latin America: the influence of environmental exposures. *Environ Health Perspect.* 123(3):201-9.

<sup>10</sup> Hanna, R., & Oliva, P. (2016b). Implications of Climate Change for Children in Developing Countries. *The Future of Children*, 26(1), 115–132; Hagos, S., Lunde, T., Mariam, D. H., Woldehanna, T., & Lindtjørn, B. (2014). Climate



This brief describes five pathways through which climate change harms children’s physical health: (1) heat stress; (2) changes in vector distribution and ecology; (3) disruption to food systems and access to safe water; (4) deterioration in air quality; and (5) extreme weather and environmental degradation. It then reviews climate change mitigation and adaptation actions with co-benefits for child health.

## 2. IMPACTS

### 2.1 Heat stress increases the risk of adverse birth outcomes, infant mortality and heat-related illnesses

Between 2017 and 2021, the number of heat-related deaths in South American countries has increased by 160%; children and infants are especially susceptible to extreme heat<sup>11,12</sup>. There is a strong association between extreme heat and infant mortality, largely through its effects on preterm birth risk and neonatal mortality. A complementary study drawing on data from 53 Low and Middle-Income Countries (LMIC) - including 228,189 infants from Bolivia, Colombia, Dominican Republic, Guyana, Haiti, Honduras and Peru - found that every additional very hot and humid day (i.e. 100°F or 38°C at 55% humidity) experienced in the first month of life increased neonatal mortality by 0.7 deaths per thousand births<sup>13</sup>.

Maternal exposure to high and extreme temperatures also increases the risk of congenital anomalies, miscarriage, preterm birth, stillbirth, low birth weight, pre-eclampsia, and gestational diabetes<sup>14,15,16</sup>. For example, a study drawing on data from 1.5 million births in Colombia found that exposure to heatwaves during the third trimester of pregnancy reduced infant birth weight by 4.1g<sup>17</sup>. Children born with low birth weight are at greater risk of neurodevelopmental problems in early life as well as of developing non-communicable diseases such as Type 2 Diabetes and cardiovascular disease in adulthood<sup>18</sup>. Severe prematurity also has a wide range of adverse effects on development and health across the life-course<sup>19</sup>.

The 2022 Lancet Countdown Report for South America estimated that, between 2010 and 2020, infants younger than 1 year old were already exposed to far more heatwave days compared to the reference

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change, crop production and child under nutrition in Ethiopia; a longitudinal panel study. *BMC Public Health*, 14(1), 884.

<sup>11</sup> Ahdoot, S. et al. (2015). Global climate change and children’s health. *Pediatrics*, 136(5), e1468-e1484; Hartinger, et al. (2023). The 2022 South America report of The Lancet Countdown on health and climate change: trust the science. Now that we know, we must act. *The Lancet Regional Health - Americas*, 20, 100470.

<sup>12</sup> Yu, S. et al. (2020). Trends in summer heatwaves in central Asia from 1917 to 2016: Association with large-scale atmospheric circulation patterns. *International Journal of Climatology*, 40(1), 115–127.

<sup>13</sup> Geruso, M., & Spears, D. (2018). *Heat, Humidity, and Infant Mortality in the Developing World* (No. w24870; p. w24870). National Bureau of Economic Research.

<sup>14</sup> Chersich, M. F. et al. (2020). Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. *BMJ*, m3811.

<sup>15</sup> Auger, N. et al. (2017). Risk of Congenital Heart Defects after Ambient Heat Exposure Early in Pregnancy. *Environmental Health Perspectives*, 125(1), 8–14.

<sup>16</sup> Eberle, C., & Stichling, S. (2022). Environmental health influences in pregnancy and risk of gestational diabetes mellitus: a systematic review. *BMC Public Health*, 22(1), 1572.

<sup>17</sup> Andalon, M. et al. (2016). Weather Shocks and Health at Birth in Colombia. *World Development*, 82, 69–82.

<sup>18</sup> Knop, M. R. et al. (2018). Birth Weight and Risk of Type 2 Diabetes Mellitus, Cardiovascular Disease, and Hypertension in Adults: A Meta-Analysis of 7 646 267 Participants From 135 Studies. *Journal of the American Heart Association*, 7(23), e008870.

<sup>19</sup> Wolke, D. et al. (2019). The Life Course Consequences of Very Preterm Birth. *Annual Review of Developmental Psychology*, 1(1), 69–92.

period (1986–2005), with especially high exposures in Brazil, Colombia, and Venezuela<sup>20</sup>. Future generations of children will face even greater exposure to extreme heat. By the year 2100, under the worse-case scenario (RCP [representative concentration pathways] 8.5), countries including Brazil, Venezuela, Colombia, Nicaragua, Honduras, and Costa Rica will face over 200 days per year above a lethal threshold of temperature and humidity<sup>21</sup>. These stark warnings about potentially lethal heat have recently been re-iterated drawing on empirical observations<sup>22</sup>.

Frequent hot days and heatwaves have direct consequences for children’s health, including heat exhaustion, temporary loss of consciousness (syncope), heat stroke, and electrolyte imbalances<sup>23</sup>. A study drawing on a national Peruvian dataset of weekly clinic visits for diarrhoea among children under 5 between 2004 and 2015 found an association between more frequent visits, higher temperatures and intensifying El Niño events. Specifically, an increase of 1°C in temperature was associated with a 3.8% higher rate of visits for diarrhoea, with an even higher incidence rate during moderate to strong El Niño events and dry season<sup>24</sup>.

Children’s vulnerability to extreme heat go beyond physiological features – they are less likely to regulate their own heat risk by drinking water or removing clothing, and may not be able to communicate to adults when they feel overheated<sup>25</sup>. Extreme heat also affects children’s ability to concentrate and learn in school, with consequences for job prospects in adulthood<sup>26</sup>. An analysis of standardised school test data from 2000 to 2015 in 58 countries - including Chile and Peru - found that students who were in school during hotter periods scored worse in exams than their peers in the same country who were schooled in cooler periods. The educational losses associated with hotter temperature were larger for lower-income populations<sup>27</sup>.

## 2.2 Climate change increase children’s risk of contracting infectious diseases

Climate change is modifying temperatures and rainfall patterns. Along with other ecological changes, temperature and rainfall changes are shifting the geographical distribution and transmission rates of vector-borne diseases such as malaria<sup>28,29</sup>. Malaria cases are already being detected in regions that were

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<sup>20</sup> Hartinger et al. (2023), supra.

<sup>21</sup> Mora, C. et al. (2017). Global risk of deadly heat. *Nature Climate Change*, 7(7), 501–506.

<sup>22</sup> Powis, C. et al (2023) Observational and model evidence together support wide-spread exposure to noncompensable heat under continued global warming. *Sci Adv.*; 9(36): eadg9297.

<sup>23</sup> Hanna & Oliva (2016a), supra.

<sup>24</sup> Delahoy, M. J. et al. (2021). Meteorological factors and childhood diarrhea in Peru, 2005–2015: a time series analysis of historic associations, with implications for climate change. *Environmental Health*, 20(1), 22.

<sup>25</sup> Zivin, J. G., & Shrader, J. (2016). Temperature Extremes, Health, and Human Capital. *The Future of Children*, 26(1), 31–50.

<sup>26</sup> Zivin & Shrader (2016), supra.

<sup>27</sup> Park, R. J. et al. (2020). Learning is inhibited by heat exposure, both internationally and within the United States. *Nature Human Behaviour*, 5(1), 19–27.

<sup>28</sup> Watts, N. et al. (2019). The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet*, 394(10211), 1836–1878.

<sup>29</sup> Caminade, C. et al. (2014). Impact of climate change on global malaria distribution. *Proceedings of the National Academy of Sciences*, 111(9), 3286–3291.

previously unsuitable for transmission<sup>30</sup>. This poses significant risks for pregnant women and children, given malaria is linked to increased risk of child mortality, malnutrition, and poor development<sup>31,32</sup>.

Climate change is also impacting children's exposure to arboviruses, including dengue, Chikungunya, and Zika<sup>33</sup>. Climate suitability for the transmission of dengue in South America has increased by 35.3% over the past decade<sup>34</sup>. From 1951–60 to 2013–22, South and Central America had the biggest increase in dengue transmission potential of any world region<sup>35</sup>. Dengue remains the main vector-borne disease of concern for children in Small Islands and Developing States in the Eastern Caribbean<sup>36</sup>. The 2015–2017 Zika virus (ZIKV) outbreak in the Americas raised concerns about potential increases in transmission as climate change makes more environments suitable for *Aedes* mosquitos. Models suggest that, in the worst-case scenario (RCP 8.5), more than 1.3 billion new people could live in areas with suitable transmission temperatures for ZIKV by 2050 (35). Under this scenario, there would be continued exposure in Latin America and the Caribbean, and increased exposure in North America, where naïve populations are likely to be particularly vulnerable<sup>37</sup>. Dengue, Zika and Chikungunya all have severe consequences for children: dengue infection during pregnancy increases the risk of stillbirth and neonatal death, Zika can cause microcephaly, and newborns infected with Chikungunya through their mothers can experience fever, peripheral oedema, neurological problems, haemorrhagic symptoms, and myocardial disease<sup>38</sup>. Changes in global infectious disease risk patterns are likely to disproportionately affect the poorest children and those with the least access to preventive and curative care, exacerbating inequalities in child health across the Americas<sup>39</sup>.

