PRELIMINARY NOTE TO THE INTERNATIONAL COURT OF JUSTICE
regarding
***Amicus Curiae* Submission on the**
Request for advisory opinion of the International Court of Justice on the obligations of States with respect to climate change

The following submission is 21 pages in length.
Footnotes account for <u>half</u> of this length and include links to ensure the Court can easily access **all** the source materials.

Additionally, there are approximately 88 pages of **Annexes** to ensure the Court can easily access the **key** source materials.

In consideration of the environment, for **printing purposes,** the ***Amicus Curiae* Submission** contains the core information.

The **Annexes** only should only be printed as needed.

If the Court would like copies of any of the source materials relied upon in this submission or further information regarding the qualifications of many of the cited scientific experts, this be provided upon request. In-person testimony by experts can also arranged.

In the

INTERNATIONAL COURT OF JUSTICE

Request for Advisory Opinion on Obligations of States in Respect of Climate Change

Resolution A/RES/77/276 of 29 March 2023

***Amicus Curiae* Submission**

21 March 2024

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Amicus Curiae **Submission**
Centering Best Available Science and Children's Rights when Considering States' Obligations in the Context of Climate Change

"The climate question is the question of our time. It is the question that casts destiny upon us and the answers we formulate will decide the future of humanity—or if there will be any future at all."

— Luiz Edson Fachin, Justice of the Supreme Federal Court, Brazil[1]

I. Introduction and Purpose of Submission

1. Courts around the world have recognized that climate change could "jeopardize the survival of [humans] on Earth",[2] that it is coming dangerously close to "approaching the point of no return",[3] and that today greenhouse gas emissions "are released into the atmosphere beyond what prudence and respect for human rights require […risking the…] human rights of future generations."[4] As the principal judicial tribunal for the United Nations, the International Court of Justice ("Court" or "ICJ") issues globally respected and influential decisions. As such, the Court's forthcoming Advisory Opinion[5] clarifying States' obligations to restore climate stability and protect fundamental rights guaranteed by international law—especially for children and future generations[6] could profoundly influence the course of humanity.

2. This *Amicus Curiae* brief is submitted by Our Children's Trust to assist the Court by providing a **succinct overview of the best available climate science** to serve as a sound evidentiary basis for the Court's findings regarding States' obligations to **mitigate** climate change under international law. **Specifically, this submission sets forth an upper limit for atmospheric greenhouse gas concentrations based on the best available science**. This approach aligns with the **ultimate objective** of the U.N. Framework Convention on Climate Change ("UNFCCC") and related legal instruments to achieve "**stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system**" within a sufficient timeframe.[7]

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[1] Supreme Federal Court, *PSB et al. v. Brazil*, ADPF 708, Concurring Opinion, at 3 (1 Jul. 2022) (unofficial translation). https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20220701_ADPF-708_decision-3.pdf.
[2] Supreme Federal Court, *PSB et al. v. Brazil*, ADPF 708, Decision, at 3, para. 7 (1 Jul. 2022) (unofficial translation). https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20220701_ADPF-708_decision-1.pdf.
[3] U.S. Ninth Circuit Court of Appeals, *Juliana v. United States*, No. 18-36082, Opinion, at 15 (17 Jan. 2020). https://cdn.ca9.uscourts.gov/datastore/opinions/2020/01/17/18-36082.pdf.
[4] 2ème Chamber Cour d'Appeal Bruxelles, *VZW Klimaatzaak v. Kingdom of Belgium,* Arrêt, 2022/AR/891, para. 266 (30 Nov. 2023) (unofficial translation) https://prismic-io.s3.amazonaws.com/affaireclimat/4460824d-989f-4c3e-ad14-6dc1e4c9a1d3_SP520190923113012320+en.pdf.
[5] U.N. General Assembly, *Request for Advisory Opinion of the International Court of Justice on the obligations of States with respect of climate change*, Resolution 77/276 (29 Mar. 2023).
[6] ICJ Reports 1996, *Legality of the threat or use of nuclear weapons*, Advisory Opinion, International Court of Justice 226, para. 35 (8 Jul. 1996) (This court has considered the impact of State action on future generations stating, "the use of nuclear weapons would be a serious danger to future generations. Ionizing radiation has the potential to damage the future environment, food and marine ecosystems, and to cause genetic defects and illness in future generations."); *see also* Dissenting Opinion of Judge Weeramantry at 455 ("This Court, as the principal judicial organ of the United Nations, empowered to state and apply international law with an authority matched by no other tribunal must, in its jurisprudence, pay due recognition to the rights of future generations. If there is any tribunal that can recognize and protect their interests under the law, it is this Court.").
[7] U.N. Framework Convention on Climate Change, Art. 2 (9 May 1992).

This content is vital, as the Court cannot afford to err on a matter as consequential as the viability of the planet's life-support system.

3. This submission **focuses exclusively on mitigation**—not adaptation or loss and damage—because **there is a limit to the level of climate imbalance to which humanity can adapt and damages for which it can compensate**.[8] Beyond that limit, no technological innovation or level of financial support will allow humanity—especially Small Island nations and those in the global south—to adapt.[9] In the words of Vanessa Nakate, the founder of Youth for Future Africa, "We cannot adapt to starvation, we cannot adapt to extinction, we cannot adapt to lost cultures, lost traditions, to lost histories, and the climate crisis is taking all of these things away."[10]

II. Interest of *Amicus Curiae*

4. Our Children's Trust (*"Amicus"*) submit this statement on its own initiative, pursuant to Practice Direction XII, to ensure that **young people** and **future generations**, who face disproportionate harm from climate change, **are considered in this tremendously consequential Advisory Opinion proceeding.** Our Children's Trust is a non-profit, children's rights law firm specializing in protecting fundamental human rights, in part, by conveying climate science to courts on behalf of youth already imperiled by climate change. *Amicus* represent 169 young plaintiffs globally in landmark cases[11] such as *Juliana v. U.S.* and *Held v. State of Montana*: the first cases, worldwide, to recognize the right to a climate

[8] IPCC, *2023: Summary for policymakers.* In: Climate change 2023: Synthesis report, at 19, para. B.4.2 (2023) ("With additional global warming, limits to adaptation and losses and damages, strongly concentrated among vulnerable populations, will become increasingly difficult to avoid (high confidence).")
https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

[9] Future Earth, et al.,*10 new insights in climate science*, 1-46 at 13 (2022) ("Limits to adaptation are being breached already in different places across the world. Climate adaptation will become increasingly difficult as we approach 1.5°C […]." and ("[A]s the planet continues to warm, we will be increasingly confronted with intolerable impacts of climate change to which people and ecosystems are not able to adapt. In other words, there are limits to adaptation.") https://10insightsclimate.science/wp-content/uploads/2023/02/10NICS-2022-Report-digital.pdf; Federal Constitutional Court*, Neubauer et al. v. Germany*, Case No. 1 BvR 2656/18, 1 BvR 78/20, 1nBvR 96/20, and 1 BvR 288/20, Order, para. 157 (24 Mar. 2021) ("[A]daptation measures on their own would not be enough to sufficiently contain the risks posed to life and health over the long term […]. The legislator must therefore protect life and health by, in particular, taking action to stop climate change […with…] laws that limit greenhouse gas emissions.") (official English translation) https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2021/20210324_11817_order-1.pdf; and Supreme Court of the Netherlands*, Urgenda Foundation v. State of the Netherlands*, No. 19/00135, Judgement, para. 7.5.2 (20 Dec. 2019) ("[A]lthough it is correct that the consequences of climate change can be mitigated by taking adaptation measures, it has not been demonstrated or made plausible that the potentially disastrous consequences of excessive global warming can be adequately prevented by such measures.")
https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2020/20200113_2015-HAZA-C0900456689_judgment.pdf.

[10] People's World, *Ugandan environmental activist Vanessa Nakate: 'We cannot adapt to extinction'* (10 Dec. 2021)
https://www.peoplesworld.org/article/ugandan-environmental-activist-vanessa-nakate-we-cannot-adapt-to-extinction/ (last accessed 16 Mar. 2024).

[11] Our Children's Trust is currently litigating the Canadian climate case *La Rose v. His Majesty the King* (T-1750-19, 2020 FC 1008), ongoing cases in Mexico including *Jóvenes v. Gobierno de México,* No. 1854 (2019), *Pandey v. Union of India* at the National Green Tribunal, Case 187 (2017), *Mbabazi and Others v. Attorney General and National Environmental Management Authority,* High Court of Uganda Holden at Kampala, Civil Suit No. 283 (2012), and cases in several U.S. states: *Layla H. v. Commonwealth of Virginia,* No. CL22000632-00, Va. Ct. App. (2022); *Natalie R. v. State of Utah,* No. 20230022-SC, Utah Sup. Ct. (2022); and *Navahine F. v. Hawai'i Department of Transportation,* No. 1CCV-22-0000631, Haw. Cir. Ct. (2023) where full trial, including the presentation of scientific evidence by experts is scheduled for 24 June 2024 to 14 July 2024.

system capable of sustaining human life,[12] and to enshrine science-based protections for children's fundamental rights into law.[13] *Amicus* have also presented legal and scientific analyses on climate change impacts to various international and regional tribunals, including the U.N. Committee on the Rights of the Child, U.N. Special Rapporteur for Human Rights and the Environment, U.N. Special Rapporteur in the Field of Cultural Rights, European Court of Human Rights, International Tribunal for the Law of the Sea, and Inter-American Court of Human Rights. *Amicus'* legal work is supported by over 50 prominent scientists, including Nobel Prize Laureates, who are the leading experts on topics such as the effect of rising concentrations of atmospheric carbon dioxide ("CO_2") on Earth's current energy imbalance; the cascading global climate harms the world faces with respect to food and water supplies, disease, human health, energy security, national security, economic stability, displacement and mass migration induced by extreme weather events and sea-level rise, and armed conflict; and the technical ability of States to immediately reduce emissions and appreciably avert impending threats and impact. Drawing upon this combination of legal and scientific expertise, together with over a decade of experience supporting youth in legal actions, *Amicus* respectfully submit that Our Children's Trust is well-positioned to represent the interests of young people and future generations.

III. Fundamental Rights Protected by International Law Encompass the Right to a Life-Sustaining Climate System

5. Climate change is an all-enveloping crisis of unrivaled severity and scale, which burdens numerous fundamental rights protected by international law,[14] particularly the rights to: life; adequate food; enjoyment of highest attainable standard of physical and mental health; adequate housing; self-determination; safe drinking water and sanitation; work and the right to development; subsistence.[15] The climate crisis also interferes with the rights to property; private life and family;[16] participation in cultural life;[17] not to be forcibly displaced; non-discrimination; a healthy environment;[18] and the rights of

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[12] United States District Court for the District of Oregon, *Juliana v. United States*, No. 6:15-cv-01517-TC, Opinion and Order, at 32 (10 Nov. 2016) *rev'd and remanded on other grounds*, 947 F.3d 1159 (9th Cir. 2020) ("Exercising my 'reasoned judgment,' I have no doubt that the right to a climate system capable of sustaining human life is fundamental to a free and ordered society.") https://climatecasechart.com/wp-content/uploads/case-documents/2016/20161110_docket-615-cv-1517_opinion-and-order-2.pdf.

[13] Montana First Judicial District Court*, Held et al. v. State of Montana*, No. CDV-2020-307 (2023). bit.ly/HeldFindingsConclusionsOrder.

[14] *See e.g.* U.N. General Assembly, Human Rights Council, *Human rights and climate change*, A/HRC/RES/41/21, at 2 (23 Jul. 2019) ("[C]limate change poses an existential threat for some countries, and recognizing also that climate change has already had an adverse impact on the full and effective enjoyment of the human rights enshrined in the Universal Declaration of Human Rights and other international human rights instruments […].").

[15] U.N. General Assembly, Human Rights Council, *Human rights and climate change*, A/HRC/RES/41/21, at 2 (12 Jul. 2019).

[16] *See e.g.* U.N. Human Rights Committee, *Views adopted by the Committee under article 5 (4) of the Optional Protocol, concerning communication No. 3624/2019: Daniel* Billy *et al. v. Australia,* CCPR/C/135/D/3624/2019, at para. 8.12 (18 Sep. 2023*)* ("The Committee concludes that the information made available to it indicates that, by failing to discharge its positive obligation to implement adequate adaptation measures to protect the authors' home, private life and family, the State party violated the authors' rights […]").

[17] *See e.g.* U.N. Human Rights Committee, *Views adopted by the Committee under article 5 (4) of the Optional Protocol, concerning communication No. 3624/2019: Daniel* Billy *et al. v. Australia,* CCPR/C/135/D/3624/2019, at para. 8.14 (18 Sep. 2023*)* ("[T]he State party's failure to adopt timely adequate adaptation measures to protect the [petitioners'] collective ability to maintain their traditional way of life and to transmit to their children and future generations their culture and traditions and use of land and sea resources discloses a violation of the State party's positive obligation to protect the [petitioners'] right to enjoy their minority culture.").

[18] U.N. General Assembly, *The human right to a clean, healthy and sustainable environment,* A/RES/76/300 (28 Jul. 2022); *see e.g.* ILO Convention, *Indigenous and Tribal Peoples Convention, No. 169* (27 Jun.1989); African Union, *African Charter on Human and Peoples'*

children.[19] Moreover, climate change not only burdens the exercise and enjoyment of these fundamental rights, it also exacerbates the violation of such rights. **These are undisputed facts.** Just as many States have chosen to include the right to a clean and healthy environment in law,[20] so too has the U.N. General Assembly recognizing "the right to a clean, healthy and sustainable environment as a human right […and…] is related to other rights and existing international law."[21]

6. Many courts have also acknowledged the relationship between a healthy environment, stable climate change, and human rights. Judicial decisions recognizing that climate change violates human rights are being issued more broadly and with greater frequency than ever before. While a full survey of the hundreds of decisions at the intersection of climate change and human rights is beyond the scope of this submission,[22] courts, commissions, and tribunals recognize that "the full enjoyment of all human rights depends on a suitable environment";[23] climate change "negatively affects a host of, if not all, human rights";[24] that "climate change is a constitutional matter […imposing…] the duty to defend, preserve and restore it, for present and future generations";[25] "[t]he intergenerational aspect of climate change risks makes the rights of children paramount […and…] places responsibility with today's decision makers to make wise choices for future generations";[26] and the "right to a clean and healthful environment […] encompasses the right to a life-sustaining climate system".[27]

Rights, Art. 24 (1981); Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights ("Protocol of San Salvador") Art. 11 (16 Nov. 1999); I/A Court H.R., The Environment and Human Rights, Advisory Opinion OC-23/17, Series A No. 23 (15 Nov. 2017); and the constitutions and laws of over 150 States.

[19] *See e.g.* U.N. General Assembly, Human Rights Council, *Report of the Office of the United Nations High Commissioner for Human Rights on the relationship between climate change and human rights,* A/HRC/10/61, at 16, para. 48 (15 Jan. 2009) ("Studies show that climate change will exacerbate existing health risks and undermine support structures that protect children from harm. Overall, the health burden of climate change will primarily be borne by children in the developing world."); U.N. General Assembly, *The human right to a clean, healthy and sustainable environment,* A/RES/76/300, at 2 (28 Jul. 2022) ("[T]he human rights implications of environmental damage […] are felt most acutely by […] those segments of the population that are already in vulnerable situations, including […] children […]."); and U.N. Committee on the Rights of the Child, *General comment No. 26 (2023) on children's rights and the environment, with a special focus on climate change* (22 Aug. 2023).

[20] U.N. General Assembly, *Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment*, A/73/188, at 13, para. 36 (19 Jul. 2018) ("Taking into consideration the ratification of regional human rights agreements and environmental treaties, constitutions and national legislation, more than 150 States have already established legal recognition of the right to a healthy environment, with corresponding obligations.").

[21] U.N. General Assembly, *The human right to a clean, healthy and sustainable environment,* A/RES/76/300, at 3 (28 Jul. 2022).]

[22] A summary of judicial decisions invoking fundamental rights in the context of climate change could be prepared upon request.

[23] I/A Court H.R., The Environment and Human Rights, Advisory Opinion OC-23/17, Series A No. 23, at 28, para. 64 (15 Nov. 2017) https://www.corteidh.or.cr/docs/opiniones/seriea_23_ing.pdf.

[24] Commission on Human Rights of the Philippines, *Report: National Inquiry on Climate Change,* at 30 (2022) https://www.escr-net.org/sites/default/files/caselaw/nicc_report.pdf.

[25] Supreme Federal Court, *PSB et al. v. Brazil*, ADPF 708, Decision, at 8, para. 16 (1 Jul. 2022) (unofficial translation) https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20220701_ADPF-708_decision-1.pdf.

[26] Land Court of Queensland, *Waratah Coal Pty Ltd v. Youth Verdict Ltd & Ors* (No. 6)) QLC 21, Decision, para. 1603 (2022). https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20221125_2020-QLC-33-2021-QLC-4-2021-QLC-36-2022-QLC-3-2022-QLC-4_decision.pdf.

[27] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc.,* SCOT-22-0000418, Opinion, at 16, 18 (13 Mar. 2023) https://climatecasechart.com/wp-content/uploads/case-documents/2023/20230313_docket-SCOT-22-0000418_opinion.pdf; *see e.g.* United States District Court for the District of Oregon, *Juliana v. United States*, No. 6:15-cv-01517-TC, Opinion and Order, at 32 (10 Nov. 2016) *rev'd and remanded on other grounds*, 947 F.3d 1159 (9th Cir. 2020) ("Exercising my 'reasoned judgment,' I have no doubt that the right to a climate system capable of sustaining human life is fundamental to a free and ordered society.") https://climatecasechart.com/wp-content/uploads/case-documents/2016/20161110_docket-615-cv-1517_opinion-and-order-2.pdf.

7. Recognizing that a **healthy and stable climate system** is a **prerequisite** to the full exercise and enjoyment of almost every fundamental right protected by international law, *Amicus* respectfully submit a **crucial foundational step** would be for the Court's Advisory Opinion to:

   a. Build on the U.N.'s existing findings—and the emerging jurisprudence of other Courts—and expressly **find** that the fundamental rights enumerated above and protected by international law encompass and **rely upon the right to a life-sustaining climate system.**

   b. **Advise** States to formally recognize in their national laws that the fundamental rights guaranteed by international law and national constitutions **encompass and include the right to a life-sustaining climate system**.

IV. Climate Mitigation Targets Must be Grounded in Best Available Science

8. To enjoy the benefits of scientific progress is a fundamental right.[28] This elemental "right to science" provides the international community with knowledge about the risks and harms posed by toxic and hazardous substances—including greenhouse gas pollution—on the environment, human health, and human rights.[29] It also enables States to develop and implement evidence-based policies, practices, and targets to address such threats—including the existential threat of anthropogenic climate change—and protect the range of human rights that are ravaged when the climate system is destabilized.[30]

9. Legal history offers numerous examples of unreliable scientific evidence contaminating legal proceedings and seriously harming the innocent. To ensure all rights are justly upheld, the time-honored principle of sound evidence, together with international climate agreements, requires courts to employ the **best available science** to determine States' obligations to address the climate crisis.[31]

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[28] U.N. General Assembly, International Covenant on Economic, Social and Cultural Right, Resolution 2200A (XXI), Art. 15(1)(b) (16 Dec. 1966).

[29] *See generally* U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61 (26 Jul. 2021).

[30] *See generally* U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61 (26 Jul. 2021).

[31] U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61, para. 10, *see also* paras. 43, 67 (26 Jul. 2021); I/A Court H.R., The Environment and Human Rights, Advisory Opinion OC-23/17, Series A No. 23, paras. 142, 172 (15 Nov. 2017) (the obligation to prevent environmental degradation must be undertaken in accordance with "scientific or technological knowledge" and the obligation to mitigate damage and reverse climate change relying upon the "best available scientific data and technology".); U.N. Framework Convention on Climate Change, Preamble and Art. 4(2)(c)(d) (1992) ("Recognizing that steps required to understand and address climate change will be environmentally, socially and economically most effective if they are based on relevant scientific, technical and economic considerations and continually re-evaluated in the light of new findings in these areas") (9 May 1992); Kyoto Protocol, Art. 9(1) and Art. 13(4)(b) (10 Dec. 1997); and Glasgow Climate Pact, I(1) (13 Nov. 2021) ("Recognizes the importance of the best available science for effective climate action and policymaking"); and Paris Agreement, Preamble and Art. 4(1) (12 Dec. 2015); *see e.g.* Supreme Federal Court, *PSB et al. v. Brazil*, ADPF 708, Concurring Opinion, at 2 (1 Jul. 2022) ("[t]his is not about opinion or ideology, but about scientific evidence) (unofficial translation) https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20220701_ADPF-708_decision-3.pdf; and Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc,* SCOT-22-0000418, Concurrence, at 10 (13 Mar. 2023) ("Current scientific consensus, as opposed to political consensus in the Paris Agreement regarding an acceptable increase in global average temperature, suggests that mitigation strategies must be consistent with achieving global atmospheric CO_2 concentrations below 350 parts per million ("ppm") by 2100.") (emphasis by the Court) https://climatecasechart.com/wp-content/uploads/case-documents/2023/20230313_docket-SCOT-22-0000418_opinion-2.pdf.

10. "Best available science" has yet to be defined in international law, but in practice means: (i) the most **up-to-date** science that; (ii) is based on internationally recognized scientific **practices, methodologies**, and **standards,** where such standards exist; (iii) maximizes the **quality** and **objectivity** of information used, including statistics and assumptions; (iv) **publicly releases** the data used to reach its conclusions, and publishes its results through the **peer-review** process; (v) clearly **communicates risks** and **uncertainties** in the scientific bases for its conclusions; and (vi) reflects a **consensus** (where consensus exists) or at least rests on multiple peer-reviewed studies from different research groups. [32]

11. The International Covenant on Economic, Social and Cultural Rights, UNFCCC, Kyoto Protocol, Glasgow Climate Pact, and Paris Agreement all **require** that States use the **best available science** to address the climate emergency.[33] This obligation is reiterated by numerous U.N. and international bodies.[34] National and regional courts have also echoed the obligation to use the best available science, underscoring that climate change "is not about opinion or ideology, but about scientific evidence."[35]

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[32] This definition is *predominately* distilled from best practices in scientific research. However, it is also informed by principles established in law. *See e.g.,* U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61, at 9-10, para. 51 (26 Jul. 2021) ("The best available [scientific] evidence consists of reproducible data and analyses derived from trustworthy and unbiased sources, adhering to accepted principles of scientific integrity and responsible conduct of research, published in scientific literature following a process of peer-review. The best available science can be identified because it is broadly accepted by the scientific community or, at minimum, subject to minimal epistemic contestation."); U.S. Supreme Court, *Daubert et al. v. Merrell Dow Pharmaceuticals Inc.,* 509 U.S. 579 at 579, 592-595 (28 Jun. 1993) (The five non-exclusive factors judges should consider when determining whether evidence is based on scientifically valid reasoning and been properly applied are: (i) whether the technique or theory can be or has been tested; (ii) whether it has been subjected to peer review and publication; (iii) the known or potential error rate; (iv) the existence and maintenance of standards controlling its operation; and (v) whether it has attracted wide acceptance within a relevant scientific community.) https://supreme.justia.com/cases/federal/us/509/579/; and 33 U.S.C. § 1321(a)(27).

[33] U.N. General Assembly, International Covenant on Economic, Social and Cultural Right, Resolution 2200A (XXI), Art. 15(1)(b) (16 Dec. 1966); U.N. Framework Convention on Climate Change, Preamble, Art. 4(2)(c)(d), and Art. 7 (9 May 1992); Kyoto Protocol, Art. 9(1) and 13(4)(b) (10 Dec. 1997); Glasgow Climate Pact, I(1) (13 Nov. 2021); and Paris Agreement, Preamble and Art. 4(1) (12 Dec. 2015).

[34] *See e.g.* U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61, para. 10 (26 Jul. 2021) ("The right to science requires that governments adopt measures to prevent exposure to hazardous substances on the basis of the best available scientific evidence."); U.N. Committee on the Rights of the Child, *General comment No. 26 (2023) on children's rights and the environment, with a special focus on climate change*, CRC/C/GC/26, para. 97 (22 Aug. 2023) ("Mitigation objectives and measures should be based on the best available science […]."); and *see* para. 95 (Further calling "for urgent collective action by all States to mitigate greenhouse gas emissions, in line with their human rights obligations."); U.N. Special Rapporteur on the promotion and protection of human rights in the context of climate change, *Exploring approaches to enhance climate change legislation, supporting climate change litigation and advancing the principle of intergenerational justice*, A/78/255, para. 69(d) (28 Jul. 2023) ("With respect to mitigation, it should be ensured that new climate legislation: (d) Ensures that science and Indigenous knowledge are given primacy in decision-making processes associated with climate change mitigation actions […]."); Office of the High Commissioner for Human Rights, *Panel discussion on the adverse impact of climate change on the full and effective enjoyment of human rights by people in vulnerable situations*, A/HRC/52/48, para. 55 (27 Dec. 2022) (stating that States' policies should be "in line with the recommendations of the scientific community, as well as States' human rights obligations."); U.N. Environment Program, *Ministerial declaration of the United Nations Environment Assembly at its fifth session*, UNEP/EA.5/HLS.1, para. 18 (4 Dec. 2022) ("We recognize the importance of the best available science for effective action and policymaking on climate change, biodiversity and pollution […]."); and U.N. Special Rapporteur human rights and the environment, *Thematic Report: The human right to a clean, healthy and sustainable environment: a catalyst for accelerated action to achieve the Sustainable Development Goals,* A/77/284, para. 41(b) (10 Aug. 2022) ("Establish monitoring programmes, assess major causes of harm to the climate …] and use the best available scientific evidence to develop laws, regulations, standards and policies.")

[35] Supreme Federal Court, *PSB et al. v. Brazil*, ADPF 708, Concurring Opinion, at 2 (1 Jul. 2022) (unofficial translation)

This recognized obligation to rely on the best available science ensures that judicial **findings of fact are accurate** and, consequently, that **legal conclusions** issued by courts regarding States' obligations to address climate change **are effective, just, and practical**.[36]

12. Considering the recognized legal obligation to use the best available science, *Amicus* respectfully submit that the Court's Advisory Opinion:

    a. **Reiterate** and **elevate** the importance of States' existing commitment to use the **best available science** to address the climate crisis in accordance with their obligations under international law.

    b. To complement this finding, **advise** States to ensure their national laws, policies, practices, and mitigation targets are **aligned** with the **best available science.**

V. The Temperature Targets in Art. 2(1)(a) of the Paris Agreement Are Political, Conflict with the Best Available Science, and Are Unsafe for Humanity

13. In judicial proceedings where climate is at issue, the **non-science based** Paris temperature targets of "[h]olding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels"[37] have been represented inaccurately to courts as the best scientific evidence and *de facto* legal standard for compliance with international legal principles, obligations, and human rights.[38] **Importantly, the 1.5ºC Paris**

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https://climatecasechart.com/wp-content/uploads/non-us-case-documents/2022/20220701_ADPF-708_decision-3.pdf; *See e.g.* Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc,* SCOT-22-0000418, Concurrence, at 10 ("Current scientific consensus, as opposed to political consensus in the Paris Agreement regarding an acceptable increase in global average temperature, suggests that mitigation strategies must be consistent with achieving global atmospheric CO_2 concentrations below 350 parts per million ("ppm") by 2100 (emphasis by the Court) (13 Mar. 2023). https://climatecasechart.com/wp-content/uploads/case-documents/2023/20230313_docket-SCOT-22-0000418_opinion-2.pdf; and I/A Court H.R., The Environment and Human Rights, Advisory Opinion OC-23/17, Series A No. 23, para. 142, 172 (15 Nov. 2017). (The Inter-American Court of Human Rights determined that States' obligation to prevent environmental degradation must be undertaken in accordance with "scientific or technological knowledge" and that States have the obligation to mitigate damage and reverse climate change relying upon the "best available scientific data and technology".).

[36] *See* Alexa Koenig et al., *Climate candor: Ridding climate case of questionable science*, Open Global Rights, Center for Human Rights and Global Justice and the Future of Rights Program at New York University School of Law (5 Dec. 2023) https://www.openglobalrights.org/climate-candor-ridding-climate-cases-questionable-science/ (last accessed 16 Mar. 2024).

[37] Paris Agreement, Art. 2(1)(a) (12 Dec. 2015).

[38] Andrea Rodgers et al., *The injustice of 1.5 °C–2 °C: The need for a scientifically based standard of fundamental rights protection in constitutional climate change cases*, Va. Env't L. J., 40:102-151 at 102, 105 (2022) http://www.velj.org/uploads/1/2/7/0/12706894/40.2_va_envt_l.j._rodgers_sancken_marlow_102_151.pdf; *See e.g.* ECHR, *KlimaSeniorinnen v. Switzerland*, No. 53600/20, Observations on the facts, admissibility, and the merits (2 Dec. 2022) (In 2016, over 2,000 older women asserted that Switzerland failed to take sufficient climate action exposing them to climate-induced heatwaves. To remedy the resulting violations, Applicants asked the court to order Switzerland to meet the 1.5°C Paris target. In 2016, the Earth's average surface temperature was ~1.07°C above pre-industrial levels. The Applicants erred in asking the Court to sanction a target that is *higher* than the temperature at the time the violations occurred.) s*ee e.g.* Executive Summary, para. 4; Section 1.10, paras. 33-36; Section 3, paras. (2)(a-d), https://en.klimaseniorinnen.ch/wp-content/uploads/2022/12/221202_53600_20_Observations_GC_KlimaSeniorinnen_and_others_v_Switzerland.pdf; *Duarte Agostinho and Others v. Portugal and 32 Others*, Application No. 39371/20, Observations of the Applicants on admissibility and the merits (9 Feb. 2022) (Assertions similar to those in *KlimaSeniorinnen* were made by child applicants from Portugal against 33 States. Applicants also presented the 1.5°C target as the remedy on 559 pages of their 868-page submission even though the average global temperature was *lower* at the time the violations occurred.) *see e.g.* paras. 2, 5(a)(i), 5(e), and 5(f) (accessible via https://youth4climatejustice.org/case-documents/ (last accessed 16 Mar. 2024); and ITLOS, *Request for an Advisory Opinion on Climate Change and International Law,* Case No. 31, Written statement of the commission of small island states on climate change

Agreement target is compatible with neither the best available science nor with States' human rights obligations, for two critical reasons.

14. First, **the 1.5ºC target is a product of political negotiation, not scientific inquiry**.[39] As this Court is aware, States established the UNFCCC and the Conference of the Parties ("COP") to continuously adopt decisions, review progress, and consider further action on climate change.[40] States Parties do this by conducting regular meetings to "negotiate limits to global greenhouse gas (GHG) emissions [… operating] by 'agreement by consensus'."[41] Consequently, "the target selection process was less concerned with scientific precision and more concerned with forming international consensus."[42] These negotiations reached a pinnacle at the 2015 COP where "French hosts understood the grand game of international negotiation and used every trick in the diplomatic playbook to get countries working together to achieve an agreement signed by all."[43] The target set forth in this 2015 agreement—1.5°C to

(16 Jun. 2023) (The Commission of Small Island States (COSIS) underscores "up-to-date scientific data is a critical yardstick against which States' environmental due diligence obligations must be measured" and highlights the "devastating effects" Small Island States will suffer even if global warming remains under 1.5°C. Yet, the COSIS concludes that a 1.5°C target would be an acceptable legal standard.) *see e.g.* paras. 6 and 122 (https://www.itlos.org/fileadmin/itlos/documents/cases/31/written_statements/2/C31-WS-2-4-COSIS.pdf, s*ee also* ITLOS, Case No. 31, *Amicus Curiae* Submission, Our Children's Trust and Oxfam International (16 Jun. 2023) https://static1.squarespace.com/static/571d109b04426270152febe0/t/648cd2f4ad01e61bc15fe7ba/1686950668877/2023.06.15+ITLOS+Submission+FINAL.pdf.

[39] Andrea Rodgers et al., *The injustice of 1.5˚C–2˚C: The need for a scientifically based standard of fundamental rights protection in constitutional climate change cases*, Va. Env't L. J., 40:102-151 at 104 (2022) ("By design, the Paris Agreement target began as a heuristic intended to guide policy decisions addressing climate change. A review of the history leading up to the Paris Agreement reveals the target was based on intergovernmental compromise, not science.") http://www.velj.org/uploads/1/2/7/0/12706894/40.2_va_envt_l.j._rodgers_sancken_marlow_102_151.pdf; Béatrice Cointe et al., *A history of the 1.5°C target,* WIREs Clim. Change, e824:1-11 (2023) (Referring to 1.5°C as "originated with a political impetus", a "politically driven target"; "politically approved"; with its origins "clearly on the diplomatic side"; with an "overtly political history"; and "the result of intense and difficult negotiations") https://doi.org/10.1002/wcc.824; Maslin M. Lang et al., *A short history of the successes and failures of the international climate negotiations,* UCL Open: Environment, 5(08):1-16 at 5-6 (2023) ("There were some important *political* breakthroughs, including the agreement on the 2°C target […]. Paris was a high-stakes game of *geopolitical poker*.")(emphasis added) https://doi.org/10.14324/111.444/ucloe.000059; Reto Knutti et al., *A scientific critique of the two-degree climate change target*, Nat. Geosci., 9(1):13-18 at 13 (2016) ("[T]he UNFCCC formally decided in 2012 to pursue actions in line with a 2°C global temperature increase target. This target was a *political* decision informed by science, but no scientific assessment ever defended or recommended a particular target.") (emphasis added) https://www.nature.com/articles/ngeo2595; Justin Gillis, *Paris climate talks avoid scientists' idea of 'carbon budget'*, New York Times (28 Nov. 2015) ("Yet the negotiators gathering in Paris will not be discussing any plan that comes close to meeting their own stated goal of limiting the increase of global temperatures to a reasonably safe level. They have pointedly *declined* to take up a recommendation from scientists […]" because "Politically, it would be very difficult.") https://www.nytimes.com/2015/11/29/science/earth/paris-climate-talks-avoid-scientists-goal-of-carbon-budget.html (last accessed 16 Mar. 2024); James E. Hansen, Ph.D., Expert Report in *Juliana v. United States*, 339 F. Supp. 3d 1062, No. 6:15-cv-01517-TC (D. Or. 28 Jun. 2018), ECF No. 274-1 at 24 ("This 450 ppm CO_2 target [~2.0°C] avoided the need to face the task of confronting the powerful fossil fuel industry in the near term.") https://climatecasechart.com/wp-content/uploads/case-documents/2018/20180628_docket-615-cv-1517_exhibit-7.pdf; and *see generally* Piero Morseletto et al., *Governing by targets: Reductio ad unum and evolution of the two-degree climate target*, Int'l Env't Agreements: Pol., L. & Econ., 17:655-676 (2017) https://link.springer.com/article/10.1007/s10784-016-9336-7.

[40] U.N. Framework Convention on Climate Change, Preamble and Art. 7(2) (9 May 1992).

[41] Maslin M. Lang et al., *A short history of the successes and failures of the international climate negotiations,* UCL Open: Environment, 5(08):1-16 at 2 (2023) https://doi.org/10.14324/111.444/ucloe.000059.

[42] Andrea Rodgers et al., *The injustice of 1.5˚C–2˚C: The need for a scientifically based standard of fundamental rights protection in constitutional climate change cases*, Va. Env't L. J., 40:102-151 at 112 (2022) http://www.velj.org/uploads/1/2/7/0/12706894/40.2_va_envt_l.j._rodgers_sancken_marlow_102_151.pdf.

[43] Maslin M. Lang et al., *A short history of the successes and failures of the international climate negotiations,* UCL Open: Environment, 5(08):1-16 at 6 (2023) https://doi.org/10.14324/111.444/ucloe.000059. A more detailed history of how power dynamics

2°C above pre-industrial levels—still stands today. While the Paris Agreement is an important and relevant achievement of international negotiation and cooperation, the Paris temperature targets reflect the **best consensus** that States were able to reach in 2015 but, crucially, not **the best available science** available at the time—and certainly not the best science available today.[44] **To be clear, the notion that the immutable laws of physics and chemistry would bend to conform to the agreement of international negotiators who cast science aside for political consensus is a profoundly flawed approach to safeguard humanity.**

15. Second, **the best available science from the Intergovernmental Panel on Climate Change ("IPCC") and countless scientific studies have found that even the more ambitious temperature target of 1.5ºC of warming is not safe[45] and would result in widespread and serious human rights violations on a staggering scale**,[46] particularly for children,[47] the global south,[48] and small island developing states.[49]

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between governments of the global north and global south and between governments and the fossil fuel industry—not science—drove States to 1.5ºC is beyond the scope of this submission; however, it is available in Annex B; and Juan Auz et al., *The neocolonial violence of 1.5°C*, Open Global Rights, Center for Human Rights and Global Justice and the Future of Rights Program at New York University School of Law (6 Oct. 2023) https://www.openglobalrights.org/neocolonial-violence-1-5C-threshold/.

[44] Notably, the Paris Agreement temperature targets were supported by the fossil fuel majors, including Exxon Mobil, who stated as of 2021: "We commend President Biden's decision to rejoin the Paris Agreement, a framework that ExxonMobil has supported since its adoption in 2015." ExxonMobil, *Reaffirming our commitment to the Paris Climate Agreement*, (20 Jan. 2021) https://corporate.exxonmobil.com/news/viewpoints/commitment-paris-agreement (last accessed 16 Mar. 2024).

[45] IPCC *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C,* at 44 (2019) https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf.

[46] IPCC, *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C,* (2019) https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf; IPCC, *2023: Summary for Policymakers.* In: Climate change 2023: Synthesis report (2023) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf; and IPCC, *2023: Longer Report,* In: Climate change 2023: Synthesis report (2023) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.

[47] *See e.g.* U.N. Children's Fund, *The climate crisis is a child rights crisis: Introducing the children's climate risk index*, at 11 (2021) ("Almost every child on Earth is exposed to **at least 1** […] major climate and environmental hazards, shocks and stresses.") (emphasis by UNICEF) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf. Further scientific findings available upon request.

[48] *See e.g.* Matthew W. Jones et al., *Global and regional trends and drivers of fire under climate change*, Rev. Geophys., 60(e2020RG000726):1-76 at 12 (2022) (At current levels of warming (1990-2019 average), South America has experienced the second highest increase in length of the fire season and has experienced the greatest increase in conditions conducive to fire ignition and spread anywhere in the globe. This is expected to worsen relative to the 1990-2019 average by 21% for fire season length and 55.6% for extreme fire weather under the 1.5°C scenario). https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2020RG000726. Further scientific findings available upon request.

[49] *See e.g.* Michalis I. Vousdoukas et al., *Small island developing states under threat by rising seas even in a 1.5ºC warming world*, Nat. Sustain., 1-13 at 3 (2023) (Small island developing states already suffer high losses and damage from extreme events. For instance, in 2019, tropical cyclone Dorian resulted in over US $3 billion in damages and losses linked to flooding only in the Bahamas, with 30,000 people impacted, 67 fatalities, and 282 missing. Losses and damages will increase as the world approaches 1.5°C); Adele M. Dixon et al., Future loss of local-scale thermal refugia in coral reef ecosystems, PLoS Climate, 1(2):1-20 at 4 (2022) (From 1986-2019, ~84% of areas within coral reefs served as a refuge for coral protecting coral from rising sea temperatures. At 1.5°C the area of refuge drops drastically to 0.2%) https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000004. Further scientific findings available upon request.

16. In 2008—**seven years before** the Paris Agreement—scientists raised the alarm that the then-existing warming of 0.9°C-1.0°C[50] was "already in the dangerous zone."[51] Scientists subsequently warned that planetary heating of 1.5°C will have disastrous consequences for human society.[52] In 2018, the IPCC **explicitly confirmed** these earlier warnings:

> Warming of **1.5°C is not considered** "**safe**" […] and poses significant risks to natural and human systems as compared to the current warming of 1°C […]. The impacts of 1.5°C of warming would disproportionately affect disadvantaged and vulnerable populations through **food insecurity, higher food prices, income losses, lost livelihood opportunities, adverse health impacts and population displacements** […]. Some of the **worst impacts** on sustainable development are expected to be felt among […] **children** […]."[53]

17. Since 2018, the IPCC has only **reiterated** its conclusions:

> **Risks** and projected adverse impacts and related losses and damages from climate change will **escalate with <u>every increment</u> of global warming** […]. They are higher for global warming of 1.5°C than at present […]. [54]

18. More recent research affirms the litany of problems with 1.5°C:

> [T]here is agreement that **1.5°C** or more of warming **entails enormous danger for human society** and the broader Earth system […]. We now know that continued use of fossil fuels associated with 1.5–2°C scenarios would result in **hundreds of millions of pollution deaths** and likely **trigger multiple tipping elements** in the Earth system. […]

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[50] The 2008 estimated increase of 0.9°C-1.0°C of mean average global temperature increase above preindustrial levels is relative to the 1881-1910 average and based on the following data sets: NASA's Goddard Institute for Space Studies (0.9°C), NOAA Global Surface Temperature Dataset (0.9°C), Berkley Earth (1.0°C), and the Hadley Centre (1.0°C). Datasets available at: https://data.giss.nasa.gov/gistemp/, https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.ncdc:C01585, https://berkeleyearth.org/data/, and https://www.metoffice.gov.uk/hadobs/hadcrut5/.

[51] James Hansen et al., *Target atmospheric CO_2: Where should humanity aim?,* Open Atmospheric Sci. J., 2:217-231 at 218, 228 (2008) ("[T]he present global mean CO_2, 385 ppm, is already in the dangerous zone." and, "[T]oday's CO_2, about 385 ppm, is already too high to maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted.") https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf; and IPCC, *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C,* (2019) (In 2018, the IPCC estimated that global warming had already reached between 0.8° C and 1.2°C of warming and that this level of warming was already burdening human rights.) https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf.

[52] IPCC, *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C,* (2019) https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf; IPCC, *2023: Summary for Policymakers.* In: Climate change 2023: Synthesis report (2023) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf; and IPCC, *2023: Longer Report,* In: Climate change 2023: Synthesis report (2023) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf; *See also,* Annex A.

[53] IPCC *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C,* at 44 (2019) (emphasis added) https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_LR.pdf.

