

4. Downing, A, Cuerrier A. A synthesis of the impacts of climate change on the First Nations and Inuit of Canada. *Indian Journal of Traditional Knowledge* 2011; 10(1): 57–70.
5. Durkalec A, Furgal C, Skinner MW, Sheldon T. Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community. *Social Science & Medicine* 2015; 136-137, 17–26.
6. Kimmerer, R. W. (2020). *Braiding sweetgrass: indigenous wisdom, scientific knowledge and the teachings of plants*. London: Penguin Books.
7. Ford J. Indigenous health and climate change. *American Journal of Public Health* 2012; 102(7): 1260–1266.
8. Whyte K. Indigenous climate change studies: Indigenizing futures, decolonizing the anthropocene. *English language notes* 2017, 55(1-2), 153–162.
9. Harper SL, Edge VL, Schuster-Wallace CJ, Berke O, McEwen SA. Weather, Water Quality and Infectious Gastrointestinal Illness in Two Inuit Communities in Nunatsiavut, Canada: Potential Implications for Climate Change. *EcoHealth* 2011; 8(1): 93–108.
10. Reid M, Hamilton C, Reid S, Trousdale W, Hill C, Turner N, ... Matthews D. Indigenous climate change adaptation planning using a values-focused approach: A case study with the Gitga'at nation. *Journal of Ethnobiology* 2014; 34(3): 401–424.
11. Lavoie JG, Kornelsen D, Wylie L, Mignone J, Dwyer J, Boyer Y, ... Odonnell K. (2016). Responding to health inequities: Indigenous health system innovations. *Global Health, Epidemiology and Genomics* 2016; 1.
12. Alexander C, Bynum N, Johnson E, King U, Mustonen T, Neofotis P, ... Weeks B. Linking indigenous and scientific knowledge of climate change. *BioScience* 2011; 61(6): 477–484.
13. McDonald ME, Papadopoulos A, Edge VL, Ford J, Sumner A, Harper SL. (2016). What do we know about health-related knowledge translation in the Circumpolar North? Results from a scoping review. *International Journal of Circumpolar Health* 2016; 75(1): 312–23.
14. McDonald E, Papadopolous A, Harper S. (2015). Retrieved from [https://atrium2.lib.uoguelph.ca/xmlui/bitstream/handle/10214/9265/McDonald\\_MargaretE\\_201509\\_MSc.pdf?sequence=1&isAllowed=y](https://atrium2.lib.uoguelph.ca/xmlui/bitstream/handle/10214/9265/McDonald_MargaretE_201509_MSc.pdf?sequence=1&isAllowed=y) Saini M, Roche S, Papadopoulos A.
15. Markwick N, Shiwak I, Flowers C, ... Harper SL. Promoting Inuit health through a participatory whiteboard video. *Canadian Journal of Public Health* 2019; 111(1): 50–59.

## ENVIRONMENTAL HEALTH

# Climate change and human health

*The choice between surviving and thriving.*

BY LING WU & HUGH MONTGOMERY



Protestor holds up a sign during the 2019 Global Climate Strike in Eriangen, Germany

photo credit - Markus Spiske

Climate change is the greatest and most unprecedented challenge we are facing in the 21st century: one that threatens every facet of life upon which we rely. There is increasing evidence of the profound impact of climate change on human health including consequences of extreme weather events, and most pressingly, newly emerging patterns of infectious disease. The severe impacts of global climate change on public health requires the sustainable action of individuals, businesses, and governments to shoulder the responsibility of preventing a rise in global temperatures. Most importantly, this involves reaching the societal targets of the Paris Agreement – keeping average temperatures below two degrees Celsius above pre-industrial levels [1].

In Geneva, the first World Health Organization [WHO] Global Conference on Air Pollution and Health was held in 2018. The chief aim of which was to catalyze a global response against air pollution, associated disease exposures, and overall cost to society [2]. This same objective is echoed by the Lancet Countdown on Health and Climate Change [LCHCC], an annual, international, and multidisciplinary report that highlights and monitors the evolving landscape of health in the era of climate change [3]. In its 2019 report, the LCHCC addressed our pressing fight with climate change as “an unprecedented challenge” that “demands an unprecedented response.”