### **2.3 Climate change is disrupting food systems and access to clean water, increasing malnutrition food- and water-borne diseases**

Children are at particular risk from the long-term consequences of undernutrition; these include poor growth and worsened school performance<sup>40</sup>. Climate change is worsening child malnutrition through two main pathways: it affects its underlying causes (e.g., food security, dietary diversity, nutrient quality), but also the social and economic drivers that determine these (e.g. livelihoods, incomes, infrastructure)<sup>41</sup>.

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<sup>30</sup> Romanello, M. et al. (2022). The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *The Lancet*, 400(10363), 1619–1654.

<sup>31</sup> Helldén, D. et al. (2021). Climate change and child health: a scoping review and an expanded conceptual framework. *The Lancet Planetary Health*, 5(3), e164–e175.

<sup>32</sup> Chua, C. L. L. et al. (2021). Poor Birth Outcomes in Malaria in Pregnancy: Recent Insights Into Mechanisms and Prevention Approaches. *Frontiers in Immunology*, 12, 621382.

<sup>33</sup> Ebi, K. L., & Nealon, J. (2016). Dengue in a changing climate. *Environmental Research*, 151, 115–123.

<sup>34</sup> Hartinger et al. (2023), supra.

<sup>35</sup> Romanello, M. et al. (2023). The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harm. *The Lancet*, [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7)

<sup>36</sup> O'Garro, L. (2009). *Gap Analysis: Children and Climate Change in the Small Island Development States (SIDS) of the Eastern Caribbean*. UNICEF Office for Barbados and Eastern Caribbean.

<sup>37</sup> Ryan, S. J. et al. (2019). Global expansion and redistribution of *Aedes*-borne virus transmission risk with climate change. *PLOS Neglected Tropical Diseases*, 13(3), e0007213.

<sup>38</sup> Ferreira, F. C. et al. (2021). Vertical transmission of chikungunya virus: A systematic review. *PLOS ONE*, 16(4), e0249166.

<sup>39</sup> Madeleine, C. T. et al. (2018). Climate Impacts on Disasters, Infectious Diseases and Nutrition. In C. T. Madeleine & J. M. Simon, *Climate Information For Public Health Action* (1st ed., pp. 16–41). Routledge.

<sup>40</sup> Hagos, S. et al. (2014). Climate change, crop production and child under nutrition in Ethiopia; a longitudinal panel study. *BMC Public Health*, 14(1), 884.

<sup>41</sup> Agostoni, C. et al. (2023). Interlinkages between Climate Change and Food Systems: The Impact on Child Malnutrition—Narrative Review. *Nutrients*, 15(2), 416.

Climate change undermines food security by reducing both the quantity and quality of agricultural crops<sup>42</sup>. Unpredictable shifts in rainfall patterns and temperature reduce farmers' yields, cutting the amount of food available, increasing its cost, and affecting children's dietary diversity<sup>43</sup>. For example, a study with 42,521 children under five years in Peru, Guyana, Colombia, Dominican Republic, and Haiti found that higher than average temperatures in the year prior to the survey was associated with reductions in child dietary diversity<sup>44</sup>. Climate change is intensifying the effects of El Niño/Southern Oscillation (ENSO) on rainfall in countries like Peru and Chile<sup>45</sup>, and Peruvian research has found that ENSO indices predict changes in children's diets. For example, severe La Niña (the cold counterpart to El Niño) conditions in 2011-2 led to flooding and displacement in the Peruvian Amazon, significantly reducing children's dietary diversity.

Reductions in dietary diversity combined with increased infection risk have direct effects on children's nutritional status, as reflected through wasting (acute malnutrition), stunting (chronic malnutrition), and underweight (a composite indicator). A 2022 systematic review of 22 studies found that 17 reported a significant relationship between climate change proxies and at least one malnutrition metric; droughts were particularly harmful and associated with both increased wasting and underweight. The impacts of climate on nutrition are often greatest among the most marginalised children: research using 1996-2012 data from Peru found that rural, indigenous children whose mothers had experienced excess rainfall during pregnancy had a 0.35 reduction in height-for-age (which reflects long-term growth); this effect endured when children were aged 4-5 years but was absent or reversed among non-indigenous urban children<sup>46</sup>. Climate change has indirect effects on children's nutritional status by reducing agricultural workers' labour productivity, reducing incomes, and therefore decreasing households' ability to purchase nutritious foods for children. In 2021, the regional income loss resulting from decreased labour capacity due to extreme heat in South America was estimated at US\$ 22 billion, with the construction and agricultural sectors being the hardest hit<sup>47</sup>.

In 2019, an estimated 6,041 deaths of children under five years in Latin America and the Caribbean were due to unsafe water, sanitation, and hygiene<sup>48</sup>. Both heavy rainfall and prolonged droughts disrupt the availability of safe drinking water and sanitation facilities. This puts children at increased risk from diarrhoeal diseases, which account for c.9% of all deaths to children under five years worldwide, the equivalent of 1300 children dying each day<sup>49</sup>. A quarter of the population in Latin America and the Caribbean lacks access to drinking water and 66% has no access to sanitation services<sup>50</sup>.

## **2.4 Climate change impacts air quality, harming children's respiratory health**

<sup>42</sup> Fanzo, J. et al. (2018). The effect of climate change across food systems: Implications for nutrition outcomes. *Global Food Security*, 18, 12–19.

<sup>43</sup> Agostoni et al. (2023), supra; Kroeger, C. (2023). Heat is associated with short-term increases in household food insecurity in 150 countries and this is mediated by income. *Nature Human Behaviour*, 1-10.

<sup>44</sup> Niles, M. T. et al. (2021). Climate impacts associated with reduced diet diversity in children across nineteen countries. *Environmental Research Letters*, 16(1), 015010.

<sup>45</sup> Latif, M., & Keenlyside, N. S. (2009). El Niño/Southern Oscillation response to global warming. *Proceedings of the National Academy of Sciences*, 106(49), 20578–20583.

<sup>46</sup> Nicholas, K. et al. (2021). Climate anomalies and childhood growth in Peru. *Population and Environment*, 43(1), 39–60.

<sup>47</sup> Hartinger et al. (2023), supra.

<sup>48</sup> CEPAL (2023). Regional water action agenda: Towards universal access to clean water and sanitation. Economic Commission for Latin America and the Caribbean.

<sup>49</sup> World Health Organization (WHO) and Maternal Child & Epidemiology Estimation (MCEE). (2021). *Child Causes of Death, 2000-20*.

<sup>50</sup> CEPAL (2023), supra.

Air pollution and climate change are linked: air pollutants and greenhouse gases often come from the same sources, including coal-fired power plants and diesel-powered vehicles<sup>51</sup>. Air pollution is already the largest environmental public health concern in Latin America and the Caribbean<sup>52</sup>. In this environment of poor air quality, rising temperatures linked to climate change are increasing ground-level ozone, a harmful air pollutant responsible for reduced lung function in children and around 1 million premature respiratory deaths globally<sup>53,54</sup>. Methane, the second most important greenhouse gas after CO<sub>2</sub>, is responsible for half the observed rise in ground-level ozone and, through this, is a key contributor to poor respiratory health in children<sup>55</sup>. Methane is also the main component of natural gas, which is used for home heating, cooking, and to produce electricity. Methane leakage is common, with one 2018 study estimating that 13 million metric tons of methane leak into the atmosphere being used. Methane leakage often comes with the release of volatile organic compounds that form ozone<sup>56</sup>. In some areas of the United States, such as Arlington (Texas), public schools and licensed daycares are within a short distance of gas wells, exposing mothers and children to toxic pollution which puts children at higher risk of birth defects and developing asthma<sup>57,58</sup>.

Climate change is also increasing air pollution from particulate matter (PM) because desertification and drought are causing more dust to be suspended in the atmosphere. There is strong evidence that exposure to PM<sub>2.5</sub> (a combination of fine particulate matter) during pregnancy raises the risk of preterm birth, stillbirth, low birth weight, and spontaneous abortion<sup>59</sup>. For example, a study using DHS and Aerosol Index data (a proxy for surface air quality highly correlated with ground-based measures of PM<sub>2.5</sub>) from Bolivia, Colombia, and Peru found that a 10% increase in air pollution exposure in utero was associated with a 50g reduction in birth weight, the equivalent of smoking five cigarettes a day during pregnancy<sup>60</sup>. PM<sub>2.5</sub> air pollution also elevates child mortality rates and the overall burden of disease, particularly among infants. Young children exposed to PM<sub>2.5</sub> are at a higher risk of developing airway inflammation, acute respiratory infections, and chronic respiratory conditions such as asthma<sup>61</sup>. Air pollution causes systemic effects, with impacts felt well beyond the respiratory system. For example, a

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<sup>51</sup> Orru, H. et al. (2017). The Interplay of Climate Change and Air Pollution on Health. *Current Environmental Health Reports*, 4(4), 504–513.

<sup>52</sup> Salman, F. et al. (2020). Environment and energy landscape in Latin America and the Caribbean: an analysis of trends 2020-2030. USAID.

<sup>53</sup> Perera, F.P. (2017) Multiple threats to child health from fossil fuel combustion: impacts of air pollution and climate change. *Environ Health Perspect.* 125(2): 141-148.

<sup>54</sup> Malley, C. S. et al. (2017). Updated Global Estimates of Respiratory Mortality in Adults ≥30Years of Age Attributable to Long-Term Ozone Exposure. *Environmental Health Perspectives*, 125(8), 087021.

<sup>55</sup> Malley et al. (2017), supra.

<sup>56</sup> Alvarez, R.A. et al. (2018) Assessment of methane emissions from the U.S. oil and gas supply chain. *Science* 361 (6398): 186-18.