[54] IPCC, *2023: Summary for policymakers,* In: Climate change 2023: Synthesis report, at 15, para. B.2.2, *see also* paras. B.1, B.1.3, Figure SPM.2, B.2, Figure SPM.4, C.1.1, and Figure SPM.6 (2023) (emphasis added) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

> If sustained through the end of the century or longer, this level of warming would very likely result in **immense damage to human society** […].[55]

The research concludes:

> The UN's Paris Agreement goal of keeping global warming between 1.5 and 2°C is **dangerously obsolete** and needs to be replaced by a commitment to **restore Earth's climate.**[56]

19. Moreover, science increasingly demonstrates that the 1.5°C target "is associated with substantial risk of triggering irreversible large change and that crossing tipping points cannot be excluded even at lower temperature increases."[57]

20. The failure of States to update the temperature targets set forth in the 2015 Paris Agreement is also at odds with the: (i) mandate set forth by States Parties in the UNFCCC;[58] and (ii) obligation to align government policies with the best and most up-to-date scientific evidence. The mandate necessitates that States continually "assess[] the effects of the measures taken by Parties and the progress made in achieving the ultimate objective of the Convention."[59] The obligation to use the best available science demands that "processes be established for the review of outdated policy decisions, taking into account the evolving, non-static nature of scientific information."[60]

21. Over eight years have passed since the Paris Agreement temperature targets were negotiated and the **scientific evidence indicating the immense dangers** of allowing global heating to continue up to—and then remain at—even the lower target of 1.5°C **continues to mount**. Yet, despite clear and convincing evidence that 1.5°C will cause immense disruption and grave human rights violations, **States remain silent** on the adequacy of the targets **knowingly** allowing the severity of climate change to reach catastrophic proportions.[61, 62]

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[55] Benjamin W. Abbott et al., *Accelerating the renewable energy revolution to get back to the Holocene,* Earth's Future, 11:1-14 at 1-2 (2023) (emphasis added) https://doi.org/10.1029/2023EF003639.

[56] Benjamin W. Abbott et al., *Accelerating the renewable energy revolution to get back to the Holocene,* Earth's Future, 11:1-14 at 1 (2023) (emphasis added) https://doi.org/10.1029/2023EF003639.

[57] Katherine Richardson et al., *Earth Beyond Six of Nine Planetary Boundaries,* Science Advances 9:1-16 at 2 (2023) https://www.science.org/doi/epdf/10.1126/sciadv.adh2458; David Armstrong McKay et al., *Exceeding 1.5°C global warming could trigger multiple climate tipping points,* Sci., 377 (6611):1-10 at 1 ("We show that even the Paris Agreement goal of limiting warming to well below 2°C and preferably 1.5°C is not safe as 1.5°C and above risks crossing multiple tipping points.") https://doi.org/10.1126/science.abn7950.

[58] U.N. Framework Convention on Climate Change, Art. 2 and Art. 7(2)(a), (e) and (l) (9 May 1992).

[59] U.N. Climate Change, *Conference of the Parties (COP)*, https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop (last accessed 16 Mar. 2024).

[60] U.N. General Assembly, Human Rights Council, *Right to science in the context of toxic substances: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes,* A/HRC/48/61, para. 39 (26 Jul. 2021).

[61] Benjamin W. Abbott et al., *Accelerating the renewable energy revolution to get back to the Holocene,* Earth's Future, 11:1-14 at 1 (2023) ("Despite convincing evidence that 1.5°C of warming would cause immense disruption to Earth systems, especially human civilization, many policy makers and researchers continue to treat this target as acceptable […].") https://doi.org/10.1029/2023EF003639.

[62] A discussion with respect to the adequacy the temperature targets in Art. 2(1)(a) of the Paris Agreement has not been on the agenda of any of the COP since 2015. Further, at the most recent COP in Dubai, States resisted calls to commit to "phasing out" fossil fuels—a requisite action to even keep the 1.5°C target within reach (*see* paras. 27-29 below). Instead, State Parties merely pledged to transition away from fossil fuels. To access the agendas for all the COPs, https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop (last accessed 16 Mar. 2024).

22. Considering: (i) the Paris temperature targets were reached via **political consensus** rather than based on the state of scientific knowledge in 2015 and today; (ii) the **IPCC's consistent findings** that 1.5°C is not safe; (iii) the **copious additional research** cataloging the dangers of 1.5°C of heating; and (iv) the **outdated status** of the targets, *Amicus* respectfully submit that the Court's Advisory Opinion:

    a. **Avoid reinforcing the misconception** that restricting the average global temperature increase to 1.5°C is legally sufficient in light of the best available science.

    b. **Affirm** that **scientific consensus** finds that even the Paris Agreement's more restrictive target of 1.5°C is unsafe for humanity.

    c. **Find** that the **Paris temperature targets are a flawed reference point** for determining States' compliance with their obligations under international law.

    d. **Advise** States to **update** their international commitments and national laws, policies, practices, and mitigation targets to recognize that the temperature targets established in the Paris Agreement fail to protect fundamental rights.

VI. The Best Available Science Finds that to Protect Human Rights, the Level of Atmospheric CO_2—the Primary Climate Pollutant—Must be Limited to 350 ppm

23. The best available science finds that **to restore Earth's energy balance**[63] and stabilize the climate system States must reduce the annual mean concentration[64] of atmospheric CO_2 from the 2023 level of **421 parts per million ("ppm")**[65] (a level currently resulting in ~1.2°C to 1.3°C of temperature rise

[63] The Global Climate Observing System, *Where does the heat go?* ("Earth Energy Imbalance is the difference between the amount of energy from the sun arriving at the Earth and the amount returning to space. It serves as a fundamental metric to allow the scientific community and the public to assess how well the world responds to the task of bringing climate change under control.") https://gcos.wmo.int/en/news/where-does-heat-go#:~:text=The%20Earth%20Energy%20Imbalance%20(EEI,bringing%20climate%20change%20under%20control (last visited 16 Mar. 2024).

[64] "Annual mean concentration of atmospheric CO_2" is the amount of carbon dioxide in the atmosphere. It is measured in parts per million (ppm). Ppm is the number of CO_2 molecules per million molecules of the air that sits 8-12 kilometres above the Earth's surface. Just as one percent means one out of a hundred, one ppm means one out of a million. While each ppm denotes a *very* small numerical value, the geologically unprecedented large and rapid change in ppm of CO_2 in our atmosphere over the last century are devastating for the planet and human rights, such that *every ppm matters*. *See* https://climate.nasa.gov/vital-signs/carbon-dioxide/ (last accessed 16 Mar. 2024).

[65] The annual mean concentration of atmospheric CO_2 by year from 1959 to present is available at *Trends in atmospheric Carbon Dioxide,* NOAA Earth System Research Lab., https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_annmean_mlo.txt (last accessed 16 Mar. 2024).

above pre-industrial levels)[66] to **350 ppm** or lower.[67] **This ceiling is known as the 350 ppm limit or Earth's** "**planetary boundary**".

24. The 350 ppm limit is uncontroversial. Scientists continue to identify 350 ppm as the maximum "safe" limit for CO_2 and **no scientific body or journal—including the IPCC—has published any scientific evidence indicating that concentrations *above* 350 ppm are safe.** Moreover, as discussed in Part VII below, emerging jurisprudence supports the legal finding that States should be obligated to adopt and implement climate action to achieve the 350 ppm limit, and *not* the 1.5ºC Paris target, as protective of human rights.[68]

[66] The indeterminacy of global average temperature rise is one of the reasons temperatures make a poor metric for evaluating the extent of global warming. For purposes of the submission, the average global temperature rise above pre-industrial levels through 2023 was ~1.2°C–1.3°C. The difference in the temperature records—and in turn the range of calculated temperature rise above preindustrial levels from NOAA, NASA, Hadley, Copernicus, and Berkeley Earth—make it difficult to determine whether and when global temperature targets may have been breached and are one of the reasons why measurements of atmospheric CO_2 are much more precise. The IPCC indicates a "likely range of total human caused global surface temperature increase" of 0.8°C to 1.3°C however this range is outdated.

[67] *See e.g.* James Hansen et al., *Target atmospheric CO_2: Where should humanity aim?,* Open Atmospheric Sci. J., 2:217-231 at 217, 229 (2008) ("If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm, but likely less than that.") https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf; Johan Rockström et al., *A safe operating space for humanity*, Nature 461:472-475 at 473 (2009) ("[H]uman changes to atmospheric CO_2 concentrations should not exceed 350 parts per million by volume [...] above pre-industrial levels.") https://www.nature.com/articles/461472a; Will Steffen et al., *Planetary boundaries: Guiding human development on a changing planet*, Science, 347:736-746 at 739 (2015) ("We retain the control variables and boundaries originally proposed—i.e., an atmospheric CO_2 concentration of 350 parts per million (ppm) […].) https://www.science.org/doi/10.1126/science.1259855; Katherine Richardson et al., *Earth beyond six of nine planetary boundaries*, Sci. Adv., 9:1-16 at 2 (2023) ("Precaution places the planetary boundary at the start of increasing risk (350 ppm ≈ 1°C)") https://www.science.org/doi/10.1126/sciadv.adh2458; Benjamin W. Abbott et al., *Accelerating the renewable energy revolution to get back to the Holocene,* Earth's Future, 11:1-14 at 1 (2023) ("Despite convincing evidence that 1.5°C of warming would cause immense disruption to Earth systems, especially human civilization, many policymakers and researchers continue to treat this target as acceptable […].").https://doi.org/10.1029/2023EF003639; and Annex A.

[68] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc,* SCOT-22-0000418, Concurrence, at 9-11 (13 Mar. 2023) ("Governments cannot use the 1.5°C Paris Agreement target as a mechanism to delay reducing emissions until that threshold has been met. […] The target for emission reductions must instead be based on the level of atmospheric CO_2 that ensures a life-sustaining climate system. […] Current scientific consensus, as opposed to political consensus in the Paris Agreement regarding an acceptable increase in global average temperature, suggests that mitigation strategies must be consistent with achieving global atmospheric CO_2 concentrations below 350 parts per million ("ppm") by 2100. […] Limiting atmospheric CO_2 levels to below 350 ppm is essential to […] 'restore a viable climate system on which the life, liberty, and property' of all people depend."); and Montana First Judicial District Court, *Held et al. v. State of Montana*, CDV-2020-307, Findings of Fact at paras. 67-92 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.

25. Another **misconception** that emerges from the 1.5°C target is that **States can still emit CO_2** in line with their "remaining" carbon budgets because the planet is not yet in an "overshoot" scenario. **This is categorically incorrect.** Earth crossed the 350 ppm limit in 1988, the year the United Nations established the IPCC.[69] Today—at ~70 ppm over the limit[70]—**Earth has been immersed in an overshoot scenario for 35 years**.[71] Research concludes that "**[i]f the present overshoot of this target CO_2 is not brief, there is a possibility of seeding irreversible catastrophic effects.**"[72]

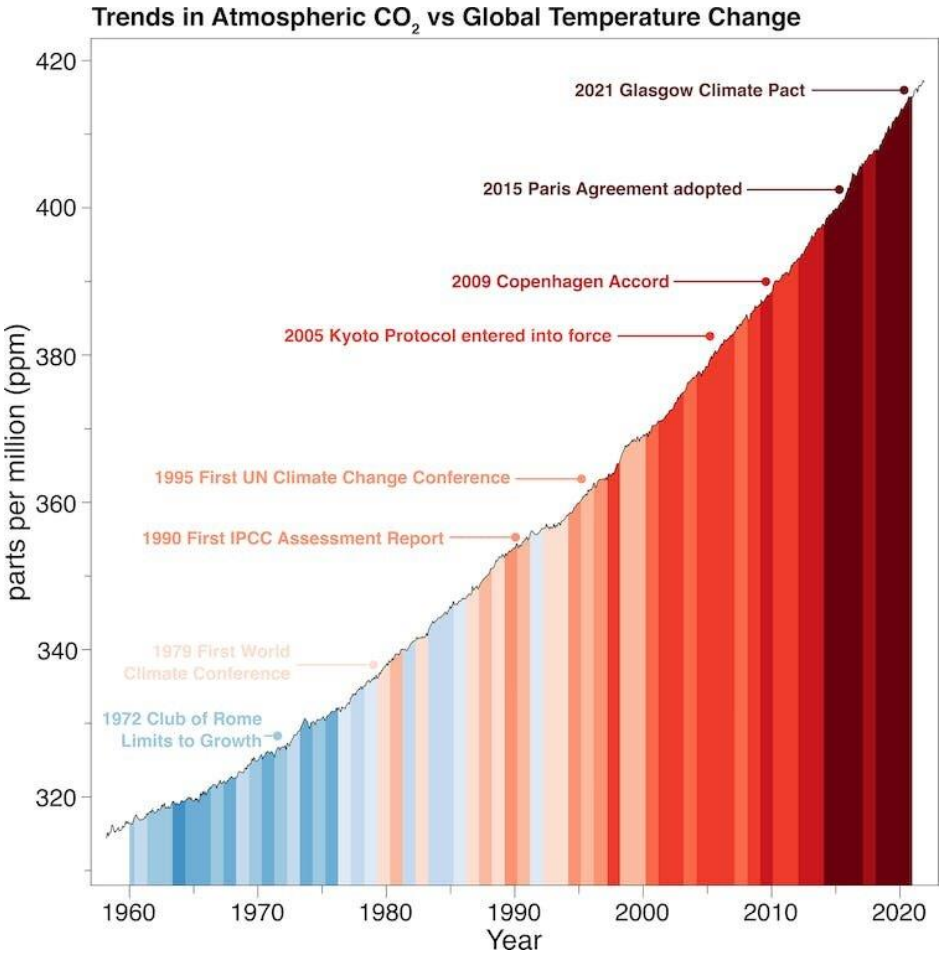

Figure 1. Successive COPs have failed to arrest the upward trajectory of atmospheric CO_2 emissions.[73]

[69] *Trends in atmospheric Carbon Dioxide,* NOAA Earth System Research Lab., https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_annmean_mlo.txt (last accessed 16 Mar. 2024).
[70] *Trends in atmospheric Carbon Dioxide*, NOAA Earth System Research Lab., https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_annmean_mlo.txt (last accessed 16 Mar. 2024).
[71] Robin D. Lamboll, *Assessing the size and uncertainty of remaining carbon budgets,* Nat. Clim. Change, 13:1360-1367 (2023) (For comparison with the unsafe target of 1.5°C: to achieve a *50% chance* of keeping warming to—not below—1.5°C, as of January 2023 States could only emit a total of another 250 gigatons of CO_2, which is around six years of current CO_2 emissions.) https://doi.org/10.1038/s41558-023-01848-5.
[72] James Hansen, *Target atmospheric CO_2: Where should humanity aim?*, Open Atmospheric Sci. J., 2:217-230 at 217 (2008) (emphasis added) https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf; and Johan Rockström et al., *A safe operating space for humanity*, Nature 461:472-475 at 473 (2009) ("Transgressing these boundaries will increase the risk of irreversible climate change […].") https://www.nature.com/articles/461472a.
[73] Mark Maslin et al., *Opinion: COP27 will be remembered as a failure—here's what went wrong,* Phys.org (22 Nov. 2022) https://phys.org/news/2022-11-opinion-cop27-failurehere-wrong.html (last accessed 16 Mar. 2024).

26. The irreversible catastrophic effects that scientists are most concerned about are **climate tipping points**,[74] or points of no return.[75] If one tipping point is crossed, it increases the likelihood of triggering other tipping points, causing an unstoppable cascade of impacts.[76] This would further reinforce global warming, resulting in runaway effects that cannot be controlled, and may make large areas of our planet uninhabitable for humanity.[77]

27. Fortunately, pathways to 350 ppm of atmospheric CO_2 are not only technologically feasible, but also promote economic health, increased energy security, and climate justice. In brief, to achieve 350 ppm, States must prioritize two **objectives**: (i) phase out the emission of economy-wide CO_2 and minimize other greenhouse gas emissions; and (ii) maximize the removal of already-existing CO_2 pollution from the atmosphere.[78]

28. Focusing on the phase-out of fossil fuel emissions, myriad scientific studies find that **CO_2-emitting fossil fuels are *not* needed to power human energy systems[79] and roadmaps developed by top energy scientists provide States with pathways to rapidly transition energy infrastructure in all sectors[80] to 100% clean, renewable energy[81] by as early as 2035, but by no later than 2050, with an 80% transition by 2030.[82]** Consequently, not only is this transition feasible, but if implemented it will eliminate CO_2 pollution, save lives, create jobs, and substantially reduce the risks associated with energy insecurity.[83] Equally as important, the greatest benefits will materialize in the communities

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[74] David I. Armstrong McKay et al., *Exceeding 1.5°C global warming could trigger multiple climate tipping points*, Sci. 377:1-10 at 1, 10 (2022) ("[E]ven the Paris Agreement goal of limiting warming to well below 2°C and preferably 1.5°C is not safe as 1.5°C and above risks crossing multiple tipping points. Crossing these [climate tipping points] can generate positive feedbacks that increase the likelihood of crossing other [climate tipping points]" and "The Earth may have left a safe climate state beyond 1°C global warming.") https://doi.org/10.1126/science.abn7950.

[75] *See* Alexandria Herr et al., *The 7 climate tipping points that could change the world forever*, Grist (3 Dec. 2019) https://grist.org/climate-tipping-points-amazon-greenland-boreal-forest/ (last accessed 16 Mar. 2024).

[76] David I. Armstrong McKay et al., *Exceeding 1.5°C global warming could trigger multiple climate tipping points*, Sci. 377:1-10 at 1, 7 (2022) https://doi.org/10.1126/science.abn7950.

[77] *See* Will Steffen et al., *Trajectories of the Earth system in the Anthropocene,* PNAS, 115:8252-8259 at 8256 (2018) https://www.pnas.org/doi/epdf/10.1073/pnas.1810141115; and *see generally* David Wallace-Wells, *The uninhabitable Earth: Life after warming* (2019), https://www.crisrieder.org/thejourney/wp-content/uploads/2019/05/The-Uninhabitable-Earth-David-Wallace-Wells.pdf.

[78] James Hansen, et al., *Young people's burden: Requirement of negative CO_2 emissions*, Earth Sys. Dyn., 8: 577-616 at 595 (2017) (Because "the world has already overshot appropriate targets for [greenhouse gas] amount, [...] we thus infer an urgent need for (1) rapid phasedown of fossil fuel emissions, (2) actions that drawdown atmospheric CO_2 [...]."; *and also* at 593 (There is "no persuasive scientific reason to a priori reject as implausible a rapid phasedown of fossil fuel emissions.") https://esd.copernicus.org/articles/8/577/2017/.

[79] IPCC*, 2023: Summary for policymakers.* In: Climate change 2023: Synthesis report*,* at A.4.2 ("[M]itigation options [...] are technically viable, are becoming increasingly cost effective and are generally supported by the public.") https://bit.ly/IPCC_ar6; and Christian Breyer et al., *On the history and future of 100% renewable energy systems research*, IEEE Access, 10:78176-78218 at 78176, 78202 (2022) ("The main conclusion of most of these studies is that 100% renewables is feasible worldwide at low cost.") https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9837910.

[80] For this submission, "all sectors" is defined as: electricity, transportation, buildings, industry, agriculture/forestry/fishing, and the military.

[81] For this submission, 100% clean, renewable energy encompasses wind, water, and solar.

[82] Mark Z. Jacobson et al., *Low-cost solutions to global warming, air pollution, and energy insecurity for 145 countries*. Energy Environ. Sci., 15:3343–3359 (2022) https://web.stanford.edu/group/efmh/jacobson/Articles/I/145Country/22-145Countries.pdf; and Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Trial Transcript, Testimony of Mark Z. Jacobson, p. 1057 (16 Jun. 2023) (underscoring that the roadmaps set forth only one of many scenarios to reach 100% renewables providing States with a starting point to tailor their climate actions) (available upon request).

[83] Mark Z. Jacobson et al., *No miracles needed: How today's technology can save our climate and clean our air,* Cambridge University Press (2023) https://www.cambridge.org/core/books/no-miracles-needed/8D183E65462B8DC43397C19D7B6518E3 (restricted access, available upon request).

currently suffering the worst environmental injustice.[84] In short, the transition to a renewable energy system is a win-win for States, human rights, and children.

29. Importantly, **if States fail** to urgently phase-out fossil fuel emissions, the IPCC has recognized—**with very high confidence**—that the **"[r]isks and projected adverse impacts and related losses and damages from climate change will escalate with every increment of global warming.**"[85] Based on this undisputed scientific fact, together with an extensive evidentiary record developed at a full trial on the merits, the District Court of Montana, U.S., concluded: **"Every additional ton of GHG [greenhouse gas] emissions exacerbates [youth] Plaintiffs' injuries and risks locking in irreversible climate injuries[,]"[86] and "[youth] Plaintiff's injuries will grow increasingly severe and irreversible without science-based actions to address climate change."**[87] Given the fixed laws of physics and chemistry and global nature of climate change, the District Court's science-based findings of fact and conclusions of law are **universally relevant** and **poised to be adopted** by other courts.

30. Considering that the **best available science** finds: (i) the current level of atmospheric CO_2 far exceeds the limit that is safe for humanity, resulting in a destabilized climate system; and (ii) pathways to restore climate stability exist and could enhance economies and advance sustainable development, *Amicus* respectfully submit that the Court's Advisory Opinion:

    a. **Find** that to protect human rights, the **best available science requires** States to urgently reduce the level of atmospheric CO_2 from the current concentration of ~421 ppm to **350 ppm or less** as quickly as possible, and by no later than 2100 with further reductions after that.[88]

    b. **Advise** States to **update their commitments** under the Paris Agreement and national laws to: (i) **reflect the best available science**; (ii) **minimize further violations** of fundamental human rights; and (iii) **avert breaching irreversible climate tipping points**, by adopting the 350 ppm limit as the highest atmospheric concentration of CO_2 that is consistent with States' obligations to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system."[89]

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[84] Benjamin W. Abbott et al., *Accelerating the renewable energy revolution to get back to the Holocene,* Earth's Future, 11:1-14 at 6 (2023) https://doi.org/10.1029/2023EF003639.

[85] IPCC, *2023: Summary for policymakers,* In: Climate change 2023: Synthesis report*,* para. B.2.2, *see also* paras. B.1, B.1.3, Figure SPM.2, B.2, Figure SPM.4, C.1.1, and Figure SPM.6 (2023) (emphasis added) https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

[86] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law at 87, para. 6 (14 Aug. 2023); *see also* Findings of Fact at 24, para. 92 ("Every ton of fossil fuel emissions contributes to global warming and impacts to the climate and thus increases the exposure of Youth Plaintiffs to harms now and additional harms in the future.") bit.ly/HeldFindingsConclusionsOrder.

[87] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law at 87, para. 7 (14 Aug. 2023) (emphasis added) bit.ly/HeldFindingsConclusionsOrder.

[88] See e.g. The studies in Annex A which includes*:* James Hansen et al., *Target atmospheric CO_2: Where should humanity aim?,* Open Atmospheric Sci. J., 2:217-231 at 228 (2008); and also 218 ("[T]he present global mean CO_2, 385 ppm, is already in the dangerous zone.") https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf; and Johan Rockström et al., *A safe operating space for humanity,* Nature 461:472-475 at 473 (2009) ("[H]uman changes to atmospheric CO_2 concentration should not exceed 350 parts per million by volume […] above pre-industrial levels.") https://www.nature.com/articles/461472a.

[89] U.N. Framework Convention on Climate Change, Art. 2 (9 May 1992).

c. **Find** that States compliance with the best available science and international law **requires** deep, rapid, and sustained reductions in greenhouse gas emissions, which means **phasing out at least 80% of fossil fuels by 2030 and 100% by 2035, but no later than 2050**.[90, 91]

VII. Courts Have Already Adopted the 350 ppm Limit as the Legal Standard to Protect Fundamental Rights

31. Courts are already turning away from the 1.5ºC target and treating 350 ppm as the appropriate benchmark to restore Earth's energy balance and protect human rights. In the United States, Montana's First Judicial District Court issued a decision in *Held v. Montana* that received nationwide recognition from the National Judicial College for its "demonstrated courage in upholding the rule of law and providing justice for all".[92] The District Court held that State laws **promoting fossil fuels** and **prohibiting the analysis of greenhouse gas emissions**, including CO_2, violated the youth plaintiffs' constitutional rights to equal protection, dignity, liberty, health, and safety predicated on the right to a clean and healthful environment, including the right to a stable climate.[93]

32. Referencing the Keeling Curve[94] to show the rise of atmospheric CO_2—which primarily results from fossil fuel emissions—and indicate the safe level of atmospheric CO_2 at 350 ppm,[95] the District Court's key findings of fact and conclusions of law relevant to this Court's Advisory Opinion include:

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[90] IPCC 2023: *Summary for policymakers*. In: Climate change 2023: Synthesis report, at C.3 ("Rapid and far-reaching transitions across all sectors and systems are necessary to achieve deep and sustained emissions reductions and secure a livable and sustainable future for all."); *see also* B.1, B.3, B.3.1, B.6, B.6.1, B.6.2, Figure SPM.5, B.7.3, C.2, C.2.1, and C.2.4. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf; and James Hansen et al., *Young people's burden: Requirement of negative CO_2 emissions*, Earth Sys. Dyn., 8: 577-616 at 595 (2017) (Because "the world has already overshot appropriate targets for GHG amount, [...] we thus infer an urgent need for (1) rapid phasedown of fossil fuel emissions, (2) actions that drawdown atmospheric CO_2 [...]."; *and also* at 593 (There is "no persuasive scientific reason to a priori reject as implausible a rapid phasedown of fossil fuel emissions.") https://esd.copernicus.org/articles/8/577/2017/. This submission focuses solely on the phasedown of atmospheric CO_2 removal of already-existing carbon pollution from the atmosphere. However, guidance on drawdown is crucial as well and *Amicus* respectfully suggest this should also be addressed in this Advisory Opinion.

[91] There are many actions States could implement to achieve the transition that include but are not limited to: i) prohibiting the renewal of permits or new, intensified, or expanded instances of fossil fuel extraction or fossil fuel infrastructure (defined broadly); (ii) auditing all anthropogenic CO_2 emissions from human activities in State-controlled territory, calculated in good faith according to best practices, without relying on carbon offsets; and (iii) identifying the State's laws, regulations, policies, and practices that contribute to, encourage, facilitate, or tolerate continuing CO_2 emissions and modify as necessary in light of phasing out CO_2 emissions. This process of identification could encompass: acts and omissions; all scales of government activity, including local government and state-owned enterprises; and all spheres of government activity, including government purchasing practices, land-use policies, subsidies, investigation and enforcement practices, public education, and the diplomatic sphere. If helpful, a synopsis of the actions States could implement could be drafted upon request.

[92] The National Judicial College, *60 Courageous Judges Honorees,* https://www.judges.org/60th_anniversary/60-courageous-judges-honorees/ (last accessed 16 Mar. 2024); Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, Conclusions of Law, and Order (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.

[93] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law, at 92, para. 30(b); *and also* Order, at 102, paras. 6, 7, 11 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.

[94] The Keeling Curve is a daily record of global atmospheric CO_2 concentration maintained by Scripps Institution of Oceanography at the University of California, San Diego, https://keelingcurve.ucsd.edu/ (last accessed 16 Mar. 2024).

[95] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 20, para. 76 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.

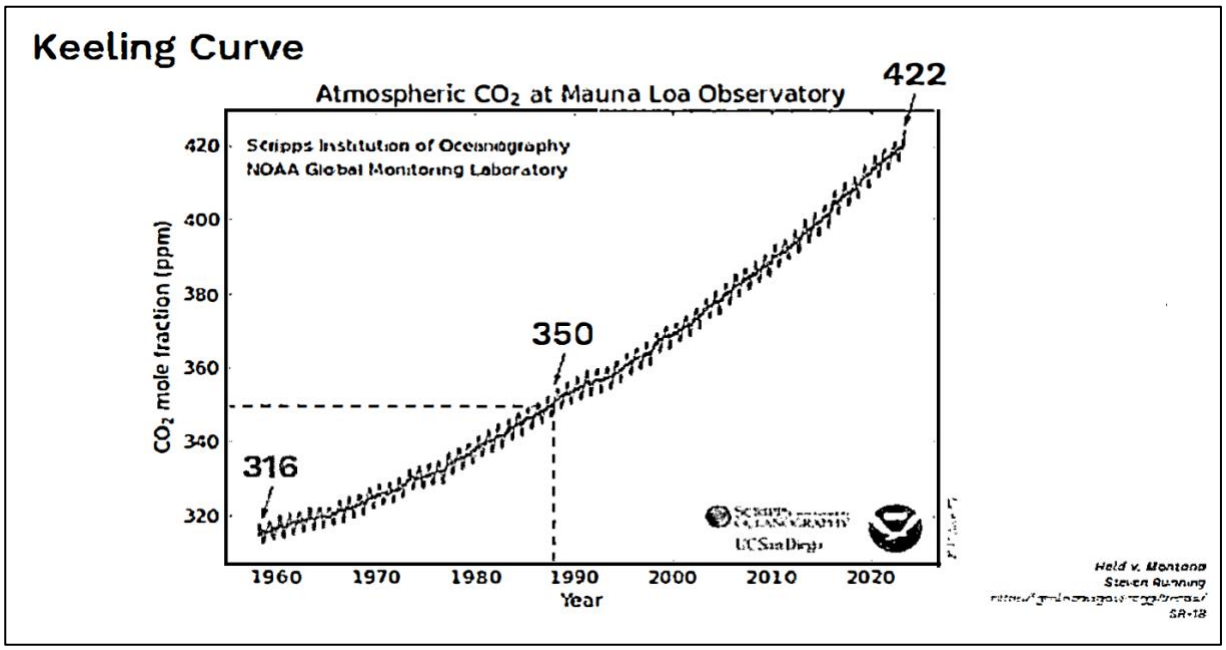

Figure 2. The demonstrative included in the District Court's Findings of Facts, *Held v. Montana.*

a. "The **Earth's energy imbalance […] is what climate scientists describe as the most critical metric** for determining the amount of global heating and climate change we have already experienced and will experience as long as the Earth's energy imbalance exists."[96]

b. "The **scientific consensus** is that **CO_2 from fossil fuel pollution is the primary driver** of Earth's energy imbalance. […] Due to the buildup of CO_2 from about 280 ppm to 419 ppm in the past 140 years […], more solar energy is now retained on Earth and less energy is released back to space."[97]

c. "The Earth's energy **imbalance is currently significant**."[98]

d. **"As long as there is an energy imbalance, the Earth will continue to heat**, ice will continue to melt, and weather patterns will become more extreme."[99]

e. **"If more GHGs [greenhouse gases] are added** to the atmosphere and more incoming energy received from the sun is trapped as thermal energy, the **Earth's climate system will continue to heat up**."[100]

[96] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 22, para. 82 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[97] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 23, para. 86 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[98] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 22, para. 83 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[99] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 23, para. 85 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[100] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 23, para. 85 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.

f. **"Until atmospheric GHG [greenhouse gas] concentrations are reduced**, extreme weather events and other climactic events such as droughts and heatwaves will occur more frequently and in greater magnitude, and [youth] **Plaintiffs will be unable to live clean and healthy lives […].**"[101]

g. "[Youth] Plaintiffs have proven that as **children and youth**, they **are disproportionately harmed** by fossil fuel pollution and climate impacts."[102]

h. "**Every additional ton** of GHG [greenhouse gas] emissions **exacerbates** [youth] Plaintiffs' **injuries and risks locking in irreversible climate injuries**."[103]

i. "[Youth] Plaintiffs' **injuries will grow increasingly severe and irreversible without science-based actions to address climate change**."[104]

33. In early 2023, the U.S. State of Hawai'i's Supreme Court concluded that, "**[w]ith each year, the impacts of climate change amplify and the chances to mitigate dwindle**"[105] and unanimously held that the fundamental right to a clean and healthful environment "**encompasses the right to a life sustaining climate system […]**"[106] reasoning that "**yesterday's good enough has become today's unacceptable.**"[107] Further, in light of the best available science, the Concurrence underscored that at the "**current level of atmospheric carbon concentrations**, **humanity faces an imminent global emergency.**"[108] It then set forth the State's corresponding obligation:

> Governments cannot use the 1.5°C Paris Agreement target as a mechanism to delay reducing emissions until that threshold has been met. […] **The target for emission reductions must instead be based on the level of atmospheric CO_2** that ensures a life-sustaining climate system. […] **Current scientific consensus**, as opposed to political consensus in the Paris Agreement regarding an acceptable increase in global average temperature, **suggests that mitigation strategies must be consistent with** achieving global atmospheric CO_2 concentrations below **350 parts per million** ("ppm") by 2100.

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[101] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Findings of Fact, at 24, para. 89 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[102] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law, at 87, para. 8; and *see also* Findings of Fact, at 28, para. 104 ("Children are uniquely vulnerable to the consequences of climate change, which harms their physical and psychological health and safety, interferes with family and cultural foundations and integrity, and causes economic deprivations.") (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[103] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law, at 87, para. 6 (14 Aug. 2023); *see also* Findings of Fact, at 24, para. 92 ("Every ton of fossil fuel emissions contributes to global warming and impacts to the climate and thus increases the exposure of Youth Plaintiffs to harms now and additional harms in the future.") bit.ly/HeldFindingsConclusionsOrder.
[104] Montana First Judicial District Court, *Held et al. v. State of Montana,* CDV-2020-307, Conclusions of Law, at 87, para. 7 (14 Aug. 2023) bit.ly/HeldFindingsConclusionsOrder.
[105] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc,* SCOT-22-0000418, Opinion, at 19 (13 Mar. 2023) (emphasis added) https://s3.documentcloud.org/documents/23706794/6368709716.pdf.
[106] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc.,* SCOT-22-0000418, Opinion, at 16, 18 (13 Mar. 2023) (Also finding that the right to a clean and healthful environment is "is not just affirmative; it is constantly evolving.") https://s3.documentcloud.org/documents/23706794/6368709716.pdf.
[107] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc.,* SCOT-22-0000418, Opinion, at 19 (13 Mar. 2023) https://s3.documentcloud.org/documents/23706794/6368709716.pdf.
[108] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc.,* SCOT-22-0000418, Concurrence, at 11 (13 Mar. 2023) (emphasis added) https://www.courthousenews.com/wp-content/uploads/2023/03/re-hu-honua-opinion-affirmed-wilson.pdf.

> […] Limiting atmospheric CO_2 levels to below 350 ppm is essential to […] "restore a viable climate system on which the life, liberty, and property" of all people depend.[109]

34. The above-referenced judicial opinions—grounded in the best available science—point the way towards an understanding of how a stable climate system (i.e., one in which the Earth's energy system is balanced by achieving the 350 ppm limit) underpins the effective enjoyment of human rights. These decisions further foreshadow the emergence of a right to a life-sustaining climate system.

35. *Amicus* respectfully urge that **this Court now has a unique opportunity to reinforce this timely jurisprudence** informed by robust scientific evidence.

VIII. Conclusion

36. Today, climate is the prism through which all humanity will pass. As this Court originates a robust body of legal guidance at the intersection of international law and climate change, the words of former ICJ Judge C.G. Weeramantry are particularly instructive:

> When incontrovertible scientific evidence speaks of pollution of the environment on a scale that spans hundreds of generations, this Court would fail in its trust if it did not take serious note of the ways in which the distant future is protected by present law. The ideals of the United Nations Charter do not limit themselves to the present, for they look forward to the promotion of social progress and better standards of life, and they fix their vision, not only on the present, but on "succeeding generations". This one factor of impairment of the environment over such a seemingly infinite time span would by itself be sufficient to call into operation the protective principles of international law which the Court, as the pre-eminent authority empowered to state them, must necessarily apply.[110]

In the deliberations over the guidance that will be provided to States in the hope of protecting humanity from an existential crisis of our own making, *Amicus* respectfully submit that the only practical and effective path States can take to comply with their international human rights obligations is to **adhere to the enduring laws of physics and chemistry.** Only then will we have a chance at safeguarding fundamental human rights, especially for children and future generations.

Additional Information: Best Available Medical Evidence

This submission focuses exclusively on climate rather than medical science, as *Amicus* presume other submissions will highlight the critical findings that unequivocally demonstrate the disproportionate impact climate change has on the health of children. UNICEF and pediatricians worldwide emphatically conclude that the real-time decisions made by States directly influence the physical and mental well-being—and even the survival—of billions of children globally.[111] If the Court wishes to review a summary of best available

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[109] Supreme Court of the State of Hawai'i, *In the Matter of Hawai'i Electric Light Company, Inc.,* SCOT-22-0000418, Concurrence, at 9-11 (13 Mar. 2023) (emphasis by the Court and added) https://www.courthousenews.com/wp-content/uploads/2023/03/re-hu-honua-opinion-affirmed-wilson.pdf.

[110] ICJ Reports 1996, *Legality of the threat or use of nuclear weapons*, Advisory Opinion, 8 Jul. 1996, International Court of Justice, Dissenting Opinion of Judge Weeramantry, at 456, https://www.icj-cij.org/sites/default/files/case-related/95/095-19960708-ADV-01-12-EN.pdf.

[111] U.N. Children's Fund, *The climate crisis is a child rights crisis: Introducing the children's climate risk index* (2021) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf; and Annex C, Scientific findings on the effects of climate change on child health.

medical evidence, an Annex was submitted to the Inter-American Court of Human Rights in response to the Request for an Advisory Opinion on the Climate Emergency and Human Rights[112] and is included here as **Annex C**. **This Annex is supported by 18 pediatric associations representing over one million medical professionals from more than 120 countries**.[113]

Pediatricians are uniquely positioned as experts to inform the Court on these matters. Every day, pediatricians worldwide bear witness to the unjust burdens imposed upon children by the climate crisis. They, more than any other profession, possess unparalleled insight into the physiological and psychological distinctions between children and adults and, in turn, the disproportionate harms children suffer from the emission of fossil fuels and resulting air pollution and climate change in ways that differ from older generations.

Accordingly, if helpful to the Court, *Amicus* stand ready to summarize the following upon request: (i) the **disproportionate impact** climate change has on children's physical and mental health globally;[114] (ii) the **key evidence** of how the **ongoing emission of fossil fuels by States constitutes discrimination against children**; and (iii) the **emerging jurisprudence** finding that children are entitled to extra protection requiring that all laws, regulations, policies, standards, guidelines, plans, and strategies affecting their rights be made in light of the **best interests of the child** and grounded in the principle of **intergenerational equity**. Furthermore, arrangements can be made for in-person testimony by pediatricians if deemed necessary by the Court.

On behalf of *Amicus Curiae,*

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[112] I/A Court H.R., Request for an Advisory Opinion submitted by Chile and Colombia on the Climate Emergency and Human Rights, (9 Jan. 2023) https://www.corteidh.or.cr/docs/opiniones/soc_1_2023_en.pdf.
[113] I/A Court H.R., *Amicus Curiae* Submission on the Request for an Advisory Opinion on the Climate Emergency and Human Rights, Our Children's Trust et al., (11 Dec. 2023) https://static1.squarespace.com/static/655a2d016eb74e41dc292ed5/t/657a0182e1880b5417feb13f/1702494611469/_2023.12.11+IACtHR+Amicus+Brief.pdf.
[114] The best available medical evidence universally finds that climate change disproportionally harms children for the following key reasons. First, they are physiologically and psychologically different from adults. Second, they are dependent on caregivers for their safety and well-being. Third, children have more years left to live than adults do and will therefore be exposed to worse climate effects over a larger portion of their lives. Fourth, children currently bear the greatest burden of impacts of climate change yet contribute least to the cause of the problem. Additionally, children have no vote to change the policies that affect their short-term and long-term health, safety, and longevity on the planet.

Important Scientific Studies on the Limit of Atmospheric CO_2 Required to Protect Human Rights

The Paris temperature targets of 1.5°C and 2.0°C are often portrayed as the "best available science" and "protective of human rights". The targets are neither. An overwhelming body of scientific research—including numerous conclusions from the Intergovernmental Panel on Climate Change (IPCC)—conclude that **1.5ºC of warming poses significant risks for natural and human systems and will result in grave human rights violations**. In turn, the Paris temperature targets should not serve as a meaningful benchmark for protecting human rights. Instead, and looking back at the original objective of the UN Framework Convention on Climate Change, **States should urgently aim to reduce the concentration of greenhouse gases—especially CO_2—in the atmosphere to prevent dangerous anthropogenic interference with the climate system.**

This bibliography provides a synopsis and links to **important scientific studies dating back to 2008** that provide research findings and conclusions on the Earth's atmospheric greenhouse gas boundary. These studies address why the annual mean concentration of CO_2 in Earth's atmosphere must fall from 2023 levels of ~421 parts per million (ppm) (a level currently resulting in ~1.2°C to 1.3°C of warming above pre-industrial levels) to below 350 ppm as soon as possible and no later than 2100 to reverse climate change and avoid further exacerbating violations of human rights. **This ceiling is known as the 350 ppm limit.** Additionally, the studies discuss the dangers of remaining above the 350 ppm limit, and the associated risks of reaching and remaining at the Paris temperature target of 1.5°C of warming above pre-industrial levels.

Benjamin W. Abbott and 12 Others, Accelerating the Renewable Energy Revolution to Get Back to the Holocene, 11:9 Earth's Future 1 (2023)

Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2023EF003639

Synopsis: This scientific article explains that the UN's Paris Agreement goal of keeping global warming between 1.5°C and 2.0°C is dangerously obsolete, will result in hundreds of millions of pollution deaths, is poised to trigger multiple tipping elements in the Earth system, and imposes an immense burden on young people and future generations. The article further explores ways to avoid these harms via rapid defossilization and climate restoration efforts that are both technically feasible and economically viable.

Katherine Richardson and 28 Others, Earth Beyond Six of Nine Planetary Boundaries, 9:37 Science Advances 1 (2023)

Link: https://www.science.org/doi/10.1126/sciadv.adh2458

Synopsis: This research reinforces that: i) greenhouse gas emissions are one of the most important drivers of anthropogenic impacts on Earth's energy budget; ii) the planetary boundary for atmospheric CO_2 concentration is 350 ppm; iii) human activities brought the climate system outside of its safe operating space around 1988; and iv) today's level of atmospheric CO_2 concentration places Earth even further outside the safe operating space. The research suggests the possibility of extreme Earth system impacts even at 1.5°C warming, with risks already markedly increasing above 1.0°C of warming.