## Surviving

Present day populations are fighting against extreme weather, insecurity of food and water, volatile patterns of infectious disease, and the exacerbation of existing health threats [3]. Of note are the adverse effects of climate change on maternal and children's health. Unsurprisingly, mothers and children in low- and middle-income countries face greater risk of malnutrition due to food insecurity, challenges to affordability of food, and lack of adequate healthcare [4,5]. Stunted growth, severe wasting, and restricted intrauterine growth cause 2.2 million deaths globally, and 21 per cent of disability-adjusted life-years [DALYs] among children younger than five years [4].

The 2019 LCHCC highlights the importance of child health against the backdrop of an increasingly changing climate. It emphasizes how our response to climate change today can shape the health profile of the future, creating one of extremes and uncertainty, or one in which population health, especially that of children, is not defined by a changing climate [3].

Children born today are projected to experience terrestrial temperatures four degrees Celsius higher than the pre-industrial average [3]. Air pollution is anticipated to accumulate to dangerously high levels in over 90 per cent of cities [3]. Food shortages and insecurity are predicted to rise due to shortened crop growth seasons and reduced crop yield, increasing risks of malnutrition amongst susceptible populations [3,5]. Simultaneously, the world is facing changes to disease transmission, notably, increased transmission of lethal viral diseases such as dengue, for which incidence has increased over 15 fold in the last 20 years [6]. Children across the globe, specifically those living in African and coastal areas will experience greater disease burdens from infectious diseases, especially dengue, malaria, diarrhea, gastroenteritis, wound infections, septicemia, and cholera [3]. As they age, organs such as the lungs and heart of children born today, will be damaged principally by fossil fuel-driven air pollution; it is predicted that these effects will accumulate over

the span of their entire life [3]. Global deaths due to air pollution approached seven million in 2012, whilst global premature deaths due to fine particulate matter reached 2.9 million in 2016 [7]. On the other hand, the livelihoods of the aging families of children born today are threatened by worsening changes in weather patterns and conditions, causing higher incidences of heatwaves, stronger droughts, floods, and storms [3]. Specifically, increased cases of annual daily human exposure to wildfires were recorded globally in 78 per cent of countries between 2015 and

*“Our response to climate change today, will determine the world we live in tomorrow.”*

*- The Lancet Countdown*

2018, with the largest being at nearly 21 million person-days in India and 17 million person-days in China [3].

Climate change will have impacts on us all. At present, humanity is experiencing the effects of climate change: such as delayed spring, advanced summer, and intensive storms. To a large extent, the ecological system is disrupted by the overwhelming energy gain, especially fossil fuel consumption [8]. Consequently, generations are witnessing ice melting, rising sea levels, and weather becoming more and more extreme. Indeed, the increased production and trapping of greenhouse gases through the fossil-fuels emissions have led to global temperature fluctuations, and the disruption of ecosystems through greater incidences of natural disasters, most notably the bush fires of Australia in 2019 [9].

Fortunately, the outlook of our future does not have to be defined by current projections. Should considerable actions be taken, scientists believe that limiting the rise of global average temperatures to “well below two degrees Celsius” is possible, and would ultimately reshape the health of a child born today [3].

## Thriving

Ambitious action, global adaptation and mitigation efforts should be enforced for the prosperity of our planet and future generations. Countries are becoming more resilient to the effects of climate change through the implementation of climate services to the health sector after recognition of the importance of national climate change risk assessments. 54 per cent of cities throughout the world carried out climate change risk surveys in 2018,

and 109 countries have medium to high levels of infrastructure to mitigate consequences from health emergencies such as pandemics and changes in weather patterns such as air pollution and floods [3].

Increased media coverage of climate change and its effects on human health have raised global awareness and catalyzed individual initiatives to lead low-carbon lifestyles. Global action and engagement by governments has also increased in recent years, with even small island developing states such as Fiji, Palau, and Samoa, placing greater attention to health and climate change [3]. In 2017, France committed to ban the sales of petrol and diesel vehicles by 2040 and to become a carbon-neutral country by 2050 to meet its targets under the Paris Agreement [10]. In 2018, Canada committed to phase-out traditional coal-fired electricity and improve greenhouse gas regulations for natural gas-fired electricity by 2030 [11]. In 2020, the United Kingdom announced plans to close coal-fired power stations by 2024 and ban the sale of new diesel and gas cars [12,13]. Should targets such as these be reached, children born in the UK and Canada today would see the phase-out of coal by their fourth and

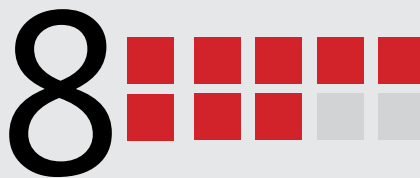
tenth birthdays, followed by the roll-out of solar and wind energy [3,11–13]. Children born in France would witness the replacement of petrol with renewable energy vehicles by the age of 20 [10]. In 2050, generations would witness net-zero emissions all over the world.