<sup>57</sup> American Lung Association. (2022) Why everyone should care about methane pollution. <https://www.lung.org/blog/methane-gas-pollution> [Accessed October 16th, 2023]

<sup>58</sup> Li, A. J. et al. (2021) A review of environmental occurrence, toxicity, biotransformation and biomonitoring of volatile organic compounds. *Environmental Chemistry and Ecotoxicology* 3: 91-116.

<sup>59</sup> Heft-Neal, S. et al. (2020). Dust pollution from the Sahara and African infant mortality. *Nature Sustainability*, 3(10), 863–871.

<sup>60</sup> Aparicio, G. et al. (2019). Gender Gaps in Birth Weight Across Latin America: Evidence on the Role of Air Pollution. *Journal of Economics, Race, and Policy*, 2(4), 202–224; Heft-Neal, S., Burney, J., Bendavid, E., Voss, K. K., & Burke, M. (2020). Dust pollution from the Sahara and African infant mortality. *Nature Sustainability*, 3(10), 863–871.

<sup>61</sup> Perera (2022), supra.

2022 systematic review found that air pollution increases the likelihood of lower cognitive function in children, with supporting evidence from neuroimaging studies and inflammatory biomarkers<sup>62</sup>.

Climate change also harms children's health by increasing exposure to wildfires. In South America, the risk of exposure to very high or extremely high wildfire danger has increased in nine of out 12 countries over the past decade, particularly in Argentina and Chile<sup>63</sup>. In Brazil, a study has found an 8% increase in child respiratory hospital admissions linked to PM<sub>2.5</sub> emitted from burnings in the Amazon region (for the period 2004–2005)<sup>64</sup>.

Finally, climate change harms children's respiratory health by amplifying the production and concentration of outdoor aeroallergens, such as pollens and fungal spores<sup>65</sup>. The combination of extreme weather events and heightened aeroallergen concentrations increases the risk of epidemic events like 'thunderstorm asthma' and emergency department admissions for respiratory problems<sup>66</sup>, though data on this are mainly from the global north, including North America<sup>67</sup>.

## 2.7 Extreme weather and environmental degradation harm children's health

Extreme weather events frequently cause child injuries, fatalities, and displacement. UNICEF estimates that 63 million children in Latin America and the Caribbean were affected by extreme climate and disasters in the last 30 years<sup>68</sup>. As discussed earlier, climate change will make children's exposure to extreme weather events more frequent in the future. The leading causes of death among adolescents aged 10-19 years in Latin America and the Caribbean are violence, injury, and drowning, all of which are more likely in the aftermath of disasters<sup>69,70</sup>. Exposure to disasters in utero also has long-term effects on survivors: using data on natural disasters from all Latin America and Caribbean countries between 1900 and 2000, one study found that a person impacted by a flood in utero had 0.472 fewer years of education (compared to those not exposed), and a 10% increased probability of being unemployed<sup>71</sup>. While such studies are subject to multiple sources of bias and confounding, they fit with a wide body of literature highlighting the long-term impacts of health insults in utero on human capital<sup>72</sup>.

In addition to causing death and injury directly and having repercussions across the life-course, extreme weather events disrupt health systems' capacities to address the needs of children and their families. For

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<sup>62</sup> Chandra, M. et al. (2022). Air Pollution and Cognitive Impairment across the Life Course in Humans: A Systematic Review with Specific Focus on Income Level of Study Area. *International Journal of Environmental Research and Public Health*, 19(3), 1405.

<sup>63</sup> Hartinger et al. (2023), supra.

<sup>64</sup> Ignotti, E. et al. (2010). Impact on human health of particulate matter emitted from burnings in the Brazilian Amazon region. *Revista de Saúde Pública*, 44(1), 121–130.

<sup>65</sup> Evans, J. et al. (2022). Birth Outcomes, Health, and Health Care Needs of Childbearing Women following Wildfire Disasters: An Integrative, State-of-the-Science Review. *Environmental Health Perspectives*, 130(8), 086001.

<sup>66</sup> Helldén et al. 2021, supra.

<sup>67</sup> Evans, J. et al. (2022). Birth Outcomes, Health, and Health Care Needs of Childbearing Women following Wildfire Disasters: An Integrative, State-of-the-Science Review. *Environmental Health Perspectives*, 130(8), 086001.

<sup>68</sup> UNICEF. (2020). Children in Latin America and the Caribbean: an Overview. United Nations Children's Fund.

<sup>69</sup> Liu, L. et al. (2022). National, regional, and global causes of mortality in 5–19-year-olds from 2000 to 2019: a systematic analysis. *The Lancet Global Health*, 10(3), e337–e347.

<sup>70</sup> Meddings, D. R. et al. (2021). Drowning prevention: turning the tide on a leading killer. *The Lancet Public Health*, 6(9), e692–e695.

<sup>71</sup> Caruso, G. D. (2017). The legacy of natural disasters: The intergenerational impact of 100 years of disasters in Latin America. *Journal of Development Economics*, 127, 209–233.

<sup>72</sup> Randell, H., & Gray, C. (2019). Climate change and educational attainment in the global tropics. *Proceedings of the National Academy of Sciences*, 116(18), 8840–8845.

instance, in Florida, women residing in areas severely affected by Hurricane Michael were more likely to experience delays in postnatal care, contributing to an elevated risk of their infants being Small for Gestational Age<sup>73</sup>.

Finally, extreme weather events and environmental degradation both contribute to migration, whether from rural-to-rural areas, rural to urban centres, or within and between countries. The 2018 and 2021 World Bank 'Groundswell' reports estimated that, without substantial climate action, as many as 216 million people could be internal climate migrants across the six World Bank regions, including 17 million in South America<sup>74</sup>. Children living in low-lying coastal and remote rural regions are particularly susceptible to migration, as climate change leads to rising sea levels and heightened risks of floods and droughts in their areas<sup>75</sup>. Child migration raises the risk of poor physical health, malnutrition, violence, and trafficking, especially for unaccompanied minors. Violence against women and girls (VAWG) often surges following conflicts and disasters, and with exposure to extreme heat<sup>76</sup>. A systematic review of 41 studies found that VAWG perpetrated by both close relatives and strangers increased during or after extreme weather events<sup>77</sup>. This was frequently linked to economic instability, food scarcity, mental stress, and disrupted infrastructure.

### 3. MITIGATION AND ADAPTATION ACTIONS WITH HEALTH CO-BENEFITS FOR CHILDREN

**3.1 Clean energy** Phasing out coal, oil, and gas production this decade and shifting to electricity production from renewable sources will, with high confidence, lead to significant improvements in child health both globally and in the Americas<sup>78</sup>. Rapid fossil fuel phase out will improve child health, make a major contribution towards the goal of zero emissions by 2050, and reduce the severity of climate change, protecting children from its worsening effects. Not all countries are equally responsible for greenhouse gas emissions driven by high levels of consumption: high-income countries are responsible for 74% of material use in excess of sustainable planetary boundaries, with the USA (27%) and EU-28 high-income countries (25%) being the main drivers<sup>79</sup>; they must urgently commit to concrete, achievable plans for achieving zero emissions and reducing resource extraction by 2050. Countries in the Americas can also take action: in 2020, all nine countries in South and Central America still provided net subsidies to fossil fuels and had low median net carbon prices<sup>80</sup>.

In 2020, over 90% of people in the South American region used clean fuels and technologies for cooking, but with significant disparities between countries: Chile has had universal access to clean cooking fuels since 1990 but other countries have lower use of clean fuels, particularly in rural areas (e.g. 40% in Paraguay and 42% in Peru).<sup>81</sup> Transitioning to clean fuels for transport and cooking will cut

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<sup>73</sup> Pan, K. et al. (2021). Effects of Hurricane Michael on Access to Care for Pregnant Women and Associated Pregnancy Outcomes. *International Journal of Environmental Research and Public Health*, 18(2), 390.

<sup>74</sup> Clement, V. et al. (2021). *Groundswell part 2: Acting on internal climate migration*. World Bank.

<sup>75</sup> Schwerdtle, P. N. et al. (2020). Health and migration in the context of a changing climate: a systematic literature assessment. *Environmental Research Letters*, 15(10), 103006.

<sup>76</sup> Zhu, Y. et al. (2023). Association of Ambient Temperature With the Prevalence of Intimate Partner Violence Among Partnered Women in Low- and Middle-Income South Asian Countries. *JAMA Psychiatry*, 80(9), 952.

<sup>77</sup> Thurston, A. M., Stöckl, H., & Ranganathan, M. (2021). Natural hazards, disasters and violence against women and girls: a global mixed-methods systematic review. *BMJ Global Health*, 6(4), e004377.

<sup>78</sup> Perera (2022), supra.

<sup>79</sup> Hickel, J. et al. (2022). National responsibility for ecological breakdown: a fair-shares assessment of resource use, 1970–2017. *The Lancet Planetary Health*, 6(4), e342–e349.

<sup>80</sup> Romanello, M. et al. (2023). supra.

<sup>81</sup> Hartinger et al. (2023), supra.

greenhouse gas emissions and reduce exposure to indoor and outdoor air pollution, both of which have systemic effects on children's health.