Johan Rockström and 50 Others, Safe and Just Earth System Boundaries, 619 Nature 102 (2023)

Link: https://www.nature.com/articles/s41586-023-06083-8

Synopsis: This study proposes various Earth system boundaries for maintaining the resilience and stability of the Earth system and minimizing exposure to significant harm to humans from Earth system change. The study determines that the just boundary for avoiding significant harm to tens of millions of people should be set at or below 1.0°C of average surface temperature increase above pre-industrial levels, which is only achieved through keeping atmospheric CO_2 below 350 ppm.

Nico Wunderling and 7 Others, Global Warming Overshoots Increase Risks of Climate Tipping Cascades in a Network Model, 13 Nature Climate Change 75 (2022)

Link: https://www.nature.com/articles/s41558-022-01545-9

Synopsis: This study looks at a range of temperature overshoot scenarios using a stylized network model of four interacting climate tipping elements to investigate the danger of crossing tipping-point thresholds and the high likelihood of crossing these thresholds under current policies and actions. It also identifies a high climate-risk zone at or above 1.5°C and explains that to avoid tipping events final convergence temperatures must fall substantially below 1.5°C in the long run with safe levels found only at global temperatures lower than the current levels.

David Armstrong McKay and 9 Others, Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points, 377:6611 Science 1 (2022)

Link: https://www.science.org/doi/10.1126/science.abn7950

Synopsis: This scientific article identifies a series of irreversible climate tipping points in Earth's climate system that are increasingly likely to be triggered as global average surface temperature increases to 1.5ºC or 2.0ºC above pre-industrial levels, leading to dramatic and difficult to predict consequences for all other regions of the world. Avoiding such tipping points, or a safe climate system, is only possible by maintaining a climate with a global mean temperature less than 1.0°C.

Will Steffen and 17 Others, Planetary Boundaries: Guiding Human Development on a Changing Planet, 347:6223 Science 736 (2015)

Link: https://www.science.org/doi/10.1126/science.1259855

Synopsis: This article updates the planetary boundary framework to identify levels of anthropogenic perturbations below which the risk of destabilization of the Earth System is likely to remain low. Based on analysis of several human factors affecting Earth System functioning, the article narrows the planetary boundary to 350 to 450 ppm, with climate risks increasing above 350 ppm, and cautions against moving too far away from a Holocene-like state. It finds that the upper limit for a safe climate is atmospheric CO_2 <350 ppm.

James Hansen and 17 Others, Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, 8:12 PLOS ONE 1 (2013)

Link: https://doi.org/10.1371/journal.pone.0081648

Synopsis: This scientific article analyzes different sets of climate data to conclude that society should reassess what constitutes a "dangerous level" of global warming. It uses the atmospheric CO_2 limit of <350ppm to determine the magnitude of emission reduction needed to stabilize the climate system and avoid potentially disastrous impacts on young people, future generations, and nature.

Johan Rockström and 28 Others, A Safe Operating Space for Humanity, 461 Nature 472 (2009)

Link: https://www.nature.com/articles/461472a

Synopsis: This article identifies and proposes several planetary boundaries that, if transgressed, will increase the risk of irreversible climate change. It cautions that human changes to atmospheric CO_2 should not exceed 350 ppm by volume if human development is to continue.

James Hansen and 9 Others, Target Atmospheric CO_2: Where Should Humanity Aim?, 2 The Open Atmospheric Science Journal 217 (2008)

Link: https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf

Synopsis: This study uses paleoclimate data to show that long-term climate has high sensitivity to climate forcings and that the global mean CO_2 of 385 ppm is in the dangerous zone. It further explains that an initial CO_2 target of 350 ppm is supported by the data and necessary to avoid irreversible catastrophic effects and maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted.

ANNEX B

Andrea Rodgers et al., ***The Injustice of 1.5°C-2°C: The Need for a Scientifically Based Standard of Fundamental Rights Protections in Constitutional Climate Change Cases,*** **In: Virginia Environmental Law Journal (2022)**

THE INJUSTICE OF 1.5°C–2°C: THE NEED FOR A SCIENTIFICALLY BASED STANDARD OF FUNDAMENTAL RIGHTS PROTECTION IN CONSTITUTIONAL CLIMATE CHANGE CASES

Andrea Rodgers[*]
Lauren E. Sancken[**]
Jennifer Marlow[***]

In 2015, signatories to the Paris Agreement agreed to the goal of keeping global temperature rise this century to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Although the adoption of the Paris Agreement was in many ways a political triumph, seven years later many climate advocates are presenting the Paris target to judicial bodies as the de facto legal standard for fundamental rights protection in climate change cases. Yet, the history leading up to the signatories' ultimate adoption of the Paris Agreement target suggests that the target is somewhat arbitrary and not a product of scientific debate, but rather the outcome of political diplomacy. There is no scientific support for the notion that 1.5°C or 2°C will stabilize the Earth's Energy Imbalance, a metric scientists deem fundamental for assessing the mitigation of climate change. The scientific consensus suggests that the impacts of 1.5°C or 2°C of global heating will result in the eradication of entire populations and places, causing devastating climate change impacts and placing many people in peril. The IPCC's Special Report on Global Warming of 1.5°C, as well as peer-reviewed climate science, illustrates that in a world 1.5°C warmer, humanity will suffer, with the most disadvantaged and vulnerable communities threatened the most.

This Article describes how the global community came to coalesce around the Paris Agreement target and asks a controversial question: whether a target obtained through international agreement should be used by climate advocates and judicial bodies as a proxy legal standard for fundamental rights protection and the fair administration of justice

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when the science says otherwise? Part One of this Article describes the history of the 1.5°C–2°C target and its subsequent acceptance and popularization as a limit based on "science." Part Two analyzes how legal practitioners and courts are relying on the Paris Agreement as the basis for establishing legal standards of protection for fundamental rights in climate change litigation and how judicial endorsement of an unsafe target threatens human rights. Part Three proposes that science-based climate mitigation standards are a more appropriate legal standard for protecting human rights in climate change cases.

INTRODUCTION

Judicial bodies are perilously adopting the Paris Agreement target, a limit negotiated by governments to limit global average heating to 1.5°C–2°C, as the legal standard for protecting fundamental rights in the climate

change context.[1] By design, the Paris Agreement target began as a heuristic intended to guide policy decisions addressing climate change. A review of the history leading up to the Paris Agreement reveals the target was based on intergovernmental compromise, not science.[2] Yet, the Paris Agreement target is frequently ascribed by climate advocates as "science based."[3] In fact, current climate science does not support the notion that limiting warming to 1.5°C or 2°C would stabilize the Earth's Energy Imbalance ("EEI"), a metric scientists deem "fundamental" to determining "how well the world is doing in the task of bringing climate change under control,"[4] or to avoid triggering several critical climate tipping points.[5] This Article argues that climate change advocates should present judicial bodies with science-based standards to achieve climate stability, rather than rely on the Paris Agreement target, as the touchstone for compliance with governments' human rights obligations.

Although the Paris Agreement target of "[h]olding the increase in the global average temperature to well below 2°C above industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels"[6] has been tacitly accepted as the end goal in popular media and by many governments around the world, the Intergovernmental Panel on Climate Change ("IPCC")—the consensus-based scientific body informing the United Nations Framework Convention on Climate Change ("UNFCCC")—characterized 1.5°C of

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[1] Paris Agreement art. 2, § 1(a), 12 Dec. 2015, 3156 U.N.T.S. 54113, https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

[2] Johannes Urpelainen, *Here's What Political Science Can Tell Us About the Paris Climate Deal*, WASH. POST (Dec. 14, 2015), https://www.washingtonpost.com/news/monkey-cage/wp/2015/12/14/heres-what-political-science-can-tell-us-about-the-paris-climate-deal/ (examining the political undertones behind the Paris Agreement); Samuel Randalls, *History of the 2°C Climate Target*, 1 WILEY INTERDISC. REV. CLIMATE CHANGE 598, 602 (2010) (noting briefly the political undertones behind the widespread acceptance of a 2°C target).

[3] *See, e.g.*, Reto Knutti, Joeri Rogelj, Jan Sedláček & Erich M. Fischer, *A Scientific Critique of the Two-Degree Climate Change Target*, 9 NATURE GEOSCIENCE 1, 1 (2016) [hereinafter Knutti et al.] ("This target was a political decision informed by science, but no scientific assessment ever defended or recommended a particular target."); Randalls, *supra* note 2, at 601–02 (acknowledging the scientific skepticism surrounding the 2°C target, but noting that it has been widely embraced); Hans Joachim Schellnhuber, Stefan Rahmstorf & Ricarda Winkelmann, *Why the Right Climate Target Was Agreed in Paris*, 6 NATURE CLIMATE CHANGE 649, 653 (2016) ("Almost miraculously, the countries of the world . . . have agreed on a sensible, science-based climate target . . . .").

[4] *See* Karina von Schuckmann et al., *Heat Stored in the Earth System: Where Does the Energy Go?*, 12 EARTH SYS. SCI. DATA, 2013, 2029, 2029 (2020) (defining the metric of stabilizing the Earth's energy system imbalances).

[5] *See* David I. Armstrong McKay et al., *Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points*, 377 SCIENCE 1171, 1171, 1178 (2022) (citing nine core tipping points, five of which have lower bounds that become likely at the Paris Agreement range of 1.5°C–2°C, and suggesting "that ~1°C is a level of global warming that minimizes the likelihood of crossing [climate tipping points]").

[6] Paris Agreement, *supra* note 1.

heating as "not . . . safe for most . . . communities."[7] Even at present levels of heating of approximately 1°C, climate impacts are devastating communities around the world, and the science suggests that any additional heating is highly dangerous, particularly for those most exposed to the impacts of climate change.[8] In a 1.5°C–2°C warmer world, those most vulnerable to climate impacts—peoples who live in the Arctic and low-lying island nations, youth, and those already experiencing socioeconomic or political vulnerabilities, for example—will be denied the ability to exercise fundamental rights on this planet.[9]

This Article critiques the trend of climate advocates using the Paris Agreement target as a proxy symbolizing the outer bounds of global climate policy in the fundamental rights context. In addition, this Article argues that if the Paris Agreement target becomes the de facto equivalent legal standard for fundamental rights protections, multilateral environmental negotiators become the arbiters of the rights of peoples whose lives that very target expends. Although judicial bodies can and often do draw lines in the sand to define the scope of fundamental rights, legal standards for climate rights should not automatically be imported from the realm of political negotiations, particularly when the science says otherwise.

Part I of this Article describes the history of the Paris Agreement target as a vehicle of political consensus, its acceptance by the international political community, and the dangers of adopting the Paris Agreement target as the legal standard for protecting fundamental rights. Part II describes the role of *Juliana v. United States*, one of the first human rights-centered climate change cases, in utilizing scientific evidence to support recognition of a U.S. Constitutional right "to a climate system capable of sustaining human life,"[10] as well as the international trend of advocates adopting the Paris Agreement target as protective of human

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[7] Joyashree Roy et al., *Sustainable Development, Poverty Eradication and Reducing Inequalities*, *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 445, 447 (Valérie Masson-Delmotte et al. eds., 2018) [hereinafter GLOBAL WARMING OF 1.5°C], https://www.ipcc.ch/sr15/chapter/chapter-5/.

[8] *Id.* ("Warming of 1.5°C is not considered 'safe' for most nations, communities, ecosystems and sectors and poses significant risks to natural and human systems as compared to current warming of 1°C . . . . The impacts of 1.5°C of warming would disproportionately affect disadvantaged and vulnerable populations . . . ."); Armstrong McKay et al., *supra* note 5, at 1171 ("We show that even the Paris Agreement goal of limiting warming to well below 2°C and preferably 1.5°C is not safe as 1.5°C and above risks crossing multiple tipping points.").

[9] *See id.*

[10] Juliana v. United States, 217 F. Supp. 3d 1224, 1250 (D. Or. 2016).

rights to life, liberty, security of the person, and privacy, among others. Finally, Part III critiques the use of the Paris Agreement target from a legal perspective and proposes that advocates present the best available scientific evidence of EEI and urge the adoption of a scientifically based legal standard when seeking fundamental rights protections in climate change cases.

I. A LIMIT IS NOT A GOAL: HOW 2°C BECAME POPULARIZED AS A CLIMATE TARGET AND LEGAL STANDARD OF PROTECTION

This section chronicles the historic emergence of the Paris Agreement target across disciplines, its solidification in consensus-driven climate conferences, and its subsequent popularization and acceptance as a legal standard of protection.

A. The Acceptance and Popularization of 2°C as a Consensus-Driven Target

The first mentions of limiting warming to 2°C were largely tangential. After World War II, scientists within the U.S. Office of Naval Research took note of the rising levels of atmospheric carbon dioxide ("CO_2") and began exploring what level of warming would result from a doubling of CO_2.[11] The science on this question continued to develop, and in 1967, Syukuro Manabe and Richard Wetherald co-authored a paper in the Journal of Atmospheric Sciences, *Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity*,[12] that estimated that a doubling of CO_2 concentrations in the atmosphere would result in warming of approximately 2°C.[13] A decade later, in 1977, economics Professor William Nordhaus authored two papers noting that warming of more than 2°C would exceed historical limits:

> According to most sources the range of variation between distinct climatic regimes is on the order of [around] 5°C, and at present time the global climate is at the high end of this range. If there were global temperatures more than 2 or 3°C above the current average temperature, this would take the climate outside of the

[11] Expert Report of James E. Hansen, Ph.D. at 8–9, Juliana v. United States, 217 F. Supp. 3d 1224 (D. Or. 2016) [hereinafter *Juliana*, Hansen Expert Report].

[12] Syukuro Manabe & Richard T. Wetherald, *Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity*, 24 J. ATMOSPHERIC SCI. 241 (1967).

[13] *Id.* at 241. *See also* Piero Morseletto, Frank Biermann & Philipp Pattberg, *Governing by Targets: Reductio Ad Unum and Evolution of the Two-Degree Climate Target*, 17 INT'L ENV'T AGREEMENTS: POL., L. & ECON. 655, 658 (2017).

> range of observations which have been made over the last several hundred thousand years.[14]

Although this was a tangential point in a paper otherwise focused on economics, it was, "perhaps, the first suggestion to use 2°C as a critical limit for climate policy . . . ."[15] Importantly, in these early papers, the number appeared as a heuristic, not as normative policy guidance or as a limit grounded in science.[16]

In 1988, the 2°C threshold emerged as an aspirational warming limit in a World Meteorological Organization report, *Developing Policies for Responding to Climatic Change*, which summarized findings from two meetings of the Advisory Group on Greenhouse Gases ("AGGG").[17] The report offered "recommendations for the development of a climate convention by examining the underlying science and its implications for policy[makers]."[18] At that time, 1988 had been the warmest year on record.[19] This fact was made publicly known by NASA scientist Dr. James Hansen, who famously testified to the United States Congress that year about the causal link between a warming world and the emission of greenhouse gases ("GHGs") and the impacts of an accumulation of CO_2 in the atmosphere on more frequent and extreme weather events.[20] He presented the following graph during his congressional testimony:[21]

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[14] *See, e.g.*, William D. Nordhaus, *Strategies for the Control of Carbon Dioxide* 39–40 (Yale U. Cowels Found. for Rsch. in Econ., Working Paper No. 443, 1977). *See generally Two Degrees: The History of Climate Change's Speed Limit*, CARBON BRIEF (Aug. 12, 2014, 10:45 AM), https://www.carbonbrief.org/two-degrees-the-history-of-climate-changes-speed-limit (noting Professor Nordhaus's two papers).

[15] Carlo C. Jaeger & Julia Jaeger, *Three Views of Two Degrees*, 11 REGUL. ENV'T CHANGE, at S15, S16 (2011).

[16] Morseletto, Biermann & Pattberg, *supra* note 13, at 658.

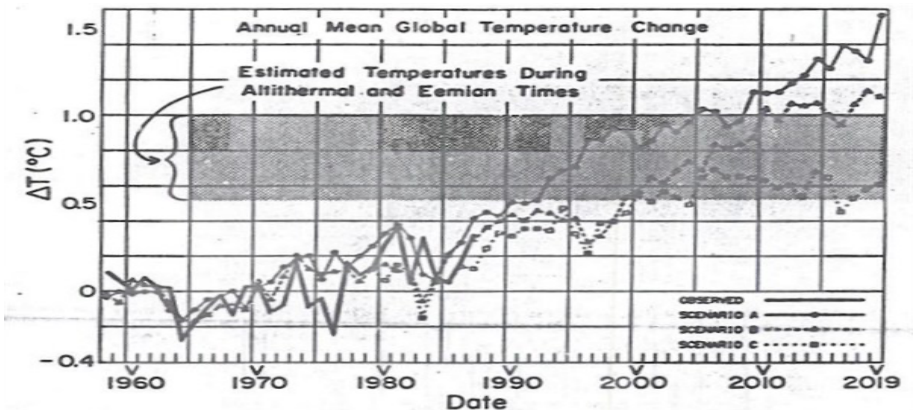
[17] *Id.* For the report, see REPORT OF THE FIRST SESSION OF THE WMO/INEP INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Nov. 1988).

[18] *See* Morseletto, Biermann & Pattberg, *supra* note 13, at 658.

[19] *The Greenhouse Effect: Impacts on Current Global Temperature and Regional Heat Waves Before the Comm. on Energy & Nat. Res.*, 100th Cong. 39 (1988) (statement of Dr. James Hansen, Director, NASA Goddard Institute for Space Studies).

[20] *Id.*

[21] *Id.* at 48 fig.3.



Dr. Hansen, while presenting the scientific data of global warming and stating a high degree of confidence that a cause-and-effect relationship between global warming and human-caused GHG emissions existed, did not offer guidance on a safe limit of warming, nor did he suggest that 1.5°C–2°C of warming is supported by the science as safe or desirable from a planetary science perspective.[22]

Later that same year, the AGGG convened three working groups coordinated by the Stockholm Environmental Institute to specifically examine the impacts of warming at a rate of a 0.1°C increase per decade and to analyze a 1°C or 2°C increase as potential temperature targets guiding policy-making efforts.[23] In 1990, these working groups compiled a "Targets and Indicators of Climate Change" report that recommended two absolute temperature targets for committed warming, each with a different level of risk: (i) "A maximum temperature increase of 1.0°C above pre-industrial global mean temperature"; and (ii) "A maximum temperature increase of 2.0°C above pre-industrial global mean temperature."[24] The report assumed that "temperature changes greater than the lower limit may be unavoidable due to greenhouse gases already emitted," but explicitly cautioned that "[a]n absolute temperature limit of 2.0°C can be viewed as an upper limit beyond which the risks of grave damage to ecosystems, and of non-linear responses, are expected to increase rapidly." [25] Importantly, this thirty-year-old report never condoned 2°C as "safe."

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[22] *Id.* at 39–46.

[23] Morseletto, Biermann & Pattberg, *supra* note 13, at 658.

[24] TARGETS AND INDICATORS OF CLIMATIC CHANGE, at viii (Frank R. Rijsberman & Rob J. Swart, R. J. eds., 1990) [hereinafter SEI TARGETS AND INDICATORS DRAFT REPORT].

[25] *Id.* at viii–ix.

The "Targets and Indicators of Climate Change" working group was aware of the advantages and shortcomings of using a "target approach" to frame allowable temperature increase:

> The clear advantage of the target approach is that—once appropriate targets are universally adopted—progress towards them should be quantifiable and unambiguous. Other authors criticize the target approach because of the difficulty of setting appropriate targets that are generally acceptable.
>
> Where there is no universal agreement over the usefulness of climate policy targets, there is certainly not yet agreement as to what such targets should be.[26]

The working group also acknowledged that it was "difficult to obtain a good understanding of the implications of specific targets" given the complexity of the climate system and interrelated systems: "e.g., what the cost will be of adopting targets, and the impacts thereof on the economy." [27] Indeed, it advocated for periodically reviewing and adjusting targets to accommodate new developments in science.

Efforts to create an objective limit of global warming emerged in the international political arena shortly after the convergence of these working groups. In 1990, the IPCC published an assessment report to provide objective scientific and technical assessments on global warming.[28] The IPCC "provide[s] policymakers with regular scientific assessments on climate change, its implications and potential future risks, [and] put[s] forward adaptation and mitigation options."[29] As a quasi-political body of scientists, "[t]he IPCC is mandated to produce consensus" [30] and provides guidance that is "policy-relevant but not policy-prescriptive."[31] In keeping with its role, the IPCC has neither endorsed nor recommended the adoption of 1.5°C or 2°C as a target in its 1990 report nor in any subsequent reports; rather, the IPCC reports on the scientific consensus on climate impacts associated with different levels of warming. Although IPCC reports have summarized a significant body of science projecting that warming of 1.5°C or 2°C would be

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[26] F.R. Rijsberman, G.W. Geil & B.T. Bower, *Setting Targets for Climate Policies*, *in id.* at 9 (internal citations omitted).

[27] *Id.*

[28] G.A. Res. 43/53, Protection of Global Climate for Present and Future Generations of Mankind (Dec. 6, 1988).

[29] *The Intergovernmental Panel on Climate Change*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [hereinafter *IPCC*], https://www.ipcc.ch/ (last visited Sept. 10, 2022).

[30] Martin Mahony & Mike Hulme, *The Colour of Risk: An Exploration of the IPCC's "Burning Embers" Diagram*, 6 SPONTANEOUS GENERATIONS: J. HIST. & PHIL. SCI. 75, 81 (2012).

[31] *IPCC*, *supra* note 29.

catastrophic,[32] the IPCC does not dictate what temperature target should be adopted to be protective of fundamental rights.[33] Instead, IPCC assessments "present projections of future climate change based on different scenarios and the risks that climate change poses and discuss the implications of response options, but they do not tell policymakers what actions to take."[34]

The 1990 IPCC report indicated that the global mean temperature would likely increase "about 1°C above the present value by 2025 (about 2°C above that in the pre-industrial period), and 3°C above today's value before the end of the next century (about 4°C above pre-industrial)."[35] These projections indicated that the impact of concurrent drought or heat stress could be severe, glaciers and ice sheets would decrease, permafrost would degrade, ecosystems would be dramatically altered, and major health impacts would be possible.[36] The report urged quick strategic action given the severity of these predictions: "The potentially serious consequences of climate change on the global environment . . . give sufficient reasons to begin by adopting response strategies that can be justified immediately even in the face of such significant uncertainties."[37]

The UNFCCC, which was adopted at the 1992 Rio Earth Summit and came into force in 1994,[38] was designed to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[39] However, the treaty did not define "dangerous," nor did it promote a specific numeric temperature target. The UNFCCC established a Conference of the Parties ("COP"), a "legislative-like body that meets annually and is charged with devising ways to implement the UNFCCC's

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[32] *See* Jaeger and Jaeger, *supra* note 15, at S18.

[33] IPCC FACTSHEET: WHAT IS THE IPCC? 1 (July 2021), https://www.ipcc.ch/site/assets/uploads/2021/07/AR6_FS_What_is_IPCC.pdf. *See also IPCC*, *supra* note 29 ("IPCC reports are neutral, policy-relevant but not policy-prescriptive.").

[34] *See* IPCC FACTSHEET: WHAT IS THE IPCC? 1 (July 2021), https://www.ipcc.ch/site/assets/uploads/2021/07/AR6_FS_What_is_IPCC.pdf.

[35] *See Preface to the IPCC Overview*, *in* THE IPCC FIRST ASSESSMENT REPORT 51, 52 (1990), https://www.ipcc.ch/site/assets/uploads/2018/05/ipcc_90_92_assessments_far_overview.pdf.

[36] *Id.* at 55–56.

[37] CLIMATE CHANGE: THE 1990 AND 1992 IPCC ASSESSMENTS 124 (June 1992), https://www.ipcc.ch/site/assets/uploads/2018/05/ipcc_90_92_assessments_far_full_report.pdf.

[38] U.N. Framework Convention on Climate Change, May 1992, 1771 U.N.T.S. 30822 [hereinafter U.N. Framework]; *What is the United Nations Framework Convention on Climate Change?*, U.N. CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change (last visited Sept. 10, 2022).

[39] U.N. Framework, *supra* 38, at art. 2.

goals."[40] The Parties, currently 197 states and one regional economic integration organization,[41] rely upon the reports issued by the IPCC to inform their negotiations and political decision-making, but the parties are by no means bound to heed the science. By the end of this period, in the early 1990s, consensus existed that there should be a target, but precisely what it should be was an open question that both scientists and policy makers continued to explore.

B. Promotion of the 2°C Target and its Influence on International Political Consensus

After the UNFCCC was established and before the first COP in 1995, European governmental institutions began honing in on 2°C as a numeric target to meet the narrative standard of "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[42] The number itself, however, was a "suitable simplification for non-specialists" and not intended to represent a warming limit informed by science or tied to the protection of fundamental rights.[43] In fact, the authors of the 1990 "Targets and Indicators" report recognized that the choice of a target for purposes of the UNFCCC process should be "a product of the political process of negotiation," presumably because that is how international agreement among governments is achieved.[44] But, during this time, scientists' "ability to understand the mechanisms driving global warming and predict the impacts more precisely had improved dramatically."[45] Particularly, scientists gained "[a]nother layer of quantitative verification of [their] understanding of global climate change": EEI.[46] According to Dr. James Hansen:

> It had long been understood that when greenhouse gases such as CO_2 increase, they would cause a planetary energy imbalance by reducing Earth's heat radiation to space: thus the energy in absorbed sunlight would temporarily exceed the energy returned to space. The planet must warm in response to this positive energy

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[40] Michael B. Gerrard, *Introduction and Overview*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 18 (Michael B. Gerrard ed., 2007).

[41] *Status of Ratification of the Convention*, U.N. CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-convention/status-of-ratification/status-of-ratification-of-the-convention (last visited Aug. 28, 2022).

[42] U.N. Framework, *supra* note 38, at art. 2.

[43] Morseletto, Biermann & Pattberg, *supra* note 13, at 660.

[44] *See* SEI TARGETS AND INDICATORS DRAFT REPORT, *supra* note 24, at viii; *see also* Morseletto, Biermann & Pattberg, *supra* note 13, at 660.

[45] *Juliana*, Hansen Expert Report, *supra* note 11, at 17.

[46] *Id.* at 18. *See also* von Schuckmann et al., *supra* note 4, at 2014.

> imbalance, but full response to the forcing could require a very long time, decades or even centuries, because of the great thermal inertia of the ocean. The question we undertook to study was the extent of such an energy imbalance and whether it was quantitatively consistent with estimates of climate sensitivity. . . . [O]n the basis of climate model simulations for the period 1979–1996 with several alternative representations of the ocean, there should have been a planetary energy imbalance of about +0.5 W/m^2 averaged over the entire planet in 1979, and this would grow to as much as 0.7-1 W/m^2 at the end of the 20th century.
>
> It is the ocean's thermal inertia that slows the planet's response to changing climate forcing, so the planetary energy imbalance (the net incoming energy) is largely flowing into the ocean. Much smaller amounts of energy go into a net melting of ice and a warming of the ground and atmosphere. . . .
>
> . . . .
>
> Measurements of ocean heat gain, and smaller heat gains inferred from melting ice and warming land and atmosphere, meant that Earth was substantially out of energy balance by the year 2000, by 0.5 to 1 W/m^2.[47]

As scientists were furthering their understanding of the causes and implications of global heating, the target selection process was less concerned with scientific precision and more concerned with forming international consensus. The eventual adoption of the 2°C target in the Paris Agreement is due, in large part, to the influence of the Netherlands and Germany.[48] Both nations adopted the target internally and subsequently promoted the target to other European nations. In 1996, the Council of the European Union, working closely with the German Advisory Council on Global Change, identified the 2°C target as a means to avoid dangerous risk, noting that "[g]iven the serious risk of such an increase [in temperature], the Council believes that global average temperatures should not exceed 2 degrees above pre-industrial level and that therefore concentration levels lower than 550 ppm $CO_{[2]}$ should guide global limitation and reduction efforts."[49] The United States, by

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[47] *Juliana*, Hansen Expert Report, *supra* note 11, at 18–19 (citing James E. Hansen et al., *Forcings and Chaos in Interannual to Decadal Climate Change*, 102 J. GEOPHYSICAL RSCH. 25679 (1997)).

[48] Morseletto, Biermann & Pattberg, *supra* note 13, at 660.

[49] European Commission Press Release PRES/96/188, 1939th Council Meeting Community Strategy on Climate Change (June 25–26, 1996), https://ec.europa.eu/commission/presscorner/detail/en/PRES_96_188.

contrast, opposed accepting any clear target during the early 2000s.[50] Although the United States was formally in favor of stabilizing GHG concentrations, it preferred that the IPCC lead this charge, not the AGGG.[51] This created "instability at the political level" as the world's two largest economic zones and emitters of GHGs proposed different global climate change policy approaches.[52]

Meanwhile, by the early 2000s, according to Dr. Hansen's testimony in the *Juliana v. United States* climate change case brought by twenty-one young Americans in 2015, scientists were becoming "reasonably convinced, mainly on the basis of [EEI and] paleoclimate evidence [to determine climate sensitivity], that 2°C global warming (equivalent to an atmospheric CO_2 concentration of approximately 450 ppm) would be highly dangerous."[53] He explained that: "Our scientific understanding indicated an initial target of no more than 350 ppm CO_2 to avoid dangerous impacts, but the target must be continually evaluated as the world [makes] progress in turning around CO_2 growth (CO_2 in 2007 was already 358 ppm)."[54]

Nevertheless, for the next decade, institutions around the world began embracing 2°C as a long-term, set-in-stone target, "even though there was substantial scientific evidence showing such a target was highly dangerous to humanity."[55] For example, in 2005, the International Climate Change Taskforce[56] reported "a long-term objective of preventing average global surface temperature from rising by more than 2°C . . . ."[57] In 2009, the Major Economies Forum on Energy and Climate, a forum of seventeen international economies,[58] recognized that

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[50] Morseletto, Biermann & Pattberg, *supra* note 13, at 660. *See generally* NATHANIEL RICH, LOSING EARTH: A RECENT HISTORY (2019) (summarizing the United States' political role and influence in the UNFCCC process, and how the United States wielded its power to thwart meaningful progress on climate change on the international level by detailing the United States' political machinations to avoid effective action on climate change in the domestic and international realms).

[51] Morseletto, Biermann & Pattberg, *supra* note 13, at 660.

[52] *Id.*

[53] *Juliana*, Hansen Expert Report, *supra* note 11, at 22.

[54] *Id.*

[55] *Id.* at 23.

[56] An alliance of the Institute for Public Policy Research in the United Kingdom, the Center for American Progress in the United States, and the Australia Institute. INTERNATIONAL CLIMATE CHANGE TASKFORCE, MEETING THE CLIMATE CHALLENGE: RECOMMENDATIONS OF THE INTERNATIONAL CLIMATE CHANGE TASKFORCE 9 (2005), https://www.ippr.org/files/images/media/files/publication/2011/05/meeting_the_climate_challenge_1331.pdf.

[57] *Id.* at 3.

[58] *President Obama Announces Launch of the Major Economies Forum on Energy and Climate*, WHITE HOUSE (Mar. 28, 2009), https://obamawhitehouse.archives.gov/the-press-office/president-obama-announces-launch-major-economies-forum-energy-and-climate. This forum of seventeen

global temperatures should not exceed 2°C.[59] Most notably, the 2009 Copenhagen and 2010 Cancun COPs recognized 2°C as an objective target.[60]

At the 2009 COP in Copenhagen, 141 countries endorsed the 2°C target and suggested that they would consider a more ambitious target of 1.5°C—a number initially raised by small island states threatened by sea-level rise—in the future.[61] However, consensus around the 2°C target was mainly symbolic and useless as a practical matter.[62] The Parties did not specify any emissions reductions or a timeline for achieving it, which "depriv[ed] the target of both a specific context and instruments for its concrete fulfilment."[63] Furthermore, the United States, China, and many other developing nations prioritized their economic growth over commitments toward a binding 2°C target.[64] Therefore, the target remained symbolically resilient, despite the dearth of scientific evidence supporting 2°C as a means to prevent dangerous climate change and protect fundamental human rights.

The 2°C temperature goal was ultimately memorialized into a major climate governance agreement in the 2015 Paris Agreement. The governments that signed the Paris Agreement agreed to the long-term goal of limiting the global average temperature increase to "well below 2°C above pre-industrial levels" and to "pursu[e] efforts to limit the temperature increase to 1.5°C above pre-industrial levels . . . ."[65] The ultimate acceptance of the 2°C limit with an aspiration toward 1.5°C was the product of negotiations around three target options. Negotiators

large economies brought together the G8 along with: Australia, Brazil, China, Indonesia, Korea, Mexico, Russia, and South Africa. *Id.*

[59] Morseletto, Biermann & Pattberg, *supra* note 13, at 662. *See Declaration of the Leaders the Major Economies Forum on Energy and Climate*, WHITE HOUSE (July 9, 2009), https://obamawhitehouse.archives.gov/the-press-office/declaration-leaders-major-economies-forum-energy-and-climate.

[60] Morseletto, Biermann & Pattberg, *supra* note 13, at 665.

[61] *Id.* at 664; *Information Provided by Parties to the Convention Relating to the Copenhagen Accord*, U.N. CLIMATE CHANGE, https://unfccc.int/process/conferences/pastconferences/copenhagen-climate-change-conference-december-2009/statements-and-resources/information-provided-by-parties-to-the-convention-relating-to-the-copenhagen-accord (last visited Sept. 10, 2022).

[62] Morseletto, Biermann & Pattberg, *supra* note 13, at 665.

[63] *Id.* at 664. The Copenhagen conference, originally touted as "Hopenhagen," *see, e.g.*, Martin Mark Jones, *"Hopenhagen" to "Nopenhagen"? The Role of Public Expectation at the Copenhagen Summit*, E-INT'L REL. (July 3, 2011), https://www.e-ir.info/2011/07/03/"hopenhagen"-to-"nopenhagen"-the-role-of-public-expectation-at-the-copenhagen-summit/, failed to achieve meaningful implementation strategies largely due to the influence of the United States, which refused legally binding accords. Morseletto, Biermann & Pattberg, *supra* note 13, at 664.

[64] Morseletto, Biermann & Pattberg, *supra* note 13, at 664.

[65] Paris Agreement, *supra* note 1, at art. 2, § 1(a).

presented (1) a 2°C goal, (2) a 1.5°C goal, and (3) a 2°C goal with an aspiration toward 1.5°C.[66]

Although the Paris Agreement was quickly adopted by most nations, like the predecessor agreements from Copenhagen and Cancun, the agreement lacked any legally binding emissions reduction targets or strict deadlines for achieving interim goals.[67] The drafters of the Paris Agreement were likely influenced by the perceived failures of the 1997 Kyoto Protocol and the non-ratification of the agreement by the United States Senate, which objected to the country-specific emissions targets.[68] The Paris Agreement, by contrast, and once again accommodating economic influencers such as the United States, avoided enforcement of specific emissions targets. It focused, instead, on achieving consensus through a loosely expressed target range of "well below 2°C" and through the promotion of nonbinding, voluntary Nationally Determined Contributions ("NDCs"), seemingly enforceable only if translated into national laws and policies.[69]

Under the Paris Agreement, governments agreed to pursue "the highest possible ambition" when establishing their NDCs.[70] Yet, "target culture" typically leads to minimization, where "[e]ven if you say 'this target is the minimum', as the [Paris Agreement] does, politicians treat it as merely the line they need to cross."[71] Under current NDCs, for example, many countries are "pursuing efforts" that will result in approximately

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[66] Hari Osofsky et al., *The 2015 Paris Agreement on Climate Change: Significance and Implications for the Future*, 46 ENV'T L. REP. NEWS & ANALYSIS 10267, 10271 (2016).

[67] Maria L. Banda, *The Bottom-Up Alternative: The Mitigation Potential of Private Climate Governance After the Paris Agreement*, 42 HARV. ENV'T L. REV. 325, 331 (2018).

[68] *See, e.g.*, *id.* at 332.

[69] *See, e.g.*, Commune de Grande-Synthe v. France [CE] [highest administrative court], July 1, 2021, http://climatecasechart.com/climate-change-litigation/non-us-case/commune-de-grande-synthe-v-france/ (issuing a decision on July 1, 2021 ordering the government to "take all the measures necessary" to reduce GHG emissions in line with its Paris Agreement commitment by 40% in 2030 compared to 1990 levels, "noting that . . . current climate regulations were insufficient to meet the target" and "[t]he Council ordered the government to take the necessary measures by March 31, 2022"). *See generally* Lisa Benjamin & Adelle Thomas, *1.5°C to Stay Alive?: AOSIS and the Long Term Temperature Goal in the Paris Agreement* (2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3392503.

[70] Paris Agreement, *supra* note 1, at art. IV, § 3. *See also Key Aspects of the Paris Agreement*, U.N. CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/key-aspects-of-the-paris-agreement.

[71] George Monbiot, Opinion, *Let's Abandon Climate Targets, and Do Something Completely Different*, GUARDIAN (Jan. 29, 2020), https://www.theguardian.com/commentisfree/2020/jan/29/climate-targets-committee-on-climate-change-report.

2.9°C or higher of heating;[72] a strategy that has irreversible consequences.[73] Many countries that purport to align domestic emissions laws to the Paris Agreement's target are woefully off track, thereby illustrating that political ambition does not necessarily equate to changes on the ground without enforcement mechanisms in place.[74]

Notwithstanding persistent pleas for more aggressive, enforceable limits on the amount of allowable heating,[75] the Copenhagen Accord enshrined 2°C as the central goal of international climate politics, stating only that countries would "consider" limiting temperature increases to less than 1.5°C (no country did at the time).[76] Similarly, the Paris Agreement agreed only to "pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[77] All the while, these agreements, rightly celebrated as successes in international diplomacy, obfuscate the reality that there is no scientific support for the notion that achieving such goals will restore EEI, avert dangerous climate change, or protect human rights. The Paris Agreement target, if achieved, essentially sanctions dangerous climatic interference by setting allowable levels of global heating too high, which begs the question of its relevance in the realm of fundamental rights protection.

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[72] CLIMATE ACTION TRACKER: PARIS AGREEMENT TURNING POINT 1 (Dec. 2020), https://climateactiontracker.org/documents/829/CAT_2020-12-01_Briefing_GlobalUpdate_Paris5Years_Dec2020.pdf.

[73] Monbiot, *supra* note 71. *See also* Martin Parry, Jason Lowe & Clair Hanson, *Overshoot, Adapt and Recover*, 458 NATURE 1102 (2009) (arguing that more attention should be paid to the importance of adaptation); W. Neil Adger & Jon Barnett, *Four Reasons for Concern about Adaptation to Climate Change*, 41 ENV'T & PLAN. A: ECON. & SPACE 2800 (2009) (expressing concern about the ability to successfully adapt to the realities of climate change).

[74] *See Australia*, CLIMATE ACTION TRACKER (Aug. 2, 2022), https://climateactiontracker.org/countries/australia (rating Australia's NDC under the Paris Agreement as "insufficient" because "its recent support for new gas projects and ongoing backing of fossil fuel projects indicates a discrepancy with its new NDC target"); *Canada*, CLIMATE ACTION TRACKER (Sept. 15, 2022), https://climateactiontracker.org/countries/canada (rating Canada's NDC under the Paris Agreement as "highly insufficient" because "[r]ecent climate policy developments, while positive, are insufficient to address the climate crisis" and their "2030 target is not quite Paris compatible" and "are only in line with 4°C warming"); *USA*, CLIMATE ACTION TRACKER (Aug. 16, 2022), https://climateactiontracker.org/countries/usa/ (rating the United States' NDC under the Paris Agreement as "insufficient" because while "President Biden signed into law the Inflation Reduction Act (IRA), the most ambitious and potentially impactful climate policy in US history," the "US will need to implement additional policies to reach its proposed 50-52% reduction target").

[75] Robin Webster, *A Brief History of the 1.5C Target*, CLIMATE HOME NEWS (Oct. 12, 2015), https://www.climatechangenews.com/2015/12/10/a-brief-history-of-the-1-5c-target/. Since at least 2008, a key demand of the Alliance of Small Island States ("AOSIS") has been to limit global heating to 1.5°C as compared to pre-industrial levels. *Id.*

[76] *Id.*

[77] Paris Agreement, *supra* note 1, at art. 2, § 1(a).

C. The Popularization and Acceptance of the 2°C Target as a Standard to Protect Fundamental Rights

The Paris Agreement target became popularized and accepted because it brought a complex, multi-dimensional problem down to a scale that was "readable for policymakers" while still, in theory, "retaining the flexibility needed to integrate both scientific and political uncertainties."[78] A more blunt assessment of the forward-looking target is that it enabled countries to continue emitting vast quantities of GHG emissions, passing the conundrum of decarbonizing economies onto the young and future generations. One clear value of the target is that it communicates the policy direction adopted by the international community, even if it obscures other scientific complexities and truths. A downside is that such oversimplification tends to focus on a single, static indicator (e.g., an absolute temperature target), when, in fact, attention to the relationship between a series of scientifically supported and measurable indicators (e.g., EEI) would allow for a more precise, equally manageable policy prescription.[79]

Despite the known risks of oversimplification and the lack of scientific support, the 2°C target nevertheless grew in popularity as it was echoed and repeated throughout social and political outlets leading up to and after the Paris Agreement. An analysis of media communications regarding 2°C, for example, reveals that, throughout the 1990s and leading up to Copenhagen in 2009, news reports around the world relied on the use of "anonymous expertise to legitimate claims of a two degree dangerous limit."[80] In fact, major newspapers began to report that there was a "growing consensus around two degrees" and indicated that scientists had endorsed this number, noting it was "determined on the basis of the science" or the opinion of unidentified "many scientists."[81] Moreover, news coverage of the G8 Summit in 2009 championed that world leaders

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[78] Béatrice Cointe, Paul-Alain Ravon & Emmanuel Guérin, *2°C: The History of a Policy–Science Nexus* 1 (IDDRI SciencesPo, Working Paper No. 19, 2011), https://www.researchgate.net/publication/303018742_2C_the_history_of_a_policy-science_nexus.