Fortunately, climate change is gradually arising to the consciousness of individuals, catalyzing the modification of lifestyles and patterns of consumption. Indeed, a strong and sustainable response to climate change requires an unprecedented level of global participation. This begins with dedicated and sustained individual action: buying plant-based foods that are seasonal and local; reducing ruminant meat and dairy consumption; lowering thermostat temperature [each degree reduction can save on average 1000 pounds of greenhouse gas emissions a year]; switching to 100 per cent renewable energy sources; increasing cycling, walking, and public transit usage; reducing flights; and lastly, increasing economic reinvestment in the renewable energy sector [3,14,15].

In reality, societies have yet to do enough. Despite the efforts of governments to promote renewable energy, the allocated budgets are much less than those used in the expansion of fossil fuel use. Moreover, engagement and cooperation by all sectors from individuals, businesses, and governments are essential to the success of ambitious and sustained responses to climate change that can incite a global commitment to lasting reductions in emissions. Consequently, the interactions of energy gain, global climate change, public health, massive migration, extreme poverty, social unrest, and mental illness will affect not only children but people of every age and on every continent.

#### REFERENCES

1. UNFCCC. What is the Paris Agreement? [Internet]. United Nations Climate Change. 2015 [cited 2020 Apr 25]. Available from: <https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement>
2. World Health Organization. COP24 Special report: Health and Climate Change. Geneva: World Health Organization. 2018.
3. Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Belesova K, Boykoff M, et al. The 2019 report of The Lancet Countdown



of the ten  
**HOTTEST** years  
on record occurred in the  
last decade.

Every **SECOND**  
our world consumes on average:



**171,000 kg**  
of coal



**116,000,000 L**  
of gas



**186,000 L**  
of oil

4. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008 Jan 19;371(9608):243–60.
5. FAO, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition. Rome, FAO. 2018;
6. Dengue and severe dengue [Internet]. [cited 2020 Apr 25]. Available from: <https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>
7. World Health Organization. Ambient Air Pollution: A global assessment of exposure and burden of disease. World Health Organization. 2016.
8. Shaftel H. Causes | Facts – Climate Change: Vital Signs of the Planet [Internet]. NASA's Jet Lab Propulsion Laboratory California Institute of Technology. 2018 [cited 2020 May 11]. Available from: <https://climate.nasa.gov/causes/>
9. Phillips N. Climate change made Australia's devastating fire season 30% more likely. *Nature*. 2020 Mar 4;
10. France set to ban sale of petrol and diesel vehicles by 2040. *BBC News*. 2017 Jul 6;
11. Coal phase-out: the Powering Past Coal Alliance - Canada.ca [Internet]. [cited 2020 Apr 25]. Available from: <https://www.canada.ca/en/services/environment/weather/climatechange/canada-international-action/coal-phase-out.html>
12. Frangoul A. End of an era? Two large coal-fired power stations in the U.K close down on same day. *CNBC*. 2020 Apr 1;
13. Castle S. Britain to Ban New Diesel and Gas Cars by 2040 - *The New York Times*. *The New York Times*. 2017 Jul 6;
14. Hedenus F, Wirsenius S, Johansson DJA. The importance of reduced meat and dairy consumption for meeting stringent climate change targets. *Clim Change*. 2014;124(1):79–91.
15. 10 Ways to Stop Global Warming: Facilities - Northwestern University [Internet]. [cited 2020 Apr 25]. Available from: <https://www.northwestern.edu/fm/fm-staff/10-ways-to-stop-global-warming.html>

Numbers from the 2019 Lancet Countdown .  
Icons by Adrien Coquet, Designer Kanan, and  
Vectors Market.