**3.2 Sustainable, healthy diets** – In Latin America and the Caribbean, the land and food systems are responsible for just under half of greenhouse gas emissions<sup>82</sup>. South and Central America had the largest emissions per person from red meat consumption in 2020, representing 70%, and 81% of their agricultural emissions<sup>83</sup>. The consumption has serious health impacts. Since 2010, the South American region has seen a 28% increase in premature deaths attributed to high consumption of red meat, processed meat, and dairy products<sup>84</sup>; dietary habits are formed in childhood and imbalanced diets contribute to childhood overweight and obesity. Reducing consumption of red and processed meat and dairy products will reduce emissions from the food system and help improve children's diets, bringing significant health gains<sup>85,86</sup>. Research also suggests that children could retain healthy consumption of animal proteins within environmental limits if regenerative production practices were used, and with an emphasis on more diverse sources of animal proteins (e.g. fish, poultry, eggs)<sup>87</sup>.

**3.3 Sustainable land use** - Adopting sustainable agricultural and land management practices will help prevent deforestation in key biodiversity areas like the Amazon, supporting carbon sequestration as well as benefitting families' food security, incomes, and children's development. From 2001 to 2021, Brazil lost 62.8 Mha of tree cover – the equivalent to 34.5 Gt of CO<sub>2</sub>e emissions – because of land clearing to produce soy, beef, and timber. Deforestation increases the risk of infectious disease spread, exacerbates food insecurity, reduces the availability of clean drinking water, and increases the risk of land degradation and floods. Policies that prevent deforestation will therefore promote child health and nutrition<sup>88</sup>.

**3.4 Resilient health systems** – A study with data from nationally representative surveys in 27 countries across the Americas found that one third of people experienced multiple barriers to accessing healthcare, including for suspected cases of childhood pneumonia and diarrhoea<sup>89</sup>. Achieving universal health coverage will help address the growing burden of climate-sensitive diseases in children. Developing early warning systems that identify and address climate-related health hazards will help implement early interventions and response systems to reduce the health impacts of climate change on

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<sup>82</sup> World Resources Institute (2022). Climate Watch Historical Country Greenhouse Gas Emissions Data (1990- 2018). World Resources Institute.

<sup>83</sup> Romanello, M. et al. (2023), supra.

<sup>84</sup> Hartinger et al. (2023), supra.

<sup>85</sup> Aleksandrowicz, L. et al. (2016). The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, and Health: A Systematic Review. *PLOS ONE*, 11(11), e0165797.

<sup>86</sup> Karlsson, J. O. et al. (2019). The carbon footprint of breastmilk substitutes in comparison with breastfeeding. *Journal of Cleaner Production*, 222, 436–445.

<sup>87</sup> Alexander, P. et al. (2017). Could consumption of insects, cultured meat or imitation meat reduce global agricultural land use? *Global Food Security*, 15, 22–32; Hollis, J. L. et al. (2020). Defining healthy and sustainable diets for infants, children and adolescents. *Global Food Security*, 27, 100401; Willett, W. et al. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492.

<sup>88</sup> Rasolofson, R. A. et al. (2018). Impacts of forests on children's diet in rural areas across 27 developing countries. *Science Advances*, 4(8), eaat2853.

<sup>89</sup> Báscolo, E., Houghton, N., & Del Riego, A. (2020). Leveraging household survey data to measure barriers to health services access in the Americas. *Revista Panamericana de Salud Pública*, 44, 1.



children<sup>90</sup>. In 2021 however, only two countries of SA (Argentina and Brazil) reported that their health systems used meteorological information to plan for or respond to climate-related hazards<sup>91</sup>.

**3.5 Resilient communities** - Building communities' resilience to heat waves and other climate disasters is an essential component of adaptation to safeguard maternal and child health. Structural changes to buildings (e.g. reflective roofs and insulation), the expansion of green spaces and free sources of clean water, public campaigns to promote cooling solutions such as electric fans, wearing light clothing soaked in water and immersing arms in cool water can help reduce children's core temperature and avoid the worst effects of heat stress<sup>92</sup>. Conducting such public health campaigns before and during heatwaves would help reduce the risk of heat-related morbidity and mortality in children, and also reduce energy poverty<sup>93</sup>. Systemic changes to environments will support and have greater impact than individual behaviour change<sup>94</sup>.

**3.6 Green space** - in 2021, 84% of urban centres in South America were classified as having low, very low, or exceptionally low greenspace coverage. Investing in well-designed urban green spaces (parks, gardens, green roofs) provides important benefits for children's physical and mental health<sup>95,96</sup>. Reviews have found that higher levels of neighbourhood green space are linked to more outdoor play time for children<sup>97</sup>. Public spaces with substantial tree canopies and shade can also reduce the risk of heat stress for pregnant women and children<sup>98</sup>.

**3.7 Planning and funding for adaptation** - Urgent mitigation needs to go hand in hand with climate change adaptation for health. As of October 2021, Brazil was the only country in SA that reported having completed a climate change and health vulnerability and adaptation assessment as well as a national health and climate change strategy. This lag in the creation of HNAPs limits the ability of governments to adequately address health issues related to climate change, procure funding, and identify solutions to strengthen the resilience of health systems. Increasing funding for health adaptation is urgently required: only 10% (US\$36 million) of approved adaptation-related funding were dedicated to health in 2021.

**3.8 Supporting children's leadership in climate action**- In an online survey with 1000 young people aged 16-25 years from Brazil and 1000 from the USA, over 70% of young people in both countries felt afraid of climate change; in addition, 62% (USA) and 78% (Brazil) thought governments were lying about

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<sup>90</sup> Romanello, M. et al. (2021). Monitoring climate change and child health: The case for putting children in all policies. *Journal of Paediatrics and Child Health*, 57(11), 1736–1740.

<sup>91</sup> Hartinger et al. 2023, supra.

<sup>92</sup> Jay, O. et al. (2021). Reducing the health effects of hot weather and heat extremes: from personal cooling strategies to green cities. *The Lancet*, 398(10301), 709–724.

<sup>93</sup> Romanello et al. (2022), supra.

<sup>94</sup> McLoughlin, N. et al. (2023) Changing behavioral responses to heat risk in a warming world: How can communication approaches be improved? *Wires Climate* 14(2): e819.

<sup>95</sup> Davis, Z. et al. (2021). The association between natural environments and childhood mental health and development: A systematic review and assessment of different exposure measurements. *International Journal of Hygiene and Environmental Health*, 235, 113767.

<sup>96</sup> Zhang, Y. et al. (2020). The Association between Green Space and Adolescents' Mental Well-Being: A Systematic Review. *International Journal of Environmental Research and Public Health*, 17(18), 6640.

<sup>97</sup> Lambert, A. et al. (2019). What Is the Relationship between the Neighbourhood Built Environment and Time Spent in Outdoor Play? A Systematic Review. *International Journal of Environmental Research and Public Health*, 16(20), 3840.

<sup>98</sup> Fedra, D. M. et al. (2015). Neighbourhood parks and reduction in stress among adolescents: Results from Buffalo, New York. *Indoor and Built Environment*, 24(5), 631–639.

the effectiveness of the actions there were taking<sup>99</sup>. Supporting children’s leadership in climate action can help. Several studies suggest that both ‘everyday’ and formalised activism can have positive impacts by providing constructive hope, social connectedness, and a sense of agency in addressing problems that might otherwise lead to feelings of helplessness<sup>100,101</sup>. Some city councils, regions, and children’s parliaments support Youth Climate Assemblies to provide insights for policymakers. Additionally, Argentina, Brazil, Cuba, Ecuador, and Nicaragua have lowered the voting age to 16 or 17, allowing older children to have a say in climate-related policies that will impact their future; however, there is limited evidence on the long-term effects of these practices on climate policies and child health.

## Conclusions

In summary, climate change has wide-ranging and long-term impacts on children’s physical health and development across the Americas. This undermines their right to life, the highest attainable standard of health and other rights mentioned in the United Nations Convention on the Rights of the Child. Interactions between different climate risks - for example risks posed by extreme weather events and those arising from ecosystem degradation and chronic undernutrition – interact with each other and further amplify harms to children. Because early childhood is a sensitive period that shapes long-term health and wellbeing, exposure to climate-related harms in childhood can impact on individual and population health across the life-course and intergenerationally.

In addition, climate change exacerbates existing health and educational disparities, leading to increased poverty, inequality, and involuntary migration among children growing up in the world’s most severely affected regions. These are primarily located in the Global South, due to a combination of greater climate risks and lower adaptation capacity, despite most emissions originating from the Global North. The 2022 South America Report of the Lancet Countdown strongly suggests that lack of progress in reducing greenhouse gas emissions from fossil fuels puts the continent’s children’s health at risk now and in the future<sup>102</sup>. Committing to reaching zero emissions by 2050, preserving and restoring green infrastructure, building resilient health systems and communities, and supporting children’s leadership in climate action can help safeguard child health from climate change in the Americas.

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<sup>99</sup> Hickman, C. et al. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The Lancet Planetary Health*, 5(12), e863–e873.

<sup>100</sup> Haugestad, C. A. P. et al. (2021). Why do youth participate in climate activism? A mixed-methods investigation of the #FridaysForFuture climate protests. *Journal of Environmental Psychology*, 76.

<sup>101</sup> Wallis, H., & Loy, L. S. (2021). What drives pro-environmental activism of young people? A survey study on the Fridays For Future movement. *Journal of Environmental Psychology*, 74, 101581.