[79] *See* Knutti et al., *supra* note 3, at 1 (noting that temperature increase was only one of many available metrics for measuring dangerous anthropogenic warming. Other targets assessed included limits to GHG concentrations, energy uptake, sea-level rise, ocean acidification, rates of temperature change, regional climate change, specific local impacts, emissions reductions, and avoidance of tipping points like loss of the Greenland ice sheet); *see also* von Schuckmann et al., *supra* note 4, at 2015 (explaining that EEI is the most crucial measure of climate change because "EEI is less subject to decadal variations associated with internal climate variability than global surface temperature and therefore represents a robust measure of the rate of climate change").

[80] Christopher Shaw, *Choosing a Dangerous Limit for Climate Change: Public Representations of the Decision Making Process*, 23 GLOB. ENV'T CHANGE 563, 567 (2013).

[81] *Id.*

had embraced the 2°C target. A representative headline stated: "World leaders last night pledged to stop the planet's temperature rising by more than two degrees."[82] If the science itself supported a lower target, as explained by Dr. Hansen and others, how did such a value become so widely accepted?

One theory is that the target found favor with political leaders because it was "'the vaguest and the least directly binding' target."[83] Political leaders could endorse the 2°C target, secure with the knowledge that the "target [was] vague enough to avoid the perils of policy implications," particularly those that are politically difficult to achieve.[84] In fact, according to John Holdren, President Barack Obama's Science Advisor, "[t]he 2°C figure was agreed [to] not because it would be 'safe', but because multiple analyses had indicated that doing much better would be extremely difficult technologically and economically."[85] However, these analyses did not change what was scientifically necessary for the planet. In addition, scholars have observed that the "primary function of the two degree limit is not to accurately communicate scientific knowledge about likely future climate impacts so much as to act as an anchoring device that frames climate change in a language commensurate with policy making and simplifies complexities for a non-expert, public audience."[86] In short, from a policy perspective, many held the opinion that "any limit is better than no limit at all."[87]

Policymakers and many others presumed the 2°C target was "science based," an assumption now advanced by many climate change advocates today. Even subsequent publications of the UNFCCC are at odds with its own mandate.[88] Some scholars have postulated that the implicit trust in viewing 2°C as an acceptable target may have been a product of the "opportunism of policymakers in placing responsibility for action onto the scientists or on misinterpretation by policymakers of the meaning and

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[82] *Id.*

[83] Morseletto, Biermann & Pattberg, *supra* note 13, at 663.

[84] *Id.*

[85] Eric Larson et al., Princeton Univ., Net-Zero America: Potential Pathways, Infrastructure, and Impacts, at 4 (Dec. 15, 2020), https://environmenthalfcentury.princeton.edu/sites/g/files/toruqf331/files/2020-12/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf.

[86] Shaw, *supra* note 80, at 568.

[87] *Id.*

[88] *See* Knutti et al., *supra* note 3, at 1 ("Following the Copenhagen Accord in 2009, the UNFCCC formally decided in 2012 to pursue actions in line with a 2 °C global temperature increase target. This target was a political decision informed by science, but no scientific assessment ever defended or recommended a particular target. Policymakers like to hide behind scientific evidence, ask for 'actionable science' and claim to make 'science-based decisions'. Some argue that this process 'has more in common with a salad bar — where people pick and choose convenient studies — than with the balanced search for truth that science aspires to'.").

implications of the 2°C target."[89] Whatever the reason, the 2°C target was assigned scientific support it simply lacks. According to Sir David King, Chief Scientific Advisor to the UK government from 2007–2013, the Foreign Secretary's Permanent Special Representative on Climate Change from 2013–2017, and a highly influential negotiator leading up to the Paris Agreement's embrace of the 1.5°C aspirational target: "The analyses of the IPCC show that even an average temperature rise from 1.5 to 2.0 degrees C above pre-industrial levels would severely impact on [sic] human well-being, worldwide."[90] As a result, he said, "I have now changed my position. I'm now saying to everyone, I was wrong. 1.5 degrees is far too much," a conclusion clearly supported by the science as described below.[91]

D. The Impacts of Current Warming and Projected Heating of 1.5°C–2°C Impacts Human Rights

There is near-universal scientific agreement that planetary heating of 1.5°C–2°C will have disastrous consequences. Our current situation, after all, is wholly unprecedented.[92] In 2020, global average CO_2 levels reached 412.5 ppm.[93] May 2021 saw a monthly average of 419 ppm:

> [This] is now comparable to where it was during the Pliocene Climatic Optimum, between 4.1 and 4.5 million years ago, when CO_2 was close to, or above 400 ppm. During that time, sea level was about 78 feet higher than today, the average temperature was 7 degrees Fahrenheit higher than in pre-industrial times, and studies indicate large forests occupied areas of the Arctic that is now tundra.[94]

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[89] Morseletto, Biermann & Pattberg, *supra* note 13, at 661 (internal citations omitted).

[90] Zoe Blackler, *Defence Statement by Sir David King in Support of Five Extinction Rebellion Defendants*, EXTINCTION REBELLION (Jan. 31, 2020), https://extinctionrebellion.uk/2020/01/31/defence-statement-by-sir-david-king-in-support-of-five-extinction-rebellion-defendants/. *See also* Alberto Lidji, *Guest Profile: Sir David King*, CLIMATE REPAIR (Oct. 4, 2020), https://www.lidji.org/sir-david-king.

[91] Lidji, *supra* note 90.

[92] BRUNO LATOUR, DOWN TO EARTH 44 (Catherine Porter trans., 2018) ("We understand nothing about the vacuity of contemporary politics if we do not appreciate the stunning extent to which the situation [of the Anthropocene] is unprecedented."). *See also* SUMMARY FOR POLICYMAKERS 6 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf (reflecting a summary of the major findings in the Sixth Assessment Report conducted by the IPCC in 2021).

[93] *Despite Pandemic Shutdowns, Carbon Dioxide and Methane Surged in 2020*, NOAA RSCH. NEWS (Apr. 7, 2021), https://research.noaa.gov/article/ArtMID/587/ArticleID/2742/Despite-pandemic-shutdowns-carbon-dioxide-and-methane-surged-in-2020.

[94] *Carbon Dioxide Peaks Near 420 Parts Per Million at Mauna Loa Observatory*, NOAA RSCH. NEWS (June 7, 2021) (internal citations omitted), https://research.noaa.gov/article/ArtMID/587/ArticleID/2764/Coronavirus-response-barely-

Already, impacts at current levels of warming (~1.0°C–1.2°C)[95] are threatening entire irreplaceable ecosystems and harming the communities around the globe who depend on them, disproportionately burdening the most poor and vulnerable—especially the young.[96] In regions such as the Arctic, for instance, the migration of climate zones toward the poles is causing a "new climate state," with such shifts "changing the geography of the planet":[97]

> Because warming is not equally distributed across the globe, a 2 degree C average warming across the globe implies a 4 to 6 degrees C warming in the Arctic. This means seasonal sea ice cover will be gone, [the] Greenland ice sheet will melt almost completely and all Antarctic ice shelves will break up and disappear, entraining rapid speed up of the glaciers and multiple meter[s] of sea level rise per century.[98]

Other physical systems, such as the Amazon Rainforest and permafrost, are similarly nearing irrecoverable tipping points. Coral reefs are already in "considerable irreversible decline," and "restraining warming to 'well below' 2°C (equivalent to approximately 450 ppm of CO_2) will still result in the loss of 90% of today's corals."[99]

slows-rising-carbon-dioxide. *See also Highest-Ever Mauna Loa CO2 Levels*, CO2-EARTH, https://www.co2.earth/co2-records (last visited Aug. 28, 2022) (recording 422.06 ppm of CO_2 in the Earth's atmosphere on April 26, 2021, the highest level ever recorded).

[95] At present, current figures estimate that human activities are responsible for causing 1.0°C of global warming. SUMMARY FOR POLICYMAKERS, *supra* note 92, at 5.

[96] *Climate Justice*, U.N. SUSTAINABLE DEV. GOALS (May 31, 2019), https://www.un.org/sustainabledevelopment/blog/2019/05/climate-justice/.

[97] Andrew Glikson, *Polar-Ward Climate Zones Shift and Consequent Tipping Points*, ARCTIC NEWS (Dec. 4, 2020), https://arctic-news.blogspot.com/2020/12/polar-ward-climate-zones-shift-and-consequent-tipping-points.html. *See generally* Laura Landrum & Marika M. Holland, *Extremes Become Routine in an Emerging New Arctic*, 10 NATURE CLIMATE CHANGE 1108 (2020).

[98] Expert Report of Eric Rignot, Ph.D. at 2, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 262-1).

[99] Expert Report of Ove Hoegh-Guldberg, Ph.D. at 8, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 21-11) (internal citations omitted). *See also* Armstrong McKay et al., *supra* note 5, at 1177, 1178.

In 2020 alone, deadly wildfires burned in Australia,[100] Siberia,[101] the American West,[102] and South America,[103] and torched a quarter of Brazil's Pantanal, the world's largest tropical wetland, in some instances with devastating health consequences.[104] In 2021, "heat domes" shrouded the Western U.S., smashing temperature records in June and baking an already desiccated landscape, setting the stage for more deadly wildfires.[105] The heat wave of 2021 "erased" the Canadian town of Lytton, British Columbia, with incalculable consequences for its residents.[106] In 2022, Malaysia experienced heavy rain and massive flooding forcing the evacuation of nearly 125,000 people,[107] Antarctica had an unprecedented heat wave in March setting a new world record for

[100] Matthew Cappucci, *Australian Fires Had Bigger Impact on Climate than Covid-19 Lockdowns in 2020*, WASH. POST (July 27, 2021), https://www.washingtonpost.com/weather/2021/07/27/australian-bushfires-smoke-climate-covid/ ("More than 42 million acres burned in an unprecedented outbreak of extreme fires, which produced lightning, launched smoky aerosols into the stratosphere and turned New Zealand's glaciers brown with ash. The suffocating smoke was blamed for hundreds of deaths.").

[101] *Why Forest Fires in Siberia, Russia Threaten Us All*, BBC NEWS (Sept. 17, 2020), https://www.bbc.com/news/av/science-environment-54126762 ("Wildfires in Siberia have been releasing record amounts of greenhouse gases, scientists say, contributing to global warming.").

[102] *A Wall of Smoke on the U.S. West Coast*, EARTH OBSERVATORY (Sept. 9, 2020), https://earthobservatory.nasa.gov/images/147261/a-wall-of-smoke-on-the-us-west-coast ("Wildfires continue to rage in the Western United States. . . . The smoke was so thick and widespread that it was easily visible from 1.5 million kilometers (1 million miles) away from Earth.").

[103] Uki Goñi, Sam Cowie & William Costa, *'Total Destruction': Why Fires Are Tearing Across South America*, GUARDIAN (Oct. 9, 2020), https://www.theguardian.com/environment/2020/oct/09/a-continent-ablaze-why-fires-are-tearing-across-south-america ("Argentina, Brazil, Paraguay and Bolivia this year have seen a raging tsunami of fires, in what may become the longest and most destructive environmental crisis faced by the four neighboring countries.").

[104] Catrin Einhorn, Maria Magdalena Arréllaga, Blacki Migliozzi & Scott Reinhard, *The World's Largest Tropical Wetland Has Become an Inferno*, N.Y. TIMES (Oct. 13, 2020), https://www.nytimes.com/interactive/2020/10/13/climate/pantanal-brazil-fires.html. *See, e.g.*, Yisi Liu et al., *Health Impact Assessment of the 2020 Washington State Wildfire Smoke Episode: Excess Health Burden Attributable to Increased $PM_{2.5}$ Exposures and Potential Exposure Reductions*, 5 GEOHEALTH 1, 6 (2021), https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2020GH000359 ("According to [the] health impact assessment using the [concentration reform function] for total $PM_{2.5}$, the 13-day exposure to wildfire smoke exposure may have led to 92.2 (95% CI: 0.0, 178.7) cases of excess all-cause mortality.").

[105] Matthew Cappucci, *Yet Another Major Heat Wave Is Set to Roast the Western U.S. and Canada by the Weekend*, WASH. POST (July 15, 2021), https://www.washingtonpost.com/weather/2021/07/14/western-heat-wave-rockies/.

[106] Vjosa Isai, *Heat Wave Spread Fire That 'Erased' Canadian Town*, N.Y. TIMES (July 10, 2021), https://www.nytimes.com/2021/07/10/world/canada/canadian-wildfire-british-columbia.html.

[107] *Malaysia Floods Hit Seven States Forcing Thousands to Evacuate*, CNN WORLD (Jan. 2, 2022), https://www.cnn.com/2022/01/02/asia/malaysia-floods-evacuation-intl-hnk/index.html.

the largest temperature increase above normal,[108] India had its hottest March in 122 years,[109] and Yellowstone National Park had so much rainfall it caused substantial flooding and mudslides.[110]

This current planetary emergency is simultaneously triggering a societal emergency. Climate-induced migration is but one example. Although it is difficult to know the true number of people displaced directly or indirectly by climate change, estimates range from 25 to over 200 million.[111] In 2018 alone, sudden-onset natural disasters displaced 17.2 million people.[112] In March 2021, it was reported that "[o]ver 12 million people around the world have been pushed out of their homes in the last six months . . . 80 percent of whom were displaced due to natural and climate-related disasters."[113] In August 2022, unprecedented flooding resulted in a third of Pakistan being underwater, with a half a million people forced to flee their homes.[114] A second example of societal turmoil comprises the profound and worsening health impacts of climate change, especially on those, including children, who are most susceptible. A recent United Nations report, which introduces a children's climate risk index, frames the climate crisis as a "child rights crisis" that creates

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[108] *Antarctic Heatwave: A Rapid Analysis of the March 2022 Dome C Record Heatwave*, BERKELEY EARTH (Apr. 12, 2022), https://berkeleyearth.org/antarctic-heatwave-rapid-attribution-review-dome-c-record/.

[109] Soumya Sarkar, *India Experiences its Hottest March in 122 Years,* QUARTZ INDIA (Apr. 19, 2022), https://qz.com/india/2156332/india-experiences-its-hottest-march-in-122-years/.

[110] Jim Robbins, Thomas Fuller & Christine Chung, *Flooding Chaos in Yellowstone, a Sign of Crises to Come,* N.Y. TIMES (June 15, 2022), https://www.nytimes.com/2022/06/15/us/yellowstone-national-park-floods.html.

[111] KANTA KUMARI RIGAUD ET AL., GROUNDSWELL: PREPARING FOR INTERNAL CLIMATE MIGRATION 21 (2018), https://openknowledge.worldbank.org/handle/10986/29461; VIVIANE CLEMENT ET AL., GROUNDSWELL PART 2: ACTING ON INTERNAL CLIMATE MIGRATION, at xx, xxii (2021), https://openknowledge.worldbank.org/handle/10986/36248 (noting that "[t]he two reports' combined findings provide, for the first time, a global picture of the potential scale of internal climate migration . . . allowing for a better understanding of how [slow-onset] climate change impacts, population dynamics, and development contexts shape mobility trends"); *Climate Change Could Displace 216 Million by 2050: Report*, ALJAZEERA (Sept. 14, 2021), https://www.aljazeera.com/news/2021/9/14/climate-change-could-displace-216-million-by-2050-report.

[112] GLOBAL REPORT ON INTERNAL DISPLACEMENT 1 (2019), http://www.internal-displacement.org/sites/default/files/publications/documents/2019-IDMC-GRID.pdf.

[113] Katelyn Weisbrod, *Warming Trends: Climate Refugees, Ocean Benefits and Tropical Species Moving North*, INSIDE CLIMATE NEWS (Mar. 20, 2021), https://insideclimatenews.org/news/20032021/warming-trends-natural-disasters-create-the-most-refugees-new-climate-benefits-from-ocean-protections-and-tropical-species-moving-to-the-southern-us/.

[114] Emily Atkinson, *Pakistan Floods: Third of Country Under Water with Half a Million Forced from Homes*, INDEPENDENT (Aug. 29, 2022), https://www.independent.co.uk/climate-change/news/pakistan-floods-climate-minister-b2155169.html.

"incredibly challenging environments for children to live, play and thrive."[115]

In a world with 1.5°C of warming, virtually all natural and human systems will be altered, and disadvantaged and vulnerable communities will be hit the hardest.[116] As the IPCC acknowledges, "Compared to current conditions, 1.5°C of global warming would nonetheless pose heightened risks to eradicating poverty, reducing inequalities and ensuring human and ecosystem well-being."[117] The IPCC concludes:

> Warming of 1.5°C is not considered 'safe' for most nations, communities, ecosystems and sectors and poses significant risks to natural and human systems as compared to the current warming of 1°C (*high confidence*). The impacts of 1.5°C of warming would disproportionately affect disadvantaged and vulnerable populations through food insecurity, higher food prices, income losses, lost livelihood opportunities, adverse health impacts and population displacements (*medium evidence, high agreement*). Some of the worst impacts . . . are expected to be felt among agricultural and coastal dependent livelihoods, indigenous people, children and the elderly, poor labourers, poor urban dwellers in African cities, and people and ecosystems in the Arctic and Small Island Developing States (SIDS) (*medium evidence, high agreement*).[118]

Experiencing these impacts firsthand, climate vulnerable states have advocated for a revised target below 1.5°C. The International Indigenous Peoples' Forum on Climate Change,[119] CARICOM (Caribbean

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[115] NICHOLAS REES ET AL., THE CLIMATE CRISIS IS A CHILD RIGHTS CRISIS: INTRODUCING THE CHILDREN'S CLIMATE RISK INDEX 6 (2021), https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf ("Almost every child on earth is exposed to at least one climate and environmental hazard, shock or stress such as heatwaves, cyclones, air pollution, flooding and water scarcity. But a record-breaking 850 million—approximately one-third of all children—are exposed to four or more stresses . . . .").

[116] Ove Hoegh-Guldberg et al., *Impacts of 1.5°C of Global Warming on Natural and Human Systems*, *in* GLOBAL WARMING OF 1.5°C, *supra* note 7, at 178, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter3_Low_Res.pdf

[117] Joyashree Roy et al., *Sustainable Development, Poverty Eradication and Reducing Inequalities*, *in* GLOBAL WARMING OF 1.5°C, *supra* note 7, at 446, https://www.ipcc.ch/sr15/chapter/chapter-5/.

[118] *Id.*

[119] Press Release, International Indigenous Peoples Forum on Climate Change, Durban Platform for Enhanced Action (ADP) Negotiations, Bonn, Germany (June 4, 2014), https://www.forestpeoples.org/sites/default/files/news/2014/06/ADP_IIPFCC2_0.pdf.

Community),[120] and the Climate Vulnerable Forum[121] have called for limiting global average surface warming to well *below* 1.5°C above pre-industrial levels, with the Climate Vulnerable Forum further requiring the "long-term stabilisation of atmospheric greenhouse gas concentrations at well below 350ppm [sic]."[122] Coalitions of the world's most climate-vulnerable nations have taken on the additional role of gap-filling IPCC science, given its "overly-conservative"[123] nature as a consensus body that does not conduct the primary scientific research "compared to the most recent, real-world observations and peer-reviewed literature."[124] Although those most susceptible to the consequences of climate change may not have a powerful voice at the UNFCCC negotiating tables, they are documenting their stories in judicial fora around the world, presenting judicial bodies with important legal questions as to how to uphold fundamental rights in the face of the climate crisis.

II. THE ROLE OF COURTS IN ADJUDICATING FUNDAMENTAL RIGHTS IN THE CLIMATE CHANGE CONTEXT

This section briefly surveys several judicial decisions that have considered climate change as a fundamental rights issue and identifies the legal risks inherent in an advocate's use of the Paris Agreement target as a proxy legal standard designed to protect fundamental rights.

A. Courts Are Finding Climate Change Infringes Fundamental Rights

Legal arguments that climate change infringes fundamental rights have largely succeeded. The central challenge for judicial bodies hearing climate change cases has been assigning a remedy that actually protects fundamental rights. Although an increasing number of climate change

[120] Press Release, CARICOM, CARICOM Declaration for Climate Action (June 5, 2015), https://caricom.org/caricom-declaration-for-climate-action/.

[121] Press Release, Climate Vulnerable Forum, Declaration of the Climate Vulnerable Forum (Nov. 10, 2009), https://daraint.org/wp-content/uploads/2010/12/Declaration-of-the-CVF-FINAL2.pdf.

[122] *Id.*

[123] Declaration of Kevin E. Trenberth in Support of Plaintiffs' Urgent Motion Under Circuit Rule 27-3(b) for Preliminary Injunction at 4–5, Juliana v. United States, 947 F.3d 1159 (9th Cir. 2020) (No. 18-36082).

[124] *Id. See also* Indigenous Women of the Americas Defenders of Mother Earth Treaty Compact, Sept. 27, 2015, http://indigenouswomenrising.org/defenders-of-mother-earth-treaty/ (stating that the natural laws "have been violated to such an extreme degree that the sacred system of life is now threatened and does not have the capacity for life to continue safely in the way in which it has existed for millions of years" and calling for women to "[n]onviolently rise up with others in [their] communities and around the world to demand immediate changes in the laws that have created the destruction").

cases appear in courts today,[125] climate change cases have been litigated for over thirty years, and thus the central legal issues have evolved over time.[126] In some of the early climate change cases, judges struggled with the quandary of an injury that appeared too distant or hypothetical.[127] But, more recently, plaintiffs have been able to surmount the injury threshold.[128] As a Belgian court recently acknowledged in *Klimaatzaak*

[125] Jocelyn Timperley, *The Law That Could Make Climate Change Illegal*, BBC (July 7, 2020), https://www.bbc.com/future/article/20200706-the-law-that-could-make-climate-change-illegal; Matthew Green, Valerie Volcovici & Emma Farge, *Climate Battles Are Moving into the Courtroom, and Lawyers Are Getting Creative*, REUTERS (July 2, 2020, 4:15 PM), https://www.reuters.com/article/us-climate-change-lawsuits/climate-battles-are-moving-into-the-courtroom-and-lawyers-are-getting-creative-idUKKBN2433G5?edition-redirect=uk; Holding Redlich, *Climate Change Litigation and the Human Rights Act 2019*, LEXOLOGY (July 1, 2020), https://www.lexology.com/library/detail.aspx?g=9d4ee4ae-68c8-440c-bf02-aa4963b5dcb4. *See also* Ellen M. Gilmer, *Climate Cases Poised for Bigger Fights as Courts Clear Hurdles*, BLOOMBERG L. (June 2, 2020, 3:01 AM), https://news.bloomberglaw.com/environment-and-energy/climate-cases-poised-for-bigger-fights-as-courts-clear-hurdles?context=article-related; Quinn Emanuel Urquhart & Sullivan, LLP, *May 2020: A Critical Period for Climate Change Litigation*, JD SUPRA (June 1, 2020), https://www.jdsupra.com/legalnews/may-2020-a-critical-period-for-climate-65829/.

[126] *See, e.g.*, Found. on Econ. Trends v. Watkins, 731 F. Supp. 530, 530–31, 533 (D.D.C. 1990) (hearing plaintiffs' complaint against the Secretaries of Interior, Agriculture, and Energy for "authorizing, carrying out, approving, funding, or participating in programs that contribute to the 'greenhouse effect'" without evaluating environmental impacts of the actions under the National Environmental Policy Act and denying defendants' motion to dismiss as plaintiffs were not seeking an advisory opinion, claims were ripe, and plaintiffs had standing); Los Angeles v. Nat'l Highway Traffic Safety Admin., 912 F.2d 478, 485, 490 (D.C. Cir. 1990) (finding that cities and state had standing to challenge NHTSA's decision not to prepare environmental impact statements under the National Environmental Policy Act prior to issuing Corporate Average Fuel Economy Standards for automobiles, but deciding the agency's decision was not arbitrary, capricious, or otherwise contrary to law), *overruled by* Fla. Audubon Soc'y v. Bentsen, 94 F.3d 658 (D.C. Cir. 1996) (en banc); Border Power Plant Working Grp. v. Dep't of Energy, 260 F. Supp. 2d 997, 1016, 1023 (S.D. Cal. 2003) (holding that the environmental impact of Mexican power plants had to be considered under the National Environmental Policy Act and agency determination that the operation of the power plants would not have significant impact on ecologically critical area was arbitrary and capricious); Native Vill. of Kivalina v. ExxonMobil Corp., 696 F.3d 849, 853, 858 (9th Cir. 2012) (holding that the Clean Air Act preempted federal common law, thus precluding plaintiff's public nuisance claim); Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 420, 424 (2011) (an equally divided Court held that plaintiff-states had standing to sue, but a majority held that the Clean Air Act "displace[d] any federal common-law right to seek abatement of . . . emissions from fossil-fuel fired powerplants").

[127] *See, e.g.*, Massachusetts v. EPA, 549 U.S. 497, 541–42 (2007) (Roberts, C.J., dissenting) (noting that "[t]he very concept of global warming seems inconsistent with this particularization requirement" and "accepting a century-long time horizon and a series of compounded estimates [of sea level rise] renders requirements of imminence and immediacy utterly toothless"); Ctr. for Biological Diversity v. U.S. Dep't of Interior, 563 F.3d 466, 478 (D.C. Cir. 2009) ("Petitioners can only aver that any significant adverse effects of climate change 'may' occur at some point in the future. This does not amount to the actual, imminent, or 'certainly impending' injury required to establish standing.").

[128] *See* Juliana v. United States, 947 F.3d 1159, 1168 (9th Cir. 2020) (noting that "'it does not matter how may persons have been injured' if the plaintiffs' injuries are 'concrete and personal'" (quoting *Massachusetts*, 549 U.S. at 517)); *see also* Cath. League for Religious & C.R. v. City &

ASBL v. Belgium, "[i]n the current state of climate science . . . there can no longer be any doubt that there is a real threat of dangerous climate change with a direct negative effect on the daily lives of current and future generations . . . ."[129] Similarly, in *Juliana v. United States*, the Ninth Circuit Court of Appeals recognized that climate change is affecting the plaintiffs "now in concrete ways and will continue to do so unless checked."[130]

The severity of climate change injuries has prompted courts and international bodies to recognize that climate injuries implicate rights fundamental to human existence. In *Klimaatzaak*, the court held that "in pursuing their climate policy, the [government] defendants infringe the fundamental rights of the plaintiffs, and more specifically Articles 2 and 8 of the [European Convention on Human Rights], by failing to take all necessary measures to prevent the effects of climate change on the plaintiffs' life and privacy[.]"[131] In *Neubauer v. Germany*, the German Constitutional Court recognized that "[t]he state's [constitutional] duty of protection . . . also includes the duty to protect life and health against the risks posed by climate change."[132]

In denying the federal government and fossil fuel industry intervenors' motions to dismiss in *Juliana*, Oregon District Court Judge Ann Aiken became the first judge to recognize a climate-specific fundamental right, closely tied to the rights to life and liberty secured by the U.S. Constitution:

> Exercising my "reasoned judgment," I have no doubt that the right to a climate system capable of sustaining human life is fundamental to a free and ordered society. Just as marriage is the "foundation of the family," a stable climate system is quite literally the foundation "of society, without which there would be neither civilization nor progress."
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> . . . .
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> In this opinion, this Court simply holds that where a complaint alleges governmental action is affirmatively and substantially

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Cnty. of San Francisco, 624 F.3d 1043, 1048–53 (9th Cir. 2010); Novak v. United States, 795 F.3d 1012, 1018 (9th Cir. 2015); Jewel v. Nat'l Sec. Agency, 673 F.3d 902, 910 (9th Cir. 2011); Newdow v. Lefevre, 598 F.3d 638, 642 (9th Cir. 2010), *cert. denied*, 562 U.S. 1271 (2011).

[129] ASBL Klimaatzaak v. Belgium, Civ. [Tribunal of First Instance] Brussels (4th ch.), June 17, 2021, p. 61 [hereinafter *Klimaatzaak*], https://prismic-io.s3.amazonaws.com/affaireclimat/18f9910f-cd55-4c3b-bc9b-9e0e393681a8_167-4-2021.pdf.

[130] *Juliana*, 947 F.3d at 1168.

[131] *Klimaatzaak*, *supra* note 129, at 83.

[132] Neubauer v. Germany, BVerfG, 1 BvR 2656/18 et al., March 24, 2021, ¶ 148 [hereinafter *Neubauer*] (internal citations omitted), http://climatecasechart.com/wp-content/uploads/sites/16/non-us-case-documents/2021/20210324_11817_order-1.pdf.

> damaging the climate system in a way that will cause human deaths, shorten human lifespans, result in widespread damage to property, threaten human food sources, and dramatically alter the planet's ecosystem, it states a claim for a due process violation[.] To hold otherwise would be to say that the Constitution affords no protection against a government's knowing decision to poison the air its citizens breathe or the water its citizens drink. Plaintiffs have adequately alleged infringement of a fundamental right.[133]

Although *Juliana* is the only U.S. federal court to date to recognize a climate-specific right,[134] some state courts, such as the Hawai'i Supreme Court, have followed suit and ruled that the state's constitutional right to a clean and healthful environment "subsumes a right to a life-sustaining climate system."[135] In the U.S. state of Montana, Judge Kathy Seeley held that sixteen youth plaintiffs sufficiently alleged that Montana's fossil fuel energy policy implicated their right to a clean and healthy environment secured by the Montana Constitution.[136] Some state supreme court justices in dissenting opinions have followed Judge Aiken's lead in acknowledging the existence of a fundamental climate right. Justices Peter Maassen and Susan Carney, in a youth climate change case before the Alaska Supreme Court, wrote in dissent:

> I disagree with the court's rejection of declaratory relief as serving no useful purpose. In my view, a balanced consideration of prudential doctrines requires that we explicitly recognize a constitutional right to a livable climate – arguably the bare minimum when it comes to the inherent human rights to which the Alaska Constitution is dedicated.[137]

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[133] Juliana v. United States, 217 F. Supp. 3d 1224, 1250 (D. Or. 2016) (internal citations omitted), *rev'd and remanded*, 947 F.3d 1159 (9th Cir. 2020).

[134] In Washington state, King County Superior Judge Hollis Hill found, in the context of a climate change case brought by youth plaintiffs, that the "fundamental and inalienable right of the people of the State of Washington to live in a healthful and pleasant environment" codified in statute, WASH. REV. CODE § 43.21A.010 (1970), constitutes a retained right under Article I, Section 30 of the Washington State Constitution. Foster v. Wash. State Dep't of Ecology, No. 14-2-25295-1 SEA (Wash. Super. Ct. Nov. 19, 2015) (internal citations omitted); DEP'T OF ECOLOGY, WASHINGTON GREENHOUSE GAS EMISSION REDUCTION LIMITS (Dec. 2014) ("Climate change is not a far off risk. It is happening now globally and the impacts are worse than previously predicted, and are forecast to worsen. . . . If we delay action by even a few years, the rate of reduction needed to stabilize the global climate would be beyond anything achieved historically and would be more costly.").

[135] *In re* Maui Elec. Co., 506 P.3d 192, 202 n.15 (Haw. 2022).

[136] Held v. Montana, No. CDV-2020-307, at 14 (Mont. First Jud. Dist. Ct. Lewis & Clark Cnty. Aug. 4, 2021), http://climatecasechart.com/climate-change-litigation/wp-content/uploads/sites/16/case-documents/2021/20210804_docket-CDV-2020-307_order.pdf.

[137] Sagoonick v. Alaska, 503 P.3d 777, 805 (Alaska 2022) (Maassen, J., dissenting in part). *See also* Aji P. v. State of Washington, 497 P.3d 350, 353 (Wash. 2021) (Gonzalez, J., dissenting)

Several other decisions from the international circuit, including Belgium, Canada, Colombia, Germany, Norway, Portugal, and Pakistan have opened the door for climate protections based on other fundamental rights, such as the right to life, personal security, or privacy.[138] The Netherlands Supreme Court found that "no other conclusion can be drawn but that the State is required . . . to take measures to counter the genuine threat of dangerous climate change" to protect the rights to life and respect for private and family life secured by Articles 2 and 8 of the European Convention on Human Rights, which "encompass[] the positive obligation to take reasonable and appropriate measures to protect individuals against possible serious damage to their environment."[139] In Canada, Judge Carole J. Brown recognized that youth's climate change claims against the province of Ontario engaged the Canadian Charter of

("[T]he court should not avoid its constitutional obligations that protect not only the rights of these youths but all future generations who will suffer from the consequences of climate change.").

[138] Norway's Supreme Court heard a climate change case over seven days involving Article 112 of its constitution and Arctic oil exploration in Norway's Barents Sea. *See* Alexandru Gociu & Suryapratim Roy, *Norway's Supreme Court Is Set to Rule on Whether the Country Can Keep Searching for New Arctic Oil*, ARCTIC TODAY (Nov. 3, 2020), https://www.arctictoday.com/norways-supreme-court-is-set-to-rule-on-whether-the-country-can-keep-searching-for-new-arctic-oil/ ("The case focuses on Article 112 of the Norwegian Constitution, which focuses on sustainability and protection of the environment. In 2014, [Article 112] was updated to introduce a duty of care on the government to provide a livable environment for current and future generations.").

In September 2020, a group of Portuguese youth activists filed a climate change lawsuit in the European Court of Human Rights. The suit was filed against thirty-three countries and argued that those countries needed to make more ambitious emissions cuts to safeguard their future physical and mental well-being. While the European Court of Human Rights has yet to hear the merits of the case, the court did order the thirty-three governments to respond to the plaintiffs' allegations. The court also asked the governments to explain whether their failure to reduce their emissions violated various articles of the European Convention on Human Rights. Claudio Duarte Agostinho v. Portuga, App. No. 39371/20, at 2–5 (Nov. 30, 2020), https://www.nhri.no/wp-content/uploads/2020/11/DUARTE-AGOSTINHO-and-others-vs-PORTUGAL-and-32-others-unofficial-translation-fr.en_.pdf.

In 2015, a lawsuit was brought by a Pakistani farmer who argued that Pakistan had failed to live up the country's own climate plans, specifically with regard to increasing the country's resilience to climatic change. Noting that the "delay and lethargy" of the state "offend[ed]" fundamental rights, such as the rights to life and human dignity, under the Pakistani Constitution, the judge ordered the Pakistani government to establish a national commission on climate change with a clear remit to ensure steps would be taken to improve climate resiliency. Leghari v. Fed'n of Pak., (2015) W.P. No. 25501 (High Ct. Lahore) (Pak.) 1, 2, 6–7, https://elaw.org/system/files/pk.leghari.090415_0.pdf.

See also Rechtbank Den Haag 24 juni 2015 (Stichting Urgenda/Staat der Nederlanden) (Neth.), ¶ 2.38, http://climatecasechart.com/wp-content/uploads/sites/16/non-us-case-documents/2015/20150624_2015-HAZA-C0900456689_decision-1.pdf; *Sharma ex rel. Sister Marie Brigid Arthur v. Minister for the Env't [No. 2]* (2021) FCA 774 (Austl.), ¶ 58–59, https://equitygenerationlawyers.com/wp/wp-content/uploads/2021/07/Sharma-v-Minister-No-2-2021-FCA-774.pdf.

[139] HR 20 december 2019, RvdW 2020 (De Staat der Nederlanden/Stichting Urgenda) (Neth.), ¶¶ 5.6.2, 5.2.3 [hereinafter *Urgenda* Supreme Court Opinion].

Rights and Freedoms rights to life, liberty, security of the person, and equality, such that they were entitled to a trial to challenge the province's GHG emissions target and plan to reduce GHG emissions.[140]

International bodies, such as the United Nations Human Rights Office of the High Commissioner, acknowledge that the first step toward an effective remedy is a declaration that because climate change threatens the enjoyment of the full suite of human rights, states have an "obligation to prevent the foreseeable adverse effects of climate change and ensure those affected by it, particularly those in vulnerable situations, have access to effective remedies and means of adaptation to enjoy lives of human dignity."[141]

Courts are also coming to grips with the multicausal reality that defines climate change cases and are acknowledging the influential role governments play in setting policies that result in GHG emissions.[142] In recognizing that the youth had proffered sufficient evidence to show that the U.S. government's role in contributing to climate change by purposefully promoting a climate polluting fossil-fuel energy system was a "substantial factor in causing the plaintiffs' injuries," the majority in *Juliana* summarized the U.S. federal government's role as follows:

> [T]he federal government has long understood the risks of fossil fuel use and increasing carbon dioxide emissions. As early as 1965, the Johnson Administration cautioned that fossil fuel emissions threatened significant changes to climate, global temperatures, sea levels, and other stratospheric properties. In 1983, an Environmental Protection Agency ("EPA") report projected an increase of 2 degrees Celsius by 2040, warning that a "wait and see" carbon emissions policy was extremely risky. And, in the 1990s, the EPA implored the government to act before it was too late. Nonetheless, by 2014, U.S. fossil fuel emissions had climbed to 5.4 billion metric tons, up substantially from 1965. This growth shows no signs of abating. From 2008 to 2017, domestic petroleum and natural gas production increased by nearly 60%, and the country is now expanding oil and gas extraction four times faster than any other nation.[143]

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[140] Mathur v. Ontario, [2020] O.N.S.C. 6918, ¶¶ 143–47, 267–68 (Can. Ont. Sup. Ct.) [hereinafter *Mathur*], https://ecojustice.ca/wp-content/uploads/2020/11/Reasons-for-Decision-CJB-FINAL-signed-2020-11-12.pdf.

[141] *OHCHR and Climate Change*, U.N. HUM. RTS. OFF. HIGH COMM'R, https://www.ohchr.org/en/climate-change#:~:text=States (last visited Aug. 7, 2022).

[142] The attribution science is tremendously helpful on the causation issue. *See* Michael Burger, Jessica Wentz & Randley Horton, *The Law and Science of Climate Change Attribution*, 45 COLUM. J. ENV'T L. 57, 112–13 (2020).

[143] Juliana v. United States, 947 F.3d 1159, 1166 (9th Cir. 2020).

The Ninth Circuit went on to reject the argument that "the causal chain is too attenuated because it depends in part on the independent actions of third parties."[144] Other courts have similarly declined to endorse the argument that governments should not be held accountable for their conduct that contributes to climate change simply because the problem may have many contributing factors. For example, according to the Supreme Court of the Netherlands in *Netherlands v. Urgenda Foundation*:

> Partly in view of the serious consequences of dangerous climate change . . . the defence that a state does not have to take responsibility because other countries do not comply with their partial responsibility, cannot be accepted. Nor can the assertion that a country's own share in global greenhouse gas emissions is very small and that reducing emissions from one's own territory makes little difference on a global scale, be accepted as a defence. Indeed, acceptance of these defences would mean that a country could easily evade its partial responsibility by pointing out other countries or its own small share. If, on the other hand, this defence is ruled out, each country can be effectively called to account for its share of emissions and the chance of all countries actually making their contribution will be greatest . . . .[145]

Similarly, in the *Klimaatzaak* case in Belgium, the court found that "[t]he global dimension of the problem of dangerous global warming does not exempt the Belgian public authorities from their pre-described obligation under Articles 2 and 8 of the [European Convention on Human Rights]."[146]

In *Mathur v. Her Majesty the Queen in Right of Ontario*, a case brought by a group of Ontario youth challenging the provincial government's 2030 GHG emission target and climate change plan as insufficiently ambitious and violative of constitutional rights, the court recognized that "the government is acting to cause the harm in question. By lowering the target for Ontario, the government is essentially authorizing, incentivizing, and itself creating the very GHGs that are the cause of the alleged *Charter* violations in the Application." [147] The court acknowledged that "Ontario is actively authorizing and creating the very emissions that are causing harm."[148]

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[144] *Id.* at 1169.

[145] *Urgenda* Supreme Court Opinion, *supra* note 139, ¶ 5.7.7. *See also Neubauer*, *supra* note 132, ¶ 200.

[146] *Klimaatzaak*, *supra* note 129, at 61.

[147] *Mathur*, *supra* note 140, ¶ 194.

[148] *Id.* ¶ 200. The Applications point out that "Ontario established a target that essentially allows GHG emitters to continue to emit GHGs into the atmosphere, thereby causing harm." *Id.* ¶ 218.

In light of the recognition that climate change can implicate individual constitutional and human rights in legally cognizable ways, the question presented to advocates is how to present climate change injury and causation stories to the courts so as to justify not only recognition of the individual's climate change injuries and a challenged entity's role in causing climate change, but to support a finding of liability and imposition of a legal remedy that actually protects the rights from being infringed.[149] In nearly all climate change cases being litigated today, the remedy remains the holy grail. The issuance of a remedy requires judicial bodies to feel secure in deciding the standard by which to gauge a violation of fundamental rights.[150]

B. The Unfortunate Trend of Advocates Adopting the 1.5°C–2°C Paris Target as the Legal Standard Protective of Fundamental Rights

In several recent climate change cases, judicial bodies have begun to equate the Paris Agreement temperature target to the legal standard that gauges a government's compliance with its obligations to protect fundamental rights. For example, the Dutch Supreme Court's well-known and precedent-setting *Urgenda* decision characterizes 1.5°C of heating as "safe" and leaves decision makers assured in their course of conduct pursuing policies that result in such increases in temperature, regardless of what the science says will ensue at such levels of warming.[151] More recently, in *Neubauer*, the court upheld as "constitutionally permissible" the legislature's decision to incorporate the Paris Agreement temperature target into Germany's climate law, finding that the Paris Agreement target:

> [M]ust indeed also be understood as being a specification of the climate action required under constitutional law. This is primarily supported by the fact that the [1.5°C and 2°C] climate target[s] . . . [are] the internationally agreed temperature limit[s] of Art. 2(1)(a) PA, which the legislator has deliberately and explicitly taken as a basis. [Their] constitutional law significance

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[149] *See* David B. Owens, Comment, *Fourth Amendment Remedial Equilibration: A Comment on* Herring v. United States *and* Pearson v. Callahan, 62 STAN. L. REV. 563, 563–65 (2010) (quoting Marbury v. Madison, 5 U.S. (1 Cranch) 137, 163 (1803)) (citing Chief Justice Marshall's "general and indisputable rule" that "where there is a legal right, there is also a legal remedy by suit or action at law, whenever that right is invaded" while noting that "without a remedy there is no right," such that "even if a court says a lot about the value of a right, the manner in which it vindicates that right is really what determines its value").