<sup>102</sup> Hartinger et al. (2023), supra



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## ANNEX B

## IMPACTS OF CLIMATE CHANGE ON CHILDREN'S MENTAL HEALTH, 18 December 2023

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### **Introduction**

Climate change has significant and multi-faceted impacts on children's mental health and emotional wellbeing. Impacts arise from exposure to both sudden extreme weather events such as wildfires, heatwaves, floods, and hurricanes, and slower-acting climate events such as rising temperatures, droughts, air pollution and sea-level rise. **Direct** impacts are caused by children's experiences during these events, and **indirect** impacts occur through disruptions in the overall caregiving system (familial, social, economic, and environmental) which supports their mental health and wellbeing<sup>1</sup>. Further, whether or not they have already experienced climate disasters first-hand, most children and young people around the world **know about climate change and are deeply worried** about its impacts on their lives<sup>2</sup>. The approaches to **protecting children from psychological harms** from climate change range from global and national action to reduce emissions (the most critical requirement), through community-based approaches, to more individually-focussed strategies.

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<sup>1</sup> Burke, Sanson & Van Hoorn, The Psychological Effects of Climate Change on Children, *Current Psychiatry Reports* (2018) 20:35; Lawrance, E. et al. (2022), The impact of climate change on mental health and emotional wellbeing: A narrative review of current evidence and its implications. *Int. Review. Psychiatry*. 34:5, 443-498; Sanson, Malca, Van Hoorn & Burke, *Children and Climate Change* (2022), Cambridge.

<sup>2</sup> Hickman, C., Marks, E., Pihkala, P., Clayton, S., et al.. (2021). Young people's voices on climate anxiety, government betrayal and moral injury: A global phenomenon. *Lancet Planetary Health*, 5(12), e863-e873.

## 1. Climate-related disasters – direct mental health impacts

Exposure to **sudden extreme weather events** can have significant impacts on children's mental health<sup>3</sup>. These may result from experiences such as injury, death of a loved one, damage or loss of property and pets, disruption of livelihoods, separation from parents, witnessing injuries or deaths, and forced evacuation or migration. Following such experiences, children show significant increases in mental health problems, including post-traumatic stress disorder (PTSD), depression and anxiety, sleep disorders, attachment disorders, regressive behaviours, somatic complaints, cognitive deficits, and learning problems<sup>4</sup>.

Some examples: After the 2010 floods in Pakistan, 73% of children aged 10-19 displayed high levels of PTSD, with displaced girls most affected<sup>5</sup>. After Hurricane Andrew in the US, PTSD symptoms were two to three times more likely and longer-lasting in children than adults<sup>6</sup>. After a major storm in France, 94% of children aged 0-5 presented at least one manifestation of acute stress, and about a third showed developmental regression<sup>7</sup>. Four months after a flood in Australia, 22% of children scored in the "severe" range for posttraumatic stress symptoms<sup>8</sup>. Mental health problems can be persistent: Gibbs et al. (2021)<sup>9</sup> found evidence of continuing impacts on mental health and wellbeing among many children 10 years after their exposure to bushfires in Victoria, Australia. Traumatic stress has also been shown to be connected to witnessing of deaths and injuries arising from extreme weather events<sup>10</sup>. Other psychological reactions to extreme weather events include: distress, grief, and anger; loss of identity; feelings of helplessness and hopelessness; increased rates of suicide; and increased aggression and violence<sup>11</sup>.

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<sup>3</sup> For reviews, see Sanson et al., 2022 supra; Clayton, Manning, Krygsman, & Speiser (2017). Mental health and our changing climate: impacts, implications, and guidance. *APA/ecoAmerica*; Burke, et al., 2018, supra.

<sup>4</sup> Clemens V et al, Report of the intergovernmental panel on climate change: implications for the mental health policy of children and adolescents in Europe - a scoping review (2020) *European Child & Adolescent Psychiatry*; Anderko, Du, & Hauptman (2020). Climate changes reproductive and children's health: A review of risks, exposures, and impacts. *Pediatric Research*, 87(2), 414–419; Majeed & Lee, J. (2017). The impact of climate change on youth depression and mental health. *The Lancet Planetary Health*, 1, e94-e95.

<sup>5</sup> Gibbons (2014) Climate change, children's rights, and the pursuit of intergenerational climate justice. *Health & Human Rights Journal*, 16, 19.

<sup>6</sup> Shaw, Applegate, & Schorr (1996). Epidemiology of tropical cyclones: The dynamics of disaster, disease, and development. *J Amer. Acad. Child & Adol. Psychiatry*, 35(3), 359–364.

<sup>7</sup> Richez, et al. (2022). Storm Alex: Acute stress responses in the pediatric population. *Eur. J. Psychotraumatology*, 13(1), 2067297.

<sup>8</sup> Poulsen, McDermott, Wallis, & Cobham (2015), School-based psychological screening in the aftermath of a disaster: Are parents satisfied and do their children access treatment?. *J. Traumatic Stress*, 28: 69-72.

<sup>9</sup> Gibbs, et al. (2021). Child and adolescent psychosocial support programs following natural disasters: A scoping review of emerging evidence. *Current Psychiatry Reports*, 23(12), 82.

<sup>10</sup> UNHRC, *Analytical study on the relationship between climate change and the full and effective enjoyment of the rights of the child*, supra.

<sup>11</sup> Clayton et al. (2017), supra.

Even prenatal exposure to climate change events can derail normal development and increase the risk for a range of social, cognitive, psychiatric, and behavioral dysfunctions, including developmental regression, anxiety or depressive disorder, ADHD, lower scores on activity and extraversion levels, and lower levels of self-control as well as risk of psychiatric disorders later in life<sup>12</sup>.

More generally, exposure to climate change stressors is increasingly considered to constitute an 'adverse childhood event'<sup>13</sup>. Adverse childhood events have been shown to increase the risk of depression in adulthood by four times, and suicide attempts by 30 times<sup>14</sup>. Modelling shows that, if global climate action is limited to what was pledged in 2021, a child born in 2020 will experience 7 times as many heatwaves in their lives as someone born in 1960. Similar or stronger results were found for six other types of extreme climate-related events (wildfires, crop failures, droughts, river floods, heatwaves, and tropical cyclones). Combined, this equates to a child born in 2020 experiencing 24 times as many climate disasters in their lifetimes<sup>15</sup>. Children in Low and Middle Income Countries (LMICs), which includes many countries in Latin America, are particularly vulnerable to such repeated exposure<sup>16</sup>. Evidence suggests that repeated exposure to such events - the likely scenario for many children - results in an exacerbation of symptoms<sup>17</sup>.

Less research has focused on the psychological impacts of **slower climate changes** such as rising temperatures, drought, poor air quality, rising sea levels, ocean acidification, salinization, land degradation, and the loss of biodiversity on children's mental health, but existing evidence indicates that they can increase the risk of anxiety, depression, bipolar disorder, cognitive function impairment, and interpersonal aggression, among other consequences<sup>18</sup>. Psychological impacts can

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<sup>12</sup> For reviews see Clayton et al., 2023, supra; Vergunst & Berry (2022). Climate change and children's mental health: a developmental perspective. *Clin. Psych. Science*, 10(4), 767-785.

<sup>13</sup> Harvard T.H. Chan School of Public Health, "Mental Health."

<sup>14</sup> Hughes K, et al. (2017). The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health*. 2017 Aug;2(8):e356-e366.

<sup>15</sup> Thiery, W., et al.. (2021). Intergenerational inequities in exposure to climate extremes. *Science*, 374(6564), 158-160. <https://doi.org/10.1126/science.abi7339>; Save the Children (2021). 'Born into the climate crisis'.

[https://www.savethechildren.org.au/getmedia/dfb07742-4f10-40fa-8011-971399140136/\\_stc-cc-full-report\\_final\\_220921\\_no-map.pdf.aspx](https://www.savethechildren.org.au/getmedia/dfb07742-4f10-40fa-8011-971399140136/_stc-cc-full-report_final_220921_no-map.pdf.aspx)

<sup>16</sup> UNICEF (2015). *Unless We Act Now: The Impact of Climate Change on Children*.

[http://www.unicef.org/publications/files/Unless\\_we\\_act\\_now\\_The\\_impact\\_of\\_climate\\_change\\_on\\_children.pdf](http://www.unicef.org/publications/files/Unless_we_act_now_The_impact_of_climate_change_on_children.pdf)

<sup>17</sup> Leppold, C., Gibbs, L., Block, K., Reifels, L., & Quinn, P. (2022). Public health implications of multiple disaster exposures. *Lancet Public Health*, 7 (3), e274-e286.

<sup>18</sup> Burke et al., 2018, supra; Clayton et al., 2023, supra.

also contribute to other developmental complications like problems with emotion regulation, behavioural issues, impaired language development, and impaired learning<sup>19</sup>.

Increases in temperature due to climate change can lead to psychological difficulties. Niu et al. (2023)<sup>20</sup> found that as summer temperatures rose in New York City, children and adolescents made more mental health-related emergency department and hospital visits. Non-Hispanic Black children and children covered by Medicaid were overrepresented in these emergency visits. Increases in temperature are also linked to higher levels of air pollution. Burning of fossil fuels not only is the major contributor to climate change, it also impacts on air quality by releasing pollutants (such as methane, nitrogen oxide and fine particulate matter) that harm physical and mental health. Air pollution can increase the risk of anxiety, depression, schizophrenia, bipolar disorder, personality disorder, and use of mental health services, and impairs cognitive function and life satisfaction<sup>21</sup>. Exposure to air pollution during childhood not only has potential negative impacts on neurological development but is linked to later psychopathology such as major depressive disorder<sup>22</sup>. Both prenatal and postnatal exposure to air pollutants threaten cognitive abilities and mental health<sup>23</sup>. Roberts et al. (2019) found a correlation between exposure to higher levels of air pollution at the age of twelve and the later development of depression by the age of eighteen<sup>24</sup>. Air pollution has also been associated with increased hospital emergency room visits for young people with mental health disorders<sup>25</sup>.