[150] *Id.* at 565.

[151] *Urgenda* Supreme Court Opinion, *supra* note 139, ¶ 2.1 ("In recent years, new insights have shown that the temperature can only safely rise by no more than 1.5°C, which translates into a greenhouse gas concentration level of no more than 430 ppm in the year 2100.").

> goes beyond the consent given by the German legislator to the Paris Agreement in passing the act of approval.[152]

In Brazil, four political parties filed a case challenging the federal government's failure to adopt administrative measures to implement the statutorily created National Climate Change Fund, which was designed to ensure funding for climate mitigation and adaptation activities.[153] The parties alleged that while the Ministry for the Environment was legally obligated to prepare an annual plan for the Climate Fund, it had been inoperative and unfunded, which violated constitutional obligations to protect and preserve the environment, forests, fauna, and flora; Brazil's commitments under the Paris Agreement; and separation of powers.[154] Calling climate change "one of the defining issues of our time" that "may put at risk the survival of man on Earth,"[155] the Brazilian Supreme Court ruled that there was a constitutional duty to make the Climate Fund operative.[156] While the court made no findings as to what temperature target would protect human rights, the court held that environmental treaties like the Paris Agreement "are a species of the genus human rights treaties," which enjoy "supranational status," and define the contours of the constitutional duty to fund climate mitigation under Brazilian law.[157]

Rather than looking to peer-reviewed scientific evidence to decide the standard of protection for fundamental rights, some courts appear to be defaulting to acceptance of the Paris Agreement target, and whether a government's conduct aligns with its commitments under the Paris Agreement, as the litmus test for fundamental rights protection. As two legal scholars reflected, "the [*Urgenda*] court was relieved of the need to articulate detailed normative implications of the science, given that plaintiffs sought only to hold the . . . government to its own previously stated commitments."[158] But, if judicial bodies are to be "relieved" of the exercise of reviewing the actual scientific evidence in climate change cases, which appears to be the trend,[159] how can advocates ensure that

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[152] *Neubauer*, *supra* note 132, ¶ 209.

[153] PSB v. Brazil, S.T.F. 708, Apelação Cível, Relator: Luís Roberto Barroso, 1.7.2022 (Braz.), http://climatecasechart.com/non-us-case/psb-et-al-v-federal-union/.

[154] *See generally id.*, http://climatecasechart.com/wp-content/uploads/sites/16/non-us-case-documents/2022/20220701_ADPF-708_decision-1.pdf (unofficial translation).

[155] *Id.* ¶¶ 6, 7.

[156] *Id.* ¶ 37.

[157] *Id.* ¶ 17.

[158] R. Henry Weaver & Douglas A. Kysar, *Courting Disaster: Climate Change and the Adjudication of Catastrophe*, 93 NOTRE DAME L. REV. 295, 339, 339 n.312 (2017) (citing the Dutch government's commitments under the 2020 Cancun Agreements).

[159] *E.g.*, *Klimaatzaak*, *supra* note 129, at 64 ("The scientific community agrees on the need to contain the concentration of GHGs to 450 ppm by 2100, whereas currently the concentration of GHGs is already above 400 ppm.").

protection of fundamental rights extends to those most vulnerable to climate harms?

Because of the devastating climate harms associated with 1.5°C–2°C of heating, judicial decisions calibrating the protection of fundamental rights to the Paris Agreement target implicitly endorse the infringement of certain (often minoritized) clients' rights. In these cases, even if there is a "win" for lawyers who seek to enforce compliance with Paris Agreement commitments,[160] there is a net loss for people and other life on our planet. In other words, in these cases, legal climate advocates may "fulfil their legal duty, even if they fail to fulfil their wider duty of care." [161] The science suggests that blind adherence to the Paris Agreement target locks us into disaster *even if* the target is achieved, and thus a different approach is worth exploring when the ultimate goal is the protection of universal fundamental rights.

III. Introducing a Scientifically Based Standard of Protection in Fundamental Rights Based Climate Change Cases

The work of defining and protecting fundamental rights falls squarely within the province of judicial bodies, and it is imperative that such bodies have a full understanding of the underlying science when rendering such existential decisions. This section proposes a specific evidence-based and scientifically supported standard for stabilizing the climate system as an alternative to the Paris Agreement target, analyzes whether this standard is justiciable, and argues that advocates should use it instead of the Paris Agreement target to define the legal standard of protection of fundamental rights in climate change cases.

A. The Scientific Prescription to Stabilize the Climate System and Protect Fundamental Rights

Fundamental rights protection requires a climate system standard that is not only safe for humanity, but scientifically supported and measurable

[160] These decisions are rightfully classified as a "win" in the realm of global climate litigation for a variety of reasons, including, for example, in *Urgenda*, the court's ruling as to the justiciability of climate change claims under the ECHR and the Dutch Constitution and its ultimate holding that the government of the Netherlands is legally obligated to reduce its GHG emissions. *Urgenda* Supreme Court Opinion, *supra* note 139. *See also* Commune de Grande-Synthe v. France [CE] [highest administrative court] July 1, 2021, http://climatecasechart.com/climate-change-litigation/non-us-case/commune-de-grande-synthe-v-france/ (representing the first ruling of its kind in France).

[161] Monbiot, *supra* note 71. *See also* Weaver & Kysar, *supra* note 158, at 354 (citing First Amended Complaint at 5, 36, 87, 93, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 6:15-cv-01517)) (noting that the *Juliana* plaintiffs, although alleging constitutional violations, "also speak in the register of tort, invoking a 'duty of care' on the part of the trustee governments").

as well. When representing clients before judicial bodies, advocates have a duty of care to seek an evidence-based, peer-reviewed prescription as a fundamental rights standard of protection. The very foundation of judicial systems around the world relies on the use of best evidence to assure fair, impartial, and just remedies. There is no controversy with respect to advocates using scientific evidence to document how climate change is injuring individuals and how government decisions are causing and contributing to those injuries; the science of EEI should similarly be used as evidence to define the legal standard of human rights protection and appropriate remedies.[162]

EEI determines the "temporal evolution of Earth's climate," which scientists have characterized as "[t]he most practical way to monitor climate state, variability and change."[163] Scientists advise that "[t]his simple number, EEI, is the most fundamental metric that the scientific community and public must be aware of as the measure of how well the world is doing in the task of bringing climate change under control."[164] It is vital for judicial bodies to understand the extent of EEI because it "is the most critical number defining the prospects for continued global warming and climate change,"[165] indicating the severity of the human rights infringement.

The restoration of Earth's energy balance would approximate the Earth's climate system in which human civilization was able to develop and thrive during the last several thousand years, which fluctuated at the naturally slow, glacial pace over the millions of years of Earth's history. Today there are two aspects of human-caused climate change that scientists tell us are dangerous. First, atmospheric CO_2 levels are much higher today than at any time in human civilization.[166] Second, the

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[162] "An intelligent evaluation of facts is often difficult or impossible without the application of some scientific, technical, or other specialized knowledge." FED. R. EVID. 702 advisory committee's note to 1972 proposed rules.

[163] von Schuckmann et al. explain: "All energy entering or leaving the Earth climate system does so in the form of radiation at the top of the atmosphere (TOA). The difference between incoming solar radiation and outgoing radiation, which is the sum of the reflected shortwave radiation and emitted longwave radiation, determines the net radiative flux at TOA. Changes of this global radiation balance at TOA – the so-called Earth energy imbalance (EEI) – determine the temporal evolution of Earth's climate: If the imbalance is positive (i.e., less energy going out than coming in), energy in the form of heat is accumulated in the Earth system, resulting in global warming – or cooling if the EEI is negative. . . . Contemporary estimates of the magnitude of the Earth's energy imbalance range between about 0.4 and 0.9 w/m^{-2} . . . and are directly attributable to increases in carbon dioxide and other greenhouse gases in the atmosphere from human activities." von Schuckmann et al., *supra* note 4, at 2014–15 (internal citation omitted).

[164] *Id.* at 2014.

[165] *Id.*

[166] *See, e.g.*, Henry Fountain, *Carbon Dioxide Levels Are Highest in Human History*, N.Y. TIMES (June 3, 2022), https://www.nytimes.com/2022/06/03/climate/carbon-dioxide-record.html.

increase in the amount of greenhouse gases (such as methane and CO_2) in our atmosphere, and thus the rate of climatic change, is largely unprecedented in the Earth's history, according to the scientific record.[167] According to recent calculations, the United States alone is emitting carbon into the atmosphere at a rate that is at least the same order of magnitude, or more than double the rate, that resulted in the end-Permian extinction 251.9 million years ago that resulted in the disappearance of 95% of marine species.[168]

Dr. James Hansen, one of the most prominent scientists that has studied EEI, in an expert report submitted for *Juliana v. United States*, has explained that "in light of approaching points of no return," the current state of EEI justifies an initial target of returning to less than 350 ppm of CO_2 by 2100. A global mitigation trajectory that is consistent with achieving global atmospheric CO_2 concentrations of below 350 ppm would result in a mid-century peak of approximately 1.3°C before temperatures begin to cool again, with global surface temperatures stabilizing at ~1°C above pre-industrial temperatures by 2100 and reducing even further in the twenty-second century as the EEI corrects. In the *Juliana* litigation, Dr. Hansen testified:

> The enormity of the potential consequences of . . . [the] loss of coastal cities and extermination of countless species, demanded reassessment of what constituted "dangerous human-made interference with the climate system," which the global community sought to avoid by ratifying the United Nations Framework Convention on Climate Change in 1992. That reassessment led me and others to conclude in 2008 that the political guardrail of 2°C of warming (corresponding approximately to an atmospheric CO_2 concentration of ~450 ppm) is highly dangerous, and that an initial target of < 350 ppm CO_2 is justified by the relevant science.
>
> Particularly in light of approaching points of no return, it is, in my expert opinion, essential to commence serious and sustained action to return atmospheric CO_2 to < 350 ppm without further delay; essential, that is, to preserve coastal cities from rising seas

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[167] *See* Tik Root, *Earth Is Now Trapping an 'Unprecedented' Amount of Heat, NASA Says*, WASH. POST (June 16, 2021, 4:00 PM), https://www.washingtonpost.com/climate-environment/2021/06/16/earth-heat-imbalance-warming/.

[168] *See* S.D. Burgess, J.D. Muirhead & S.A. Bowring, *Initial Pulse of Siberian Trap Sills as the Trigger of the End-Permian Mass Extinction,* 8 NATURE COMMC'NS 1, 2 (2017); Gavin L. Foster, Pincelli Hull, Daniel J. Lunt & James, *Placing Our Current 'Hyperthermal' in the Context of Rapid Climate Change in Our Geological Past*, 376 PHIL. TRANSACTIONS ROYAL SOC'Y, Aug. 7, 2018, at 3–4; Justin L. Penn & Curtis Deutsch, *Avoiding Ocean Mass Extinction from Climate Warming*, 376 SCI. 524, 525–26 (2022); *see also* Personal Conversation with Anders Carlson, Climate Analyst, Our Children's Trust (May 17, 2022) (on file with authors).

> and floods (caused in part by melting of Antarctic and Greenland ice) and superstorms, and otherwise to restore a viable climate system on which the life, liberty, and property prospects of Plaintiffs, young citizens of America, and future generations so thoroughly depend.[169]

The 350 ppm standard is becoming more significant given the increasing EEI trend.[170] A positive EEI manifests as "symptoms" of climate change harms, such as global temperature rise, increased ocean warming, ocean acidification, and sea level rise.[171] For example, in 2020 one study showed that "[t]he world's oceans absorbed 20 sextillion joules of heat due to climate change and warmed to record levels."[172] The quantity of warming—20,000,000,000,000,000,000,000 joules—is equal to the energy of ten Hiroshima atomic bombs being detonated every second of the year, or the amount required to take 1.3 trillion trips to the moon.[173] According to a scientific paper by Dr. Hansen, co-author Karina von Schuckmann, and dozens of respected scientists across the world:

> Stabilization of climate, the goal of the universally agreed UNFCCC and the Paris Agreement, requires that EEI be reduced to approximately zero to achieve Earth's system quasi-equilibrium. The change of heat radiation to space for a given greenhouse gas change can be computed accurately. The amount of CO_2 in the atmosphere would need to be reduced from 410 to 353 ppm (i.e., a required reduction of -57+/- 8 ppm) to increase

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[169] *Juliana*, Hansen Expert Report, *supra* note 11, at 4–5. *See also* von Schuckmann et al., *supra* note 4, at 2014.

[170] *See* von Schuckmann et al., *supra* note 4, at 2015 (citing Karina von Schuckmann, et al., *An Imperative to Monitor Earth's Energy Imbalance*, 6 NAT. CLIMATE CHANGE 138 (2016)); Ryan J. Kramer et al., *Observational Evidence of Increasing Global Radiative Forcing*, 48 GEOPHYSICAL RSCH. LETTERS 1, 1 (2021) (finding radiative forcing has increased 0.53 +/- 0.11 W/m^2 from 2003 to 2018 and confirming "that rising greenhouse gas concentrations account for most of the increases in the radiative forcing, along with reductions in reflective aerosols. This serves as direct evidence that anthropogenic activity has affected Earth's energy budget in the recent past"); Norman G. Loeb et al., *Satellite and Ocean Data Reveal Marked Increase in Earth's Heating Rate*, 48 GEOPHYSICAL RS. LETTERS 1, 1 (2021) ("Satellite and in situ observations independently show an approximate doubling of Earth's Energy Imbalance (EEI) from mid-2005 to mid-2019."); *see Juliana*, Hansen Expert Report, *supra* note 11, at 7 ("Because EEI is such a fundamental property of the climate system, the implications of an increasing EEI trend are far reaching.").

[171] Loeb et al., *supra* note 170, at 7 (internal citation omitted) ("A positive EEI is manifested as 'symptoms' such as global temperature rise, increased ocean warming, sea level rise, and intensification of the hydrological cycle.").

[172] Ben Deacon, *Climate Change Pushed Ocean Temperatures to Record High in 2020, Study Finds*, ABC NEWS (Jan. 17, 2021, 12:15 PM), https://www.abc.net.au/news/2021-01-18/ocean-temperatures-reached-record-high-in-2020-study-finds/13062628.

[173] *Id.*; *The World Continued to Warm in 2020*, CAMBRIDGE NETWORK (Jan. 18, 2021), https://www.cambridgenetwork.co.uk/news/world-continued-warm-2020; Personal Conversation with Anders Carlson, Climate Analyst, Our Children's Trust (on file with authors).

> heat radiation to space by 0.87 W/m^{-2}, bringing Earth back towards energy balance . . . .[174]

Other scientific experts have similarly expressed the necessity of the 350 ppm standard, given the importance of restoring Earth's energy balance. Dr. Ove Hoegh-Guldberg, one of Australia's preeminent experts on coral reefs, testified in *Juliana* about the risks of acidification:

> [P]resent levels of atmospheric CO_2, as with any level above 350 parts per million (ppm), presents serious and ongoing threat through dangerous acidification of the world's oceans.
>
> . . . In fact, even achieving the goals of the Paris Climate Agreement . . . and restraining warming to "well below" 2°C (equivalent to approximately 450 ppm of CO_2) will still result in the loss of 90% of today's corals.
>
> At today's level of ~410 ppm, most reefs worldwide are committed to a considerable irreversible decline. The rate, extent, and nature of this decline will become increasingly severe if atmospheric CO_2 concentrations continue to increase above current levels. Returning the atmosphere to a safe level of CO_2 for coral reefs requires atmospheric CO_2 concentrations below 350 ppm and achieving long-term targets of a maximum temperature peak of 1.3°C above the Pre-Industrial Period with a gradual cooling below those levels through the end of this century and beyond.[175]

Dr. Eric Rignot, an expert on ice sheets, has testified that "[a]s an interim step to returning to preindustrial CO_2 concentrations, we should at minimum aim to return to no more than 350 ppm by 2100" to preserve ice sheets in Antarctica and Greenland.[176]

It is thus vital for advocates to present judicial bodies with primary scientific evidence of how to stabilize the climate system and protect these vital planetary systems, as opposed to solely what levels of heating have been deemed to be politically palatable by governments under the Paris Agreement. If advocates do not at least present judicial bodies this critical scientific information and urge that it be used to define the legal standard of protection in the fundamental rights context, there is a formidable risk that the rights of the most climate vulnerable populations on the planet get erased. There are also strategic legal reasons for presenting judicial bodies with the best available scientific information

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[174] von Schuckmann et al., *supra* note 4, at 2029 (internal citations omitted).

[175] Expert Report of Ove Hoegh-Guldberg, Ph.D. at 8, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 15-cv-01517) (internal citations omitted).

[176] Expert Report of Eric Rignot, Ph.D. at 2, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 15-cv-01517) (internal citation omitted).

as opposed to a politically negotiated target, including the need to overcome justiciability arguments currently impeding many climate change cases from going to trial.

Some may say it is too late, or impossible, to limit global average temperature rise to below 1.5°C, and that the Paris Agreement target is the best we can achieve. Surely, global temperature has already surpassed 1°C. However, many experts have opined that, while challenging, achieving a science-based prescription to restore Earth's energy balance is still feasible.[177] Such feasibility, however, becomes more precarious the longer that emissions continue to rise without an appropriate judicial check consistent with a scientifically backed standard. It would be a tragedy to advocate for a standard of global heating that does not reflect the current state of climate science and knowingly exacerbates existing climate injuries. The physical principles at play in EEI, and the resulting climate change, will not accommodate the political compromises captured in the Paris Agreement. Human laws should be consistent with the laws of physics, as should advocates' presentation of evidence before judicial bodies.

B. Scientific Evidence Can Be Judicially Manageable

Many governments in climate change cases take the position that there are no judicially manageable standards to decide the question of whether conduct that causes climate change infringes fundamental rights.[178] In essence, the argument is that there are no standards by which to judge when a government's contribution to climate change, or its failure to reduce GHG emissions, crosses the fundamental rights threshold. The argument is attractive because its endorsement essentially gives the political branches of government full, unreviewable discretion to continue their conduct that contributes to climate change despite the known danger, viable alternatives, and their own legal commitments to

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[177] *See, e.g.*, James Hansen et al., *Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, 8 PLOS ONE 1, 2 (2013); BEN HALEY ET AL., 350 PPM PATHWAYS FOR THE UNITED STATES 6 (2019), https://irp-cdn.multiscreensite.com/be6d1d56/files/uploaded/350PPMPathwaysfortheUnitedStates.pdf; Mark Jacobson, et al., *100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World*, 1 JOULE 108, 108 (2017); Expert Report of James H. Williams, Ph.D. at 11, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 15-cv-01517); Expert Report of G. Philip Robertson at 3, Juliana v. United States, 339 F. Supp. 3d 1062 (D. Or. 2018) (No. 15-cv-01517).

[178] *See, e.g.*, Defendants State of Florida, the Florida Department of Agriculture and Consumer Services, Commissioner Nikkie Fried, and the Florida Public Service Commission's Motion to Dismiss the First Amended Complaint at 8–10, Reynolds v. Florida, No. 84521673 (App. Ct. Fla. 2019); La Rose v. Her Majesty the Queen, [2020] F.C. 1008 (Can. Ont.); *Mathur*, *supra* note 140, ¶ 123.

reduce GHG emissions. It is also alluring to raise during the initial stages of litigation, such as in the context of a motion to dismiss, as it is an easier argument to make in the abstract, without the benefit of a fully developed factual record that can be reviewed for whether the standard, as presented and applied, was in fact manageable.

Courts routinely adopt and apply a panoply of legal standards when deciding claims of infringement of fundamental rights in a variety of different factual contexts.[179] For example, courts in the United States have been hearing and deciding Fifth Amendment substantive due process and equal protection claims, the type of constitutional legal claims raised in *Juliana v. United States*, for decades. In 1882, the U.S. Supreme Court acknowledged that the substantive due process clause is "of that character which it is intended the courts shall enforce when cases involving their operation and effect are brought before them."[180] In such cases, government "policies that classify on suspect bases or infringe on fundamental rights are strongly presumptively unconstitutional; they can be upheld only if necessary to serve a compelling governmental interest."[181] The U.S. Supreme Court has stated that the fundamental standard of culpability for state-created danger in a substantive due process claim, one of the claims in the *Juliana* litigation, is deliberately indifferent behavior that "shocks the conscience."[182] Only "conduct intended to injure in some way unjustifiable by any government interest" would rise to a conscience-shocking level for purposes of due process.[183]

In many (but not all) countries, it is the courts, not political bodies, who are ultimately charged with upholding individual fundamental rights

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[179] *See* Richard H. Fallon, Jr., *Implementing the Constitution*, 111 HARV. L. REV. 54, 67 (1997) (identifying "eight relatively common kinds of tests, all employed by the Court (either alone or in combination) in some areas of constitutional law to help define constitutional limits on governmental powers").

[180] United States v. Lee, 106 U.S. 196, 218, 220 (1882) ("Courts of justice are established, not only to decide upon the controverted rights of the citizens as against each other, but also upon rights in controversy between them and the government, and the docket of this court is crowded with controversies of the latter class.").

[181] Fallon, Jr., *supra* note 179, at 88. *See also* Washington v. Glucksberg, 521 U.S. 702, 720 (1997) ("The [Due Process] Clause also provides heightened protection against government interference with certain fundamental rights and liberty interests.").

[182] Cnty. of Sacramento v. Lewis, 523 U.S. 833, 846 (1998). The Court recognized that "[r]ules of due process are not . . . subject to mechanical application in unfamiliar territory," and "preserving the constitutional proportions of substantive due process demands an exact analysis of circumstances before any abuse of power is condemned as conscience shocking." *Id.* at 850. *See also* Farmer v. Brennan, 511 U.S. 825, 832–34 (1994) (deliberate indifference to violence from other prisoners); Wilson v. Seiter, 501 U.S. 294, 302–04 (1991) (deliberate indifference to conditions of confinement); Estelle v. Gamble, 429 U.S. 97, 104–05 (1976) (deliberate indifference to serious medical needs of prisoners).

[183] *Lewis*, 523 U.S. at 849.

against claims of compelling state interest. As U.S. Supreme Court Justice Elena Kagan noted during a recent oral argument, courts are the arbiters of rights: "[I]sn't the point of a right that you don't have to ask Congress? Isn't the point of a right that it doesn't really matter what Congress thinks or what the majority of the American people think as to that right?"[184] In fact, "[t]he Court retains an independent constitutional duty to review factual findings when constitutional rights are at stake. . . . Uncritical deference to Congress' factual findings in these [constitutional] cases is inappropriate."[185]

The U.S. Supreme Court has explained: "In determining what lines are unconstitutionally discriminatory, we have never been confined to historic notions of equality, any more than we have restricted due process to a fixed catalogue of what was at a given time deemed to be the limits of fundamental rights."[186] Familiar legal standards that both define fundamental rights and set the standards of infringement are applied by courts in a wide variety of factual scenarios, even some that are politically contentious such as the death penalty, abortion, and guns. Even when the legal standard is informed by constitutional "text-and-history" as opposed to science, as relevant in the Second Amendment context under U.S. law, the Supreme Court has acknowledged that these are legal standards capable of being applied by courts.[187] That some injuries are caused by climate change, a complex scientific issue with "political implications,"[188] should not automatically exempt the issue of climate change from a court's application of familiar legal standards in the fundamental rights context; nor should it excuse the parties from

[184] Transcript of Oral Argument at 75, Whole Woman's Health v. Jackson, 142 S. Ct. 522 (2021) (No. 21-463).

[185] Gonzales v. Carhart, 550 U.S. 124, 165–66 (2007).

[186] Harper v. Va. State Bd. of Elections, 383 U.S. 663, 669 (1966).

[187] N.Y. State Rifle & Pistol Ass'n, Inc. v. Bruen, 142 S. Ct. 2111, 2130 n.6 (2022) (finding that petitioners have a constitutional right to bear arms in public for self-defense based on a plain text reading of the Second Amendment and on a historical review of the American tradition of firearm regulation).

[188] Courts in many jurisdictions reject the notion that cases are nonjusticiable merely "because the issues have political implications . . . ." INS v. Chadha, 462 U.S. 919, 943 (1983). Under Canadian law, claims that the government has interfered with a plaintiffs' rights have never been held to be non-justiciable simply because they raise complex social, political, and economic issues. *See, e.g.*, Carter v. Canada, [2015] 1 S.C.R. 331 (Can.); Canada v. Bedford, [2013] 3 S.C.R. 1101 (Can.); Canada v. PHS Cmty. Serv. Soc'y, [2011] 3 S.C.R. 134 (Can.); Chaoulli v. Quebec, [2005] 1 S.C.R. 791 (Can.); Victoria v. Adams, [2009] B.C.C.A. 563 (Can.). The Netherlands Supreme Court also recognized that while the government and parliament "have a large degree of discretion to make the political considerations that are necessary," "[i]t is up to the courts to decide whether, in availing themselves of this discretion, the government and parliament have remained within the limits of the law by which they are bound." *Urgenda* Supreme Court Opinion, *supra* note 139, ¶ 8.3.2.

withholding from the court the best available scientific evidence needed to decide the case.

The inquiry relevant to this Article is how legal standards can be manageably applied with respect to claims based on injuries related to climate change. Climate change is a scientific phenomenon that is objectively measurable in terms of GHG emissions and the extent to which GHG emissions are contributing to EEI. Ultimately, in order to avert the worst impacts of climate change and thus prevent further injury, Earth must be brought back toward energy balance.[189] A legal standard measuring the challenged conduct against its impact on the ability to restore Earth's energy balance, i.e., reducing atmospheric CO_2 concentrations to below 350 ppm by 2100, can be established as a matter of scientific evidence.[190] Once that is established as the legal standard needed to preserve fundamental rights, it becomes an exercise of applying the facts to the law to ascertain whether the challenged conduct exceeds this standard, a familiar judicial task that courts should begin to undertake.

The argument that some claims are "beyond the competence of courts" is not unique; as "[s]ome make the same point as regards the problem of equal protection in cases involving racial segregation,"[191] as in other areas. How can a court decide when the government is violating one's right to life, liberty, or property. one's right to private family life; one's right to be free from cruel and unusual punishment; one's right to privacy; or one's right to bear arms? On the flip side, how do courts determine whether a state's interest outweighs an individual's rights, such as a state's interest in "potential life" weighed against the rights of a woman to her privacy and bodily autonomy? For better or worse, making those calls is the proper role of the courts when interpreting constitutions or other laws that secure fundamental rights, and science in many cases can and should inform where courts ought to draw the line in the sand. As U.S. Supreme Court Justice Clarence Thomas recently acknowledged in the case of *New York State Rifle & Pistol Ass'n v. Bruen*, these kinds of constitutional inquiries are not made in the abstract because courts decide cases based upon the record compiled by the parties, and that often includes scientific evidence.[192]

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[189] *See* von Schuckmann et al., *supra* note 4, at 2029.

[190] *See, e.g.*, *Juliana*, Hansen Expert Report, *supra* note 11, at 25.

[191] Baker v. Carr, 369 U.S. 186, 245 (1962) (Douglas, J., concurring) ("Adjudication is often perplexing and complicated.")

[192] N.Y. State Rifle & Pistol Ass'n, Inc. v. Bruen, 142 S. Ct. 2111, 2130 n.6 (2022); *see also* Roper v. Simmons, 543 U.S. 551, 569 (2005) (referencing the "scientific and sociological studies" in the record that differentiated juveniles and adults to justify holding that imposing the death penalty on juvenile offenders violates the Eighth Amendment of the U.S. Constitution).

The complexity or novelty of the issue, whether it be climate change, racial segregation, gun rights, or discrimination on the basis of sex or gender, is no basis for courts to shrink from their role to hear and decide constitutional cases. As Judge Staton noted in her dissenting opinion in *Juliana*: "There is no justiciability exception for cases of great complexity and magnitude."[193] The Canadian Supreme Court has similarly ruled: "The fact that the matter is complex, contentious or laden with social values does not mean that the courts can abdicate the responsibility vested in them by our Constitution . . . when citizens challenge it."[194] If courts decide not to draw the line simply because the issue is complex, novel, or politically charged, the fundamental rights at stake technically become meaningless.[195]

Justice Carol J. Brown in Ontario, Canada, recently recognized the manageability of constitutional climate change claims based upon scientific evidence in the *Mathur* case: "[T]his Application is capable of scientific proof and the Applicants have already included many facts based on scientific and social science findings."[196] Justice Brown said that she was "satisfied that appropriate levels of global GHG emissions can be established through scientific evidence, based on the past and projected emission levels" and that "the Applicants cite various facts that are capable of scientific proof and about which courts are capable of making determinations, based on expert evidence . . . ."[197] Judge Staton, in her dissenting opinion in *Juliana*, agreed: "Here, the right at issue is fundamentally one of a discernable standard: the amount of fossil-fuel emissions that will irreparably devastate our Nation. That amount can be established by scientific evidence like that proffered by the plaintiffs."[198] She pointed out that "[n]either the government nor the majority has articulated why the courts could not weigh scientific and prudential

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[193] Juliana v. United States, 947 F.3d 1159, 1185 (9th Cir. 2020) (Staton, J., dissenting).

[194] Chaoulli v. Quebec, [2005] 1 S.C.R. 791, 844 (Can.).

[195] ERWIN CHEMERINSKY, CLOSING THE COURTHOUSE DOOR: HOW YOUR CONSTITUTIONAL RIGHTS BECAME UNENFORCEABLE 206 (2017) ("But enforcement of the Constitution should never be left to the political process. The Constitution exists to limit the government, those limits have meaning only if they are enforceable, and to think that the political process will address such issues is usually to indulge a fiction.").

[196] *Mathur*, *supra* note 140, ¶ 171. *See also id.* ¶ 94 (internal citation omitted) ("Lastly, the Applicants cite decisions in other countries to demonstrate that their claim is capable of scientific proof. For example, in *Urgenda* . . . the Supreme Court of the Netherlands affirmed that reduction in emissions was necessary for the Dutch government to protect human rights. The court recognized that 'each additional molecule of GHG in the atmosphere causes a demonstrable increase in the harm, with a single molecule of carbon dioxide causing a warming effect.'").

[197] *Id.* ¶ 96.

[198] *Juliana*, 947 F.3d at 1187 (Staton, J., dissenting).

considerations—as we often do—to put the government on a path to constitutional compliance."[199] Furthermore:

> In sum, resolution of this action requires answers only to scientific questions, not political ones. . . .
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> . . . .
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> . . . Nothing about climate change, however, is *inherently* political. The majority is correct that redressing climate change will require consideration of scientific, economic, energy, and other policy factors. But that endeavor does not implicate the way we elect representatives, assign governmental powers, or otherwise structure our polity.[200]

Judicial bodies are often well-equipped to hear and decide cases involving a wide range of scientific evidence.[201] For example, the U.S. Supreme Court has developed a well-established litmus test for the admission of expert scientific testimony. In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, Justice Blackmun ruled that judges in their evidentiary "gatekeeping" role "must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable."[202] As to reliability:

> [I]n order to qualify as "scientific knowledge," an inference or assertion must be derived by the scientific method. Proposed testimony must be supported by appropriate validation—*i.e.*, "good grounds," based on what is known. In short, the

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[199] *Id.* at 1189.

[200] *Id.* at 1189–90 (emphasis added).

[201] *See, e.g.*, FED. R. EVID. 702 ("A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case."). *See also* Jeff Tollefson, *Inside the US Supreme Court's War on Science*, 609 NATURE 460 (2022) (discussing recent U.S. Supreme Court decisions that, in contrast to earlier cases, dismiss rather than defer to science), https://www.nature.com/articles/d41586-022-02920-4.

[202] Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 589, 597 (1993). Further, despite Chief Justice Rehnquist's fear that the *Daubert* standard turns judges into "amateur scientists," the rules of evidence do not require it. *Id.* at 600–01 (Rehnquist, C.J., concurring in part and dissenting in part). Brian Leiter, *The Epistemology of Admissibility: Why Even Good Philosophy of Science Would Not Make for Good Philosophy of Evidence*, 1997 BYU L. REV. 803, 816 ("[T]he discovery of truth is only *one* of the aims of adjudication under the Federal Rules. The rules of evidence serve distinctly nonepistemic purposes as well: the promotion of various policy objectives (like encouraging the repair of dangerous conditions) and the efficient and timely resolution of disputes."). Both nonepistemic purposes apply directly to any evidence presented on the dangerous urgency of the climate crisis.

> requirement that an expert's testimony pertain to "scientific knowledge" establishes a standard of evidentiary reliability.[203]

Many factors are considered as to whether the proffered scientific testimony is admissible, including whether the scientific theory or technique can be or has been tested, whether it has been subject to peer review, "the known or potential rate of error," and its "general acceptance" in the relevant scientific community.[204] A criterion notably absent from this list is whether the scientific evidence has been accepted through international political consensus. In fact, in *Rucho v. Common Cause*,[205] the U.S. Supreme Court explicitly cautioned that a judicially manageable standard must be "clear, manageable, and *politically neutral*."[206] Advocates asking judicial bodies to interpret and protect fundamental rights in climate change cases can and should present genuine climate science, not overlook it, substitute for it, or avoid it altogether.

Other courts outside the U.S. have been able to at least partially navigate the divide between justiciable and political issues in climate change cases. In *Klimatzaak*, the Belgian court declared that Belgium's climate policy infringed the fundamental rights of the plaintiffs but declined to issue an injunction requiring Belgium to reduce its GHG emissions by certain percentages requested by the plaintiffs. The court found that "while it is within the remit of the tribunal to note a failure on the part of the federal state and the three regions [defendants], this does not authorise it, by virtue of the principle of separation of powers, to itself set targets for reducing Belgium's GHG emissions."[207] The court thus felt comfortable making a determination that Belgium crossed the standard of protection, but was unwilling to announce where that line was. In *Urgenda*, on the other hand, the Netherlands court not only found a violation of fundamental rights but ordered a reduction in emissions. Although these reductions were in line with the government's earlier political commitments and not based on genuinely supported scientific prescriptions, one wonders whether the outcome would have been

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[203] *Daubert*, 509 U.S. at 590.

[204] *Id.* at 593–94.

[205] *Rucho* is the primary case relied upon by two of three judges in *Juliana v. United States* to justify dismissal of the youth's constitutional climate change case on redressability grounds, even though the majority explicitly stated it did not find the claims to raise a political question. *Compare* Juliana v. United States, 947 F.3d 1159, 1173–74, 1174 n.9 (9th Cir. 2020) *with id.* at 1189–90 (Staton, J., dissenting) (identifying the flaws in the majority's reliance on *Rucho*).

[206] Rucho v. Common Cause, 139 S. Ct. 2484, 2498 (2019) (quoting Vieth v. Jubelirer, 541 U.S. 267, 307–08 (2004) (plurality opinion)).

[207] *Klimaatzaak*, *supra* note 129, at 82.

different had the court been presented with the science of EEI.[208] *Urgenda*'s win can equally be considered a loss if the goal was to protect the fundamental rights of the Netherlands' most climate vulnerable, including the youth and future generations who face devastating climate harms at 1.5°C–2°C of warming.

The unfortunate default "action" by many judicial bodies (particularly in the United States) deciding climate cases has been judicial restraint—dismissing these cases before hearing the evidence on the merits.[209]

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[208] *Urgenda* Supreme Court Opinion, *supra* note 139, ¶¶ 8.3.4, 8.3.5.

[209] *See* Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 420, 424 (2011) (holding that while some plaintiffs had standing to sue defendant fossil-fuel power plants to seek abatement of their contribution to global warming, the Clean Air Act displaced any federal common law right plaintiffs had to pursue their claim); Lujan v. Defs. of Wildlife, 504 U.S. 555, 564, 568 (1992) (holding that plaintiffs did not assert a sufficiently imminent injury to have Article III standing and that plaintiffs' claimed injury was not redressable); City of New York v. Chevron Corp., 993 F.3d 81, 95 (2d Cir. 2021) (holding that plaintiff's state-law nuisance action against defendant multinational oil companies implicated federal common law rather than New York state law, and federal common law, in turn, was displaced by the Clean Air Act); Juliana v. United States, 947 F.3d 1159, 1170–71, 1174 (9th Cir. 2020) (holding that plaintiffs' suit, which called for declaratory and injunctive relief against the United States to stop the continued federal permitting, authorization and subsidization of fossil fuel extraction, as well as development, consumption and exportation of the same, presented a nonjusticiable political question and that plaintiffs' failed to show redressability); Wash. Env't Council v. Bellon, 732 F.3d 1131, 1147 (9th Cir. 2013) (holding that plaintiffs lacked Article III standing to assert their claim that the state of Washington was required, under the Clean Air Act, to regulate greenhouse gas emissions released by the state's five oil refineries); Clean Air Council v. United States, 362 F. Supp. 3d 237, 249 (E.D. Penn. 2019) (dismissing plaintiffs' claim that their rights were violated by the Executive branch's "rolling back" of environmental laws and regulations on the ground plaintiffs failed to state an injury redressable by court action); Amigos Bravos v. Bureau of Land Mgmt., 816 F. Supp. 2d 1118, 1138–39 (D.N.M. 2011) (dismissing suit by six environmental groups, who alleged that the BLM failed to fully consider the issue of climate change when the agency approved several oil and gas lease sales, on the ground the plaintiffs failed to demonstrate both an injury-in-fact and a particularized interest in the land at issue and that plaintiffs failed to establish causation); City of New York v. BP P.L.C., 325 F. Supp. 3d 466, 471–72, 475 (S.D.N.Y. 2018) (holding that New York City's federal common law nuisance suit, which sought to recover for injuries the City suffered due to rising sea levels that the City alleged were caused by emissions of greenhouse gases sold by the defendants, was displaced by the Clean Air Act and that the City's claims were otherwise barred by the presumption against extraterritoriality); WildEarth Guardians v. Salazar, 880 F. Supp. 2d 77, 86 (D.C. Cir. 2012) (holding that plaintiffs, who challenged the decision by several federal agencies to authorize the lease of public lands for coal mining, lacked standing to challenge the lease decision based on climate change impacts to plaintiffs' recreational, aesthetic and economic interests); Animal Legal Def. Fund v. United States, 404 F. Supp. 3d 1294, 1300–01 (D. Or. 2019) (holding that plaintiffs, who claimed that the government's failure to protect them from the effects of climate change on federally owned and managed lands violated their constitutional right to a safe and sustainable environment, lacked constitutional standing and that their suit was not a justiciable case or controversy); Comer v. Murphy Oil USA, Inc., 839 F. Supp. 2d 849, 862, 865, 868 (S.D. Miss. 2012) (holding that suit by plaintiffs, property owners who asserted public and private nuisance claims alleging that defendant oil companies release of emissions increased global warming that caused damage to plaintiffs' properties, was barred by res judicata, collateral estoppel, the lack of standing, preemption by the Clean Air Act, and the implication of non-justiciable political questions).

Scholars, and some dissenting state supreme court justices, have referred to such judicial restraint as resulting in a judicial "nihilism," whereby courts assert supreme power by their inaction.[210] Reasons for such nihilism point more to ideology largely perpetuated by fossil fuel producers—that climate change is a special policy preference exempt from judicial review—than to a lack of judicially manageable standards or an inability to grapple with scientific evidence.[211] Nevertheless, some judges are beginning to reject the notion that courts should sit on the sidelines of the climate crisis. As expressed by the Washington Supreme Court's Chief Justice Steven C. Gonzaléz and Justice G. Helen Whitener in their dissent in *Aji P. v. Washington*:

> We recite that we believe the children are our future, but we continue actions that could leave them a world with an environment on the brink of ruin and no mechanism to assert their rights or the rights of the natural world. This is our legacy to them described in the self-congratulatory words of judicial restraint. . . .
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> . . . .
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> The court should not avoid its constitutional obligations that protect not only the rights of these youths but all future generations who will suffer from the consequences of climate change.[212]

This sentiment reflects an important evolution in the history of climate change cases. If judicial bodies are becoming open to hearing and deciding these cases, as is happening in Montana state court in the *Held*

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[210] Weaver & Kysar, *supra* note 158, *passim*. *Cf.* Hollis Hill, Opinion, *Let Youth Have Day in Court Over Climate Change*, SEATTLE TIMES (Oct. 1, 2021, 1:53 PM), https://www.seattletimes.com/opinion/let-youth-have-day-in-court-over-climate-change/ ("Washingtonians must face the hard truth: Climate change is happening, and if we do not change course, it will only get worse. As a former judge, I know it is critical that all three branches of government use every tool at their disposal to turn the tide."). *Cf.* Alfred T. Goodwin, *A Wake-Up Call for Judges*, BULLETIN (June 14, 2015), http://www.bendbulletin.com/opinion/3222160-151/a-wake-up-call-for-judges ("Whether grounded in Article III or state constitutional provisions, the third branch must now recognize its obligation to provide a check on government exercise of power over the public trust. The third branch can, and should, take another long and careful look at the barriers to litigation created by modern doctrines of subject-matter jurisdiction and deference to the legislative and administrative branches of government.").

[211] *See, e.g.*, Weaver & Kysar, *supra* note 158, at 320–22 (providing some explanations for "nihilistic reading[s] of catastrophe" in tort climate change cases, including "societal consequences" and "popular backlash").

[212] Aji P. v. Washington, No. 99564-8, at 2, 5 (Wash. Oct. 6, 2021) (González, C.J., dissenting). *See also* Held v. Montana, No. CDV-2020-307, at 24 (Mont. First Jud. Dist. Ct. Lewis & Clark Cnty. Aug. 4, 2021) (denying state's motion to dismiss constitutional climate change claims and allowing the case to proceed to trial).

case and in the *Mathur* case in Ontario, they should be presented with the best evidence to protect fundamental rights.