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<sup>19</sup> Burke et al., 2018, supra; Anderko et al., 2020, supra.

<sup>20</sup> Niu, et al. (2023). Temperature and mental health-related emergency department and hospital encounters among children, adolescents and young adults. *Epidem. & Psychiatric Sciences* 32, 2045- 7960.

<sup>21</sup> Khan, et al. (2019). Environmental pollution is associated with increased risk of psychiatric disorders in the US and Denmark. *PLoS Biology*, 17(8), e3000353; for review, see Clayton et al. 2023, supra

<sup>22</sup> Trombley J. (2023) Fine particulate matter exposure and pediatric mental health outcomes: An integrative review. *J. Nurs. Scholarsh.*;55(5):977-1007.

<sup>23</sup> Perera et al. (2019) Towards a fuller assessment of benefits to children's health of reducing air pollution and mitigating climate change due to fossil fuel combustion *Environmental Research*, 172 55-72.

<sup>24</sup> Roberts S et al, Exploration of NO<sub>2</sub> and PM<sub>2.5</sub> air pollution and mental health problems using high-resolution data in London-based children from a UK longitudinal cohort study (2019) *Psychiatry Research*, Vol. 272, pp.8-17.

<sup>25</sup> Szyszkowicz, et al. (2020). Air pollution and emergency department visits for mental disorders among youth. *Int J Envir Res & Pub Health*, 17(12), 4190.



## **2. Climate-related disasters – indirect impacts**

Children are more susceptible to the *indirect* effects of climate change, including family disruption, food shortages, intergroup conflict, economic dislocation, and forced migration<sup>26</sup>, which themselves also increase the risks of violence, abuse, neglect and disrupted education<sup>27</sup>.

Infants and young children are particularly vulnerable to malnutrition resulting from food shortages, because most of the brain's neural pathways supporting communication, understanding, social development and emotional well-being develop rapidly in the first three years. Children who have been severely malnourished as infants do less well at school and have less chance of doing productive work and forming healthy relationships. They are also more vulnerable to physical and mental illness<sup>28</sup>.

Particularly for younger children, their dependency on adults can lead to health and psychosocial consequences due to impacts on parents' well-being, family functioning, and economic status<sup>29</sup>. Climate stressors impact the physical and mental health of caregivers, thereby limiting their capacity to provide care and protection, and the sensitive, warm and responsive parenting that is vital to child development. Further, increased levels of domestic violence have been documented following climate-related disasters such as hurricanes. A high prevalence of unintentional injuries to children was documented after floods in Bangladesh, when caregivers preoccupied with post-flood cleaning and reconstruction could not effectively supervise children<sup>30</sup>. A study in Puerto Rico after Hurricane Maria showed that higher stress and depression scores among mothers were associated with higher negative affect and lower self-regulation in infants<sup>31</sup>. Separation from parents during disasters can have long-term consequences: 28 years after Australian children were separated from their parents during bushfires, even for a short time, they were more likely to have

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<sup>26</sup> Akresh, R. (2016). Climate change, conflict, and children. *The Future of Children*, 26(1), 51-71.

<sup>27</sup> Save the Children, A Collection of Success Stories from the Humanitarian Sector, Bangladesh (2016); Save the Children, Two Years of Drought Response in Ethiopia (2016); Save the Children, Climate Change in Kenya: Projections, Impacts and Way Forward (2016) (see §14 of Save the Children's submissions on Duarte [here](#)).

<sup>28</sup> UNICEF/WHO/World Bank (2023). Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group joint child malnutrition estimates: Key findings of the 2023 edition. <https://www.who.int/publications/i/item/9789240073791>

<sup>29</sup> Clayton et al., 2023, supra; Sanson et al., 2022, supra

<sup>30</sup> Biswas, A., Rahman, A., Mashreky, S., Rahman, F., & Dalal, K. (2010). Unintentional injuries and parental violence against children during flood: A study in rural Bangladesh. *Rural & Remote Health*, 10(1), 1199.

<sup>31</sup> Martinez, K.G. (2020). Climate change and hurricanes: The effect of hurricane-related stress on infant temperament. *J.Amer. Academy of Child & Adolescent Psychiatry*, 59(10), S39-S39.

an avoidant attachment style as adults — that is, experienced more difficulty forming close bonds<sup>32</sup>.

Environmental shocks produced by climate change increase household vulnerability, resulting in economic hardship, food and water insecurity, and, with extreme events, uninhabitable living conditions. The actions that families may take to try to face these challenges can create harmful situations for children - such as migration, child labour, and child marriage, placing them at higher risk of suffering violence and other threats as well as disrupting their education<sup>33</sup>. Research highlights the increased risk for children of experiencing for different types of violence, including neglect, corporal punishment, sexual abuse, sex trafficking, and gender-based violence in the context of such events<sup>34</sup>. All of these have well-documented impacts on psychological health and wellbeing.

The impacts on cognitive development and education are also well documented. Climate disasters often damage school infrastructure, teachers are often unavailable, many families can no longer afford to send their children to school, and children (especially girls) drop out of school or reduce their school attendance<sup>35</sup>. Even without interruptions in school attendance, distress and disruption can impact children's mental health which in turn affects their academic performance. Students from highly bushfire-affected schools in Victoria, Australia were more likely to show academic delays 2-4 years later, indicating neuropsychological impacts from disaster-related trauma and family, school and community-level disruptions, which were then reflected in lower academic scores 10 years later<sup>36</sup>. Furthermore, impacts on physical health can prevent children from attending schools regularly. Extreme heat also reduces the capacity to learn: a study of more than 144 million 15- to 19-year-olds across 12,000 US school districts showed that the rate of learning decreases with an increase in the number of hot school days, especially in schools in lower socioeconomic areas<sup>37</sup>. Further, a study comparing school-age children in Mexico City highly exposed to air pollution with those in an area of Mexico with less pollution found that the cognitive

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<sup>32</sup> Bryant, R. et al. (2017). Separation from parents during childhood trauma predicts adult attachment security and post traumatic stress disorder. *Psychological Medicine*, 47(11), 2028–2035.

<sup>33</sup> For review, see Sanson et al., 2020, supra.

<sup>34</sup> Biswas et al., 2010, supra; Rubenstein, B.L. & Stark, L. (2017). The impact of humanitarian emergencies on the prevalence of violence against children: An evidence-based ecological framework. *Psychol, Health & Medicine*, 22(sup1), 58–66.

<sup>35</sup> Gibbons, 2014, supra; for review, see Sanson et al., 2022, supra

<sup>36</sup> Gibbs, L., et al. (2019). Delayed disaster impacts on academic performance of primary school children. *Child Development*, 90(4), 1402–1412; Gibbs, et al. (2021), supra

<sup>37</sup> Park, R. J., Behrer, A. P., & Goodman, J. (2021). Learning is inhibited by heat exposure, both internationally and within the United States. *Nature Human Behaviour*, 5(1), 19-27.

deficits in the highly-exposed children matched the localization of the volumetric differences detected in the brain<sup>38</sup>.

More broadly, climate change is reinforcing existing social and economic vulnerabilities which impact on children's psychological development and wellbeing. Since 2008, an average of 22.5 million people have been displaced by climate- or weather-related disasters each year, many of them children<sup>39</sup>, and the Institute for Economics and Peace (2022)<sup>40</sup> projects the climate-fueled displacement of over one billion people by 2050. Further, the World Bank estimates that up to 132 million people will be pushed into extreme poverty as a result of climate change by the end of this decade<sup>41</sup>. Both poverty and forced migration pose multiple risks for children's physical and mental health<sup>42</sup>. Children's mental and physical health is adversely affected by forced migration and population displacement, perpetuating poverty and civil unrest in low-income and developing countries<sup>43</sup>. Children in the Global South are already experiencing the disproportionate burden of adverse environmental and geopolitical impacts of climate change<sup>44</sup>, reflected in their high rankings on UNICEF's (2021a) Children's Climate Risk Index (CCRI)<sup>45</sup>. According to the CCRI, an estimated 169 million children in Latin America and the Caribbean live in areas impacted by at least two climate and environmental hazards and 47 million children (1 out of 4) live in areas impacted by at least four shocks. In more detail, 55 million children are exposed to water scarcity, 60 million to cyclones, 85 million to Zika, 115 million to Dengue, 45 million to heatwaves, and 105 million children are exposed to air pollution<sup>46</sup>. In Latin America and the Caribbean (LAC), weather-related disasters such as riverine floods and storm surges caused 2.3 million internal displacements of children over a six-year period - 1000 child

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<sup>38</sup> Calderón-Garcidueñas L, et al. (2011) Exposure to severe urban air pollution influences cognitive outcomes, brain volume and systemic inflammation in clinically healthy children. *Brain Cogn.* 77:345–355.

<sup>39</sup> IDMC, *Global Estimates 2015: people displaced by disasters*, Internal Displacement Monitoring Centre.

<sup>40</sup> Institute for Economics and Peace (2022). *Ecological threat report 2022: Analysing ecological threats, resilience & peace*. <http://visionofhumanity.org/resources>

<sup>41</sup> Jafino, B. A., Walsh, B., Rozenberg, J., & Hallegatte, S. (2020). *Revised estimates of the impact of climate change on extreme poverty by 2030*. Policy Research Working Paper No. 9417. World Bank.

<sup>42</sup> Maternowska, M. & Fry, (2018). The multi-country study on the drivers of violence affecting children: An overview. *Vulnerable Children and Youth Studies*. 13. 12-25.

<sup>43</sup> Sheffield PE, & Landrigan PJ. 2011. Global climate change and children's health: Threats and strategies for prevention. *Environ Health Perspect* 119:291–298; doi:10.1289/ehp.1002233.

<sup>44</sup> Swaminathan, A., Lucas, R. M., Harley, D., & McMichael, A. J. (2014). Will global climate change alter fundamental human immune reactivity: Implications for child health? *Children*, 1(3), 403–423.

<sup>45</sup> United Nations Children's Fund. (2021a). *The climate crisis is a child rights crisis. Introducing the Children's Climate Risk Index*. <https://www.unicef.org/reports/climate-crisis-child-rights-crisis>

<sup>46</sup> UNICEF Latin America and the Caribbean (n.d.) Climate change. <https://www.unicef.org/lac/en/climate-change#:~:text=In%20Latin%20America%20and%20the,by%20at%20least%20four%20shocks>

displacements a day<sup>47</sup>. Garry Conille, UNICEF Regional Director for Latin America and the Caribbean, said: “When families are hit hard by these climate-related disasters, children lose their homes but also their access to education, health, water and protection. Their entire future is in jeopardy and their only option is to flee because there is nothing left”<sup>48</sup>. It is estimated that 1.5 million children in Brazil and 672,000 children in Mexico could be displaced by riverine floods and storm surges over the next 30 years.

Overall, therefore, the conclusion by UNICEF’s Executive Director Henrietta Fore<sup>49</sup> (UNICEF, 2021b) that climate change is already “*creating incredibly challenging environments for children to live, play and thrive*” is well-founded.

### **3. The psychological impacts of knowledge about climate change**

Even in the absence of direct exposure to climate impacts such as extreme weather events, the awareness of climate change, and the knowledge of current and projected future impacts have been found to induce a range of negative emotions and psychological responses such as anxiety and distress<sup>50</sup>. As the impacts of climate change accelerate, and many people have 24-hour access to information and global news through the internet, climate awareness and concern are on the rise. With no regulation on how it is framed in the media, stories of impending doom and catastrophe proliferate, meaning children and adolescents are frequently exposed to deeply distressing information about climate change<sup>51</sup>.

There is growing interest and understanding of the wide range of negative emotional states linked to climate awareness (which have been described using various terms including eco-anxiety, climate anxiety and climate distress). It is important to note that these reactions are not in themselves considered a mental health condition. The psychological effects of climate change awareness can be considered as a spectrum, where lower, manageable levels of worry or concern

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<sup>47</sup> UNICEF (2023) *Children displaced in a changing climate*

<https://www.unicef.org/reports/children-displaced-changing-climate>

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<https://www.unicef.org/lac/en/press-releases/latin-america-and-caribbean-23-million-children-displaced-weather-related-disasters>. See also UNICEF *Normal life washed away in Guatemala* (20 January 2021).

<https://www.unicef.org/lac/en/stories/normal-life-washed-away-in-guatemala>

<sup>49</sup> United Nations Children’s Fund. (2021b). Foreword by Henrietta Fore to *The climate crisis is a child rights crisis. Introducing the Children’s Climate Risk Index*.

<https://www.unicef.org/reports/climate-crisis-child-rights-crisis>

<sup>50</sup> Lawrance, E. et al. (2022), *supra*.

<sup>51</sup> Gislason, M. K., Kennedy, A. M. & Witham, S. M. (2021) The interplay between social and ecological determinants of mental health for children and youth in the climate crisis. *Int. J. Environ. Res. Public Health* 18, 4573; O’Brien, K., Selboe, E. & Hayward, B. M. (2018). Exploring youth activism on climate change: dutiful, disruptive, and dangerous dissent. *Ecol. Soc.* 23: 42.

can promote engagement and action-taking (e.g. adopting more pro-environmental behaviours) but stronger reactions may be overwhelming or difficult to manage, and interfere with overall wellbeing and everyday functioning in education or work, interpersonal relationships, and leisure or social engagements<sup>52</sup>. Spiraling distress can lead to ‘eco-paralysis’, a state of hopelessness and helplessness<sup>53</sup>. Many factors influence individuals’ positioning along this spectrum, including current events and media coverage, social/familial support systems, and individual coping skills<sup>54</sup>.

Researchers and mental health practitioners have raised concerns that the already high rates of climate anxiety in young people, coupled with insufficient global action to meet necessary climate targets, is setting the stage for escalating mental health difficulties<sup>55</sup>. Persistent worry can become unconstructive and lead to adverse mental health outcomes<sup>56</sup>. More specifically, a recent empirical study on climate anxiety demonstrated that it can contribute to or co-exist with clinically relevant disorders such as Generalised Anxiety Disorder and Major Depressive Disorder<sup>57</sup>. A large 25-country survey study found that negative climate-related emotions were linked to insomnia symptoms and poorer self-assessed mental health ratings<sup>58</sup>. While these findings are not specific to children, there are valid reasons to hold concern for the wellbeing of younger people, who typically express more climate concerns than older people<sup>59</sup>. As the majority of mental health conditions start before the age of 24<sup>60</sup>, children and adolescents are developmentally vulnerable and thus may be more prone to experiencing adverse mental health outcomes as a result of climate anxiety. This is starting to become apparent in clinical practice. For instance, in 2020, over half (57%) of child and adolescent psychiatrists in England reported seeing children and young people distressed

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<sup>52</sup> Clayton S. (2020) Climate anxiety: psychological responses to climate change. *J. Anxiety Disord.* 74: 102263

<sup>53</sup> Albrecht, G. (2011). Chronic environmental change: Emerging ‘psychoterratic’ syndromes. In *International and Cultural Psychology*; Springer: New York; pp. 43–56.

<sup>54</sup> Léger-Goodes T. et al. (2022). A scoping review of the mental health impacts of the awareness of climate change. *Front Psychol.* 25: 872544

<sup>55</sup> Sanson A. & Belleomo M. (2021). Children and youth in the climate crisis. *BJPsych. Bull.* 45(4): 205-209

<sup>56</sup> McNeill, I. M., & Dunlop, P.D. (2016). Development and preliminary validation of the Constructive and Unconstructive Worry Questionnaire: A measure of individual differences in constructive versus unconstructive worry. *Psychological Assessment*, 28(11), 1368–1378.

<sup>57</sup> Schwartz, S.E.O., Benoit, L., Clayton, S. et al. (2023) Climate change anxiety and mental health: Environmental activism as buffer. *Curr. Psychol* 42, 16708–16721.

<sup>58</sup> Ogunbode, C.A. et al. (2023). Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries. *Curr. Psychol.* 42: 845–854.

<sup>59</sup> Bell, J., Poushter, J., Fagan, M., & Huang, C. (2021, September 14). In response to climate change, citizens in advanced economies are willing to alter how they live and work. *Pew Research Center’s Global Attitudes Project*. <https://www.pewresearch.org/global/2021/09/14/in-response-to-climate-change-citizens-in-advanced-economies-are-willing-to-alter-how-they-live-and-work>

<sup>60</sup> Kessler et al., Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication, *Arch Gen Psychiatry* 2005 June; 62(6): 593-602.

about the climate crisis and the state of the environment<sup>61</sup>. While there are no comparable surveys from the Americas, there is growing recognition among the medical and psychological profession that indirect and vicarious exposure to climate change presents a significant threat to youth mental health and wellbeing among young people worldwide<sup>62</sup>.

The empirical body of research has produced key insights into the vicarious climate impacts experienced by children and young people:

(1) *Development and prevalence of climate anxiety among children and young people*

A scoping review of the literature found that negative emotions stemming from climate change awareness and wellbeing impacts are common among child populations<sup>63</sup>. The largest international survey study among young people (10,000 16-25 year olds over 10 countries including the US and Brazil) found the vast majority (84%) were at least moderately worried about climate change and over 45% said their feelings about climate change negatively affected their daily life and functioning<sup>64</sup>. Brazil was eclipsed only by the Philippines in terms of youth anxiety over climate change (89% of Brazilian respondents were at least moderately worried, and 67% were very/extremely worried; half of all respondents said this worry affected their ability to function in everyday life). In one of few longitudinal studies, an Australian study<sup>65</sup> showed that most adolescents hold at least some degree of climate-related worry throughout their adolescence. Those with high and increasing levels of worry tended to be more engaged with politics and current affairs, and those with persistently high worry over time were more likely to report symptoms of depression, again suggesting that, if the threat of climate change remains unaddressed, sustained worry may result in negative mental health and wellbeing outcomes through adolescence.

Preliminary findings from a multi-national research project including Barbados, Trinidad & Tobago and Guyana on youth mental health and wellbeing during two concurrent global health crises – the COVID-19 pandemic and climate change – show that mental health problems, particularly anxiety, were common among youth. Youth showed more interest and concern about climate change than

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<sup>61</sup> Royal College of Psychiatrists (2020). The Climate Crisis Is Taking a Toll on the Mental Health of Children and Young People. [Link](#).

<sup>62</sup> Singh, G., Xue, S. & Poukhovski-Sheremetyev (2022). Climate emergency, young people and mental health: time for justice and health professional action. *BMJ Paediatr. Open.* 6(1): e001375.