C. Litigators Should Present a Scientific Target Rather than the Paris Agreement Target to Define Fundamental Rights

There are several reasons, both legal and practical, for climate advocates to present judicial bodies with peer-reviewed science to define a constitutional standard of protection for fundamental rights. First, advocates that characterize the Paris Agreement target as the threshold for fundamental rights protection run the risk of enforcing an unfortunate trend; judicial bodies endorsing the Paris Agreement target as science based, safe, or protective of fundamental rights now and into the future when in fact it is catastrophic. Judicial endorsement has had the effect of legalizing and perpetuating the ongoing infringement of rights. As Justice Jackson foretold in his dissenting opinion in the tragic case of *Korematsu v. United States*:

> [A] judicial construction of the due process clause that will sustain this [internment of Japanese citizens during World War II] order is a far more subtle blow to liberty than the promulgation of the order itself. . . . [O]nce a judicial opinion rationalizes such an order to show that it conforms to the Constitution, or rather rationalizes the Constitution to show that the Constitution sanctions such an order, the Court for all time has validated the principle of racial discrimination . . . . The principle then lies about like a loaded weapon ready for the hand of any authority that can bring forward a plausible claim of an urgent need.[213]

Second, once a constitutional standard is embedded in law, history shows that policies that flow from that constitutional standard will inevitably allow full maximization of pollution levels that lead to the brink of that standard. For example, in the climate change context, very few governments achieve even the inadequate GHG emission targets (from a perspective of restoring Earth's energy balance) they commit to achieving under domestic or international law, and even fewer governments are able to increase ambition of existing commitments as the years of failure mount.[214]

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[213] Korematsu v. United States, 323 U.S. 214, 245–46 (1944) (Jackson, J., dissenting).

[214] For example, Canada has failed to meet its GHG emission reduction targets it set beginning in 1988. Statement of Claim to the Defendants ¶ 5, at 4, La Rose v. Her Majesty the Queen (Oct. 25, 2019), No. T-1750-19 (Can. Fed. Ct.), http://climatecasechart.com/climate-change-litigation/wp-content/uploads/sites/16/non-us-case-documents/2019/20191025_T-1750-19_complaint.pdf. *See also* WASH. STATE DEP'T OF ECOLOGY, WASHINGTON STATE GREENHOUSE GAS EMISSION REDUCTION LIMITS: REPORT PREPARED UNDER RCW 70.235.040, at 16 (Dec. 2019) ("In terms of progress towards the greenhouse gas emission limits currently in

Third, a standard that characterizes 1.5°C or 2°C of heating as protective of fundamental rights undercuts plaintiffs' abilities to provide judicial bodies with present-day injury stories. The Paris Agreement on its face, without underlying scientific explanation, implies that the climate system, and the people within it, can withstand additional heating above and beyond what has occurred to date. Although such an assumption is untrue, it is a dangerous one to present to judicial bodies charged with protecting human rights, as exhibited in August 2022 when severe rains and flooding in Pakistan affected at least 33 million people, killing at least 1,033 people, including hundreds of children.[215] Relatedly, advocates' use of the Paris Agreement target as the legal standard of fundamental rights protection may make it even more difficult to establish a breach, since Earth has not yet reached such levels of warming. Scientists have confirmed that we are already in the danger zone at about 1°C of heating.[216] Although scientists agree that existing climate impacts will likely worsen as the heating increases,[217] the evidence provided to a judicial body should realistically portray the current catastrophe facing humanity, particularly those most vulnerable whose fundamental rights are most imminently at stake. According to John Holdren, who served as Science Advisor to President Barack Obama:

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statute, as of 2017, Washington is 7.0 MMTCO2e or 7.7% higher than the 2020 target."); Joeri Rogelj et al., *Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development*, *in* GLOBAL WARMING OF 1.5°C, *supra* note 7, at 95, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf ("Under emissions in line with current pledges under the Paris Agreement (known as Nationally Determined Contributions, or NDCs), global warming is expected to surpass 1.5°C above pre-industrial levels, even if these pledges are supplemented with very challenging increases in the scale and ambition of mitigation after 2030 . . . ."); *see also* Armstrong McKay et al., *supra* note 5, 1171 ("Currently the world is heading toward ~2 to 3°C of global warming; at best, if all net-zero pledges and nationally determined contributions are implemented it could reach just below 2°C. This would lower tipping point risks somewhat but would still be dangerous as it could trigger multiple climate tipping points.").

[215] Michelle Velez & Teele Rebane, *Hundreds of Children Among 1,000 People Killed by Pakistan Monsoon Rains and Floods*, CNN (Aug. 28, 2022), https://www.cnn.com/2022/08/28/asia/pakistan-flooding-intl/index.html.

[216] U.S. DEP'T OF STATE & U.S. EXECUTIVE OFFICE OF THE PRESIDENT, THE LONG-TERM STRATEGY OF THE UNITED STATES: PATHWAYS TO NET ZERO GREENHOUSE GAS EMISSIONS BY 2050, at 10 (2021) ("Climate change already inflicts serious damage on the United States and the world, particularly the most vulnerable that are least equipped to adapt—and the science is clear that, without faster global action, these impacts will become much more frequent and severe."); Joyashree Roy et al., *Sustainable Development, Poverty Eradication and Reducing Inequalities*, *in* GLOBAL WARMING OF 1.5°C, *supra* note 7, at 447, https://www.ipcc.ch/sr15/chapter/chapter-5/ ("Warming of 1.5ºC is not considered 'safe' for most nations, communities, ecosystems, and sectors and poses significant risks to natural and human systems as compared to current warming of 1°C . . . .").

[217] SUMMARY FOR POLICYMAKERS, *supra* note 92, at 9–10.

> At a mere 1°C or so above the average temperature of 120 years ago, the world is experiencing increases in the frequency and intensity of deadly heat waves in many regions; increases in torrential downpours and flooding in many others; large expansions in the annual area burned in regions prone to wildfires (and expansion of wildfires into regions not previously prone to them); an increase in the power of the strongest tropical storms; expanded impacts of pests and pathogens across large parts of the globe; disruptive changes in monsoons; other alterations in atmospheric and oceanic circulation patterns that, together with other impacts, are affecting agriculture and ocean fisheries; an accelerating pace of global sea-level rise; and ocean acidification arising from absorption of some of the excess carbon dioxide in the atmosphere.[218]

Plaintiffs' present-day injury stories based on current impacts are often of critical import, spurring an increasing number of judicial bodies to step up, recognize a fundamental rights violation, and order a remedy.

Fourth, the use of politically negotiated as opposed to science-based standards increases the risk that judicial bodies will find climate change cases nonjusticiable. In the United States, federal courts have held in a limited number of cases that the political question doctrine bars judicial review of claims based on the political branches' involvement in foreign affairs.[219] Asking courts to define a government's obligation to protect individual fundamental rights based upon its international political commitments, or the commitments of other nations (provided they have not been enshrined into domestic law), presents a risk of the claim being found non-justiciable.[220] Judicial bodies could find that if countries are working on climate change through international negotiations, there is no need to hold countries accountable on the domestic level.

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[218] Larson et al., *supra* note 85, at 4.

[219] *See, e.g.*, El-Shifa Pharm. Indus. Co. v. United States, 607 F.3d 836, 837–38, 845 (D.C. Cir. 2010) (dismissing for posing political questions the plaintiffs' declaratory and injunctive claims that the United States mistakenly destroyed a pharmaceutical plant via drone strike in Sudan as part of efforts to dismantle a terrorist network); Bancoult v. McNamara, 445 F.3d 427, 429, 436 (D.C. Cir. 2006) (dismissing for posing political questions the claims for injunctive relief raised by residents of the island of Chagos who alleged that they were systematically tortured and displaced to make way for a United States naval base).

[220] *See, e.g.*, Baker v. Carr, 369 U.S. 186, 211 (1962) ("There are sweeping statements to the effect that all questions touching foreign relations are political questions."); Thompson v. Oklahoma, 487 U.S. 815, 868 n.4 (1988) (Scalia, J., dissenting) (stating that "where there is not first a settled consensus among our own people, the views of other nations, however enlightened the Justices of this Court may think them to be, cannot be imposed upon Americans through the Constitution"). Courts in other nations appear to be more amenable to defining constitutional standards based upon international political commitments, *see, e.g.*, *Urgenda* Supreme Court Decision, *supra* note 139, ¶¶ 2.1, 8.3.4, but this case raises the other problems associated with constitutional standards of protection that may not align with best available science.

Finally, a clear body of peer-reviewed science exists that contradicts the use of the Paris Agreement temperature target as a standard of "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"[221] and protect fundamental rights. It is impossible to forecast the precise role judicial bodies will play in resolving the climate crisis. But, if judges are only being asked to enforce the Paris Agreement, that will be the extent of what they do. If, on the other hand, advocates ensure judges are presented with the most current climate science and what scientists prescribe needs to be done to protect our vital planetary systems and people whose most fundamental rights depend upon the health of such systems, there is a greater chance that governments will address climate change in a way that respects and protects fundamental rights for all.

CONCLUSION

Although the Paris Agreement target began as a heuristic to serve as a guiding objective for policymakers seeking international consensus, it has since evolved into an oft-articulated legal standard for the protection of fundamental rights in constitutional climate change cases. The IPCC has never scientifically affirmed the Paris Agreement target as being "safe" or not dangerous, and, indeed, more current peer-reviewed science says otherwise.[222] Yet, it is becoming increasingly frequent for advocates, and judicial bodies to whom these arguments are presented, to characterize the 1.5°C–2°C target as somehow reflecting a scientific consensus as to what is needed to preserve fundamental rights in climate change cases.[223] Judicial bodies' universal adoption of the Paris Agreement target as a proxy for fundamental rights protections will have catastrophic consequences. Such an approach confines humanity to a world of political majoritarianism, where, absent legal remedies, constitutional redress for global heating becomes geophysically

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[221] U.N. Framework, *supra* note 38, at art. 2.

[222] *See, e.g.*, Yun Gao, Xiang Gao & Xiaohua Zhang, *The 2°C Global Temperature Target and the Evolution of the Long-Term Goal of Addressing Climate Change—From The United Nations Framework Convention on Climate Change to the Paris Agreement*, 3 ENGINEERING 272, 272–73 (2017). *See also* Armstrong McKay et al., *supra* note 5.

[223] *See, e.g.*, *Urgenda* Supreme Court Opinion, *supra* note 139, ¶ 2.1 ("There has long been a consensus in climate science—the science that studies climate and climate change—and in the international community that the average temperature on earth may not rise by more than 2°C compared to the average temperature in the pre-industrial era."); *id.* ¶ 4.3 ("Climate science long ago reached a high degree of consensus that the warming of the earth must be limited to no more than 2°C and that this means that the concentration of greenhouse gases in the atmosphere must remain limited to a maximum of 450 ppm.").

impossible. If advocates do not present courts with scientifically based standards of fundamental rights protections in constitutional climate cases, then where does the law leave us? The emergent jurisprudence of climate catastrophe, after all, is one that should expand, not contract, the norms of justice.[224]

[224] *See* Weaver & Kysar, *supra* note 158, at 298, 301.

Annex C: Scientific findings on the effects of climate change on child health

This Annex was submitted to the Inter-American Court of Human Rights on 11 December 2023 in response to the Request for an Advisory Opinion on the Climate Emergency and Human Rights[1] and is included here for the Court's information.

This Annex is supported by 18 pediatric associations representing over one million medical professionals from more than 120 countries.[2]

[1] I/A Court H.R., Request for an Advisory Opinion submitted by Chile and Colombia on the Climate Emergency and Human Rights, (9 Jan. 2023) https://www.corteidh.or.cr/docs/opiniones/soc_1_2023_en.pdf.

[2] I/A Court H.R., *Amicus Curiae* Submission on the Request for an Advisory Opinion on the Climate Emergency and Human Rights, Our Children's Trust et al., (11 Dec. 2023) https://static1.squarespace.com/static/655a2d016eb74e41dc292ed5/t/657a0182e1880b5417feb13f/1702494611469/_2023.12.11+IACtHR+Amicus+Brief.pdf.

Annex C: Scientific findings on the effects of climate change on child health

Introduction

C.1. We stand in the midst of a climate emergency whose magnitude and urgency require an appropriately immense and urgent response.[1]

C.2. The climate emergency is already exacting a brutal toll[2] on individuals and communities throughout the Americas, from the Arctic to Patagonia. Not a single State Party to the American Convention on Human Rights has been spared.

C.3. Insofar as States continue to allow the emergency to intensify, the harms to child health will intensify, too. Unless States act forcefully now, our children and theirs will inherit an inherently unstable world that lacks the necessary ecological and social stability to support even the most basic levels of health and wellbeing.[3]

C.4. The signatories to this Annex are associations of pediatricians who are well-placed to attest that young patient regularly present with the described harms in exam rooms, emergency clinics, and hospitals all around the world. In this Annex, the signatories offer the Court a curated synopsis of the vast body of scientific evidence examining the impact of human-induced climate change on child health.

C.5. The science summarized in this Annex demonstrates that **each individual disaster** that is caused or intensified by climate change—every heatwave, cyclone, drought, and flood—**on its own, tremendously harms children and child health**. The fact that *ongoing* CO_2 emissions are continuing to make such disasters *even more powerful and frequent* going forward, is unacceptable.

C.6. For example, in 2020, Hurricane Eta ravaged vast areas of Central America.[4] Within days Eta was followed by Hurricane Iota. It was **the first time in meteorological history** that "two storms made landfall so close in time and place at Category 4

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[1] Raisa Uddin et al., *A global child health perspective on climate change, migration and human rights*, Curr. Probl. Pediatr. Adolesc. Health Care, 51(6):1-8 at 1 (2021) https://doi.org/10.1016/j.cppeds.2021.101029.
[2] *See e.g.* Annex B; IPCC, *Chapter 12: Central and South America* In: Climate Change 2022: Impacts, Adaptation and Vulnerability, Working Group II, Sixth Assessment Report, pp. 1689–1816 (2022) https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter12.pdf; and World Meteorological Organization, *State of the Climate in Latin America and the Caribbean 2022,* WMO-No. 1322 (2023) https://library.wmo.int/idurl/4/66252.
[3] Frederica Perera, *Pollution from fossil-fuel combustion is the leading environmental threat to global pediatric health and equity: Solutions exist*, Int. J. Environ. Res. Public Health, 15(1):1-17 at 2 (2018) https://doi.org/10.3390/ijerph15010016.
[4] Relief Web, *Central America: Hurricanes Eta & Iota - Operations update no. 5 (MDR43007)*, https://reliefweb.int/report/guatemala/central-america-hurricanes-eta-iota-operations-update-no-5-mdr43007 (last accessed Dec. 6, 2023).

intensity."[5] **Climate change drove both hurricanes** to intensify unusually quickly.[6] The winds, floods, and torrential rains **affected 3.5 million children**[7] by destroying their homes and classrooms, contaminating their water supply with diseases, and inflicting untold psychological stress.[8] At least 42 children were killed.[9] Others were orphaned. Thousands were displaced into shelters, where children, especially girls, were exposed to sexual abuse.[10]

[5] James M. Shultz et al., *Convergence of climate-driven hurricanes and COVID-19: The impact of 2020 hurricanes Eta and Iota on Nicaragua*, J. Clim. Change Health, 3(100019):1-5 at 2 (2021) https://doi.org/10.1016/j.joclim.2021.100019.
[6] James M. Shultz et al., *Convergence of climate-driven hurricanes and COVID-19: The impact of 2020 hurricanes Eta and Iota on Nicaragua*, J. Clim. Change Health, 3(100019):1-5 at 2 (2021) https://doi.org/10.1016/j.joclim.2021.100019.
[7] United Nations Children's Fund (UNICEF), *The impact of hurricanes Eta and Iota,* https://www.unicef.org/lac/en/stories/impact-of-hurricanes-eta-and-iota (last accessed Dec. 6, 2023).
[8] United Nations Children's Fund (UNICEF), *The impact of hurricanes Eta and Iota,* https://www.unicef.org/lac/en/stories/impact-of-hurricanes-eta-and-iota (last accessed Dec. 6, 2023).
[9] BBC News, *Huracanes Eta e Iota: la crisis humanitaria que dejaron en Centroamérica las tormentas (agravada por la pandemia)* (22-30 children killed in a landslide in Guatemala) https://www.bbc.com/mundo/noticias-america-latina-55479861 (last accessed Dec. 6, 2023); Diario las Américas, *Siguen lluvias por Eta en Centroamérica; van 13 muertos* (7 children killed by Eta in various locations in Guatemala and Honduras) https://www.diariolasamericas.com/siguen-lluvias-eta-centroamerica-van-13-muertos-n4209948 (last accessed Dec. 6, 2023); Diario las Américas, *Huracán Iota deja al menos 38 muertos en Centroamérica* (at least 7 children killed by Iota in Nicaragua) https://www.diariolasamericas.com/america-latina/huracan-iota-deja-al-menos-38-muertos-centroamerica-n4210786 (last accessed Dec. 6, 2023); Gustavo Palencia et al., *Tormenta Iota se disipa sobre El Salvador, deja inundaciones y más de 20 muertos*, Reuters (3 children killed by Iota in Honduras) https://www.reuters.com/article/clima-iota-idLTAKBN27Y2CF (last accessed Dec. 6, 2023); Los Angeles Times, *Tres niños mueren a causa de Eta en Panamá, aún se desconoce la cantidad general de desaparecidos* (3 children killed by Iota in Panama) https://www.latimes.com/espanol/internacional/articulo/2020-11-06/tres-ninos-mueren-a-causa-de-eta-en-panama-aun-se-desconoce-la-cantidad-general-de-desaparecidos (last accessed Dec. 6, 2023).
[10] United Nations Honduras, *Honduras: Tormentas tropicales Eta e Iota, informe de situación No. 05* (Measures needed to be taken to prevent sexual abuse and violence in the shelters) https://honduras.un.org/sites/default/files/2020-12/SitRep%205%20Tormentas%20Eta%20e%20Iota%20HN%202020.pdf (last accessed Dec. 6, 2023); UNFPA, *Contar con datos que salvan vidas ayuda a UNFPA en la respuesta ante el Huracán Eta y Iota,* (Data visualization helped the Honduran government and international organizations address children's vulnerability to sexual violence in the shelters) https://lac.unfpa.org/es/news/contar-con-datos-que-salvan-vidas-ayuda-unfpa-en-la-respuesta-ante-el-hurac%C3%A1n-eta-y-iota (last accessed Dec. 6, 2023); BBC News, Boris Miranda, *Los abusos sexuales a los que están expuestas miles de niñas y adolescentes en albergues de Centroamérica por los huracanes Iota y Eta*, https://www.bbc.com/mundo/noticias-america-latina-55431077 (last accessed Dec. 6, 2023).

C.7. Hurricanes Eta and Iota combined to form **a <u>single</u> climate disaster. Cumulatively**, the increasingly frequent and severe impacts of climate change are harming children and child health **on a staggering scale**.

<u>Key finding #1</u>:
All children are in a situation of extreme vulnerability to the harms caused by climate change *because* they are children

C.8. The World Health Organization estimates that 88% or greater of the existing global burden of disease attributable to climate change occurs in children younger than 5 years old in both industrialized and developing countries[11] and these "[e]ffects on children [...] are already—and are projected to continue to be—disproportionately heavy."[12]

C.9. Climate change disproportionately burdens child health[13] for four primary reasons.

C.10. First, **children have distinct physiology**.[14] Children are not small adults. All their major vital organs are still developing.[15] Consequently, when children are exposed to

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[11] Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics,136(5):e1468-1484 at e1470 (2015) https://doi.org/10.1542/peds.2015-3233; and Perry E. Sheffield et al., *Global climate change and children's health: Threats and strategies for prevention*, Environ. Health Perspect., 119:291-298 at 292, 296 (2011) https://doi.org/10.1289/ehp.1002233.

[12] Perry E. Sheffield et al., *Global climate change and children's health: Threats and strategies for prevention*, Environ. Health Perspect., 119:291-298 at 296 (2011) https://doi.org/10.1289/ehp.1002233.

[13] *See e.g.* Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics, 136(5):e1468-1484 at e1468-1469 (2015) ("Children are a uniquely vulnerable group that suffers disproportionately from these effects) https://doi.org/10.1542/peds.2015-3233; and Susie E.L. Burke et al., *The psychological effects of climate change on children*, Curr. Psychiatry Rep., 20(35):1-8 at 1 (2018) ("Children represent a uniquely vulnerable group but have received less research focus than adults.") https://doi.org/10.1007/s11920-018-0896-9 (restricted access, available upon request).

[14] *See e.g.* Laura Anderko, et al., *Climate changes reproductive and children's health: A review of risks, exposures, and impacts*, Pediatr. Res., 87:414-419 (2020) https://doi.org/10.1038/s41390-019-0654-7; Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics, 136(5):e1468-e1484 at e1470 (2015) https://doi.org/10.1542/peds.2015-3233; and Expert Report of Lori G. Byron, MD, MS and Robert G. Byron, MD, MPH, *Held et al. v. The State of Montana et al.*, Montana First Judicial District Court, Case No. CDV-2020-307 at 4 (May 16, 2022) (available upon request).

[15] Frederica Perera et al., *Climate change, fossil-fuel pollution, and children's health*, N. Engl. J. Med., 386:2303-2314 at 2304-2305 (2022) ("The fetus, infant, and child are uniquely vulnerable to climate-related environmental impacts and air pollution owing to a host of biologic and behavioral factors.") https://www.nejm.org/doi/pdf/10.1056/NEJMra2117706?articleTools=true; Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics, 136(5):e1468-e1484 at e1470 (2015) (Children's "immature physiology and metabolism; incomplete development; higher exposure to air, food, and water per unit body weight; unique behavior patterns; and dependence on caregivers place children at much higher risk of climate-related health burdens than adults") https://doi.org/10.1542/peds.2015-3233; U.S. Environmental Protection Agency, *Climate change and children's health and well-being in the United States*, *pp.* 1-108 at 36-37 (2023) (addressing a child's respiratory system and brain development) https://www.epa.gov/system/files/documents/2023-04/CLiME_Final%20Report.pdf; Zhiwei Xu et al., *Climate change and children's health: A call for research on what works to protect children*, Int. J. Environ. Res. Public Health, 9:3298-3316 at 3299 (2012) ("Climate change poses a significant threat to children's health because

climate-induced heat, smoke, pollution, diseases, and stress, their bodies respond to these stimuli differently than adults' bodies would. All told, the key physiological differences between children and adults that make children more vulnerable to the effects of climate change are:

a. Children have lower cardiac output than adults,[16] a less-developed thermo-regulatory system, a greater body surface-area-to-mass ratio, and produce more heat during exercise.[17] As a result, children's bodies produce or absorb more heat but are less able to dissipate it, making children more vulnerable to heat illness.[18]

b. Children breathe faster with higher minute ventilation, which enables more polluted air to enter the lungs per unit of body weight.[19] This makes children particularly vulnerable to the effects of air pollution, including pollution from burning fossil fuels[20] and indoor air contaminated by mold spores after floods.

c. Because children's lungs continue to grow and develop into young adulthood,[21] their respiratory systems are especially susceptible to environmental damage.

d. A child's immune system develops gradually during childhood.[22] For that reason, children are more vulnerable than adults to dying from numerous diseases including diarrheal illnesses, one of the biggest killers of children globally.[23]

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children have unique metabolism, behavior, physiology and development characteristics.") https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3499869/pdf/ijerph-09-03298.pdf; and Maureen Andrew et al., *Maturation of the hemostatic system during childhood*, Blood, 80(8):1998–2005 at 1998, 2003 (1992) ("[T]he coagulation system in children is distinctly different from that in adults, and this difference must be considered physiologic.") https://doi.org/10.1182/blood.V80.8.1998.1998.

[16] Giovanni de Simone et al., *Stroke volume and cardiac output in normotensive children and adults*, Circulation, 95(7):1837–1843 (1997) https://doi.org/10.1161/01.CIR.95.7.1837.

[17] Caroline J. Smith, *Pediatric thermoregulation: Considerations in the face of global climate change,* Nutrients, 11(9):1-24 at 2–4, 6–7 (2019) https://doi.org/10.3390/nu11092010; *see also* Miklós Székely et al., *Chapter 23: Thermoregulation and age,* Handbook of clinical neurology, 156:377-395 at 377, 379, 381, 384 (2018) https://doi.org/10.1016/B978-0-444-63912-7.00023-0 (restricted access, available upon request).

[18] Caroline J. Smith, *Pediatric thermoregulation: Considerations in the face of global climate change,* Nutrients, 11(9):1-24 at 2–4, 6–7 (2019) https://doi.org/10.3390/nu11092010.

[19] Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics, 136(5):e1468-e1484 at e1470, e1472 (2015) https://doi.org/10.1542/peds.2015-3233.

[20] Samantha Ahdoot et al., *Global climate change and children's health*, Pediatrics, 136(5):e1468-e1484 at e1472 (2015) https://doi.org/10.1542/peds.2015-3233.

[21] American Lung Association, *Lung capacity and aging*, https://www.lung.org/lung-health-diseases/how-lungs-work/lung-capacity-and-aging (last accessed Dec 6, 2023).

[22] A. Katharina Simon et al., *Evolution of the immune system in humans from infancy to old age*, Proc. Royal Soc. B, 282:1-9 at 1–4 (2015) https://doi.org/10.1098/rspb.2014.3085.

[23] *See e.g.* Pin Wang et al., *Associations between long-term drought and diarrhea among children under five in low-and middle-income countries,* Nature Comms., 13(3661):1-10 at 2 (2022) ("The World Health Organization estimated that in 2050, climate change could be responsible for approximately 32,954 additional diarrheal deaths worldwide among children aged 0–15 year. [...] In addition to causing mortality, diarrhea in children can also have lasting adverse effects such as impaired growth and cognitive development and increased susceptibility to chronic diseases.) https://doi.org/10.1038/s41467-022-31291-

e. Children have higher metabolic demands, requiring more calories and water per unit of body weight.[24] This makes child health especially vulnerable to malnourishment due to disruptions in food systems.

f. Children's central nervous systems do not reach full maturation until their twenties,[25] which makes children more susceptible to damage from neurotoxicants, and also dependent on adults to provide for their basic needs.

C.11. Second, **children are in a formative window of psychosocial development.**[26] As illustrated in Figure C.1, exposure to severe stressors during childhood has a *stronger* and *longer-term* impact on a person's mental health going forward, than if the exposure had occurred during adulthood.[27] Thus, **preventing exposure to severe stressors**—including those by brought on by climate change—is key to child mental health.

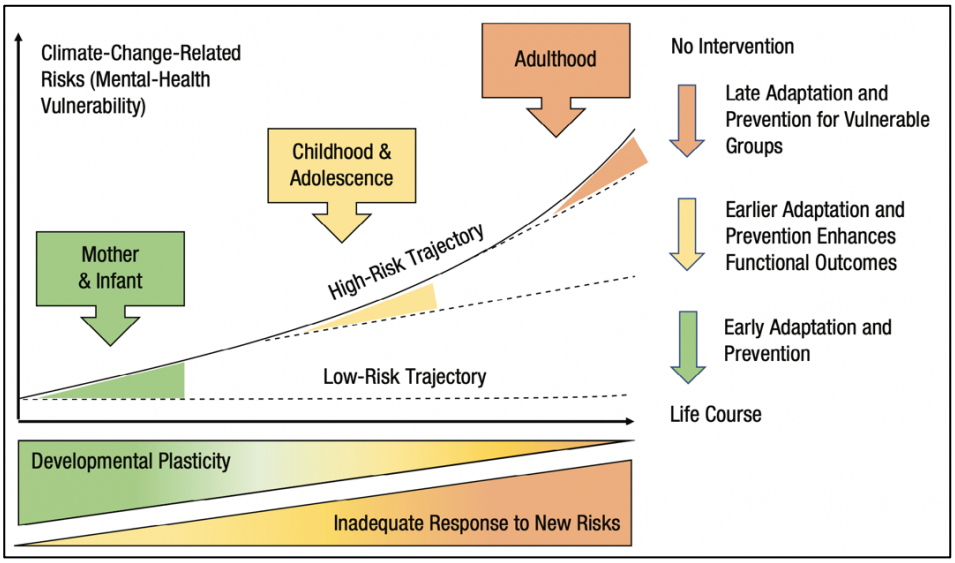

Figure C.1. Childhood is a formative—or plastic—period for psychosocial development. This mental plasticity decreases with age. Exposure to severe climate stressors during childhood sets children on a trajectory for greater vulnerability to mental illness as adults. By contrast, preventing climate harms in the first place puts children on a trajectory for lower risk of mental illness as adults.[28]

7; Carolyn Kousky, *Impacts of natural disasters on children*, Future Child., 26(1):73-92 at 73, 79-80 (2016) https://files.eric.ed.gov/fulltext/EJ1101425.pdf; and World Health Organization (WHO), *Diarrheal disease,* https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease (last accessed Dec. 6, 2023).

[24] Laura Watson et al., *Centile reference chart for resting metabolic rate through the life course*, 108:545-549 at 547 (2023) https://adc.bmj.com/content/108/7/545.

[25] Mariam Arain et al., *Maturation of the adolescent brain*, Neuropsychiatr. Dis. Treat., 9:449–461 at 459 (2013) ("The development and maturation of the prefrontal cortex occurs primarily during adolescence and is fully accomplished at the age of 25 years.") https://doi.org/10.2147/NDT.S39776.

[26] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 768 (2022) ("[C}hildhood is a period of extremely high developmental vulnerability when most psychiatric disorders are first established [...].") https://doi.org/10.1177/21677026211040787.

[27] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 769-775 (2022) https://doi.org/10.1177/21677026211040787.

[28] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 769 (2022) https://doi.org/10.1177/21677026211040787.

C.12. Third, **newborn health is uniquely vulnerable to permanent harm**. When mothers are exposed to heatwaves during pregnancy, it increases the risk that the newborn will be born preterm,[29] with a lifelong disability,[30] or stillborn.[31] Maternal exposure to air pollution from fossil fuel development and combustion during pregnancy also harms newborn health, causing the newborn a range of permanent health impacts ranging from asthma to death.[32]

C.13. Fourth, **children have more years of life ahead of them** than adults do. Today's children will be exposed to a greater number (and greater severity) of adverse climate effects over the course of their lives than today's adults will.[33] Those effects will therefore adversely affect the entirety of children's lives, unlike today's adults who largely had childhoods free from climate-induced harms.

C.14. For these reasons, children's exposure to adverse climate events makes them more susceptible than any other group to lifelong health effects arising from greenhouse gas pollution — pollution they had no part in creating.[34]

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[29] *See e.g.* Matthew Francis Chersich et al., *Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: Systematic review and meta-analysis*, BMJ, 371(m3811):1-13 (2020) (Review of 47 studies found that "preterm births were more common at higher than lower temperatures.") https://doi.org/10.1136/bmj.m3811; and Lara Cushing et al., *Extreme heat and its association with social disparities in the risk of spontaneous preterm birth*, Paediatr. and Perinat. Epidemiol., 36:13–22 at 20 (2021) https://onlinelibrary.wiley.com/doi/epdf/10.1111/ppe.12834.

[30] *See e.g.* Christopher P. Howson et al., Born too soon: *Preterm birth matters*, Reprod. Health, 10(Supp. 1):1-9 at 1 (2013) http://www.reproductive-health-journal.com/content/10/S1/S1.

[31] *See e.g.* Matthew Francis Chersich et al., *Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: Systematic review and meta-analysis*, BMJ, 371(m3811):1-13 (2020) (Review of eight studies on stillbirths "all showed associations between temperature and stillbirth, with stillbirths increasing 1.05-fold (1.01 to 1.08) per 1°C rise in temperature.") https://doi.org/10.1136/bmj.m3811; Jenner Kanner et al., *Ambient temperature and stillbirth: Risks associated with chronic extreme temperature and acute temperature change*, Environ. Res., 189(109958):1-8 (2020) https://doi.org/10.1016/j.envres.2020.109958 (restricted access, available upon request); and L.B. Strand et al., *Maternal exposure to ambient temperature and the risks of preterm birth and stillbirth in Brisbane, Australia*, Am. J. Epidemiol., 175(2):99–107 (2012) https://doi.org/10.1093/aje/kwr404.

[32] Insa Korten et al., *Air pollution during pregnancy and lung development in the child*, Paediatr. Respir. Rev., 21:38-46 (2017) https://doi.org/10.1016/j.prrv.2016.08.008 (restricted access, available upon request).

[33] *See e.g.* Emmanuelle Arpin et al., *Climate change and child health inequality: A review of reviews*, Int. J. Environ. Res. Public Health, 18(10896):1-17 at 12 (2018) https://doi.org/10.3390/ijerph182010896.

[34] *See e.g.* Helen Clark et al., *A future for the world's children? A WHO-UNICEF-Lancet commission*, Lancet, 395(10224):605-658 at 609 (2020) (Children are [...] the most vulnerable to the lifelong environmental effects caused by climate change arising from anthropogenic greenhouse gas emissions, and from industry linked pollution of the air, water, and land.") https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32540-1/fulltext; Emmanuelle Arpin et al., *Climate change and child health inequality: A review of reviews*, Int. J. Environ. Res. Public Health, 18(10896):1-17 at 12 (2018) https://doi.org/10.3390/ijerph182010896; and Anthony J. McMichael, *Climate change and children: Health risks of abatement inaction*, *health gains from action*, Children, 1:99-106 (2014) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4928726/pdf/children-01-00099.pdf.

C.15. While all children are at risk, certain populations of children are *especially at risk*. The most at-risk of all are children with chronic or pre-existing medical conditions, disabilities, and those who are socially and economically disadvantaged.[35]

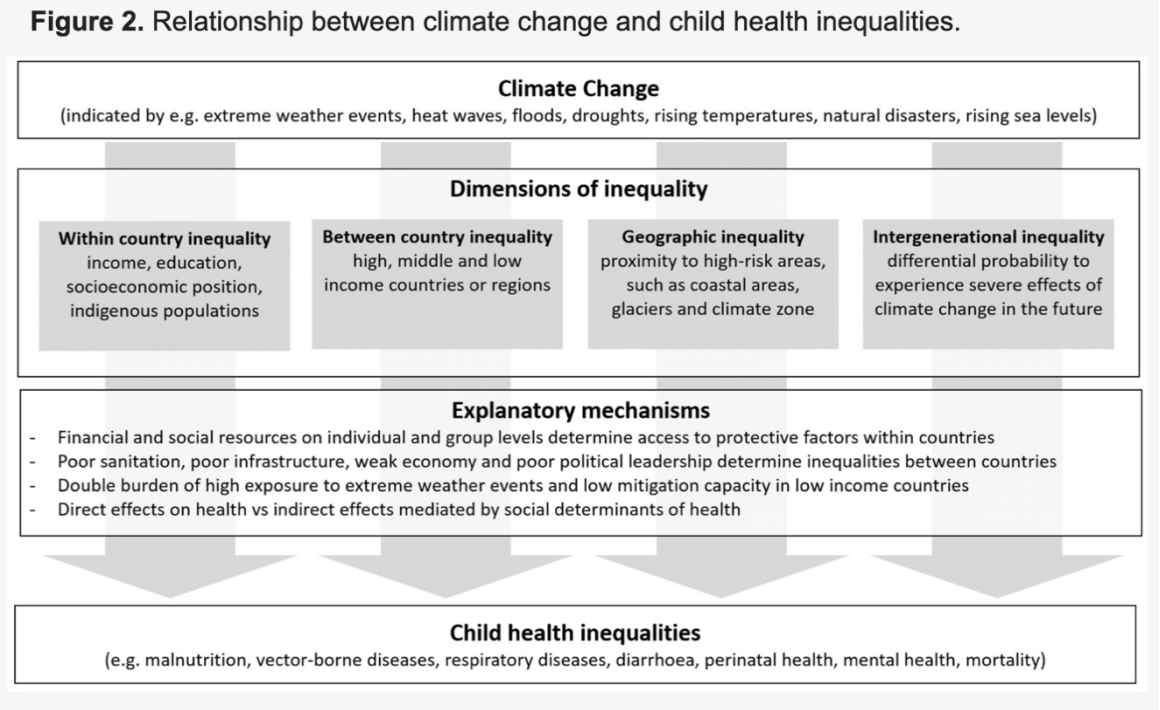

Figure C.2. Relationship between climate change and a number of child health inequalities.[36]

C.16. Among the State Parties to the Convention, approximately 18 million children have a disability, and over 68 million children live in conditions of social and economic disadvantage.[37] The climate emergency exposes children in **intersectional**

[35] *See e.g.* Cadeyrn J. Gaskin et al., *Factors associated with the climate change vulnerability and the adaptive capacity of people with disability: A systematic review*, Weather Clim. Soc., 9(4):801-814 at 801 (2017) ("[P]eople with disability are especially at risk of the direct and indirect effects of climate change.") https://doi.org/10.1175/WCAS-D-16-0126.1; Emmanuelle Arpin et al., *Climate change and child health inequality: A review of reviews*, Int. J. Environ. Res. Public Health, 18(10896):1-17 at 11 (2018) ("[C]limate change acts as an amplifier of existing inequities with the result that the world's poorest and socially-disadvantaged children will bear the greatest burden of climate change-related ill-health.") https://doi.org/10.3390/ijerph182010896; Federica Perera et al., *Climate change, fossil-fuel pollution, and children's health*, N. Engl. J. Med., 386:2303-2314 at 2303 (2022) https://www.nejm.org/doi/pdf/10.1056/NEJMra2117706?articleTools=true; and State of Colorado, *In the Matter of Changes to the Rules and Regulations of the Oil and Gas Conservation Commission*, Docket No. 200600155*, Expert Testimony of Susan E. Pacheco, M.D., Department of Pediatrics, University of Texas Health Science Center,* p. 2 para 5 (Oct. 16, 2020) (available upon request).

[36] Emmanuelle Arpin et al., *Climate change and child health inequality: A review of reviews*, Int. J. Environ. Res. Public Health, 18(10896):1-17 at 13 (2018) https://doi.org/10.3390/ijerph182010896.

[37] United Nations Children's Fund (UNICEF), *UNICEF data warehouse: Population under age 18,* (Total child population of all Convention party states) https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.DM_POP_U18.&startPeriod=2020&endPeriod=2023 (last accessed Dec. 6, 2023); United Nations

situations to multiple layers of risk: it especially burdens them because they are children, and also because of their other situation(s) of risk.[38]

Key finding #2:
Climate change exposes child health to harms that are multiple, overlapping, complex, long-term, and compound over time

C.17. While some climate effects are highly visible, such as an immediate death or bodily injury, many are not (see Figure C.3). Climate change's less-visible effects take place within the body, the mind, on a microscopic scale (in the air, soil, or water), and in the infrastructure and social institutions that children depend on for health and survival.

Children's Fund (UNICEF), *Seen, counted, included: Using data to shed light on the well-being of children with disabilities*, pp. 1-175 at 18, 21, and 166 (2021) (Percentages of children in each country with a disability) https://data.unicef.org/wp-content/uploads/2022/12/Disabilities-Report_11_30.pdf; United Nations Children's Fund (UNICEF), *Every child has a fair start in life* (Number of children in poverty in Latin America and the Caribbean) https://www.unicef.org/lac/en/every-child-has-fair-start-life (last accessed Dec. 6, 2023); United Nations Children's Fund (UNICEF), *Pobreza monetaria y privaciones no monetarias en Argentina*, pp. 1-50 at 6 (2023) (Approximately 6.8 million children in Argentina live in poverty) https://www.unicef.org/argentina/informes/pobreza-monetaria-y-privaciones-no-monetarias-en-ni%C3%B1as-ni%C3%B1os-y-adolescentes-en-argentina; United Nations Children's Fund (UNICEF), *Children in monetary poverty in Brazil*, pp. 1-41 at 17 (2022) (Approximately 40% or 21 million children in Brazil live in poverty) https://www.unicef.org/brazil/media/18866/file/children-in-monetary-poverty-in-brazil.pdf; United Nations Children's Fund (UNICEF), *Alianza Erradicación de la Pobreza Infantil, Nacer y crecer en pobreza y vulnerabilidad*, pp. 1-436 at 21 (2021) (Approximately 22.9% or nearly 1 million children in Chile live in multidimensional poverty) (last accessed Dec. 6, 2023); UNICEF, *Pobreza y privaciones múltiples en la infancia en Uruguay*, at 9 (2016) (Approximately 18.4% or 144,300 children in Uruguay live in poverty) https://www.unicef.org/lac/sites/unicef.org.lac/files/2019-10/PrivacionesMultiplesUruguay.pdf (last accessed Dec. 6, 2023); UNICEF Ecuador, *Privaciones múltiples en la niñez y adolescencia en Ecuador: una aproximación desde el enfoque de derechos a partir de los resultados de la Encuesta Nacional de Salud y Nutrición 2018*, at 43 (Approximately 57.5% or 3.1 million children in Ecuador live in multidimensional poverty) (2022) https://www.ecuadorencifras.gob.ec/documentos/web-inec/Bibliotecas/Libros/cuadernos_trabajo/Privaciones%20UNICEF_12_09.pdf (last accessed Dec. 6, 2023).https://www.unicef.org/chile/media/6311/file/Nacer%20y%20crecer%20en%20pobreza%20Final%20.pdf; United Nations Children's Fund (UNICEF), *Pobreza y privaciones múltiples en la infancia en Uruguay*, pp. 1-132 at 9 (2016) (Approximately 18.4% or 144,300 children in Uruguay live in poverty) https://www.unicef.org/lac/sites/unicef.org.lac/files/2019-10/PrivacionesMultiplesUruguay.pdf; UNICEF Ecuador, *Privaciones múltiples en la niñez y adolescencia en Ecuador: una aproximación desde el enfoque de derechos a partir de los resultados de la Encuesta Nacional de Salud y Nutrición 2018*, pp. 1-63 at 43 (2022) (Approximately 57.5% or 3.1 million children in Ecuador live in multidimensional poverty) https://www.ecuadorencifras.gob.ec/documentos/web-inec/Bibliotecas/Libros/cuadernos_trabajo/Privaciones%20UNICEF_12_09.pdf.

[38] *See e.g.* Cadeyrn J. Gaskin et al., *Factors associated with the climate change vulnerability and the adaptive capacity of people with disability: A systematic review*, Weather Clim. Soc., 9:801-814 (2017) https://doi.org/10.1175/WCAS-D-16-0126.1; *See* United Nations Children's Fund (UNICEF), *The climate crisis is a child rights crisis: Introducing the children's climate risk index*, pp. 1-125 at 73 (2021) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf.