<sup>63</sup> Martin, G. et al. (2022). The impact of climate change awareness on children's mental wellbeing and negative emotions – A scoping review. *Child. Adolesc. Ment. Health.* 27(1): 59-72

<sup>64</sup> Hickman, C., Marks, E. et al. (2021), *supra*

<sup>65</sup> Sciberras, E. & Fernando, J.W. (2022). Climate change-related worry among Australian adolescents: an eight-year longitudinal study. *Child Adolesc Ment Health*, 27: 22-29

the pandemic, as well as more feelings of guilt<sup>66</sup>. Further analyses (unpublished data<sup>67</sup>) demonstrated significantly greater self-reported psychological distress in relation to climate change than the pandemic. The respondents with the highest levels of climate distress also reported lower mental wellbeing, again raising concerns that long-term climate distress may contribute to the development of mental health conditions. Given the existing mental health burden across Latin America – in 2021, 16 million adolescents were diagnosed as having a mental disorder, with 11 adolescents per day dying by suicide – urgent action is required to ensure that children can mature in safety and climate stability<sup>68</sup>.

The amount of stress/anxiety about climate change – as reported by their caretakers – appears to increase as children age<sup>69</sup>. Climate anxiety and pessimism related to climate change are even more prevalent in adolescents and emerging adults, compared with children and adults<sup>70</sup>. Children's reactions to climate change threats are affected by their interactions with micro- (family, peers), meso- (school, community), exo- (government, media) and macro- (culture) systems<sup>71</sup>. For example, they are shaped through parental modelling and parent-child interactions about environmental issues. By early adolescence, their ability to comprehend the severity and extent of the issue potentially deepens feelings of anxiety and affects their conceptualisation of their future lives. Negative feelings can be exacerbated when young people lack a sense of agency (belief in their capacity to act on the problem) or the resources to do so.

### *Inadequate action exacerbates climate distress*

In their survey of 10,000 young people, Hickman et al.<sup>72</sup> found that the perceived failure by governments to respond effectively to climate change was linked to increased distress. Smaller qualitative studies that provide a more in-depth understanding of young people's experiences confirm these survey findings. Young people feel frustrated with adult generations, for both

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<sup>66</sup> Vercammen, A. et al. (2023). Investigating the Mental Health Impacts of Climate Change in Youth: Design and Implementation of the International Changing Worlds Study. *Challenges*. 14(3): 34.

<sup>67</sup> Vercammen, A. et al. (unpublished). Youth concerns in three Caribbean countries: The perceived impacts of climate change and COVID-19.

<sup>68</sup> The Lancet Child & Adolescent Health (2022). Adolescence in Latin America and the Caribbean (Editorial). *Lancet. Child. Adolesc. Health*. 6(11): 747.

<sup>69</sup> Baker, C., Clayton, S. & Bragg, E. (2021). Educating for resilience: parent and teacher perceptions of children's emotional needs in response to climate change. *Environ. Educ. Res.* 27(5): 687-705.

<sup>70</sup> Ojala, M. (2012). Hope and climate change: The importance of hope for environmental engagement among young people. *Environ. Educ. Res.* 18(5): 625-642; Clayton, S. & Karazsia (2020). Development and validation of a measure of climate change anxiety. *J. Env. Psych.* 69: 101434.

<sup>71</sup> Crandon, T.J., et al. (2022). A social-ecological perspective on climate anxiety in children and adolescents. *Nat. Clin. Chang.* 12: 123-131.

<sup>72</sup> Hickman, C., Marks, E. et al. (2021), supra.

contributing to climate change and failing to act to stop it<sup>73</sup>. The sense that people in power are responding without sufficient urgency contributes to despair, and adds to fears of future impacts and disenfranchisement<sup>74</sup>. Failure of governments to prevent harm from climate change thus potentially constitutes moral injury (the distressing psychological aftermath experienced when one perpetrates and/or witnesses actions that violate moral or core beliefs).

At the individual level, several factors contribute to increased worry and potentially adverse wellbeing outcomes. These include having a strong connection to the land or nature, as is common for Indigenous peoples, being a girl/young woman, and not having the possibility of taking action<sup>75</sup>.

In sum, the stress of bearing witness to the climate crisis during a crucial developmental phase, in conjunction the increased likelihood of experiencing direct and potentially traumatic climate events throughout life, is expected to significantly increase the incidence of mental illness over the life course of today's children and young people. Negative affective states, maladaptive thought patterns and behaviours linked to climate change awareness are exacerbated by the perceived lack of action and insufficient commitments by governments under international agreements.

### 3. Supporting children's mental health in the context of the climate emergency

Addressing the complex threats posed by climate change to child physical and psychological development requires attention to the causes of climate change, and to the multisystem processes that protect individuals in the near term and nurture resilience for the future<sup>76</sup>.

Three basic approaches to building resilience in the context of adversity, including major disasters, have emerged<sup>77</sup>.

- The **first** approach, risk reduction, aims to prevent or lower the intensity and cumulative level of threats to human survival and development. Risk reduction is clearly the most critical strategy in the context of the existential threats posed by climate change. UNICEF (2021a)<sup>78</sup> makes a powerful case for viewing the climate crisis as a children's rights issue due to enormity of the risks it poses to young people, both those already born and those yet to be born, and the high

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<sup>73</sup> Thomas, I. et al. (2022) Understanding youths' concerns about climate change: a binational qualitative study of ecological burden and resilience. *Child. Adolesc. Psychiatry. Ment. Health.* 16: 110.

<sup>74</sup> Diffey et al. (2022). "Not about us without us" – the feelings and hopes of climate-concerned young people around the world. *Int. Rev. Psychiatry.* 34(5): 499-509.

<sup>75</sup> Léger-Goodes T. et al. (2022). A scoping review of the mental health impacts of the awareness of climate change. *Front Psychol.* 25: 872544.

<sup>76</sup> Sanson, A. & Masten, A. (2023). Climate change and resilience: Developmental science perspectives. *International Journal of Behavioral Development* 1–10.

<sup>77</sup> Masten, A.S. (2021). Resilience in developmental systems. In A.S. Masten (Ed.), *Multisystemic resilience* (pp. 113–134). Oxford University Press.

<sup>78</sup> United Nations Children's Fund. (2021a), *supra*.



vulnerability of children and youth. The most important form of risk reduction is *rapid lowering of greenhouse gas emissions on a global level*, through strategies directed at multiple system levels. If we do not succeed in lowering this global risk to the earth's climate, there will be little we can do to prevent massive suffering for people of all ages, everywhere.

- The **second** approach is to boost access to resources associated with positive development, and
- The **third** is to mobilize powerful adaptive systems that buffer or protect against harmful effects of adversity and drive positive adaptation. These require identification of the resources, protections, and capabilities at multiple system levels that can be mobilized on behalf of child survival and development.

*To build resilience at a national and community level*, UNICEF (2021a) recommended investments that improve access to resilient water, sanitation and hygiene (WASH) services; to health and nutrition services; and to social protection and poverty-reduction programs. It also recommended investing in education on climate change and sustainability, which can build the knowledge and skills that children and youth will need to adapt, cope and contribute effectively in the future that awaits them<sup>79</sup>.

*To build the resilience of individual children and youth*, building effective coping strategies is important. Ojala has identified 3 types of coping with climate anxiety<sup>80</sup>. Problem-focused coping refers to engaging with the cause of the issue, e.g. through information searching or taking action. Taking *collective* action (as part of a larger group) has been shown to attenuate the link between climate anxiety and depression<sup>81</sup> and being involved in activism and having positive images of the future are also protective<sup>82</sup>. However, problem-focused coping can exacerbate negative affect because it increases visibility and understanding of the severity of the problem, while opportunities to act on it effectively as an individual remain limited. Emotion-focused coping (distancing oneself from the threat, e.g. through avoidance or distraction) can help regulate anxiety symptoms but it also disengages the individual from the issues, and it is observed more commonly in those who do not hold strong pro-environmental values. Meaning-focused coping, which involves positive reappraisal, recognising successes in addressing previous large-scale problems,

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<sup>79</sup> Sanson, A. & Masten, A. (2023), *supra*.

<sup>80</sup> Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. *J. Env. Psych.* 32(3):225-233; Ojala, M. (2013). Coping with climate change among adolescents: Implications for subjective well-being and environmental engagement. *Sustainability* 5: 2191–2209.

<sup>81</sup> Schwartz, S.E.O., et al. (2022). Climate change anxiety and mental health: Environmental activism as buffer. *Curr. Psychol.* Feb 28:1-14.

<sup>82</sup> Burke, S.E.L. et al. (2018), *supra*.

and putting trust in societal actors, tends to evoke a sense of purpose and optimism, more active engagement in environmental issues, and also promotes greater subjective well-being and life satisfaction<sup>83</sup>.

The recommendation from Ojala's work therefore is to not only provide children and young people with a solid understanding of climate change, but also to equip them with constructive coping mechanisms and to promote realistic positive thinking. This includes building their sense of agency and efficacy (ability to take effective action), and is supported by young people having trusted role models of adults taking action<sup>84</sup>. Educational systems, teachers/educators, mental health professionals, parents, and other adults can thus contribute to protecting children's mental health in the face of climate change. Sciberras and Fernando (2022) point out that if we wish to unburden our children and adolescents, taking or supporting climate action is more productive than attempting to shield children or adolescents from the reality of climate change<sup>85</sup>. The ultimate responsibility for protecting today's and tomorrow's young people, however, rests on governments who have the capacity to undertake the speedy global action that is required to ensure that they can inherit a liveable planet.



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<sup>83</sup> Ojala, M. Hope and climate change: the importance of hope for environmental engagement among young people. *Environ. Educ. Res.* 18, 625–642 (2011); Ojala, M. Adolescents' worries about environmental risks: subjective well-being, values, and existential dimensions. *J. Youth Stud.* 8, 331–347 (2005).

<sup>84</sup> Sanson et al. (2022), supra.

<sup>85</sup> Sciberras, E. & Fernando, J.W. (2022), supra.