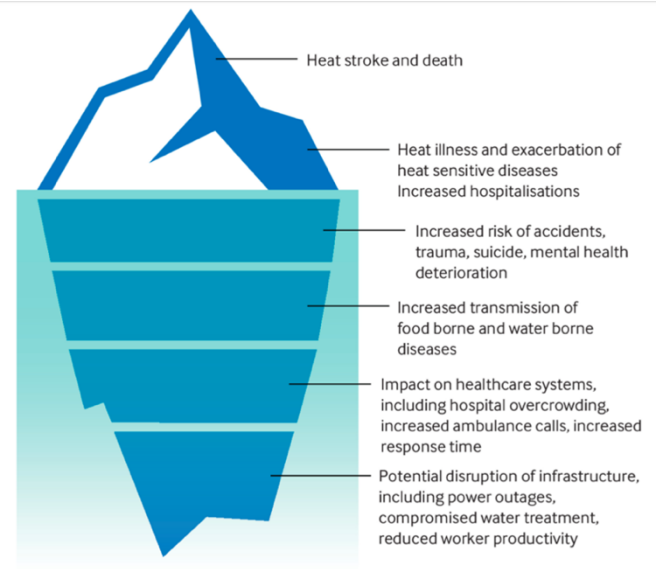

Figure C.3. Using the example of heatwaves, climate change adversely impacts health not only through instantaneous death and bodily injury. Many of the most harmful health impacts operate "below the surface" and therefore may not be immediately apparent to a casual observer.[39]

C.18. A single climate event can harm child physical and mental health through multiple, overlapping pathways:[40] By introducing an entirely new health problem that the child did not have before the event (such as asthma, a laceration, or an emotional trauma);

a. By triggering or exacerbating a **pre-existing health problem**;

b. By interacting with pollutants already in the environment to introduce a **new kind of risk** to child health (such as floodwaters spreading industrial chemicals to contaminate cropland or drinking water);

c. By **destroying physical items** that are necessary to meet a child's needs (such as a house, school, health clinic, water main, road, or crop); and

d. By **destabilizing social arrangements** that the child's welfare depends on (such as their family, school, health care system, economy, or government).

C.19. As multiple harms from a single climate event ripple through a child's environment, those harms interact with one another and compound. **As harms from climate events compound, they *overdetermine*** the child's susceptibility to adverse health

[39] Cecilia Sorensen et al., *Heat illness in clinical practice*, BMJ, 378(e070762):1-7 at 3 (2022) https://doi.org/10.1136/bmj-2022-070762 (restricted access, available upon request).
[40] Laura Anderko, et al., *Climate changes reproductive and children's health: A review of risks, exposures, and impacts*, Pediatr. Res., 87:414-419 (2020) https://doi.org/10.1038/s41390-019-0654-7; and Anthony J. McMichael, *Globalization, climate change, and human health,* N. Engl. J. Med., 368:1335-1343 at 1338 (2013) https://www.nejm.org/doi/full/10.1056/nejmra1109341.

outcomes such as poor nutrition, impaired child development, mental health problems, infectious diseases, and poor health in adulthood (see Figure C.4).[41]

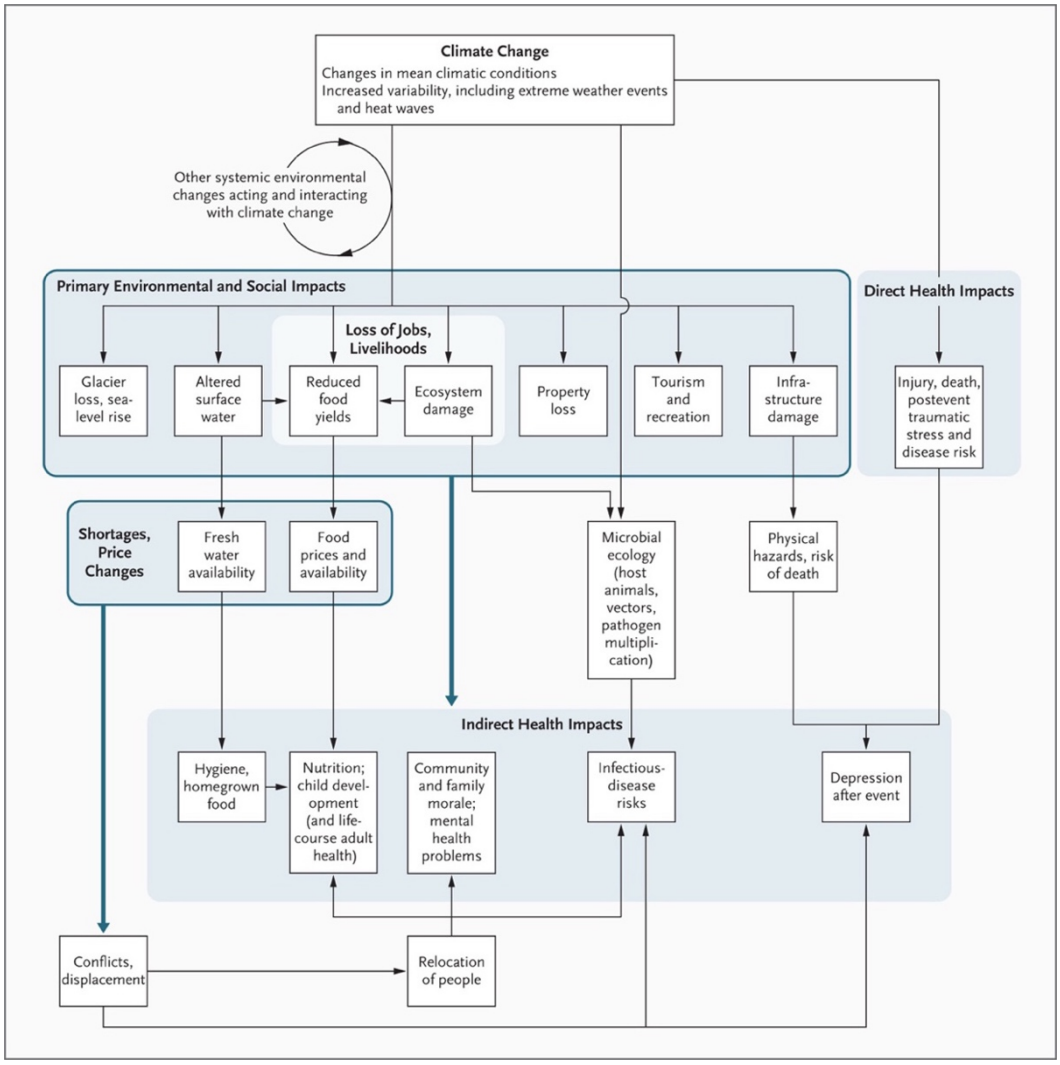

Figure C.4. A single climate-change event can easily affect child health through multiple pathways. These pathways compound with one another to overdetermine a child's susceptibility to infectious diseases, depression, and poor health in adulthood.[42]

C.20. Compound exposure is already happening. **90% of children** in Latin America are already exposed to ***at least two climate-related shocks*** (such as heatwaves and flooding),[43] and these numbers will rise insofar as the atmospheric concentration of greenhouse gases—especially CO_2—continues to increase.

[41] Anthony J. McMichael, *Globalization, climate change, and human health,* N. Engl. J. Med., 368:1335-1343 at 1339 (2013) https://www.nejm.org/doi/full/10.1056/nejmra1109341.
[42] Anthony J. McMichael, *Globalization, climate change, and human health,* N. Engl. J. Med., 368:1335-1343 at 1339 (2013) https://www.nejm.org/doi/full/10.1056/nejmra1109341.
[43] United Nations Children's Fund (UNICEF), *9 out of 10 children in Latin America and the Caribbean are*

C.21. Many effects of climate change harm child health **in the long term, through adulthood**. These long-term harms include permanent cognitive changes, predispositions to adult mental illnesses,[44] and reduced educational achievement and earning potential which leads to poverty.[45]

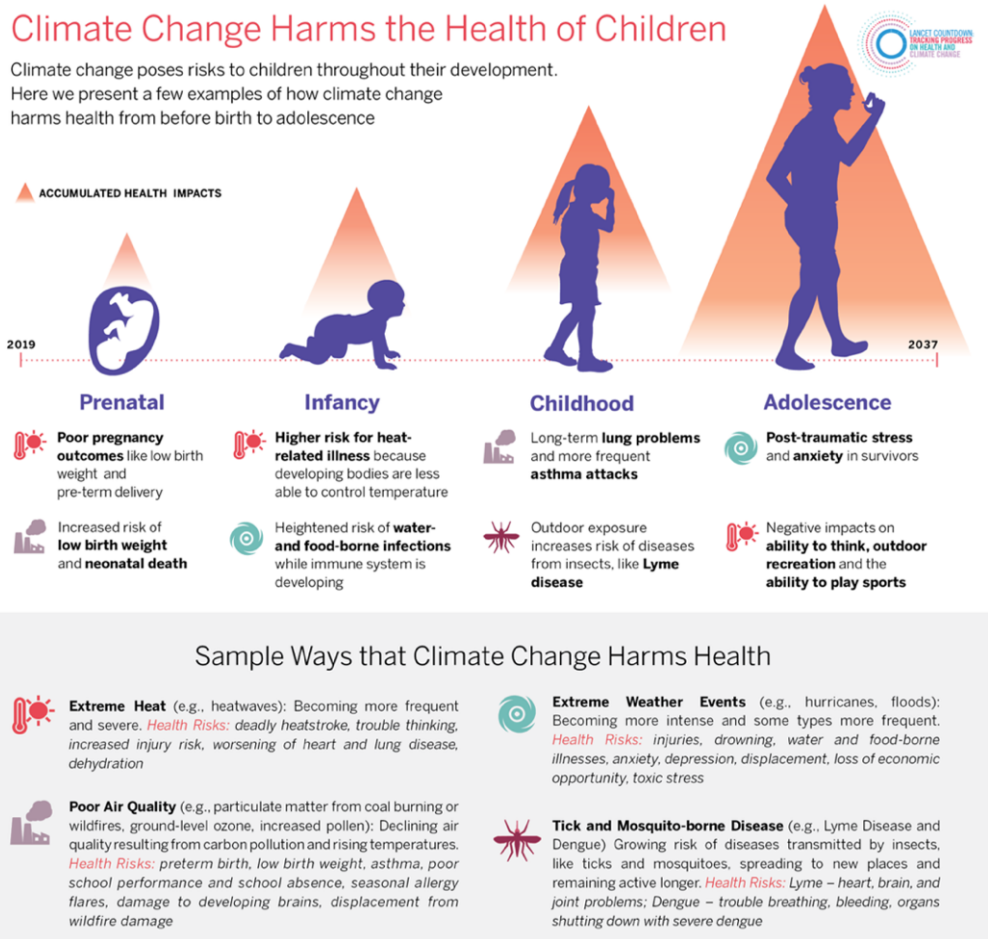

Figure C.5. Climate change harms children over the long term throughout their development, from birth to adulthood.[46]

exposed to at least two climate and environmental shocks, https://www.unicef.org/lac/en/press-releases/children-latin-america-and-caribbean-are-exposed-climate-climate-environmental-shocks (last accessed Dec. 6, 2023).

[44] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 769 (2022), https://doi.org/10.1177/2167702621104078.

[45] Phoebe C.M. Williams et al., *Ethical considerations regarding the effects of climate change and planetary health on children*, J. Paediatr. Child Health, 57(11):1775-1780 at 1778 (2021) https://doi.org/10.1111/jpc.15704.

[46] Harvard T.H. Chan School of Public Health, *2019 Lancet countdown on health and climate change: Policy brief for the U.S.,* https://www.hsph.harvard.edu/c-change/news/2019-lancet-countdown/ (last accessed Dec. 6, 2023).

C.22. The next sections will present evidence documenting how specific climate-change events harm child health. This evidence will be presented in the following order:

a. Harms from extreme heat and heatwaves;
b. Harms from severe weather disasters such as storms, floods, hurricanes, landslides, and droughts;
c. Harms exacerbated by dangerous air quality due to fossil fuels;
d. Climate-related harms to mental health; and
e. Amplified harms to children who have additional risk factors.

Key finding #3:
Child health is uniquely vulnerable to heatwaves

C.23. Heatwaves are prolonged periods of excessive heat.[47] Exposure to extreme heat is one of the gravest health threats in the 21st century due to global warming.[48] Globally, children under the age of one year were exposed to 2.35 million more person-days of heatwaves each year in 2012-2021 as compared to 1996–2005.[49] In 2022, 559 million children were exposed to high frequencies of heatwaves, and by 2050, the figure is predicted to increase nearly ***four-fold*** to over 2 billion affecting virtually every child on earth.[50]

C.24. The number of heat-related deaths in South America has been increasing since 2000.[51] In Argentina, heat-related deaths have nearly doubled since 2000.[52] In Paraguay they have *more* than doubled; in Chile, they have *more than tripled*, and in Ecuador they have increased ***over 15-fold***.[53] Currently, anthropogenic climate change is causing ***more than 60%*** of all heat-related deaths in Colombia, Ecuador,

[47] S. E. Perkins-Kirkpatrick & S.C. Lewis, *Increasing trends in regional heatwaves*, Nat. Commun., 11(3357):1-8 at 2 (2020) https://doi.org/10.1038/s41467-020-16970-7.
[48] Marjan Mosalman Haghighi et al., *Impacts of high environmental temperatures on congenital anomalies: A systematic review*, Int. J. Environ. Res. Public Health, 18(4910):1-15 at 2 (2021) https://doi.org/10.3390/ijerph18094910.
[49] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act.* Lancet Reg. Health - Am., 20(100470):1–35 at 2, 8 (2023) https://doi.org/10.1016/j.lana.2023.100470.
[50] United Nations Children's Fund (UNICEF), *The coldest year of the rest of their lives: Protecting children from the escalating impacts of heatwaves*, pp. 1-48 at 6, 9 (2022) https://www.unicef.org/media/129506/file/UNICEF-coldest-year-heatwaves-and-children-EN.pdf.
[51] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act,* Lancet Reg. Health - Am., 20(100470):1–35 at 8 (2023) https://doi.org/10.1016/j.lana.2023.100470.
[52] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act,* Lancet Reg. Health - Am., 20(100470):1–35 at 8 (2023) https://doi.org/10.1016/j.lana.2023.100470.
[53] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act,* Lancet Reg. Health - Am., 20(100470):1–35 at 8 (2023) https://doi.org/10.1016/j.lana.2023.100470.

Peru, Brazil, Costa Rica, and Guatemala; more than 40% of those in Chile, Paraguay, Panama, and Mexico; and 20% in Argentina and Uruguay.[54]

C.25. For each additional 1.0°C rise in ambient temperature above 29.0°C, adults experience a 1%-3% increase in mortality.[55] For children, the increase is 50-100% higher.[56] Infants and children under 5 are even more vulnerable.[57] In other words, ***every degree of temperature rise creates an increased chance of death that is orders of magnitude higher for children.***

C.26. There are **twenty-seven different ways** that a heatwave can kill a person.[58] Put differently, heat triggers twenty-seven physiological pathways, each of which can lead to organ failure and death.[59] Each pathway consists of a heat-triggered physiological response (i.e. ischemia, heat cytotoxicity, inflammation, disseminated intravascular coagulation, and/or rhabdomyolysis) that acts on one of seven vital organs (brain, heart, intestines, kidneys, liver, lungs, and pancreas).[60] These pathways are diagrammed in Figure C.6 and illustrated in Figure C.7.

[54] Ana M. Vicedo-Cabrera et al., *The burden of heat-related mortality attributable to recent human-induced climate change*, Nat. Clim. Change, 11:492-509 at 497 (2021) https://www.nature.com/articles/s41558-021-01058-x (restricted access, available on request).
[55] Joshua Graff Zivin et al., *Temperature extremes, health, and human capital*, Future Child., 26(1):31-50 at 35 (2016) https://files.eric.ed.gov/fulltext/EJ1101427.pdf; *see also* Jean Calleja-Agius et al., *The effect of global warming on mortality*, Early Hum. Dev., 155(105222):1-5 at 3 (2021) ("[A]t temperatures above 27°C, the daily mortality rate increases more rapidly per degree rise compared to when it drops below 27°C.") https://doi.org/10.1016/j.earlhumdev.2020.105222.
[56] Joshua Graff Zivin et al., *Temperature extremes, health, and human capital,* Future Child., 26(1):31-50 at 35 (2016) https://files.eric.ed.gov/fulltext/EJ1101427.pdf.
[57] Joshua Graff Zivin et al., *Temperature extremes, health, and human capital,* Future Child., 26(1):31-50 at 35 (2016) https://files.eric.ed.gov/fulltext/EJ1101427.pdf; United Nations Children's Fund (UNICEF), *Protecting Children from heat stress: A technical note*, pp. 1-44 (2023) https://www.unicef.org/media/139926/file/Protecting-children-from-heat-stress-A-technical-note-2023.pdf; Instituto Mexicano del Seguro Social, *Qué onda con el calor* (2023) https://www.imss.gob.mx/sites/all/statics/pdf/guarderias/onda-calor.pdf.
[58] Camilo Mora et al., *Twenty-seven ways a heat wave can kill you: Deadly heat in the era of climate change*, Circ: Cardiovasc. Qual. Outcomes, 10(11):1-3 at 1 (2017) https://doi.org/10.1161/CIRCOUTCOMES.117.004233.
[59] Camilo Mora et al., *Twenty-seven ways a heat wave can kill you: Deadly heat in the era of climate change*, Circ: Cardiovasc. Qual. Outcomes, 10(11):1-3 at 2 (2017) https://doi.org/10.1161/CIRCOUTCOMES.117.004233.
[60] Camilo Mora et al., *Twenty-seven ways a heat wave can kill you: Deadly heat in the era of climate change*, Circ: Cardiovasc. Qual. Outcomes, 10(11):1-3 at 2 (2017) https://doi.org/10.1161/CIRCOUTCOMES.117.004233.

Organs Damaged by Physiological Mechanisms Triggered by Heat Exposure

Organs	Mechanisms				
	Ischemia	Heat Cytotoxicity	Inflammatory Response	Disseminated Intravascular Coagulation	Rhabdomyolysis
Brain	①	⑦	⑬	⑳	
Heart	②	⑧	⑭		
Intestines	③	⑨	⑮	㉑	
Kidneys	④	⑩	⑯	㉒	㉕
Liver	⑤	⑪	⑰	㉓	㉖
Lungs		⑫	⑱	㉔	㉗
Pancreas	⑥		⑲		

Figure C.6. The 27 pathways through which heat exposure kills.[61]

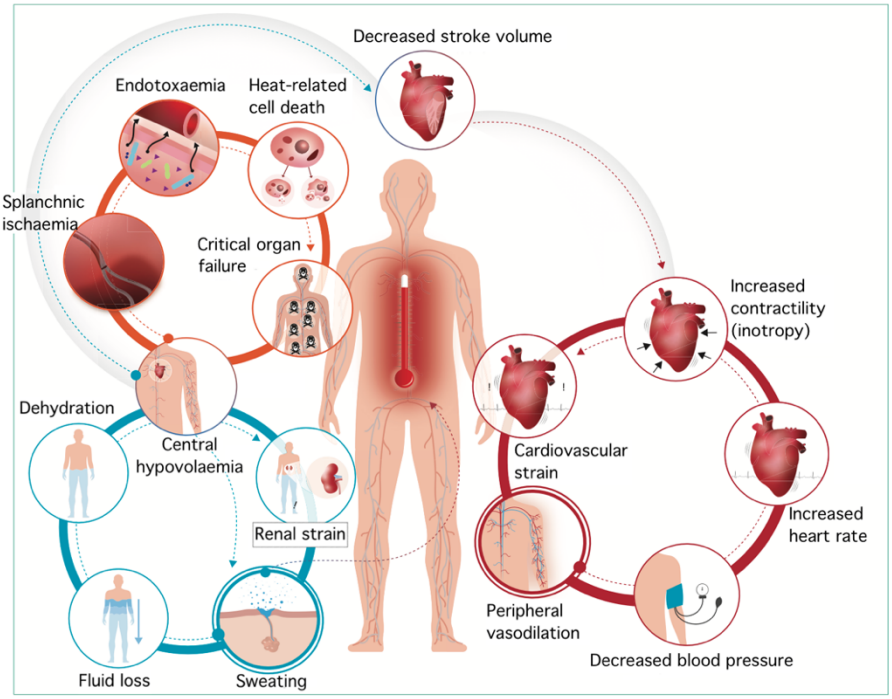

Figure C.7. The physiological processes through which heat exposure damages organs.[62]

[61] Camilo Mora et al., *Twenty-seven ways a heat wave can kill you: Deadly heat in the era of climate change*, Circ: Cardiovasc. Qual. Outcomes, 10(11):1-3 at 2 (2017) https://doi.org/10.1161/CIRCOUTCOMES.117.004233.
[62] Kristie L. Ebi et al., *Hot weather and heat extremes: Health risks*, Lancet, 398(10301):698–708 at 700 (2021) https://doi.org/10.1016/S0140-6736(21)01208-3.

C.27. Even when heat exposure does not prove fatal, it can still cause heat rash (miliaria),[63] heat exhaustion,[64] dehydration, heat stroke,[65] kidney disease,[66] liver injury,[67] respiratory illnesses,[68] and electrolyte imbalance.[69] Because heat lowers sleep quality, heatwaves indirectly cause diabetes, higher blood pressure, and lower immune functionality.[70] Due to their developing physiology, infants and children are at a higher risk of developing heat-related illnesses than are healthy adults.[71]

C.28. Heat triggers seizures.[72] Seizures harm health because they cause brain damage.[73] The higher a child's body temperature is during a seizure, the worse the brain damage that results.[74] Seizures can also cause death.[75] Currently, an estimated 10% of people suffer at least one seizure in their lifetime,[76] and 3% of children suffer from febrile seizures.[77] These seizures can be triggered by body temperature that becomes too hot for any reason, including a very hot day.[78] People with epilepsy are at especially high risk of heat-related seizure. An estimated 0.6% of people have

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[63] Karla C. Cuerra, *Milaria*, Nat'l. Lib. of Med. and Nat'l. Center for Biotech. Info., (2023) https://www.ncbi.nlm.nih.gov/books/NBK537176/.
[64] Courtney Mangus et al., *Heat-related illness in children in an era of extreme temperatures*, Pediatr. Rev., 40(3):97–107 at 98 (2019) https://renaissance.stonybrookmedicine.edu/system/files/Heat-Related-Illness-in-Children.pdf.
[65] Kristie L. Ebi et al., *Hot weather and heat extremes: Health risks*, Lancet, 398(10301):698–708 at 699 (2021) https://doi.org/10.1016/S0140-6736(21)01208-3.
[66] Cecilia Sorensen et al., *A new era of climate medicine: Addressing heat-triggered renal disease*, N. Engl. J. Med. 381:693–696 at 693 (2019) https://www.nejm.org/doi/full/10.1056/NEJMp1907859.
[67] Cecilia Sorensen et al., *Heat illness in clinical practice*, BMJ, 378(e070762):1-7 at 5 (2022) https://doi.org/10.1136/bmj-2022-070762 (restricted access, available upon request).
[68] Cecilia Sorensen et al., *Heat illness in clinical practice*, BMJ, 378(e070762):1-7 at 1 (2022) https://doi.org/10.1136/bmj-2022-070762 (restricted access, available upon request); Kristie L. Ebi et al., *Hot weather and heat extremes: Health risks*, Lancet, 398(10301):698–708 at 698-699 (2021) https://doi.org/10.1016/S0140-6736(21)01208-3.
[69] Cecilia Sorensen et al., *Heat illness in clinical practice*, BMJ, 378(e070762):1-7 at 5 (2022) https://doi.org/10.1136/bmj-2022-070762 (restricted access, available upon request).
[70] Newton R. Matandirotya et al., *Chapter 15: Assessing the climate change-related health hazards in Africa* In: Climate Change and Health Hazards, pp. 293-305 at 294-295 (2023) https://link.springer.com/chapter/10.1007/978-3-031-26592-1_15 (restricted access; available upon request).
[71] Courtney Mangus et al., *Heat-related illness in children in an era of extreme temperatures*, Pediatr. Rev., 40(3):97–107 at 99 (2019) (children's risk of heat illness is similar to that of adults with cardiovascular disease) https://renaissance.stonybrookmedicine.edu/system/files/Heat-Related-Illness-in-Children.pdf.
[72] Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 2 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.
[73] Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 2, 6, 7 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.
[74] Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 2, 6, 7 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.
[75] Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 2, 3 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.
[76] World Health Organization (WHO), *Epilepsy,* https://www.who.int/news-room/fact-sheets/detail/epilepsy (last accessed Dec. 6, 2023).
[77]Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 4 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.
[78] Medine I. Gulcebi et al., *Climate change and epilepsy: Insights from clinical and basic science studies*, Epilepsy Behav., 116(107791):1-11 at 4 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9386889/.

epilepsy,[79] a number that is expected to rise because maternal exposure to heat during pregnancy increases the incidence of low birthweight,[80] which increases risk of epilepsy.[81]

C.29. Heat illness can cause mental illness.[82] Higher temperatures are associated with increased substance abuse and mental health disorders, including depression.[83] Numerous studies have documented a correlation between increased ambient temperatures and suicides.[84] Increased heat also causes a marked increase in interpersonal violence, including domestic violence.[85]

C.30. Heat makes it more difficult for children to learn on hot days.[86] Children perform school tasks approximately 20% better if classroom temperature is lowered from 30ºC to 20ºC, with the optimum temperature for learning being 22ºC.[87] Cumulative

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[79] World Health Organization (WHO), *Epilepsy,* https://www.who.int/news-room/fact-sheets/detail/epilepsy (last accessed Dec. 6, 2023).
[80] World Health Organization (WHO), *Epilepsy,* https://www.who.int/news-room/fact-sheets/detail/epilepsy (last accessed Dec. 6, 2023).
[81] Yuelian Sun et al., *Gestational age, birth weight, intrauterine growth, and the risk of epilepsy*, Am. J. Epidemiol., 167(3):262–270 at 262, 267 (2008) https://doi.org/10.1093/aje/kwm316.
[82] Cecilia Sorensen et al., *Heat illness in clinical practice*, BMJ, 378(e070762):1-7 at 1, 3 (2022) https://doi.org/10.1136/bmj-2022-0707sor62 (restricted access, available upon request).
[83] *See* Maria I. Rinderu et al., *Climate, aggression and violence (CLASH): A cultural-evolutionary approach,* Curr. Opin. Psychol., 19:113-118 (2018) https://research.vu.nl/ws/portalfiles/portal/72579474/Climate_aggression_and_violence_CLASH_a_cultural_evolutionary_approach.pdf; and Haris Majeed et al.*, The impact of climate change on youth depression and mental health,* Lancet, 1(3):e94-e95 (2017) https://www.thelancet.com/action/showPdf?pii=S2542-5196%2817%2930045-1.
[84] Hyewon Lee et al., *Chapter 8: Heat exposure and mental health in the context of climate change* In: Heat exposure and human health in the context of climate change, Elsevier, pp. 155-187 at 172–174 (2023) https://doi.org/10.1016/B978-0-12-819080-7.00008-2.
[85] Hyewon Lee et al., *Chapter 8: Heat exposure and mental health in the context of climate change* In: Heat exposure and human health in the context of climate change, Elsevier, pp. 155-187 at 174 (2023) ("The link between heat exposure and violence has been studied for a very long time. It has been consistently observed that high ambient temperature caused aggressive or violent behaviors of individuals towards others.") https://doi.org/10.1016/B978-0-12-819080-7.00008-2; and Isabel Maria L. Silva et al., *Chapter 4: Climate change impact on mental health: Is nature fighting us back?* In: Climate change and health hazards, Springer, pp. 57-73 at 65, 67 (2023) https://link.springer.com/chapter/10.1007/978-3-031-26592-1_4 (restricted access, available upon request).
[86] Pawel Wargocki et al., *The relationship between classroom temperature and children's performance in school*, Build. Environ., 157:197-204 (2019) https://doi.org/10.1016/j.buildenv.2019.04.046; *see also* Jose Guillermo Cedeño Laurent et al., *Reduced cognitive function during a heat wave among residents of non-air-conditioned buildings: An observational study of young adults in the summer of 2016*, PloS Med., 15(7):1-20 at 11 (2018) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039003/pdf/pmed.1002605.pdf.
[87] Pawel Wargocki et al., *The relationship between classroom temperature and children's performance in school*, Build. Environ., 157:197-204 (2019) https://doi.org/10.1016/j.buildenv.2019.04.046; *see also* Pawel Wargocki et al., *The effects of moderately raised classroom temperatures and classroom ventilation rate on the performance of schoolwork by children*, HVAC&R Res., 13(2):193-220 (2007) (Classroom temperature and ventilation affect school performance.) https://www.researchgate.net/publication/233004128_The_Effects_of_Moderately_Raised_Classroom_Temperatures_and_Classroom_Ventilation_Rate_on_the_Performance_of_Schoolwork_by_Children_RP-1257.

heat exposure further inhibits child cognitive development.[88]

C.31. Maternal exposure to heatwaves during pregnancy harms newborn health.[89] When pregnant mothers are exposed to heatwaves, it substantially increases the incidence of miscarriage,[90] stillbirth,[91] preterm birth,[92] and low birth weight,[93] and also increases risk of birth defects.[94]

C.32. **Preterm birth** harms child health in many ways. Ten percent of babies born prematurely die directly as a result of their prematurity.[95] Another 10% die from complications of preterm birth, such as infections.[96] Preterm babies who survive infancy have an elevated risk of significant lifelong disability, and preterm birth currently accounts for 3.1% of all disabilities globally.[97] Thus, when climate change increases the number of unusually hot days, it reduces newborn' odds of being born alive and healthy, increases their risk of dying shortly after birth, and increases their

[88] *See* Joshua Goodman et al., *Heat and learning*, American Economic J.: Economic Policy, 12(2):1-58 at 26 (2018) https://www.nber.org/system/files/working_papers/w24639/w24639.pdf.
[89] Maryia Bakhtsiyarava et al., *Ambient temperature and term birthweight in Latin American cities*, Environ. Int., 167(107412):1-11 at 6 (2022) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9376808/; Louisa Samuels et al., *Physiological mechanisms of the impact of heat during pregnancy and the clinical implications*, Int. J. Biometeorol., 66:1505-1513 at 1505 (2022) https://link.springer.com/article/10.1007/s00484-022-02301-6.
[90] Tamás Hajdu et al., *Climate change and the mortality of the unborn*, J. Environ. Econ. Manag., 118(102771):1-12 (2023) https://www.sciencedirect.com/science/article/pii/S0095069622001243.
[91] Tamás Hajdu et al., *Climate change and the mortality of the unborn*, J. Environ. Econ. Manag., 118(102771):1-12 (2023) https://www.sciencedirect.com/science/article/pii/S0095069622001243; Linn B. Strand et al., *Maternal exposure to ambient temperature and the risks of preterm birth and stillbirth in Brisbane, Australia,* Am. J. Epidemiol., 175(2):99–107 (2012) https://academic.oup.com/aje/article/175/2/99/82520; Jenna Kanner et al., *Ambient temperature and stillbirth: Risks associated with chronic extreme temperature and acute temperature change,* Environ. Res., 189(109958):1-8 (2020) https://doi.org/10.1016/j.envres.2020.109958 (restricted access, available upon request).
[92] Matthew Francis Chersich et al., *Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: Systematic review and meta-analysis,* BMJ, 371(m3811):1-13 (2020) https://doi.org/10.1136/bmj.m3811; and Lara Cushing et al., *Extreme heat and its association with social disparities in the risk of spontaneous preterm birth*, Paediatr. Perinat. Epidemiol., 36:13–22 (2021) https://onlinelibrary.wiley.com/doi/epdf/10.1111/ppe.12834.
[93] Maryia Bakhtsiyarava et al., *Ambient temperature and term birthweight in Latin American cities*, Environ. Int., 167(107412):1-11 at 6 (2022) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9376808/; Pin Wang et al., *Temperature variability and birthweight: Epidemiological evidence from Africa*, Environ. Int'l., 173(107792):1-9 at 1-2 (2023) https://doi.org/10.1016/j.envint.2023.107792; and Daniel Helldén et al., *Climate change and child health: A scoping review and an expanded conceptual framework*, Lancet, 5(3):e164-175 at e170 (2021) https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930274-6.
[94] Marjan Mosalman Haghighi et al., *Impacts of high environmental temperatures on congenital anomalies: A systematic review*, Int'l. J. Environ. Res. Public Health, 18(4910):1-15 at 2 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8124753/pdf/ijerph-18-04910.pdf.
[95] Christopher P. Howson et al., *Born too soon: Preterm birth matters*, Reprod. Health, 10(Supp. 1):1-9 at 1 (2013) https://pubmed.ncbi.nlm.nih.gov/24625113/.
[96] Christopher P. Howson et al., *Born too soon: Preterm birth matters*, Reprod. Health, 10(Supp. 1):1-9 at 1 (2013) https://pubmed.ncbi.nlm.nih.gov/24625113/.
[97] Christopher P. Howson et al., *Born too soon: Preterm birth matters*, Reprod. Health, 10(Supp. 1):1-9 at 1 (2013) https://pubmed.ncbi.nlm.nih.gov/24625113/.

chance of being born with a lifelong disability.

C.33. Babies born with **low birth weight** have a much greater risk of dying during childhood or having poor neurocognitive development, poor educational attainment, and a greater risk of chronic diseases such as heart disease and diabetes in adulthood.[98] Babies born underweight have worse health outcomes in childhood and adulthood than their normal birth-weight peers.[99] The percentage of newborns born underweight is expected to increase as the climate crisis intensifies.[100]

C.34. **Birth defects** caused by maternal heat exposure during pregnancy include defects of the heart,[101] hypospadias, congenital cataracts, renal agenesis/hypoplasia, spina bifida, and craniofacial defects.[102] Risk of birth defects generally increases with duration and intensity of maternal heat exposure.[103]

C.35. Increased heat raises the risk of future **pandemics**[104] by expanding the geographical and seasonal habitats of the **mosquitoes and ticks** that are vectors for malaria, dengue, Zika, and Lyme disease.[105]

C.36. Regarding malaria, children are more likely than adults to die from malaria or suffer complications such as anaemia, cerebral malaria, and long-term nerve problems.

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[98] Pin Wang et al., *Temperature variability and birthweight: Epidemiological evidence from Africa*, Environ. Intl., 173(107792):1-9 at 1-2 (2023) https://doi.org/10.1016/j.envint.2023.107792; Mabel Andalón et al., *Weather shocks and health at birth in Colombia*, World Dev., 82:69–82 at 69 (2016) https://doi.org/10.1016/j.worlddev.2016.01.015 (restricted access, available upon request).
[99] Mabel Andalón et al., *Weather shocks and health at birth in Colombia*, World Dev., 82:69–82 at 69 (2016), https://doi.org/10.1016/j.worlddev.2016.01.015 (restricted access, available upon request).
[100] Daniel Helldén et al., *Climate change and child health: A scoping review and an expanded conceptual framework*, Lancet, 5(3):e164-e175 at e170 (2021) https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(20)30274-6/fulltext; Pin Wang et al., *Temperature variability and birthweight: Epidemiological evidence from Africa*, Environ. Intl., 173(107792):1-9 at 1-2 (2023) https://doi.org/10.1016/j.envint.2023.107792.
[101] Marjan Mosalman Haghighi et al., *Impacts of high environmental temperatures on congenital anomalies: A systematic review*, Int'l. J. Environ. Res. Public Health, 18(4910):1-15 at 4 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8124753/pdf/ijerph-18-04910.pdf.
[102] Marjan Mosalman Haghighi et al., *Impacts of high environmental temperatures on congenital anomalies: A systematic review*, Int'l. J. Environ. Res. Public Health, 18(4910):1-15 at 1 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8124753/pdf/ijerph-18-04910.pdf.
[103] Marjan Mosalman Haghighi et al., *Impacts of high environmental temperatures on congenital anomalies: A systematic review*, Int'l. J. Environ. Res. Public Health, 18(4910):1-15 at 2, 12 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8124753/pdf/ijerph-18-04910.pdf.
[104] UN Environment Programme, *Preventing the next pandemic: Zoonotic diseases and how to break the chain of transmission,* https://www.unep.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and (last accessed Dec. 6, 2023).
[105] World Health Organization (WHO), *Dengue: The region of the Americas,* https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON475#:~:text=Since%20the%20beginning%20of%202023,the%20entire%20year%20of%202022 (last accessed Dec. 6, 2023); United Nations, *Spike in dengue cases due to global warming, warns WHO,* https://news.un.org/en/story/2023/07/1138962 (last accessed Dec. 6, 2023).

C.37. Dengue has increased ***eight-fold*** globally since 2000, largely due to climate change.[106] Incidence is rising throughout Latin America,[107] No treatment for dengue exists, and current medicines treat only its symptoms (fever and severe pain).[108] According to UNICEF, children are at especially risk of dying from dengue.[109] For example, Peru's 2023 dengue outbreak killed 31 children.[110]

C.38. **Diarrhoeal diseases** are already a leading cause of death for children under 5 years old globally,[111] and heat increases the range of diarrhoea-causing pathogens such as cholera. Warmer waters also encourage blooms of toxic algae.[112]

C.39. Children spend more time **playing outdoors** than adults, which generally benefits their physical and mental health.[113] However, more frequent heatwaves make it harder—and at some temperatures, dangerous—to play outdoors.[114]

C.40. Children in situations of poverty are particularly vulnerable to the adverse health impacts of extreme heat due to **poor access to air conditioning**, shelter, clean water, and healthcare facilities.[115]

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[106] World Health Organisation (WHO), *Spike in dengue cases due to global warming, warns WHO,* https://news.un.org/en/story/2023/07/1138962 (last accessed Dec. 6, 2023); Marina Romanello et al., *The 2022 report of the Lancet countdown on health and climate change: Health at the mercy of fossil fuels*, Lancet, 400:1619–1654 at 1635 (2022) https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(22)01540-9.pdf.

[107] José Luis San Martín et al., *The epidemiology of dengue in the Americas over the last three decades: A worrisome reality*, Am. J. Trop. Med. Hyg., 82(1):128–135 at 128 (2010) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2803522/; and *see also* Roberto Tapia-Conyer et al., *Dengue: An escalating public health problem in Latin America*, Paediatr. Int. Child Health, 32:14–17 at 14 (2012) (Dengue has increased significantly throughout Latin America since 1980) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3381443/.

[108] World Health Organization (WHO), *Spike in dengue cases due to global warming, warns WHO,* https://news.un.org/en/story/2023/07/1138962 (last accessed Dec. 6, 2023).

[109] United Nations Children's Fund (UNICEF), *The climate crisis is a child rights crisis: Introducing the children's climate risk index*, 1-125 at 43 (2021) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf.

[110] Sanjeet Bagcchi, *Dengue outbreak in Peru affects adults and children*, Lancet, 23(9):e339 at e339 (2023) https://doi.org/10.1016/S1473-3099(23)00229-3.

[111] Margaret Mokomane et al., *The global problem of childhood diarrhoeal diseases: emerging strategies in prevention and management*, Ther. Adv. Infectious Dis., 5(1):29-43 at 29 (2018) https://doi.org/10.1177/2049936117744429.

[112] Andrew W. Griffith et al., *Harmful algal blooms: A climate change co-stressor in marine and freshwater ecosystems*, Harmful Algae, 91(101590):1-12 at 6 (2020) https://doi.org/10.1016/j.hal.2019.03.008.

[113] Early Childhood Learning and Knowledge Center, *Going outside improves children's health,* https://eclkc.ohs.acf.hhs.gov/learning-environments/supporting-outdoor-play-exploration-infants-toddlers/going-outside-improves-childrens-health (last accessed Dec. 6, 2023).

[114] Gregory W. McGarr et al., *Heat strain in children during unstructured outdoor physical activity in a continental summer climate*, Temperature, 8(1):80-89, at 80 (2021) https://doi.org/10.1080/23328940.2020.1801120.

[115] United Nations Children's Fund (UNICEF), *The coldest year of the rest of their lives: Protecting children from the escalating impacts of heatwaves*, https://www.unicef.org/media/129506/file/UNICEF-coldest-year-heatwaves-and-children-EN.pdf (last accessed Dec. 6, 2023).

C.41. **Children who work outdoors** are at especially high risk for heat-related illness and death. Central America has recently seen an alarming rise in deaths of agricultural-working children and young adults from **heat-related kidney failure**.[116] The rise is so extreme that this heat-related form of kidney failure is now the **second leading cause of death** in Nicaragua and El Salvador.[117] These children are often exposed to extreme heat without adequate acclimatization or preventive measures to avoid heat-related illness.[118] Yet because of climate change, "[w]e may have now reached a physiological limit, in terms of heat exposure, at which acclimatization and behavioral modifications can no longer overcome the biologic stressors of [working outdoors] in these hot spot communities."[119]

C.42. In 2020, heat waves exposed **98 million *more* people** globally to food insecurity per year as compared to 1981-2010.[120] That is because rising temperatures reduce the duration of crop growth in many countries, which in turn reduces crop yields—and increases the risk of child malnutrition.[121]

C.43. For all of these reasons, heat is among the most dangerous of climate hazards for children.[122] Therefore, climate-linked heatwaves put the health and survival of children at risk.[123]

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[116] Pedro Ordúñez et al., *Chronic kidney disease mortality trends in selected Central America countries, 1997–2013: Clues to an epidemic of chronic interstitial nephritis of agricultural communities*, J. Epidemiology Community Health, 72:280–286 (2018) http://dx.doi.org/10.1136/jech-2017-210023; *see also* Eleni Geladari et al., *Failing kidneys in a failing planet; CKD of unknown origin*, Rev. Environ. Health, 38(1):125–135 (2023) https://doi.org/10.1515/reveh-2021-0109; *see also* Cecilia Sorensen et al., *A new era of climate medicine: Addressing heat-triggered renal disease*, N. Engl. J. Med., 381:693–696 (2019) https://www.nejm.org/doi/full/10.1056/NEJMp1907859.

[117] Cecilia Sorensen et al., *A new era of climate medicine: Addressing heat-triggered renal disease*, N. Engl. J. Med. 381:693–696 at 693 (2019) https://www.nejm.org/doi/full/10.1056/NEJMp1907859.

[118] Alexandra Adams et al., *Climate change and human health in Montana: A special report of the Montana Climate Assessment, 1-187* (2021) https://scholarworks.montana.edu/xmlui/handle/1/16028.

[119] Cecilia Sorensen et al., *A new era of climate medicine: Addressing heat-triggered renal disease*, N. Engl. J. Med., 381:693–696 at 693 (2019) https://www.nejm.org/doi/full/10.1056/NEJMp1907859.

[120] Marina Romanello et al., *The 2022 report of the Lancet countdown on health and climate change: Health at the mercy of fossil fuels*, Lancet, 400(10363):1619-1654 at 1631 (2022) https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(22)01540-9/fulltext.

[121] Marina Romanello et al., *The 2022 report of the Lancet countdown on health and climate change: Health at the mercy of fossil fuels*, Lancet, 400(10363):1619-1654 at 1630 (2022) https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(22)01540-9/fulltext.

[122] World Health Organization (WHO), *Heatwaves*, https://www.who.int/health-topics/heatwaves#tab=tab_1 (last accessed Dec. 6, 2023).

[123] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act,* Lancet Reg. Health - Am., 20(100470):1–35 at 2 (2023) https://doi.org/10.1016/j.lana.2023.100470.

Key finding #4:
Child health is uniquely vulnerable to storms, floods, landslides, and droughts

C.44. Storms (including hurricanes), floods, landslides, and droughts are on the rise in the Americas due to climate change.[124] These disasters kill thousands in Latin America every year, with children being especially vulnerable.[125]

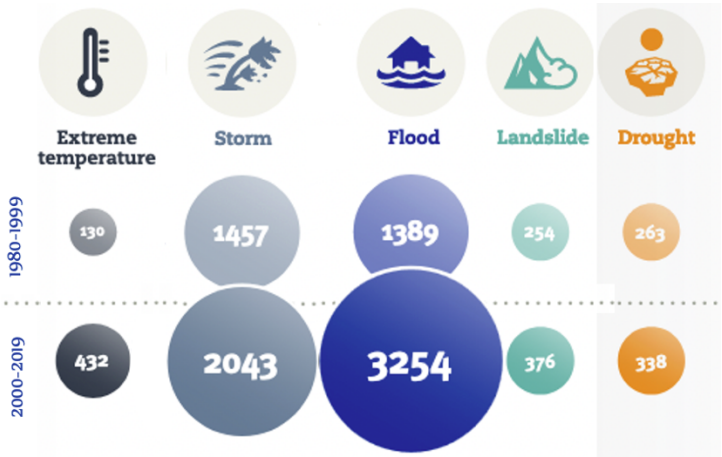

Figure C.7. A comparison of the total number of disaster events by type from 1980-1999 vs. 2000-2019.[126]

C.45. Storms (including cyclones) unleash heavy rains that can trigger **landslides**.[127] Landslides have increased ***tenfold*** in the past 50 years, and 81% of the people killed in landslides in Latin America and the Caribbean live in poor or informal settlements.[128] The victims are often children. For example, a single landslide in Guatemala triggered by hurricanes Eta and Iota killed between 22 and 30 children.[129]

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[124] Centre for Research on the Epidemiology of Disasters and the UN Office for Disaster Risk Reduction, *The human cost of disasters: An overview of the last 20 years (2000-2019),* https://www.undrr.org/publication/human-cost-disasters-overview-last-20-years-2000-2019 (last accessed Dec. 6, 2023).
[125] Stella M. Hartinger et al., *The 2022 South America report of the Lancet countdown on health and climate change: Trust the science. Now that we know, we must act,* Lancet Reg. Health - Am., 20(100470):1–35 at 8, 23 (2023) https://doi.org/10.1016/j.lana.2023.100470.
[126] Centre for Research on the Epidemiology of Disasters and the UN Office for Disaster Risk Reduction, *The human cost of disasters: An overview of the last 20 years (2000-2019),* https://www.undrr.org/publication/human-cost-disasters-overview-last-20-years-2000-2019 (last accessed Dec. 6, 2023).
[127] Ugur Ozturk et al., *How climate change and unplanned urban sprawl bring more landslides*, Nature, 608: 262-265 at 262 (2022) https://doi.org/10.1038/d41586-022-02141-9.
[128] Ugur Ozturk et al., *How climate change and unplanned urban sprawl bring more landslides*, Nature, 608:262-265 at 262 (2022) https://doi.org/10.1038/d41586-022-02141-9; Diana, Renee, *Brazil flood death toll reaches 335,* McClatchy-Tribune Business News (Jan. 13, 2011) (2,000 homes destroyed in Brazil in January 2011 from mudslides triggered by flooding and heavy rains).
[129] BBC News Mundo, *Huracanes Eta e Iota: la crisis humanitaria que dejaron en Centroamérica las tormentas (agravada por la pandemia),* https://www.bbc.com/mundo/noticias-america-latina-55479861 (last accessed Dec. 6, 2023).

C.46. Storms also produce **floods**, which are the deadliest of all climate-related disasters. In 2019, floods were responsible for ***43.5% of all deaths*** (including those of children) **from weather events** globally.[130]

C.47. In the Caribbean, the number of children displaced by storms and floods grew ***six-fold*** between 2013-2019 due to climate change.[131]

C.48. Floods increase the spread of numerous vector-borne diseases.[132]

C.49. Homes damaged by floodwaters tend to harbor mold, mycotoxins, and dust mites, which cause respiratory problems for families when they move back into their water-damaged houses.[133] Exposure to mold triggers inflammation, upper airway symptoms, cough, wheeze, and asthma, among other adverse health impacts.[134]

C.50. Floods damage water infrastructure. Such damage contaminates drinking water with sewage and toxic agro-industrial chemicals.[135] Contaminated water also exposes children to infectious diseases such as cholera;[136] typhoid;[137] respiratory infections;[138] skin diseases;[139] and gastrointestinal illness.[140] In adults,

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[130] Centre for Research on the Epidemiology of Disasters, *Natural disasters 2019: Now is the time to not give up,* (2020) https://www.preventionweb.net/files/73050_asdr.pdf.
[131] UNICEF, *As impact of climate crisis worsens, Caribbean islands see six-fold increase in number of children displaced by storms, new UNICEF report shows,* https://www.unicef.org/press-releases/impact-climate-crisis-worsens-caribbean-islands-see-six-fold-increase-number (last accessed Dec. 6, 2023).
[132] Friederike Suhr et al., *Epidemiology of floods in sub-Saharan Africa: A systemic review of health outcomes*, BMC Public Health, 22(268):1-15 at 2 (2022) https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-022-12584-4.
[133] Nathalie Acevedo et al., *House dust mite allergy under changing environments*, Allergy Asthma Immunol. Res., 11(4):450-469 at 457 (2019) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6557771/pdf/aair-11-450.pdf; and Janette Hope, *A review of the mechanism of injury and treatment approaches for illness resulting from exposure to water-damaged buildings, mold, and mycotoxins*, Sci. World J., 1-20 at 2 (2013) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3654247/pdf/TSWJ2013-767482.pdf.
[134] *See e.g.,* Institute of Medicine of the National Academies, *Damp indoor spaces and health*, Washington DC: National Academies Press (2004) https://www.ncbi.nlm.nih.gov/books/NBK215643/pdf/Bookshelf_NBK215643.pdf.
[135] Amin Kiaghadi, *Environmental damage associated with severe hydrologic events: A LiDAR-based geospatial modeling approach*, Nat. Hazards, 103(3):2711-2729 at 2726 (2020) https://doi.org/10.1007/s11069-020-04099-1; Defensoría del Pueblo Ecuador, *Agua y saneamiento en situaciones de emergencia y desastres naturales*, at 10, 14 (2016) https://www.cndh.org.mx/sites/default/files/doc/OtrosDocumentos/Doc_2016_046.pdf.
[136] Pan American Health Organization (PAHO), *Cholera in disaster situation,* https://www.paho.org/en/health-emergencies/cholera-disaster-situations (last accessed Dec. 6, 2023).
[137] World Health Organization (WHO), *Typhoid,* https://www.who.int/news-room/fact-sheets/detail/typhoid (last accessed Dec. 6, 2023).
[138] Naciones Unidas, *Las enfermedades transmitidas por el agua amenazan a más de medio millón de niños en Haití,* https://news.un.org/es/story/2021/09/1496322 (last accessed Dec. 6, 2023).
[139] Dr. Mónica Pun Chinarro, *Impacto del agua en la salud pública*, Ministerio de Salud Perú, Dirección General de Intervenciones Estratégicas en Salud Pública, (2016) https://www.paho.org/es/file/57050/download?token=RJSQWJZE.
[140] United Nations Children's Fund (UNICEF), *The climate crisis is a child rights crisis: Introducing the children's*

gastrointestinal diseases are often mild, but for children they are much more severe,[141] and can be fatal.[142] Waterborne infections cause diarrhea,[143] one of the biggest killers of children globally.[144]

C.51. Floods disrupt food systems through at least three pathways. First, floods destroy crops.[145] Second, polluted floodwaters carry industrial and agricultural chemicals, which contaminate cropland and future crops.[146] Third, floods wash away topsoil, especially in areas that have been deforested or overgrazed, thereby reducing future crop productivity.[147] By disrupting the food supply, floods increase food insecurity and contribute to child malnutrition.[148]

C.52. **Droughts**, too, contribute to child undernutrition. Droughts dry out fields, lower water availability, reduce seed germination, change the dynamics of crop diseases, lower the nutritional value of crops, and sometimes result in the full loss of a harvest.[149] Drought-induced crop failure and economic hardship are already causing food insecurity in Central America,[150] particularly in children ages 5 and younger,[151] which will worsen as warming is allowed to continue.[152]

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climate risk index, pp. 1-125 at 33 (2021) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf; Naciones Unidas, *Las enfermedades transmitidas por el agua amenazan a más de medio millón de niños en Haití,* https://news.un.org/es/story/2021/09/1496322 (last accessed Dec. 6, 2023).

[141] *See* Instituto Mexicano del Seguro Social, *Enfermedades gastrointestinales* (2023) (children under 5 years are at greatest risk of gastrointestinal illness) http://www.imss.gob.mx/salud-en-linea/enfermedades-gastrointestinales.

[142] U.S. Environmental Protection Agency, *Effects of global change on human* health, in Analyses of the effects of global change on human health and welfare and human systems, pp. 2-1–2-78 at 2-9 (2008) https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=197244.

[143] Carolyn Kousky, *Impacts of natural disasters on children*, Future Child., 26(1):73-92 at 73, 79-80 (2016) https://files.eric.ed.gov/fulltext/EJ1101425.pdf.

[144] United Nations Children's Fund (UNICEF), *The climate crisis is a child rights crisis: Introducing the children's climate risk index*, pp. 1-125 at 33 (2021) https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf.

[145] *See e.g.*, Yoshito Takasaki et al., *Smoothing income against crop flood losses in Amazonia: Rain forest or rivers as a safety net*?, Rev. Dev. Econ., 14(1):48–63 at 49 (2010) https://doi.org/10.1111/j.1467-9361.2009.00538.x.

[146] FAO and ITPS, *Status of the world's soil resources: Main report, pp.* 1-607 at 119 (2015) https://www.fao.org/3/i5199e/i5199e.pdf.

[147] FAO and ITPS, *Status of the world's soil resources: Main report,* pp. 1-607 at 365, 371, 374 (2015) https://www.fao.org/3/i5199e/i5199e.pdf.

[148] Carolyn Kousky, *Impacts of natural disasters on children*, Future Child., 26(1):73-92 at 73 (2016) https://files.eric.ed.gov/fulltext/EJ1101425.pdf.

[149] Daniel Helldén et al., *Climate change and child health: A scoping review and an expanded conceptual framework,* Lancet, 5(3):e164-175 at e169 (2021) https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930274-6.

[150] Food and Agricultural Organization of the UN, *Dry corridor Central America: Situation report June 2016,* https://www.fao.org/3/br092e/br092e.pdf (last accessed Dec. 6, 2023).

[151] Migration Policy Institute, *Climate extremes, food insecurity, and migration in Central America: A complicated nexus,* https://www.migrationpolicy.org/article/climate-food-insecurity-migration-central-america-guatemala (last accessed Dec. 6, 2023).

[152] IPCC, *Chapter 12: Central and South America* In: Climate Change 2022: Impacts, Adaptation and

C.53. Droughts increase children's risk of infectious diseases such as cholera because drought limits families' access to clean water for drinking, cooking, hygiene, and sanitation.[153]

C.54. **Severe weather** cuts off access to medical care by washing out roads, damaging medical facilities, or forcing facilities to close due to lack of water.[154] Such injuries to the health system exacerbate the health crises that accompany climate disasters.

C.55. Storms, floods, landslides, and drought have all been associated with mental health disorders (see ¶¶ C.70 *et seq.*) and increased violence against children.[155]

C.56. Alone, each of these severe weather events affects food security and has long-term effects on child nutrition, with the most disadvantaged children being at the greatest risk.[156] When such crises overlap, their cumulative impacts are extreme.

C.57. Due to overlapping climate impacts, some regions are particularly vulnerable to climate-induced **migrations and displacements**. In Latin America, the regions most vulnerable to climate-induced displacement are the Andes, northeastern Brazil, and northern Central America.[157]

Key finding #5:
Child health is uniquely vulnerable to air pollution caused directly and indirectly by fossil fuel combustion

C.58. Although combustion of coal, oil, and natural gas causes climate change, it also creates a parallel crisis of air pollution. Combustion of these fuels releases massive amounts of dangerous air pollutants including fine particulate matter (airborne fine respirable particles with an aerodynamic diameter of 2.5 μm or less, also known as $PM_{2.5}$), sulfur dioxide, nitrogen oxides, polycyclic aromatic hydrocarbon, mercury, and volatile chemicals that form ground-level ozone.

Vulnerability, Working Group II, Sixth Assessment Report, pp. 1689–1816 at 1699 (2022) https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter12.pdf.

[153] Ankush K. Niranjan et al., *Resurgence of cholera in the COVID-19 era: A global health concern,* Ann. Med. Surg., 85(4):1321–1322 at 1321 (2023) https://dx.doi.org/10.1097/MS9.0000000000000415.

[154] Carolyn Kousky, *Impacts of natural disasters on children*, Future Child., 26(1):73-92 at 73 (2016) https://files.eric.ed.gov/fulltext/EJ1101425.pdf.

[155] *See* Jorge Cuartas et al., *The climate crisis and violence against children*, Lancet Child Adolesc. Health, 7(9):605-607 at 605 (2023) https://doi.org/10.1016/ S2352-4642(23)00137-2 (restricted access, available upon request).

[156] Daniel Helldén et al., *Climate change and child health: A scoping review and an expanded conceptual framework,* Lancet, 5(3):e164-e175 at e169 (2021) https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930274-6.

[157] IPCC, *Chapter 12: Central and South America* In: Climate Change 2022: Impacts, Adaptation and Vulnerability, Working Group II, Sixth Assessment Report, pp. 1689-1816 at 1691 (2022) https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter12.pdf.

C.59. Burning fossil fuels also increases the frequency and intensity of wildfires.[158] Wildfire smoke pollutes the air up to thousands of kilometers away.[159]

C.60. The World Health Organization (WHO) establishes safety limits for pollutants resulting from fossil fuel combustion and smoke.[160] 99% of the world's population breathe air that exceeds those limits.[161] WHO estimates that 7 million people, many of them children, die prematurely early every year from breathing these pollutants.[162]

C.61. These pollutants take a major toll on child health through multiple pathways.[163]

C.62. Being closer to the ground increases children's exposure to air pollution from car exhausts.[164]

C.63. When a pregnant mother is exposed to air pollution from burning fossil fuels, her exposure increases the newborn's risk of serious medical conditions including

[158] Kristina A Dahl et al., *Quantifying the contribution of major carbon producers to increases in vapor pressure deficit and burned area in western US and southwestern Canadian forests*, Environ. Res. Letters, 18(6):1-10 (2023) https://iopscience.iop.org/article/10.1088/1748-9326/acbce8.
[159] Marshall Burke et al., *The contribution of wildfire to PM2.5 trends in the USA*, Nature, 622:761-766 (2023) https://doi.org/10.1038/s41586-023-06522-6.
[160] World Health Organization (WHO), *WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide,* https://www.who.int/publications/i/item/9789240034228 (last accessed Dec. 6, 2023).
[161] World Health Organization (WHO), *Ambient (outdoor) air pollution,* https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health (last accessed Dec. 6, 2023).
[162] World Health Organization (WHO), *Ambient (outdoor) air pollution,* https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health (last accessed Dec. 6, 2023).
[163] Federica Perera et al., *Climate change, fossil-fuel pollution, and children's health*, N. Engl. J. Med., 386:2303-2314 at 2303 (2022) https://www.nejm.org/doi/full/10.1056/NEJMra2117706; Frederica Perera, *Multiple threats to child health from fossil fuel combustion: Impacts of air pollution & climate change*, Environ. Health Perspect., 125(2):141-148 at 142 (2017) https://ehp.niehs.nih.gov/doi/epdf/10.1289/EHP299; Yali Zhang et al., *The impact of fossil fuel combustion on children's health and the associated losses of human capital*, Global Transitions 5:117-124 (2023) https://www.sciencedirect.com/science/article/pii/S2589791823000154.
[164] UNICEF, *Childhood air pollution exposure key messages,* https://www.unicef.org/media/123156/file/Childhood_Air_Pollution_Key_Messages_2022.pdf (last accessed Dec. 6, 2023).

cancer,[165] autism,[166] behavior problems,[167] high blood pressure,[168] obesity,[169] and lung problems including asthma.[170]

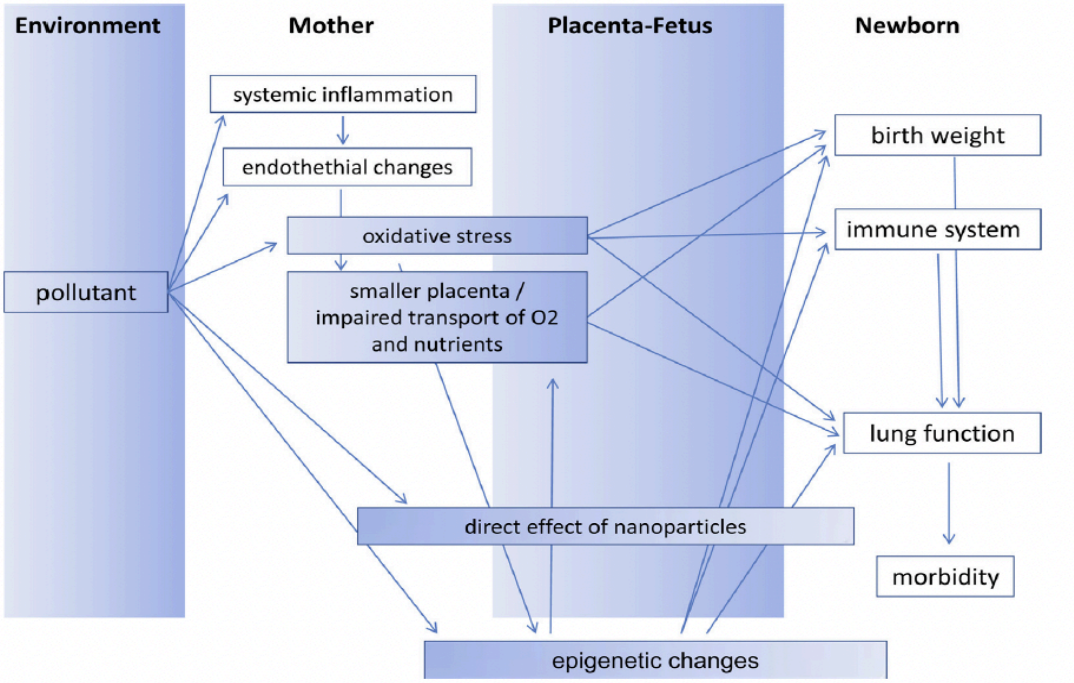

Figure C.8. Impacts of air pollution during pregnancy on birth outcomes and lung development.[171]

[165] Jo Kay C. Ghosh et al., *Prenatal exposure to traffic-related air pollution and risk of early childhood cancers*, Am. J. Epidemiol., 178(8):1233-1239 (2013) https://academic.oup.com/aje/article/178/8/1233/83907?login=false; *see also* Vickie Boothe et al., *Residential traffic exposure and childhood leukemia: A systematic review and meta-analysis*, Am. J. Prev. Med., 46(4):413–422 at 413 (2018) http://europepmc.org/articles/pmc5779082?pdf=render.

[166] Juleen Lam et al., *A systematic review and meta-analysis of multiple airborne pollutants and autism spectrum disorder*, PLoS ONE, 11(9):1-27 (2016) https://doi.org/10.1371/journal.pone.0161851.

[167] Frederica Perera et al., *Early-life exposure to polycyclic aromatic hydrocarbons and ADHD behavior problems*, PLoS ONE, 9(11):1-9 (2014) https://doi.org/10.1371/journal.pone.0111670.

[168] Mingyu Zhang et al., *Maternal exposure to ambient particulate matter ≤2.5 μm during pregnancy and the risk for high blood pressure in childhood*, Hypertension, 72(1):194–201 (2018) https://doi.org/10.1161/HYPERTENSIONAHA.117.10944.

[169] Michael Jerrett et al., *Traffic-related air pollution and obesity formation in children: A longitudinal, multilevel analysis*, Environ. Health, 13(49):1-9 (2014) https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-13-49.

[170] Insa Korten et al., *Air pollution during pregnancy and lung development in the child*, Paediatr. Respir. Rev., 21:38-46 (2017) https://doi.org/10.1016/j.prrv.2016.08.008 (restricted access, available upon request).

[171] Insa Korten et al., *Air pollution during pregnancy and lung development in the child*, Paediatr. Respir. Rev., 21:38-46 at 43 (2017) https://doi.org/10.1016/j.prrv.2016.08.008 (restricted access, available upon request).

C.64. Maternal exposure to air pollution during pregnancy also increases the newborn's risk of being stillborn,[172] born preterm, underweight, or dying during infancy.[173] Babies born preterm or underweight who survive infancy have an elevated risk of lifelong disability[174] and poor health,[175] including heart disease and diabetes. [176]

C.65. n the brain, childhood exposure to air pollution can impact a child's ability to learn.[177] Such exposure has also been linked to higher rates of depression,[178] anxiety,[179] suicide risk,[180] and neurodevelopmental disorders such as autism.[181] Such exposure has also been associated with increased risk of schizophrenia.[182]

C.66. Air pollution from burning fossil fuels can trigger or worsen juvenile idiopathic arthritis.[183]

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[172] Kaili Zhang et al., *Association between atmospheric particulate matter and adverse pregnancy outcomes in the population*, Int. J. Clin. Exp. Med., 9(11):20594-20604 at 20600 (2016) (Regarding stillbirth, further studies are needed. Some studies have found a positive association between particulate matter and stillbirth, but results are inconsistent) https://e-century.us/files/ijcem/9/11/ijcem0036940.pdf.
[173] Insa Korten et al., *Air pollution during pregnancy and lung development in the child*, Paediatr. Respir. Rev., 21:38-46 at 43-44 (2017) https://doi.org/10.1016/j.prrv.2016.08.008 (restricted access, available upon request).
[174] Christopher P. Howson et al., Born too soon: *Preterm birth matters*, Reprod. Health, 10(Supp. 1):1-9 at 1 (2013) https://pubmed.ncbi.nlm.nih.gov/24625113/.
[175] Mabel Andalón et al., *Weather shocks and health at birth in Colombia*, World Dev., 82:69–82 at 69 (2016), https://doi.org/10.1016/j.worlddev.2016.01.015 (restricted access, available on request).
[176] Pin Wang et al., *Temperature variability and birthweight: Epidemiological evidence from Africa*, Environ. Intl., 173(107792):1-9 at 1-2 (2023) https://doi.org/10.1016/j.envint.2023.107792; Mabel Andalón et al., *Weather shocks and health at birth in Colombia*, World Dev., 82:69–82 at 69 (2016), https://doi.org/10.1016/j.worlddev.2016.01.015 (restricted access, available on request).
[177] Annalisa Castagna et al., *Air pollution and neurodevelopmental skills in preschool- and school-aged children: A systematic review,* Neurosci. Biobehav. Rev., 136(104623) (2022) https://www.sciencedirect.com/science/article/abs/pii/S0149763422001129.
[178] Cristina Vert, *Effect of long-term exposure to air pollution on anxiety and depression in adults: A cross-sectional study*, Int. J. Hyg. Environ. Health, 220(6):1074-1080 (2017) https://pubmed.ncbi.nlm.nih.gov/28705430/.
[179] Isobel Braithwaite et al., *Air pollution (particulate matter) exposure and associations with depression, anxiety, bipolar, psychosis and suicide risk: A systematic review and meta-analysis*, Environ. Health Perspect., 127(12):1-23 (2019) https://pubmed.ncbi.nlm.nih.gov/31850801/.
[180] Isobel Braithwaite et al., *Air pollution (particulate matter) exposure and associations with depression, anxiety, bipolar, psychosis and suicide risk: A systematic review and meta-analysis*, Environ. Health Perspect., 127(12):1-23 (2019) https://pubmed.ncbi.nlm.nih.gov/31850801/.
[181] Lucio G. Costa et al., *Effects of air pollution on the nervous system and its possible role in neurodevelopmental and neurodegenerative disorders*, Pharmacol. Ther., 210(107523):1-47 (2020) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7245732/.
[182] Henriette Thisted Horsdal et al., *Association of childhood exposure to nitrogen dioxide and polygenic risk score for schizophrenia with the risk of developing schizophrenia*, JAMA Network Open, 2(11):1-12 (2019) https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2753791.
[183] Sylvia C.L. Farhat et al., *Air pollution in autoimmune rheumatic diseases: A review*, Autoimmun. Rev., 11(1):14–21 (2011) https://www.sciencedirect.com/science/article/abs/pii/S1568997211001509 (restricted access, available on request).

C.67. Exposure to environmental air pollutants can **increase a child's risk of developing asthma *60-fold***.[184]

C.68. Once a child has asthma, exposure to fossil fuel pollution can trigger or worsen asthma attacks.[185] Severe asthma attacks can be fatal.

C.69. When pollutants from fossil fuel combustion interact with sunlight on a hot day, the combination produces tropospheric ozone (O_3). This pollutant increases asthmatic children's need for emergency medication and heightens allergies.[186]

C.70. Plants produce more pollen in response to higher atmospheric levels of CO_2, and children under 24 months are especially vulnerable to developing "early wheeze" as a result, especially in agricultural communities.[187]

Key finding #6:
Climate change has particularly deleterious effects on child mental health

C.71. Children are in a formative window of psychosocial development. [188] As a child develops through adolescence, their mental health loses plasticity and begins to take on a trajectory.[189] Although a trajectory is not destiny, exposure to severe stressors during childhood tends to have a formative impact on child mental health going forward in life.[190]

C.72. Dramatic disasters such as cyclones, floods, wildfires, and landslides negatively impact child mental health,[191] and can be inherently traumatic.

C.73. Slower-onset climate harms can be even more harmful. A meta-analysis of studies looking at the health impacts of extreme weather disasters on children found that "the cumulative stress brought on by **slower-onset but chronic** climate related

[184] Jessica Stern et al., *Asthma epidemiology and risk factors*, Semin. Immunopathol., 42:5-15 at 6, 10 (2020) https://doi.org/10.1007/s00281-020-00785-1 (restricted access, available on request).
[185] *See* Susan C. Anenberg et al., *Long-term trends in urban NO_2 concentrations and associated paediatric asthma incidence: Estimates from global datasets*, Lancet, 6(1): e49-e58 at e49 (2022) https://www.thelancet.com/action/showPdf?pii=S2542-5196%2821%2900255-2.
[186] Gennaro D'Amato et al., *The effects of climate change on respiratory allergy and asthma induced by pollen and mold allergens*, Allergy, 75:2219–2228 at 2225 (2020) https://doi.org/10.1111/all.14476.
[187] Gennaro D'Amato et al., *The effects of climate change on respiratory allergy and asthma induced by pollen and mold allergens*, Allergy, 75(9):2219–2228 at 2223 (2020) https://doi.org/10.1111/all.14476.
[188] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 767 (2021) https://doi.org/10.1177/21677026211040787.
[189] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 769 (2021) https://doi.org/10.1177/21677026211040787.
[190] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 772-775 (2021) https://doi.org/10.1177/21677026211040787.
[191] Nick Obradovich et al., *Empirical evidence of mental health risks posed by climate change*, PNAS, 115(43):10953–10958 at 10953 (2018) https://doi.org/10.1073/pnas.18015281.

changes like severe drought or sea-level rise" tend to lead to **the most "serious mental health problems** including depression and suicidality."[192]

C.74. Severe climate stressors often leave children struggling with post-traumatic stress disorder, [193] depression, anxiety, phobias, sleep disorders, attachment disorders, substance abuse, and suicidality.[194]

C.75. These mental health struggles in turn can lead to problems with emotion regulation, cognition, learning, behavior, language development, and academic performance.

C.76. Exposure to climate disasters also adversely affects children's ability to learn effectively due to family loss or separation, school interruption, scarcities of food or water, home evacuation, and public service outages during crucial stages of their growth and development. [195]

C.77. Climate change can impact a child's **sense of hope** by diminishing their ability to realistically imagine a viable future for themselves. A 2022 UNICEF poll of almost 250,000 respondents worldwide found that **two-thirds of young people** in Latin America and the Caribbean considered moving to another city or country because of climate change.[196]

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[192] Susie E. L. Burke et al., *The psychological effects of climate change on children*, Curr. Psychiatry Rep. 20(35):1-8 at 3 (2018), https://doi.org/10.1007/s11920-018-0896-9 (restricted access, available upon request).
[193] *Compare* Robert Kohn et al., *Psychological and psychopathological reactions in Honduras following Hurricane Mitch: Implications for service planning,* Pan Am. J. Public Health,18:287-295 at 292 (2005) (10% of adult victims of Hurricane Mitch in Honduras developed PTSD) https://pubmed.ncbi.nlm.nih.gov/16354426/ (restricted access, available upon request), *with* Annette M. La Greca et al., *Hurricane-related exposure experiences and stressors, other life events, and social support: Concurrent and prospective impact on children's persistent posttraumatic stress symptoms*, J. Consult. Clin. Psychol., 78(6):794–805 (2010) (33% of child victims of Hurricane Katrina in Louisiana developed PTSD) https://doi.org/10.1037/a0020775 (restricted access, available upon request).
[194] Susie E. L. Burke et al., *The psychological effects of climate change on children*, Curr. Psychiatry Rep., 20(35):1-8 (2018) https://doi.org/10.1007/s11920-018-0896-9 (restricted access, available upon request); Hanna-Andrea Rother et al., *Impact of extreme weather events on Sub-Saharan African child and adolescent mental health: The implications of a systematic review of sparse research findings*, J. Clim. Change Health, 5(100087):1-7 (2021) https://doi.org/10.1016/j.joclim.2021.100087; *see also* Lukoye Atwoli et al., *Mental health and climate change in Africa*, BJ Psych. Intl., 19(4):86-89 at 87 (2022) https://www.cambridge.org/core/services/aop-cambridge-core/content/view/65A414598BA1D620F4208A9177EED94B/S2056474022000149a.pdf/mental-health-and-climate-change-in-africa.pdf; Harvard School of Public Health, *Climate change and mental health* https://www.hsph.harvard.edu/c-change/subtopics/climate-change-and-mental-health/ (last accessed Dec. 6, 2023).
[195] Federica Perera et al., *Climate change, fossil-fuel pollution, and children's health*, N. Engl. J. Med., 386:2303-2314 at 2304-2307 (2022) https://www.nejm.org/doi/full/10.1056/NEJMra2117706; Daniel Martinez Garcia et al., *Extreme weather-driven disasters and children's health*, Int. J. Health Serv., 46 (1):79 at 88 (2016) ("Abrupt disruptions in a child's life such as family loss or separation; school interruption; changes in food and water supply and shelter conditions; and public service outages may cause direct acute shock and other emotional trauma, as well as longer-term indirect effects.") https://doi.org/10.1177/0020731415625254.
[196] UN News, *Young people reconsidering parenthood due to climate change, UNICEF poll reveals,* https://news.un.org/en/story/2022/11/1130377 (last accessed Dec. 6, 2023).

C.78. More broadly, child mental health is negatively impacted by an awareness of the gravity and urgency of climate change, commonly referred to as climate anxiety.[197] A global survey of 10,000 children—including from low-middle income countries—found that,

> [a] large proportion of children and young people around the world report emotional distress and a wide range of **painful, complex emotions** (sad, afraid, angry, powerless, helpless, guilty, ashamed, despair, hurt, grief, and depressed). Similarly, large numbers report experiencing some functional impact and have pessimistic beliefs about the future (people have failed to care for the planet; the future is frightening; humanity is doomed; they won't have access to the same opportunities their parents had; things they value will be destroyed; security is threatened; and they are hesitant to have children).[198]

C.79. Children's climate anxiety is exacerbated by a **sense of betrayal at government actions** that continue to contribute to climate change, as well as woefully inadequate government efforts to address the problem.[199]

C.80. Many children are exposed to multiple harms from climate change that cut across many layers of their lived experience. As the various layers of climate risk overlap and compound, they impose a mounting psychological toll on young people[200] and

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[197] Caroline Hickman et al., *Climate anxiety in children & young people and their beliefs about government and responses to climate change: A global survey*, Lancet Planet. Health., 5(12):e863-e873 at e870 (2021) https://doi.org/10.1016/S2542-5196(21)00278-3; and Susie E. L. Burke et al., *The psychological effects of climate change on children*, Curr. Psychiatry Rep., 20(35):1-8 (2018) https://doi.org/10.1007/s11920-018-0896-9 (restricted access, available upon request).

[198] Caroline Hickman et al., *Climate anxiety in children and young people and their beliefs about government and responses to climate change: A global survey*, Lancet Planet. Health, 5(12):e863-e873 at e870 (2021) https://doi.org/10.1016/S2542-5196(21)00278-3 (emphasis added).

[199] Caroline Hickman et al., *Climate anxiety in children and young people and their beliefs about government and responses to climate change: A global survey*, Lancet Planet. Health, 5(12):e863-e873 at e870 (2021) https://doi.org/10.1016/S2542-5196(21)00278-3.

[200] *See, e.g.,* UNHCR, *Analytical study on the relationship between climate change and the full and effective enjoyment of the rights of the child,* A/HRC/35/13 at 18 (2017) https://www.ohchr.org/en/documents/reports/analytical-study-relationship-between-climate-change-and-full-and-effective ("Climate change and the impacts of traumatic stress connected to climate change, such as war/insecurity, sexual and physical violence and witnessing deaths and injury related to extreme weather disasters, negatively affect children's mental health. Children who lose a family member or experience life-threatening situations as a result of the impacts of climate change have a higher chance of experiencing post-traumatic stress, anxiety disorders, suicidal ideation, and depression. Disasters can also affect children's cognitive capacity with corresponding impacts on their emotional well-being. For example, children affected by El Niño during early childhood posted lower scores in language development, memory and spatial reasoning than other children of a similar age. […] Lower cognitive functioning in early life has been shown to increase the risk of future mental health problems. […]"); Zhiwei Xu et al., *Climate change and children's health: A call for research on what works to protect children*, Int. J. Environ. Res. Public Health, 9:3298-3316 at 3308 (2012) ("Climate change is threatening a number of fragile ecosystems […]. Children's health depends on the continuous supply of various ecological services—'the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life' […], and ecological services are underpinned by biodiversity which is also threatened by a number of climate change mechanisms. In addition,

can predispose them to having adverse mental health outcomes as adults.[201]

C.81. These harms are exacerbated by the fact that mental health is under-resourced in Latin America. Latin America has only 9 mental health workers per 100,000 people, as compared to 69 in the Caribbean and 125 in the United States.[202] In addition, the mental health resources that currently exist in Latin America are generally not child- and adolescent-friendly due to a lack of professional training programs in child and adolescent mental health.[203]

Key finding #7:
Climate change especially burdens children in situations of intersectional vulnerability

C.82. Climate change operates as a risk multiplier. It compounds risks for populations that are already in situations of vulnerability because such populations have a more limited capacity to adapt to or avoid new threats and impacts.[204] Thus, intensification of the climate emergency will further endanger child health by worsening global inequality and environmental injustice.[205]

C.83. Children in poverty bear a disproportionate burden.[206] Due to a lack of structural and economic resources, children in low-middle income countries such as Bolivia, Haiti, Honduras, and Nicaragua[207] are more susceptible to the consequences of climate change than are children living in high-income (and high emitting) countries such as the United States and Canada.[208] Low-middle income countries will experience an increased burden of avoidable deaths among children under 5 years old due to the projected increase in diarrhea, malaria, and nutritional deficiencies that will be

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rising sea levels and inundation of coastal areas, exacerbated by climate change, could render major disruption of social systems.") https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3499869/pdf/ijerph-09-03298.pdf (last accessed Dec. 6, 2023).

[201] Susie E. L. Burke et al., *The psychological effects of climate change on children*, Curr. Psychiatry Rep., 20(35):1-8 (2018) https://doi.org/10.1007/s11920-018-0896-9 (restricted access, available upon request).

[202] Robert Kohn et al., *Mental health in the Americas: An overview of the treatment gap*, Rev. Panam. Salud Publica, 42:1-10 at 4 (2018) https://doi.org/10.26633/RPSP.2018.165.

[203] Robert Kohn et al., *Mental health in the Americas: An overview of the treatment gap*, Rev. Panam. Salud Publica, 42:1-10 at 5 (2018) https://doi.org/10.26633/RPSP.2018.165.

[204] Francis Vergunst et al., *Climate change and children's mental health: A developmental perspective*, Clin. Psychol. Sci., 10(4):767–785 at 768 (2021) https://doi.org/10.1177/21677026211040787.

[205] Frederica Perera, *Pollution from fossil-fuel combustion is the leading environmental threat to global pediatric health and equity: Solutions exist*, Int. J. Environ. Res. Public Health, 15(16):1-17 at 1 (2018) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5800116/pdf/ijerph-15-00016.pdf.

[206] Frederica Perera, *Pollution from fossil-fuel combustion is the leading environmental threat to global pediatric health and equity: Solutions exist*, Int. J. Environ. Res. Public Health, 15(16):1-17 at 1 (2018) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5800116/pdf/ijerph-15-00016.pdf.

[207] World Bank, *World bank country and lending groups* (2023) https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (last accessed Dec. 6, 2023).

[208] The World Resources Institute, *This interactive chart shows changes in the world's top 10 emitters,* World Resources Institute, https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters (last accessed Dec. 6, 2023).

caused by climate change.[209] Low-middle income countries will also experience an increase in the risk of pregnancy complications, preterm delivery, and low birthweight due to the expected increase in malaria, dengue fever, and schistosomiasis among pregnant women due to climate change.[210]

C.84. Indigenous populations are at disproportionate risk of climate-related increases in infectious tropical disease due to inadequate access to healthcare, extreme poverty, and the fact that their native lands are often exploited for mining and other forms of environmental degradation.[211] Such situations are unfolding among the Yanomami Indigenous people in Amazonian Venezuela and Brazil, the Wayuu in La Guajira in Colombia near the Venezuela border, and others.[212]

C.85. Although wildfire smoke causes two premature deaths per 100,000 people annually across South America on average, **wildfire smoke is *twice* as deadly in Indigenous territories**—and in some Indigenous territories in Bolivia and Brazil, it is ***six times*** as deadly.[213]

Conclusion

C.86. There are moments in history when simply following inherited norms by perpetuating an unjust status quo is insufficient and unacceptable. Instead, such moments call us to rise to the generational challenge and do what is necessary for continued human progress and survival. The climate emergency presents us with such a moment.

C.87. When a newborn takes their first breaths in the world, their breaths should be clear and easy. That is their birthright. Yet as pediatricians, we see increasing number of newborns whose **first breaths are full of struggle, pain, and peril.** For what noble purpose are these tiny, innocent beings—who had no part in creating this crisis—making such a tremendous sacrifice? It is for no purpose other than to pay for States' desire to continue emitting greenhouse gases with indifference to the result.

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[209] Emmanuelle Arpin et al., *Climate change and child health inequality: A review of reviews*, Int. J. Environ. Res. Public Health, 18(10896):1-17 at 1-2 (2021) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8535343/pdf/ijerph-18-10896.pdf; Rebecca P. Philipsborn et al., *Climate change and global child health*, Pediatrics, 141(6):1–5 at 1-2 (2018) https://doi.org/10.1542/peds.2017-3774 (restricted access, available upon request).
[210] Charlotta Rylander et al., *Climate change and the potential effects on maternal and pregnancy outcomes: An assessment of the most vulnerable — the mother, fetus, and newborn child*, Glob. Health Action, 6(19538):1-9 at 3 (2013) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3595418/pdf/GHA-6-19538.pdf.
[211] Peter J. Hotez et al., Central Latin America: Two decades of challenges in neglected tropical disease control, PLoS Negl. Trop. Dis., 14(3):1–7 at 5 (2020) https://doi.org/10.1371/journal.pntd.0007962.
[212] Peter J. Hotez et al., Central Latin America: Two decades of challenges in neglected tropical disease control, PLoS Negl. Trop. Dis., 14(3):1–7 at 5 (2020) https://doi.org/10.1371/journal.pntd.0007962.
[213] Eimy X. Bonilla et al., *Health impacts of smoke exposure in South America: Increased risk for populations in the Amazonian Indigenous territories*, Environ. Res. Health, 1(021007):1-10 at 1 (2023) https://doi.org/10.1088/2752-5309/acb22b.

C.88. As pediatricians, we have taken an oath to treat our patients. Therefore, we will continue to treat children as they come to us with health impacts from climate change—even as those impacts increase exponentially as the crisis intensifies. Yet we have also taken an oath **to prevent harm and to do no harm**. It is not within our power as pediatricians to compel States to change their behavior to stop making climate change worse. But **it is within this Court's power** to do so. We therefore urge this Court to clarify to States that they have a legal obligation to alter their behavior to stop contributing to the climate crisis. Such clarity is our only hope for protecting the coming generations of children from facing an even more dire future.